

NEWMAN TO JIMBLEBAR TRANSMISSION LINE AND NEWMAN TOWN SUBSTATION TERRESTRIAL FAUNA ASSESSMENT

Prepared for:

WorleyParsons



Desert Rainbow Skink *Carlia triacantha*

Job No: 09.064

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EXECUTIVE SUMMARY

ENV.Australia Pty Ltd (ENV) was commissioned by WorleyParsons Resources and Energy in March 2009 on behalf of BHP Billiton Iron Ore to undertake a terrestrial fauna assessment for the proposed Newman to Jimblebar transmission line and Newman Substation.

The objectives of the fauna assessment were to: document and map habitat types, previously recorded fauna and the fauna assemblage within the project area; identify potentially occurring fauna of conservation significance; discuss the impacts the proposed development; and determine if the proposed development will have a significant impact upon conservation significant fauna.

The fauna field survey was undertaken from 21 - 27 April 2009 and consisted of a fauna habitat assessment, general fauna searches, bat echolocation detection (Anabat) and opportunistic observations.

There were five fauna habitat types identified in the project area: Mulga plain, low hills, riverine, floodplain and hilltop/ breakaway. The project area has a moderate level of disturbance from existing heavy industry and infrastructure, and pastoral activities. Of the habitat types identified, all were considered to be of low to moderate local significance.

The Level One fauna survey recorded a total of 88 terrestrial vertebrate fauna species, including one amphibian species, 14 reptile species, 58 bird and 15 mammal species. Of those species recorded, two species are conservation significant, the Rainbow Bee-eater (*Merops ornatus*) and Star Finch (*Neochmia ruficauda clarescens*). A further 14 conservation significant fauna species potentially occur in the project area.

The level of habitat disturbance from the proposed development is low in a regional context and it is unlikely that the proposed transmission line and sub-station will have a significant impact upon any conservation significant fauna.

1 INTRODUCTION

1.1 THE PROJECT

ENV.Australia Pty Ltd (ENV) was commissioned by WorleyParsons Resources and Energy in March 2009 on behalf of BHP Billiton Iron Ore ('BHPBIO') to undertake a terrestrial fauna assessment of the Newman to Jimblebar Transmission Line and Newman Town Substation (herein referred to as the project area).

1.1.1 Objectives

The fauna assessment comprises the findings of a Level One fauna survey in accordance with *Guidance Statement 56* (EPA 2004).

The objectives of the terrestrial fauna assessment were to:

- document the general habitat types in the survey area as they relate to faunal assemblages;
- compile a list of terrestrial vertebrate fauna previously recorded in the region, based on database searches;
- document and describe the fauna assemblages within the project area;
- identify other terrestrial vertebrate fauna of conservation significance that potentially occur within the project area;
- develop a map illustrating the fauna habitat types and other important habitat features;
- discuss the impacts the proposed development may have on fauna and fauna habitats within the project area, and other ecological factors (e.g. linkages and corridors); and
- determine if the proposed development will have a significant impact upon conservation significant species.

1.1.2 Location

The proposed Newman-Jimblebar Transmission Line begins at the existing power station within the BHPBIO Mount Whaleback Mine tenement and ends at the BHPBIO Wheelarra Hill Mining operation (Figure 1). The proposed transmission line is approximately 50 km long and the project area is a 100 m-wide strip. The Newman substation is located adjacent to the Great Northern

Highway and is approximately 1.6 km north-north-east of Newman and 0.8 km from the Newman to Port Hedland Railway (Figure 1).

1.1.3 Previous Biological Studies

Historically, the flora and fauna of the Pilbara has been disparately recorded, with notable exceptions being flora studies carried out by Burbidge (1959) and Beard (1975). More recently, the Department of Agriculture (van Vreeswyk *et al.* 2004) conducted an inventory and condition survey of the Pilbara region. This report provides a regional inventory of flora species and a description of land resources. A comprehensive and systematic field review of Pilbara regional fauna is underway by the Department of Environment and Conservation (DEC) (DEC Pilbara Biological Survey 2002-2009), but is yet to be published.

In recent decades, a boom in large-scale regional resource development projects has resulted in a significant amount of site-specific biological survey work being carried out in the region, most of which is undertaken for formal environmental approvals. Near the site, a number of biological surveys have been conducted within the last 15 years. Those more relevant to the current survey are as follows:

- *Jimblebar Mine Site Biological Survey* (Endersby 1994);
- *Orebody 18 Biological Assessment Survey* (ecologia 1995a);
- *Orebody 25 Biological Assessment Survey* (ecologia 1995b);
- *Mount Whaleback Fauna Monitoring Programme: Baseline Sampling 1997-1998* (ecologia 1998);
- *Orebody 24 Expansion Biological Survey* (ecologia 2004a);
- *Jimblebar-Wheelarra Hill Expansion Biological Survey* (ecologia 2004b);
- *East Jimblebar Exploration Project Biological Survey* (ecologia 2005);
- *Mount Whaleback Flora and Fauna Assessment Phase III* (ENV 2006a);
- *Orebody 24 Flora and Fauna Assessment Phase II* (ENV 2006b);
- *Orebody 18 Fauna Assessment* (ENV 2006c);
- *Orebody 18 Fauna Assessment Phase II* (ENV 2007a); and
- *West Jimblebar Lease Fauna Assessment* (ENV 2007b).

A more comprehensive bibliography of biological survey work undertaken in the Pilbara is available at the DEC website (DEC 2009a).

1.2 PHYSICAL ENVIRONMENT

1.2.1 Climate

The project area is in the Pilbara region of Western Australia. The nearest accessible climate data to the project area is available from the Bureau of Meteorology (BoM) Newman Aero weather station located approximately 9.4 km from the Newman Township .

The Pilbara has an arid-tropical climate with two distinct seasons, a hot summer from October to April and a mild winter from May to September. The area experiences a wide range of temperatures, with an average annual temperature of 31.4°C (1965-1998). In summer, maximum temperatures may reach 46.0°C, whilst in winter, minimum temperatures may reach -2.0°C (BoM 2009). The average maximum temperature over this three month period was 26.1°C.

Rainfall in the Pilbara is often sporadic, and can occur in summer and winter. The Newman area has average annual rainfall of 310 mm (1971-2009) (Figure 3). Summer rainfall is typically associated with tropical storms in the north, or tropical cyclones that cross the coast and move inland. Winter rainfall is generally less significant, and is commonly the result of cold fronts moving north-easterly across the State.

The Newman area received a relatively low amount of rainfall in the 2008/2009 summer season, with the area having received 122.8 mm (December - February). On average the area usually receives 175.8 mm over the December to February period (BoM 2009). However, for the three months preceding the survey the area received 204 mm (January - March 2009), compared with 179.1 mm for the long-term (1971–2009) average for the same period (BoM 2009).

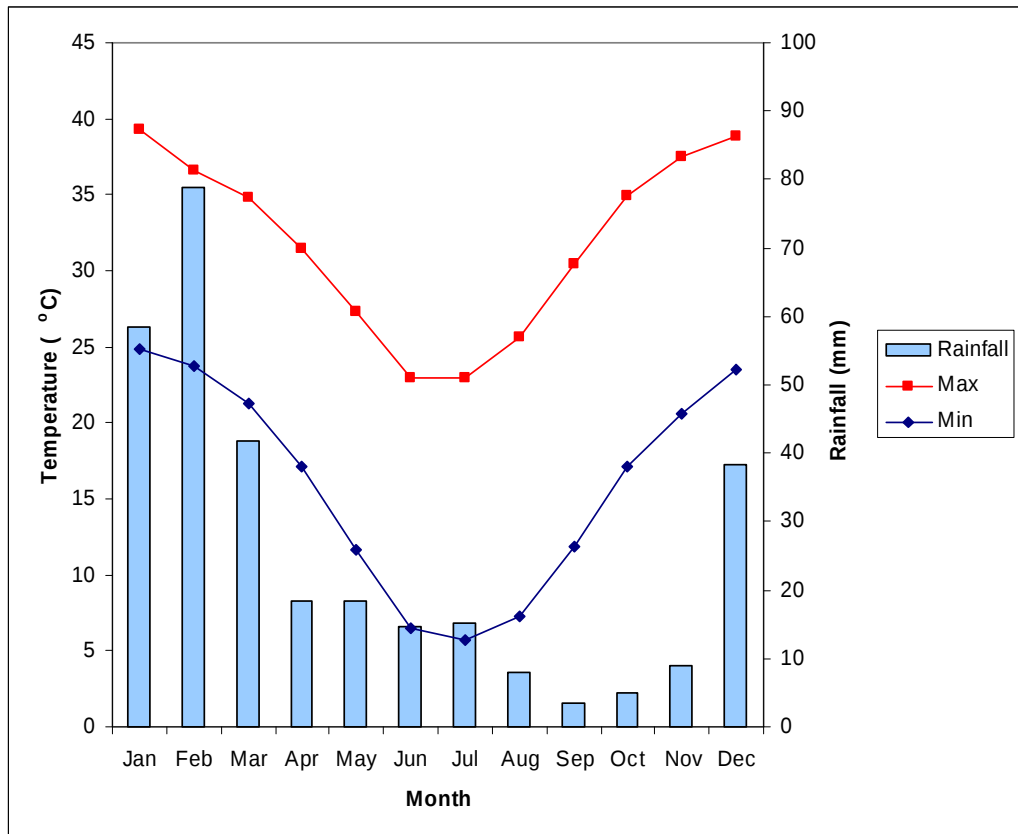


Figure 3: Average Monthly Rainfall from 1971–2009 and Maximum and Minimum Temperatures at Newman from 1965–2009 (BoM 2009)

1.2.2 Geology

Tyler, Hunter & Williams (1991) mapped the geology of the Newman region, which includes the project area. Seven units occur within the project area, as listed below:

- Qa: Alluvium: clay, silt, sand, gravel: in drainage channels and adjacent flood plains;
- Qc: Colluvium and minor alluvium: quartz pebble and rock fragments in silt, sand; adjacent to bedrock; scree, talus slope deposits;
- Czc: Colluvium: partly consolidated and consolidated ferruginized silt, sand, gravel; valley-fill deposits dissected by present drainage;
- Czk: Calcrete: sheet carbonate usually formed in major drainage lines;
- Hj: Weeli Wolli Formation: interlayered banded iron-formation and metadoleritic sills, minor shale. Often overlies the Brockman Iron Formation (Hb); and

Hm: Marramamba iron formation: chert, ferruginous chert and banded iron-formation with minor shale.

1.2.3 Land Systems

Land system mapping is based on regional patterns in topography, soils and vegetation. The most recent land system mapping of the Pilbara bioregion, in which the current project area lies, was completed by van Vreeswyk *et al.* (2004). The mapping classifies the Pilbara region into 102 land systems.

The project area comprises of eight land systems, as listed below:

- New: Newman: Rugged jaspilite plateaux, ridges and mountains; supporting hard Spinifex grasslands; forms 8.0% of the Pilbara bioregion;
- Bgd: Boolgeeda: Stony lower slopes and plains below hill slopes; supporting hard and soft Spinifex grasslands and Mulga scrublands; forms 4.3% of the Pilbara bioregion;
- Div: Divide: Sand plains and occasional dunes supporting shrubby hard spinifex grasslands; forms 2.9% of the Pilbara bioregion;
- Mck: McKay: Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands; forms 2.3% of the Pilbara bioregion;
- Riv: River: Active flood plains and major rivers supporting grassy eucalypt woodlands and soft spinifex grasslands; forms 2.3% of the Pilbara bioregion;
- Jam: Jamindie: Stony hardpan plains and rises supporting groved mulga shrublands, occasionally with spinifex understorey; forms 1.1% of the Pilbara bioregion;
- Wsp: Washplain: Hardpan plains supporting groved mulga shrublands; forms 0.5% of the Pilbara bioregion; and
- Eli: Elimunna: Stony plains on basalt supporting sparse *Acacia* and *Cassia* shrublands and patchy tussock grasslands; forms 0.3% of the Pilbara bioregion.

1.3 BIOLOGICAL ENVIRONMENT

1.3.1 IBRA and Beard Vegetation Mapping

The IBRA divides Australia into 85 bioregions based on major biological and geographical/geological attributes (Thackway and Cresswell 1995). These bioregions are subdivided into 404 subregions, as part of a refinement of the IBRA framework (Department of Environment, Water, Heritage and the Arts [DEWHA] 2009).

The project area is located within the Hamersley subregion (PIL3) of the Pilbara region and the Augustus subregion (GAS3) of the Gascoyne region (Thackway and Cresswell 1995).

The Hamersley subregion is characterised by mountain ranges and plateaux of Proterozoic sedimentary rock, dissected by gorges (Kendrick 2001). The vegetation is characterised by mulga low woodland over bunch grasses on fine textured soils in valley floors, and Snappy Gum (*Eucalyptus leucophloia*) over *Triodia brizoides* on skeletal soils of the ranges (Kendrick 2001).

The Augustus subregion is characterised by rugged low Proterozoic sedimentary and granite ranges divided by broad flat valleys (Desmond *et al.* 2001). The vegetation is characterised by Mulga woodland with *Triodia* on shallow stony loams on rises and shallow earthy loams over hardpan on the plains are covered by Mulga parkland (Desmond *et al.* 2001).

Vegetation mapping of the Pilbara region was completed on a broad scale (1:1,000,000) by Beard (1975). The project area is situated in the Hamersley Plateau, which forms part of the Fortescue Botanical District in the Eremaean Botanical Province of Western Australia as per Beard (1975), who mapped the project area as two vegetation associations:

a₁Li: Low woodland; Mulga (*Acacia aneura*); and

e₁₆Lr.t₃Hi: Hummock grasslands, low tree steppe; Snappy Gum (*Eucalyptus leucophloia* subsp. *leucophloia*) over *Triodia wiseana*.

2 METHODOLOGY

2.1 BACKGROUND TO SURVEY METHODOLOGY

2.1.1 State and Federal Legislation

All surveys undertaken by ENV are performed to meet the requirements of the following State and Federal legislation:

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

The surveys were carried out in a manner compliant with the Environmental Protection Authority (EPA) requirements for the environmental surveying and reporting of fauna surveys in Western Australia:

- *Terrestrial Biological Surveys as an Element of Biodiversity Protection. Position Statement No. 3 (EPA 2002).*
- *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. Guidance Statement No. 56 (EPA 2004).*

2.1.2 EPA Guidance Statement No. 56

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

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

Where the scale and nature of the proposed impact is moderate to high, a Level Two survey will be required in most areas of the state and is typically required for resource development projects. The expectations of the EPA are delineated in *Guidance Statement No. 56 (EPA 2004)*. Specifically, it details the extent, design and intensity of field surveys for environmental assessments.

The methodology of the current survey, a Level One survey, has been developed in consideration of the EPA *Guidance Statement No. 56*. There is a well developed knowledge of local faunal assemblages, based on the many biological

surveys that have taken place in the Newman area. Considering this, and the relatively small size of the project area, a Level One survey is appropriate for the proposed development.

2.1.3 Fauna of Conservation Significance

Fauna species can be classified as conservation significant on an international, commonwealth, state, or local level, in accordance with the EPA *Guidance Statement No. 56* (EPA 2004). Under each level, the conservation status of fauna is determined by a number of different Acts and Agreements. A short description of these Acts and Agreements is outlined below, with definitions of the conservation codes detailed in Appendix A.

International Level:

International Migratory Bird Agreements: Australia has agreements with the Governments of Japan, China and Korea relating to the protection of birds which migrate between Australian and these countries. These agreements are known as the Japan-Australia Migratory Bird Agreement (JAMBA), the China-Australia Migratory Bird Agreement (CAMBA) and the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA). Migratory birds in Australia are also protected under the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention). Bird species from all the abovementioned agreements are protected as Migratory under the *EPBC Act 1999* (described below).

Commonwealth Level:

Environment Protection and Biodiversity Conservation Act 1999: The act aims to protect matters of national environmental significance, which are detailed in Appendix A. Under the *EPBC Act*, the Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA) lists protected species and Threatened Ecological Communities (DEWHA 2009b) by criteria set out in the act (Commonwealth of Australia 2006). Species are considered to be conservation significant if they are listed as Threatened (ie, Vulnerable, Endangered etc), or Migratory. Marine listed species are only considered conservation significant when a proposed development occurs in a Commonwealth marine area (i.e. any Commonwealth Waters or Commonwealth Marine Protected Area).

State Level:

- *Wildlife Conservation Act 1950*: The Minister for the Environment produces a notice where fauna taxa are listed as protected and are classified as Schedule 1 through to Schedule 4 according to their relative need for protection.

- Department of Environment and Conservation Priority species: The DEC produces a list of Priority species that have not been assigned statutory protection under the WC Act. Priority Fauna are under consideration as 'Scheduled' fauna, but are in urgent need of further survey or require regular monitoring, and although not currently threatened may become so in the future.

Informal Recognition of Threatened Fauna:

Certain populations or communities may be of local significance or interest because of their patterns of distribution and abundance. For example, fauna may be locally significant because they are range extensions to the previously-known distribution or are newly-discovered taxa (and therefore have the potential to be listed as threatened in the future). In addition, many species are in decline as a result of threatening processes, and relict populations of such species may assume local importance.

2.2 DESKTOP REVIEW METHODOLOGY

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

- Western Australian Museum's (WAM) and (DEC) combined biological database *NatureMap* (DEC 2009b);
- DEC Threatened and Priority Fauna database (DEC 2009c);
- DEWHA *Protected Matters Search Tool* (DEWHA 2009c), also known as an EPBC search;
- previous fauna surveys (e.g. previous ENV reports, other consultants reports, DEC reports); and
- discussions with personnel from State wildlife agencies and relevant non-government organisations.

Collectively, these sources were used to compile a list of species that have been previously recorded in the region (Appendix B). This list will invariably include some species that do not occur in the project area, because some fauna species have a limited or patchy distribution, high level of habitat specificity, are locally extinct or were erroneously identified in previous surveys. Some records were excluded from this list, such as extinct species and clearly erroneous records. Previously recorded conservation significant species are also separately listed in Appendix C, with a description of their distribution and ecology.

2.3 FIELD SURVEY METHODOLOGY

The purpose of the field survey was to verify the accuracy of the desktop survey and further delineate and characterise the fauna and faunal assemblages present in the project area. The fauna field survey was undertaken from 21st -27th April 2009. The survey consisted of:

- a fauna habitat assessment;
- general fauna searches;
- bat echolocation detection (Anabat); and
- opportunistic observations.

2.3.1 Fauna Habitat Assessment

During the field survey, broad fauna habitats were identified based on vegetation associations and landforms. These fauna habitats were then assessed for their potential to support species of conservation significance and the quality of habitat they provide to a wider suite of fauna. Habitats were assessed on the basis of their complexity, the presence of microhabitats, including significant trees with hollows, loose bark, fallen hollow logs and leaf litter, and other habitat features likely to provide food or shelter for fauna. Caves were inspected for suitability for cave-dwelling bats.

To determine the conservation value of each fauna habitat in the project area, measures of both regional and local habitat value were quantified to give an overall rating for each habitat type (Appendix D). The purpose of this matrix is to quantify habitat value measures that influence the significance of habitat types (on two levels, *regional and local*) and present them clearly. This provides a general guide to the value of each habitat for native fauna (particularly conservation significant species), to aid the process of planning development and determining the impact of developments upon threatened species.

Regional habitat significance measures how important each habitat type is in the greater biogeographic region, and is calculated based on the *regional representation*, and *conservation significant species diversity*. *Regional representation* is a measure of how widespread each habitat type is in the Pilbara region, so less common habitats score high, while widespread habitat types score low. For *conservation significant species diversity*, habitats that are known to support fewer species or less habitat-specific species score low, while habitats with more species and more habitat-specific species score high. The formulas used to score and rate *regional habitat significance* are shown in Appendix D.

Local habitat significance measures how important each habitat type is within the project area and in a local perspective. The number of actual or potential conservation significant species for the project area is used to calculate *conservation significant species diversity*. This measure is rated as higher when habitat-specific or resident species are concerned and lower where generalists or transient species are concerned. *Habitat condition* is based on the scale used in Bush Forever (Government of Western Australia 2000). The formulas used to score and rate *local habitat significance* are shown in Appendix D.

2.3.2 General Fauna Searches

General searches for diurnal fauna were undertaken throughout the project area, for a total of 45.5 person hours. These surveys involved:

- ornithological (bird) searches;
- investigating burrows, rock crevices and tree hollows;
- turning rocks, leaf litter and fallen timber and opening standing timber crevices; and
- investigating scats, tracks, feeding signs and other traces.

Details of survey effort for general fauna searches are given in Appendix E, and locations of the surveys are shown in Figures 3a-3g.

2.3.3 Acoustic Bat Recording

Bat recordings were undertaken at night, using an AnaBat recording unit to document bat species in the area. The recording units convert ultrasonic echolocation signals produced by bats into audible electronic signals, which are later analysed for species-specific calls.

One AnaBat SD1 unit was set for a total of 6 nights along drainage lines, since this is where most bat activity was expected in the project area. One of these locations was outside of the project area at a waterhole on Homestead Creek, while another was set in the power station project area (Figure 3a). Anabats were set on a timer to turn on at dusk and off at dawn (recording all night). Further details of survey effort and locations for the Anabat survey are given in Appendix E and locations of the surveys are shown in Figures 3a-3g.

2.3.4 Opportunistic Observations

While walking or driving around the project area, fauna was opportunistically observed and recorded. Field staff also investigated scats, tracks, burrows and other traces of animals throughout the entire survey. Where conservation-significant species were found, GPS coordinates were recorded.

2.3.5 Taxonomic Identification

Species were identified in the field using relevant field guides. In particular Tyler *et al* (2000) and Cogger (2000) were used to identify frogs. Wilson and Swan (2008), Storr *et al* (1999, 2002) and Cogger (2000) were used to identify reptiles. Pizzey and Knight (1997) and Simpson and Day (2004) were used to identify birds. Menkhorst and Knight (2004), van Dyke and Strahan (2008) and Churchill (1998) were used to identify mammals. Triggs (1996) was used to identify mammal scats, tracks and traces. Where field identification of scats, tracks and traces was not possible, scats (including hairs and bones within predator scats), photographs of tracks and traces, or other mammal remains were sent to Barbara Triggs (consultant mammalogist) for identification. Where field identification of animals was not possible, specimens were collected and later identified by expert taxonomists from the Western Australian Museum Collections and Research Facility.

2.4 PERMITS

Fauna was trapped and collected in accordance with DEC Permit SF006869 issued to Michael Brown.

3 RESULTS

3.1 VARIABLES INFLUENCING THE FAUNA SURVEY

It is important to note the variables associated with individual surveys, which are often difficult to predict, as is the extent to which they will ultimately influence survey outcomes. Survey variables are detailed in Table 1.

Table 1: Variables associated with the fauna survey

Variable	Impact on Survey Outcomes
Experience levels/ Resources	The biologists that executed these surveys included practitioners that are regarded as suitably qualified in their respective fields. • Mr Mike Brown – Zoologist • Mr Mick Welsh – Senior Zoologist
Scope: sampling methods/ Intensity	The survey carried out was a Level One survey. As such, many species that occur in the project area would not have been observed during the survey, particularly small ground-dwelling fauna that are normally recorded by trapping.
Sources of Information	There is a high level of knowledge of the fauna assemblages of the area, because there has been many fauna surveys that have been conducted nearby (as listed in section 1.3).
Proportion of field survey completed	The field survey was completed adequately, considering only a Level One survey was required. Anabat surveys would not normally be considered.
Timing, weather, season.	The survey was undertaken between 21-27 April 2009. The area had received 173 mm of rainfall in the three months preceding the survey, including 123 mm in March and 5.4 mm three days before the beginning of the survey (Bureau of Meteorology 2009). The daily maximum temperatures varied from 26-34°C (mean 29.5°C), with overnight temperatures ranging from 9-21°C (mean 15°C) (BoM 2009). The level of rainfall received across the project area preceding the survey was good. This resulted in many animals being active especially those only likely to occur when water is present, such as frogs and waterbirds. For at least part of the survey, relatively low temperatures resulted in lower activity levels of ectothermic animals such as reptiles and frogs. Being a cool time of year there was less insect activity, thus insectivorous vertebrates were probably less active.

3.2 HABITAT ASSESSMENT

3.2.1 Fauna Habitat Present in the Project Area

There were five fauna habitat types identified in the project area (Table 2). Each habitat type is mapped in Figures 3a- 3h, with photographs given in Appendix F. Habitat types are described below, and their conservation value is discussed in section 4.1.

Table 2: Major Habitat Types of the Project Area

Project Area Section	Habitat Type	Approximate Area of Habitat Type (Ha)	Photograph #
Newman- Jimblebar Transmission Line	Mulga Plain	236	1, 2
	Low Hills	368	3
	Riverine	39	4, 5
	Floodplain	100	6
	Hill Top / Breakaway	14	7, 8 and 9
Newman Substation	Low Hills	0.4	10

Mulga Plain

The Mulga plain habitat type consisted of a sparse to moderate shrub canopy of Mulga (*Acacia* sp.) and mallee (*Eucalyptus* sp.) ranging from 5-7 m in height. There was also a sparse to thick ground cover up to 1 m in height consisting of Spinifex (*Triodia*), or in more disturbed areas, Buffel Grass (*Cenchrus ciliaris*). Vegetation condition varied from degraded to good, with the major disturbances being cattle grazing, clearing for infrastructure and introduced grasses (e.g. Buffel Grass). There was a thin and very sparse leaf litter layer, and a sparse cover of woody debris, with 20-50% of the ground being bare. There was a moderate cover of small surface rocks, and very little other rock formations in this habitat type. Typical soil type was a red-brown loam.

Low Hills

The low hills habitat throughout the proposed transmission line easement consisted of a moderate ground cover of Spinifex of around 0.5 m in height, and in places there was a sparse canopy of small trees (*Eucalyptus* sp.) of up to 4 m in height with shrubs (mainly *Acacia* sp.) of up to 1.5 m. There was little or no leaf litter or woody debris and 5-65% of the ground was bare. There were few if any

hollow-bearing trees in this habitat. The condition of the vegetation was generally good. Small and large surface rocks were common in this habitat type and the soil was typically stony. There were some disturbances within the expansion area from roads and adjacent infrastructure.

The low hills habitat (at the Newman substation site) consists of a scattered overstorey of trees (*Eucalyptus leucophloia*), with an open mid-storey of shrubs (*Acacia* sp.) and an open ground-cover of exotic Buffel Grass (Appendix F, photo 10). The condition of the vegetation ranged from Degraded to Completely Degraded. There was a high level of disturbance within the expansion area from roads, adjacent infrastructure (i.e. existing sub-station and powerlines) and introduced species (Buffel Grass).

Riverine

Several major creek lines pass through the project area, including the Fortescue River (Figure 3c). The creek lines are lined with a sparse to moderate cover of trees (*Eucalyptus* sp. and *Corymbia* sp.) up to 10 m in height. There was a sparse understorey of *Acacia* sp. ranging from 2-5 m in height. There was a moderate to thick ground cover of Spinifex or reeds (*Typha* sp.), or in more disturbed area, Buffel Grass. There was a thin and very sparse leaf litter layer, and a sparse cover of woody debris, with 5-50% of the ground being bare. In places, small surface rocks were common. Soils were typically red-brown sands.

At the time of the survey the creeks were completely dry (in the project area), which is reflective of the typical state of the creek. Some water pools were present in other parts of the creek (out of the project area), so it would be expected that some animals may have occurred during the survey than may be absent at drier times of the year.

The creek is lined with *Eucalyptus* that are larger than any plants in the surrounding plains, so it is likely that it is a corridor for some wildlife. In particular, birds, bats, large mammals (such as the Euro) and wide-ranging reptiles (such as snakes and goannas) are likely to use the creek as a movement corridor. Larger trees provide a moderate abundance of tree hollows, ranging from small to large hollows.

The vegetation condition varied from degraded to good, with the major disturbances being cattle grazing, clearing for infrastructure and introduced grasses (e.g. Buffel Grass).

Floodplain

The floodplain habitat consists of a scattered overstorey of trees (*Eucalyptus* sp. and *Corymbia* sp.), up to 8 m in height with a moderate mid-story of shrubs (mostly *Acacia* sp.) of up to 4 m, with a sparse to thick ground-cover of Buffel

Grass up to 0.5 m in height. Hollow-bearing trees are rare. The vegetation is of moderate complexity, providing some microhabitat such as fallen timber and leaf litter that can be utilised by terrestrial and arboreal fauna. The vegetation condition varied from degraded to good, with the major disturbances being clearing for infrastructure and introduced species (e.g. Buffel Grass). There was a thin and very sparse leaf litter layer, and a sparse cover of woody debris, with 5-70% of the ground being bare. Small surface rocks were rare. Soils were typically red-brown sands or loams.

Hilltops/ Breakaways

Within the low hills habitat type were hills or rocky ironstone outcrops and breakaways. Breakaway habitat also occurred where major drainage lines passed through slightly higher rocky country, such as north of Orebody 25 (Figure 3b). The vegetation in these areas consisted of a sparse to moderate cover of Spinifex up to 0.5 m in height, with a sparse shrub layer of *Acacia* sp. up to 2 m in height and sparse cover of low trees (*Eucalyptus* sp.). There was little or no leaf litter or woody debris, and 35-50% of the ground was bare ground, the rest being covered in small and large surface rocks, boulders and boulder piles.

Some low cliffs were present in the larger patches of this habitat type, of up to approximately 20m in height above the scree. Within these cliffs were many cracks and small caves. There were some moderate-sized caves that provide roosting habitat for cave-dwelling bats (Photo 9, Appendix F). Some common cave bats were found roosting in the rear of the larger caves during the survey. All significant caves suitable for bats are mapped in Figures 3a-3g, and details and co-ordinates of them are given in Appendix G.

3.3 FAUNA ASSEMBLAGE IN THE PROJECT AREA

All fauna species recorded during the survey (including opportunistic observations) are listed in Appendix B. A total of 88 terrestrial vertebrate fauna were recorded during the survey, including one amphibian species, 14 reptile species, 58 bird and 15 mammal species (Appendix B).

3.3.1 Amphibians

One amphibian species (*Litoria rubella*) was recorded in the project area (Appendix B). No conservation significant frogs were found during the survey.

3.3.2 Reptiles

Fourteen species of reptiles was recorded in the project area (Appendix B). The most common reptile in rocky country (low hills) was the Ring-tailed Rock Dragon (*Ctenophorus caudicinctus*) while the Military Sand Dragon (*Ctenophorus*

isolepis) was the most common reptile in Mulga Plains and Floodplains. No conservation significant reptile species were found during the survey.

3.3.3 Birds

A total of 58 bird species were recorded in the project area (Appendix B). Two species of conservation significance were found during the survey, the Rainbow Bee-eater (*Merops ornatus*) and the Star Finch (*Neochmia ruficauda clarescens*). These species were found in riverine and floodplain habitat along Whaleback Creek.

3.3.4 Mammals

A total of 15 species being were recorded in the project area (Appendix B). No conservation significant mammals species were found during the survey.

Some bat species echolocation calls can overlap in frequency, so some calls may not be able to be reliably identified by Anabat analysis. Four species of bats were only tentatively identified from the Anabat analysis (Appendix H), but have been included in the species list nevertheless. None of these species were conservation significant. One other bat taxa (an unidentified long-eared bat) could not be identified to species level by Anabat analysis (Appendix H).

Four species of introduced mammals were found during the survey, the European Rabbit (*Oryctolagus cuniculus*), the Dingo (*Canis lupus*), Fox (*Vulpes vulpes*) and the Feral Cat (*Felis catus*) (Appendix B).

3.4 CONSERVATION SIGNIFICANT FAUNA

Of all the conservation significant fauna species previously recorded in the region, some will not occur in the project area because they have a limited or patchy distribution, high level of habitat specificity, are locally extinct or were erroneously recorded in previous surveys. Appendix C lists all previously recorded conservation significant fauna, their distribution and ecology, and discusses the likelihood of them occurring in the project area, based on the habitat present.

Two conservation significant species were recorded during the survey and a further 14 species potentially occur in the project area based on the habitat present (Table 3). Details of each species' ecological requirements and habitat preference are given below.

Table 3: Conservation Significant Fauna Species Found During the Survey, and Those Potentially Occurring in the Project Area, and Their Potential Utilisation of the Site

Species	Conservation Code			Potential utilisation of the site			
	EPBC	WC	DEC	Foraging	Roosting/ Sheltering	Breeding/ Nesting	Dispersal / Migratory path
REPTILES							
<i>Lerista macropisthopus remota</i>			P2	X	X	X	X
<i>Ramphotyphlops ganei</i>			P1	X	X	X	X
Pilbara Olive Python	VU	S1		X	X		X
BIRDS							
Great Egret	Mi, Ma			X			
Peregrine Falcon		S4		X	X		
Australian Bustard			P4	X	X		
Common Sandpiper	Mi, Ma			X			
Bush Stone-curlew			P4	X			
Fork-tailed Swift	Mi			X			
Rainbow Bee-eater *	Mi			X	X	X	
Star Finch *			P4	X	X		X
MAMMALS							
Long-tailed Dunnart			P3	X	X	X	
Black-footed Rock-wallaby	VU	S1		X	X		
Ghost Bat			P4	X	X		
Pilbara Leaf-nosed Bat	VU	S1		X	X		
Western Pebble-mound Mouse			P4	X	X	X	X

Key: EPBC= Environmental Protection and Biodiversity Conservation Act 1999, WC= Wildlife Conservation Act 1950, DEC= Department of Conservation Priority Code, *= recorded during the survey. See Appendix A for and explanation of conservation codes and Appendix B for full details of species common or scientific names.

3.4.1 Reptiles

Three conservation significant reptile species potentially occur on the site, and are discussed below.

Lerista macropisthopus remota

Lerista macropisthopus remota occurs in *Acacia* shrublands and woodlands, and is found in loose soil under leaf litter at the base of shrubs (Wilson & Swan 2008). Little is known of its habitat requirements, with few specimens having been collected. Considering this species' ecology, individuals of this species may forage, shelter and breed in the project area in the Mulga plains.

Ramphotyphlops ganei

Ramphotyphlops ganei is a rare blind snake, with little known about its habitat requirements. There are few records of the species in the Pilbara, making it one of the rarest reptiles for the region. Blind snakes are typically very hard to detect during biological surveys, yet more common blind snakes such as *Ramphotyphlops gryp* are typically recorded at least once per trapping survey. It appears this species prefers rocky or stony soils (Wilson & Swan 2008) which suggests it should occur broadly across the region. It is possible that this species occurs in habitat with rocky soils such as the low hills.

Pilbara Olive Python (*Liasis olivaceus barroni*)

Olive Pythons are found in a range of habitats, including drier areas of woodland (Wilson & Swan 2008). They are associated with rocky gorges and gullies around watercourses, habitats which are not present in the project area. Considering this species' ecology, however, individuals of this species may occasionally forage and move through the riverine habitat on a transitory basis.

3.4.2 Birds

Two conservation significant birds species were recorded in the survey and a further six species potentially occur in the project area, and are discussed below.

Great Egret (*Ardea alba*)

The Great Egret inhabits mostly shallow fresh lakes, pools in rivers, lagoons, lignum swamps, clay pans and samphire flats, large dams and sewage ponds (Johnstone & Storr 1998). It also inhabits shallow saltwater habitat such as mangrove creeks, tidal pools, samphire swamps and salt work ponds. It breeds colonially at wooded swamps and river pools, nesting in various riparian trees (Johnstone & Storr 1998). Considering this species' ecology, it is only likely to occur along the riverine habitat on a transitory basis, after or during the wet season when water is present.

Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon occurs mainly along coastal cliffs, rivers and ranges as well as wooded watercourses and lakes (Johnstone & Storr 1998). The Peregrine Falcon nests primarily on cliffs, granite outcrops and quarries, and feed mostly on birds (Johnstone and Storr 1998). Potential nesting locations are present in the project area in hilltop / breakaway habitat, but no Peregrine Falcons or their nests were recorded during the survey, so it is unlikely they breed in the project area. This species could, however, forage in the project area on a transitory basis.

Australian Bustard (*Ardeotis australis*)

The Australian Bustard is typically found in grasslands, especially tussock grasses, arid scrub and dry open woodlands (Morcombe 2000). The abundance of this species varies according to habitat and season, and in particular on the abundance of grasshoppers (Johnstone & Storr 1998). They are migratory or nomadic, and are wide ranging, so can potentially forage anywhere in the Pilbara on a transitory basis. Considering this, it can be expected that the species may forage from time to time in any habitat in the project area.

Common Sandpiper (*Tringa hypoleucos*)

The Common Sandpiper occurs along the coast of Western Australia, and in much of the interior. They inhabit sheltered salt and fresh waters such as estuaries, mangrove creeks, rocky coasts, salt lakes, river pools, lagoons, claypans, drying swamps, flood waters, dams and sewage ponds (Johnstone and Storr 1998). They occasionally occur inland in a variety of wetlands (Geering, Agnew & Harding 2007). They are a non-breeding migrant to Western Australia occurring at any time of year (Johnstone and Storr 1998). This species may occur on a temporary basis in the region, particularly during the wet season. In the project area they may occur during this time temporarily in the riverine habitat or floodplain of the Fortescue River.

Bush Stone-curlew (*Burhinus grallarius*)

The Bush Stone-curlew inhabits dry open woodlands with groundcover of small sparse shrubs, grass or litter of twigs. It tends to avoid dense forest and closed-canopy habitats (Morcombe 2000). The species generally occurs near a watercourse or swamp (Geering, Agnew & Harding 2007). Bush Stone-curlews are locally rare because of predation by foxes - the main concern for their regional decline (Johnstone and Storr 1998). It is unlikely that this species occurs on a permanent basis in the project area because of the presence of foxes, and being close to disturbances such as mining activity and roads. It is possible however, that they occur on an occasional temporary basis in the project area.

Fork-tailed Swift (*Apus pacificus*)

The Fork-tailed Swift is a summer migrant which forages high above the tree canopy and rarely lower so is independent of terrestrial habitats. Considering this it is likely that this species will occasionally forage high over any part of the project area.

Rainbow Bee-eater (*Merops ornatus*)

The Rainbow Bee-eater migrates to south-western Australia to breed in spring and summer. The Rainbow Bee-eater is a common and widespread species in

Western Australia. It occurs in lightly wooded, often sandy country, preferring areas near water. The Rainbow Bee-eater feeds on airborne insects, and nests throughout its range in Western Australia in burrows excavated in sandy ground or banks, often at the margins of roads and tracks (Johnstone & Storr 1998). Considering this species' ecology it is likely that it forages regularly in the project area. During the survey it was recorded in the riverine and floodplain habitat along Whaleback Creek, and this is where it is most likely to forage.

Star Finch (Western subspecies) (*Neochmia ruficauda clarescens*)

The Star Finch occurs in grasslands with sparse vegetation, and feeds mainly on grass seeds and some small insects (Johnstone & Storr 2004). Like most finches this species needs regular water, so is likely to occur near permanent water for most of the dry season then disperse out to a wider area during and after the wet season when ephemeral pools have water. This species was observed along Whaleback Creek and the Fortescue River during the survey. It is likely to occur in the riverine habitat frequently during and after the wet-season, when pools of water are still present along the creek lines. Due to the lack of permanent water it is not expected that this species would reside year-round in the project area and is unlikely to breed there.

3.4.3 Mammals

Five conservation significant mammal species potentially occur in the project area, and are discussed below.

Long-Tailed Dunnart (*Sminthopsis longicaudata*)

The Long-tailed Dunnart is native to northern and central Western Australia, where it occurs in spinifex grasslands in association with low open mulga woodland, usually with nearby rocky outcrops (van Dyck & Strahan 2008). It is possible that a population of this species occurs in the mulga plains in the project area, and if so, would only be expected to occur in and around the rocky outcrops.

Black-footed Rock-wallaby (*Petrogale lateralis lateralis*)

The Black-footed Rock-wallaby has a scattered distribution throughout its range from the Pilbara south, and appears to be being reduced in numbers by fox predation (van Dyck & Strahan 2008). Pearson & Kinnear (1997) reported that local and regional extinctions of Black-footed Rock Wallabies continue to occur. There have been numerous reported sightings of the Black-footed Rock-wallaby in the Pilbara, but many are likely to be erroneous because of the similarity in appearance of this species to the common Rothschild's Rock-wallaby.

Colonies are largely confined to hilly outcrops of granite boulders in remnants of mallee scrub surrounded by cleared agricultural land, and are highly vulnerable to fox predation. The Black-footed Rock-wallaby uses rocky outcrops and breakaways for shelter (van Dyck & Strahan 2008), in association with partial grass and shrub cover for foraging. While it is unlikely that this species occurs in large numbers in the project area, some could occasionally move through the more rocky parts of the site, such as the area of hilltop/ breakaway habitat north of Orebody 25 (Figure 3b).

Ghost Bat (*Macroderma gigas*) and Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*)

Both the Ghost Bat and the Pilbara Leaf-nosed Bat occurs in a wide variety of habitats, and require undisturbed caves, deep fissures or disused mine shafts in which to roost (van Dyck and Strahan 2008). Based on the habitat present either may roost in caves on a temporary basis, however none of the caves in the project area are large enough to be provide breeding habitat for either species (Appendix G). Either species could also forage occasionally on the site particularly in the riverine, floodplain or hilltop / breakaway habitat.

Western Pebble-mound Mouse (*Pseudomys chapmani*)

The Western Pebble-mound Mouse is endemic to the Pilbara, and is confined to the central and eastern Pilbara, including Karijini National Park (Menkhorst & Knight 2004).

The construction of extensive pebble mounds, built from small stones, which typically cover areas from 0.5-9.0 m², is characteristic of this species (Van Dyke & Strahan 2008). Mounds are restricted to suitable-class stones (0.05 to 10 grams), and are usually found on rocky slopes and spurs (Van Dyke & Strahan 2008).

In the project area there is potential habitat for this species in the low hills habitat type. Many inactive pebble-mounds were found during the survey, however it is still possible that active mounds still exist in more isolated parts of the project area.

3.5 CONSERVATION SIGNIFICANT ECOLOGICAL COMMUNITIES

Threatened ecological communities (TEC) need to be taken into account by State assessment bodies as part of the environmental impact assessment processes, and are indirectly protected under the *Environmental Protection Act 1986* and Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (DEC 2009d).

One threatened ecological community, the Ethel Gorge Aquifer Stygobiont Community, occurs in the vicinity of the project area (Figure 3c). This community is listed as Endangered by the DEC (DEC 2007). Although Stygofauna are not terrestrial vertebrates (and therefore outside the scope of this assessment), ENV has included the record of this ecological community so that WorleyParsons is at least aware of their presence. Considering that the project area is approximately 1km from the TEC (Figure 3c), and the nature of the proposed development, it is unlikely that there will be any direct or indirect impacts upon this TEC.

4 DISCUSSION

4.1 SAMPLING ADEQUACY

A total of 88 terrestrial vertebrate fauna species were recorded during the survey, including one amphibian species, 14 reptile species, 58 bird and 15 mammal species. Because this was a Level One survey and no trapping was undertaken, many other fauna species are likely to occur in the project area that were not recorded during the survey. Many of the common species (that are not conservation significant) listed in Appendix B are likely to occur in the project area. For conservation significant species, the habitat present has been considered and those deemed to potentially occur on the site have been addressed in this section, including the potential impacts from the proposed development (Section 4.3).

4.2 SIGNIFICANCE OF FAUNA HABITAT IN THE PROJECT AREA

Despite the length of the proposed transmission line, the project area is a relatively small area (approximately 767 ha of native vegetation). There is a considerable amount of heavy industry nearby, including several large iron-ore mines as well as roads, rail-lines and transmission lines in the immediate vicinity.

Mulga Plain

Mulga plain habitat in the Pilbara generally has a moderate richness of conservation significant fauna species, but has a widespread *regional representation*, so has low *regional habitat value* (Appendix D). In the project area, the mulga plain habitat is in good condition, but has few potential conservation significant species, so therefore has low *local habitat value* (Appendix D).

Low Hills

Low hills habitat in the Pilbara generally has a moderate level of fauna diversity and conservation significant species diversity, but has a widespread *regional representation*, so has low *regional habitat significance* (Appendix D). In the project area, the low hills habitat is in good condition, but has few potential conservation significant species, so therefore has low *local habitat value* (Appendix D).

Riverine

Riverine habitat in the Pilbara generally has a high richness of conservation significant species, and has a confined *regional representation*, so has high *regional habitat value* (Appendix D). In the project area the riverine habitat is in

generally very good condition and may support a moderate level of conservation significant species diversity, so has moderate *local habitat value* (Appendix D).

The riverine habitats form linear fauna corridors likely to be used from time to time by conservation significant species such as the Pilbara Olive Python or Star Finch.

Floodplain

Floodplain habitat in the Pilbara generally has a moderate richness of conservation significant species, and has a moderate *regional representation*, so has moderate *regional habitat value* (Appendix D). In the project area the floodplain habitat is in generally good condition but has a low richness of conservation significant species, so has low *local habitat value* (Appendix D).

Hillcrests/ Breakaways

Hillcrest/ breakaway habitat in the Pilbara generally has a high richness of conservation significant species, and has a confined *regional representation*, so has high *regional habitat value* (Appendix D). In the project area the hillcrest/ breakaway habitat is generally in very good condition and has a moderate richness of conservation significant species, so has low *moderate habitat value* (Appendix D).

Caves in the project area in this habitat type were found to have common cave bats roosting in them. While it is unlikely that conservation significant bats breed in these caves, they may temporarily roost in them.

4.3 IMPACT ASSESSMENT

This assessment aims to identify potential impacts of the proposed development, and to explore measures to minimise these impacts. The net impact on fauna is discussed, with particular focus on conservation-significant species.

4.3.1 Potential Impacts from the Proposed Development

The major impacts upon fauna from the development are likely to be from clearing of habitat, and mortalities to flying animals that collide with the transmission line.

The most obvious impact upon fauna habitat from the development will be land clearing for the tracks and pads for the transmission line towers. Based on the track to the existing transmission line that runs parallel to the project area, a track ranging from 5-10 m in width may be constructed for part or all of the length of the proposed transmission line. Based on existing transmission line tracks in the area, the tracks are likely to be placed in flatter country and avoid rocky outcrops,

hilltops and breakaways. Pads approximately 10 m wide will be constructed along or adjacent to this track for the transmission towers.

Considering that the project area was a 100 m-wide strip, the area of actual clearing for the proposed development will be significantly less than the total size of the project area. The clearing or access track and pads is likely to slightly reduce the area of potential habitat for local fauna, and may slightly reduce the population size of local, ground-dwelling fauna such as reptiles and small mammals.

Birds are also susceptible to mortality through collision with transmission lines (Erickson et al. 2005) and it is possible that some birds may be electrocuted while perching or nesting in substations. Birds most likely to strike transmission lines are those that are large, and those that fly at night.

Considering there are currently hundreds of kilometres of transmission line already existing in the Pilbara, including one that runs parallel to the project area (passing over the Fortescue River), the proposed development does not go beyond what already exists in the region. The proposed transmission line is therefore only likely to increase the level of anthropogenic mortality on a local scale.

As with most developments that involve the clearing of land, weeds could be potentially introduced or spread by the proposed development. This has the potential to affect fauna habitat by modifying the foraging habitat available for herbivorous species, or through secondary effects that weeds may have upon the ecology of the habitat.

4.3.2 Significance of Impacts upon Conservation Significant Fauna

The removal or disturbance of fauna habitat for tracks and power pole pads is unlikely to affect a significant amount of foraging habitat for any fauna species. Tracks are unlikely to impact upon features in the landscape such as rocky outcrops, breakaways and caves because throughout the project area these features are easily avoided by the placement of the track. Existing tracks for the transmission line adjacent to the project area are constructed in this manner. In the context of the region, the proposed development will cause a very limited level of habitat disturbance.

The proposed 50 km-long transmission line does not pass any major lake or swamp, however it does pass several major drainage lines, including the Fortescue River. Where the proposed transmission line bisects the Fortescue River, the river is a wide floodplain, consisting of several branches. Some birds may collide with the proposed transmission line, particularly along the creek lines, and most likely along the Fortescue River

The impact of the proposed development upon specific conservation significant fauna that was found during the survey or potentially occur in the project area is discussed below.

***Lerista macropisthopus remota*, *Ramphotyphlops ganeii*, and Pilbara Olive Python**

Three species of conservation significant reptiles potentially occur in the project area, including *Lerista macropisthopus remota*, *Ramphotyphlops ganeii* and the Pilbara Olive Python.

The proposed development will only result in a relatively small area of disturbance to habitat types that are considered to be of low or moderate habitat significance for these species. It is therefore not expected that a significant amount of habitat for reptiles will be affected by the development.

It is unlikely that the proposed transmission line will have a major disruption to the riverine habitat that would stop the movement of fauna, so movements of the Pilbara Olive Python through the project area is unlikely to be hindered.

Great Egret and Common Sandpiper

The Great Egret and Common Sandpiper are likely to occur in the riverine habitat in the project area, however it is unlikely that either of these species breeds or are resident species in the area. Both species are likely to forage along the major drainage lines, in particular the Fortescue River, in summer and autumn after major rainfall events. Being a large bird, the Great Egret may be susceptible to striking powerlines. Based on the apparent impacts of existing transmission lines in the area, the amount of habitat in these habitat types that will be disturbed as part of the proposed transmission line is insignificant.

Peregrine Falcon

The Peregrine Falcon is rare in the Pilbara, and is not likely to occur in the project area on a regular basis. They are most likely to forage in riverine and floodplain habitat, along drainage lines (Johnstone & Storr 1998). The amount of foraging habitat impacted by the proposed transmission line will be minimal. The Peregrine Falcon is only likely to be flying at transmission line height during daylight so it is unlikely to strike powerlines.

Clearing for tracks associated with the proposed development are unlikely to have an impact upon breakaway habitat, because tracks will most likely be placed in flat terrain. Therefore no cliffs are likely to be destroyed, so breeding habitat for the Peregrine Falcon is highly unlikely to be affected by the proposed development.

Australian Bustard

The Australian Bustard has the potential to collide with the proposed transmission lines. At a local population level this could potentially add to the level of anthropocentric mortality for this species in the area that already exists from roads, rail lines and transmission lines. The Australian Bustard occurs throughout the Pilbara, and also occurs through much of Western Australia, and is known to be declining in the south-west of Western Australia (Johnstone & Storr 1998). While the proposed development may have a slight local impact upon this species, significant impacts on a regional or state scale are highly unlikely.

Bush Stone-curlew

Being a relatively large bird, the Bush Stone-curlew may be susceptible to colliding with power lines. The Bush Stone-curlew is, however, very rare in the area and not expected to occur in the project area regularly. Therefore it is unlikely that the construction and operation of the proposed transmission line will result in significant mortality for this species.

Fork-tailed Swift

Fork-tailed Swifts forage high in the air-space, and it is unlikely that foraging habitat for the species will be affected by the development.

Rainbow Bee-eater

Potential nesting habitat for the Rainbow Bee-eater exists along the banks of drainage lines in the project area. If any infrastructure such as tracks should pass through these drainage lines they may actually increase the amount of exposed earth in which Rainbow Bee-eaters could nest. As such the proposed development is unlikely to result in a net loss of potential breeding habitat for this species.

Star Finch

It is possible that Star Finches could nest in trees in the project area, particularly in the riverine or floodplain habitat. The proposed development is unlikely to result in a significant loss of this habitat type.

Long-tailed Dunnart and Western Pebble-mound Mouse

The proposed development will only result in a relatively small area of disturbance to habitat types that are considered to be of low or moderate habitat significance for these species. In addition, rocky habitat where the Long-tailed Dunnart could potentially reside is unlikely to be affected by the proposed

development, and no active Western Pebble-mound Mouse mounds were recorded during the survey. It is therefore not expected that a significant amount of habitat for ground mammals will be affected by the development.

Black-footed Rock Wallaby

The Black-footed Rock Wallaby is unlikely to occur in the project area regularly. It may temporarily pass through the hilltop/ breakaway habitat. As discussed earlier in this section, the proposed development is unlikely to have a significant impact upon this habitat type. The proposed development is therefore highly unlikely to have an impact upon this species.

Ghost Bat and Pilbara Leaf-nosed Bat

The Ghost Bat and Pilbara Leaf-nosed Bat roost and breed in deep, humid caves. Provided that no significant caves are destroyed by the proposed development, there will minimal impact upon either of these bat species.

While macrobats (fruit bats) are known to collide with or become electrocuted by powerlines, microbats are unlikely to strike powerlines because they are relatively small, agile, and using their echolocation, are able to avoid stationary objects such as powerlines. Therefore, no bats are likely to be affected by the proposed transmission line.

5 CONCLUSION

The Level One fauna survey recorded a total of 88 terrestrial vertebrate fauna species, including one amphibian species, 14 reptile species, 58 bird and 15 mammal species.

Of those species recorded, two species are conservation significant (the Rainbow Bee-eater and Star Finch). A further 14 conservation significant fauna species potentially occur in the project area.

The project area has a moderate level of disturbance, being close to existing heavy industry and infrastructure, and is subject to pastoral activities. Of the habitat types identified, all were considered to be of low to moderate local significance. The proposed development envelope is relatively small in the context of the Pilbara region and the level of habitat disturbance is expected to be low.

Some species of bird may collide with powerlines, however considering there are currently hundreds of kilometres of transmission line already existing in the Pilbara, including one that runs parallel to the project area (passing over the Fortescue River); the proposed development does not go beyond what already exists in the region.

It is therefore unlikely that the proposed transmission line and sub-station will have a significant impact upon any conservation significant fauna.

6 REFERENCES

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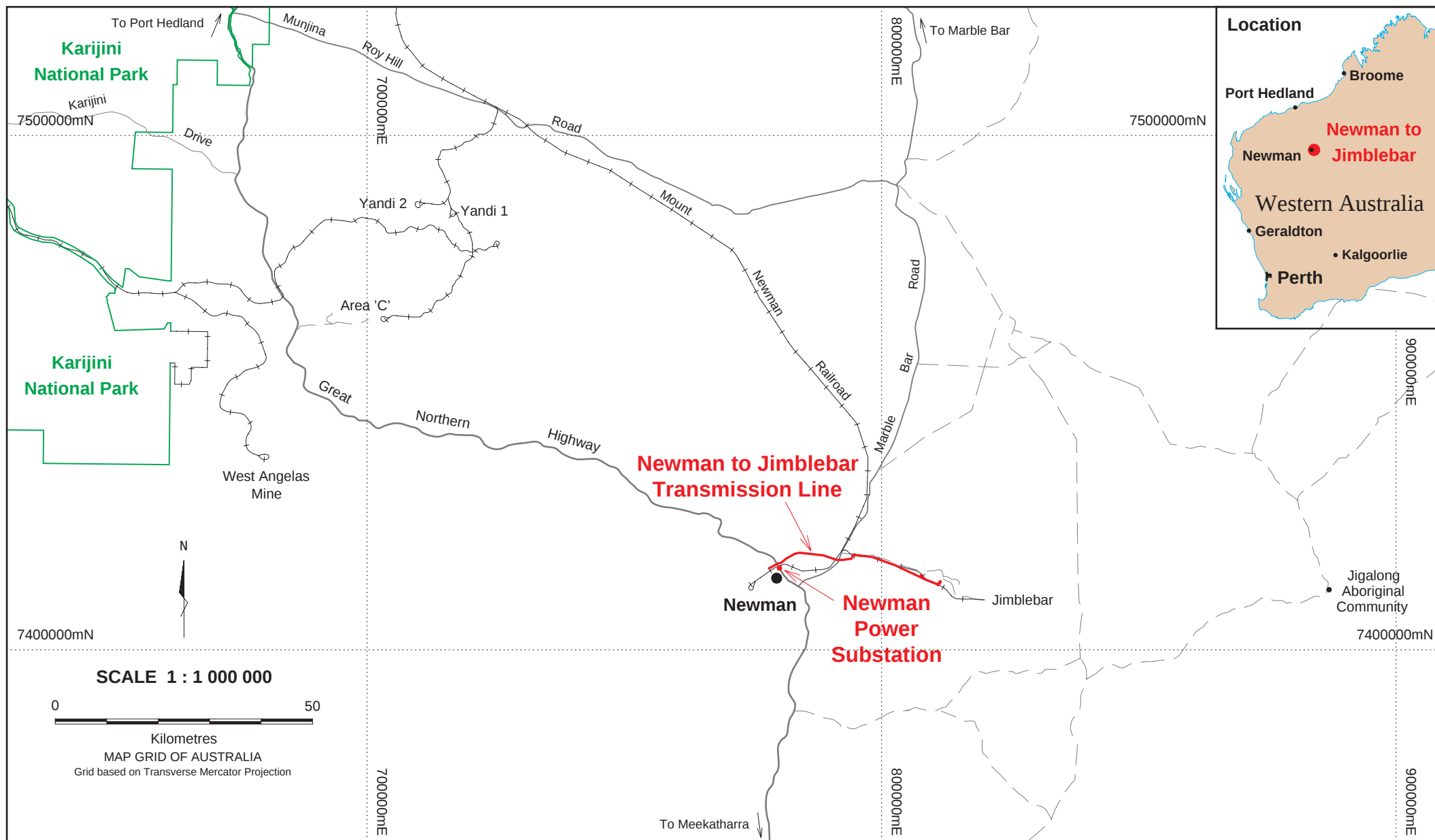
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FIGURES



Author: M.Welsh

Drawn: S.Coleman

Status:

Job Number: 09.063

Client:

WORLEYPARSONS

Project:

**NEWMAN TO JIMBLEBAR
 TRANSMISSION LINE AND NEWMAN TOWN SUBSTATION
 TERRESTRIAL FAUNA ASSESSMENT**

PROJECT AREA LOCATION

Date: 14 September 2009

Scale: ~~NT\$~~ Million

Figure No. **1**

Plan No. **NJ-001**

A4





Legend

Survey Locations

△ AB 1

Anabat Survey

○ Cave 1

Cave Assessment

□ GF 11

General Diurnal Survey

Fauna Habitat Type Legend

Riverine

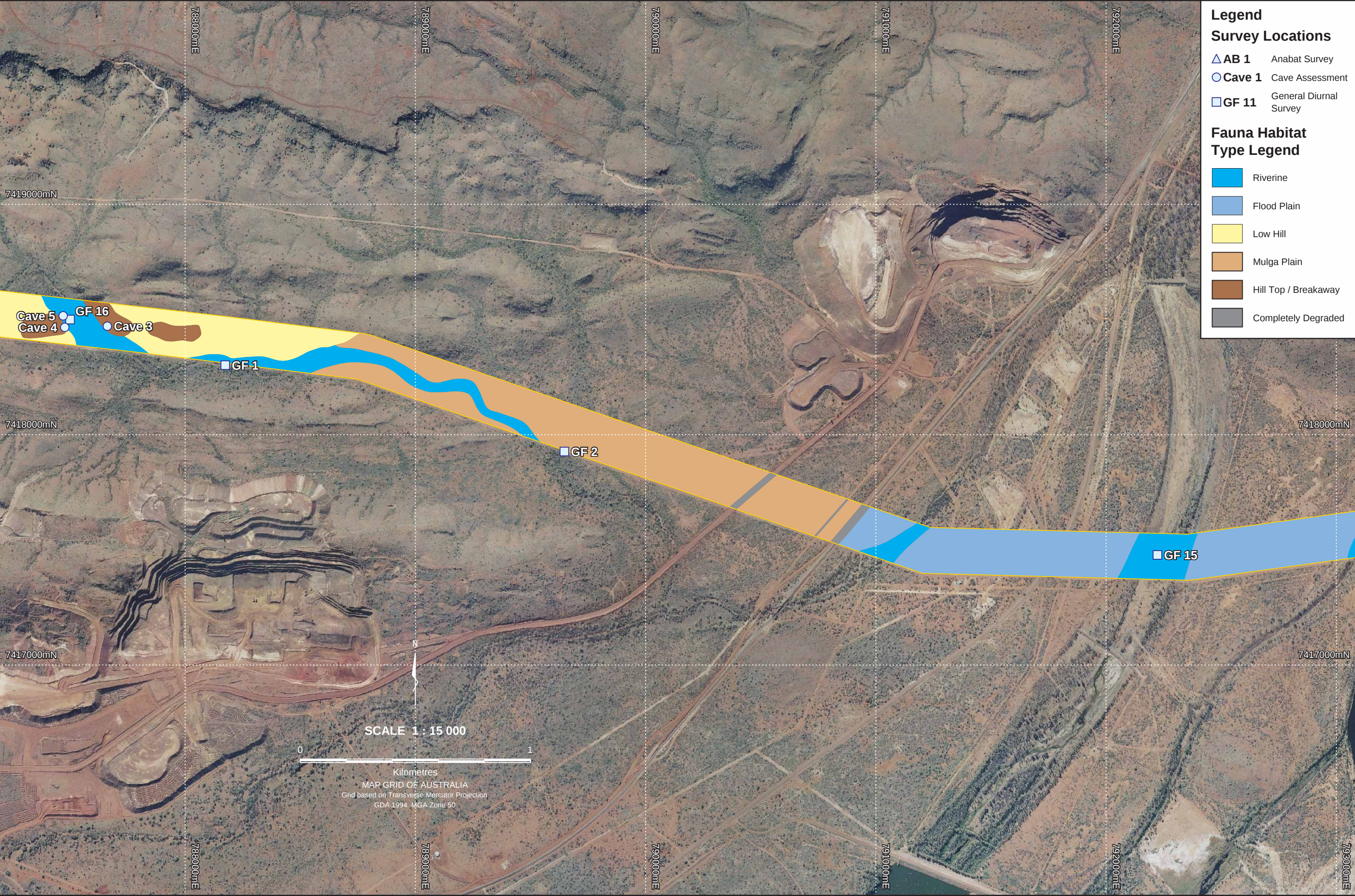
Flood Plain

Low Hill

Mulga Plain

Hill Top / Breakaway

Completely Degraded



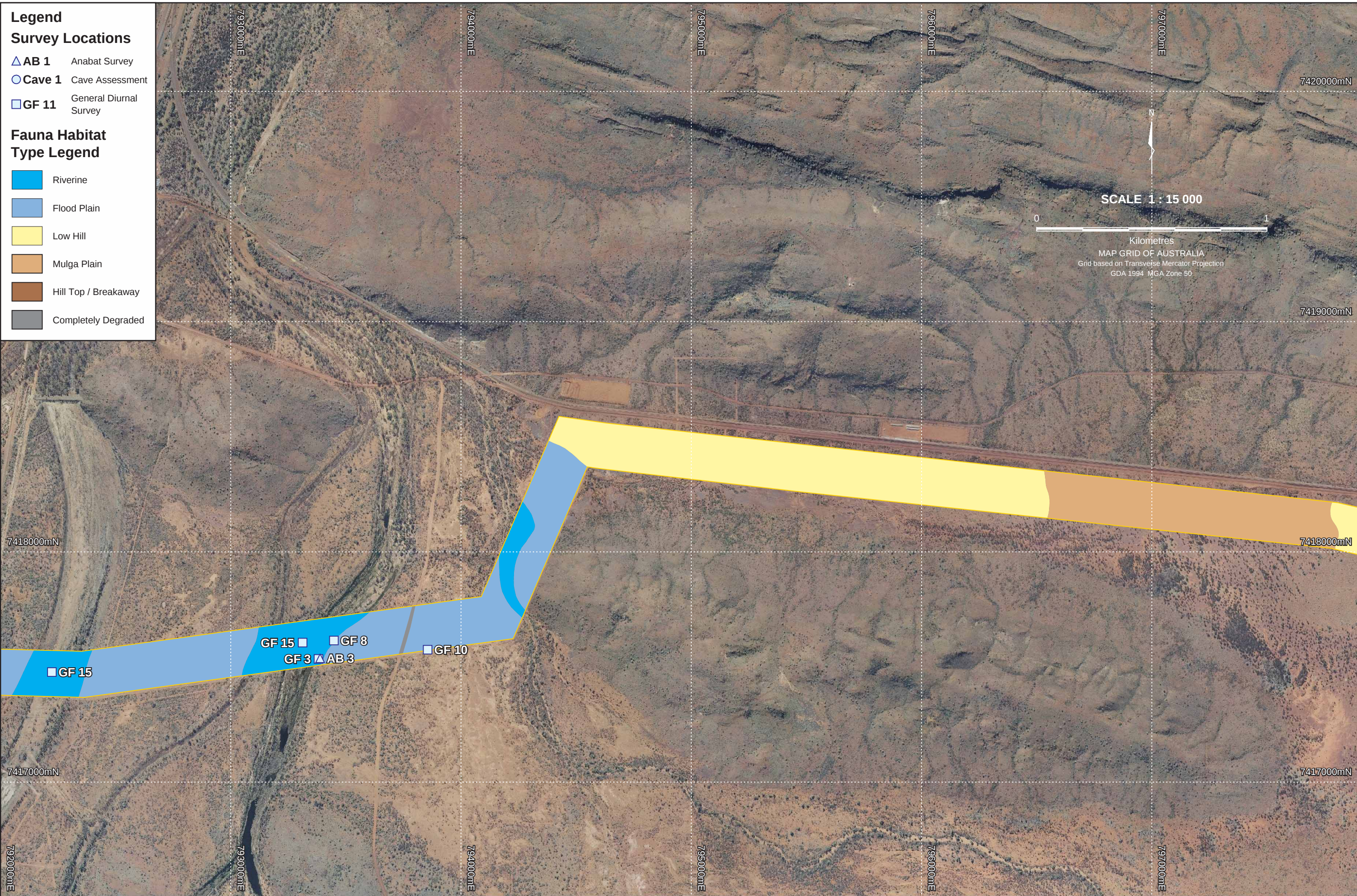
Legend

Survey Locations

- △ **AB 1** Anabat Survey
- **Cave 1** Cave Assessment
- **GF 11** General Diurnal Survey

Fauna Habitat Type Legend

- Riverine
- Flood Plain
- Low Hill
- Mulga Plain
- Hill Top / Breakaway
- Completely Degraded



Legend

Survey Locations

△

AB 1

Anabat Survey

○

Cave 1

Cave Assessment

□

GF 11

General Diurnal Survey

Fauna Habitat Type Legend

Riverine

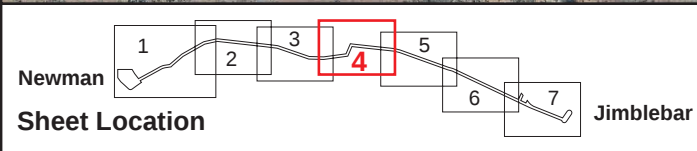
Flood Plain

Low Hill

Mulga Plain

Hill Top / Breakaway

Completely Degraded



Author: M.Welsh	Client: WORLEYPARSONS
Drawn: S.Coleman	NEWMAN TO JIMBLEBAR TRANSMISSION LINE AND NEWMAN TOWN SUBSTATION TERRESTRIAL FAUNA ASSESSMENT
Status:	
Job Number: 09.063	
Project:	

**FAUNA HABITAT
MAP 4 OF 7**

Date: 19 August 2009

Scale: 1:15 000

Figure No. **3d**

Plan No. **NJ-012**

A3



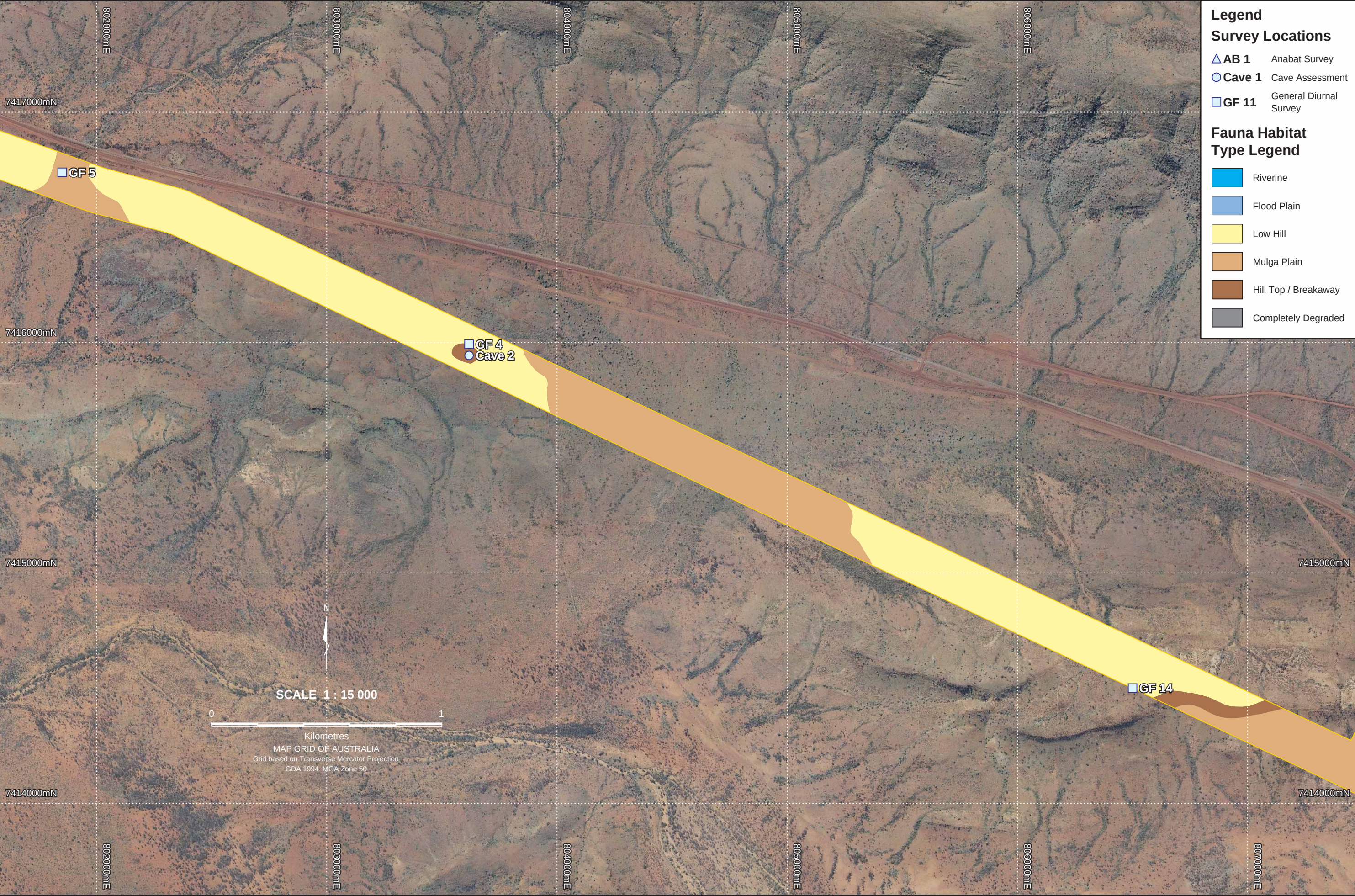
Legend

Survey Locations

- △ AB 1 Anabat Survey
- Cave 1 Cave Assessment
- GF 11 General Diurnal Survey

Fauna Habitat Type Legend

- Riverine
- Flood Plain
- Low Hill
- Mulga Plain
- Hill Top / Breakaway
- Completely Degraded



Legend

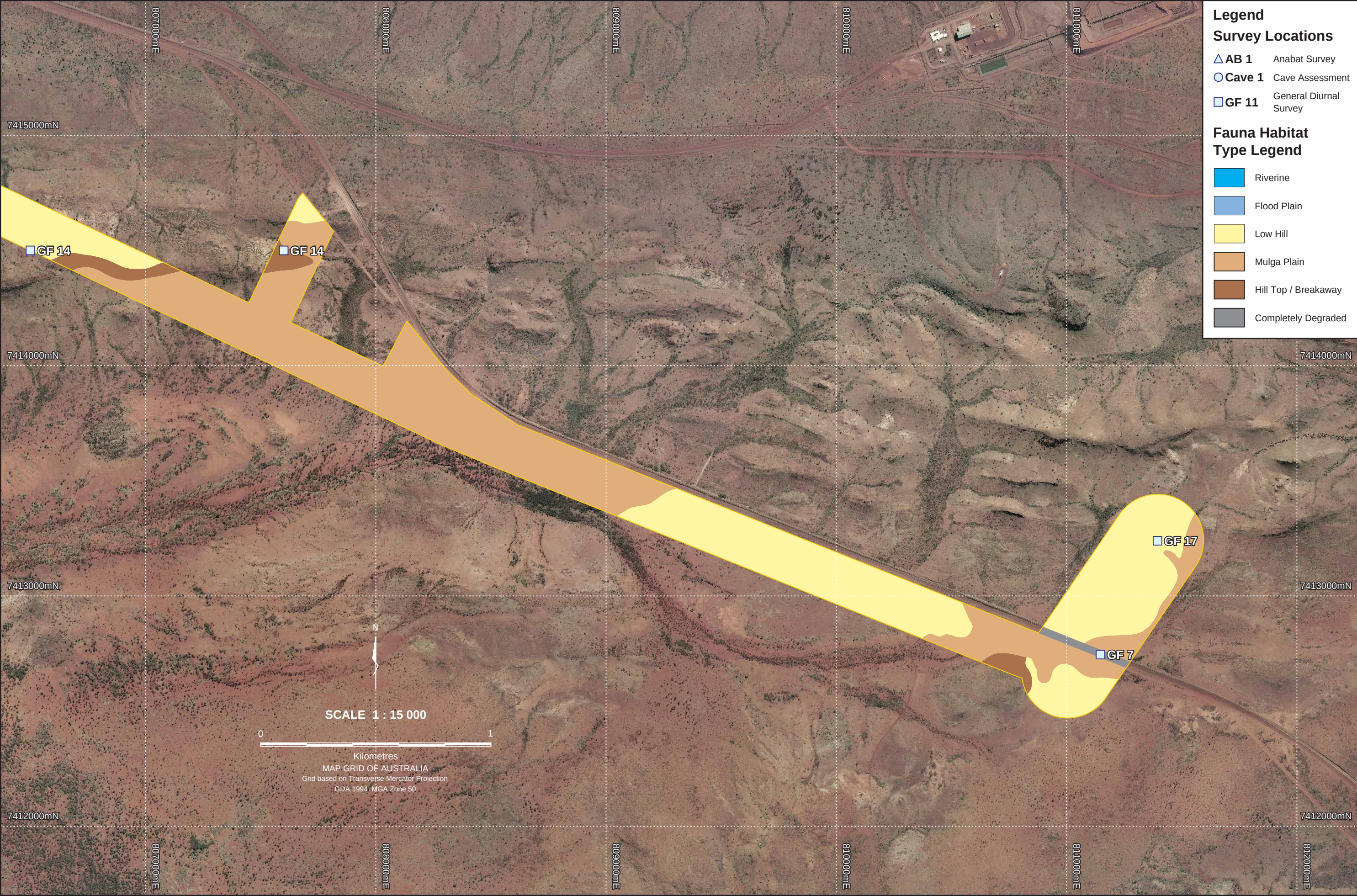
Survey Locations

- △ **AB 1** Anabat Survey
- **Cave 1** Cave Assessment
- **GF 11** General Diurnal Survey

Fauna Habitat Type Legend

- Riverine
- Flood Plain
- Low Hill
- Mulga Plain
- Hill Top / Breakaway
- Completely Degraded

Sheet Location Newman Jimblebar		Author: M.Welsh	Client: WORLEYPARSONS	FAUNA HABITAT MAP 6 OF 7	Date: 19 August 2009
		Drawn: S.Coleman	NEWMAN TO JIMBLEBAR TRANSMISSION LINE AND NEWMAN TOWN SUBSTATION TERRESTRIAL FAUNA ASSESSMENT		Scale: 1:15 000
		Status:			Figure No. 3f
		Job Number: 09.063			Plan No. NJ-014



Legend

Survey Locations

△

AB 1

Anabat Survey

○

Cave 1

Cave Assessment

□

GF 11

General Diurnal Survey

Fauna Habitat Type Legend

Riverine

Flood Plain

Low Hill

Mulga Plain

Hill Top / Breakaway

Completely Degraded

Newman

1 2 3 4 5 6 7

Jimblebar

Sheet Location

env

Australia

Author: M.Welsh

Drawn: S.Coleman

Status:

Job Number: 09.063

Client: WORLEYPARSONS

NEWMAN TO JIMBLEBAR TRANSMISSION LINE AND NEWMAN TOWN SUBSTATION

Project: TERRESTRIAL FAUNA ASSESSMENT

FAUNA HABITAT

MAP 7 OF 7

Date: 19 August 2009

Scale: 1:15 000

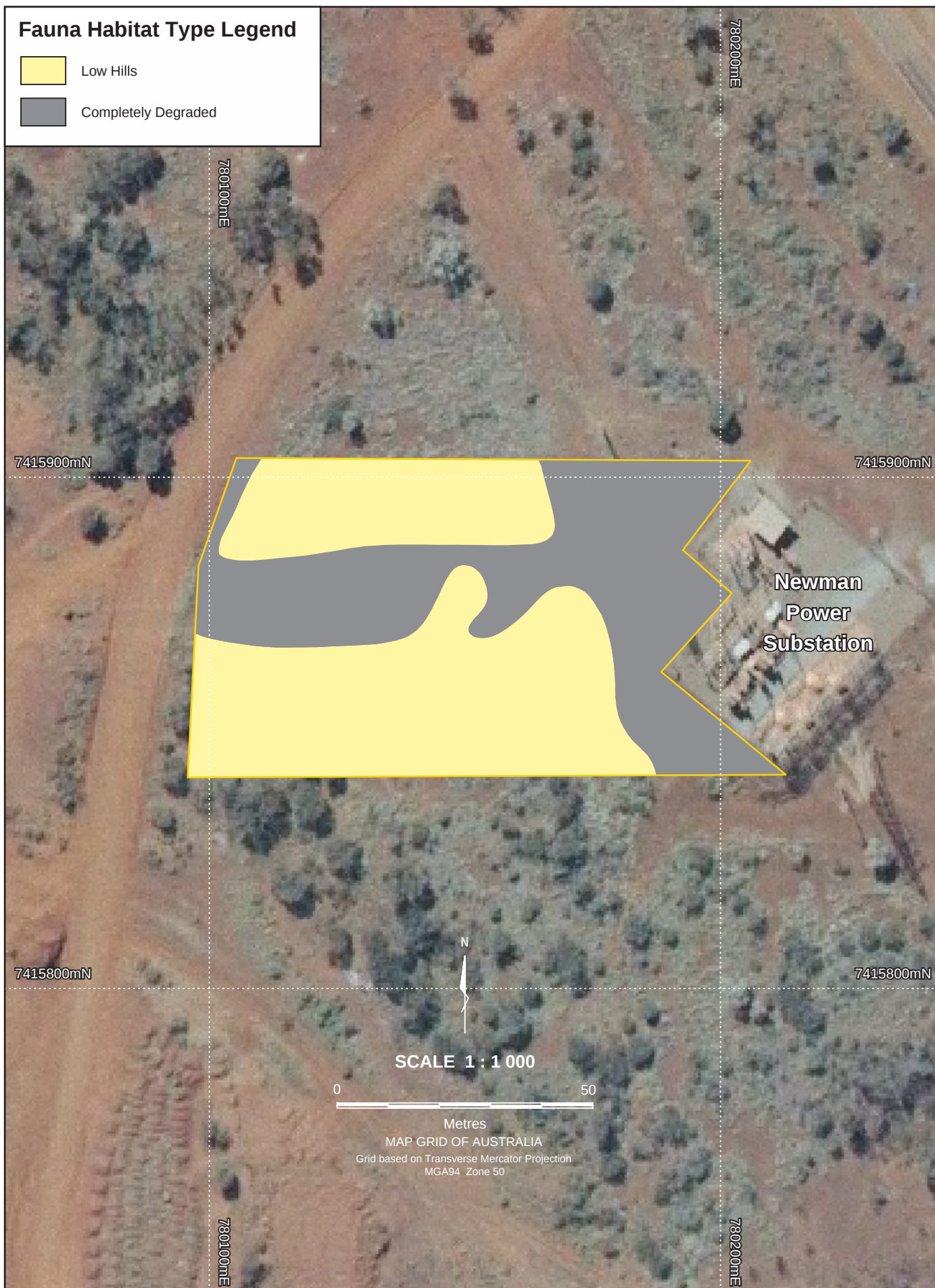
Figure No. **3g**

Plan No. **NJ-015**

A3

Fauna Habitat Type Legend

- Low Hills
- Completely Degraded



Client: **WORLEYPARSONS**

**NEWMAN TO JIMBLEBAR
TRANSMISSION LINE AND
NEWMAN TOWN SUBSTATION
TERRESTRIAL FAUNA**

Project: **ASSESSMENT**

09.063

FAUNA HABITAT TYPES

Date: 19 August 2009

Scale: 1:1000

Author: M.W. / S.C.

Figure No. **3h**

Plan No. **NJ-043**

A4

APPENDIX A

CONSERVATION CODES

NEWMAN TO JIMBLEBAR TRANSMISSION LINE AND NEWMAN TOWN SUBSTATION VERTEBRATE FAUNA ASSESSMENT

APPENDIX A

Definitions of Conservation Codes for Fauna of Conservation Significance

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

The EPBC Act prescribes seven matters of national environmental significance:

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

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

Category	Code	Description
Extinct	Ex	Taxa for which there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild	ExW	Taxa known to survive only in cultivation, in captivity or as a naturalised population well outside its past range; or not recorded in its known and/or expected habitat at appropriate seasons anywhere in its past range despite exhaustive surveys over a timeframe appropriate to its life cycle and form.
Critically Endangered	CE	Taxa facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	E	Taxa not critically endangered and facing a very high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Vulnerable	V	Taxa not critically endangered or endangered and facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Conservation Dependent	CD	Taxa which are the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within five years.
Migratory	Mi	Taxa that migrate to Australia and its external territories, or pass through or over Australian waters during their annual migrations, that are included in an international agreement approved by the Minister for the Environment, Heritage and the Arts and that have been placed on the national List of Migratory Species under the provisions of the EPBC Act. At present there are four such agreements: • the Bonn Convention • the China-Australia Migratory Bird Agreement (CAMBA) • the Japan-Australia Migratory Bird Agreement (JAMBA) • the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)

Category	Code	Description
Marine	Ma	Taxa protected in a Commonwealth Marine Protected Area by virtue of section 248 of the EPBC Act. These taxa include certain seals, crocodiles, turtles and birds, as well as various marine fish. Commonwealth marine areas are matters of national environmental significance under the EPBC Act. An action will require approval if the: • action is taken in a Commonwealth marine area and the action has, will have, or is likely to have a significant impact on the environment, or • action is taken outside a Commonwealth marine area and the action has, will have, or is likely to have a significant impact on the environment in a Commonwealth marine area¹ The Commonwealth marine area is any part of the sea, including the waters, seabed, and airspace, within Australia's exclusive economic zone and/or over the continental shelf of Australia, that is not State or Northern Territory waters. The Commonwealth marine area stretches from 3 to 200 nautical miles (approximately 5-370 km) from the coast. Marine protected areas are marine areas which are recognised to have high conservation value.

Western Australian Threatened Fauna Categories

Wildlife Conservation Act 1950 (WA)

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

Department of Environment and Conservation (DEC) Fauna Priority Codes

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

APPENDIX B

PREVIOUSLY RECORDED VERTEBRATE FAUNA AND SPECIES RECORDED DURING THE SURVEY

NEWMAN TO JIMBLEBAR TRANSMISSION LINE AND NEWMAN TOWN SUBSTATION VERTEBRATE FAUNA ASSESSMENT

APPENDIX B

Previously Recorded Vertebrate Fauna, and Species Recorded During the Survey

Key: EPBC= Environmental Protection and Biodiversity Conservation Act 1999, WC= Wildlife Conservation Act 1950, DEC= Department of Conservation Priority Code.
A= Listed in Naturemap or DEC Threatened and priority Database, B= Listed in EPBC Act Procted Matters Report, C= Endersby (1994), D= ecologia 1995a, E= ecologia 1995b, F= ecologia (1998), G= ecologia (2004a), H= ecologia (2004b), I= ecologia 2005, J= ENV (2006a), K= ENV 2007a, L= ENV (2006b), M= ENV (2007b), N (Shaded)= This Survey.

x= recorded during survey, o= recorded during survey out of survey area.

Note. This list excludes exclusively marine species. For Definitions of Conservation Codes see Appendix A.

SCIENTIFIC NAME	COMMON NAME	Conservation Codes																Notes	
		EPBC	WC	DEC	A	B	C	D	E	F	G	H	I	J	K	L	M		N
AMPHIBIA	AMPHIBIANS (FROGS)																		
HYLIDAE																			
Cyclorana maini	Main's Frog				x					x						x			
Cyclorana platycephala	Water-holding Frog															x			
Litoria rubella	Desert Tree Frog				x					x		x	x			x		x	
MYOBATRACHIDAE																			
Opisthodon spenceri	Spencer's Frog				x					x		x							
Notaden nichollsi	Desert Spadefoot											x							
Uperoleia russelli	Russell's Toadlet				x							x							
Neobatrachus centralis	Desert Trilling Frog											x							
REPTILIA	REPTILES																		
CHELUIDAE																			
Chelodina steindachneri	Flat-shelled Turtle				x					x		x						x	
AGAMIDAE																			
Amphibolurus longirostris	Long-nosed Dragon				x					x		x	x	x		x	x	x	
Caimanops amphiboluroides	Mulga Dragon				x														
Ctenophorus caudicinctus	Ring-tailed Rock Dragon				x			x	x	x	x	x	x	x	x	x	x	x	
Ctenophorus isolepis	Military Sand Dragon				x			x		x			x	x				x	

SCIENTIFIC NAME	COMMON NAME	Conservation Codes																Notes
		EPBC	WC	DEC	A	B	C	D	E	F	G	H	I	J	K	L	M	
<i>Ctenophorus nuchalis</i>	Central Netted Dragon				x			x									x	
<i>Ctenophorus reticulatus</i>	Western Netted Dragon				x					x					x			
<i>Diporiphora valens</i>															x			
<i>Pogona minor</i>	Bearded Dragon							x	x	x				x	x			
<i>Pogona minor minor</i>	Bearded Dragon				x													
<i>Pogona minor mitchelli</i>	Bearded Dragon																x	
<i>Tympanocryptis cephalo</i>	Earless Pebble Dragon				x													
GEKKONIDAE																		
<i>Strophurus ciliaris</i>	Northern Spiny-tailed gecko											x	x					
<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko				x					x				x				
<i>Diplodactylus mitchelli</i>					x													
<i>Diplodactylus savagei</i>					x					x	x			x	x			
<i>Lucasium stenodactylum</i>	Pale-snouted Ground Gecko				x					x	x	x	x	x	x	x	x	
<i>Lucasium wombeyi</i>	Pilbara Ground Gecko				x					x	x	x			x		x	
<i>Gehyra pilbara</i>	Pilbara Dtella				x												x	
<i>Gehyra punctata</i>	Spotted Rock Dtella				x		x	x	x	x				x	x	x	x	x
<i>Gehyra variegata</i>	Variegated Tree Dtella				x		x	x	x	x		x	x		x		x	x
<i>Heteronotia binoei</i>	Bynoe's Gecko				x			x	x	x		x	x	x	x	x	x	
<i>Heteronotia spelea</i>	Pilbara Cave Gecko				x					x		x			x	x		
<i>Nephurus wheeleri cinctus</i>	Banded Knob-tailed Gecko				x					x	x					x		
<i>Oedura marmorata</i>	Marbled Velvet Gecko				x					x				x		x	x	x
<i>Rhynchoedura ornata</i>	Beaked Gecko				x			x		x	x		x		x			
<i>Strophurus elderi</i>	Jewelled Gecko				x										x			
<i>Strophurus jeanae</i>													x					
<i>Strophurus wellingtonae</i>					x					x			x	x	x	x	x	
<i>Nephurus milii</i>	Barking Gecko																	
PYGOPODIDAE																		
<i>Delma butleri</i>	Unbanded Delma				x									x	x			
<i>Delma elegans</i>					x													
<i>Delma haroldi</i>					x					x								
<i>Delma nasuta</i>	Long-nosed Delma				x			x		x	x	x		x	x			
<i>Delma pax</i>					x			x			x	x		x	x		x	
<i>Lialis burtonis</i>	Burton's Legless Lizard				x				x			x		x		x	x	
<i>Pygopus nigriceps</i>	Hooded Scaly-foot				x					x						x		
SCINCIDAE																		
<i>Carlia munda</i>					x					x	x			x		x		
<i>Carlia triacantha</i>	Desert Rainbow Skink				x					x		x			x			x
<i>Cryptoblepharus buchani</i>	Buchanan's snake-eyed Skink				x													

SCIENTIFIC NAME	COMMON NAME	Conservation Codes																Notes
		EPBC	WC	DEC	A	B	C	D	E	F	G	H	I	J	K	L	M	
<i>Cryptoblepharus ustulatus</i>	Russet snake-eyed Skink				x													
<i>Cryptoblepharus carnabyi</i>	Spiny-palmed Shinning Skink									x				x	x	x		
								x							x			
<i>Ctenotus ariadnae</i>					x										x			
<i>Ctenotus duricola</i>					x						x	x			x			
<i>Ctenotus grandis titan</i>											x				x			
<i>Ctenotus helenae</i>					x			x		x	x	x		x	x	x	x	x
<i>Ctenotus leonhardii</i>					x		x	x	x			x	x	x	x			
<i>Ctenotus pantherinus ocellifer</i>	Leopard Ctenotus				x			x	x	x	x	x		x	x			x
<i>Ctenotus rubicundus</i>					x					x	x							
<i>Ctenotus rutilans</i>					x													
<i>Ctenotus saxatilis</i>	Rock Ctenotus				x			x		x	x	x		x	x	x	x	x
<i>Ctenotus serventyi</i>																	x	
<i>Ctenotus uber uber</i>					x											x		
<i>Cyclodomorphus melanops melanops</i>	Spinifex-slender Bluetongue				x			x	x	x								
<i>Egernia depressa</i>	Pygmy Spiny-tailed Skink				x						x							
<i>Egernia formosa</i>	Goldfields Crevice Skink				x						x					x		
<i>Eremiascincus richardsonii</i>	Broad-banded Sand-swimmer				x					x		x	x					
<i>Lerista bipes</i>																	x	
<i>Lerista macropisthopus remota</i>				P2						x								
<i>Lerista muelleri</i>					x			x							x		x	
<i>Lerista neander</i>					x			x		x		x			x			
<i>Lerista zietzi</i>					x			x		x		x			x	x		
<i>Menetia greyii</i>	Common Dwarf Skink				x			x							x			
<i>Menetia surda</i>					x													
<i>Morethia ruficauda</i>	Fire-tailed Skink						x	x		x		x		x	x	x	x	
<i>Morethia ruficauda subsp. exquisita</i>	Fire-tailed Skink				x													x
<i>Tiliqua multifasciata</i>	Central Bluetongue				x							x	x	x	x			
<i>Tiliqua occipitalis</i>	Western Bluetongue															x		
VARANIDAE																		
<i>Varanus acanthurus</i>	Spiny-tailed Monitor				x			x	x	x	x	x		x	x	x	x	
<i>Varanus brevicauda</i>	Short-tailed Monitor				x													
<i>Varanus bushi</i>														x				
<i>Varanus caudolineatus</i>	Striped-tailed Monitor									x							x	
<i>Varanus eremius</i>	Pygmy Desert Monitor														x		x	
<i>Varanus giganteus</i>	Perentie							x	x	x				x		x		
<i>Varanus gouldii</i>	Gould's Sand Monitor				x		x								x		x	
<i>Varanus panoptes rubidus</i>	Yellow-spotted Monitor				x					x		x	x				o	
<i>Varanus pilbarensis</i>	Pilbara Rock Monitor				x			x	x	x						x		

SCIENTIFIC NAME	COMMON NAME	Conservation Codes																Notes
		EPBC	WC	DEC	A	B	C	D	E	F	G	H	I	J	K	L	M	
<i>Varanus tristis tristis</i>	Black-headed Monitor				x		x	x		x		x			x	x		
TYPHLOPIDAE																		
<i>Ramphotyphlops ganei</i>				P1	x										x			
<i>Ramphotyphlops grypus</i>	Beaked Blind Snake				x			x		x		x		x	x			
<i>Ramphotyphlops hamatus</i>					x													
<i>Ramphotyphlops ammodytes</i>																	x	
BOIDAE																		
<i>Antaresia perthensis</i>	Pygmy Python				x			x	x	x	x	x				x		
<i>Antaresia stimsoni stimsoni</i>	Western Stimson's Python				x											x	x	
<i>Aspidites melanocephalus</i>	Black-headed Python				x													
<i>Liasis olivaceus barroni</i>	Pilbara Olive Python	VU	S1		x	x										x		
ELAPIDAE																		
<i>Acanthophis wellsi</i>	Pilbara Death Adder				x					x						x		
<i>Brachyuropsis approximans</i>	Northwestern Shovel-nosed Snake				x					x					x	x		
<i>Demansia psammophis cupreiceps</i>	Yellow-faced Whip-Snake				x								x	x	x		x	
<i>Demansia rufescens</i>	Rufous Whip-Snake				x					x					x			
<i>Furina ornata</i>	Moon Snake				x											x	x	
<i>Parasuta monachus</i>	Monk Snake				x					x								
<i>Pseudechis australis</i>	Mulga Snake				x				x	x		x		x		x		x
<i>Pseudonaja modesta</i>	Ringed Brown Snake				x											x		
<i>Pseudonaja nuchalis</i>	Gwardar				x						x					x		
<i>Suta fasciata</i>	Rosen's Snake				x					x								
<i>Suta punctata</i>	Spotted Snake				x													
<i>Vermicella snelli</i>	Pilbara Bandy Bandy Snake				x													
AVES																		
DROMAIIDAE																		
<i>Dromaius novaehollandiae</i>	Emu							x	x						x		x	x
PHASIANIDAE																		
<i>Coturnix ypsilophora</i>	Brown Quail															x		x
<i>Coturnix pectoralis</i>	Stubble Quail	Ma											x					
ANHINGIDAE																		
<i>Anhinga melanogaster</i>	Darter																	x
PHALACROCORACIDAE																		
<i>Phalacrocorax varius</i>	Pied Cormorant																	x
ARDEIDAE																		
<i>Ardea alba</i>	Great Egret	Mi, Ma				x												
<i>Ardea ibis</i>	Cattle Egret	Mi, Ma				x												

SCIENTIFIC NAME	COMMON NAME	Conservation Codes																Notes	
		EPBC	WC	DEC	A	B	C	D	E	F	G	H	I	J	K	L	M		N
ACCIPITRIDAE																			
<i>Elanus caeruleus</i>	Black-shouldered Kite							x		x	x			x	x		0	x	
<i>Lophoictinia isura</i>	Square-tailed Kite										x								
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard												x	x	x	x		x	
<i>Milvus migrans</i>	Black Kite										x			x	x	x			
<i>Haliastur sphenurus</i>	Whistling Kite							x	x	x	x			x	x	x	x	x	
<i>Circus assimilis</i>	Spotted Harrier							x		x	x								
<i>Accipiter fasciatus</i>	Brown Goshawk									x		x		x			x	x	
<i>Accipiter cirrhocephalus</i>	Collared Sparrowhawk								x	x	x						x		
<i>Aquila audax</i>	Wedge-tailed Eagle				x					x	x	x	x	x	x	x	x		
<i>Hieraaetus morphnoides</i>	Little Eagle								x				x			x	x	x	
FALCONIDAE																			
<i>Falco berigora</i>	Brown Falcon				x			x	x	x	x	x	x	x	x	x	x	x	
<i>Falco longipennis</i>	Australian Hobby				x					x						x		x	
<i>Falco subniger</i>	Black Falcon										x	x	x						
<i>Falco peregrinus</i>	Peregrine Falcon		S4						x	x							0		
<i>Falco cenchroides</i>	Nankeen Kestrel				x		x	x	x	x	x	x	x	x	x	x	x	x	
OTIDAE																			
<i>Ardeotis australis</i>	Australian Bustard			P4	x			x		x			x				0		
TURNICIDAE																			
<i>Turnix velox</i>	Little Button-quail				x			x	x	x	x			x	x	x	x	x	
SCOLOPACIDAE																			
<i>Tringa hypoleucos</i>	Common Sandpiper	Mi, Ma													x				
BURHINIDAE																			
<i>Burhinus grallarius</i>	Bush Stone-curlew			P4	x							x			x				
GLAREOLIDAE																			
<i>Glareola maldivarum</i>	Oriental Pratincole	Mi, Ma				x													
COLUMBIDAE																			
<i>Phaps chalcoptera</i>	Common Bronzewing						x		x	x		x	x	x	x		x		
<i>Ocyphaps lophotes</i>	Crested Pigeon									x	x	x	x	x	x	x	x	x	
<i>Geophaps plumifera</i>	Spinifex Pigeon						x	x	x	x	x	x		x	x	x	0		
<i>Geopelia cuneata</i>	Diamond Dove						x	x	x	x	x	x	x	x	x	x	x	x	
<i>Geopelia placida</i>	Peaceful Dove																	x	
CACATUIDAE																			
<i>Cacatua roseicapilla</i>	Galah				x		x	x	x	x		x	x	x	x	x	x	x	
<i>Cacatua sanguinea</i>	Little Corella							x		x		x		x		x	0	x	
<i>Nymphicus hollandicus</i>	Cockatiel									x	x				x	x	x	x	
PSITTACIDAE																			
<i>Barnardius zonarius</i>	Australian Ringneck				x			x	x	x	x	x	x	x		x	x	x	

SCIENTIFIC NAME	COMMON NAME	Conservation Codes																Notes
		EPBC	WC	DEC	A	B	C	D	E	F	G	H	I	J	K	L	M	
<i>Psephotus varius</i>	Mulga Parrot									X							X	
<i>Melopsittacus undulatus</i>	Budgerigar						X	X	X		X		X	X	X	X	X	
<i>Neopsephotus bourkii</i>	Bourke's Parrot				X											X	X	
<i>Pezoporus occidentalis</i>	Night Parrot	EN	S1			X												
CUCULIDAE																		
<i>Cuculus pallidus</i>	Pallid Cuckoo							X	X	X	X				X	X	X	
<i>Chrysococcyx osculans</i>	Black-eared Cuckoo									X								
<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo							X		X	X	X				X	X	
CENTROPIDAE																		
<i>Centropus phasianinus</i>	Pheasant Coucal															X		
STRIGIDAE																		
<i>Ninox novaeseelandiae</i>	Southern Boobook Owl						X		X	X	X					X	X	
TYTONIDAE																		
<i>Tyto alba</i>	Barn Owl									X	X	X		X				
PODARGIDAE																		
<i>Podargus strigoides</i>	Tawny Frogmouth											X	X		X	X		
CAPRIMULGIDAE																		
<i>Eurostopodus argus</i>	Spotted Nightjar				X			X		X	X		X		X	X	X	
AEGOTHELIDAE																		
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar						X	X		X	X		X		X			
APODIDAE																		
<i>Apus pacificus</i>	Fork-tailed Swift	Mi				X												
HALCYONIDAE																		
<i>Dacelo leachii</i>	Blue-winged Kookaburra									X	X			X		X		X
<i>Todiramphus pyrrhopygia</i>	Red-backed Kingfisher							X	X	X	X	X		X	X	X	X	X
<i>Todiramphus sanctus</i>	Sacred Kingfisher									X			X			X		X
MEROPIIDAE																		
<i>Merops ornatus</i>	Rainbow Bee-eater	Mi				X					X	X	X	X			X	X
CLIMACTERIDAE																		
<i>Climacteris melanura</i>	Black-tailed Treecreeper				X													
MALURIDAE																		
<i>Malurus splendens</i>	Splendid Fairy-wren																X	
<i>Malurus lamberti</i>	Variegated Fairy-wren				X		X	X	X	X	X	X	X	X	X	X	X	
<i>Malurus leucopterus</i>	White-winged Fairy-wren								X	X	X	X	X	X		X	X	X
<i>Stipiturus ruficeps</i>	Rufous-crowned Emu-wren									X								
<i>Amytornis striatus</i>	Striated Grasswren				X		X	X	X	X	X	X		X	X	X		
PARDALOTIDAE																		
<i>Pardalotus rubricatus</i>	Red-browed Pardalote									X	X	X			X	X		
<i>Pardalotus striatus</i>	Striated Pardalote				X			X	X	X	X	X				X		X

SCIENTIFIC NAME	COMMON NAME	Conservation Codes																Notes	
		EPBC	WC	DEC	A	B	C	D	E	F	G	H	I	J	K	L	M		N
<i>Pyrholaemus brunneus</i>	Redthroat																X		
<i>Smicrornis brevirostris</i>	Weebill						X		X	X	X	X		X	X	X	X	X	
<i>Gerygone fusca</i>	Western Gerygone										X				X	X	X	X	
<i>Acanthiza apicalis</i>	Inland Thornbill								X	X		X					X		
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill				X		X		X	X		X				X	X		
<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill								X								X	X	
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill				X				X								X		
<i>Aphelocephala leucopsis</i>	Southern Whiteface																X		
MELIPHAGIDAE																			
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater						X			X	X	X	X	X	X	X	X	X	
<i>Manorina flavigula</i>	Yellow-throated Miner						X			X	X	X	X	X	X	X	X	X	
<i>Lichenostomus virescens</i>	Singing Honeyeater						X	X	X	X	X	X	X	X	X	X	X	X	
<i>Lichenostomus keartlandi</i>	Grey-headed Honeyeater				X		X	X	X	X	X	X		X	X	X	X	X	
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater						X			X	X	X	X	X	X	X	X	X	
<i>Melithreptus gularis</i>	Black-chinned Honeyeater										X	X					X		
<i>Lichmera indistincta</i>	Brown Honeyeater						X	X	X	X	X	X	X		X	X	X	X	
<i>Phylidonyris albifrons</i>	White-fronted Honeyeater						X	X	X	X	X						X		
<i>Conopophila whitei</i>	Grey Honeyeater				X												X		
<i>Certhionyx niger</i>	Black Honeyeater							X	X								X	X	
<i>Certhionyx variegatus</i>	Pied Honeyeater							X									X		
<i>Epthianura tricolor</i>	Crimson Chat							X	X	X					X		X		
<i>Epthianura aurifrons</i>	Orange Chat				X														
PETROICIDAE																			
<i>Petroica goodenovii</i>	Red-capped Robin						X	X	X	X	X	X		X			X	X	
<i>Melanodryas cucullata</i>	Hooded Robin						X			X			X		X	X	X		
POMATOSTOMIDAE																			
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler									X	X	X		X	X	X	X	X	
<i>Pomatostomus superciliosus</i>	White-browed Babbler									X							X		
CINCLOSOMATIDAE																			
<i>Psophodes occidentalis</i>	Chiming Wedgebill												X						
PACHYCEPHALIDAE																			
<i>Oreocitta gutturalis pallescens</i>	Crested Bellbird				X		X	X		X	X	X			X	X	X	X	
<i>Pachycephala rufiventris</i>	Rufous Whistler							X	X	X	X	X	X	X	X	X	X	X	
<i>Colluricincla harmonica</i>	Grey Shrike-thrush						X	X	X	X	X	X	X	X	X	X	X		
DICRURIDAE																			
<i>Grallina cyanoleuca</i>	Magpie-Lark									X	X	X	X	X	X	X	X	X	
<i>Rhipidura fuliginosa</i>	Grey Fantail																X		
<i>Rhipidura leucophrys</i>	Willie Wagtail						X	X	X	X	X	X	X	X	X	X	X	X	
CAMPEPHAGIDAE																			

SCIENTIFIC NAME	COMMON NAME	Conservation Codes																Notes
		EPBC	WC	DEC	A	B	C	D	E	F	G	H	I	J	K	L	M	
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike				x		x	x	x	x	x	x	x	x	x	x	x	
<i>Coracina maxima</i>	Ground Cuckoo-shrike										x	x						
<i>Lalage tricolor</i>	White-winged Triller							x	x	x	x	x		x	x	x	x	
ARTAMIDAE																		
<i>Artamus personatus</i>	Masked Woodswallow									x								
<i>Artamus cinereus</i>	Black-faced Woodswallow						x		x	x	x	x	x		x	x	x	x
<i>Artamus minor</i>	Little Woodswallow						x	x	x	x	x	x		x	x	x	x	x
<i>Cracticus torquatus</i>	Grey Butcherbird						x			x		x	x	x		x	x	
<i>Cracticus nigrogularis</i>	Pied Butcherbird						x	x	x	x	x	x	x		x	x	x	x
<i>Gymnorhina tibicen</i>	Australian Magpie						x		x	x	x	x		x	x	x	x	x
CORVIDAE																		
<i>Corvus bennetti</i>	Little Crow																	x
<i>Corvus orru</i>	Torresian Crow						x		x	x	x	x	x	x	x	x	x	x
PTILONORHYNCHIDAE																		
<i>Chlamydera guttata</i>	Western Bowerbird								x		x	x		x		x	x	x
ALAUIDAE																		
<i>Mirafrja javanica</i>	Singing Bushlark															x	x	
MOTACILLIDAE																		
<i>Anthus novaeseelandiae</i>	Richard's Pipit						x	x	x	x	x	x	x	x	x		x	x
PASSERIDAE																		
<i>Taeniopygia guttata</i>	Zebra Finch						x	x	x	x	x	x	x	x	x	x	x	x
<i>Neochmia ruficauda clarescens</i>	Star Finch			P4												x		x
<i>Emblema pictum</i>	Painted Finch							x	x		x	x		x	x	x	x	x
DICAEIDAE																		
<i>Dicaeum hirundinaceum</i>	Mistletoebird							x		x	x	x		x		x		
HIRUNDINIDAE																		
<i>Cheramoeca leucosternus</i>	White-backed Swallow						x			x		x	x					
<i>Hirundo nigricans</i>	Tree Martin									x								x
<i>Hirundo ariel</i>	Fairy Martin									x	x			x	x	x		
SYLVIIDAE																		
<i>Eremiornis carteri</i>	Spinifex Bird				x		x	x	x	x	x	x		x	x	x	x	
<i>Megalurus gramineus</i>	Little Grassbird				x													
<i>Acrocephalus australis</i>	Clamorous Reed Warbler																	x
<i>Cincloramphus mathewsi</i>	Rufous Songlark									x		x		x	x	x	x	
<i>Cincloramphus cruralis</i>	Brown Songlark											x					x	
MAMMALIA	MAMMALS																	

SCIENTIFIC NAME	COMMON NAME	Conservation Codes																Notes
		EPBC	WC	DEC	A	B	C	D	E	F	G	H	I	J	K	L	M	
TACHYGLOSSIDAE																		
Tachyglossus aculeatus	Short-beaked Echidna							X		X				X		X		X
DASYURIDAE																		
Dasykaluta rosamondae	Little Red Kaluta				X		X			X	X	X						
Ningau timealeyi	Pilbara Ningau				X			X		X		X						
Planigale ingrami	Long-tailed planigale																	
Planigale sp.	Planigale							X		X	X							
Pseudantechinus woolleyae	Woolley's Pseudantechinus									X								
Pseudantechinus roryi	Rory's Pseudantechinus				X													
Sminthopsis longicaudata	Long-tailed Dunnart			P3	X					X								
Sminthopsis macroura	Stripe-faced Dunnart				X					X			X					
Sminthopsis ooldea	Ooldea Dunnart				X					X								
Sminthopsis youngsoni	Lesser Hairy-footed Dunnart				X													
THYLACOMYIDAE																		
Macrotis lagotis	Bilby, Dalgyte	VU	S1		X													
MACROPODIDAE																		
Macropus robustus	Euro						X	X	X	X	X	X	X	X	X	X	X	
Macropus robustus subsp. erubescen	Euro				X													X
Macropus rufus	Red Kangaroo				X					X			X	X			X	
Petrogale lateralis lateralis	Black-footed Rock-wallaby	VU	S1		X													
Petrogale rothschildi	Rothschild`s Rock-wallaby							X		X					X	X		
Petrogale sp.	Rock-wallaby										X	X		X		X		
EMBALLONURIDAE																		
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat										X		X	X		X		X ID not confirmed from anabat analysis
Taphozous georgianus	Common Sheath-tail Bat				X						X			X	X	X		X
Taphozous hilli	Hill's Sheathtail-bat				X				X	X								
MEGADERMATIDAE																		
Macroderma gigas	Ghost Bat			P4	X											X		
HIPPOSIDERIDAE																		
Rhinonictis aurantia	Pilbara Leaf-nosed Bat	VU	S1			X												
VESPERTILIONIDAE																		
Chalinolobus gouldii	Gould's Wattled Bat				X						X		X	X	X	X		X
Chalinolobus morio	Chocolate Wattled Bat																	
Nyctophilus geoffroyi	Lesser Long-eared Bat												X	X	X	X		

SCIENTIFIC NAME	COMMON NAME	Conservation Codes																Notes
		EPBC	WC	DEC	A	B	C	D	E	F	G	H	I	J	K	L	M	
<i>Nyctophilus</i> sp.	Unidentified Long-eared Bat																	X Unable to identify to species level from anabat analysis
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat									X	X							
<i>Scotorepens greyii</i>	Little Broad-nosed Bat				X					X	X		X	X	X	X		X
<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat				X					X			X	X	X	X	X	X
MOLOSSIDAE																		
<i>Chaerephon jobensis</i>	Northern Freetail-bat				X								X					X ID not confirmed from anabat analysis
<i>Mormopterus beccarii</i>	Beccari's Freetail-bat				X									X	X	X		X
<i>Mormopterus planiceps</i>	Little Mastiff-bat									X								
<i>Tadarida australis</i>	White-striped Freetail-bat										X							X
MURIDAE																		
<i>Mus musculus</i>	House Mouse				X		X	X		X	X	X		X	X	X	X	X Introduced exotic species
<i>Notomys alexis</i>	Spinifex Hopping-mouse				X					X	X				X			
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse			P4	X		X	X	X	X		X				X		
<i>Pseudomys desertor</i>	Desert Mouse				X					X	X	X		X	X			
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse				X		X	X		X	X	X		X	X			
<i>Zyzomys argurus</i>	Common Rock-rat				X		X	X		X		X		X	X	X	X	
LEPORIDAE																		
<i>Oryctolagus cuniculus</i>	European Rabbit				X		X	X		X				X				X Introduced exotic species
CANIDAE																		
<i>Canis lupus</i> subsp. <i>dingo</i>	Dingo						X		X	X	X		X			X	X	X
<i>Vulpes vulpes</i>	Fox						X							X	X			X Introduced exotic species
FELIDAE																		
<i>Felis catus</i>	Feral Cat						X						X	X	X			X Introduced exotic species

APPENDIX C

PREVIOUSLY RECORDED CONSERVATION SIGNIFICANT FAUNA

NEWMAN TO JIMBLEBAR TRANSMISSION LINE AND NEWMAN TOWN SUBSTATION VERTEBRATE FAUNA ASSESSMENT

APPENDIX C

Previously Recorded Conservation Significant Fauna

Conservation Significant Species	Distribution and Ecology	Discussion of Habitat Appropriateness/ Likelihood of Occurrence	Potentially Occurring in the Project Area
REPTILES			
<i>Lerista macropisthopus remota</i>	Occurs in Acacia shrublands and woodlands, and is found in loose soil under leaf litter at the base of shrubs (Wilson & Swan 2003). Little is known of its habitat requirements, with few specimens having been collected. <i>Lerista macropisthopus remota</i> is thought to shelter in loose soil under leaf litter at bases of shrubs.	Could potentially occur in Mulga Plains and Floodplains	yes
<i>Ramphotyphlops ganeii</i>	There are few records of the species in the Pilbara, making it one of the rarest reptiles for the region, and little is known of its habitat requirements. Blind snakes are typically very hard to detect during biological surveys, yet more common blind snakes such as <i>Ramphotyphlops grypous</i> are typically recorded at least once per trapping survey. It appears that <i>Ramphotyphlops ganeii</i> occurs in rocky or stony soils (Wilson & Swan 2003) which suggests it should occur broadly across the region.	Could potentially occur in the Low Hills and Hilltops.	yes
Pilbara Olive Python	Olive Pythons are found in a range of habitats, including drier areas of woodland (Wilson & Swan 2003). They are associated with rocky gorges and gullies around watercourses, habitats which are present in the project area. Pearson (2003) has reported that Pilbara Olive Pythons are widespread across the Pilbara, with many significant populations remaining.	It is possible that this species occasionally occur in Riverine habitat, using creek lines as a movement corridors. May shelter in Breakaways.	yes
BIRDS			
Great Egret	The Great Egret occurs in the Kimberley, Pilbara, and on the west coast from the Murchison River south, throughout the south-west, and east to Cape Arid. It inhabits mostly shallow fresh lakes, pools in rivers, lagoons, lignum swamps, clay pans and samphire flats, large dams and sewage ponds. It also inhabits shallow saltwater habitat such as mangrove creeks, tidal pools, samphire swamps and salt work ponds. It breeds colonially at wooded swamps and river pools, nesting in various riparian trees.	This species could possibly occur at the site on an occasional basis, along the drainage lines, particularly after heavy rains when they contain water.	yes
Cattle Egret	The Cattle Egret occurs in the wetter parts of WA, in particular the Kimberly and the south-west. The species inhabits short grass, in particular damp pastures and wetlands, usually in the company of cattle and occasionally other livestock. In WA it is an irregular visitor, occurring mostly in autumn, and is not thought to breed regularly in WA (Johnstone & Storr 1998).	The project area lacks inundated pastures and wetlands, so it is highly unlikely this species will occur.	no
Peregrine Falcon	The Peregrine Falcon is uncommon but wide-ranging across Australia. They occur mainly along coastal cliffs, rivers and ranges as well as wooded watercourses and lakes. The Peregrine Falcon nests primarily on cliffs, granite outcrops and quarries, and feed mostly on birds (Johnstone and Storr 1998).	No breeding habitat exists on the site for the Peregrine Falcon. They may, however forage occasionally over the site.	yes
Australian Bustard	The Australian Bustard is typically widespread and nomadic, but locally scarce. This species is distributed across most of WA, although is most prevalent in grasslands, especially tussock grasses, arid scrub and dry open woodlands (Morcombe 2000). The abundance of this species varies according to habitat and season, in particular the abundance of grasshoppers. Habitat loss has led to a decline in this species in the south-west (Johnstone and Storr 1998).	While not observed during the survey, this species could forage at the site from time to time. Most likely in Mulga Plains and Floodplains	yes

Conservation Significant Species	Distribution and Ecology	Discussion of Habitat Appropriateness/ Likelihood of Occurrence	Potentially Occurring in the Project Area
Common Sandpiper	The Common Sandpiper occurs along the coast of Western Australia, and in much of the interior. They inhabit sheltered salt and fresh waters such as estuaries, mangrove creeks, rocky coasts, salt lakes, river pools, lagoons, clay pans, drying swamps, flood waters, dams and sewage ponds (Johnstone and Storr 1998). They occasionally occur inland in a variety of wetlands (Geering <i>et al</i> 1997). They are a non-breeding migrant to Western Australia occurring at any time of year, but mostly September to March in the south-west (Johnstone and Storr 1998).	This species could possibly occur at the site on an occasional basis, along creeks and floodplains, particularly after heavy rains.	yes
Bush Stone-curlew	The Bush Stone-curlew inhabits dry open woodlands with groundcover of small sparse shrubs, grass or litter of twigs. It tends to avoid dense forest, closed-canopy habitats (Morcombe 2000). The species generally occurs near a watercourse or swamp (Geering <i>et al</i> 2007). Bush Stone-curlews are locally rare because of predation by foxes - the main concern for their regional decline (Johnstone and Storr 1998).	This taxon may utilise the area for foraging and reside in nearby permanent water bodies.	yes
Oriental Pratincole	The Oriental Pratincole occurs in the Kimberly and along the northern coast of WA, and is a summer migrant. It occurs around tidal flats and floodwaters (Johnstone & Storr 1998), or occasionally in recently burnt plains. It feeds aerially on flying insects (Johnstone & Storr 1998).	Although this species has previously been found in the area, Newman is not part of the normal range of the Oriental Pratincole (Geering <i>et al</i> 2007). The previous record was probably of a vagrant. Lack of suitable habitat on the site.	no
Night Parrot	The Night Parrot (<i>Pezoporus occidentalis</i>) is a very cryptic bird species, with few records of it since the 1880s, although it is thought to persist inland. It inhabits inland plains, around sparsely wooded spinifex near water (Johnstone and Storr 1998).	Considering the disturbances to the site (cattle, weeds, mining activity and clearing) it is highly unlikely this extremely rare species occur at the site.	no
Fork-tailed Swift	The Fork-tailed Swift is a summer migrant (October-April) to Australia. This species is an aerial species, which forages high above the tree canopy and rarely lower so is independent of terrestrial habitats. It usually occurs in flocks of up to 2000 and is often seen accompanying Tree Martins and Masked Woodswallows (Johnstone and Storr 1998).	It is likely that this species forages over the site from time to time, high in the airspace.	yes
Rainbow Bee-eater	The Rainbow Bee-eater migrates to south-western Australia to breed in spring and summer. The Rainbow Bee-eater is a common and widespread species in Western Australia. It occurs throughout Western Australia, except the drier interior of the State and the far south-west. It occurs in lightly wooded, often sandy country, preferring areas near water. The Rainbow Bee-eater feeds on airborne insects, and nests throughout its range in Western Australia in burrows excavated in sandy ground or banks, often at the margins of roads and tracks (Johnstone & Storr 1998).	This species was recorded during the survey and is likely to occur in the project regularly.	yes- found during survey
Star Finch	The western subspecies of the Star Finch is confined to the Pilbara region of WA (Pizzey & Knight 2007). The species occurs in grasslands with sparse vegetation, and feeds mainly on grass seeds and some small insects (Johnstone & Storr 2004). Like most finches this species needs regular water, so is likely to occur near permanent water for most of the season then disperse out to a wider area during and after the wet season when ephemeral pools have water.	This species was observed on the site in the riverine habitat.	yes- found during survey

Conservation Significant Species	Distribution and Ecology	Discussion of Habitat Appropriateness/ Likelihood of Occurrence	Potentially Occurring in the Project Area
MAMMALS			
Long-tailed Dunnart	The Long-tailed Dunnart is native to northern and central Western Australia, where it occurs in spinifex grasslands in association with low open Mulga woodland, usually with nearby rocky outcrops. A single individual of <i>Sminthopsis longicaudata</i> was located at Mount Whaleback by ecologia Environment in 1997 and another in 1998 (ecologia Environment 1998a).	It is possible that this species could occur in the project area, where it could potentially shelter in breakaway habitat.	yes
Bilby, Dalgite	The Bilby (<i>Macrotis lagotis</i>) has gone from being a widespread and common species to being confined to sparse desert populations in the eastern Pilbara and south to Warburton. There are recent records for this species immediately south of Port Hedland and around Mt. Goldsworthy. The presence of the Bilby is characterised by its feeding habits, evident from the numerous scattered excavations up to 10 cm deep it leaves behind, from which soil has been scattered on all sides. It is a burrowing species, and prefers sandy substrates.	No burrows were found during the survey, and considering the disturbed nature of the site and the proximity to Newman and mining operations, it is extremely unlikely that the Bilby occurs in the Project Area. Believed to be locally extinct in the Pilbara	no
Black-footed Rock-wallaby	The Black-footed Rock-wallaby (<i>Petrogale lateralis</i>) has a scattered distribution throughout its range from the Pilbara south (DEC 2008), and appears to be being reduced in numbers by fox predation. Pearson & Kinnear (1997) reported that local and regional extinctions of Black-footed Rock Wallabies continue to occur. The Black-footed Rock-wallaby uses rocky outcrops and breakaways for shelter (van Dyke and Strahan 2008), in association with partial grass and shrub cover for foraging.	The species has an extremely patchy distribution in the Pilbara (van Dyke and Strahan 2008), but it could potentially occur in the area of hilltop/ breakaway habitat north of Ore body 25 (Figure 2b) .	yes
Ghost Bat	The Ghost Bat (<i>Macroderma gigas</i>) occurs in a wide variety of habitats, and require an undisturbed cave, deep fissure or disused mine shaft in which to roost. It is patchily distributed across Australia, and is sensitive to disturbance. Colonies range in size from 400-1000 individuals (van Dyke and Strahan 2008).	Although not recorded during the Anabat survey, these species may occasionally forage on the site, particularly in the riverine habitat, and potential roosting caves occur in or near the project area.	yes
Pilbara Leaf-nosed Bat	The Pilbara Leaf-nosed Bat requires deep caves or disused mine shafts in which to roost (van Dyke & Strahan 2008), at least in the dry season. These bats have been recorded in isolated populations in the Pilbara, and are present only where suitable roosting niches are available. Pilbara Leaf-nosed Bats have been found in Iron Ore project areas in the north-west Pilbara around Yarrie (R Bullen, pers. comm.) They are generally sparsely distributed.		
Western Pebble-mound Mouse	The Western Pebble-mound Mouse is restricted to the Pilbara, where it is recognized as an endemic species. Abandoned mounds to the east of its current range indicate a decline in distribution. Abandoned mounds in disturbed areas suggest that the species is under threat by grazing and mining activities. The construction of extensive pebble mounds, built from small stones, which typically cover areas from 0.5-9.0 square meters, is characteristic of this species. Mounds are restricted to suitable-class stones, and are usually found on gentle slopes and spurs.	Throughout the low hills habitat type potential habitat exists, despite no active mounds being found.	yes

APPENDIX D

HABITAT CONSERVATION SIGNIFICANCE MATRIX

NEWMAN TO JIMBLEBAR TRANSMISSION LINE AND NEWMAN TOWN SUBSTATION VERTEBRATE FAUNA ASSESSMENT

APPENDIX D - HABITAT VALUE MATRIX

FAUNA HABITAT TYPE	REGIONAL HABITAT VALUE				LOCAL HABITAT VALUE				
	Regional Representation	Conservation Significant Species Diversity	REGIONAL HABITAT VALUE SCORE	REGIONAL HABITAT VALUE RATING	Conservation Significant Species Potentially Occuring in the Study Area	Conservation Significant Species Diversity	Average Habitat Condition Score (Bush Forever)	LOCAL HABITAT VALUE SCORE	LOCAL HABITAT VALUE RATING
Mulga Plain	1	2	2	LOW	<i>Lerista macropisthopus remota</i> , Peregrine Falcon, Australian Bustard, Bush Stone-curlew, Fork-tailed Swift, Rainbow Bee-eater	1	2	2	LOW
Low hills	1	2	2	LOW	<i>Ramphotyphlops ganei</i> , Peregrine Falcon, Australian Bustard, Fork-tailed Swift, Rainbow Bee-eater, Western Pebble-mound Mouse	1	2	2	LOW
Riverine	3	3	9	HIGH	Pilbara Olive Python, Great Egret, Peregrine Falcon, Common Sandpiper, Bush Stone-curlew, Fork-tailed Swift, Rainbow Bee-eater, Star Finch, Ghost Bat, Pilbara Leaf-nosed Bat	2	3	6	MODERATE
Floodplain	2	2	4	MODERATE	<i>Lerista macropisthopus remota</i> , Peregrine Falcon, Australian Bustard, Common Sandpiper, Bush Stone-curlew, Fork-tailed Swift, Rainbow Bee-eater	1	2	2	LOW
Hill Crest/ Breakaway	3	3	9	HIGH	<i>Ramphotyphlops ganei</i> , Grey Falcon, Peregrine Falcon, Australian Bustard, Fork-tailed Swift, Rainbow Bee-eater, Northern Quoll, Ghost Bat, Pilbara Leaf- nosed Bat, Western Pebble-mound Mouse	2	3	6	MODERATE
Measure Description	Widespread=1 Moderate=2 Confined=3 Highly Confined=4	Low= 1 Moderate= 2 High= 3	Regional Representati on x Conservation Species Diversity (out of 12)	Low= <4 Moderate= 4-7 High= 8-11 Very High= 12 (Out of a Maximum 12)		Low= 1 Moderate=2 High=3	Completely Degraded = 0 Degraded =1 Good =2 Very Good =3 Pristine- Excellent =4	Conservation significant species diversity x habitat condition (out of 12)	Low= <4 Moderate= 4-7 High= 8-11 very High= 12 (Out of a Maximum 12)

APPENDIX E

FAUNA SURVEY EFFORT

NEWMAN TO JIMBLEBAR TRANSMISSION LINE AND NEWMAN TOWN SUBSTATION VERTEBRATE FAUNA ASSESSMENT

APPENDIX E

Survey Effort and Survey Co-ordinates

Survey Type	Survey Code	Date	Zone	#Easting	#Northing	Duration
Anabat Locations	AB 1	24/4/09	50	777261	7415276	3 nights
	AB 2	24/4/09	50	781079	7419415	1 night
	AB 3	25/4/09	50	793388	7417538	2 nights
General Fauna Searches	GF 1	27/4/09	50	788174	7418302	1.5 person/ hours
	GF 2	27/4/09	50	789647	7417927	3 person/ hours
	GF 3	26/4/09	50	793381	7417535	4 person/ hours
	GF 4	25/4/09	50	803618	7415993	1 person/ hours
	GF 5	26/4/09	50	801851	7416739	4 person/ hours
	GF 6 end	26/4/09	50	800922	7417069	1 person/ hours
	GF 6 start		50	801300	7416935	
	GF 7	24/4/09	51	197732	7412930	3 person/ hours
	GF 8	24/4/09	50	793448	7417615	3 person/ hours
	GF 9	24/4/09	50	781066	7419421	2 person/ hours
	GF 10	24/4/09	50	793855	7417575	2 person/ hours
	GF 11	24/4/09	50	781086	7419426	2 person/ hours
	GF 12	24/4/09	50	779268	7416464	3 person/ hours
	GF 14 start	24/4/09	50	807600	7414500	4 person/ hours
	GF 14 end		50	806500	7414500	
	GF 15 end	26/4/09	50	792223	7417478	5 person/ hours
	GF 15 start		50	793312	7417606	
	GF 16	26/4/09	50	787500	7418500	3 person/ hours
	GF 17	26/4/09	51	197959	7413434	4 person/ hours

Coordinates = Geocentric 1994 (GDA94)

AB= Anabat survey location

GF= General fauna search at point (or where start and end points given)

APPENDIX F

SITE PHOTOS

NEWMAN TO JIMBLEBAR TRANSMISSION LINE AND NEWMAN TOWN SUBSTATION VERTEBRATE FAUNA ASSESSMENT

APPENDIX F - SITE PHOTOGRAPHS



1. Mulga Plain



2. Mulga Plain



3. Low Hills



4. Riverine



5. Riverine



6. Floodplain



7. Hilltop



8. Breakaway



9. Cave



10. Low Hills (Newman Substation)

APPENDIX G

DETAILS OF SIGNIFICANT CAVES FOUND DURING THE SURVEY

NEWMAN TO JIMBLEBAR TRANSMISSION LINE AND NEWMAN TOWN SUBSTATION VERTEBRATE FAUNA ASSESSMENT

APPENDIX G

Details of Significant Caves Found during the Survey

Cave #	#Easting	#Northing	Opening max diameter (m)	Depth (m)	Suitability for Threatened Cave Bats*	Notes
Cave 1	779171	7416595	>1	5	Possible roost	Common Sheathtail Bat recorded inside
Cave 2	803618	7415944	1.5	5-10	Possible roost	Heritage Site (pink and black flagging tape)
Cave 3	787662	7418471	3	15	Possible roost	Heritage Site (pink and black flagging tape)
Cave 4	787477	7418466	2	8	Possible roost	Heritage Site (probable burial site- no flagging tape)
Cave 5	787470	7418516	2-3	10	Possible roost	Old 40-gallon drums dumped inside

Coordinates = Geocentric 1994 (GDA94), Zone 50. Locations are also mapped in Figures 2a-2g

* Ghost Bat (*Macroderma gigas*) or Pilbara Orange Leaf-nosed Bat (*Rhinoicteris aurantia*)

APPENDIX H

ANABAT ANALYSIS REPORT



Bat call identification

from Newman – Jimblebar, WA

Type: Bat Call Analysis

Prepared for: ENV Australia

Date: 4 June 2009

Job No.: SZ113

Prepared by: Specialised Zoological
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SUMMARY

Bat identifications from Anabat echolocation call recordings are provided from between Newman and Jimblebar, Western Australia. At least seven species were identified as being present, with the possibility of others that cannot be distinguished reliably from each other based on acoustic recordings (Table 1).

Some sequences could not be identified reliably to one species. The calls of the yellow-bellied sheath-tailed bat *Saccolaimus flaviventris* can sometimes be confused with those of the northern free-tailed bat *Chaerephon jobensis*. There appeared to be calls representative of both. In addition, some calls of Beccari's free-tailed bat *Mormopterus beccarii* and the common sheath-tailed bat *Taphozous georgianus* are difficult to distinguish reliably, though most appeared to be from *T. georgianus*. The calls of *Nyctophilus* are difficult to identify to species, and those recorded may be attributed to the lesser long-eared bat *Nyctophilus geoffroyi* or the pallid long-eared bat *Nyctophilus bifax daedalus*.

Details supporting the identifications are provided, as recommended by the Australasian Bat Society (ABS 2006). A summary of pulse parameters is provided in Table 2, and representative call sequences are illustrated in Figure 1. Further data is available should verification be required.

METHODS

Signals as recorded with an Anabat SD1 unit were supplied as downloaded sequences, which were examined in AnalookW 3.7a software. Three call variables were measured on good quality search phase pulses in representative call sequences: pulse duration (milliseconds), maximum frequency (kHz) and characteristic frequency (equivalent to minimum frequency; kHz). Species were identified based on information in McKenzie and Muir (2000). Nomenclature follows Armstrong and Reardon (2006). Species designations of Churchill (2008) are not followed until formal publication of the relevant taxonomic study.

REFERENCES

- ABS (2006). Recommendations of the Australasian Bat Society Inc for reporting standards for insectivorous bat surveys using bat detectors. *The Australasian Bat Society Newsletter* 27: 6–9. [ISSN 1448-5877]
- Armstrong, K. and Reardon, T. (2006). Standardising common names of bats in Australia. *The Australasian Bat Society Newsletter* 26: 37–42.
- Churchill, S.K. (2008). *Australian bats*. 2nd ed. Allen and Unwin, Crows Nest, NSW.
- McKenzie, N.L. and Muir, W.P. (2000). Bats of the southern Carnarvon Basin, Western Australia. *Records of the Western Australian Museum Supplement* 61: 465–477.

TABLE 1. Species identifications, with the degree of confidence indicated by a code. Date correlates with site; see Table 2 for full species names.

	<i>C. gouldii</i>	<i>C. jobensis</i> / <i>S. flaviventris</i>	<i>M. beccarii</i> / <i>T. georgianus</i>	<i>Nyctophilus</i> sp.	<i>S. greyii</i>	<i>T. australis</i>	<i>T. georgianus</i>	<i>V. finlaysoni</i>
Date								
Serial 3666								
24/04/2009	NC	NC	—	—	H	H	—	H
25/04/2009	NC	NC	NC	—	H	H	H	H
26/04/2009	H	NC	NC	—	H	H	H	H
Serial 3691								
24/04/2009	H	NC	—	—	—	H	—	H
25/04/2009	H	NC	—	—	H	H	—	H
26/04/2009	H	NC	—	NC	H	H	H	H

Definition of confidence level codes:

H High. Unambiguous identification of the species at the site based on measured call characteristics and comparison with available reference material. Greater confidence in this ID would come only after capture and supported by morphological measurements or submission of a specimen/tissue to a museum.

NC Needs Confirmation. Either call quality was poor, or the species cannot be distinguished reliably from another that makes similar calls. Alternative identifications are indicated in the Summary section of this report. If this is a species of conservation significance, further survey work might be required to confirm the record.

TABLE 2. Summary of variables from representative call sequences.

Species	s,p ¹	Duration (msec) ²	Max Frequency (kHz) ²	Char frequency (kHz) ²
Gould's wattled bat <i>Chalinolobus gouldii</i>	1,11	4.6 ± 0.9 2.3 – 5.7	51.8 ± 5.2 39.0 – 57.1	32.7 ± 0.9 31.8 – 34.8
Northern free-tailed bat <i>Chaerephon jobensis</i> / Yellow-bellied sheath-tailed bat <i>Saccolaimus flaviventris</i>	5,66	10.4 ± 2.0 6.3 – 15.1	31.9 ± 4.8 21.2 – 40.8	21.0 ± 1.8 17.7 – 25.2
Beccari's free-tailed bat <i>Mormopetrus beccarii</i> / Common sheath-tailed bat <i>Taphozous georgianus</i>	3,34	5.6 ± 3.8 0.6 – 13.6	27.1 ± 2.1 24.5 – 32.8	25.6 ± 1.2 23.7 – 28.1
Unidentified long-eared bat <i>Nyctophilus</i> sp.	2,37	2.6 ± 0.9 1.3 – 5.0	71.0 ± 9.6 51.6 – 90.9	43.5 ± 5.5 34.8 – 53.0
Little broad-nosed bat <i>Scotorepens greyii</i>	2,20	7.4 ± 0.9 5.2 – 8.4	50.9 ± 3.3 46.8 – 57.1	36.3 ± 1.2 35.2 – 38.5
White-striped free-tailed bat <i>Tadarida australis</i>	2,8	13.3 ± 1.1 12 – 14.7	18.9 ± 0.8 18.2 – 20.5	11.6 ± 0.2 11.3 – 11.9
Common sheath-tailed bat <i>Taphozous georgianus</i>	3,19	12.1 ± 2.3 6.7 – 16.0	26.1 ± 0.9 24.5 – 27.9	24.7 ± 0.4 23.8 – 25.2
Finlayson's cave bat <i>Vespadelus finlaysoni</i>	1,20	5.2 ± 1.3 1.5 – 7.3	66.5 ± 5.3 56.3 – 73.4	56.3 ± 0.7 54.8 – 57.1

¹ s,p: number of sequences measured, combined total number of pulses measured;² Mean ± SD; range.

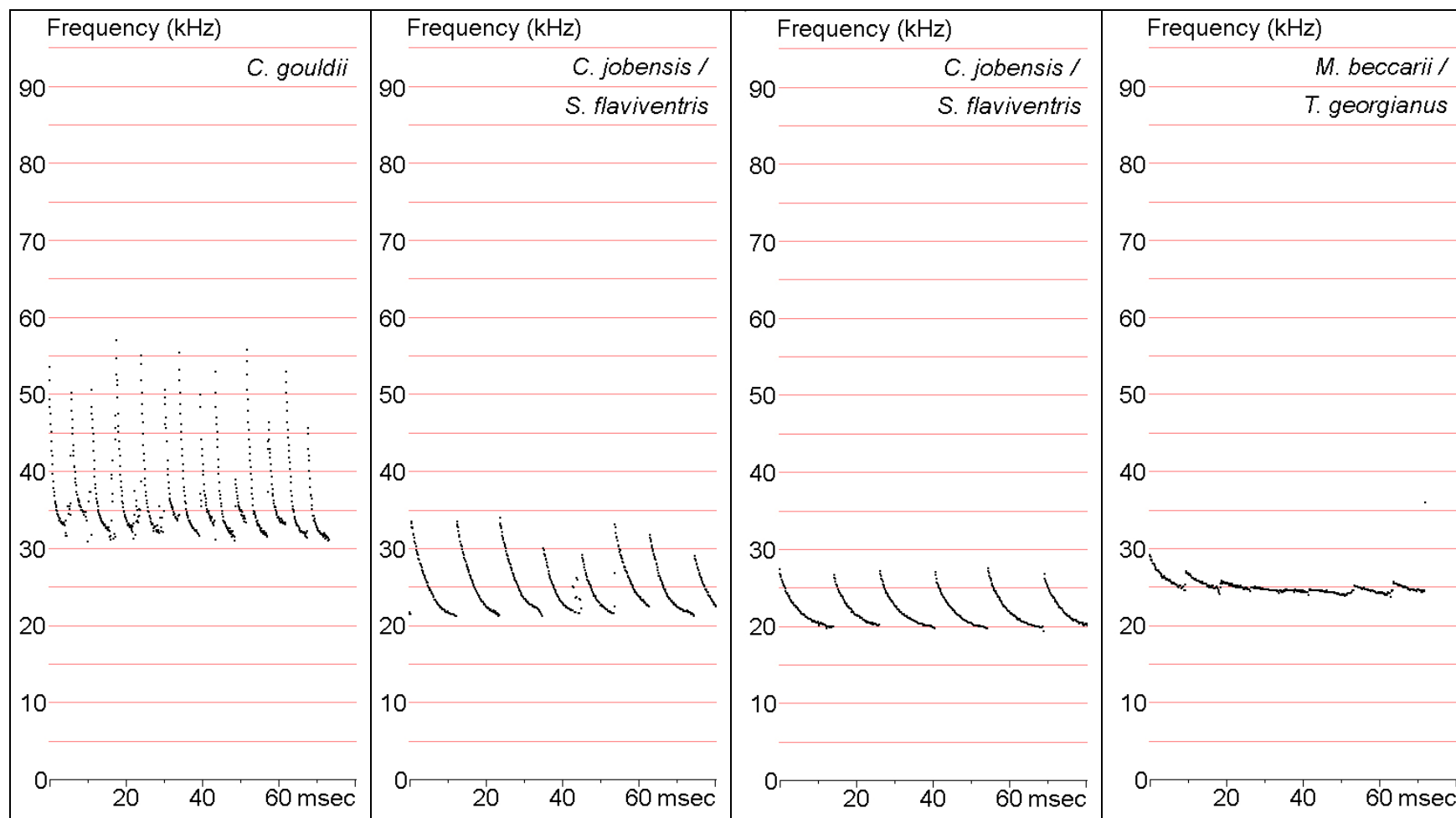


FIGURE 1A. Representative call sequences of the species identified (time is compressed between pulses).

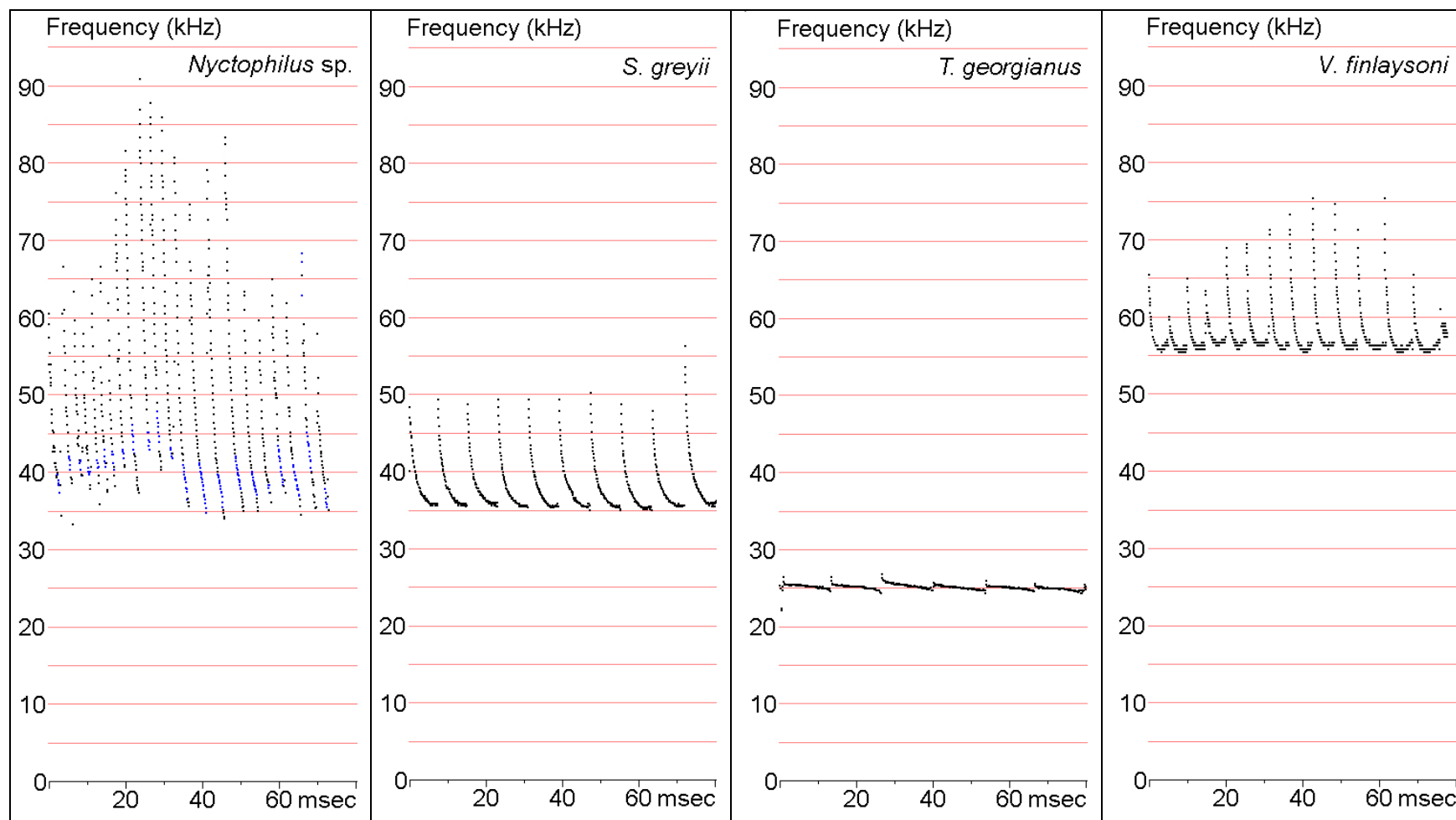


FIGURE 1B. Representative call sequences of the species identified (time is compressed between pulses).