

TECHNICAL REPORT

**TELFER BOREFIELD
FLORA AND FAUNA SURVEY**

OCTOBER 2007

**FOR
NEWCREST MINING LTD**

syrinx environmental pl
restoration remediation research operations



masterplanning landscape architecture design

SYRINX ENVIRONMENTAL PL
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EXECUTIVE SUMMARY

Newcrest Mining Pty Ltd is proposing to construct a new borefield in the Great Sandy Desert at the Telfer Gold Mine, approximately 400km east of Port Hedland. The extension of the borefields is required to abstract ground water and supply the Ore Processing Plant. This report presents the results of a flora and fauna survey undertaken in the proposed extension area.

The vegetation of the borefield area is dominated by Spinifex (*Triodia* spp) with shrub and tree species present differentiating the vegetation communities. Eighteen vegetation types and landforms were identified and mapped. 4 communities were found in sandplain over gravel areas, 3 in sandplain areas, 1 in clayey sand areas, 3 on sand dunes and 5 on rocky hills. One modified landform and vegetation type was mapped. All vegetation types are regionally common, although two are uncommon within the study area, including one at the northern extent of its distribution.

The Priority 2 species *Goodenia hartiana* was found at 6 locations, with a total population of approximately 10, 000 plants. Due to lack of flowering material present during the survey another 6 populations were tentatively identified as *Goodenia hartiana*, representing an additional 45 plants.

It is recommended a targeted survey is undertaken to gain a more regional perspective of the distribution of *Goodenia hartiana* around the Telfer region to provide a better understanding of the conservation status of the species. The main preferred habitat of *Goodenia hartiana* was *Acacia stipuligera* Shrubland at the base of rocky slopes, which is a common habitat within the Telfer region.

The Priority 2 species *Dampiera atriplicina* was found at two locations, with a population of two plants. Due to lack of flowering material, the specimens have been tentatively identified.

No Priority fauna was located during the survey, although the habitats for priority fauna are present and impact to these areas should be avoided, in particular rocky outcrops, dunes and any mature vegetation in dune swales.

1.0 INTRODUCTION

Newcrest Mining Pty Ltd is proposing to construct a new borefield at the Telfer Gold Mine, approximately 400km east of Port Hedland. The construction of the borefield is required to abstract ground water and supply the Ore Processing Plant. The new borefield will be made up of refurbished bores and drilling of new bores. The new bores will include support infrastructure such as power lines, pipes, access roads and fire breaks. The construction of the borefield will require 1 – 2% of the borefield area to be cleared of vegetation.

Newcrest Mining Pty Ltd engaged Syrinx Environmental PL to undertake a flora and fauna survey of the vegetated portion of the 2073ha proposed borefield in order to assess the likely environmental impacts of the proposal on flora and fauna.

1.1 SCOPE OF WORK

The scope of work covered in this assessment was as follows:

1. Vegetation and Flora Survey. A Level 1 survey (Guidance Statement 51) of all areas proposed for the borefield expansion to determine vegetation communities. A search for any DRF or Priority Flora potentially present, in particular *Goodenia hartiana*, was undertaken.
2. Fauna Survey. A Level 1 survey (Guidance Statement 56) was undertaken for any vertebrate species present, with an emphasis placed on identifying and describing evidence of bilby, mulgara and marsupial mole activity (i.e. burrows, tracks or scats).

The purpose of the survey was to assess the physical landscape. As water abstraction will be from an aquifer greater than 50m below the surface, the impact of the abstraction on groundwater dependent ecosystems was not undertaken

1.2 CLIMATE

An important factor with surveying flora and fauna in the Great Sandy Desert is the impact of climate, as many of the herbaceous plant species are predominantly ephemeral. Above average rainfall was recorded in March 2007 as a result of several cyclones (Cyclones George, Jacob and Kara) passing close to Telfer (

Figure 1). Prior to this, rainfall recorded during the previous three summers was erratic, with high rainfall in March 2004 as a result of Cyclone Fay, followed by a summer of below average rainfall in 2004-05 and then an average summer in 2005-06.

The data for Figure 1 is from Bureau of Meteorology Station 13030 (Telfer).

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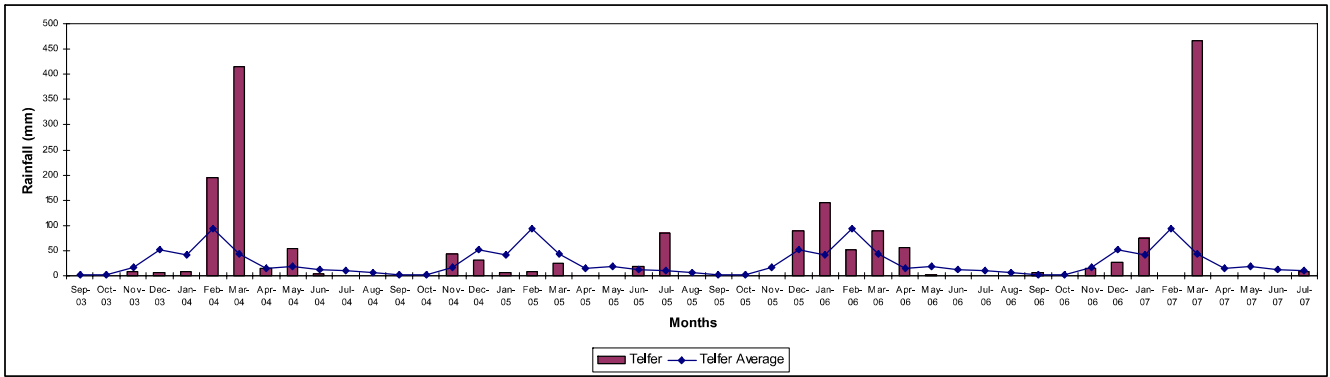


Figure 1 Actual and average rainfall recorded at Telfer between September 2003 and July 2007 (Bureau of Meteorology 2007)

2.0 METHODS

The approach taken for this survey was as follows:

1. Desktop review of the existing literature from previous reports and Department of Environment and Conservation, records of declared rare and priority flora and fauna, and threatened ecological community locations;
2. Field survey undertaken over 9 days from July 27th to August 3rd 2007.

2.1.1 Desktop Review

The desktop review examined the following reference material:

Ecologia (2003) Telfer Project-Power Supply and Infrastructure Corridor Rare and Priority Fauna and Flora Survey. Report Prepared for Newcrest Mining Limited.

Hart, Simpson and Associates Pty Ltd (1997) Telfer Minesite. Topsoil Areas Flora and Vegetation. Report Prepared for Newcrest Mining Limited.

Hart, Simpson and Associates Pty Ltd (2000) Telfer Satellite Pits, Access and Water Release Area. Ecological Survey. Report Prepared for Newcrest Mining Limited.

Hart, Simpson and Associates Pty Ltd (2002) Telfer Project Ecological Survey. Report Prepared for Newcrest Mining Limited.

Syrinx Environmental (2006) Telfer Waste Dump Expansion Flora and Fauna Survey. Prepared for Newcrest Mining Limited.

These reports, plus a search of the Declared Rare and Priority Flora list (DEC 2006) were used to compile a list of all potential Declared Rare and Priority Flora of the area, which are listed in Appendix 3.

A number of resources were used to determine potential fauna abundance on site. These included publications providing information on general patterns of distribution of frogs (Tyler et al. 2000), reptiles (Storr et al. 1983, 1990, 1999 and 2002; Wilson and Swan 2004), birds (Barrett et al. 2003; Storr, 1981) and mammals (Churchill 1998; Menkhorst and Knight 2001; Strahan 1995); and a number of previous fauna surveys from the region (Read, 1998; Burbidge and McKenzie, 1983; Hart, Simpson and Associates, 2000, 2002). Information was also extracted from several online databases:

- Birds Australia Bird Atlas II – Records of bird observations in Australia, 1995-present (searched within 21° to 22° S and 122° to 123° E).
- WA Museum Faunabase - Records of fauna specimens held in the WA Museum, including historical data (searched within 21° to 22° S and 122° to 123° E).
- Environment Protection and Biodiversity Conservation (EPBC) database - EPBC Protected Matters Search Tool (DEWR) - Records on matters protected under the

EPBC Act, including threatened species and conservation estate (searched within 21° 00' to 22° 30' S and 121° 30' to 123° 00' E).

These sources of information were used to create lists of fauna species expected to occur at the study site. As far as possible, expected species are those that are likely to utilise the study area, and such lists exclude species that have been recorded in the general region as vagrants or for which suitable habitat is absent.

2.2 VEGETATION SURVEY

2.2.1 Level of Assessment

The Telfer area lies within the Bioregion Group 4 (EPA 2004b). The scale and nature of impact of the proposal is considered moderate, therefore this survey is classified as a Level 1 under Guidance Statement No. 51 (EPA, 2004b). The survey is also a Level 1 Survey to comply with the DOIR requirements for information required to assess a clearing permit application under the Clearing of Native Vegetation Regulations 2004 and as part of a Notice of Intent, under the Mining Act 1978.

2.2.2 Vegetation Survey

Fieldwork was undertaken between July 26th and August 3rd 2007. The flora survey work was undertaken by Sandra Santich. Arthur Weston assisted with identifications of flora post-fieldwork.

Foot traverses were made of all vegetation types with dominant species noted and collected for confirmation of identification. Particular attention was made in the field to identify any of the DRF or Priority Flora listed in Appendix 3. Opportunistic collections were also made of uncommon species to ensure any potential Declared Rare or Priority Flora was collected.

The location of plots (north-west corner of each plot) and populations of any significant flora were recorded using GPS.

Upon collection, specimens were identified using a field herbarium created from specimens recently collected and identified in the area (verified at the WA Herbarium, Perth), and by comparing them with specimens in the Telfer and WA Herbarium. Most specimens were identified to species level, with ambiguous specimens identified to the genus level.

Confirmation of all species was made by Arthur Weston at the Western Australian Herbarium. Determination of species was also made by Leigh Sage, Bruce Maslin, Allan Lowrie, Paul Wilson and Rob Davis. Flora voucher specimens of all species collected will be submitted to the Western Australian Herbarium.

2.2.3 Limitations of Methods

As there was one survey effort, and was a Level 1 survey where only dominants were required, not all species would have been collected. Only annual dominants not present at the

time of survey would not have been collected. Due to the lack of rain in the two months previous to sampling some ephemeral species had very little vegetative material remaining.

2.3 FAUNA SURVEY

2.3.1 Level of Assessment

The Telfer area lies on the boundary of the Great Sandy Desert and Little Sandy Desert biogeographical regions (discussed in detail below). Both of these sites fall within the Group 4 Bioregions as described in the EPA's Guidance Statement No.56 (EPA, 2004a). As such, this report and survey are classified as a Level 1 Survey under the Guidance Statement No. 56 (EPA, 2004a). It is recommended under these guidelines that surveys include both a desktop study and a reconnaissance survey.

An extended reconnaissance survey was conducted from the 28th July – 3rd August 2007. Work carried out in the field included the following:

- Limited systematic trapping for reptiles and mammals;
- Spotlighting for nocturnal reptiles, birds and mammals;
- The use of ultra-sonic detector for bats;
- Hand searching for reptiles; and
- Opportunistic sightings of birds and other animals.

2.3.2 Fauna Survey

The fauna survey was undertaken by Brenden Metcalf. The fauna component of the field survey was conducted under DEC Regulation 17 licence number SF005962.

Taxonomy and nomenclature for fauna species used in this report generally follow publications made by the WA Museum (2001) for amphibians, reptiles and mammals, and Christidis and Boles (1994) for birds.

2.3.2.1 Trapping

Elliot traps were used to trap for reptiles and mammals at four locations within the study area. It should be noted that trapping effort was not distributed representatively over the site, with some vegetation types not being sampled (Table 1). Site C was surveyed at the request of the client to determine whether Mulgara were present in a location where Mulgara burrows had been sighted prior to the field trip. Each trap was baited with universal bait (rolled oats and peanut butter). For descriptions of the vegetation types see Section 3.2.

Table 1 Fauna trapping locations

Site	Co-ordinates	Trapping effort	Vegetation Type
A	51K 424369, 7594261	30 trap-nights	No. 3: Mixed Shrubland over <i>Acacia stellaticeps</i> open shrubland over <i>Triodia basedowii</i> grassland
B	51K	20 trap-nights	No. 10: Mixed shrubs over <i>Triodia schinzii</i>

	423360, 7592225		grassland
C	51K 4193820, 7593169	50 trap-nights	No. 3: Mixed Shrubland over <i>Acacia stellaticeps</i> open shrubland over <i>Triodia basedowii</i> grassland

2.3.2.2 Spotlighting

Spotlighting took place on three nights of the study and was carried out either on foot using head-torches (referred to as head-torching) or from a vehicle using the vehicle headlights. On all occasions, spotlighting began after sunset, when it was fully dark, and animals seen were counted, identified and, if necessary for identification, captured. Bats were surveyed through the use of an Anabat II Ultrasonic Detector during spotlighting. McKenzie *et. al.* (2002) was used as a guide for identifying bat calls.

2.3.2.3 Searching for Reptiles/Mammals

Searches for reptiles and mammals was carried out throughout the study area and involved raking through leaf-litter, breaking into dead trees, looking under bark and turning over rocks, logs and dead Spinifex.

2.3.2.4 Opportunistic Survey

At all times, observations of fauna were noted when they contributed to the accumulation of information to the site. These included casual observations of birds or reptiles seen while travelling between sites or to and from camp.

3.0 RESULTS

3.1 REGIONAL AND LOCAL CONTEXT

The regional and local context was previously described by Syrinx Environmental PL (2004 and 2006). To reiterate the significance of the location, the site lies within the Great Sandy Desert Region and within the Canning Botanical District (Beard 1974). The Telfer Mine is surrounded by dunes and vegetation is mapped as mixed shrub steppe between sand hills. The mapping was at a scale of 1:1,000,000 by Beard (1974).

Geologically the area is sandplain overlying lateritic sandstones and conglomerates, which are exposed locally. The general area is characterised by gently undulating plains dominated by longitudinal sub-parallel sand ridges known as seif dunes, aligned predominantly WNW-ESE conforming to the prevailing wind patterns. They are thought to have been formed during the last ice age approximately 15 000 years ago (Beard 1990).

The site lies on the boundary of two bio-geographical regions, the Mackay subregion of the Great Sandy Desert (Kendrick 2001) and the Trainor subregion of the Little Sandy Desert (Cowan and Kendrick 2001) and have been previously described in Syrinx Environmental PL (2006).

As described in Syrinx Environmental PL (2006), the vegetation of the dune ridges in this region is considered simple in species and structure and is extremely consistent. Dune slopes are similarly homogeneous, varying at a large scale due to differences in rainfall and temperature patterns (defined principally by the 22° latitude line). The depth of sand, presence of stony ground, fire history and presence of clay primarily influence the vegetation of the interdune swales.

Locations of the proposed borefield expansion area, including proposed locations of bores, and vegetation types are shown in Figure 2.

3.2 VEGETATION AND FLORA

A total of 112 taxa were recorded during this survey. Note, that as the survey was a level 1 survey a comprehensive species list was not required. The Priority Flora species recorded were *Goodenia hartiana* and tentative identifications made of *Dampiera atriplicina*. Descriptions of the *Goodenia hartiana* and potential *Dampiera atriplicina* populations are provided in Section 3.2.4.

The vegetation survey identified three broad landform units during the survey. These were:

- Sandplain (Swales) (9 vegetation types)
- Dune Crest and Slope (3 vegetation types)
- Rocky Outcrop (5 vegetation types)

These landform units are common regionally in the eastern Pilbara and Great Sandy Desert. A modified landform of topsoil stockpiles was also located within the survey area.

The vegetation types present were closely related to the landform types. The distribution of the vegetation types are shown in Figure 2 – 4 and described below.

All vegetation types are common regionally except the following vegetation types which were uncommon both in the study area and regionally:

- *Acacia aneura* and *Eremophila tietkensis* low open Shrubland over *Triodia basedowii* grassland. The dominant species of this vegetation type, *Acacia aneura* (Mulga), is typical of the Pilbara and is near its northern extent in the study area.
- The *Eucalyptus leucophloia* subsp. *leucophloia*/ *Corymbia candida* subsp. *dipsodes* Tall Woodland over *Acacia monticola* over mixed grass species was present only along drainage channels. The vegetation structure of a tall woodland is unusual regionally. The presence of the vegetation type is likely due to the water runoff provided by the adjacent rocky areas. Several species recorded were only found in this vegetation type.

In one location within the *Acacia stipuligera* tall shrubland over open low shrubland over *Triodia basedowii* vegetation type, the priority 2 species *Goodenia hartiana* was very common (>10, 000 plants). This site was within the western section of the study area and is of high conservation significance.

Figure 2 Vegetation map - western survey area

Figure 3 Vegetation map - eastern survey area

3.2.1 Sandplain Vegetation Types

Similar to Hart, Simpson and Associates (2002) and Syrinx Environmental (2006) the dominant vegetation type is the sandplain vegetation type dominated by *Triodia basedowii* with the overstorey changing in type and dominance depending on the soils present. The vegetation types recorded were also compared with those recorded by Hart and Associates (2002) and Syrinx Environmental (2006) in the adjacent proposed waste dump expansion area.

3.2.1.1 Sandplain over gravel vegetation types

Vegetation Type 1: *Acacia stellaticeps* open shrubland over *Triodia basedowii* grassland

Syrinx Environmental (2006): *Acacia stellaticeps* over *Triodia basedowii*

Vegetation Condition: Excellent

Regional Distribution: Very common

This vegetation type was very common and found in swales at the base of the rocky slopes throughout the study area (Figure 4). The substrate was sandy with occasional rocky areas. Whilst *Acacia stellaticeps* and *Triodia basedowii* were the dominant species present, other very occasional species included *Acacia ligulata*, *Acacia aluta*, *Gompholobium polymorphum*, *Pterocaulon sphacelatum* and *Goodenia stobbsiana*.



Figure 4 *Acacia stellaticeps* open shrubland over *Triodia basedowii* grassland

All areas present were in locations of mature vegetation which have not recently been impacted by fire.

Vegetation Type 2: Scattered *Corymbia opaca* and *Hakea lorea* over *Acacia stellaticeps* open shrubland over *Triodia basedowii*

Syrinx Environmental (2006): *Corymbia opaca* and *Hakea lorea* over *Triodia basedowii*

Vegetation Condition: Excellent

Regional Distribution: Very common

This vegetation community was located on the northern swale of the eastern section of the study area (Figure 5). Scattered overstorey species present included *Grevillea wickhamii*, *G. eriostachya* and *G. stenobotrya*, *Codonocarpus cotinifolius* and *Acacia wanyu*.

Common understorey species included *Jacksonia aculeata*, *Ptilotus polystachyus*, *Dampiera candidans*, *Newcastelia cladotricha*, *Dicrastylis georgei* and *Goodenia azurea* subsp. *hesperia*.



Figure 5 View from dune overlooking swale with scattered *Corymbia opaca* and *Hakea lorea* over *Acacia stellaticeps* open shrubland over *Triodia basedowii* grassland

Whilst not common within the study area, this vegetation type is regionally common in areas surrounding the study area where the swales are wider between dunes than what was present in the study area.

Vegetation Type 3: Mixed Shrubland over *Acacia stellaticeps* open shrubland over *Triodia basedowii* grassland

Syrinx Environmental (2006): n/a

Vegetation Condition: Excellent.

Regional Distribution: Very common

This vegetation type was not common within the study area but is common regionally. The dominant shrub species included *Acacia ancistrocarpa*, *Grevillea wickhamii*, *Acacia elecantha*, *Exocarpus sparteus* and *Senna glutinosa* subsp. *glutinosa* (Figure 6). Scattered understorey species included *Scaevola parvifolia* var. *pilbarea* and *Stylobasium spathulatum*. In open areas the vegetation type changed to Vegetation Type 1. Scattered *Corymbia candida* subsp. *dipsodes* were also present and delineated the boundary between Vegetation Types 3 and 8.



Figure 6 Mixed Shrubland over *Acacia stellaticeps* open shrubland over *Triodia basedowii* grassland with vegetation type 1 in the foreground

Vegetation Type 4: *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over mixed shrubland over *Triodia basedowii* grassland

Syrinx Environmental (2006): n/a

Vegetation Condition: Excellent

Regional Distribution: Common

Vegetation Type 4 was common in the western section of the study area. It was very similar to Vegetation Type 6 except the midstorey changed from mainly *Acacia ancistrocarpa* to a mixture of shrub species including *Grevillea eriostachya*, *Grevillea wickhamii*, *Mirbelia viminialis*, *Acacia stipuligera* and *Bonamia ?rosea* (Figure 7). Understorey species were also more diverse than Vegetation Type 6 with species such as *Goodenia stobbsiana* and *Acacia hilliiana*, reflecting the rockier substrate. Vegetation Type 4 was also regionally common in swales adjacent to rocky outcrops.

Several *Goodenia hartiana* populations were found within this vegetation type.



Figure 7 *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over mixed shrubland over *Triodia basedowii* grassland

3.2.1.2 Sandplain Vegetation Types

Vegetation Type 5: Scattered *Eucalyptus kingsmillii* subsp. *kingsmillii* and/or *Corymbia opaca* over *Acacia stipuligera* open shrubland over *Acacia stellaticeps* low open shrubland over *Triodia basedowii* grassland

Syrinx Environmental (2006): *Acacia stipuligera* shrubland

Vegetation Condition: Excellent

Regional Distribution: Very common

This was the most common vegetation type throughout most of the swales and is very common regionally (Figure 8). The *Acacia stipuligera* shrublands were densest in narrow swales, whilst in wider swales it was more scattered and in general confined to the edges of swales at the base of dunes.

Other scattered overstorey species included *Corymbia candida* subsp. *dipsodes* and *Hakea lorea*. In low lying areas *Jacksonia aculeata* became locally dominant. In areas where the canopy was more open *Gompholobium polymorphum* and *Scaevola parviflora* subsp. *pilbarea* became more common. In recently burnt areas *Goodenia azurea* subsp. *hesperia*, *Ptilotus polystachyus*, *Dampiera candidans* and *Newcastelia cladotricha* were very common.

Goodenia hartiana population 1 was recorded in a recently burnt area of this vegetation type which was surrounded by dense *A. stipuligera*.



Figure 8 Recently burnt area of scattered *Eucalyptus kingsmillii* subsp. *kingmillii* and/or *Corymbia opaca* over *Acacia stipuligera* open shrubland over *Acacia stellaticeps* low open shrubland over *Triodia basedowii* grassland

Vegetation Type 6: *Eucalyptus kingsmillii* subsp. *kingmillii* low open woodland over mixed shrubland over *Triodia basedowii* grassland

Syrinx Environmental (2006): n/a

Vegetation Condition: Excellent

Regional Distribution: Very common

In the widest swales this vegetation type replaced Vegetation Type 4. The mid storey was more diverse than Vegetation Type 4 and consisted of a mixture of species including *Acacia ancistrocarpa*, *Eucalyptus odontocarpa*, *Aluta maissoneuvei* subsp. *maissoneuvei*, *Grevillea wickhamii* and *Grevillea eriostachya* (Figure 9). All understorey species were the same as Vegetation Type 4. In localised areas where the substrate had more gravel *Acacia stellaticeps* was the dominant understorey species.



Figure 9 View from dune overlooking *kingsmillii* subsp. *kingmillii* low open woodland over mixed shrubland over *Triodia basedowii* grassland

Vegetation Type 7: *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Acacia ancistrocarpa* shrubland over *Triodia basedowii* grassland

Syrinx Environmental (2006): Mixed Acacia's over *Triodia basedowii*

Vegetation Condition: Good to degraded

Regional Distribution: Common

Vegetation Type 6 was very common in the swales of the western section of the study area, including the areas surrounding the temporary diversion ponds (Figure 10). Whilst *Acacia ancistrocarpa* was the most dominant species other mid storey species occasionally present included *Grevillea eriostachya*, *Grevillea wickhamii*, *Acacia stipuligera*, *Calytrix carinata*.

In the study area, Vegetation Type 6 was common in swales adjacent to rocky outcrops and disturbed areas close to the minesite.



Figure 10 *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Acacia ancistrocarpa* shrubland over *Triodia basedowii* grassland

3.2.1.3 Clayey Sandplain Vegetation Types

Vegetation Type 8: *Acacia aneura* and *Eremophila tietkensis* low open shrubland over *Triodia basedowii* grassland

Syrinx Environmental (2006): n/a

Vegetation Condition: Very Good

Regional Distribution: Uncommon

Vegetation type 8 was restricted within the study area; both locations present were characterised by scattered bands of the dominant overstorey species, *Acacia aneura*, among the large mainly bare areas comprising a mixture of small annual species (Figure 11).

The two locations surveyed appeared to have a more sandy clay substrate compared to surrounding swale areas which were predominantly sandy or sand with gravel. *Acacia aneura* (Mulga), while very common in the Pilbara, is close to the northernmost extent of this species.



Figure 11 *Acacia aneura* and *Eremophila tietkensis* low open shrubland over *Triodia basedowii* grassland

Vegetation Type 9: *Corymbia opaca* *C. candida* subsp. *dipsodes* woodland over *Acacia monticola* tall open shrubland over mixed grassland

Syrinx Environmental (2006): n/a

Vegetation Condition: Very Good

Regional Distribution: Uncommon

Vegetation Type 9 was mainly present at locations which were the main areas which received rainfall runoff from the adjacent rocky outcrops (Figure 12). Several species only present in this community type included *Acacia monticola*, a dominant mid storey species in both occurrences of this vegetation type, and *Trachymene oleracea*.

This vegetation had the highest weed diversity and abundance of Buffel Grass (*Cenchrus ciliaris*) compared to the rest of the survey area. This is likely a result of camels using the areas for shelter and possibly also reflects the wetter conditions.



Figure 12 *Corymbia opaca* *C. candida* subsp. *dipsodes* woodland over *Acacia monticola* tall open shrubland over mixed grassland

3.2.2 Sand Dune Vegetation Type

Vegetation Type 10: Mixed shrubs over *Triodia schinzii*

Syrinx Environmental (2006): Mixed shrubs on dunes

Vegetation Condition: Excellent

Regional Distribution: Very common

This was the common vegetation type on dunes throughout the study area. Common shrub species included *Otton simplicifolium*, *Dampiera atripliciana*, *Dicrastylis doranii*, *Grevillea stenobotrya* and *Aluta maissoneuvei* subsp. *maissoneuvei* (Figure 13). *Acacia melleodora*, a tall spindly shrub to 2m, was common on mixed shrub dunes in the western survey area. Grass species present included *Aristida holathera* var. *holathera* and *Eragrostis eriopoda*.

Uncommon species include *Acacia tenuissima* which was collected on a dune with localised disturbance near topsoil stockpiles.



Figure 13 Mixed shrubs over *Triodia schinzii*

Vegetation Type 11: Scattered *Corymbia chippendalei* over mixed shrubland over *Triodia schinzii* grassland

Syrinx Environmental (2006): n/a

Vegetation Condition: Excellent

Regional Distribution: Very common

Vegetation Type 11 was very similar to Vegetation Type 10 with the only difference being the presence of scattered *Corymbia chippendalei* (Figure 14). All dunes except one had been burnt within the previous few years.



Figure 14 Scattered *Corymbia chippendalei* over mixed shrubland over *Triodia schinzii* grassland (burnt within 5 years)

The remaining mature dune which had not been burnt had less diverse shrub species present and *Triodia schinzii* dominated the understorey (Figure 15). Species not present on other dunes included *Acacia ligulata* and *Crotolaria cunninghamii*.



Figure 15 Scattered *Corymbia chippendalei* over mixed shrubland over *Triodia schinzii* grassland (not burnt within 5 years)

Vegetation Type 12: *Grevillea stenobotrya* shrubland over *Triodia schinzii* grassland

Syrinx Environmental (2006): n/a

Vegetation Condition: Excellent

Regional Distribution: Uncommon

This vegetation type was present on one low dune which had been recently burnt and the regrowth was dominated by *Grevillea stenobotrya* (Figure 16). Although it is uncommon regionally, it is possibly a successional community and as the vegetation matures it is likely to become more like Vegetation Type 11.



Figure 16 *Grevillea stenobotrya* Shrubland over *Triodia schinzii* grassland

3.2.3 Rocky Outcrop Vegetation Type

3.2.3.1 Typical Rocky Outcrops

Vegetation Type 13: *Triodia schinzii* grassland

Syrinx Environmental (2006): *Triodia schinzii* grassland

Vegetation Condition: Excellent

Regional Distribution: Very common

The main difference between the rocky outcrops from the surrounding sandplain areas was the change in dominance of *Triodia* species with *Triodia schinzii* becoming the dominant species replacing the sandplain dominant *T. basedowii* (Figure 17).



Figure 17 *Triodia schinzii* grassland

Other occasional species included *Eucalyptus leucophloia* subsp. *leucophloia*, *Goodenia triodiophylla*, *Ptilotus polystachyus*, and *Acacia wanyu*, which was locally common in protected pockets of the outcrop. Most species found on the rocky outcrops were not present in the surrounding sandplain areas.

On the largest rocky outcrop along the southern boundary *Goodenia stobbsiana* was locally dominant on the lower slopes.

Vegetation Type14: Scattered shrubs over *Triodia basedowii* grassland

Syrinx Environmental (2006): n/a

Vegetation Condition: Excellent

Regional Distribution: Very common

Present on low rocky slopes at the eastern extent of the study area. Other common species include *Amphipogon caricinus* var *caricinus*, *Goodenia stobbsiana*, *Grevillea wickhamii*, *Goodenia azurea* subsp. *hesperia* (Figure 18).

Some localised disturbance was present on the rocky outcrops where gravel has been removed, in these locations the same suite of species was present but at a lower density.

This vegetation type was not typical of other rocky outcrops as many sandplain species were still dominant such as *Triodia basedowii*, *Goodenia azurea* subsp. *hesperia*, *Jacksonia aculeata*, *Dampiera candidans* and *Halgania solanaceae* var. *solanaceae*.



Figure 18 Scattered shrubs over *Triodia basedowii* grassland

Vegetation Type 15: Scattered shrubs over mixed *Triodia* grassland

Syrinx Environmental (2006): *Triodia schinzii* grassland

Vegetation Condition: Excellent

Regional Distribution: Very common

Vegetation Type 15 was present on low rocky areas in the western extent of the study area. Although similar in structure to Vegetation Type 14, the scattered shrubs present were species restricted to the rocky outcrops and did not include the sandplain species present in Vegetation Type 14 (Figure 19). The scattered shrubs included *Acacia robeorum*, *A. acradenia*, *Tribulus suberosus* and *Senna sericea*.

Triodia species present included *Triodia basedowii* and *T. schinzii* and *T. epactia*



Figure 19 Scattered shrubs over mixed *Triodia* grassland

Vegetation Type 16: Scattered *Eucalyptus leucophloia* subsp. *leucophloia* over *Senna glutinosa* subsp. *luerssenii* over *Triodia basedowii*

Syrinx Environmental (2006): n/a

Vegetation Condition: Excellent

Regional Distribution: Common

This vegetation type was on the main drainage lines on all large rocky outcrops (Figure 20). All species were present elsewhere on the rocky outcrops but were denser along drainage channels. Species present included *Acacia stipuligera*, *Senna sericea*, *Acacia robeorum*, *Grevillea wickhamii* and *Corymbia opaca*.



Figure 20 *Eucalyptus leucophloia* subsp. *leucophloia* over *Senna glutinosa* subsp. *luerssenii* a over *Triodia basedowii*

3.2.3.2 White quartzite scree slopes

Vegetation Type 17: Scattered shrubs over *Triodia epactia* grassland

Syrinx Environmental (2006): n/a

Vegetation Condition: Excellent

Regional Distribution: Common

Vegetation Type 17 was found on the only white quartzite scree slopes in the study area (Figure 21). The vegetation present was slightly different to the rest of the rocky outcrops, distinguished by the *Triodia epactia* species present plus *Scaevola ?amblyanthera*, not found on the other rocky outcrops. Other occasional species included *G. wickhamii*, *Acacia robeorum*, *Eremophila latrobea* subsp. *latrobea*.

The base of the quartzite scree slopes/siltstone hill outcrops were dominated by *Acacia stellaticeps* closed shrubland.



Figure 21 Scattered shrubs over *Triodia epactia* grassland

3.2.4 Modified Vegetation Type

Vegetation Type 18: Mixed shrubland

Syrinx Environmental (2006): n/a

Vegetation Condition: Excellent

Regional Distribution: n/a

This vegetation type was present on topsoil stockpiles near the tailings dam within the eastern survey area (Figure 22). It is a modified vegetation type as the species present were a mixture of the landforms the topsoil stockpiles originated from. Species present included typical swale and dune species. Dominant species present included *Acacia stipuligera*, *A. ancistrocarpa*, *A. stellaticeps*, *Jacksonia aculeata*, *Otton simplicifolium*, *Triodia schinzii*, *T. basedowii*, *Eragrostis eriopoda*, *Dampiera candidans* and *Gompholobium polymorphum*.



Figure 22 Mixed shrubland

3.2.5 Significant Flora

The Priority 2 species, *Goodenia hartiana* was located at 12 locations within the surveyed area. The location and population sizes are listed in Table 2. The projection was AMG Zone 51 (AGD 94). Photos of each population are shown in Figure 23 to 34.

Most populations were located west of the existing mine site, generally on the lower slopes of rocky outcrops, but within nearly all vegetation types with *Acacia stipuligera* Shrubland as part of the mid-storey in areas of sand over rock (Vegetation Types 4 and 7). The superficially similar species *Goodenia azurea* subsp. *hesperia* species was common throughout the entire study area within dune swales but was not common in the areas that *Goodenia hartiana* was located.

Note that this species recently changed names (Sage 2006). In Syrinx Environmental (2006) *Goodenia hartiana* was referred to by its previous temporary name (*Goodenia* sp. Rudall River).

Table 2 *Goodenia hartiana* and *G. ?hartiana* populations

Population Number	Population Size	GPS Location (AMG Zone 51 AGD 94)	Notes
1*	2	0422311, 7590980	At northern base of dune under <i>A. stipuligera</i>
2*	22	0418672, 7591427	Small recently burnt area within a larger area of mature vegetation in the middle of a dune swale
3*	>200	0413926, 7600135	Along old exploration tracks through a sandy area at the base of a rocky outcrop
4*	100	0413772, 7600153	In an area of mature vegetation of <i>Acacia stipuligera</i> over mixed shrubs
5*	100	0413793, 7600216	As above
6*	30	0413869, 7600178	As above
7	500	0414303, 7600732	As above
8	>10,000	0414414, 7600043	Over a large area between rocky outcrops where there is sand over rock and localised disturbance, mainly old exploration tracks.
9	6	0413662, 7600062	Edge of road along bore line
10	30	0414758, 7600278	At the base of the rocky outcrop along old exploration tracks
11	~200	0414826, 7600441	Along either side of a main track at the base of the large rocky outcrop
12	~500	0414399, 7600552	Within a dune swale underneath <i>A. stipuligera</i> .
Total	~ 12, 000		

* = *Goodenia ?hartiana* population

The Priority 2 species *Dampiera atriplicina* was tentatively identified at two locations, with a population of two plants in total. Both specimens were located on the top of dune crests in the eastern section of the study area. Due to lack of flowering material, the specimens have been tentatively identified. As the specimens were opportunistically collected GPS locations were not recorded, however locations are shown in Figure 3.

Table 3 *Dampiera ?atriplicina* populations

Population Number	Population Size	Notes
1	1	On top of a mixed shrub dune
2	1	On top of low dune which had been recently burnt and was dominated by <i>Grevillea stenobotrya</i>



Goodenia ?hartiana

Figure 23 *Goodenia ?hartiana* Population 1



Goodenia ?hartiana

Figure 24 *Goodenia ?hartiana* Population 2



Figure 25 *Goodenia ?hartiana* Population 3



Figure 26 *Goodenia ?hartiana* Population 4



Figure 27 *Goodenia ?hartiana* Population 5

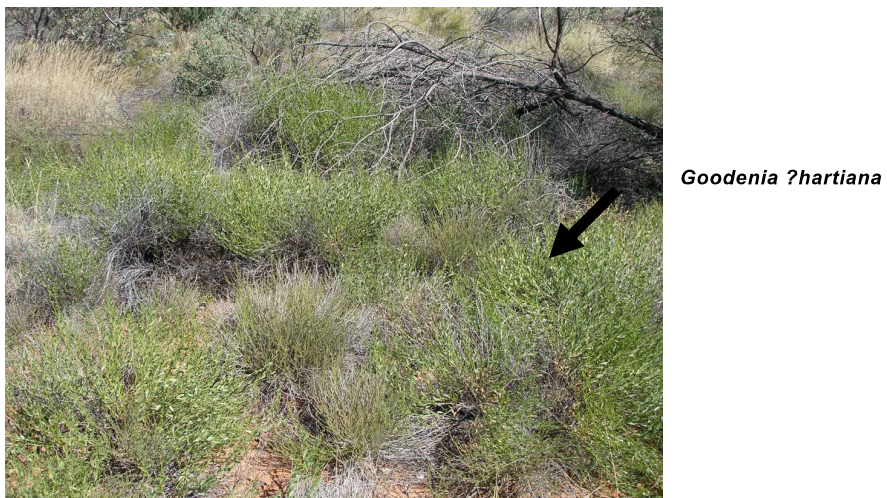


Figure 28 *Goodenia ?hartiana* Population 6



Figure 29 *Goodenia hartiana* Population 7



Figure 30 *Goodenia hartiana* Population 8



Figure 31 *Goodenia hartiana* Population 9



Figure 32 *Goodenia hartiana* Population 10



Figure 33 *Goodenia hartiana* Population 11



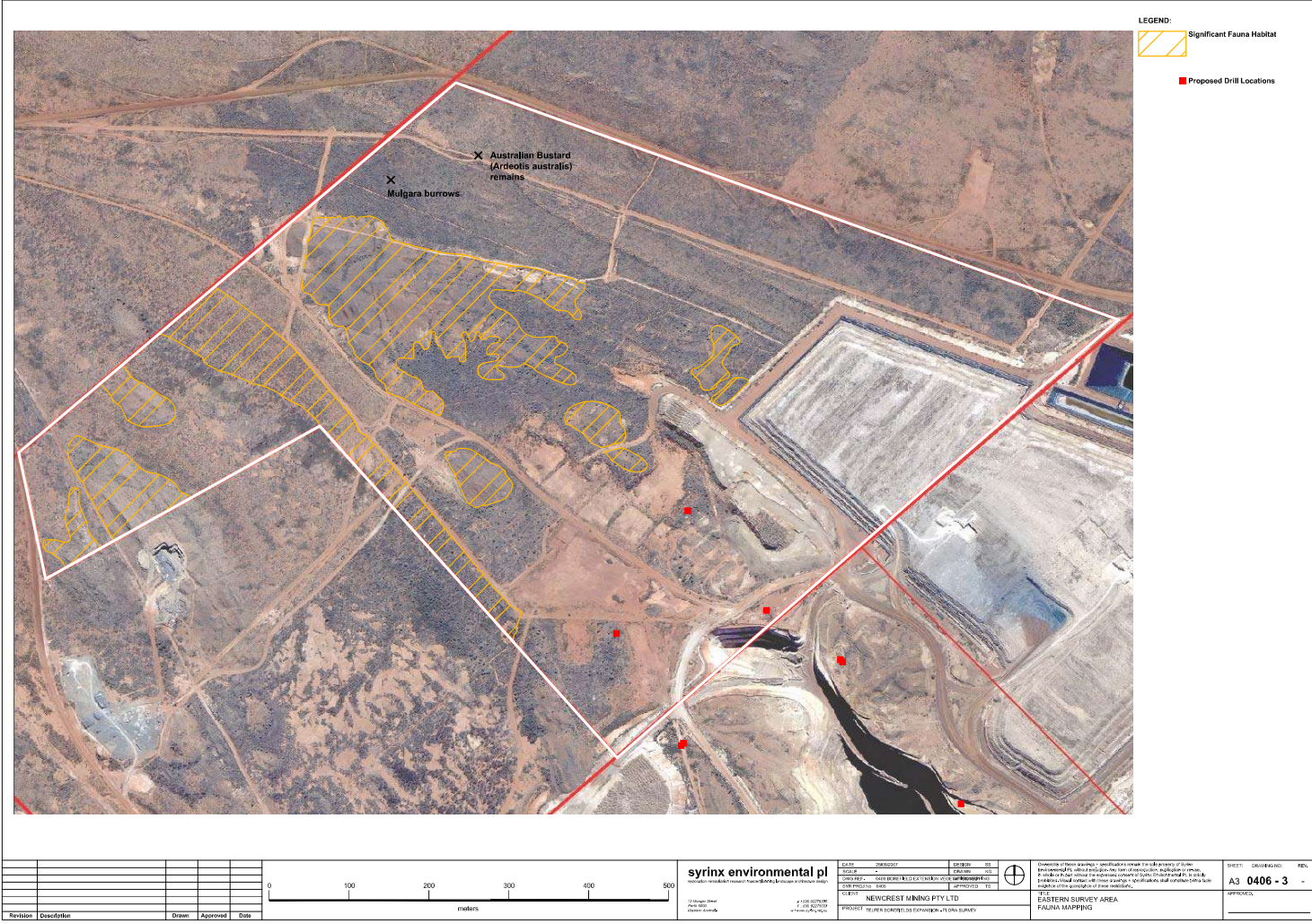
Figure 34 *Goodenia hartiana* Population 12



3.3 VERTEBRATE FAUNA

On the basis of known species distributions and habitats available, there are 238 species of vertebrate fauna that may be expected to occur in the proposed borefield extension area with 59 recorded during the July/August 2007 assessment. This includes 8 frogs, 96 reptiles, 100 birds and 34 mammals (26 native and 6 introduced mammals). A list of all species expected and those species considered extinct from the region are provided in Appendix 4. Of the species expected, 14 are considered to be conservation significant.

Lists of species recorded during field work are provided in Tables 2 – 5. Locations of significant fauna and trapping sites are shown in Figure 35 and 36.

**Figure 35 Trapping sites and significant fauna locations and trapping sites-
western survey area**



LEGEND:
 Significant Fauna Habitat
 Proposed Drill Locations

X Australian Bustard
(*Ardeotis australis*)
remains
 X Mulgara burrows

Revision	Description	Drawn	Approved	Date



syrix environmental pl
 syrix environmental planning & environmental services
 11 Maitland Street
 Sydney NSW 2000
 Australia
 Phone: +61 (0)2 9550 1000
 Fax: +61 (0)2 9550 1001
 Email: info@syrix.com.au

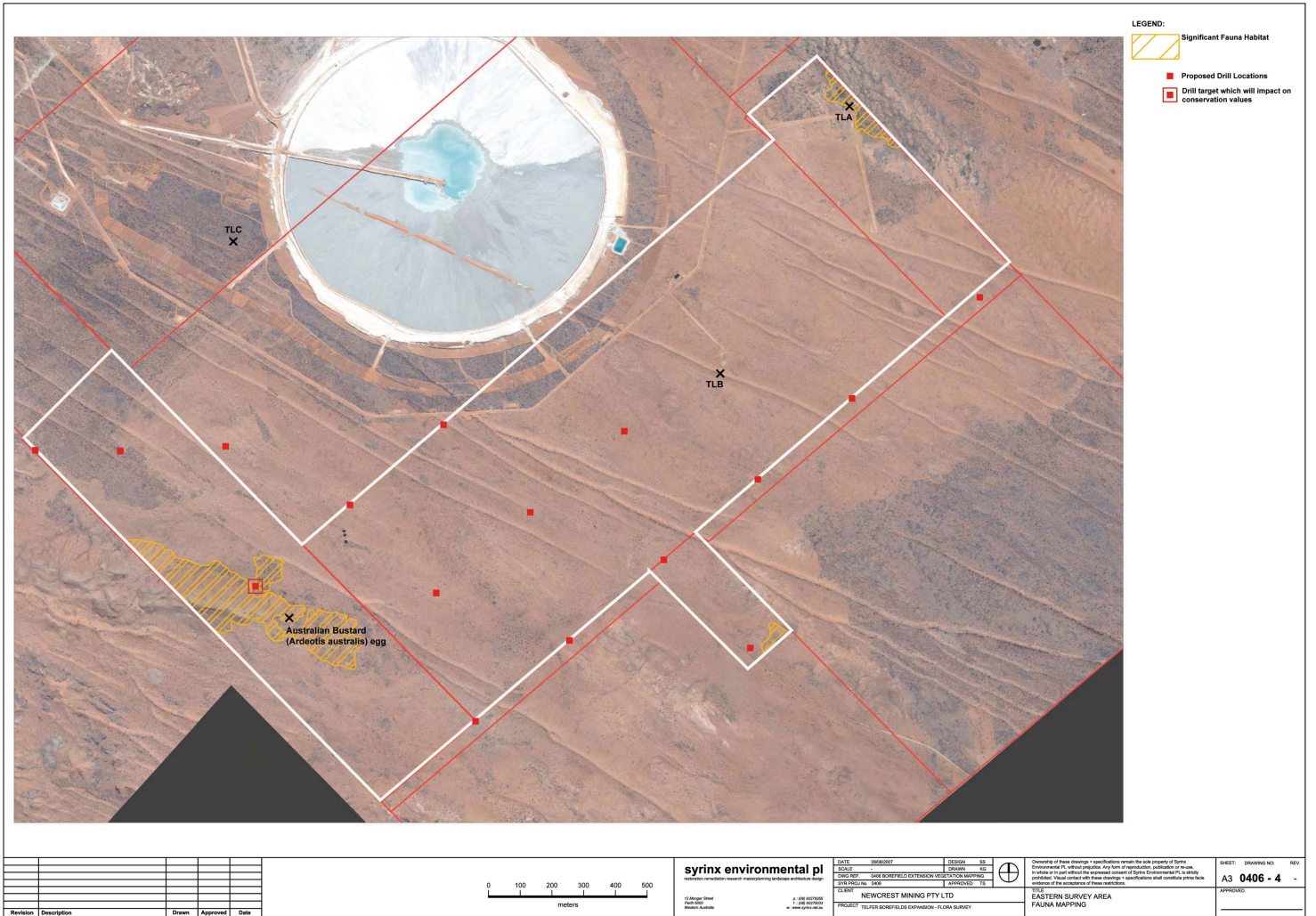
DATE: 20/03/2017
 DRAWN BY: J. BROWN
 CHECKED BY: J. BROWN
 CLIENT: NEWCREST MINING PTY LTD
 PROJECT: TELEREX CONTROLLED EXPANSION - TELEREX SURVEY

Consent to these planning identification maps for the purposes of environmental planning and environmental assessment, including to ensure that the proposed development is consistent with the relevant planning instruments and that the proposed development is consistent with the relevant planning instruments and that the proposed development is consistent with the relevant planning instruments.

TELEREX SURVEY AREA
 FAUNA MAPPING

SHEET: DRAWING NO: 0406 - 3
 APPROVALS:

**Figure 36 Trapping sites and significant fauna locations and trapping sites-
eastern survey area**



3.3.1 Mammals

A total of 32 mammal species (26 native, six introduced) are expected to occur in the study area, of which six species were recorded during the site visit (refer to Appendix 4). This included one dasyurid, two native rodents, the Dingo, the Feral Cat and the Feral Camel.

Although no species of conservation significance were directly recorded during the survey, possible *Mulgara* burrows were found in a number of areas. Many of the areas of swale vegetation, with an understorey of mature spinifex, appear suitable for this species, in particular the sandplain over gravel vegetation types of 1 to 5. Recently abandoned burrows that probably belonged to this species were recorded from the northern section of the north-western study area (Table 4).

4 burrows within a 10m radius of the GPS point.

Hart, Simpson and Associates (2002) recorded 15 mammals from the area, including 12 native species and three introduced species.

Table 4 Mammal species recorded within the borefield expansion area

Name	Common Name	Vegetation Type No.	Notes	Significant	GPS location
<i>Dasyercus cristicauda</i>	Mulgara	5	Recently abandoned burrows found in mature vegetation at the north-western site	✓	413719 7600862 (4 burrows within a 10m radius)
<i>Dasykaluta rosamondae</i>	Little Red Kaluta	1	Two caught just outside of study area but in habitat represented within the study area		
<i>Notomys alexis</i>	Spinifex Hopping-mouse	5	At least one seen near entrance to Big Tree Rd during night-spotting and two caught near proposed topsoil stockpile area just outside of study area		
<i>Pseudomys desertor</i>	Desert Mouse	1	Several caught in Elliott traps		
<i>Canis familiaris dingo</i>	Dingo		Several seen around camp and throughout the site.		

<i>Felis catus</i>	Feral Cat		Prints and scats seen across the site.		
<i>Camelus dromedarius</i>	Feral Dromedary, Camel		Tracks recorded across the site, and several groups of 1-9 seen throughout the site		

Table 5 Captures from the Telfer study area

Date	Species	Crown (mm)	Age/Sex	Trapping Site
28/7/07	<i>Pseudomys desertor</i>	30	Pregnant Female	A
2/8/07	<i>Notomys alexis</i>	33.4	Sub-adult Male	E
3/8/07	<i>Notomys alexis</i>	30.8	Adult Female	E
3/8/07	<i>Dasykaluta rosamondae</i>	29	Sub-adult Female	E
3/8/07	<i>Dasykaluta rosamondae</i>	30	Adult Male	E

3.3.2 Reptiles

A total of 96 reptile species may occur in the study area, with 10 recorded during the site visit (Table 6). The Central Military Dragon *Ctenophorus isolepis* was the most commonly seen species, occurring throughout the site except for areas of rocky habitat. The low number of reptile species recorded reflects the low trapping effort and the limited time spent searching through microhabitat. Previous work by Hart, Simpson and Associates (2002) recorded 38 reptile species from the area.

Neither conservation significant reptile species potentially present in the area, the Great Desert Skink and Woma (see Appendix 4) were recorded during the survey

Table 6 Reptile species recorded within the borefield area

Common Name	Name	Notes
Beaked Gecko	<i>Rhynchoedura ornata</i>	Juvenile specimen found during spotlighting at the base of dune with mature vegetation (SE study area)
Blue-lined Dragon	<i>Diporiphora winneckeii</i>	One observed on pipeline access road.
Burton's Legless Lizard	<i>Lialis burtonis</i>	One recorded under spinifex spoil-heaps
Bynoe's Gecko	<i>Heteronotia binoei</i>	Several recorded under spinifex spoil-heaps
Central Military	<i>Ctenophorus isolepis</i>	The most commonly seen reptile on site

Dragon			
Central Dragon	Netted	<i>Ctenophorus nuchalis</i>	One recorded from rocky hill-slopes
Jewelled Gecko		<i>Strophurus elderi</i>	Several recorded under spinifex spoil-heaps
Leopard Ctenotus		<i>Ctenotus pantherinus</i>	One found spotlighting on sand dune
Monitor Lizards		<i>Varanus</i> spp.	Numerous diggings, seen throughout the site, predominantly in more mature vegetation.
Ringed Snake	Brown	<i>Pseudonaja modesta</i>	One seen along old access rd adjacent to the NW study area. Individual had a total length of approximately 450mm.

3.3.3 Birds

A total of 99 bird species may commonly occur in the study area (see Appendix 4), of which 46 were recorded during the site visit. The most commonly recorded bird species were the Budgerigar, Zebra Finch and the Diamond Dove. Hart, Simpson and Associates (2002) recorded a total of 50 bird species from the study area.

A total of six of the bird species that are expected to occur in the study area are considered to conservation significant, with two of these, the Peregrine Falcon and the Australian Bustard, recorded within the borefield expansion area (Table 7). It is expected that most of these species may occur in the study area on a periodic basis, in response to food availability.

The impact of fire on birds was noticeable within the study areas. Areas of early-succession vegetation supported a noticeable depauperate bird fauna compared to areas of more mature vegetation. Within early-succession areas the nectarivore guild was only represented by Singing Honeyeaters and Brown Honeyeaters, whereas an almost complete quota of expected honeyeater species (eight) was recorded from areas of mature vegetation. White-winged Fairy-wrens were moderately common throughout site, whereas Variegated Fairy-wrens were only recorded from mature vegetation types. These observations highlight the importance of having a mosaic of different aged vegetation types to support a complete assemblage of fauna species.

Table 7 Bird species recorded within the borefield expansion area

Common Name	Notes	Significant
Australian Bustard	Egg-shell found near rocky hills , remains found in mature shrubland vegetation of the NW study area	✓
Black Honeyeater	Heard and seen mainly in mature vegetation types of the study areas. Not very common; only pairs or individuals seen occasionally.	

Black-faced Cuckoo-Shrike	Groups of 2-3 seen around site, mainly over mature vegetation.	
Black-faced Woodswallow	Common over site, in flocks of 4 - 20.	
Black-fronted Dotterel	Several seen around old tailings diversion ponds (NW study area).	
Black-shouldered Kite	Several seen around mine site, including near mine administration block and over mature vegetation near the tailings dams	
Brown Falcon	Several seen throughout site	
Brown Goshawk	One seen along pipeline access road	
Brown Honeyeater	Common but not abundant in all vegetation types throughout the site.	
Budgerigar	Abundant around site with flocks of 1-100+ seen in all habitat types.	
Cockatiel	Several flocks of ~10-15 seen passing through the SE site.	
Collared Sparrowhawk	One seen in mature vegetation near the tailings dam	
Common Bronzewing	Several seen around camp and occasionally around the NW study area in all habitat types.	
Common Greenshank	One seen around old tailings diversion ponds	
Crested Pigeon	Flocks of two - eight seen around site in all habitat types.	
Crimson Chat	Several birds recorded from regrowth vegetation types of the southern study area.	
Diamond Dove	Very common throughout the site; usually seen in pairs.	
Fairy Martin	Small flocks seen over the NW site.	
Galah	Flocks of 2-40 seen around camp and site occasionally.	
Grey-headed Honeyeater	Very common in mature vegetation types of the study areas. Active cup-nest with two eggs found in <i>Acacia ancistrocarpa</i> shrub near tailings diversion dam within the NW study area.	
Horsfield's Bronze-Cuckoo	Several heard around site; does not appear restricted to particular habitat types.	
Little Button-quail	Several seen around site, usually seen as pairs in rocky spinifex areas	
Magpie-Lark	Common around camp, and several pairs seen around	

	site.	
Masked Woodswallow	Common over site, in flocks of 10 - 25.	
Nankeen Kestrel	Several seen throughout site	
Painted Finch	Several pairs seen over rocky hills at the NW study area.	
Pallid Cuckoo	One heard near mature vegetation near the tailings dam (SE study area).	
Peregrine Falcon	One seen over mature vegetation near tailings dam	✓
Pied Honeyeater	Heard and seen mainly in mature vegetation types of the study areas. Not very common; only pairs or individuals seen occasionally.	
Rainbow Bee-eater	Several heard over Acacia shrubland in NW study area; in close association with an old sand mining quarry, probably used for nesting.	
Red-backed Kingfisher	Several pairs seen, mainly on powerlines over dunes in the SE study area, but also over mature shrubland with spinifex understorey habitat in the NW study area.	
Rufous Songlark	Several birds seen throughout the site.	
Singing Honeyeater	Very common throughout site in all vegetation types.	
Spinifex Pigeon	Usually seen in pairs, often in association with rocky, spinifex covered hills.	
Spiny-cheeked Honeyeater	Heard and seen along drainage line near rocky hills in the SE study area, and occasional birds heard throughout the NW study area.	
Spotted Harrier	Several (possibly all the one individual) seen occasionally over mature vegetation near the tailings dam	
Spotted Nightjar	One heard near site A whilst spotlighting and another seen along Big Tree Rd the following night during spotlighting.	
Torresian Crow	Several birds seen throughout site.	
Variegated Fairy-wren	Several groups heard and seen in mature swale vegetation throughout the study areas (31/7, 1/8).	
Whistling Kite	One seen over site	
White-backed Swallow	Several recorded from over mature vegetation in the NW study area; in close association with an old sand quarry.	
White-plumed Honeyeater	Small groups seen in drainage line habitat of the north-western study area.	
White-winged	Heard and seen, mainly along the base of dune systems	

Fairy-wren	in the south-west portion of the SE study area.	
Willie Wagtail	Common in all habitats around site.	
Yellow-throated Miner	Abundant around camp. Small groups seen mainly in mature vegetation types within the study areas.	
Zebra Finch	Abundant around site, flocks of 100+ seen.	

3.3.4 Frogs

A total of eight frog species may occur in the study area (see Appendix 4) although none were recorded during the July/August 2007 survey. Previous work by Hart, Simpson and Associates (2002) recorded four frog species from the area.

4.0 DISCUSSION

4.1 CONSERVATION VALUES

The conservation value of this region of the Great Sandy Desert is high because of a large number of biodiversity assets (particularly the presence of rare and endangered fauna), and pristine condition of the area.

The vegetation condition of most of the area is excellent with few weed species recorded during the survey (Appendix 2). Localised disturbance was present in areas close to the minesite where temporary diversion dams were constructed and along edges of existing infrastructure corridors.

Vegetation and floristic conservation values are not considered regionally significant within the study area as they are adequately represented elsewhere in the region, although two of the vegetation types are regionally uncommon, one due to its position in the landscape along drainage channels and the second due to a dominant species being present at its northernmost extent

The Priority 2 species, *Goodenia hartiana* was recorded at 6 locations, with a total population of greater than 10,000 plants. An additional 6 populations were identified tentatively due to lack of flowering material present at the time of survey.

The Priority 2 species *Dampiera atriplicina* was tentatively identified at two locations on top of sand dunes in the eastern section of the survey area. A population of two plants was located.

The fauna conservation values are high due to the presence of suitable habitat for at least one vulnerable species.

Conservation values of the site relate mainly to the following biodiversity assets:

Rare plants and animals

- Presence of the Priority 2 species *Goodenia hartiana* and *Dampiera atriplicina*.
- Presence of habitat suitable for 14 conservation significant fauna species, including the Mulgara.

These are the most significant conservation values identified within the study site.

Special living assemblages, such as samples of local ecotypes, sites with a high level of endemism, unusual associations of plants, sites of unusually high species diversity

- Presence of unusual associations of plants – Vegetation Type 8: *Acacia aneura* and *Eremophila tietkensis* low open Shrubland over *Triodia basedowii* grassland is uncommon in the region, being at the northern extent of the distribution of *Acacia aneura* (Mulga).
- The rocky outcrop and drainage line habitats potentially support short-range endemic invertebrates.

The proposed locations of the bores do not impact on the two locations of the uncommon *Acacia aneura* vegetation type 8. One bore location will impact on the rocky outcrop and drainage line habitat, near the southern boundary of the eastern survey area.

4.2 ENVIRONMENTAL IMPACTS AND RECOMMENDATIONS

4.2.1 Landforms, Vegetation and Flora

Impacts

In no instance does the proposed borefield fully displace a landform or vegetation unit, species habitat, or species population.

None of the proposed drill locations impact directly on the regionally uncommon vegetation types, although one drill target is located within 50m at the base of the large rocky outcrop on the southern boundary of the eastern survey area (Figure 3).

All vegetation associations surveyed in the study areas are considered regionally common, except

- Vegetation Type 8: *Acacia aneura* and *Eremophila tietkensis* low open shrubland over *Triodia basedowii* grassland, which is at the northernmost extent of its distribution and uncommon in the Telfer region, and
- Vegetation Type 9: *Corymbia opaca* *C. candida* subsp. *dipsodes* Tall Woodland over *Acacia monticola* tall open Shrubland over mixed grassland, which is present along drainage channels which are uncommon in the Telfer region

The proposed borefield bore locations will not directly impact on the 12 populations of *Goodenia hartiana*. *Goodenia hartiana* appears to prefer areas of sand near the base of rocky outcrops with an overstorey of *Acacia stipuligera*. These areas should be avoided for the roads and infrastructure required for the borefield. It is likely that when the populations are

lodged at the Western Herbarium the Priority listing will change to a lower DEC priority category (*L. Sage pers. comm.*).

The proposed borefield bore locations will not directly impact on the 2 populations of tentatively identified *Dampiera atriplicina*.

Impacts will be localised and related to clearing of vegetation required for bore installation, pipes, roads etc

Recommendations

- The drill target at the base of the rocky outcrop on the southern boundary of the eastern survey area should not be used to avoid impact on Vegetation Type 9.
- Any proposed infrastructure such as roads should avoid
 - the areas of regionally uncommon vegetation types listed above; and
 - the base of rocky outcrops where *Acacia stipuligera* shrubland (Vegetation type 4) is present, as this is the preferred habitat of *Goodenia hartiana*
- As distribution of *Goodenia hartiana* is becoming better understood through several vegetation surveys around the immediate area of the minesite, it is recommended a targeted Telfer regional survey for *Goodenia hartiana* is undertaken to provide a better understanding of its actual distribution and conservation significance.
- As *Dampiera atriplicina* is restricted to the top of sand dunes, if any proposed access roads to the bores are to traverse sand dunes, surveys of this species should be undertaken prior to construction. If any are found the proposed route should be modified to avoid the species.

4.2.2 Fauna

Impacts

Some linear habitat types e.g. dunes and drainage lines, are likely to act as corridors and barriers (in the case of dunes) for fauna movement. Disruption to these habitat types could alter the way in which species move through the study area. Additionally, regular traffic along such roads may result in increased roadkills which would impact on population viability of some species.

The clearing of corridors is expected to increase the movement of introduced fauna within the study area e.g. feral cats and camels.

Restricted habitats e.g. drainage lines and rocky hills, are likely to support a higher diversity of fauna compared to more common habitats. As a consequence, any impact to these areas is likely to have a relatively greater impact on local biodiversity.

The sand dunes also provide habitat, which potentially support a large number of different fauna types, including the threatened species Northern Marsupial Moles and the Great Desert Skink.

As land clearing will be restricted to pipeline/power transmission/road corridors accessing new bores, the amount of fauna habitat lost is expected to be minimal.

Recommendations

- A number of threatened fauna species that may be present within the Telfer region are considered either nomadic or cryptic. Such species may be present within the area of interest, but were not recorded during the initial fauna assessment. Therefore proposed locations of associated infrastructure should be traversed on foot, prior to any clearing, so as to check for burrowing activities of threatened fauna, such as Great Desert Skink, Mulgara, Greater Bilby, Northern Marsupial Mole. If recent burrowing activity is present, the area must not be cleared.
- Where possible, access roads should avoid disrupting linear habitats that are likely to be used as corridors (or barriers) to fauna movement.
- Speed along access roads should be limited to 60km/h during daylight hours and 40km/h between dawn and dusk.
- Impacts to restricted habitats such as drainage lines and rocky hills should be avoided.

4.2.3 Construction**Impacts**

Dust impacts and distribution of fines into adjacent areas are to be avoided due to potential impacts on vegetation and drainage.

Recommendations

- Dust impacts and movement of soils beyond the allowable area of works are to be avoided.

4.2.4 Post-Construction Monitoring**Impacts**

The construction of roads and associated infrastructure required for the borefield may increase weeds into areas where there is very little weed presence currently, particularly the eastern survey area.

Recommendation

Construction of any infrastructure required for the borefield, such as roads, comply with all normal procedures minimising the areas disturbed, and rehabilitating disturbed areas in line with approved Environmental Guidelines and Conditions (Newcrest Mining Ltd, 2003a and 2003b). Recommendations outlined in the Environmental Protection Authority Bulletin 1127 must be strictly adhered to.

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APPENDICES

Appendix 1 Rare and Priority Flora Potentially Present

Table 8 Species previously recorded in the area by Ecologia (2003), Hart, Simpson and Associates (2000) and Syrinx Environmental PL (2006).

Name	Priority	Habitat	Distinguishing Features
<i>Fimbristylis</i> sp. Shay Gap (K Newbey 10293)	1		
<i>Goodenia lyrata</i>	1	Low lying areas around Telfer road where the route joins the road. Near claypans.	Prostrate herb with Yellow flowers in August
<i>Bulbostylis burbridgeae</i>	3		
<i>Dampiera atriplicina</i>	2	Found on base, sides, crests of dune and swales, usually in high density.	Grey white foliage, small red-purple flowers.
<i>Euphorbia clementii</i>	2	Found on rocky scree slopes	
<i>Goodenia hartiana</i>	2	Occurs at the base of dunes and across interdunal sandy plains	Similar to <i>Goodenia azurea</i> but has 'sticky' leaves
<i>Thysanotus</i> sp. Desert East of Newman (R.P. Hart 964)	2		
<i>Abutilon trudgenii</i>	3	Found on road verges and disturbed areas.	
<i>Comesperma pallidum</i>	3	Sandy loam interdunal plains	Tall spindly shrub, small yellow flowers at the end of terminal spikes
<i>Fuirena incrassata</i>	3	Low lying sites	

Other species potentially present but not yet recorded (DRF and Priority Flora List, DEC December 2006).

Name	Priority
<i>Acacia aphanoclada</i>	1
<i>Acacia cyperophylla</i> var. <i>omearana</i>	1
<i>Atriplex spinulosa</i>	1
<i>Eremophila tenella</i> ms	1
<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727)	1
<i>Indigofera ixocarpa</i> ms	2
<i>Sauropus arenosus</i>	3

Appendix 2 Flora Species List

Table 9 Flora species list

	Swales	Dunes	Rocky Outcrops	Drainage Line
DICOTYLEDONS				
AIZOACEAE				
<i>Trianthema turgidifolia</i>	✓			
AMARANTHACEAE				
<i>Ptilotus ? polystachyus</i> var. <i>polystachyus</i>	✓			
<i>Ptilotus axillaris</i>			✓	
<i>Ptilotus calostachyus</i> var. <i>calostachyus</i>	✓✓		✓	
<i>Ptilotus exaltatus</i>	✓			
<i>Ptilotus</i> sp. cf. <i>polystachyus</i>				
<i>Ptilotus sphacelatum</i>				
APIACEAE				
<i>Trachymene oleraceae</i>				✓
ASTERACEAE				
<i>Pterocaulon serrulatum</i>	✓			
<i>Pterocaulon ?sphacelatum</i>	✓			
BORAGINACEAE				
<i>Halgania solanacea</i> var. <i>solanacea</i>	✓			
<i>Heliotropium ovalifolium</i>	✓			✓
BRASSICACEAE				
<i>Lepidium pholidgynum</i>	✓			
BYBLIDACEAE				
<i>Byblis filifolia</i>	✓			
CAESALPINIACEAE				
<i>Petalostylis cassioides</i>		✓		
<i>Petalostylis labicheodides</i>		✓		
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>				✓
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	✓			
<i>Senna glutinosa</i> subsp. <i>luersseni</i>	✓			
<i>Senna notabilis</i>	✓			
<i>Senna sericea</i>			✓	✓
<i>Senna</i> sp. Austin (A. Strid 20210)				✓
CHENOPODIACEAE				
<i>Maireana tomentosa</i> ssp. <i>tomentosa</i>	✓			
<i>Maireana triptera</i>	✓			
<i>Maireana villosa</i>	✓			
<i>Sclerolaena crenata</i>	✓			
FRANKENIACEAE				
<i>Frankenia</i> sp.	✓			

	Swales	Dunes	Rocky Outcrops	Drainage Line
GOODENIACEAE				
<i>Dampiera ?atriplicina</i>		✓		
<i>Dampiera candicans</i>	✓			
<i>Goodenia hartiana</i>	✓			
<i>Goodenia armitiana</i>	✓			
<i>Goodenia azurea</i> subsp. <i>hesperia</i>	✓	✓		
<i>Goodenia stobbsiana</i>			✓✓	
<i>Goodenia triodiophila</i>	✓			
<i>Scaevola ?amblyanthera</i>			✓✓	
<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>	✓✓			
<i>Velleia connata</i>	✓			
GYROSTEMONACEAE				
<i>Codonocarpus cotinifolius</i>			✓	
HALORAGACEAE				
<i>Haloragis gossei</i>	✓			
LAMIACEAE				
<i>Dicrastylis georgei</i>	✓			
<i>Newcastelia cladotricha</i>	✓✓			
LAURACEAE				
<i>Cassytha ? capillaris</i>	✓			
LOGANIACEAE				
<i>Logania centralis</i>	✓			
MALVACEAE				
<i>Sida</i> sp ? <i>Pilbara</i> (S van Leeuwen 4377)			✓✓	✓
<i>Sida</i> sp. sand dunes (A.A. Mitchell PRP1208)		✓		
MIMOSACEAE				
<i>Acacia acradenia</i>			✓✓	
<i>Acacia adoxa</i> var. <i>adoxo</i>			✓	
<i>Acacia ancistrocarpa</i>	✓✓			
<i>Acacia aneura</i>	✓✓			
<i>Acacia coricea</i> subsp. <i>pendens</i>	✓			
<i>Acacia elecantha</i>	✓			
<i>Acacia hilliana</i>			✓	
<i>Acacia ligulata</i>				
<i>Acacia melleodora</i>	✓			
<i>Acacia monticola</i>				✓
<i>Acacia robeorum</i> ms			✓✓	
<i>Acacia sabulosa</i>		✓✓		
<i>Acacia stellaticeps</i>	✓✓			
<i>Acacia stipuligera</i>	✓✓	✓		
<i>Acacia synchronicia</i>	✓✓			
<i>Acacia tenuissima</i>	✓✓			
<i>Acacia wanyu</i>	✓			

	Swales	Dunes	Rocky Outcrops	Drainage Line
MYOPORACEAE				
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>		✓✓		
<i>Eremophila tietkensis</i>	✓✓			
MYRTACEAE				
<i>Aluta maissoneuvei</i> subsp. <i>maissoneuvei</i>		✓✓		
<i>Calytrix carinata</i>	✓	✓✓		
<i>Corymbia candida</i> subsp. <i>dipsodes</i>	✓			✓✓
<i>Corymbia chippendalei</i>		✓✓		
<i>Corymbia deserticola</i>	✓			
<i>Corymbia opaca</i>	✓✓			
<i>Eucalyptus kingsmillii</i> subsp. <i>kingsmillii</i>	✓✓			
<i>Eucalyptus leucophloia</i>	✓			
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	✓✓		✓	
<i>Eucalyptus odontocarpa</i>	✓			
<i>Melaleuca lasiandra</i>	✓			
PAPILIONACEAE				
<i>Crotalaria cunninghamii</i>		✓		
<i>Gompholobium polyzygum</i>	✓✓			
? <i>Indigofera boviparda</i>	✓			
<i>Jacksonia aculeata</i>	✓✓			
<i>Leptosema anomalum</i>	✓			
<i>Mirbelia viminalis</i>	✓			
<i>Otiun simplicifolium</i> ms		✓✓		
<i>Tephrosia arenicola</i>	✓			
<i>Tephrosia densa</i> ms			✓	
PORTULACACEAE				
<i>Calandrinia pumila</i>	✓			
PROTEACEAE				
<i>Grevillea eriostachya</i>	✓	✓		
<i>Grevillea stenobotrya</i>		✓		
<i>Grevillea wickhamii</i>	✓✓			
<i>Hakea chordophylla</i>	✓			
<i>Hakea lorea</i>	✓✓			
SANTALACEAE				
<i>Exocarpos sparteus</i>		✓		
STACKHOUSIACEAE				
<i>Macgregoria racemigera</i>	✓			
<i>Stackhousia intermedia</i>	✓			
STERCULIACEAE				
<i>Keraudrenia velutina</i> subsp. <i>elliptica</i>	✓✓			
STYLIDIACEAE				
<i>Stylidium desertorum</i>	✓			
SURIANACEAE				
<i>Stylobasium spathulatum</i>	✓	✓		
TILIACEAE				
<i>Corchorus ?walcottii</i>		✓✓		

	Swales	Dunes	Rocky Outcrops	Drainage Line
VIOLACEAE				
<i>Hybanthus aurantiacus</i>	✓			
MONOCOTYLEDONS				
CYPERACEAE				
<i>Fimbristylis dichotoma</i>			✓	
<i>Fimbristylis simulans</i>			✓✓	
<i>Fimbristylis sp. cf. simulans</i>			✓✓	
POACEAE				
<i>Amphipogon caricinus var caricinus</i>	✓✓			
<i>Aristida contorta</i>	✓			
<i>Aristida holathera var. holathera</i>	✓	✓✓		
<i>Aristida latifolia</i>	✓			✓✓
<i>Dactyloctenium radulans</i>	✓			
<i>Eragrostis eriopoda</i>	✓✓	✓✓		
<i>Eragrostis ?falcata</i>	✓			
<i>Eragrostis pergracilis</i>	✓			
<i>Eriachne aristidea</i>	✓✓	✓✓		
<i>Eriachne ciliata</i>			✓	
<i>Eriachne ?sp</i>	✓			
<i>Eriachne ?helmsii</i>	✓			
<i>Eriachne mucronata</i>	✓		✓	
<i>Triodia ?epactia</i>			✓✓	
<i>Triodia schinzii</i>		✓✓		
<i>Triodia basedowii</i>	✓✓			

Appendix 3 Categories used in the Assessment of Conservation Status of fauna

Table 10 Environmental Protection and Biodiversity Conservation (EPBC) Act and the WA Wildlife Conservation Act [Categories from IUCN, based on review by Mace and Stuart (1994)].

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

SC4	Specially Protected	Taxa listed as specially protected under Schedule 4 of the WA Wildlife Conservation Act.
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Table 11 WA Department of Environment and Conservation Priority Species

Priority 1	Taxa with few, poorly known populations on threatened lands.
Priority 2	Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.
Priority 3	Taxa with several, poorly known populations, some on conservation lands.
Priority 4	Taxa in need of monitoring.
Priority 5	Conservation dependent species.

These are species not listed under the Conservation Act, but for which there is some concern.

Regionally Significant Fauna (RS)

Taxa that, within the current study area, are considered to be:

- Uncommon;
- On the edge of the distribution; or
- Undergoing taxonomic revision.

Appendix 4 Fauna species expected to occur in the study area

5.1 VERTEBRATE FAUNA

On the basis of known species distributions and habitats available, there are 238 species of vertebrate fauna that may be expected to occur in the proposed borefield extension area with 59 recorded during the July/August 2007 assessment. This includes eight frogs, 96 reptiles, 100 birds and 34 mammals (26 native and six introduced mammals). Lists of expected species are provided in Tables 2 – 5, whilst Table 6 lists those species considered extinct from the region. Of the species expected, 14 are considered to be conservation significant.

This section details each fauna group separately, discussing those species expected and commenting on any conservation significant species.

5.1.1 Mammals

There are five conservation significant mammal species that may occur in the study area:

The **Mulgara** (*Dasyercus cristicauda*) is listed as Vulnerable under the EPBC Act and the WA Wildlife Conservation Act. Current populations are small and isolated, generally occurring in mature hummock grasslands associated with drainage systems (including paleo-drainage) on sandy soils. Threats to the species may include “habitat destruction by changed fire regimes and introduced herbivores such as cattle and rabbits, and predation by feral cats and foxes” (Maxwell et. al, 1996).

The **Northern Marsupial Mole** (*Notoryctes caurinus*) is listed as Endangered under the EPBC Act and the WA Wildlife Conservation Act. This poorly known species has been collected from the Gibson and Great Sandy Deserts, including several specimens from near Telfer (Hart, Simpsons and Associates, 2002). It seems likely, though not definite, that this species has experienced a decline likely due to some of the factors affecting other CWR (Critical Weight Range) mammals, e.g. predation by foxes and feral cats, and altered fire regimes (Maxwell et. al, 1996; Burbidge and McKenzie, 1989). It is quite likely that this species would utilise sand-dune habitat similar to that seen in and around the current study areas.

The **Greater Bilby** (*Macrotis lagoti*) is listed as Vulnerable under the EPBC Act and the WA Wildlife Conservation Act. Although formerly occurring over much of mainland Australia, the Greater Bilby is now restricted to the Western Deserts (Tanami, Gibson and Great Sandy), adjacent parts of the Pilbara and Kimberleys and also south western Queensland. The species occupies a range of habitats, although these may represent the least favourable within their former range (Pavey, 2005). Some threats to the species include increased predation by introduced predators (e.g. feral cats and foxes), habitat degradation and increased competition through introduced herbivores (e.g. rabbits, cattle and feral camels) and altered fire regimes (Pavey, 2005). As this species is known to move in response to food availability and changing vegetation cover (Johnson, 1989), it is possible that the species occurs in the study area on a periodic basis. If so, it would be expected to primarily utilise the broad drainage line that runs through the western edge of the north-west study area.

The **Spectacled Hare-Wallaby** (*Lagorchestes conspicillatus leichardti*) is classified as Priority 3 by the Dept. of Environment and Conservation, and Lower Risk (near threatened) by Maxwell et. al. (1996). Within WA, this species has experienced a significant population decline and fragmentation (Maxwell, et. al, 1996) and now only occurs as several isolated populations in the Pilbara and Kimberley regions. It occurs in a range of habitat types, with the more mature spinifex-dominated swale habitats within the study areas expected to be highly suitable (Ingleby and Westoby, 1992). The main threats to this species include introduced predators (e.g. feral cats and foxes), competition from introduced herbivores (e.g. rabbits and cattle) and altered fire regimes.

The Pilbara Pebble-mound Mouse (*Pseudomys chapmani*) is classified as Priority 4 by the Dept. of Environment and Conservation. Lee (1995) listed the species as being insufficiently known, however work conducted since has rectified the situation. This species often occurs in association with low stony hills, such as occurring in the study areas.

Table 12 Mammals that are expected to occur in the study area

Those indicated by (x) were recorded during the July survey. x* - old diggings, believed to be from the Greater Bilby, were recorded during the July 2006 visit (Syrinx Environmental 2006), although no individuals were observed. (Int.) indicates introduced species. Other codes relate to conservation significance and are explained in Appendix 3.

SCIENTIFIC NAME	COMMON NAME	Status
Family: TACHYGLOSSIDAE	Echidna	
<i>Tachyglossus aculeatus</i>	Echidna	
Family: DASYURIDAE	Carnivorous Marsupials	
<i>Antechinomys laniger</i>	Kultarr	
<i>Dasyercus cristicauda</i>	Mulgara	VU
<i>Dasykaluta rosamondae</i>	Little Red Kaluta	x
<i>Planigale ingrami</i>	Long-tailed Planigale	
<i>Sminthopsis macroura</i>	Stripe-faced Dunnart	
<i>Sminthopsis youngsoni</i>	Lesser Hairy-footed Dunnart	
Family: THYLACOMYIDAE	Bilbies	
<i>Macrotis lagotis</i>	Bilby, Dalgyte	VU, x*
Family: NOTORYCTIDAE	Marsupial Moles	
<i>Notoryctes caurinus</i>	Northern Marsupial Mole	EN
Family: MACROPODIDAE	Kangaroos and Allies	
<i>Lagorchestes conspicillatus leichardti</i>	Spectacled Hare-wallaby	P3
<i>Macropus robustus erubescens</i>	Euro, Biggada	
<i>Macropus rufus</i>	Red Kangaroo, Marlu	
Family: EMBALLONURIDAE	Sheath-tail Bats	
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	
<i>Taphozous hilli</i>	Hill's Sheathtail-bat	x
Family: VESPERTILIONIDAE	Evening Bats	
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	x
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	

<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	
<i>Scotorepens greyii</i>	Little Broad-nosed Bat	
Family: MOLOSSIDAE	Free-tail bats	
<i>Chaerephon jobensis</i>	Northern Freetail-bat	
<i>Mormopterus beccarii</i>	Beccari's Freetail-bat	
<i>Tadarida australis</i>	White-striped Freetail-bat	
Family: MURIDAE	Rodents	
<i>Mus musculus</i>	House Mouse	Int.
<i>Notomys alexis</i>	Spinifex Hopping-mouse	
<i>Pseudomys chapmani</i>	Pilbara Pebble-mound Mouse	P4
<i>Pseudomys desertor</i>	Desert Mouse	x
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse	x
Family: LEPORIDAE	Rabbits	
<i>Oryctolagus cuniculus</i>	Feral Rabbit	Int.
Family: CANIDAE	Dogs	
<i>Canis familiaris dingo</i>	Dingo	x
<i>Vulpes vulpes</i>	Red Fox	Int.
Family: FELIDAE	Cat	
<i>Felis catus</i>	Feral Cat	Int.
Family: EQUIDAE	Horses and Donkeys	
<i>Equus asinus</i>	Feral Donkey	Int.
Family: CAMELIDAE	Camels	
<i>Camelus dromedarius</i>	Feral Dromedary, Camel	x, Int.

Table 13 Extinct fauna that were previously expected to occur in the study area

This includes species that are considered completely extinct, extinct on the mainland and those species that have experienced a contraction in range. Status codes relate to conservation significance and are explained in Appendix 3.

SCIENTIFIC NAME	COMMON NAME	Status
Family: DASYURIDAE	Carnivorous Marsupials	
<i>Dasyurus geoffroii</i>	Western Quoll, Chuditch	VU
<i>Phascogale calura</i>	Red-tailed Phascogale	EN
Family: PERAMELIDAE	Bandicoots	
<i>Chaeropus ecaudatus</i>	Pig-footed Bandicoot	EX
<i>Isodon auratus auratus</i>	Golden Bandicoot	VU
<i>Perameles eremiana</i>	Desert Bandicoot	EX
Family: THYLACOMYIDAE	Bilbies	x
<i>Notaden nichollsi</i>		
<i>Macrotis leucura</i>	Lesser Bilby	EX
Family: POTOROIDAE	Bettongs	
<i>Bettongia lesueur graii</i>	Burrowing Bettong, Boodie	VU

<i>Bettongia penicillata ogilbyi</i>	Brush-tailed Bettong, Woylie	P5
Family: MACROPODIDAE	Kangaroos and Allies	
<i>Lagorchestes asomatus</i>	Central Hare-wallaby	EX
<i>Lagorchestes hirsutus hirsutus</i>	Rufous Hare-wallaby	EN
<i>Onychogalea lunata</i>	Crescent Nailtail Wallaby, Wurrung	EX
Family: MURIDAE	Rodents	
<i>Pseudomys fieldi</i>	Shark Bay Mouse	VU
<i>Rattus tunneyi</i>	Pale Field-rat	

5.1.2 Reptiles

Two reptile species occurring in the region are considered to be conservation significant:

The **Great Desert Skink** (*Egernia kintorei*) is listed as Vulnerable under the EPBC Act and the WA Wildlife Conservation Act. This species appears to have suffered a major reduction in range since European settlement and now only occurs in a number of isolated subpopulations across arid inland Australia, three of which occur in WA. The species generally prefers sand-plain and sand-ridge habitats, such as those present within Sections 3 and 6. Threats to the species may include altered fire regimes, increased predation from introduced predators (e.g. foxes and feral cats) (Dept. of Env. and Heritage, 2006; Pavey, 2002). Although suitable habitats were searched for burrow systems, none were recorded.

The **Woma** or Ramsay's Python (*Aspidites ramsayi*) is listed as specially protected under Schedule 4 of the WA Wildlife Conservation Act. This listing is based on the status of the south western population, which is considered threatened by Maryan (2002). The more northerly population is not considered to be threatened.

Table 14 Reptiles that are expected to occur in the study area

Those indicated by (x) were recorded during the July survey. Other codes relate to conservation significance and are explained in Appendix 3.

SCIENTIFIC NAME	COMMON NAME	Status
Family: GEKKONIDAE	Geckoes	
<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko	
<i>Diplodactylus stenodactylus</i>	Sand-plain Gecko	
<i>Nephurus laevis</i>	Pale Knob-tailed Gecko	
<i>Nephurus levis</i>	Smooth Knob-tailed Gecko	
<i>Rhynchoedura ornata</i>	Beaked Gecko	
<i>Strophurus ciliaris</i>	Northern Spiny-tailed Gecko	
<i>Strophurus elderi</i>	Jewelled Gecko	
<i>Strophurus jeanae</i>		
<i>Gehyra pilbara</i>	Pilbara Dtella	
<i>Gehyra purpurascens</i>		x
<i>Gehyra variegata</i>	Varied Dtella	
<i>Heteronotia binoei</i>	Bynoe's Gecko	

Family: PYGOPODIDAE	Legless Lizards	
<i>Delma borea</i>		
<i>Delma butleri</i>		
<i>Delma haroldi</i>		
<i>Delma nasuta</i>		
<i>Delma pax</i>		
<i>Delma tincta</i>		
<i>Lialis burtonis</i>	Burton's Legless Lizard	
<i>Pygopus nigriceps</i>	Western Hooded Scale-foot	
Family: SCINCIDAE	Skink Lizards	
<i>Carlia triacantha</i>		
<i>Cryptoblepharus carnabyi</i>		
<i>Cryptoblepharus plagiocephalus</i>	Fence Skink	
<i>Ctenotus ariadnae</i>		
<i>Ctenotus brooksi</i>		
<i>Ctenotus calurus</i>	Blue-tailed Ctenotus	
<i>Ctenotus dux</i>	Narrow-lined Ctenotus	
<i>Ctenotus grandis</i>		
<i>Ctenotus hanloni</i>		
<i>Ctenotus helenae</i>		
<i>Ctenotus leae</i>		
<i>Ctenotus leonhardii</i>		
<i>Ctenotus nasutus</i>		
<i>Ctenotus pantherinus</i>	Leopard Ctenotus	
<i>Ctenotus piankai</i>		
<i>Ctenotus quattuordecimlineatus</i>	Fourteen-lined Ctenotus	
<i>Ctenotus saxatilis</i>	Rock Ctenotus	
<i>Ctenotus schomburgkii</i>		
<i>Ctenotus serventyi</i>		
<i>Cyclodomorphus melanops</i>		
<i>Egernia depressa</i>	Pygmy Spiny-tailed Skink	
<i>Egernia kintorei</i>	Great Desert Skink	VU
<i>Egernia striata</i>	Night Skink	
<i>Eremiascincus fasciolatus</i>	Narrow-banded Sand-swimmer	
<i>Eremiascincus richardsonii</i>	Broad-banded Sand-swimmer	
<i>Lerista bipes</i>		
<i>Lerista ips</i>		
<i>Lerista labialis</i>		
<i>Lerista muelleri</i>		
<i>Lerista vermicularis</i>		
<i>Lerista xanthura</i>		
<i>Menetia greyii</i>	Grey's Skink	
<i>Morethia ruficauda</i>		
<i>Notoscincus ornatus</i>		
<i>Proablepharus reginae</i>		
<i>Tiliqua multifasciata</i>	Centralian Blue-tongue	
Family: AGAMIDAE	Dragons	
<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon	
<i>Ctenophorus clayi</i>	Black-collared Dragon	
<i>Ctenophorus isolepis</i>	Central Military Dragon	x

<i>Ctenophorus nuchalis</i>	Central Netted Dragon	
<i>Diporiphora winneckeii</i>	Blue-lined Dragon	x
<i>Moloch horridus</i>	Thorny Devil	
<i>Pogona minor</i>	Western Bearded Dragon	
<i>Tympanocryptis cephalo</i>	Pebble Dragon	
Family: VARANIDAE	Monitors	
<i>Varanus acanthurus</i>	Spiny-tailed Monitor	x
<i>Varanus brevicauda</i>	Short-tailed Pygmy Monitor	
<i>Varanus caudolineatus</i>	Stripe-tailed Monitor	
<i>Varanus eremius</i>	Desert Monitor	
<i>Varanus giganteus</i>	Perentie	
<i>Varanus gilleni</i>	Pygmy Mulga Monitor	
<i>Varanus gouldii</i>	Gould's Monitor	
<i>Varanus pilbarensis</i>	Pilbara Rock Monitor	
<i>Varanus tristis</i>	Black-headed Monitor	
Family: TYPHLOPIDAE	<i>Blind Snakes</i>	
<i>Ramphotyphlops ammodytes</i>		
<i>Ramphotyphlops diversus</i>		
<i>Ramphotyphlops endoterus</i>		
<i>Ramphotyphlops grypus</i>	Beaked Blind Snake	
Family: BOIDAE	Pythons	
<i>Antaresia perthensis</i>	Pygmy python	
<i>Antaresia stimsoni</i>	Stimson's python	
<i>Aspidites melanocephalus</i>	Black-headed python	
<i>Aspidites ramsayi</i>	Woma	SC4
Family: ELAPIDAE	Front-fanged Snakes	
<i>Acanthophis pyrrhus</i>	Desert Death-adder	
<i>Acanthophis wellsi</i>	Pilbara Death-adder	
<i>Brachyuropis approximans</i>	Northwestern Shovel-nosed Snake	
<i>Brachyuropis fasciolata</i>	Narrow-banded Shovel-nosed Snake	
<i>Demansia psammophis</i>	Yellow-faced Whipsnake	
<i>Demansia rufescens</i>	Rufous Whipsnake	
<i>Furina ornata</i>	Moon Snake	
<i>Pseudechis australis</i>	Mulga Snake	x
<i>Pseudonaja modesta</i>	Ringed brown snake	
<i>Pseudonaja nuchalis</i>	Gwardar	
<i>Simoselaps anomalus</i>	Desert banded snake	
<i>Suta fasciata</i>	Rosen's snake	
<i>Suta punctata</i>	Spotted snake	

5.1.3 Birds

The **Night Parrot** (*Pezoporus occidentalis*) is classified as Critically Endangered under the EPBC Act and the WA Wildlife Conservation Act. This poorly known species is believed to occur at low densities across the arid inland of Australia, preferring habitats dominated by *Triodia* sp. hummock grassland or chenopod shrublands. There have been recent records of the species from within the Pilbara, near the Fortescue Marshes (pers. obs.); this may be in response to cyclonic rains and the subsequent flush of new plant growth, including seeding

Spinifex plants. Threats may include “predation by feral cats and foxes, altered fire regimes, competition for food and degradation of habitat near water by stock or rabbits and reduced availability of water as a result of over-use by feral camels “(Garnett and Crowley, 2000). The habitats present within the study area appear suitable for the species, although due to the elusive nature of this species it is difficult to assess.

Major Mitchell’s Cockatoo (*Cacatua leadbeateri*) and the **Peregrine Falcon** (*Falco peregrinus*) are classified as “Specially Protected” under Schedule 4 of the WA Wildlife Conservation Act. The Peregrine Falcon was recorded during the survey, hunting over the old tailings diversion ponds in the north-western study area. Both of these species are considered to be uncommon in the region (Storr, 1981; Barrett et. al, 2003).

The **Grey Falcon** (*Falco hypoleucos*) is classified as Priority 4 by the Dept. of Environment and Conservation, and Near Threatened by Garnett and Crowley (2000), due to a possible reduction in range and the sparsity of the population. Populations of the species appear to be centred on inland drainage systems, which provide nesting habitat and may provide a higher density of prey. The only known potential threat to this species, within the Pilbara, is overgrazing, which may affect prey abundance (Garnett and Crowley, 2000).

The **Australian Bustard** (*Ardeotis australis*) is classified as Priority 4 by the Dept. of Environment and Conservation, and Near Threatened by Garnett and Crowley (2000). This species was recorded from the survey through a possible sighting over recently burnt dune/swale habitat near the tailings dam, the remains of an egg on rocky hill slopes in the southern section of the south-eastern study area and through the remains of a recently predated bird in the north-western study area. The species has experienced major historical declines, predominantly within the southern parts of its range. Within the Telfer region, disturbance from humans, cattle or sheep during nesting and predation by foxes are probably the most relevant of the threats recognised by Garnett and Crowley (2000).

The **Princess Parrot** (*Polytelis alexandrae*) is classified as Priority 4 by the Dept. of Environment and Conservation, and Near Threatened by Garnett and Crowley (2000), due to the species decline over 50% of its range. The species is “irregularly present through much of the central and western arid zone” and utilises seeding plants in interdunal swales as a food resource (Garnett and Crowley, 2000). Factors responsible for the species decline may include habitat degradation and reduced food availability, due to altered fire regimes and the activities of introduced herbivores (e.g. sheep, rabbits and cattle).

Table 15 Birds that are expected to occur in the study area.

Those indicated by (x) were recorded during the July survey. Other codes relate to conservation significance and are explained in Appendix 3.

SCIENTIFIC NAME	COMMON NAME	Status
Family: CASUARIIDAE	Emu	
<i>Dromaius novaehollandiae</i>	Emu	
Family: PHASIANIDAE	True Quail and Allies	
<i>Coturnix ypsilophora</i>	Brown Quail	

Family: ANATIDAE	Ducks and Allies	
<i>Anas superciliosa</i>	Pacific Black Duck	
<i>Anas gracilis</i>	Grey Teal	x
Family: PODICIPEDIDAE	Grebes	
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe	x
Family: ARDEIDAE	Herons, Egrets and Bitterns)	
<i>Egretta novaehollandiae</i>	White-faced Heron	
<i>Ardea pacifica</i>	White-necked Heron	
Family: THRESKIORNITHIDAE	Ibis and Spoonbills	
<i>Threskiornis spinicollis</i>	Straw-necked Ibis	x
<i>Platalea regia</i>	Royal Spoonbill	
Family: ACCIPITRIDAE	Eagles, Hawks and Kites	
<i>Elanus axillaris</i>	Black-shouldered Kite	
<i>Milvus migrans</i>	Black Kite	
<i>Haliastur sphenurus</i>	Whistling Kite	
<i>Circus assimilis</i>	Spotted Harrier	
<i>Accipiter fasciatus</i>	Brown Goshawk	
<i>Accipiter cirrhocephalus</i>	Collared Sparrowhawk	x
<i>Aquila audax</i>	Wedge-tailed Eagle	
<i>Hieraaetus morphnoides</i>	Little Eagle	x
Family: FALCONIDAE	Falcons	
<i>Falco berigora</i>	Brown Falcon	x
<i>Falco longipennis</i>	Australian Hobby	
<i>Falco peregrinus</i>	Peregrine Falcon	SC4
<i>Falco cenchroides</i>	Nankeen Kestrel	x
<i>Falco hypoleucos</i>	Grey Falcon	P4
Family: OTIDIDAE	Bustards	
<i>Ardeotis australis</i>	Australian Bustard	P4
Family: TURNICIDAE	Button-quails	
<i>Turnix velox</i>	Little Button-quail	
Family: CHARADRIIDAE	Plovers and Dotterels	
<i>Euseyonis melanops</i>	Black-fronted Dotterel	x
<i>Charadrius ruficapillus</i>	Red-capped Plover	x
Family: RECURVIROSTRIDAE	Stilts and Avocets	
<i>Himantopus himantopus</i>	Black-winged Stilt	x
Family: COLUMBIDAE	Doves and Pigeons	
<i>Phaps chalcoptera</i>	Common Bronzewing	x
<i>Ocyphaps lophotes</i>	Crested Pigeon	x
<i>Geophaps plumifera</i>	Spinifex Pigeon	x
<i>Geopelia cuneata</i>	Diamond Dove	x
<i>Geopelia striata</i>	Peaceful Dove	
Family: CACATUIDAE	Cockatoos	
<i>Eolophus roseicapilla</i>	Galah	x
<i>Cacatua sanguinea</i>	Little Corella	
<i>Nymphicus hollandicus</i>	Cockatiel	
<i>Cacatua leadbeateri</i>	Major Mitchell's Cockatoo	SC4

Family: PSITTACIDAE	Parrots and Lorikeets	
<i>Polytelis alexandrae</i>	Princess Parrot	P4
<i>Barnardius zonarius</i>	Australian Ringneck	
<i>Melopsittacus undulatus</i>	Budgerigar	
<i>Pezoporus occidentalis</i>	Night Parrot	CE
Family: CUCULIDAE	Cuckoos	
<i>Cuculus pallidus</i>	Pallid Cuckoo	
<i>Chrysococcyx osculans</i>	Black-eared Cuckoo	
<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo	
Family: CENTROPODIDAE	Coucals	
<i>Centropus phasianinus</i>	Pheasant Coucal	
Family: STRIGIDAE	Hawk Owls	
<i>Ninox connivens</i>	Barking Owl	
<i>Ninox novaeseelandiae</i>	Southern Boobook	
Family: TYTONIDAE	Masked Owls	
<i>Tyto alba</i>	Barn Owl	
Family: PODARGIDAE	Frogmouths	
<i>Podargus strigoides</i>	Tawny Frogmouth	
Family: CAPRIMULGIDAE	Nightjars	
<i>Eurostopodus argus</i>	Spotted Nightjar	
Family: AEGOTHELIDAE	Owlet-nightjars	
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	
Family: HALCYONIDAE	Kingfishers	
<i>Todiramphus pyrrhopygia</i>	Red-backed Kingfisher	x
Family: MEROPIIDAE	Bee-eaters	
<i>Merops ornatus</i>	Rainbow Bee-eater	x
Family: MALURIDAE	Australian Wrens	
<i>Malurus lamberti</i>	Variiegated Fairy-wren	x
<i>Malurus leucopterus</i>	White-winged Fairy-wren	
<i>Stipiturus ruficeps</i>	Rufous-crowned Emu-wren	
<i>Amytornis striatus</i>	Striated Grasswren	
Family: PARDALOTIDAE	Pardalotes and Allies	
<i>Pardalotus rubricatus</i>	Red-browed Pardalote	
<i>Pardalotus striatus</i>	Striated Pardalote	
<i>Smicronis brevirostris</i>	Weebill	
<i>Gerygone fusca</i>	Western Gerygone	
Family: MELIPHAGIDAE	Honeyeaters and Chats	
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	
<i>Manorina flavigula</i>	Yellow-throated Miner	x
<i>Lichenostomus virescens</i>	Singing Honeyeater	x
<i>Lichenostomus keartlandi</i>	Grey-headed Honeyeater	x
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater	
<i>Lichmera indistincta</i>	Brown Honeyeater	
<i>Phylidonyris albifrons</i>	White-fronted Honeyeater	

<i>Certhionyx niger</i>	Black Honeyeater	
<i>Certhionyx variegatus</i>	Pied Honeyeater	
<i>Epthianura tricolor</i>	Crimson Chat	
Family: PETROICIDAE	Australian Robins	
<i>Petroica goodenovii</i>	Red-capped Robin	
<i>Melanodryas cucullata</i>	Hooded Robin	
Family: PACHYCEPHALIDAE	Whistlers and Allies	
<i>Oreoica gutturalis</i>	Crested Bellbird	
<i>Pachycephala rufiventris</i>	Rufous Whistler	
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	
Family: DICRURIDAE	Flycatchers, Fantails and Drongos	
<i>Grallina cyanoleuca</i>	Magpie-Lark	x
<i>Rhipidura leucophrys</i>	Willie Wagtail	x
Family: CAMPEPHAGIDAE	Cuckoo-shrikes and Trillers	
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-Shrike	x
Family: ARTAMIDAE	Woodswallows, Butcherbirds and Allies	
<i>Artamus leucorhynchus</i>	White-breasted Woodswallow	x
<i>Artamus personatus</i>	Masked Woodswallow	x
<i>Artamus superciliosus</i>	White-browed Woodswallow	
<i>Artamus cinereus</i>	Black-faced Woodswallow	x
<i>Artamus minor</i>	Little Woodswallow	x
<i>Cracticus torquatus</i>	Grey Butcherbird	
<i>Cracticus nigrogularis</i>	Pied Butcherbird	
<i>Gymnorhina tibicen</i>	Australian Magpie	
Family: CORVIDAE	Crows and Ravens	
<i>Corvus bennetti</i>	Little Crow	
<i>Corvus orru</i>	Torresian Crow	x
Family: ALAUDIDAE	Bushlark	
<i>Mirafra javanica</i>	Singing Bushlark	
Family: MOTACILIDAE	Wagtails and	
<i>Anthus novaeseelandiae</i>	Richard's Pipit	x
Family: PASSERIDAE	Finches and Manikins	
<i>Taeniopygia guttata</i>	Zebra Finch	x
<i>Emblema picta</i>	Painted Finch	x
Family: HIRUNDINIDAE	Swallows and Martins	
<i>Cheramoeca leucosternum</i>	White-backed Swallow	x
<i>Hirundo neoxena</i>	Welcome Swallow	x
<i>Hirundo nigricans</i>	Tree Martin	
<i>Hirundo ariel</i>	Fairy Martin	x
Family: SYLVIIDAE	Songlarks and Allies	
<i>Eremiornis carteri</i>	Spinifexbird	

<i>Cinclorhamphus mathewsi</i>	Rufous Songlark	
<i>Cinclorhamphus cruralis</i>	Brown Songlark	

5.1.4 Frogs

One frog species, the Tanami Toadlet (*Uperoleia micromeles*), is considered to be conservation significant due to its regionally restricted distribution. Although this may reflect the lack of surveys throughout this area, within W.A. this species has a limited distribution with only a small number of records from the Great Sandy Desert.

Note: This species was not recorded during the survey.

Table 16 Frogs that are expected to occur in the study area

Those indicated by (x) were recorded during the July survey. Other codes relate to conservation significance and are explained in Appendix 3.

SCIENTIFIC NAME	COMMON NAME	Status
Family: HYLIDAE	Tree Frogs	
<i>Cyclorana maini</i>	Main's Frog	
<i>Cyclorana platycephala</i>	Water-holding Frog	
<i>Litoria rubella</i>	Desert Tree Frog	
Family: MYOBATRACHIDAE	Burrowing Frogs	
<i>Limnodynastes spenceri</i>	Spencer's Frog	
<i>Neobatrachus aquilonius</i>	Northern Burrowing Frog	
<i>Notaden nichollsi</i>	Desert Spadefoot	x
<i>Uperoleia micromeles</i>	Tanami Toadlet	RS
<i>Uperoleia russelli</i>	Russell's Toadlet	