ROY HILL BOREFIELD
VERTEBRATE FAUNA ASSESSMENT

Prepared for

HANCOCK PROSPECTING PTY LTD

Job No: 09.162

Report No: 09/008

Australia

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Prepared by

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STATEMENT OF LIMITATIONS

Scope of Services

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

Reliance on Data

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

Environmental Conclusions

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

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

Report for Benefit of Client

The report has been prepared for the benefit of the Client and for no other party. ENV assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including, without limitation, matters arising from any negligent act or omission of ENV or for any loss or damage suffered by any other party relying on the matters dealt with or conclusions expressed in the report).

Other parties should not rely on the report or the accuracy or completeness of any conclusions, and should make their own enquiries and obtain independent advice in relation to such matters.

Other Limitations

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

EXECUTIVE SUMMARY

ENV.Australia Pty Ltd was commissioned in July 2009 by Hancock Prospecting Pty Ltd to undertake a terrestrial vertebrate fauna assessment of the proposed Stage 2 Borefield at Roy Hill. The project area is located approximately 60 kilometres to the north-east of the town of Newman in the Pilbara region of Western Australia within mining tenements E47/1609, E47/1610 and E46/685.

One broad fauna habitat type, based on landform and vegetation structure, was identified as occurring in the project area, an Alluvial Plain.

A total of 1596 trap nights from the trapping arrays and over 55 hours of diurnal and nocturnal searching was conducted within the survey area. This resulted in a total of 86 fauna taxa being recorded within the project area; comprising of 19 reptile species, 52 avifauna species and 15 mammal species. One fauna species of conservation significance (Threatened under the *Environment Protection and Biodiversity Conservation Act 1999*, the *Wildlife Conservation Act 1950* or occurring on the Department of Environment and Conservation Priority list) was recorded within the project area, namely the Australian Bustard (Priority 4). A further nine conservation significant fauna species potentially occur in the project area.

The project area already exhibits a low to moderate level of disturbance due to existing infrastructure and pastoral activities. The level of habitat disturbance from the proposed development is also likely to be low in a regional context due to the small scale of proposed additional disturbance.

The main impact of the proposed borefield will be vegetation clearing which is likely to affect local populations of ground dwelling fauna species. However given the small scale of impact and the commonality of the habitat within the project area and wider surrounds no net regional impacts are expected. Therefore ENV concludes that for the proposed development there is unlikely to be fauna issues that require referral to the Commonwealth Department of Environment, Water, Heritage and the Arts for assessment under the *Environmental Protection and Biodiversity Conservation Act 1999* and / or consideration under the *Wildlife Conservation Act 1950* or *Environmental Protection Act 1986*.

1 INTRODUCTION

ENV.Australia Pty Ltd (ENV) was commissioned in July 2009 by Hancock Prospecting Pty Ltd (Hancock) to undertake a terrestrial vertebrate fauna assessment of the proposed Stage 2 Borefield at Roy Hill (project area). The project area is located approximately 60 kilometres (km) to the north-east of the town of Newman in the Pilbara region of Western Australia (Figure 1).

This fauna assessment was prepared in consideration of the Western Australian Environmental Protection Authority's (EPA) Guidance Statement No. 56 *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004).

The objectives of the vertebrate fauna assessment were to:

- conduct a comprehensive fauna database/literature review for the project area;
- conduct a terrestrial vertebrate fauna survey within the project area;
- conduct a habitat assessment of the project area documenting general habitat types;
- identify terrestrial vertebrate fauna of conservation significance that may occur in the project area; and
- prepare a report for an environmental assessment document.

1.1 LOCATION

The Roy Hill Borefield lies approximately 60km north-east of the Town of Newman in the Pilbara region of Western Australia (WA) (Figure 1). The project area lies within mining tenements E47/1609, E47/1610 and E46/685 and contains a number of active bores concerned mainly with pastoral activities (Figure 2).

1.2 REGIONAL SETTING

The Interim Biogeographic Regionalisation for Australia (IBRA) divides Australia into 85 bioregions based on major biological and geographical/geological attributes (Thackway & Cresswell 1995). These bioregions are subdivided into 404 subregions, as part of a refinement of the IBRA framework (Commonwealth Department of the Environment, Water, Heritage and the Arts [DEWHA] 2007).

The project area is located within the Fortescue subregion of the Pilbara region (Thackway & Cresswell 1995). Kendrick (2001) describes the Fortescue Plains subregion as alluvial plains with *Acacia aneura* over grass communities and River

Red Gum (*Eucalyptus camaldulensis*) woodlands fringing drainage lines. 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).

1.3 CLIMATE

The project area is located in the Pilbara region of WA. The Pilbara region experiences an arid-tropical climate which is characterised by a hot, relatively wet summer (between October and April) and a mild dry winter (between May and September). Tropical cyclones occur occasionally, usually in the months of January to April, bringing sporadic drenching rains to the region (Bureau of Meteorology [BOM] 2009).

The nearest BOM weather station is located in Newman, approximately 60km south-east of the study area. Significant variation in rainfall is noted across the region, and as such, data provided should be used as a guide only.

The area experiences a wide range of temperatures throughout the year, with an average maximum temperature of 31.4 degrees Celsius (°C) and an average minimum temperature of 17.3°C (BoM 2009) (Figure 3).

Rainfall in the Pilbara is often sporadic, and can occur in summer and winter. The Newman area has an average annual rainfall of 310.2 millimetres (mm) (BoM 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 than summer rainfall, and is commonly the result of cold fronts moving north-easterly across the State.

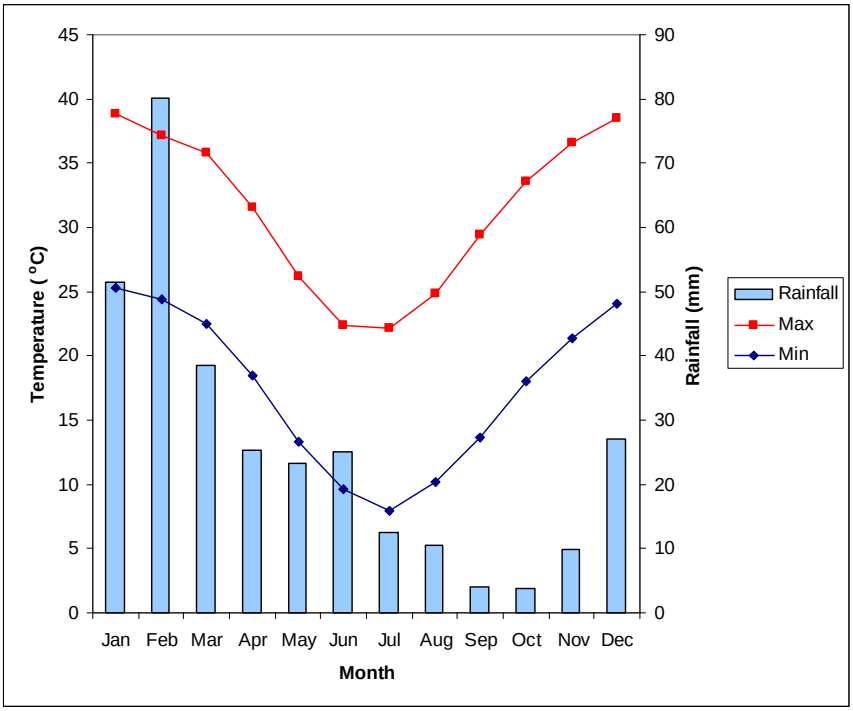

Figure 3: Average Monthly Rainfall and Maximum and Minimum Temperatures at Newman (BoM 2009).

1.4 GEOLOGY AND LANDFORMS

Thorne and Tyler (1997) mapped the geology of the area as consisting of two units:

Qs: Eoalian deposit – sand; in sheets and longitudinal dunes.

Qw: Alluvium and colluvium – red-brown sandy and clayey soil.

1.5 LAND SYSTEM MAPPING

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

Fan: Fan Land System: Wash-plains and Gilgai plains supporting groved mulga shrub-lands and minor tussock grasslands.

Div: Divide Land System: Sand-plains and occasional dunes supporting shrubby hard spinifex grasslands.

1.6 BEARD VEGETATION MAPPING

The project area is in the Abydos Plain, which forms part of the Fortescue Botanical District in the Eremaean Botanical Province of Western Australia as per Beard (1975). Beard (1975) mapped the project area as comprising the following two vegetation types:

a_1Lp: Sparse low woodland; Mulga (*Acacia aneura*), discontinuous in scattered groups.

E_{25}Sr.t_2Hi: *Eucalyptus gamophylla* and Spinifex.

1.7 PREVIOUS BIOLOGICAL STUDIES

Regional-scale Studies

Historically, the flora and fauna of the Pilbara has not generally been recorded systematically, with significant exceptions being flora studies by Burbidge (1959) and Beard (1975). More recently, the WA Department of Agriculture (van Vreeswyk *et al.* 2004) conducted an inventory and condition survey of the Pilbara. This report provides a regional inventory of flora species and a description of land resources. A comprehensive and systematic field review by the WA Department of Environment and Conservation (DEC) of Pilbara regional fauna is underway (DEC Pilbara Biological Survey 2002 to 2007), and is due for public release soon.

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. A comprehensive bibliography of biological survey work undertaken in the Pilbara is available at *http://science.dec.wa.gov.au/projects/pilbaradb/.*

Local-scale Studies

Various biological surveys have been conducted in the vicinity (<50km) of the project area in the last 10 years, these include:

- Roy Hill Iron Ore Project Vertebrate Fauna Assessment (*ecologia* Environment 2006);
- Roy Hill Iron Ore Project Infrastructure Supplementary Level 1 Vertebrate Fauna Survey (*ecologia* Environment 2008);
- Roy Hill Iron Ore Project Proposed Roy Hill Borefield Desktop Fauna Survey (*ecologia* Environment 2009a);
- Roy Hill Iron Ore Project Vertebrate Fauna Assessment (*ecologia* Environment 2009b);

- Fauna Habitats and Fauna Assemblage of the Proposed FMG Stage B Rail Corridor, Christmas Creek, Mt Lewin, Mt Nicholas and Mindy Mindy Mine Areas (Biota Environmental Sciences 2005);

- Fauna Survey of Proposed Iron Ore Mine, Cloud Break (Bamford Consulting Ecologists 2005);

- Coondiner and Mindy East Exploration Leases Fauna Assessments (ENV.Australia 2007); and

- Jimblebar to Yandi Railway Fauna Assessment (ENV.Australia 2008).

2 SURVEY AND ASSESSMENT 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 Federal and State legislation:

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

The surveys were carried out in a manner compliant with the 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 Two survey, has been developed in consideration of the EPA *Guidance Statement No. 56.*

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 Australia 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

EPBC Act 1999: The act aims to protect matters of national environmental significance, which are detailed in Appendix A. Under the EPBC Act 1999, the Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA) lists threatened species and Threatened Ecological Communities (DEWHA 2009a) by criteria set out in the act. Species are considered to be conservation significant if they are listed as Threatened (*i.e.* Vulnerable, Endangered), 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

- WC Act 1950: The Minster 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.

- DEC Priority species: The DEC produces a list of Priority species that have not been assigned statutory protection under the WC Act 1950. 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 DATABASE AND LITERATURE REVIEW

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 2009a);
- DEC Threatened and Priority Fauna database (DEC 2009b);
- DEWHA Protected Matters Search Tool (DEWHA 2009), also known as an EPBC search;
- previous fauna surveys (e.g. previous 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.

2.3 FIELD SURVEY METHODOLOGY

2.3.1 Survey Timing and Weather

The survey was undertaken from 22 to 31 July 2009 during the Pilbara 'dry' season. The area had received 41.0mm of rainfall in the three months preceding the survey (BoM 2009). Day temperatures were between 19.3^{o}C and 27.4^{o}C, with night temperatures ranging between 1.2^{o}C and 13.7^{o}C (BoM 2009).

2.3.2 Sampling Methodology

The purpose of the field survey was to verify the accuracy of the desktop survey and to further delineate and characterise the fauna species and faunal assemblages in the project area. The fauna field survey consisted of:

- a fauna habitat assessment;
- a trapping program;
- diurnal and nocturnal searches;
- an ornithological census;
- bat recordings; and
- opportunistic observations.

These components are described below.

Fauna Habitat Assessment

During the field survey, broad fauna habitats were identified based on vegetation structure 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 rated as high, moderate or low on the basis of their complexity, the presence of microhabitats, including significant trees with hollows, loose bark, fallen hollow logs and leaf litter, and their representation in the region and project area.

Trapping Program

Six vertebrate fauna trapping sites were established within the project area. The location and habitat details of each site are presented in Appendices C1 and C2 and in Figure 4.

The six trapping sites each contained ten trap lines, which consisted of seven-metre long net fences with one pit trap (20L) (29cm diameter, 35cm deep) in the centre of the 7m drift fence, and a funnel trap ('fish-bait trap'-style folding synthetic mesh traps) at each end. Each trap line was positioned approximately 30m apart, with one ground Elliott trap per trap line (9 X 9 X 32cm) and two cage traps (25 X 25 X 70cm) at each trapping site (Appendix C3).

The trapping program was conducted from 22 to 31 July 2009, with traps being open for up to seven nights. The trapping sites was subjected up to 14 trap-nights for cage traps, 70 trap-nights for bucket, and Elliott traps, and 140 trap-nights for funnel traps (Appendix C4).

Diurnal and Nocturnal Searches

Diurnal searches for fauna species were undertaken in the project area. Searches included:

- investigating burrows;
- investigating rock crevices;
- investigating scats, tracks and other traces;
- splitting exfoliated rock;
- turning rocks, fallen timber and debris;
- opening standing timber crevices; and
- raking leaf litter.

The total time spent on the above activities was 17 hours, with details of diurnal census presented in Appendix D1.

Nocturnal searches consisted of 'road cruising' the project area in a vehicle at 5km per hour with the aid of a spotlight (Figure 5). Thirteen and a half hours were spent road cruising the project area (full survey details can be seen in Appendix D2).

Ornithological Census

Ornithological diurnal surveys were undertaken throughout the project area. Census locations were not limited to trap site locations, but rather the majority of the project area was surveyed resulting in approximately 25 hours being undertaken. Details of the ornithological census are presented in Figure 6 and in Appendix E.

Bat Echolocation Recordings

Bat echolocation recordings were undertaken at night, using AnaBat recording units to document bat species in the area. AnaBat SD1 units were set on a timer to turn on at dusk and off at dawn (recording all night), and were left in place for up to six nights. The recording units convert ultrasonic echolocation signals produced by bats into audible electronic signals, which are later analysed for species-specific calls. Anabat's were set close to tree hollows identified as potential roosting locations or surface water (bores) where species may congregate to forage. All echolocation bat recording data was analysed by Mr Bob Bullen (Consultant Bat expert).

Bat survey locations and details are presented in Figure 7 and in Appendix F.

Opportunistic Observations

At all times, 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.

2.3.3 Taxonomy

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

In the field, fauna species captured and or opportunistically observed were identified using relevant field guides. In particular Tyler (1997), 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 Dyck and Strahan (2008) and Churchill (2008) were used to identify mammals, while Triggs (1996) was used to identify mammal scats, tracks and traces. One predator scat was collected and the contents were identified by Ms Barbara Triggs (Consultant Mammologist).

3 RESULTS

3.1 VARIABLES INFLUENCING THE FAUNA SURVEY

As per *Guidance Statement 56* (EPA 2004), the limitations and constraints associated with a survey need to be documented. These constraints are detailed in Table 1.

Table 1: Variables Associated with the Roy Hill Borefield Project Area Fauna Survey

Variable	Impact on Survey Outcomes
Experience levels/ Resources	The biologists who conducted the current survey were practitioners suitably qualified in their respective fields. • Mr Matthew Love - Zoologist • Mr Mike Brown – Zoologist • Mr John Trainer – Field Assistant • Mr Bob Bullen – Bat Acoustic Analysis • Ms Barbara Triggs – Consultant Mammologist
Permit	The current survey was conducted under the DEC: Licence to Take Fauna for Scientific Purposes Licence No. SF006974.
Scope: sampling methods/ Intensity	The survey carried out was a Level Two survey under EPA *Guidance Statement No. 56*, comprising of a desktop survey and a site visit that included a habitat assessment, trapping program, and opportunistic observations.
Proportion of fauna recorded/ completeness	The current field survey recorded 86 fauna species, comprising of 19 reptile, 52 bird and 15 mammal species. A total of 276 fauna species have been previously been recorded within the vicinity of Roy Hill including four amphibian species, 88 reptile species, 143 bird species and 41 mammal species. This includes records from NatureMap, Birds Australia, DEC threatened fauna database and previous surveys within the surrounds of the current project area.
Sources of Information	At the bioregion level, the Pilbara has been the subject of many targeted biological surveys, primarily for the resources sector. *ecologia* Environment had previously undertaken a vertebrate fauna survey at the proposed mining area north of the borefield for Hancock Prospecting (*ecologia* Environment 2006). A follow up Level Two fauna survey was conducted by *ecologia* Environment in the same area in 2009 (*ecologia* Environment 2009b). Furthermore a desktop review was carried within the current borefield project area by *ecologia* Environment in 2009 (*ecologia*

Variable	Impact on Survey Outcomes
	Environment 2009a). Surveys completed at Christmas Creek, Mt Lewin, Mt Nicholas, Mindy Mindy, Cloudbreak and Coondiner are also relevant, given their close proximity to the current project area (Biota 2005, Bamford Consulting Ecologists 2005 and ENV.Australia 2007).
Proportion of task completed	Trapping data was obtained from the 22 to 31 July 2009 with up to seven nights invested during the survey. In addition 17 hours of diurnal searching, 13.5 hours of nocturnal road cruising and 25 hours of ornithological census occurred within the project area.
Timing, weather, season.	The vertebrate fauna survey was undertaken from 22 to 31 July 2009 during the Pilbara dry season. The area had received 41.0mm of rainfall in the three months preceding the survey (BoM 2009). Day temperatures were between 19.3^{o}C and 27.4^{o}C, with night temperatures ranging between 1.2^{o}C and 13.7^{o}C (BoM 2009). This survey was conducted in the cool dry season, so fauna activity levels were comparatively low. As such some species (particularly ectothermic animals) that are present in the project area may not have been detected during the survey.
Disturbances	The Roy Hill Borefield project area has been moderately impacted by pastoral activities. There was a significant amount of cattle damage and weeds associated with cattle dispersal present. This will affect the diversity of ground dwelling reptiles and mammals that occur within the project area.
Access problems	No access problems affected the outcome of the fauna survey.

3.2 VERTEBRATE FAUNA HABITATS

Habitats present within the project area were ranked as having a high, moderate, or low value in accordance to fauna and fauna of conservation significance present. The project area consists of only one habitat type: an Alluvial Plain.

Alluvial Plain Habitat

The Alluvial Plain is covered by varying densities of Mulga woodlands with a sparse understorey of annual herbs and grasses. Intermittent Spinifex grasslands also occurred between Mulga groves. Soils were all consistent loamy sands with areas of clay depressions. The build-up of vegetation debris provides an abundance of microhabitats such as fallen timber and leaf litter that can be utilised by terrestrial and arboreal fauna. The vegetation is of moderate complexity

providing a different array of niches for fauna species to exploit. Despite the vegetation complexity and comparative level of biodiversity, the commonality within the project area and broad regional representation determines this habitat to be of moderate value. Furthermore due to heavy pastoral activities there are areas of high weed infestation such as Buffel Grass (*_Cenchrus ciliaris_*) and Beggars Ticks (*_Bidens bipinnate_*) which may restrict the foraging opportunities of native ground dwelling reptiles and mammals.

3.3 VERTEBRATE FAUNA SPECIES RECORDED

Eighty-six vertebrate fauna species were recorded within the project area, consisting of 19 reptile species, 52 bird species, and 15 mammal species.

A total of 277 fauna species have previously been recorded within the vicinity of Roy Hill including four amphibian species, 88 reptile species, 144 bird species and 41 mammal species. This includes records from NatureMap, Birds Australia, DEC threatened fauna database and previous surveys within the surrounds of the current project area. Six new species for the Roy Hill area were recorded during the current survey, including four reptile species, one bird species and one mammal species.

3.3.1 Amphibians

No amphibians were recorded within the project area.

3.3.2 Reptiles

Nineteen reptile species from seven separate families were recorded during the survey (Appendix B2). The most frequently represented family was Scincidae (six species), followed by Gekkonidae (five species), and Elapidae (three species). Three families, Agamidae (Dragons), Varanidae (Goannas) and Boidae (Pythons), were represented by only one species. No conservation significant reptilian species were recorded during the survey.

A total of 88 reptile species have previously been recorded within the surrounds of Roy Hill, with the current survey recording four new species for the area. The four newly recorded species for the Roy Hill vicinity include the Buchanan's Snake-eyed Skink (*_Cryptoblepharus buchani_*), *_Ctenotus schomburgkii_*, *_Varanus bushi_* and the Spotted Snake (*_Suta punctata_*). The Buchanan's Snake-eyed Skink is a newly derived taxa from the taxonomic spilt of *_Cryptoblepharus_* species (Horner and Adams 2007), whereas *_Ctenotus schomburgkii_*, *_Varanus bushi_* and the Spotted Snake are commonly recorded reptiles during biological assessments.

3.3.3 Birds

Fifty-two species from 26 different families were recorded during the survey (Appendix B3). The most frequently represented family was Meliphagidae, the honeyeaters, with six species. The second most recorded families were Accipitridae (Raptors) and Artamidae (Wood-swallows) each with four species.

A total of 144 bird species have previously been recorded within the surrounds of Roy Hill, with the current survey recording one new species for the area. The Mulga Parrot (*Psephotus varius*) is a commonly recorded species in biological assessments in the central Pilbara particularly within Mulga woodlands and in close proximity to water sources.

One species recorded during the survey was of conservation significance, the Australian Bustard (*Ardeotis australis*). The Australian Bustard is listed as Priority 4 on the DEC Priority list, and is discussed in Section 4.1.3.

3.3.4 Mammals

Fifteen mammal species from 11 separate families were recorded during the current survey (Appendix B4). The most frequently represented family was Vespertilionidae with four species, nine families were represented by only one species.

A total of 41 mammal species have previously been recorded within the surrounds of Roy Hill, with the current survey recording one new species for the area. The Dingo (*Canis lupus* subsp. *dingo*) is commonly recorded in biological assessments within the central Pilbara and does not have any conservation significance.

Five introduced mammal species were recorded, the house mouse (**Mus musculus*), the Feral Cat (**Felis catus*), the Horse (**Equus caballus*), the Camel (**Camelus dromedarius*) and European Cattle (**Bos taurus*). The above introduced mammal species are widespread across much of Australia, occurring in an extensive range of habitats (van Dyck & Strahan 2008). These species in particular the Feral Cat are known to spread rapidly occupying a variety of surroundings, preying on and competing with native species (van Dyck & Strahan 2008). The Horse, Camel and European Cattle are known to compete with native herbivores and degraded fauna habitat (van Dyck & Strahan 2008).

4 DISCUSSION

4.1 SAMPLING ADEQUACY

A total of 86 terrestrial vertebrate fauna were recorded during the survey, including 19 reptiles, 52 bird and 15 mammal species. One bird species recorded, the Australian Bustard (*Ardeotis Australis*) is of Conservation Significance. The Australian Bustard is listed as Priority 4 by the DEC. A further nine conservation significant species are expected to occur within habitat found within the project area.

Due to the survey being conducted during the 'winter' season of the central Pilbara the number of recorded species was comparatively low. Warmer climatic conditions often result in more ground dwelling reptiles and mammals being recorded. As reptiles are ectothermic they rely on warm temperatures to forage and for breeding purposes. The lack of significant rainfall pre-field activities may have also resulted in a lower recorded number of herbivorous mammals. For example six weeks after significant rainfall there is a greater abundance of food sources (grasses) therefore resulting in an increase of mammal population densities particularly granivores.

Due to the numerous baseline surveys performed in the vicinity of the project area and significant faunal assemblage knowledge of the region it can be assumed that many of the non-significant fauna listed in Appendix B occur in the project area or its immediate vicinity.

4.2 SIGNIFICANCE OF FAUNA HABITAT IN THE PROJECT AREA

Only one fauna habitat based on landform and vegetation structure was identified in the proposed Roy Hill Borefield project area; this habitat was an Alluvial Plain.

The Alluvial Plain within the project area was part of a larger Mulga plain association in close proximity to the Fortescue River and Marsh. The soils and vegetation structure were fairly consistent and similar to the surrounding areas. There is often a high biodiversity within Alluvial Plains frequently dominated by Mulga (*Acacia aneura*) however given the commonality of this habitat within the project area and the Pilbara bioregion and the relative uniformity of the vegetation, the habitat was rated as of moderate habitat value.

A number of conservation significant species particularly the Peregrine Falcon and Grey Falcon can be found foraging within Alluvial Plain shrublands and woodlands. However these species would only use the habitat within the Roy Hill Borefield project area as part of a larger foraging home range; no suitable nesting habitat was recorded. Mulga also provide opportunities for shelter and foraging for the Brush-tailed Mulgara and Lakeland Downs Mouse.

4.3 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 reported as occurring in previous surveys. Appendix G 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.

One conservation significant species was recorded during the survey and a further nine species potentially occur in the project area based on the habitat present (Table 2). No conservation significant amphibians or reptiles potentially occur in the project area.

Table 2: Conservation Significant Fauna Species Recorded During the Survey and Those Potentially Occurring in the Project Area

SCIENTIFIC NAME	COMMON NAME	EPBC Act	WC Act	DEC	Recorded
BIRDS					
Ardea alba	Eastern Great Egret	Mi			
Ardea ibis	Cattle Egret	Mi			
Falco hypoleucos	Grey Falcon			P4	
Falco peregrinus	Peregrine Falcon		S4		
Ardeotis australis	Australian Bustard			P4	x
Tringa glareola	Wood Sandpiper	Mi			
Burhinus grallarius	Bush Stone-curlew			P4	
Merops ornatus	Rainbow Bee-eater	Mi			
MAMMALS					
Dasycercus blythi	Brush-tailed Mulgara			P4	
Leggadina lakedownensis	Lakeland Downs Mouse			P4	

Key: EPBC= Environment Protection and Biodiversity Conservation Act 1999, WC= Wildlife Conservation Act 1950, DEC= Department of Conservation Priority Code. See Appendix A for and explanation of conservation codes and Appendix B for complete list of species scientific and common names.

4.3.1 Birds

One conservation significant bird species was recorded in the survey and a further seven species potentially occur in the project area (Table 3), and are discussed below.

Eastern Great Egret (*Ardea alba*)

The Eastern 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 within the vicinity of surface water particularly near active pastoral bores on a transitory basis.

Cattle Egret (*Ardea ibis*)

The Cattle Egret occurs in the wetter parts of WA, in particular the Kimberley and the south-west. The species inhabits short grass, in particular damp pastures and wetlands, usually in the company of cattle and occasionally other livestock. In WA it is an irregular visitor, occurring mostly in autumn, and is not thought to breed within the state (Johnstone & Storr 1998). Like the Eastern Great Egret this species may only be present within the project area near surface water particularly close to active pastoral bores, or near to cattle during flooding and inundation events.

Grey Falcon (*Falco hypoleucos*)

The Grey Falcon is generally regarded as a rare bird in Australia, although it occurs on the Fortescue River close to the current project area. They may be more common than the number of records suggests. Grey Falcons commonly move north during winter, although their range may become extended when conditions are optimal because of increases in local abundance of prey (Johnstone & Storr 1998). However, the birds may also be nomadic, appearing in areas as drought refugees when conditions are poor. Grey Falcons do not build their own nests when breeding, and therefore are less prone to site fidelity than their conspecifics, although they may remain faithful to a home range for several years. They are a difficult species to study, having a strongly transient nature. The Grey Falcon if present in the project area is only likely to be a transitory visitor.

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 feeds mostly on birds (Johnstone & Storr 1998). The lack of nesting habitat means that this species is only likely to forage in the project area on an infrequent basis.

Australian Bustard (*Ardeotis australis*)

The Australian Bustard is typically found in grasslands, especially tussock grasses, arid scrub and dry open woodlands (Morcombe 2004). 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 and wide ranging, so can potentially forage anywhere in the Pilbara on a transitory basis. However, they are likely to favour the Alluvial Plain habitat types in the project area. Three individuals of this species were recorded within the confines of the current project area during the survey.

Wood Sandpiper (*Tringa glareola*)

The Wood Sandpiper is a summer non-breeding migratory shorebird that occurs along the coastal as well as inland regions of Western Australia (Geering *et al.* 2007). It primarily inhabits freshwater wetlands and rarely on intertidal mudflats (Geering *et al.* 2007). The Wood Sandpiper like the previous wading water birds will only be present near available surface water.

Bush Stone-curlew (*Burnhinus grallarius*)

The Bush Stone-curlew inhabits dry open woodlands with groundcover of small sparse shrubs and grasses. It tends to avoid dense forest, closed-canopy habitats (Morcombe 2004). The species requires permanent water to be a resident species. This taxon may utilise the area for foraging and reside at nearby permanent water bodies particularly near all of the active pastoral bores. Bush Stone-curlews are locally rare because of predation by foxes – the main concern for their regional decline (Johnstone & Storr 1998). It is possible that this species occurs on a permanent basis in the project area given the amount of suitable habitat type and availability of semi-permanent water sources.

Rainbow Bee-eater (Merops ornatus)

The Rainbow Bee-eater migrates to south-western Australia to breed in spring and summer (Johnstone & Storr 1998). The Rainbow Bee-eater is a common and widespread species in WA (Johnstone & Storr 1998). 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.

4.3.2 Mammals

Two conservation significant mammal species potentially occur in the project area (Table 3), and are discussed below.

Brush-tailed Mulgara (*Dasycercus blythi*)

The Brush-tailed Mulgara has long been misidentified with the Crest-tailed Mulgara (*Dasycercus cristicauda*) despite the obvious differences in tail morphology (Van Dyck & Strahan 2008). Both species are often found in central arid Australia, and until museum specimens are correctly identified the distribution of both species is uncertain (Van Dyck & Strahan 2008). However evidence from recent survey efforts in the area suggest that the Brush-tailed Mulgara is the more commonly recorded and captured species (pers. comm., R. How WAM).

The Mulgara was once widely distributed in inland arid-zone sandplains and dunes of WA (Van Dyck & Strahan 2008). This species now has a reduced distribution throughout sandy arid areas of western and central Australia, where it inhabits hummock grass plains, sandy ridges and Mulga shrubland on loamy sand (Van Dyck & Strahan 2008). Mulgara burrows are distinctive, and usually have one large hole with several side tunnels and alternative entrances, or pop-holes (Van Dyck & Strahan 2008, Menkhorst & Knight 2004). This species is known to fluctuate in numbers in some parts of its range (Van Dyck & Strahan 2008), including the Pilbara. Despite no Mulgara evidence was recorded during the survey, through scats and burrows, it is possible this species may inhabit areas within the project area given the scale of preferred habitat available.

Lakeland Downs Mouse (*Leggadina lakedownensis*)

The Lakeland Downs Mouse occurs in a range of habitat types on seasonally inundated sandy-clay soils (Moro & Kutt 2008). In the Pilbara it occurs on stony hummock grasslands, *Acacia* shrublands and savannah woodlands on alluvial clay or sandy soils (Moro & Kutt 2008). It is generally rare, with scattered populations where very little is known of its biology however like other rodents of arid Australia this species is usually nocturnal (Moro & Kutt 2008). The Lakeland Downs Mouse, if present, may be found within the project area within built up grasslands either nesting or forging.

5 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.

5.1.1 Potential Impacts from the Proposed Development

The Roy Hill Borefield project area is approximately 37,293 hectares, however the area to be impacted will be significantly less due to the nature of disturbance proposed. Only a small area of vegetation is expected to be cleared for the drill pads and associated pipe work. The major impact upon fauna habitat from the development will be land clearing and disturbance. This is likely to slightly reduce the area of potential habitat for local fauna, and may reduce the population size of local, ground-dwelling fauna such as reptiles and small mammals. Indirectly the fauna species may be impacted through a change in fire regimes, and an increase in weed infestations, disruption to fauna through increased noise and dust pollution, and an increase in predation pressure through feral fauna activities.

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 from secondary affects that weeds may have upon the ecology of the habitat.

5.1.2 Significance of Impacts upon Conservation Significant Fauna

One species the Australian Bustard was recorded on three separate occasions during the survey. This species is highly nomadic and is therefore considered unlikely to be affected at an individual or population level by the proposal. The Australian Bustard however nests on the ground, and this usually occurs during the breeding season between October and December. Consideration of the Australian Bustards breeding requirements needs to be undertaken particularly during this time.

As well as the Australian Bustard nine other conservation significant species potentially occur within the project area. No major net effects are expected upon any of these species from the proposed development given the small scale of impact proposed. It is possible that some of the conservation significant birds, like the Grey Falcon and Peregrine Falcon, may lose some potential foraging habitat but being wide-ranging species with large home ranges, this is unlikely to be significant. In fact extra bores in the area may result in a net positive impact on some of these conservation significant fauna species. For example migratory waders and water birds such as the Eastern Great Egret, Cattle Egret and

Rainbow bee-eater may benefit from the possible increased availability of surface water.

Given the small scale of impact associated with drilling water bores and installing pipes and given the fauna habitat is consistent within the project area and found extensively outside of the project area, no impacts on conservation significant species are expected.

6 CONCLUSION

The Level Two fauna survey as per EPA Guidance Statement 56 recorded 86 terrestrial vertebrate fauna species, including 19 species of reptile, 52 bird species, and 15 mammal species.

Of those species recorded, only one species was of conservation significance, the Australian Bustard. A further nine conservation significant fauna species potentially occur in the project area.

The project area has experienced a low to moderate level of disturbance due to existing industry infrastructure and pastoral activities. The level of habitat disturbance from the proposed development is also likely to be low in a regional context due to the small scale of proposed disturbance.

The main impact of the proposed borefield will be vegetation clearing which is likely to affect local populations of ground dwelling fauna species. However given the small scale of impact the commonality of the habitat within the project area and wider surrounds no net regional impacts are expected. Therefore ENV concludes that for the proposed development there is unlikely to be fauna issues that require referral to the Commonwealth Department of Environment, Water, Heritage and the Arts for assessment under the *Environmental Protection and Biodiversity Conservation Act 1999* and or consideration under the *Wildlife Conservation Act 1950* or *Environmental Protection Act 1986*.

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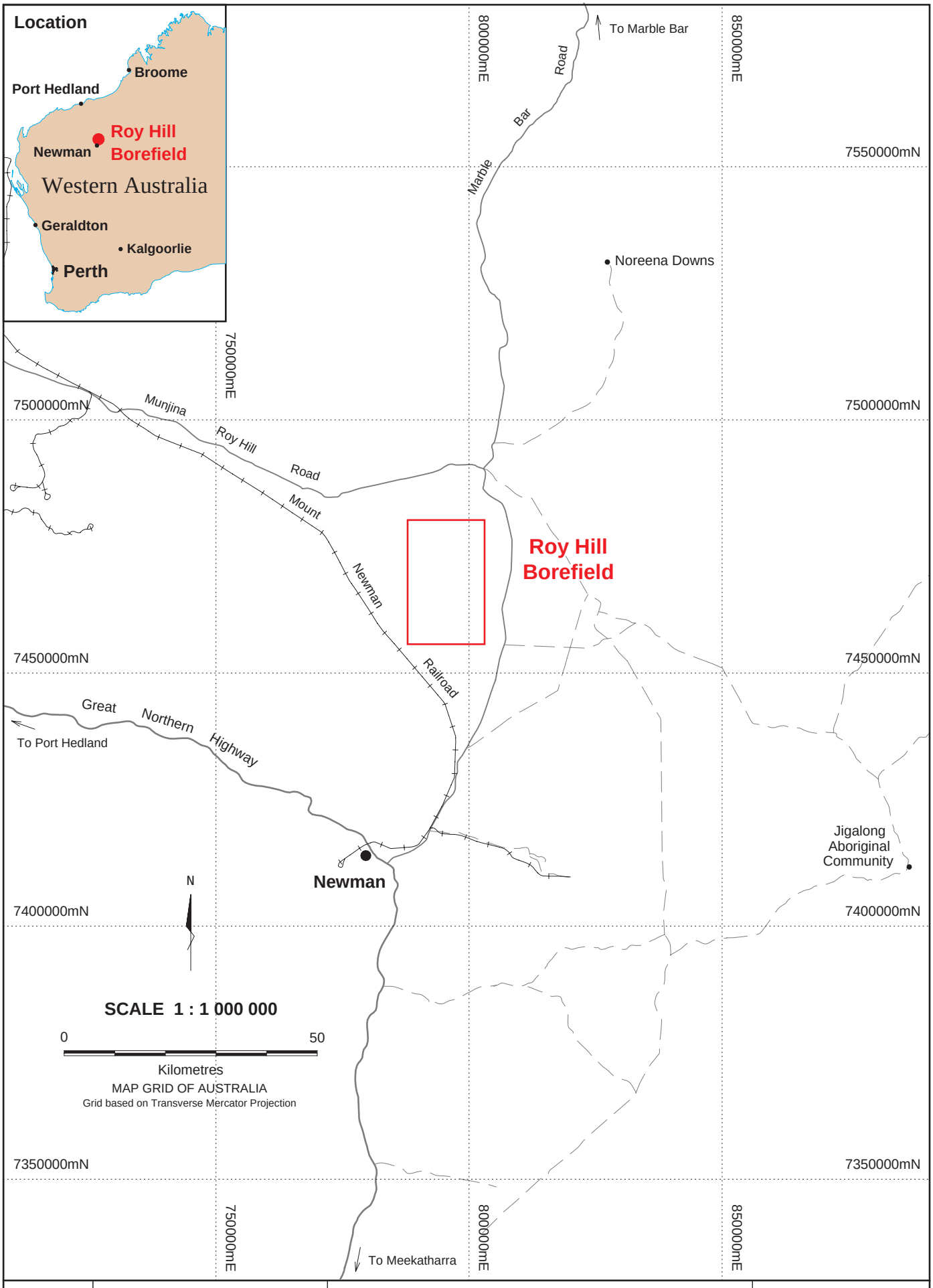
FIGURES



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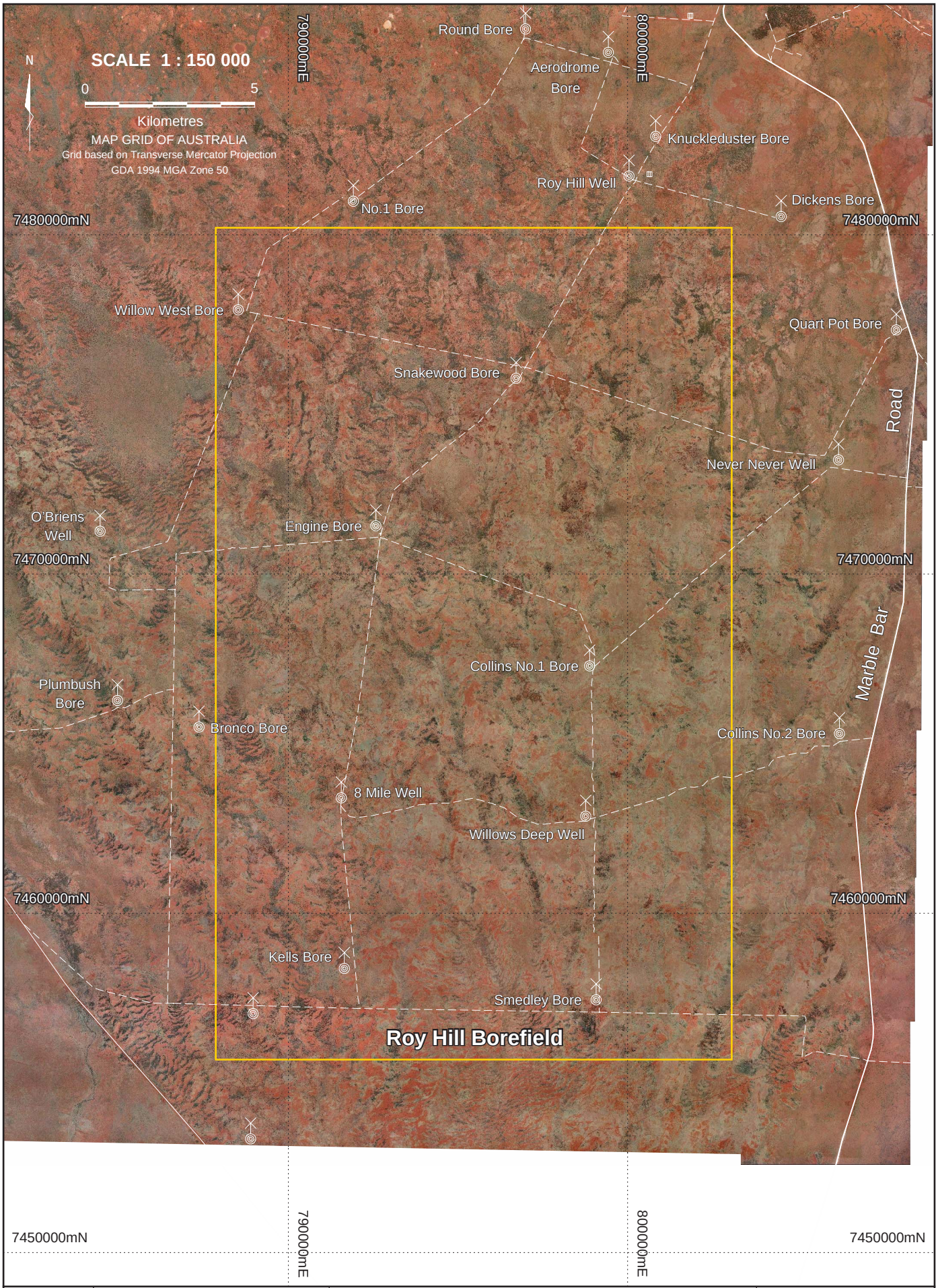

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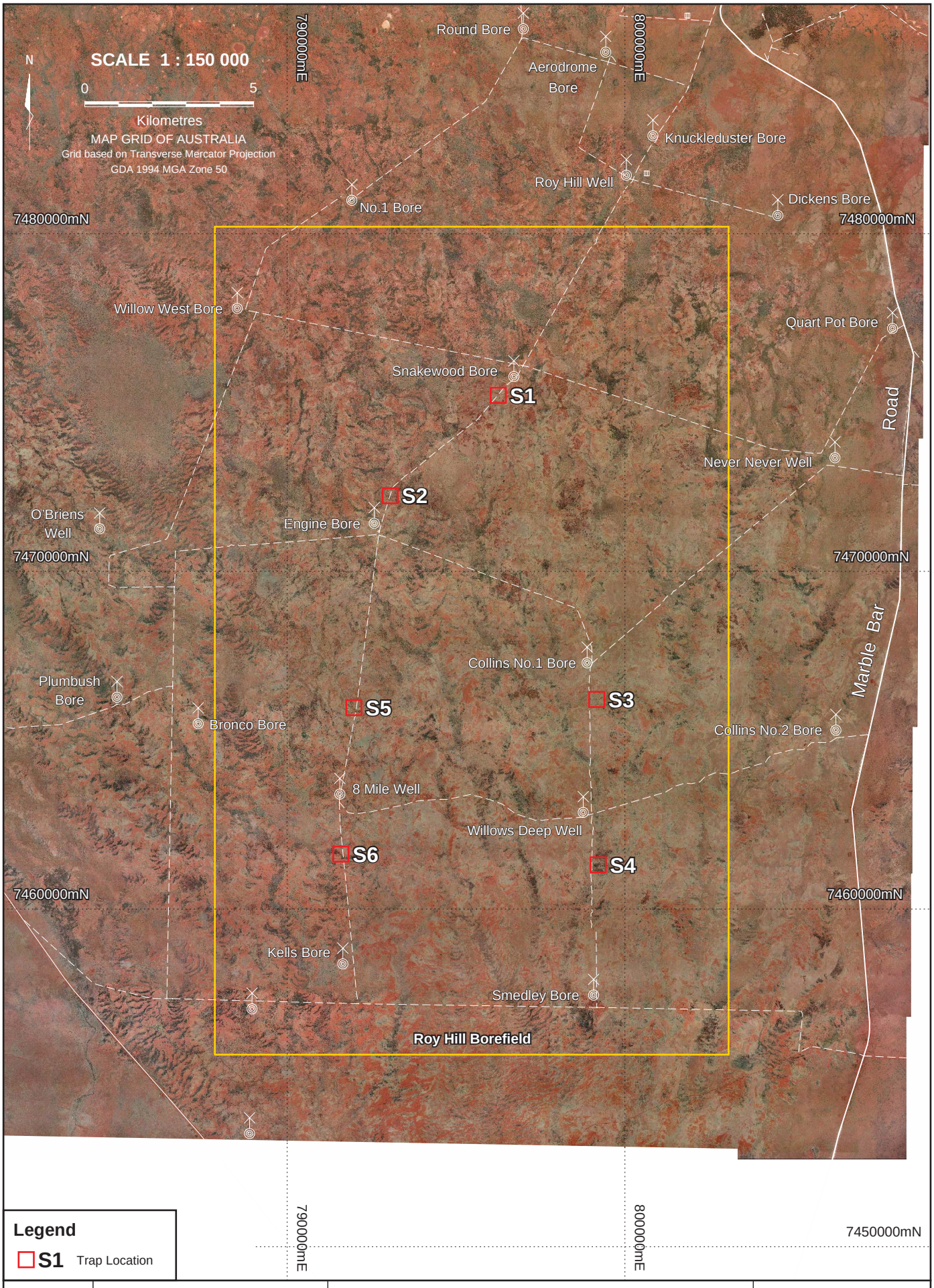

Legend

S1 Trap Location

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			Figure No. 4
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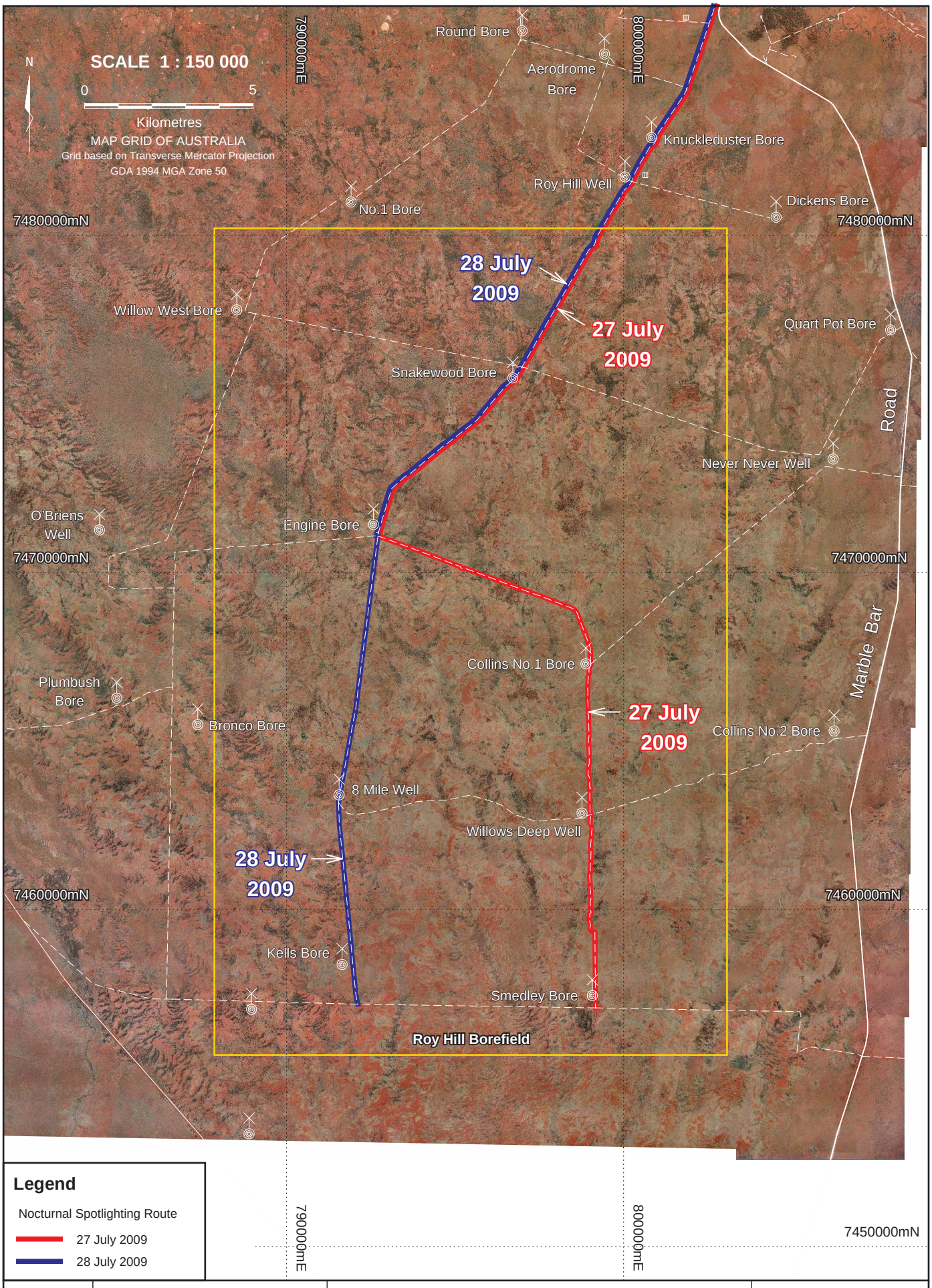

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	ROY HILL BOREFIELD VERTEBRATE FAUNA ASSESSMENT		Figure No. 5
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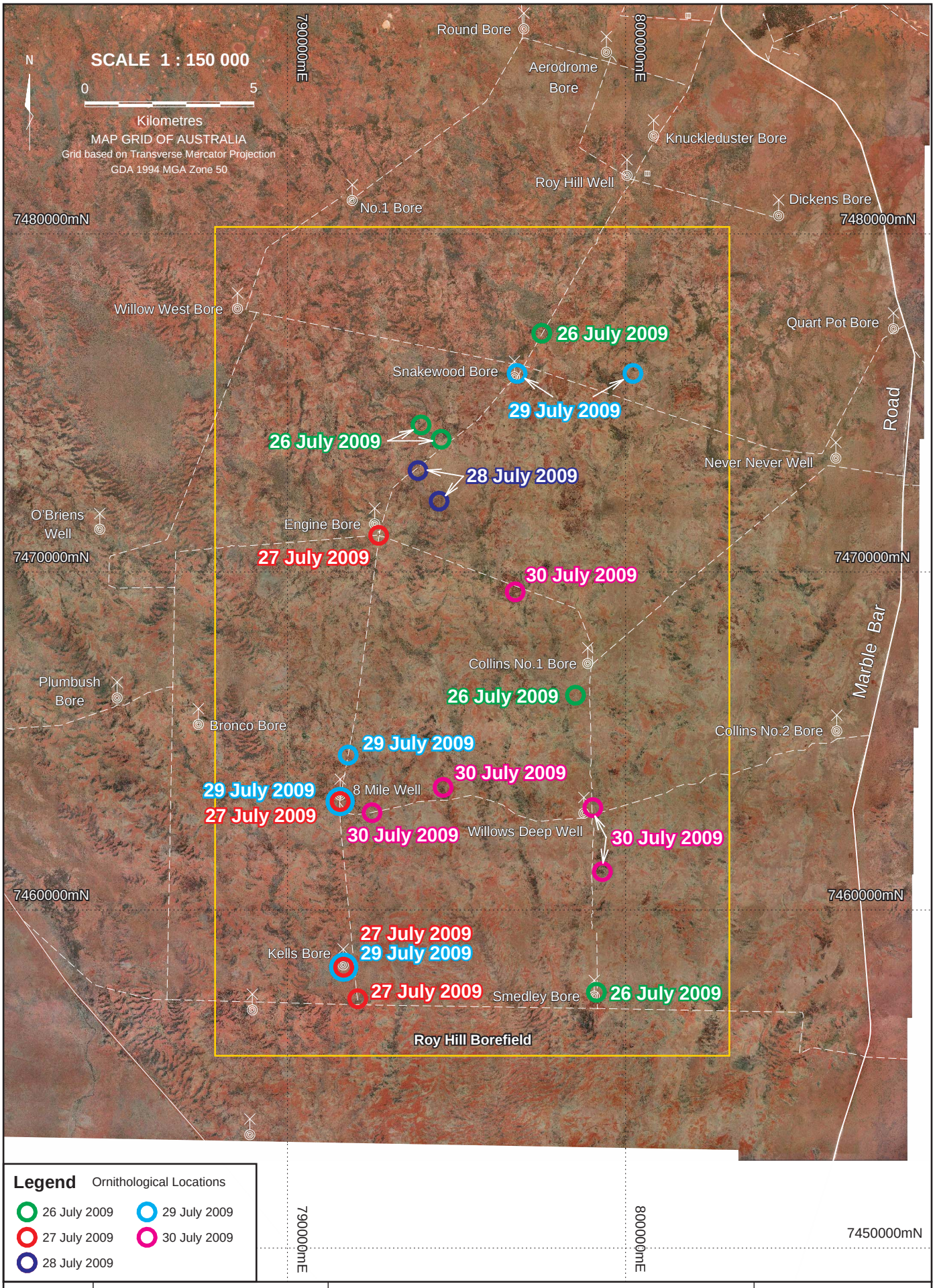

Legend Ornithological Locations

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- 28 July 2009

env Australia

Client: HANCOCK PROSPECTING PTY LTD

Project: ROY HILL BOREFIELD VERTEBRATE FAUNA ASSESSMENT

ORNITHOLOGICAL SURVEY LOCATIONS FOR THE ROY HILL BOREFIELD PROJECT AREA

09.162 A4

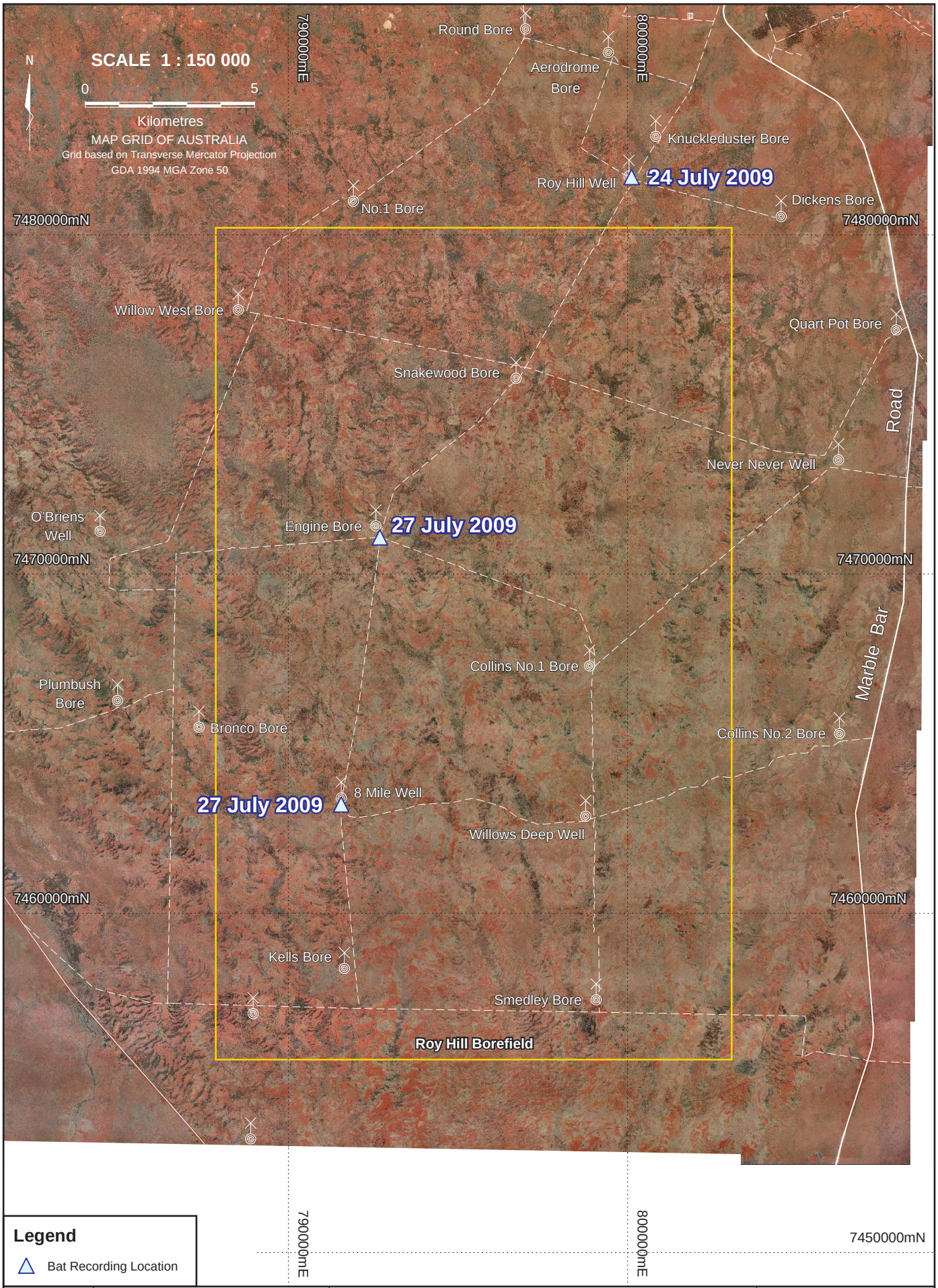
Date: 2 September 2009

Scale: 1:150 000

Author: M.L. / S.C.

Figure No. 6

Plan No. RHB-005



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△ Bat Recording Location

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			Author: M.L. / S.C.
	ROY HILL BOREFIELD VERTEBRATE FAUNA ASSESSMENT		Figure No. 7
	Project:	09.162 A4	Plan No. RHB-006

APPENDIX A

DEFINITIONS OF CONSERVATION CODES FOR FAUNA OF CONSERVATION SIGNIFICANCE

ROY HILL BOREFIELD 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; and
- Nuclear actions (including uranium mining).

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

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

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

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 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

FAUNA SPECIES PREVIOUSLY RECORDED IN THE PROJECT AREA AND WITHIN THE WIDER SURROUNDS

ROY HILL BOREFIELD VERTEBRATE FAUNA ASSESSMENT

APPENDIX B

FAUNA SPECIES PREVIOUSLY RECORDED IN THE STUDY AREA AND WITHIN THE WIDER SURROUNDS

Appendix B1 - Amphibians

Key: EPBC = Environmental Protection and Biodiversity Conservation Act 1999, WC = Wildlife Conservation Act 1950, DEC = Department of Conservation Priority Code, A = Listed in Naturemap, B = Listed by Birds Australia, C = Previous fauna surveys records (<50km), D = Current Survey

Note: For Definitions of Conservation Codes see Appendix A.

AMPHIBIANS		**Conservation Codes**						
Scientific Name	**Common Name**	**EPBC**	**WC**	**DEC**	**A**	**B**	**C**	**D**
HYLIDAE								
Cyclorana maini	Main's Frog						x	
Cyclorana platycephala	Water-holding Frog						x	
Litoria rubella	Desert Tree Frog				x		x	
MYOBATRACHIDAE								
Notaden nichollsi	Desert Spadefoot						x	

[X] fauna species recorded from the project area.

APPENDIX B

FAUNA SPECIES PREVIOUSLY RECORDED IN THE STUDY AREA AND WITHIN THE WIDER SURROUNDS

Appendix B2 - Reptile species

Key: EPBC = Environmental Protection and Biodiversity Conservation Act 1999, WC = Wildlife Conservation Act 1950, DEC = Department of Conservation Priority Code, A = Listed in Naturemap, B = Listed by Birds Australia, C = Previous fauna surveys records (<50km), D = Current Survey

Note: For Definitions of Conservation Codes see Appendix A.

REPTILES		**Conservation Codes**						
Scientific Name	**Common Name**	**EPBC**	**WC**	**DEC**	**A**	**B**	**C**	**D**
AGAMIDAE								
Amphibolurus longirostris	Long-nosed Dragon				x		x	
Caimanops amphiboluroides	Mulga Dragon				x		x	
Ctenophorus caudicinctus	Ring-tailed Rock Dragon				x		x	
Ctenophorus isolepis	Military Sand Dragon				x		x	
Ctenophorus nuchalis	Central Netted Dragon				x		x	
Ctenophorus reticulatus	Western Netted Dragon				x		x	x
Ctenophorus scutulatus							x	
Pogona minor minor	Bearded Dragon				x		x	
Tympanocryptis cephala	Earless Pebble Dragon				x		x	
GEKKONIDAE								
Diplodactylus conspicillatus	Fat-tailed Gecko				x		x	x
Diplodactylus mitchelli					x			
Diplodactylus pulcher							x	
Diplodactylus savagei							x	
Gehyra pilbara	Pilbara Dtella						x	
Gehyra punctata	Spotted Rock Dtella						x	
Gehyra variegata	Variegated Tree Dtella				x		x	x
Heteronotia binoei	Bynoe's Gecko				x		x	x
Heteronotia spelea	Pilbara Cave Gecko						x	
Lucasium stenodactylum	Pale-snouted Ground Gecko				x		x	
Lucasium wombeyi	Pilbara Ground Gecko						x	
Nephrurus wheeleri cinctus	Banded Knob-tailed Gecko						x	
Oedura marmorata	Marbled Velvet Gecko						x	
Rhynchoedura ornata	Beaked Gecko				x			x
Strophurus elderi	Jewelled Gecko						x	
Strophurus wellingtonae					x		x	x
PYGOPODIDAE								
Delma butleri	Unbanded Delma						x	x
Delma elegans							x	
Delma haroldi					x		x	
Delma nasuta	Long-nosed Delma						x	
Delma pax					x		x	
Delma tincta					x		x	x
Lialis burtonis	Burton's Legless Lizard				x		x	
Pygopus nigriceps	Hooded Scaly-foot				x		x	
SCINCIDAE								
Carlia munda							x	
Carlia triacantha	Desert Rainbow Skink				x			
Cryptoblepharus buchani	Buchanan's Snake-eyed Skink							x
Cryptoblepharus plagiocephalus	Peron's Snake-eyed Skink				x			
Ctenotus ariadnae							x	
Ctenotus duricola					x		x	
Ctenotus hanloni							x	
Ctenotus helenae					x		x	x
Ctenotus leonhardii							x	
Ctenotus pantherinus ocellifer	Leopard Ctenotus						x	

APPENDIX B

FAUNA SPECIES PREVIOUSLY RECORDED IN THE STUDY AREA AND WITHIN THE WIDER SURROUNDS

Appendix B2 - Reptile species

REPTILES		**Conservation Codes**						
Scientific Name	**Common Name**	**EPBC**	**WC**	**DEC**	**A**	**B**	**C**	**D**
Ctenotus piankai							x	
Ctenotus quattuordecimlineatus							x	
Ctenotus rubicundus							x	
Ctenotus rutilans							x	
Ctenotus saxatilis	Rock Ctenotus				x		x	
Ctenotus schomburgkii								x
Ctenotus serventyi							x	
Ctenotus uber uber							x	x
Cyclodomorphus melanops melanops	Spinifex-slender Bluetongue						x	
Eremiascincus fasciolatus	Narrow-banded Sand-swimmer						x	
Eremiascincus richardsonii	Broad-banded Sand-swimmer				x		x	
Lerista amicorum					x		x	x
Lerista bipes							x	
Lerista labialis					x			
Lerista muelleri					x		x	
Lerista zietzi							x	
Menetia greyii	Common Dwarf Skink				x		x	x
Menetia surda surda					x		x	
Morethia ruficauda subsp. *exquisita*	Fire-tailed Skink				x		x	
Notoscincus ornatus subsp. *ornatus*					x			
Tiliqua multifasciata	Central Bluetongue				x		x	
VARANIDAE								
Varanus acanthurus	Spiny-tailed Monitor						x	
Varanus bushi								x
Varanus caudolineatus	Striped-tailed Monitor				x		x	
Varanus eremius	Desert Pygmy Monitor						x	
Varanus giganteus	Perentie						x	
Varanus panoptes rubidus	Yellow-spotted Monitor						x	
Varanus tristis tristis	Black-headed Monitor						x	
TYPHLOPIDAE								
Ramphotyphlops ammodytes					x		x	
Ramphotyphlops ganei				P1			x	
Ramphotyphlops grypus	Beaked Blind Snake				x		x	
Ramphotyphlops hamatus					x		x	
Ramphotyphlops waitii					x			
BOIDAE								
Antaresia perthensis	Pygmy Python						x	
Antaresia stimsoni stimsoni	Western Stimson's Python				x			x
Aspidites melanocephalus	Black-headed Python						x	
Liasis olivaceus barroni	Pilbara Olive Python	VU	S1				x	
ELAPIDAE								
Brachyurophis approximans	Northwestern Shovel-nosed Snake						x	
Demansia psammophis cupreiceps	Yellow-faced Whip-Snake				x		x	x
Furina ornata	Moon Snake						x	
Pseudechis australis	Mulga Snake						x	
Pseudonaja modesta	Ringed Brown Snake				x		x	
Pseudonaja nuchalis	Gwardar						x	x
Suta fasciata	Rosen's Snake				x		x	
Suta punctata	Spotted Snake						x	x

[X] fauna species recorded from the project area.
[*] denotes introduced species.

APPENDIX B

FAUNA SPECIES PREVIOUSLY RECORDED IN THE STUDY AREA AND WITHIN THE WIDER SURROUNDS

Appendix B3 - Bird species

Key: EPBC = Environmental Protection and Biodiversity Conservation Act 1999, WC = Wildlife Conservation Act 1950, DEC = Department of Conservation Priority Code, A = Listed in Naturemap, B = Listed by Birds Australia, C = Previous fauna surveys records (<50km), D = Current Survey

Note: For Definitions of Conservation Codes see Appendix A.

BIRDS		**Conservation Codes**						
Scientific Name	**Common Name**	**EPBC**	**WC**	**DEC**	**A**	**B**	**C**	**D**
DROMAIIDAE								
Dromaius novaehollandiae	Emu					x	x	x
PHASIANIDAE								
Coturnix ypsilophora	Brown Quail						x	
Coturnix pectoralis	Stubble Quail						x	
ANATIDAE								
Aythya australis	Hardhead					x	x	
Anas superciliosa	Pacific Black Duck					x		
Anas gracilis	Grey Teal					x		
Chenonetta jubata	Australian Wood Duck					x		
Dendrocygna eytoni	Plumed Whistling-duck					x		
Tadorna tadornoides	Australian Shelduck					x	x	x
PODICIPEDIDAE								
Tachybaptus novaehollandiae	Australasian Grebe					x		
ANHINGIDAE								
Anhinga melanogaster	Darter					x		
PHALACROCORACIDAE								
Phalacrocorax melanoleucos	Little Pied Cormorant					x	x	
Phalacrocorax sulcirostris	Little Black Cormorant					x		
PELECANIDAE								
Pelecanus conspicillatus	Australian Pelican						x	
ARDEIDAE								
Ardea alba	Eastern Great Egret	Mi				x	x	
Ardea ibis	Cattle Egret	Mi				x		
Ardea pacifica	White-necked Heron					x	x	x
Egretta garzetta	Little Egret					x		
Egretta novaehollandiae	White-faced Heron					x	x	
THRESKIORNITHIDAE								
Platalea flavipes	Yellow-billed Spoonbill					x		
Platalea regia	Royal Spoonbill					x	x	
Threskiornis spinicollis	Straw-necked Ibis					x	x	
CICONIIDAE								
Ephippiorhynchus asiaticus	Jabiru					x		
ACCIPITRIDAE								
Elanus caeruleus	Black-shouldered Kite						x	
Lophoictinia isura	Square-tailed Kite					x	x	
Hamirostra melanosternon	Black-breasted Buzzard						x	
Milvus migrans	Black Kite					x	x	
Haliastur sphenurus	Whistling Kite					x	x	x
Circus assimilis	Spotted Harrier				x	x	x	
Accipiter fasciatus	Brown Goshawk					x	x	
Accipiter cirrhocephalus	Collared Sparrowhawk					x	x	x
Aquila audax	Wedge-tailed Eagle					x	x	x
Hieraaetus morphnoides	Little Eagle					x	x	x
FALCONIDAE								
Falco berigora	Brown Falcon					x	x	x
Falco longipennis	Australian Hobby					x	x	x
Falco hypoleucos	Grey Falcon			P4			x	
Falco subniger	Black Falcon						x	
Falco peregrinus	Peregrine Falcon		S4		x	x	x	
Falco cenchroides	Nankeen Kestrel					x	x	x
RALLIDAE								
Gallirallus philippensis	Buff-banded Rail					x	x	
Porzana tabuensis	Spotless Crake						x	

APPENDIX B

FAUNA SPECIES PREVIOUSLY RECORDED IN THE STUDY AREA AND WITHIN THE WIDER SURROUNDS

Appendix B3 - Bird species

BIRDS		Conservation Codes						
Scientific Name	Common Name	EPBC	WC	DEC	A	B	C	D
OTIDAE								
Ardeotis australis	Australian Bustard			P4	x	x	x	x
TURNICIDAE								
Turnix velox	Little Button-quail				x	x	x	
SCOLOPACIDAE								
Tringa glareola	Wood Sandpiper	Mi					x	
BURHINIDAE								
Burhinus grallarius	Bush Stone-curlew			P4	x		x	
CHARADRIIDAE								
Charadrius australis	Inland Dotterel						x	
Charadrius veredus	Oriental Plover	Mi						
Elseyornis melanops	Black-fronted Dotterel					x	x	
Erythrogonys cinctus	Red-kneed Dotterel						x	
GLAREOLIDAE								
Stiltia isabella	Australian Pratincole						x	
COLUMBIDAE								
Phaps chalcoptera	Common Bronzewing					x	x	x
Ocyphaps lophotes	Crested Pigeon					x	x	x
Geophaps plumifera	Spinifex Pigeon					x	x	
Geopelia cuneata	Diamond Dove					x	x	x
Geopelia placida	Peaceful Dove				x	x	x	
CACATUIDAE								
Cacatua roseicapilla	Galah				x	x	x	x
Cacatua sanguinea	Little Corella					x	x	
Nymphicus hollandicus	Cockatiel					x	x	x
PSITTACIDAE								
Barnardius zonarius	Australian Ringneck				x	x	x	x
Psephotus varius	Mulga Parrot							x
Melopsittacus undulatus	Budgerigar					x	x	x
Neopsephotus bourkii	Bourke's Parrot						x	
Neophema elegans	Elegant Parrot						x	
Pezoporus occidentalis	Night Parrot	EN	S1					
CUCULIDAE								
Cuculus pallidus	Pallid Cuckoo					x	x	
Chrysococcyx osculans	Black-eared Cuckoo						x	
Chrysococcyx basalis	Horsfield's Bronze-Cuckoo					x	x	
CENTROPIDAE								
Centropus phasianinus	Pheasant Coucal						x	
STRIGIDAE								
Ninox novaeseelandiae	Southern Boobook Owl					x	x	
TYTONIDAE								
Tyto alba	Barn Owl					x	x	
PODARGIDAE								
Podargus strigoides	Tawny Frogmouth					x	x	x
CAPRIMULGIDAE								
Eurostopodus argus	Spotted Nightjar					x	x	
AEGOTHELIDAE								
Aegotheles cristatus	Australian Owlet-nightjar					x	x	
APODIDAE								
Apus pacificus	Fork-tailed Swift	Mi					x	
HALCYONIDAE								
Dacelo leachii	Blue-winged Kookaburra					x	x	
Todiramphus pyrrhopygia	Red-backed Kingfisher					x	x	x
Todiramphus sanctus	Sacred Kingfisher					x	x	
MEROPIDAE								
Merops ornatus	Rainbow Bee-eater	Mi				x	x	
MALURIDAE								
Malurus lamberti	Variegated Fairy-wren					x	x	x
Malurus leucopterus	White-winged Fairy-wren					x	x	x
Stipiturus ruficeps	Rufous-crowned Emu-wren						x	
Amytornis striatus	Striated Grasswren					x	x	
PARDALOTIDAE								

APPENDIX B

FAUNA SPECIES PREVIOUSLY RECORDED IN THE STUDY AREA AND WITHIN THE WIDER SURROUNDS

Appendix B3 - Bird species

BIRDS		**Conservation Codes**						
Scientific Name	**Common Name**	**EPBC**	**WC**	**DEC**	**A**	**B**	**C**	**D**
Pardalotus rubricatus	Red-browed Pardalote				x	x	x	
Pardalotus striatus	Striated Pardalote					x	x	
Pyrrholaemus brunneus	Redthroat					x	x	
Smicrornis brevirostris	Weebill					x	x	
Gerygone fusca	Western Gerygone					x	x	x
Acanthiza apicalis	Inland Thornbill					x	x	
Acanthiza uropygialis	Chestnut-rumped Thornbill					x	x	x
Acanthiza robustirostris	Slaty-backed Thornbill						x	
Aphelocephala leucopsis	Southern Whiteface						x	
MELIPHAGIDAE								
Acanthagenys rufogularis	Spiny-cheeked Honeyeater					x	x	x
Manorina flavigula	Yellow-throated Miner					x	x	x
Lichenostomus virescens	Singing Honeyeater					x	x	x
Lichenostomus keartlandi	Grey-headed Honeyeater					x	x	
Lichenostomus penicillatus	White-plumed Honeyeater				x	x	x	
Melithreptus gularis	Black-chinned Honeyeater						x	
Lichmera indistincta	Brown Honeyeater					x	x	x
Phylidonyris albifrons	White-fronted Honeyeater						x	
Conopophila whitei	Grey Honeyeater				x		x	
Certhionyx niger	Black Honeyeater						x	x
Certhionyx variegatus	Pied Honeyeater						x	
Epthianura tricolor	Crimson Chat				x	x	x	x
PETROICIDAE								
Microeca fascinans assimilis	Jacky Winter						x	
Petroica goodenovii	Red-capped Robin					x	x	x
Melanodryas cucullata	Hooded Robin					x	x	x
POMATOSTOMIDAE								
Pomatostomus temporalis	Grey-crowned Babbler				x	x	x	x
Pomatostomus superciliosus	White-browed Babbler					x	x	x
CINCLOSOMATIDAE								
Psophodes occidentalis	Chiming Wedgebill					x		
Cinclosoma castaneothorax	Chestnut-breasted Quail-thrush						x	
NEOSITTIDAE								
Daphoenositta chrysoptera	Varied Sittella						x	
PACHYCEPHALIDAE								
Oreoica gutturalis subsp. *pallescens*	Crested Bellbird (Northern spp.)					x	x	x
Oreoica gutturalis subsp. *gutturalis*	Crested Bellbird (Southern spp.)			P4				
Pachycephala rufiventris	Rufous Whistler					x	x	x
Colluricincla harmonica	Grey Shrike-thrush					x	x	
DICRURIDAE								
Grallina cyanoleuca	Magpie-Lark					x	x	x
Rhipidura fuliginosa	Grey Fantail						x	
Rhipidura leucophrys	Willie Wagtail					x	x	x
CAMPEPHAGIDAE								
Coracina novaehollandiae	Black-faced Cuckoo-shrike					x	x	x
Coracina maxima	Ground Cuckoo-shrike						x	
Lalage tricolor	White-winged Triller					x	x	x
ARTAMIDAE								
Artamus personatus	Masked Woodswallow				x	x	x	x
Artamus cinereus	Black-faced Woodswallow					x	x	x
Artamus minor	Little Woodswallow					x	x	
Cracticus torquatus	Grey Butcherbird					x	x	x
Cracticus nigrogularis	Pied Butcherbird					x	x	x
Gymnorhina tibicen	Australian Magpie					x	x	
CORVIDAE								
Corvus bennetti	Little Crow					x	x	
Corvus orru	Torresian Crow				x	x	x	x
PTILONORHYNCHIDAE								
Chlamydera guttata	Western Bowerbird					x	x	
ALAUIDAE								
Mirafra javanica	Singing Bushlark					x	x	x
MOTACILLIDAE								

APPENDIX B

FAUNA SPECIES PREVIOUSLY RECORDED IN THE STUDY AREA AND WITHIN THE WIDER SURROUNDS

Appendix B3 - Bird species

BIRDS		**Conservation Codes**						
Scientific Name	**Common Name**	**EPBC**	**WC**	**DEC**	**A**	**B**	**C**	**D**
Anthus novaeseelandiae	Richard's Pipit					x	x	x
PASSERIDAE								
Taeniopygia guttata	Zebra Finch					x	x	x
Neochmia ruficauda clarescens	Star Finch			P4	x		x	
Emblema pictum	Painted Finch					x	x	
DICAEIDAE								
Dicaeum hirundinaceum	Mistletoebird					x	x	
HIRUNDINIDAE								
Cheramoeca leucosternus	White-backed Swallow						x	x
Hirundo nigricans	Tree Martin					x	x	
Hirundo ariel	Fairy Martin					x	x	
Hirundo neoxena	Welcome Swallow					x		
SYLVIIDAE								
Eremiornis carteri	Spinifex Bird						x	
Acrocephalus australis	Clamorous Reed Warbler					x	x	
Cincloramphus mathewsi	Rufous Songlark					x	x	x
Cincloramphus cruralis	Brown Songlark					x	x	x

[X] fauna species recorded from the project area.
[*] denotes introduced species.

APPENDIX B

FAUNA SPECIES PREVIOUSLY RECORDED IN THE STUDY AREA AND WITHIN THE WIDER SURROUNDS

Appendix B4 - Mammal species

Key: EPBC = Environmental Protection and Biodiversity Conservation Act 1999, WC = Wildlife Conservation Act 1950, DEC = Department of Conservation Priority Code, A = Listed in Naturemap, B = Listed by Birds Australia, C = Previous fauna surveys records (<50km), D = Current Survey

Note: For Definitions of Conservation Codes see Appendix A.

MAMMALS		Conservation Codes						
Scientific Name	**Common Name**	**EPBC**	**WC**	**DEC**	**A**	**B**	**C**	**D**
TACHYGLOSSIDAE								
Tachyglossus aculeatus	Short-beaked Echidna						x	
DASYURIDAE								
Dasycercus blythi	Brush-tailed Mulgara			P4			x	
Dasykaluta rosamondae	Little Red Kaluta						x	
Dasyurus hallucatus	Northern Quoll	EN	S1				x	
Ningaui timealeyi	Pilbara Ningaui						x	
Planigale maculata	Common Planigale						x	
Planigale sp.	Planigale						x	x
Sminthopsis longicaudata	Long-tailed Dunnart			P3			x	
Sminthopsis macroura	Stripe-faced Dunnart				x		x	x
Sminthopsis youngsoni	Lesser Hairy-footed Dunnart				x		x	
THYLACOMYIDAE								
Macrotis lagotis	Bilby, Dalgyte	VU	S1					
MACROPODIDAE								
Macropus robustus subsp. *erubescens*	Euro						x	
Macropus rufus	Red Kangaroo				x		x	x
Petrogale rothschildi	Rothschild`s Rock-wallaby				x		x	
EMBALLONURIDAE								
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat						x	x
Taphozous georgianus	Common Sheath-tail Bat						x	
Taphozous hilli	Hill's Sheathtail-bat							
MEGADERMATIDAE								
Macroderma gigas	Ghost Bat			P4			x	
HIPPOSIDERIDAE								
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	VU	S1					
VESPERTILIONIDAE								
Chalinolobus gouldii	Gould's Wattled Bat				x		x	x
Nyctophilus bifax daedalus	Pallid Long-eared Bat						x	
Nyctophilus geoffroyi	Lesser Long-eared Bat						x	x
Scotorepens greyii	Little Broad-nosed Bat				x		x	x
Vespadelus finlaysoni	Finlayson's Cave Bat						x	x
MOLOSSIDAE								
Chaerephon jobensis	Northern Freetail-bat						x	
Mormopterus beccarii	Beccari's Freetail-bat						x	x
MURIDAE								
Leggadina lakedownensis	Lakeland Downs Mouse			P4	x		x	
**Mus musculus*	House Mouse				x		x	x
Notomys alexis	Spinifex Hopping-mouse						x	
Pseudomys chapmani	Western Pebble-mound Mouse			P4	x		x	
Pseudomys desertor	Desert Mouse				x		x	
Pseudomys hermannsburgensis	Sandy Inland Mouse						x	
Zyzomys argurus	Common Rock-rat						x	
LEPORIDAE								
**Oryctolagus cuniculus*	European Rabbit						x	
CANIDAE								
Canis lupus subsp. *dingo*	Dingo							x
**Vulpes vulpes*	Fox						x	
FELIDAE								
**Felis catus*	Feral Cat						x	x
EQUIDAE								
**Equus asinus*	Donkey						x	
**Equus caballus*	Horse						x	x
CAMELIDAE								
**Camelus dromedarius*	Camel						x	x
BOVIDAE								
**Bos taurus*	Cow						x	x

[X] fauna species recorded from the project area.
[*] denotes introduced species.

APPENDIX C
TRAPPING PROGRAM

ROY HILL BOREFIELD VERTEBRATE FAUNA ASSESSMENT

APPENDIX C

TRAPPING PROGRAM

Appendix C1 – Trap Site Locations

Trap Number	#GPS Coordinates	
	Easting	Northing
S1.01	796088	7475290
S1.02	796119	7475282
S1.03	796160	7475265
S1.04	796185	7475253
S1.05	796221	7475236
S1.06	796251	7475197
S1.07	796276	7475183
S1.08	796300	7475153
S1.09	796328	7475136
S1.10	796381	7475111
S2.01	792888	7472303
S2.02	792912	7472295
S2.03	792945	7472274
S2.04	792973	7472258
S2.05	793003	7472252
S2.06	793056	7472237
S2.07	793078	7472231
S2.08	793112	7472226
S2.09	793136	7472222
S2.10	793169	7472212
S3.01	799007	7466290
S3.02	799032	7466273
S3.03	799058	7466261
S3.04	799076	7466250
S3.05	799107	7466225
S3.06	799135	7466215
S3.07	799173	7466189
S3.08	799218	7466168
S3.09	799247	7466152
S3.10	799283	7466137
S4.01	799049	7461336
S4.02	799071	7461334
S4.03	799093	7461330
S4.04	799129	7461329
S4.06	799187	7461315
S4.05	799156	7461318
S4.07	799222	7461324
S4.08	799264	7461315

Trap Number	#GPS Coordinates	
	Easting	Northing
S4.09	799300	7461315
S4.10	799327	7461309
S5.01	791776	7466064
S5.02	791789	7466012
S5.03	791817	7465984
S5.04	791873	7465944
S5.05	791937	7465900
S5.06	791997	7465890
S5.07	792029	7465882
S5.08	792064	7465888
S5.09	792107	7465898
S5.10	792168	7465883
S6.01	791728	7461530
S6.02	791690	7461540
S6.03	791661	7461557
S6.04	791640	7461579
S6.05	791598	7461613
S6.06	791561	7461658
S6.07	791534	7461668
S6.08	791495	7461687
S6.09	791468	7461714
S6.10	791430	7461716

Australian Geocentric 1994 (GDA94) Zone 50K

Appendix C2 – Major Habitat Types and Vegetation Descriptions of Trap Sites

Site Number	Habitat Type	Vegetation Description
S1	Alluvial Plain	
		A low open mulga woodland (*Acacia aneura*) over sparse cover of annual herbs and grasses
S2	Alluvial Plain	
		A low moderately dense mulga woodland (*Acacia aneura*) over sparse cover of annual herbs and grasses

Site Number	Habitat Type	Vegetation Description
S3	Alluvial Plain	
		A low very open mulga woodland (*Acacia aneura*) over sparse cover of annual herbs and grasses
S4	Alluvial Plain	
		A moderately dense low mulga woodland (*Acacia aneura*) over sparse cover of annual herbs and grasses
S5	Alluvial Plain	
		A low open mulga woodland (*Acacia aneura*) over sparse cover

Site Number	Habitat Type	Vegetation Description
		of annual herbs and grasses
S6	Alluvial Plain	
		A low open mulga woodland (*Acacia aneura*) over sparse cover of annual herbs and grasses

Appendix C3 – Traps and Number of Replicates Used at Each Site

Site Number	# Cage Traps	# Elliott Traps	# Funnel Traps	# Bucket Traps	Total
S1	2	10	20	10	**42**
S2	2	10	20	10	**42**
S3	2	10	20	10	**42**
S4	2	10	20	10	**42**
S5	2	10	20	10	**42**
S6	2	10	20	10	**42**
TOTAL	**12**	**60**	**120**	**60**	**252**

Appendix C4 – Systematic Trapping Program

Site Number	# trap-nights for Cage Traps	# trap-nights for Elliott Traps	# trap-nights for Funnel Traps	# trap-nights for Bucket Traps	Total # nights
S1	12	60	120	60	**252**
S2	12	60	120	60	**252**
S3	12	60	120	60	**252**
S4	12	60	120	60	**252**
S5	14	70	140	70	**294**
S6	14	70	140	70	**294**
TOTAL	**76**	**380**	**760**	**380**	**1596**

APPENDIX D

DIURNAL AND NOCTURNAL CENSUS

ROY HILL BOREFIELD VERTEBRATE FAUNA ASSESSMENT

APPENDIX D

DIURNAL AND NOCTURNAL CENSUS

Appendix D1 – Details of Diurnal Census

Date	Location	Duration
27 July 2009	Kel's Bore	2 hrs
	Engine Bore	0.5 hr
	8 Mile Bore	3 hrs
28 July 2009	Kel's Bore	2 hrs
	Roy Hill Woolsheds	5 hrs
29 July 2009	Roy Hill Woolsheds	2 hrs
	Eastern Road	2.5 hrs
TOTAL		**17 hrs**

Appendix D2 – Details of Nocturnal Census

Date	Location	Duration
27 July 2009	Eastern Road	6 hrs
28 July 2009	Eastern and Western Roads	7.5 hrs
TOTAL		**13.5 hrs**

APPENDIX E
ORNITHOLOGICAL CENSUS

ROY HILL BOREFIELD VERTEBRATE FAUNA ASSESSMENT

APPENDIX E

ORNITHOLOGICAL CENSUS

Date	#Easting	#Northing	Duration
26 July 2009	797521	7477061	0.5 hr
	794545	7473925	1 hr
	793951	7474349	1 hr
	798517	7466353	0.5 hr
	799136	7457564	1 hr
27 July 2009	792697	7471082	1 hr
	792077	7457373	1 hr
	791662	7458307	1.5 hrs
	791557	7463209	0.5 hr
	791557	7463209	1 hr
28 July 2009	793862	7472998	1 hr
	794484	7472095	2 hrs
29 July 2009	791795	7464582	2.5 hrs
	791662	7458307	1 hr
	800217	7475872	0.5 hr
	791557	7463209	0.5 hr
	796790	7475872	2 hrs
	791662	7458307	1 hr
	791557	7463209	0.5 hr
30 July 2009	792502	7462878	0.5 hr
	799032	7463027	1 hr
	799312	7461134	1 hr
	794603	7463626	0.5 hr
	796735	7469411	2 hrs
TOTAL			**25 hrs**

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

APPENDIX F
BAT RECORDINGS

ROY HILL BOREFIELD VERTEBRATE FAUNA ASSESSMENT

APPENDIX F

BAT RECORDINGS

Appendix F – AnaBat Recording Details and Locations

Date	Unit	#GPS Coordinates		Nights	Habitat
		Easting	Northing		
24 July 2009	SD1 Unit	800117	7481703	6	Water Bore
27 July 2009	Anabat II	792697	7471082	1	Water Bore
27 July 2009	Anabat II	791557	7463209	1	Water Bore

#Australian Geocentric 1994 (GDA94) Zone 50K

APPENDIX G

CONSERVATION SIGNIFICANT FAUNA SPECIES PREVIOUSLY RECORDED IN THE PROJECT AREA AND WITHIN THE WIDER SURROUNDS

ROY HILL BOREFIELD VERTEBRATE FAUNA ASSESSMENT

APPENDIX G

CONSERVATION SIGNIFICANT FAUNA SPECIES PREVIOUSLY RECORDED IN THE STUDY AREA AND WITHIN THE WIDER SURROUNDS

Conservation Significant Species	Conservation Status	Distribution and Ecology	Discussion of Habitat Appropriateness/ Likelihood of Occurrence	Potentially Occurring in the Project Area
REPTILES				
Ramphotyphlops ganei	P1	There are few records of this species in the Pilbara, making it one of the rarest reptiles for the region, and little is known of it's habitat requirements. Blind snakes are typically very hard to detect during biological surveys, yet more common blind snakes such as *Ramphotyphlops grypus* are typically recorded at least once per trapping survey. It appears that *Ramphotyphlops ganei* occurs in rocky or stony soils (Wilson & Swan 2008) which suggests it should occur broadly across the region.	The lack of suitable habitat suggests this species may not occur within the project area.	Unlikely
Pilbara Olive Python	VU, S1	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 present in the project area. Pearson (2003) has reported that Pilbara Olive Pythons are widespread across the Pilbara with many significant populations remaining.	The lack of suitable habitat suggests this species may not occur within the project area. However there is the extreme low chance some individuals may pass thought the area as part of their normal migration patterns.	Unlikely
BIRDS				
Cattle Egret	Mi	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).	This species may be found residing and or foraging in the project area when surface water is present.	Likely
Eastern Great Egret	Mi	The Eastern 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 may be found residing and or foraging in the project area when surface water is present.	Likely

APPENDIX G

CONSERVATION SIGNIFICANT FAUNA SPECIES PREVIOUSLY RECORDED IN THE STUDY AREA AND WITHIN THE WIDER SURROUNDS

Conservation Significant Species	Conservation Status	Distribution and Ecology	Discussion of Habitat Appropriateness/ Likelihood of Occurrence	Potentially Occurring in the Project Area
Grey Falcon	P4	The Grey Falcon is generally regarded as a rare bird in Australia, although it occurs on the Fortescue River and has been recorded at Packsaddle Range. Grey Falcons commonly move north during winter, although their range may become extended when conditions are optimal because of increases in local abundance of prey (Johnstone & Storr 1998). In addition, the birds may be nomadic, appearing in areas as drought refugees when conditions are poor. Grey Falcons do not build their own nests when breeding, and therefore are less prone to site fidelity than their conspecifics, although they may remain faithful to a home range for several years.	This species could be found anywhere within the project area foraging for food. A lack of suitable nesting sites suggests this species will only utilise the project area as part of a larger home range.	Likely
Peregrine Falcon	S4	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 & Storr 1998).	This species may use the project area as part of a larger foraging area. No suitable nesting sites were recorded in the project area suggesting this species will only be present when hunting.	Likely
Australian Bustard	P4	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 2004). 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 especially in the south-west (Johnstone & Storr 1998).	Three individuals were recorded within the confines of the current project areas boundaries.	Recorded
Wood Sandpiper	Mi	The Wood 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 & Storr 1998). 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 & Storr 1998).	This species may be found residing and or foraging in the project area when surface water is present.	Likely

APPENDIX G

CONSERVATION SIGNIFICANT FAUNA SPECIES PREVIOUSLY RECORDED IN THE STUDY AREA AND WITHIN THE WIDER SURROUNDS

Conservation Significant Species	Conservation Status	Distribution and Ecology	Discussion of Habitat Appropriateness/ Likelihood of Occurrence	Potentially Occurring in the Project Area
Bush Stone-curlew	P4	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 2004). The species requires permanent water to be a resident species. This taxon may utilise the area for foraging and reside in nearby permanent water bodies. Bush Stone-curlews are locally rare because of predation by foxes – the main concern for their regional decline (Johnstone & Storr 1998).	Given the abundance of suitable habitat for this species (Mulga shrubland / woodlands) it is likely this species may be present.	Likely
Oriental Plover	Mi	The Oriental Plover occurs in the Kimberley and in the north-eastern interior at Lake Gregory and the north-west coastal plains (Johnstone & Storr 1998). It is found on sparsely vegetated plains including samphire (in spinifex plains particularly after fire) as well as beaches and tidal flats. It feeds on insects (Johnstone & Storr 1998).	The site consists of Mulga woodlands and recent evidence suggests this species prefers dry open plains.	Unlikely
Night Parrot	EN, S1	The Night Parrot 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 & Storr 1998).	This highly cryptic bird is extremely scarce and little is known of its biology. It is highly unlikely this species may be found within the project area despite a possible record made near the project area at Cloudbreak in 2005.	Unlikely
Fork-tailed Swift	Mi	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 & Storr 1998).	This species is often recorded high in the airspace and therefore independent of habitat within the project area.	Unlikely
Rainbow Bee-eater	Mi	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).	Some individuals may be recorded moving through the project area as part of their normal migration patterns, or forage in and around bores.	Likely

APPENDIX G

CONSERVATION SIGNIFICANT FAUNA SPECIES PREVIOUSLY RECORDED IN THE STUDY AREA AND WITHIN THE WIDER SURROUNDS

Conservation Significant Species	Conservation Status	Distribution and Ecology	Discussion of Habitat Appropriateness/ Likelihood of Occurrence	Potentially Occurring in the Project Area
Crested Bellbird (Southern spp.)	P4	The Southern subspecies of the Crested Bellbird lives in the shrub layer of eucalypt woodlands, mallee and *Acacia* shrublands of south-west Western Australia. This species has declined due to land clearing, and is particularly susceptible to habitat fragmentation. It feeds mainly on insects as well as some grass seeds (Johnstone & Storr 1998).	This species is usually distributed within the mallee woodlands of the south-west. It is likely this record was erroneously made given the similarity to the northern subspecies.	Unlikely
Star Finch	P4	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 1998). 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.	In the Pilbara this species occurs in Riverine habitat, and is most common on large drainage lines such as the Fortescue River. Given lack of riverine habitat it is unlikely to occur within the confines of the current project area.	Unlikely

APPENDIX G

CONSERVATION SIGNIFICANT FAUNA SPECIES PREVIOUSLY RECORDED IN THE STUDY AREA AND WITHIN THE WIDER SURROUNDS

Conservation Significant Species	Conservation Status	Distribution and Ecology	Discussion of Habitat Appropriateness/ Likelihood of Occurrence	Potentially Occurring in the Project Area
MAMMALS				
Brush-tailed Mulgara	P4	The Mulgara was historically widely distributed in inland arid-zone sand plains and dunes. This species has a broad distribution throughout sandy arid areas of WA and Central Australia, where it inhabits hummock grass plains, sandy ridges and Mulga shrublands on loamy sand (van Dyck & Strahan 2008). Mulgara burrows are distinctive, and usually have one large hole with several side tunnels and alternative entrances, or pop-holes (van Dyck & Strahan 2008, Menkhorst & Knight 2004).	This species may be recorded residing and or foraging within Mulga shrublands and woodlands.	Likely
Northern Quoll	EN, S1	The Northern Quoll (Dasyurus hallucatus) occurs mainly in areas of open eucalypt woodland within 200 km of the coast, although it has been recorded in a range of vegetation types (van Dyck & Strahan 2008). The Northern Quoll favours rocky areas, taking refuge in rock crevices, and utilises gullies and drainage lines (van Dyck & Strahan 2008). The Northern Quoll may be locally common, but its former range has retracted considerably (van Dyck & Strahan 2008).	Given the lack of suitable habitat this species is unlikely to be found within the confines of the current project area	Unlikely
Long-tailed Dunnart	P3	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.	The lack of suitable habitat suggests this species may not occur within the project area.	Unlikely
Bilby	VU, S1	The Bilby 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 Bilby is believed to be locally extinct in the Pilbara it is unlikely to occur within the project area.	Unlikely

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CONSERVATION SIGNIFICANT FAUNA SPECIES PREVIOUSLY RECORDED IN THE STUDY AREA AND WITHIN THE WIDER SURROUNDS

Conservation Significant Species	Conservation Status	Distribution and Ecology	Discussion of Habitat Appropriateness/ Likelihood of Occurrence	Potentially Occurring in the Project Area
Ghost Bat	P4	The Ghost Bat is listed as a DEC Priority 4. The Ghost Bat is mainly distributed across northern Australia, and roosts in shallow caves along cliff lines, under boulder piles, in deep limestone caves and in disused mine shafts (Churchill 1998). They roost individually or in colonies of up to 1500 individuals (Churchill 1998). They occur in a range of habitats from Spinifex grasslands to tropical rainforest, and their distribution is influenced by the availability of roosting sites (Churchill 1998). Outside of the Top End of the Northern Territory they occur in low numbers and are extremely scattered (Churchill 1998). The Ghost Bat is Australia's only carnivorous bat, feeding on large insects, fogs, lizards, birds small mammals and other bats (van Dyck & Strahan 2008). This species appears to be in decline, and is sensitive to disturbance (van Dyck & Strahan 2008).	The lack of suitable habitats and roosting locations suggests this species is unlikely going to be found in the project area.	Unlikely
Pilbara Leaf-nosed Bat	VU, S1	The Pilbara Leaf-nosed Bat is the Pilbara population of the Orange leaf-nosed Bat. It is probably a sub-species, but is yet to be formally reclassified (van Dyck & Strahan 2008). Pilbara Leaf-nosed Bats require deep caves or disused mine shafts in which to roost (Strahan 2008), at least in the dry season. These bats have been recorded in the Pilbara, where suitable roosting niches are available. It is a cave-roosting species, roosting in colonies from 20 to several thousand individuals (van Dyck and Strahan 2008). In the tropical dry season (winter) they require deep caves or mine-shafts that are warm and very humid (96-100% relative humidity) (van Dyck & Strahan 2008, Churchill 1998). During the tropical wet season (summer), they disperse from caves and can probably roost in tree hollows (van Dyck & Strahan 2008, Churchill 1998).	The lack of suitable habitats and roosting locations suggests this species is unlikely going to be found in the project area.	Unlikely
Lakeland Downs Mouse	P4	The Lakeland Downs mouse occurs in a range of habitat types on seasonally inundated sandy-clay soils (van Dyck & Strahan 2008). In the Pilbara it occurs on stony hummock grassland (Menkhorst & Knight 2004). It is generally rare, with scattered populations, and very little is known of its biology (van Dyck & Strahan 2008).	This species may be recorded residing and or foraging within Mulga shrublands and woodlands of the project area.	Likely

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Conservation Significant Species	Conservation Status	Distribution and Ecology	Discussion of Habitat Appropriateness/ Likelihood of Occurrence	Potentially Occurring in the Project Area
Western Pebble-mound Mouse	P4	The Western Pebble-mound Mouse is restricted to the Pilbara, where it is recognised 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.	The lack of suitable habitat suggests this species may not occur within the project area.	Unlikely