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LandCorp

Report for Broome North Development Area

Targeted Fauna Survey

July 2009

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

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1. Introduction

LandCorp commissioned GHD Pty Ltd (GHD) to complete a Level 2 Fauna Survey for the proposed subdivision and development of Broome North (Area A and Area B) in the town of Broome. The study area is shown in Figure 1, Appendix A.

Area A comprises approximately 350 hectares and Area B comprises approximately 365 hectares. During a preliminary environmental impact assessment and biological survey of Areas A and B, GHD (GHD 2008a; GHD 2008b) reported that a number of conservation significant fauna species may be present within the project areas.

The purpose of the survey is to target conservation significant species and determine the likely risks to fauna from the proposed development. The results of a detailed fauna assessment may be required by the Department of Environment and Conservation through the Development Application Process and will also assist in the development of an Environmental Management Plan and other referral documents as required.

1.1 Scope of Works

A Preliminary Environmental Impact Assessment and Biological Survey was conducted by GHD in June 2008. The biological survey involved a Level 2 flora survey and Level 1 fauna survey. As a result of this assessment, a number of conservation significant fauna were identified as potentially occurring within the project areas. As a result, a Level 2 fauna survey was commissioned by LandCorp to assist in the approvals process.

The fauna assessment included the following aspects:

» A fauna survey conducted at the end of the wet season, undertaken by GHD's qualified zoologist and ecologist and conducted with regard to the Environmental Protection Authority's *Guidance Statement No. 56 – Terrestrial Fauna Surveys for Impact Assessment in Western Australia (2004).* This involved:
  – Targeted trapping for conservation significant fauna using Sheffield cage traps; and
  – Various searching techniques including nocturnal hand searching, diurnal hand searching, targeted bird surveys and other opportunistic observations.
» An assessment of the actual and potential impacts of the proposed developments on fauna.

1.2 Relevant Legislation

Relevant legislation for the protection of fauna within Western Australia includes the *Environmental Protection Act 1986*, the *Conservation and Land Management Act 1984*, and, in particular, the *Wildlife Conservation Act 1950*. Matters of national environmental significance are also protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Projects that have the

potential to impact on matters of national environmental significance, including projects that may impact significantly on fauna species listed under the EPBC Act, need to be referred to the Commonwealth Minister for the Environment. The Department of Environment, Water, Heritage and Arts (DEWHA) and Department of Environment and Conservation (DEC) have signed a Bilateral Agreement that gives the DEC the power to assess some projects that would otherwise be assessed by the DEWHA. Projects which trigger the EPBC Act must still be referred under the Act but there will not be a duplication of assessment at a State and Federal level.

2. Methodology

2.1 Desktop Investigations

Desktop investigations have previously been completed for the project areas by GHD and are included in the PEIA and Biological Survey (GHD, 2009a; GHD, 2009b). The desktop investigations resulted with a list of fauna species that have the potential to occur in the project area, including the likely presence of any conservation significant fauna species. GHD (GHD 2009a; GHD 2009b) reported that the following conservation significant species may possibly be present within the project areas:

- Greater Bilby (*Macrotis lagotis*) Schedule 1, Vulnerable
- Masked Owl (Northern) (*Tyto novaehollandiae*) Priority 1, Vulnerable
- Princess Parrot (*Polytelis alexandrae*) Priority 4
- Bush Stone-curlew (*Burhinus grallarius*) Priority 4
- Grey Falcon (*Falco hypoleucos*) Priority 4

2.2 Field Survey

The Level 2 fauna survey was conducted by GHD's qualified senior zoologist (Glen Gaikhorst) and ecologist (Erin D'Raine). The fauna assessment included a field survey conducted with regard to the EPA's Guidance Statement No. 56.

A number of different survey methods were employed, including opportunistic surveys and a trapping program.

Trapping Program

The capture and release program was primarily aimed at trappable mammals, in particular, the conservation significant Greater Bilby (*Macrotis Lagotis*). The Sheffield Cage traps were set over night, targeting this nocturnal mammal. The cage trapping occurred over a six-night period between the 4/05/09 and 10/05/09, which resulted in 240 Cage trap-nights.

Each study site (Area A and Area B) contained two trap lines comprising of 10 traps per line. Each trap was positioned 100 meters apart making each line one kilometre long. Traps were baited with a mixture of peanut butter, oats and sardines. The trap sites are mapped in Figure 2.

A DEC licence to Take Fauna for Scientific Purposes (SF006852) was obtained prior to the trapping. Animal ethics considerations were abided with at all times during the survey, with trapping undertaken with the comfort and safety of the animals in mind. All traps were set in sheltered areas, with hessian bags over cage traps for shading and protection from external vectors. The traps were set every afternoon and checked early in the morning, before daytime temperatures rose above animal comfort levels.

Opportunistic Surveys

The trapping was complemented with systematic searching across all habitat types. This was conducted by a number of methods, including nocturnal hand searching, diurnal hand searching and targeted bird surveys. This is to maximise the search effort and specifically focus on the listed target species.

Diurnal hand searching comprised of opportunistic observations and hand foraging. This involved searching through microhabitats including turning over logs and rocks, turning over leaf litter, and examining hollow logs. Reptiles were also sighted as they basked during the day. The site contained large amounts of dumped rubbish which also supplies hide habitat for some reptiles. Diurnal searching comprised of 40 person hours. Nocturnal hand searches comprised of spotlighting with hand held beams and road spotting to focus on the nocturnal species. This was conducted over a total of 32 person hours over both sites. The opportunistic surveys also involved visual and aural surveys for any bird species utilising the project areas. Targeted bird surveys were conducted during the morning and evening hours. A total of 18 person hours were conducted at each site.

The project areas were also searched for any fauna signs, such as tracks, scats, bones, diggings and feeding signs. In addition, species-specific search strategies were used to identify any protected species in the area or evidence that they utilise the project areas.

Nomenclature

Nomenclature used in this report follows that used by the Western Australia Museum FaunaBase program as it is deemed to contain the most up-to-date species information for Western Australia.

2.3 Limitations

This survey was aimed at identifying the terrestrial vertebrate fauna of the project areas in particular targeting conservation significant fauna. No sampling for invertebrates or fish occurred.

This survey was carried out during only one season, and in one year. Complete faunal surveys often require multiple surveys, at different times of year, and over a period of a number of years, to enable full survey of all species present. However, the field survey has been complemented with information from other sources. Further surveys in other seasons and over longer periods, may identify a greater number of species.

There were some restrictions with access over parts of the project areas due to privately owned land and fenced off areas. However the vegetation type is reasonably uniform across the sites and was generally representative of the whole study area.

3. Fauna Survey Results

The field survey recorded a total of 85 vertebrate fauna taxa including 50 bird, 26 reptile, 8 mammal and 1 amphibian species. A list of vertebrate fauna recorded during the field survey is presented in Table 2, Appendix B.

3.1 Birds

The study area has a rich avian fauna with 50 bird species identified during the field survey. A considerable number of bird species are expected due to the location of the bushland in vicinity to the coast, intertidal mudflats, mangroves and adjoining Pindan woodlands.

Birds observed within the study area comprised of 2 Acanthizids (Gerygone and Weebill), 5 Accipitrids (Hawks and Eagles), 1 Ardeid (Herons), 2 Artamids (Butcherbirds and Woodswallows), 1 Campephagid (Cuckoo-shrike), 1 Caprimulgid (Nightjar), 1 Centropodid (Pheasant Coucal), 3 Columbids (Doves and Pigeons), 1 Coraciid (Dollarbird), 1 Corvid (Crows), 1 Cracticid (Magpies), 3 Dricrurids (Larks), 1 Estrildid (Finches), 4 Falconids (Falcons), 1 Halcyonid (Kookaburra), 1 Larid (Gulls), 1 Malurid (Wrens), 5 Meliphagids (Honeyeaters), 1 Meropid (Bee-eater), 1 Motacillid (Pipit), 2 Pachycephalids (Shrike-thrushes and Whistlers), 1 Podargid (Frogmouths), 1 Pomatostomid (Babblers), 5 Psittacids (Parrots), 1 Ptilonorhynchid (Bowerbirds), 1 Strigid (Owls), 1 Sylviid (Warblers), and 1 Threskiornithid (Ibis).

The bird assemblage comprised mostly of hawks and eagles, honeyeaters, parrots and cockatoos. No introduced bird species were recorded during the field survey.

A number of other species would be expected to utilise the study area, but many of these would only be present as vagrants, possibly using flight paths over the study area and would not be subject to significant impacts from the proposed works.

3.2 Mammals

Five native mammal species and three introduced mammal species were recorded in the study area. Mammals observed within the study area comprised of 1 Canid (Dogs), 1 Equid (Horses), 1 Felid (Cats), 2 Macropods (Wallabys), 1 Murid (Mouse), 1 Phalangerid (Possum) and 1 Pteropod (Flying-fox).

The Northern Brushtail Possum (*Trichosurus vulpecular arnhemensis*) was captured on six occasions at two of the sites during the trapping program. This species was captured along both trap lines within Area A. The area where Northern Brushtail Possums were captured area can be seen on Figure 3. The Northern Brushtail Possum is not specifically listed under the *Wildlife Conservation Act, 1950* or the Federal *Environmental Protection and Biodiversity Conservation Act, 1999*.

One feral cat was also captured during the trapping program within Area B.

A Delicate Mouse (*Pseudomys delicatulus*) was observed under a mound of rubbish along the northern boundary of Area B. Two species of Wallaby, the Agile Wallaby

(*Macropus agilis*) and the Northern Nailtail Wallaby (*Onychogalea unguifera*) were observed throughout the study area. Black Flying-foxes (*Pteropus alecto*) were observed flying over and close to both sites.

Cat and dog tracks were observed over much of the study area with several dogs observed wandering in an area adjacent to the study area. One horse was observed within Area B within a fenced off area along Locke Street.

Native mammal species tend to be vulnerable to disturbances and have been heavily impacted by human settlement and associated disturbances and the introduction of feral species (particularly cats).

No captures or signs of Bilby were observed within the study area

3.3 Reptiles

A total of 26 reptile species were observed during the field survey. Reptiles observed comprised of 4 Agamids (Dragons), 4 Elapids (Snakes), 4 Gekkonids (Geckos), 1 Pygopod (Legless Lizards), 1 Pythonid (Pythons), 11 Scincids (Skinks) and 1 Typhlopid (Blind Snakes).

3.4 Amphibians

Amphibians observed comprised of 1 Hylid (Litoria). Several individuals of the Northern Green Tree Frog (*Litoria caurelea*) were observed during the nocturnal searches of the field survey.

3.5 Introduced/Pest Fauna

Four introduced fauna species were recorded from the study area, including:

- Dog (*Canis lupus*);
- Feral Cat (*Felis catus*);
- Horse (*Equus caballus*); and
- Asian House Gecko (Hemidactylus frenatus)

3.6 Specially Protected Fauna

3.6.1 Legislation

The conservation of fauna species and their significance status is currently assessed under both State and Commonwealth Acts. The acts include the *Western Australian Wildlife Conservation Act* 1950; *Wildlife Conservation (Specially Protected Fauna) Notice 2008,* and the *EPBC Act 1999*.

The significance levels for fauna used in the EPBC Act are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN). A description of Conservation Categories delineated under the EPBC Act is provided in Table 2, Appendix B and the circumstances under which a project will trigger referral to

the DEWHA are described in Appendix B. The *WA Wildlife Conservation Act 1950* uses a set of Schedules but also classifies species using some of the IUCN categories. These Schedules are described in Table 3, Appendix B.

The EPBC Act also protects migratory species that are listed under the following 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); and

» The Agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds (ROKAMBA).

Listed migratory species also include species identified in other international agreements approved by the Commonwealth Environment Minister.

The Act also protects marine species on Commonwealth lands and waters.

In Western Australia, the DEC produces a supplementary list of Priority Fauna, these being species that are not considered Threatened under the Western Australian *Wildlife Conservation Act 1950* 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. Levels of Priority are described in Table 4, Appendix A.

3.6.2 Significant Species

No fauna species of conservation significance were recorded during the field survey. However the habitat over the site is suitable for Bush Stone-curlew (*Burhinus grallarius*) and Princess Parrot (*Polytelis alexandrae*) which are Priority 4 species under the *Wildlife Protection Act, 1950*. These species are nomadic and their typical pindan habitat is well conserved so there is no particular requirement to preserve habitat in this area.

3.6.3 Migratory/Marine Species

A number of species listed as Migratory and/or Marine under the EPBC Act (Bonn Convention) were recorded during the field survey, including the Brown Goshawk (*Accipiter fasciatus didimus*), Whistling Kite (*Haliastur sphenurus*), Black-faced Cuckoo-shrike (*Coracina novaehollandiae melanops*), Spotted Nightjar (*Eurostopodus argus*), Dollarbird (*Eurystomus orientalis*), Nankeen Kestrel (*Falco cenchroides*),

Rainbow Bee-eater (*Merops ornatus*), and the Straw-necked Ibis (*Threskiornis spinicollis*).

Many of these bird species have extended home ranges and are vagrants of the study areas with use of the areas being opportunistic. The study area is not considered to contain significant habitat for marine and migratory species. Potential impacts on these species are considered to be negligible.

4. Fauna Habitat

4.1 Habitat Types

One primary habitat was identified across the study area. This was based on the predominant landforms and vegetation structure in the area, with the habitat consisting predominately of Pindan Woodland. Pindan Woodlands have been described by Kenneally *et al*. (1996) as grassland wooded by a sparse upper layer composed mainly of eucalypts with a variably dense, often thicket-forming, middle layer predominately of wattles.

No habitats were recorded that are considered to be specific to the study area.

No permanent or semi-permanent water points were located within the study area.

4.2 Habitat Importance

Where landscapes have been highly modified through urbinisation extensive fauna habitat loss has resulted. As a consequence, any remaining remnants of native vegetation are of high importance. Disturbances due to human activities have reduced the habitat value within some sections of the study area. However, the majority of the study area contains vegetation in good condition which offers excellent habitat for native fauna.

Trees, particularly mature specimens, provide feeding and breeding habitat, and may be important locations for refuge. A healthy and diverse understorey, as found across the project area, is important habitat for mammals and reptiles. The study area also contains a number of microhabitats that would be utilized by reptile species, such as areas of thick leaf litter, logs and loose sand.

Aged *Eucalyptus sp* on Area A contained suitable hollow logs for fauna to utilize, primarily the Northern Brushtail Possum. Hollow logs take many years to develop and where ever possible these areas should be maintained. If maintained they should also be linked via nature corridors to natural areas. The area where Northern Brushtail Possums were captured is presented in Figure 3. Figure 3 also highlights an area of habitat and habitat corridors for possible retention. Although there are no regulatory requirements to preserve habitat for the possum, as part of the structure planning process, special consideration should be given to areas that have biodiversity significance and which can link in with other planning objectives such as bushland retention for public use.

The vegetation types present at the site (Pindan Shrubland) are the dominant vegetation type within the surrounding area, and the surrounding area is generally in similar or better condition to that within the study area. No habitats were recorded that are considered to be specific to the study area or a significant habitat type. However, hollows were recorded in areas where Northern Brushtail Possums were caught and are regarded as important habitat aspects for this species.

4.3 Habitat Linkages

Fauna corridors and habitat linkage are important to allow animals to move between areas of resource availability. Such corridors are important for ground and aerial fauna, providing cover, resources, and linking areas suitable for rest and reproduction. Habitat corridors are important in areas where extensive clearing has occurred, to help overcome the effects of habitat fragmentation. These corridors assist in maintaining genetic diversity through connection of gene pools, enabling recolonisation of disturbed areas and the provision of habitat.

Fragmentation of habitat limits the resources available to species, particularly sedentary species, which means they may be more vulnerable to natural disasters or habitat changes over time. Fragmentation of habitat can also lead to edge effects, leading to degradation of the habitat. Where the distance between habitat fragments is small, species may still be able to move between these habitat areas, but may be more exposed to predation pressures in the cleared areas.

The Area A and Area B study areas are located adjacent to and nearby other areas of fully vegetated remnants. It is considered that the proposed project is not likely to significantly alter or fragment habitat within the Broome area. However with the future developments in the area habitat fragmentation may become an issue. A wildlife corridor should be maintained for the movement of fauna within this region and potential movement options are presented in Figure 3.

5. Potential Impacts on Fauna

5.1 Clearing Principles

Principle (a) and (b) directly relate to fauna when land is to be cleared. Only these two principles are addressed in this report.

Table 1 Assessment against the Clearing Principles

Principle Number	Principle	Assessment	Outcome
(a)	Native vegetation should not be cleared if it comprises a high level of biological diversity.	The alignment runs through habitat that is regarded as common in the Kimberley area with over 90% still intact.	The proposal would not be at variance with the Principle.
(b)	Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	No significant habitat was recorded in either Area A or B.	The proposal would not at variance with the Principle.

5.2 Potential Fauna Impacts

The main impacts on fauna are:

» *Vegetation Clearing:* This project will require the clearing of some native vegetation. No significant species were identified during the fauna assessment. Several bird species listed as Marine and Migratory were recorded utilising the native vegetation for feeding or resting. These species however are mobile and would use the area opportunistically. Terrestrial species such as the Northern Brushtail Possum and Chestnut Mouse will flee once disturbed, therefore clearing should commence in the most disturbed areas first pushing animals to safer habitat outside of the clearing zone.

» *Weed introduction and invasion*: Each of the study areas have had some degree of disturbance (mainly through rubbish dumping) and contain weeds that are relatively widespread. Disturbance from the proposed activities has the potential to introduce and/or spread weeds to the area directly impacted by, and adjacent to, the clearing. Introduced weeds may alter the availability of suitable habitat for some ground dwelling species.

» *Soil degradation and erosion*: Native vegetation serves an important role in the stabilisation of soil within the landscape. Removal of vegetation can cause land degradation, including erosion. Clearing should be undertaken in sections, and outside of the wet season, to reduce the possibility of erosion and its impacts on bushland to be retained with the study area and on adjacent bushland areas.

- *Hydrological Changes:* Changes to natural drainage from clearing or other activities may impact on both vegetation structure and fauna habitat in retained and adjoining areas.
- *Habitat loss and damage*: The habitat present in Areas A and B are common throughout the Kimberley and not considered a significant loss.
- *Death or harm to fauna species*: Any construction works have the potential to cause death or harm to fauna species. Vegetation clearing and vehicle movements are likely to result in an increased incidence of animal death or injury. Slower moving land animals (including mammals, reptiles and amphibians) are most at risk, as they are often unable to vacate disturbed areas of vegetation quickly enough to avoid harm. Animals may become disorientated following destruction of their current habitat ranges. Therefore, clearing in disturbed areas first and working into habitat not to be cleared may steer fauna in a safe direction. The use of a fauna clearance team during any habitat clearing can also assist in the safe removal of fauna such as the Brushtail Possum, from the disturbance area.

5.2.1 Management of Potential Impacts

Impacts on fauna can be minimised and managed by a number of measures which are outlined below:

- Management measures should be implemented to ensure clearing does not cause appreciable land degradation, including preventing erosion from the cleared areas.
- Management measures should be implemented to minimize the introduction and spread of weeds, such as avoiding movement of soils containing weedy species.
- Management measures should be implemented to prevent impacts on adjacent fauna from pollution, such as litter and oil spills.
- Implement measures to reduce the risk of fire starting from activities at site.
- Destruction of fauna habitat (outside of the proposed area) should be minimised during clearing. Dead, standing or fallen timber should be retained as habitat, wherever possible and used if any rehabilitation of areas is undertaken.
- When required, the use of a fauna clearance team should be used to remove and relocate disturbed fauna and venomous animals, to be used during any areas of fauna clearing.
- If possible the woodland with hollows and Northern Brushtail Possum habitat should be maintained through the planning process and linked via a corridor to other suitable habitats.
- If vegetated areas are to remain within the project area, under passes should be considered to provide animal access routes to reduce the risk of road death.

6. Conclusions

LandCorp commissioned GHD to undertake a significant fauna survey for the proposed development at Areas A and B, Broome. The results of the assessment are summarised below:

» Based on the mapping by Shepherd (2002, 2005) the vegetation type present within the study areas has approximately 100% remaining and fall into the status category of *Least Concern.* The habitat provided by this vegetation type is therefore not at threat.

» No significant fauna species were identified during the field assessment. Eight Marine and/or Migratory species were recorded but are considered vagrants to the sites and will opportunistically use the area.

» Northern Brushtail Possums were recorded on Site A in an area of Eucalyptus woodland with hollows. Although this species is not specially protected and there is no regulatory requirement to protect habitat, it is considered that this woodland area should be maintained, with habitat corridors (of approximately 100 m width) established to assist reduction in genetic fragmentation. Possible directions of possum movement have been indicated.

» This project will require the clearing of native vegetation. The extent of clearing required for this project is relatively large and warrants a fauna clearance team to move mammals and terrestrial wildlife stranded during clearing. All native wildlife is protected under the *Wildlife Conservation Act, 1950* and it is recommended that direct loss of fauna due to development is minimised where possible.

» This project is not likely to be at variance with Principles (a) and (b) of the 10 Clearing Principles, however it is recommended that some bushland be retained within the project area, with corridors linking bushland to adjacent permanent vegetation.

» Appropriate management plans need to be put in place to minimise direct impacts on fauna as a result of clearing and to assist in mitigating potential impacts, such as land degradation due to erosion, weed spread and fire.

7. Limitations

This report presents the results of a detailed fauna assessment prepared for the purpose of this commission. The data and advice provided herein relate only to the project and structures described herein and must be reviewed by a competent scientist/ecologist before being used for any other purpose. GHD accepts no responsibility for other use of the data.

Where previous reports, flora surveys and similar work have been performed and recorded by others the data is included and used in the form provided by others. The responsibility for the accuracy of such data remains with the issuing authority, not with GHD.

An understanding of the site conditions depends on the integration of many pieces of information, some regional, some site specific, some structure specific and some experience based. Hence this report should not be altered, amended or abbreviated, issued in part or issued incomplete in any way without prior checking and approval by GHD. GHD accepts no responsibility for any circumstances that arise from the issue of the report that has been modified in any way as outlined above.

For these investigations GHD has conducted desktop data searches and field surveys. The conclusions of this report were based on the information gathered during these investigations and thus reflect the environment of the site at the time of the survey. GHD accepts no responsibility for any variation in the flora and fauna present at the site due to natural and seasonal variability.

Limited stakeholder consultation has been carried out for this report. Full stakeholder consultation with relevant agencies and interest groups, such as DEC, DEWHA, and community groups should be carried out where required.

8. References

GHD Pty Ltd (2009a) *Broome North – Southern Portion (Area A), Preliminary Environmental Impact Assessment and Biological Survey*. Report prepared for LandCorp by GHD.

GHD Pty Ltd (2009b) *Broome North – Northern Portion (Area B) Preliminary Environmental Impact Assessment and Biological Survey*. Report prepared for LandCorp by GHD.

Kenneally, K.F., Edinger, D.C., and Willing, T. (1996) *Broome and Beyond. Plants and People of the Dampier Peninsula, Kimberley, Western Australia*. CALM, Western Australia.

Shepherd, D.P., Beeston, G.R., and A.J.M. Hopkins (2002) *Native Vegetation in Western Australia – Extent, Type and Status*. Resource Management Technical Report 249, Department of Agriculture, Western Australia.

Shepherd, D.P. (2005) Personal Communication. Information updated from above reference, but not as yet developed into a final report.

Appendix A

Figures

418,000 419,500 421,000

8,020,500 8,019,000 8,017,500

Area B
Lot 340

Area A
Lot 3150

SANDS ST
BUCKLEYS RD
LOCKE ST
WATTLE DR
BROOME RD
FAIRWAY DR
SANCTUARY RD
CRAB CREEK RD
LULLFITZ DR
SANCTUARY RD
GUBINGE RD
JIGAL DR
GUBINGE RD
OLD BROOME RD

Locality Map
LOMBADINA
LACEPEDE CHANNEL
BEAGLE BAY
INDIAN OCEAN
BROOME
LAGRANGE ABORIGINAL COMMUNITY
EDGAR RANGE

LEGEND

Study Areas

1:15,000 (at A3)
0 75 150 300 450 600
Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 51

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Landcorp
Broome Industrial Land Fauna Survey

Study Area

Job Number	61-23761
Revision	0
Date	27 JUL 2009

Figure 1

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GHD House, 239 Adelaide Terrace Perth WA 6004 **T** 61 8 6222 8222 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data Source: GHD: Study Areas - 20080530; Landgate: Broome Townsite Mosaic - Jun 2007. Created by: wdavis, croach2

418,000 419,500 421,000

8,020,500 8,019,000 8,017,500

SANDS ST
BUCKLEYS RD
LOCKE ST
WATTLE DR
BROOME RD
FAIRWAY DR
SANCTUARY RD
CRAB CREEK RD
LULLFITZ DR
GUBINGE RD
JIGAL DR
OLD BROOME RD

Area B
Lot 340

Area A
Lot 3150

Locality Map
LOMBADINA
LACEPEDE CHANNEL
BEAGLE BAY
INDIAN OCEAN
BROOME
LAGRANGE ABORIGINAL COMMUNITY
EDGAR RANGE

LEGEND

- Study Areas
- Trap Group 1
- Trap Group 2
- Trap Group 3
- Trap Group 4

1:15,000 (at A3)

0 75 150 300 450 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 51

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Landcorp
Broome Industrial Land Fauna Survey

Fauna Trap Line Location

Job Number	61-23761
Revision	0
Date	27 JUL 2009

Figure 2

G:\61\23761\GIS\mxds\6123761-G002.mxd

GHD House, 239 Adelaide Terrace Perth WA 6004 **T** 61 8 6222 8222 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data Source: GHD: Study Areas - 20080530; Landgate: Broome Townsite Mosaic - Jun 2007; GHD: Trap Groups - 20090708. Created by: wdavis, croach2

418,000 419,500 421,000

8,020,500 8,019,000 8,017,500

SANDS ST
BUCKLEYS RD
LOCKE ST
WATTLE DR
BROOME RD
FAIRWAY DR
SANCTUARY RD
CRAB CREEK RD
LULLFITZ DR
GUBINGE RD
JIGAL DR
OLD BROOME RD

Area B
Lot 340

Area A
Lot 3150

Northern Brushtail
Possum Area

Locality Map
LOMBADINA
LACEPEDE CHANNEL
BEAGLE BAY
INDIAN OCEAN
BROOME
LAGRANGE ABORIGINAL COMMUNITY
EDGAR RANGE

LEGEND

Study Areas

Brushtail Possum Habitat

Possible Movement Corridors

1:15,000 (at A3)
0 70 140 280 420 560
Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 51

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Landcorp
Broome North Fauna Survey

Job Number 61-23761
Revision 0
Date 27 JUL 2009

Brushtail Possum Location

Figure 3

G:\61\23761\GIS\mxds\6123761-G003.mxd

GHD House, 239 Adelaide Terrace Perth WA 6004 **T** 61 8 6222 8222 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data Source: GHD: Study Areas - 20080530; Landgate: Broome Townsite Mosaic - Jun 2007; GHD: Bushtail Possum Area and Possible Corridors - 20090708. Created by: wdavis, croach2

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.

(See Table 2)

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

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:

1. habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, or
2. habitat utilised by a migratory species which is at the limit of the species range, or
3. 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 2 Conservation Categories and Definitions for *EPBC Act* Listed 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 3 *Western Australian Wildlife Conservation Act 1950* Conservation Codes

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 4 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 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.

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