BHP Western Australian Iron Ore

East Jimblebar and Caramulla Targeted Greater Bilby Survey

June 2021

Executive summary

BHP Western Australia Iron Ore (BHP WAIO) have commissioned GHD Pty Ltd to undertake a targeted Greater Bilby (Bilby) (*Macrotis lagotis*) survey of the East Jimblebar and Caramulla area. The survey findings will be used to inform future environmental approvals across the area.

This report is subject to, and must be read in conjunction with, the limitations, assumptions and qualifications contained throughout the Report.

A targeted on-ground survey for Bilby was conducted from the 15 - 20 September 2020 by Principal Zoologist Glen Gaikhorst, and Senior Zoologist Robert Browne-Cooper. Sandplain, Hillcrest/ Hillslope, Mulga Woodland and Major Water course margin habitat occurs within the survey area and wider region is considered as potential habitat for a population of the species.

There are no known Bilby records within the survey area and only one Bilby records within the government database search area (i.e 40 km buffer of survey area). The most recent record was an old Bilby burrow approximately 5.6 km east of the survey area. This burrow was first recorded in 2018 (Biologic 2018), re-assessed in 2019 (GHD 2019) and again for this project with no change (no Bilby activity recorded) to the status of the burrow. All other Bilby records are greater than 24 years old and general in location with no confirmation of occurrence.

The Bilby habitat and targeted survey was undertaken primarily using a 2 ha plot method (Southgate *et al.* 2018). The 2 ha method is an evidence-based assessment which records digs, burrows, scats and prints where observed. Evidence of other fauna were also recorded to establish confidence in the results, but was not the main focus of this survey.

Forty-seven Bilby plots were searched covering approximately 94 ha. None of these plots recorded any evidence of Bilby activity. Tracks and other signs from a range of small fauna were detected within a number of search plots, indicating that had Bilby tracks or other signs been present, these would have also been detected.

Seven habitat types were recorded within the survey area and included Sandplain, Stony plain, Mulga Woodland, Hillcrest/hillslope, Clay Pan, Major Drainage Line and Minor Drainage Line. Of these habitats, Sandplain is most suitable to support a population of the Bilby and comprises 967 ha of the survey area. This habitat has substrate suitable for burrowing by the Bilby as well as plant groups which the Bilby is typically associated with. The plant species identified included *Acacia colei, A. stellaticeps, A. melleodora* and *Senna notabilis* and all harbour grub invertebrate species that the Bilby predate on.

Similar Sandplain habitat lies adjacent north and east of this area and is suitable for Bilby, however, due to existing disturbances in the region and impacts by grazing and feral species, the survey area is unlikely to support a population of Bilby. Mulga Woodland, Minor and Major Drainage Lines may also provide habitat for the species, however due to the grazing pressures in the region these areas are highly disturbed and any Bilby use would be likely irregular and opportunistic.

The lack of recent records and signs of the species within the survey area makes potential occurrence unlikely despite suitable habitat being present. Suitable extensive habitat is present outside of the survey area and consists mainly of sandplain. Bilby maybe present in the sandplain habitat in these areas.

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1. Introduction

1.1 Background and purpose of this report

BHP Western Australian Iron Ore (BHP WAIO) commissioned GHD Pty Ltd (GHD) to undertake a targeted Greater Bilby (Bilby) (*Macrotis lagotis*) survey of the East Jimblebar and Caramulla area (hereafter referred to as the survey area). This report details the findings of the September 2020 targeted Bilby survey.

This targeted Bilby assessment will be used to inform future environmental approvals across the area and inform the Matters of National Environmental Significance (MNES) monitoring programs conducted as a commitment under BHP WAIO's Commonwealth Strategic Approval. This survey report documents the findings for the survey area, rather than assess a specific development proposed by BHP WAIO.

1.2 Scope of works

The scope of works was to:

- Conduct a targeted Bilby survey that aligns with the Bilby Survey Guidelines (DBCA 2017a) and employs search plot analysis to assess Bilby occupancy and detectability. This analysis is based on the method developed by Richard Southgate *et al*. 2018 (Section 4.5)
- Undertake a habitat assessment and identify any potential habitat for Bilby use
- Produce a technical report (this document) detailing the method and findings of the survey
- Submit associated spatial data in accordance with BHP WAIO guidance documents and the Index of Biodiversity Surveys for Assessment (IBSA) requirements.

1.3 Survey area

The survey area is located approximately 45 km from Newman and 5 km directly east of the Jimblebar BHP WAIO mining operation covering an area of approximately 8,839 ha (Figure 1). The survey area encompasses active/ non-active Geoscience tenure, off-tenure and active mine areas.

For this report, the database search area includes the survey area and an additional 40 km radius buffer around the centre point of the survey area (23°21'53"S, 120°14'23"E). The database search area defines the limits of the desktop assessment as described in Section 4.4.

1.4 Limitations and assumptions

This report has been prepared by GHD for BHP WAIO and may only be used and relied on by BHP WAIO for the purpose agreed between GHD and the BHP WAIO as set out section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than BHP WAIO arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

GHD has prepared this report on the basis of information provided by BHP WAIO and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability

in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Site conditions may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

2. Ecology of the Bilby

2.1 Taxonomy and conservation status

The Bilby is the sole remaining representative of the sub-family *Thylacomyinae* in the Bandicoot family and one of few medium sized terrestrial mammals remaining on mainland Australia. Many species in this 'critical weight range' have become extinct since European settlement of Australia. The declines have been attributed to causal factors including increased grazing pressure, inappropriate fire regimes, competition with European rabbits (*Oryctolagos cuniculus*) and predation by introduced carnivores such as foxes (*Vulpes vulpes*), cats (*Felis catus*) and wild dogs (*Canis familiaris* subsp. *familiaris*) (Pavey 2006).

The Bilby is given "threatened" status under State and Commonwealth legislation. In Western Australia, the Bilby is listed as 'Vulnerable' under Western Australia's *Biodiversity Conservation Act 2016* (BC Act). Nationally it is also listed as 'Vulnerable' under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Internationally, this species is listed as Vulnerable on the *IUCN Red List of Threatened Species*.

2.2 Morphology

The Bilby shows sexual dimorphism with adult males reaching between 0.8 kg and 2.5 kg as compared to the smaller females at 0.6 kg to 1.1 kg. The Bilby has a distinctive appearance with long slender hind legs, small front limbs, a long tail, rabbit-like ears and a long pointed snout. The animal has silky grey fur with a proximally black and distally white tail.

2.3 Distribution and habitat

Bilby once occurred across most arid and semi-arid areas of mainland Australia. In Western Australia Bilbies are now largely restricted to the Gibson, Little Sandy and Great Sandy Deserts as well as parts of the Pilbara, Dampierland, Central Kimberley and Ord-Victoria Plains Bioregions.

Populations known from the Pilbara Bioregion have been recorded in the Hamersley Range area, along the Fortescue River and north-east of Shay Gap. Within the Pilbara Bioregion the Bilby mainly occupies sandy areas in dune systems, along drainage systems, sandplain or rocky loam plains or undulating hills habitat. Records of the species in the survey area and in the vicinity of the survey area discussed in Section 5.1.1.

Bilbies are solitary, nocturnal animals. They usually shelter in burrows during the day and intermittently at night for refuge. Burrows can be 3 m deep and some are complex systems with multiple entrances and interconnecting burrows. An individual Bilby may regularly utilize over a dozen burrows within its home range. The species is highly mobile and have been recorded using burrows over 2 km apart on consecutive days. Studies on the home range size of Bilbies range from 1 km^2 to over 3 km^2 (Pavey 2006).

Bilby are a highly mobile species which may be driven by the availability of resources (Strahan 1995), but can also persist in areas of low productivity (Southgate and Carthew 2007, Southgate *et al*. 2007 and Southgate *et al*. 2018).

2.4 Diet

Bilbies are omnivorous and many utilise an array of food resources over the landscape depending on seasonal availability and fire history. Food sources include, but are not limited to, grass, sedge seeds, ants, fungi, termites, beetles, insect larva and spiders. Some plant species are utilised to harvest insect larvae by Bilby and in the Pilbara include *Acacia bivenosa, A. colei, A. dictyophleba,*

A. melleodora, A. stellaticeps, A. trachycarpa, A. trachycarpa – dwarf variant and *Senna notabilis* (Southgate *et al.* 2018). The main insect larval group recorded in these species are from the family Cossidae (Dziminski and Carpenter 2017, Southgate *et al*. 2018) or Miller Moths. The Bilby is recognized as an ecosystem engineer as it often digs for food and this process creates variation in micro-habitat function.

2.5 Breeding

The Bilby can breed throughout the year and like many Australian arid-zone mammals can produce young quickly to take advantage of seasonal conditions and food availability. Bilbies have a polygamous mating strategy where males may mate with multiple females. Bilby gestation is 12 days long and young spend approximately 75 days in their mother's pouch before being left in the maternal burrow and weaned over two weeks (DBCA 2017b). Young generally become independent at three months of age. Female bilbies are sexually mature from five months of age while males reach sexual maturity after eight months of age. Bilbies can breed up to four times per year and one or two young are usually produced per litter (mean 1.94), however they can produce up to three young per litter (DSEWPaC 2013).

3. Environment

3.1 Desktop assessment

3.1.1 Regional biogeography

The survey area is situated in the Eremaean Botanical Province, within the Pilbara Bioregion and the Fortescue Sub-region (PIL2) as described by the Interim Biogeographic Regionalisation of Australia. The Pilbara Bioregion is characterised by vast coastal plains and inland mountain ranges with cliffs and deep gorges. Vegetation is predominantly mulga low woodlands or snappy gum over bunch and hummock grasses. Tenure comprises Aboriginal land, leasehold (for grazing cattle) and conservation reserves. The bioregion provides the majority of Western Australia exports in petroleum, natural gas and iron ore. Major population centres are Karratha, Port Hedland, Newman and Tom Price.

3.1.2 Climate

The survey area is located within the Pilbara region of WA. The climate of this region is arid to tropical with very hot summers and mild winters. Rainfall in the Pilbara is spatially and temporally variable. Rainfall in the eastern Pilbara (containing the survey area) is most influenced by tropical and monsoonal drivers which are predominantly active in the summer and autumn months (December – May) whilst rainfall in the western Pilbara is also influenced by southern mid-latitude drivers such as frontal systems during autumn and winter (March – August) (Sudmeyer 2016).

During summer and early autumn (December – March), average daily temperatures exceed 30°C across the region, with average daily maxima exceeding 35°C from October to March. During the winter months (June – August), average temperatures are around 20°C across the region.

The closest current weather station to the site is in Newman Airport (Station ID: 007176) located approximately 60 km west of the survey area boundary. Climate data from this station indicate:

- Mean maximum temperature ranges from 22.8 °C in July to 39.1 °C in December
- Mean minimum temperature ranges from 6.4 °C in July to 24.9 °C in January
- Mean annual rainfall is 334.9 mm with an average of 38.7 rain days per year (Bureau of Meteorology (BoM) 2020).

Rainfall for the previous 6 month lead up to the survey is presented Table 1 (based on Newman Airport data). The rainfall total for the previous 6 months is 28.4 mm. This is approximately 8.7 percent of the year's long-term mean annual for the Newman area. The 6 month average of 28.4 mm is below average of the months assessed, with the long-term average for the same period being 117.4 mm. When compared to the previous 2 years, 2018 and 2019 mean rainfall for the same period was 68.2 and 13.9 mm respectively. Both 2018 and 2019 were below the annual rainfall for the year and considered drier than normal.

Table 1 Rainfall 6 months prior to the survey month

Date	Rainfall (mm)
August 2020	2.2
July 2020	0
June 2020	1.0
May 2020	7.4
April 2020	17.4
March 2020	0.4

Date	Rainfall (mm)
Total	**28.4**

During the survey the weather was warm to hot. The weather over the survey period is presented in Table 2. There were no rain events in the four weeks prior to or during the survey, which precludes rain having an impact on the ability to detect some Bilby evidence.

Table 2 Weather during survey period (BoM 2020)

Date	Temperature (°C)		Rainfall (mm)
	Minimum	Maximum	
14 Sept. 2020	19.0	35.8	0
15 Sept. 2020	17.3	36.2	0
16 Sept. 2020	20.8	37.4	0.
17 Sept. 2020	18.0	27.3	0
18 Sept. 2020	9.6	29.9	0
19 Sept. 2020	14.7	37.3	0
20 Sept. 2020	25.4	35	0

3.1.3 Land systems, landforms and soils

Three soil types intersect the survey area and comprise the following (Bureau of Regional Sciences 2009):

- BE6: Extensive flat and gently sloping plains, which sometimes have a surface cover of gravels and on which red-brown hardpan frequently outcrops: chief soils are shallow earthy loams (Um5.3), with associated (Gn) soils of units My5O and Mz23 of Sheet 6. As mapped, there are inclusions of units Oc47 and BB9
- Mz25: Plains associated with the Fortescue valley; there is a surface cover of stony gravels close to the ranges and hills: chief soils are acid red earths (Gn2.11) with some neutral red earths (Gn2.12); red-brown hardpan is absent. Associated are areas of calcareous earths (Gc) and loams (Um1) on calcrete (kunkar) and some hard red (Dr) soils around creek lines
- Fa13: Ranges of banded jaspilite and chert along with shales, dolomites, and iron ore formations; some areas of ferruginous duricrust as well as occasional narrow winding valley plains and steeply dissected pediments. This unit is largely associated with the Hamersley and Ophthalmia Ranges. The soils are frequently stony and shallow and there are extensive areas without soil cover: chief soils are shallow stony earthy loams (Um5.51) along with some (Uc5. 11) soils on the steeper slopes. Associated are (Dr2.33 and Dr2.32) soils on the limited areas of dissected pediments, while (Um5.52) and (Uf6.71) soils occur on the valley plains.

The Pilbara region has been surveyed by the Department of Agriculture and Food, Western Australia and others for the purposes of land classification, mapping and resource evaluation. One hundred and two land systems have been described for the region, which are distinguished on the basis of topography, geology, soils and vegetation (Van Vreeswyk 2004). The survey area intersects 10 mapped land systems; details of these are presented in Table 3.

Table 3 Land systems within the survey area

Land system	Description	Land type
Newman	Hills and ranges with spinifex grasslands	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands
Jamindie	Wash plains on hardpan with mulga shrublands	Stony hardpan plains and rises supporting grove mulga shrublands, occasionally with spinifex understorey
Boolgeeda	Stony plains with spinifex grasslands	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands
Sylvania	Stony plains with acacia shrublands	Gritty surfaced plains and low rises on granite supporting acacia-eremophila-cassia shrublands
McKay	Hills and ranges with spinifex grasslands	Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands
Zebra	Wash plains and sandy banks on hardpan, with mulga shrublands and wanderrie grasses or spinifex	Hardpan plains with large linear gravelly sand banks supporting acacia shrublands with soft and hard spinifex
Washplain	Wash plains on hardpan with mulga shrublands	Hardpan plains supporting grove mulga shrublands
River	River plains with grassy woodlands and tussock grasslands	Active flood plains, major rivers and banks supporting grassy eucalypt woodlands, tussock grasslands and soft spinifex grasslands
Cadgie	Wash plains and sandy banks on hardpan, with mulga shrublands and wanderrie grasses or spinifex	Hardpan plains with thin sand cover and sandy banks supporting mulga shrublands with soft and hard spinifex
Divide	Sandplains and occasional dunes with spinifex grasslands	Sandplains and occasional dunes supporting shrubby hard spinifex grasslands

3.1.4 Hydrology

The survey area is intersected by Jimblebar Creek which is classified as a significant stream and Caramulla Creek, a major river (Geographic Data Atlas 2020). Both of these drainage systems have limited scattered waterbodies that are seasonal and depend largely on cyclonic and monsoonal weather events for the presence of surface water flow.

At the time of the survey, no surface water was evident in Caramulla Creek and some surface water ponds were observable in Jimblebar Creek although these are presumed to be from mining dewatering activities (Tanya Carroll *pers. comm*.).

3.1.5 Land use

The survey area comprises East Jimblebar and Caramulla tenement areas. The tenement area is licensed for exploration purposes and is 100% BHP WAIO owned with no joint venture. The survey area lies within four station leases and include Marillana, Ethel Creek, Sylvania and Prairie Downs stations that currently run several thousand head of cattle over the area. Additionally the wider Fortescue sub-region has a long history of mining and pastoral use.

3.1.6 Vegetation

Broad scale (1:1,000,000) pre-European vegetation mapping of the Pilbara region was completed by Beard (1976) at an association level. The mapping indicates there are three vegetation associations present within the survey area including:

- Low tree-steppe: Hummock grassland with scattered bloodwoods & snappy gum, *Triodia* spp., *Corymbia dichromophloia*, *Eucalyptus leucophloia*
- Low woodland, open low woodland or sparse woodland: Mulga, *Acacia aneura* and associated species
- Shrub-steppe: Hummock grassland with scattered shrubs or mallee, *Triodia* spp. *Acacia* spp., *Grevillea* spp. *Eucalyptus* spp.

4. Methodology

4.1 BHP WAIO requirements

BHP WAIO requirements applied to this survey are set out in Guidance for Vertebrate Fauna Surveys in the Pilbara (SPR-IEN-EMS-012 v6). This document outlines BHP WAIO's expectations for survey components including the level of survey, desktop assessment, survey design and intensity, timing, habitat assessment and reporting requirements.

GHD implemented BHP WAIO's Biological survey spatial data requirements (SPR-IEN-EMS-015 v11.0), which outlines the standards and format to applied. These standards enable analysis of survey data and comparison between surveys spatially and temporally.

4.2 Relevant legislation and background information

In WA all native species and communities are protected under the BC Act. Species of high conservation status (conservation significant species) are further protected under Commonwealth EPBC Act. An overview of these key legislation and guidelines, conservation codes and background information relevant to this fauna survey is provided in Appendix B.

For guidance on this project the following guidelines were utilised and include;

Environmental Protection Authority

- *Environmental Protection Authority (EPA) Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment* (EPA 2020)

Department of the Environment and Energy

- *Survey Guidelines for Australia's Threatened Mammals* (Department of the Environment, Water, Heritage and the Arts 2010)

Department of Biodiversity Conservation and Attractions

- *DBCA Guidelines for surveys to detect the presence of bilbies, and assess the importance of habitat in Western Australia* (DBCA 2017a)

Other Guidance

- Verifying Bilby presence and the systematic sampling of wild populations using sign based protocols – with notes on aerial and ground based techniques and asserting absence (Southgate *et al*. 2018).
- Dziminski, M., and Carpenter, F. (2017) The conservation and management of the bilby (Macrotis lagotis) in the Pilbara. Unpublished Progress Report to April 2016 for Department of Parks and Wildlife.
- Bradley, K., Lees, C., Lundie-Jenkins, G., Copley, P., Paltridge, R., Dziminski, M., Southgate, R., Nally, S., and Kemp, L. (2015). 2015 Greater Bilby Conservation Summit and Interim Conservation Plan: an initiative of the Save the Bilby Fund. IUCN SSC Conservation Breeding Specialist Group, Apple Valley, MN.

4.4 Desktop assessment and literature review

Prior to the field survey a desktop assessment was undertaken to collect relevant environmental and ecological information pertaining to the survey area and wider database search area, to assist with survey design. This included a review of:

- Regional biogeography of the database search area
- The DBCA *NatureMap* database for Bilbies previously recorded within the database search area (DBCA 2020) It should be noted that for Bilby the NatureMap records include DBCA's database records as well, therefore by undertaking a *Naturemap* search all Western Australian records of the species are extracted. (section 5.1.1)
- The Department of Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (PMST) to identify Bilby presence and species listed under the EPBC Act potentially occurring within the survey area (DAWE 2021) (Appendix C)
- Existing datasets including previous pre-European vegetation mapping of the survey area (Beard 1975), aerial photography, land system mapping (Van Vreeswyk 2004), and hydrology information to provide background information on the variability of the environment and likely fauna habitats.

The literature review considered two previous studies relevant to the survey area, these being GHD (2019) and Biologic (2018).

No additional reports or data were supplied by BHP WAIO for inclusion.

4.5 Field survey

The targeted Bilby survey was undertaken between 15 - 20 September 2020 by Principal Zoologist Glen Gaikhorst and Senior Zoologist Robert Browne-Cooper.

Glen has over 25 years of experience in the fauna industry with the last 12 years at GHD. He has completed numerous targeted Bilby surveys in accordance with Commonwealth and State guides for government and resource companies. Some of these projects include Broome north residential, Broome Road Industrial Estate, FMG outer harbor and rail development, Broome Motorplex relocation, Boral Turner River mineral extraction, Goldfields Highway Bilby Assessment, Coongan Gorge Realignment Bilby assessment and numerous projects on Bilby for Cape Leveque road project. Glen has been directly involved in co-authoring a recent CSIRO paper in Australian Mammalogy dealing with verifying Bilby presence via systematic field sampling (Southgate *et al.* 2018).

Rob has over 27 years of experience in the fauna industry with the last four year at GHD. Rob has completed numerous Bilby projects in the Broome and Pilbara regions undertaking evidence based assessments and habitat mapping. Some projects assessing Bilby include Water Corporation Broome waste water treatment facility, Broome Orchid Site, East Jimblebar Fauna assessment and Fortescue Bilby Assessment.

4.5.1 Habitat assessment

Habitat assessment primarily focussed on the Bilby 2 ha search plot method (refer to DBCA 2017a, Dziminski and Carpenter 2017 and Southgate *et al*. 2018). The habitat assessments were undertaken at each Bilby plots to quantify the habitat at each plot and increase survey efficiencies. Habitat data recorded in the plot was consistent with BHP WAIO spatial data requirements (SPR-IEN-EMS-012 v6) and is presented in Appendix C. The assessment included:

- Location of broad habitat type within survey area and relative percentage
- Landscape position, i.e. Landforms encompassed by the habitat

- Associated vegetation and dominant structure
- Associated fauna species observed using the habitat
- Ecological processes important to the habitat
- Disturbances (e.g. fire history, weeds, ground disturbance)
- A photograph showing a representative example of each stratified habitat type.

4.5.2 Targeted survey

Forty-seven 2 ha Bilby Plots were traversed covering approximately 94 ha and assessed using the 2 ha plot/transect evidence based method (DBCA 2017a, (Dziminski and Carpenter 2017 and Southgate *et al*. 2018). This was undertaken over a five day period in spring of 2020.

Survey methodology included the following:

- Visitation of previously recorded Bilby burrows and burrowing evidence (where GPS locations were available) within and immediately adjacent to the survey area
- Due to the size of the survey area (8,800 ha) plots were positioned approximately 4 km apart or closer depending on habitats present. Systematic searches within all major habitat types suitable for Bilby based on survey guidelines (DBCA 2017a and Southgate *et al*. 2018) using 2 ha search areas, comprising 47 plots. This comprised of 24 plots within and 23 plots outside of the survey area. Of the 47 plots 14 were re-sampled from GHD (2019). Opportunistic searches within plots were also undertaken to detect Bilby signs (tracks, scats, skeletal remains, diggings, burrows and feeding evidence)
- Each 2 ha plot (typically 100 x 200 m) was ground-truthed by two field personnel from between 25 to 45 minutes. Within the plots, personnel were spaced at 30 m intervals (dependent of vegetation cover). Evidence of fauna presence and activity was recorded and classified into age, type, amount and location
- Data was captured over a series of three electronic data sheets
    1.) Plot information, this describes the plot including location, date, plot number, observers and environmental conditions.
    2.) Plot conditions, this includes dominant plants, ground cover, track-ability, feed plant species, fire and landforms.
    3.) Plot evidence, this includes all fauna species observations made on plot or transect. Once completed these data sheets were compiled into a composite table which is presented in Appendix C
- Analysis of presence/absence data was recorded in the field to provide an assessment of detectability and occupancy. This analysis quantifies the level of confidence in survey effectiveness based on the detection of surrogate fauna and takes into account environmental limitation factors that can effect detectability
- If Bilby scats were observed, they would be collected and stored to aid with abundance assessment if chosen by BHP WAIO
- The method employed allowed for the deployment of up to 10 remote cameras opportunistically where burrows were found to help verify burrow occupancy
- Assessment of Bilby habitat throughout the survey area was completed in accordance with BHP WAIO data standards

- Opportunistic searches during the survey for other conservation significant species, such as Brush-tailed Mulgara (via on-ground visual detection of signs) were completed. Any signs were recorded via GPS and description of evidence found.

4.5.3 Data collection and management

Field data collection for the habitat assessment (section 4.5.1) and targeted survey (section 4.5.2) was undertaken using GPS enabled Samsung tablets using electronic forms in Collector and tailored to BHP WAIO spatial data requirements (SPR-IEN-EMS-015 v 11.0). Data was synced to the Cloud at the conclusion of each field day. Field photographs were stored and where applicable have been provided as part of the Project deliverables. Bilby data was collated into a composite summary with each plots trackability assessed against species recorded as well as environmental conditions. This assessment was collated into a score of trackability and other determining signs (ODS). Trackability is a score out of 4 with 4 meaning detectability was difficult at that plot, this is generally a reflection of high use by non-target species or lack of activity at the time of the survey. ODS is a score out of 14 where by 14 reflects a poor collection of detectable signs. This could be due to environmental conditions such as wind, rain or soil type.

5. Results

5.1.1 Desktop review

The *NatureMap* and PMST databases identified no Bilby records within the survey area and one Bilby records within the database search area. This record is from 2018 (Biologic 2018), which was identified as an old burrow 5.6 km east of the survey area.

Biologic (2018) undertook fauna surveys of the East Jimblebar and Caramulla tenement areas and located the inactive burrow. The inactive burrow was located within a large sandplain that extends north and east of the survey area. The habitat in this area comprised of Triodia hummock grassland with low shrubs of Acacia, Grevillia, Hakea and mixed small shrubs on red sandy soils. Small groves of Mulga Woodland and occasional Corymbia (Bloodwood) trees are scattered throughout on heavier loam soils. The majority of the sandplain in which the burrow was located appeared to have been burnt within the last three to five years. The location of the burrow identified by Biologic (2018) was investigated by GHD (2019), approximately six months after being found. At this time the old burrow had been re-inhabited by a monitor lizard likely *Varanus gouldii* or *Varanus panopties*.

The location of previously identified Bilby burrow is listed in Table 4.

Table 4 Previous Bilby records within the database search area (40 km)

Type	Lat.	Long.	Reference
Old burrow	23°22'11" S	120°22'44' E	(Biologic 2018) (GHD 2019)

* Retrieved from *NatureMap* (DBCA 2007-)

An additional eight Bilby records are >40 km from the survey area centre point but are all 24 years or older (DBCA 2007-). Of the records three are from the same general location of Jiggalong Community with four other general locations of Capricorn Roadhouse, Nullagine Community and Ethel Creek Station. The true location of these records is unknown. Only one location is an actual record and lie 57 km south east of the survey area. Table 5 below shows these records, date lodged and comments attributed (NatureMap (DBCA 2007-).

Table 5 Previous Bilby records 40 to 60 km from the survey area

Type	Date	Lat.	Long.	Comment
Bilby	1981	23°21'50" S	120°46'58' E	2 x animals general location from Jiggalong community but actually captured regionally for a captive breeding program, location unknown
Bilby	1979	23°21'19" S	120°46'50' E	General location from Jiggalong community but actually captured regionally for a captive breeding program, location unknown

Type	Date	Lat.	Long.	Comment
Bilby	1996	23°40'07" S	120°49'52' E	No Data but record is 57 km south east of the survey area
Bilby	1979	23°23'57" S	119°42'57' E	General location Capricorn roadhouse. Caught by Aboriginals and given to roadhouse manager. DBCA database
Bilby	1980	22°54'38" S	120°05'02' E	General location to Nullagine Community, Aboriginals interviewed Bilby known form area but no exact location. DBCA Database
Bilby	1980	22°58'50" S	120°27'55' E	General location of Ethel Creek Station, random sightings of Bilby but nothing confirmed. DBCA database

5.2 Targeted survey results

5.2.1 Habitats

Seven habitat types were recorded in the survey area. These broad habitat types within the survey area include;

- Sandplain
- Stony plain
- Mulga Woodland
- Hillcrest/ hillslope
- Clay Pan
- Major Drainage Line, and
- Minor Drainage Line.

The habitats and significance to the presence of Bilby is presented below in Table 6. Of the seven habitats recorded, historical Bilby records (one old burrow and one confirmed Bilby location) all occur on Sandplain. The Sandplain (which comprises of Triodia Hummock Grassland) from this assessment has the highest likelihood of maintaining Bilby (Table 6) and comprises 967 ha (11%) of the survey area. The Sandplain habitat also extends north and east well beyond the survey area.

The Sandplain habitat also demonstrated a number of plant species that Bilby are known to utilise in the Pilbara (Southgate *et al.* 2018). The plant species identified included *Acacia colei, A. stellaticeps, A. melleodora* and *Senna notabilis* and all harbour grub invertebrate species that the Bilby predate on.

The species is also known to occur along Major Drainage lines and this habitat comprises 632 ha (7%) of the survey area. Within the survey area Mulga Woodland, Minor and Major Drainage Lines may also provide habitat for the species, however due to the grazing pressures in the region these areas are highly disturbed. Therefore, any Bilby use would be likely irregular and opportunistic. A population could persist in the Minor and Major Drainage Lines but only on the river banks; with flood zones and the river bed areas not suitable. All other habitat types are considered unsuitable to support the Bilby. BHP point habitat assessment and Bilby plot search locations are presented in Figure 2, 3 and Appendix C.

Table 6 Habitats present within the survey area

Habitat type	Area (ha)	Condition	Fire evidence	Burrowing suitability	Plant species present potentially utilised	General Bilby suitability	Image
Mulga Woodland	4052 ha	Good, but large areas are degraded via grazing especially those near water courses	Long unburnt	Suitable	None recorded	Suitable for Bilby to potentially reside and feed in however some areas are highly disturbed limiting likely use by Bilby, no favoured plant species recorded. A population could not persist in this habitat; however may use it for foraging and dispersal. Due to the heavier clay soils Bilby would not burrow, therefore, Mulga habitat is not breeding habitat.	

Habitat type	Area (ha)	Condition	Fire evidence	Burrowing suitability	Plant species present potentially utilised	General Bilby suitability	Image
Sandplain	967 ha	Good, but areas are degraded via grazing especially those near water courses	Long unburnt within the survey area a large portion of this habitat is burnt (within 3 years) outside of the survey area	Suitable	Scattered areas of *Acacia colei, A. stellaticeps, A. melleodora* and *Senna notabilis*	Suitable for Bilby to potentially reside and feed in as burrowing potential exists and plants species favoured by Bilby. A population could persist in this habitat	
Hillcrest/ Hillslope	3040 ha	Good, but areas are degraded via grazing especially those near water courses	Long unburnt	Generally unsuitable but patches of sandy soils may provide some digging potential	Scattered *Acacia bivenosa*	Unsuitable as substrate generally too rocky. Any use likely to be occasional and sporadic such as during dispersal. A population could not persist in this habitat; however may utilise the patches of sandy soil for foraging and dispersal only.	

Habitat type	Area (ha)	Condition	Fire evidence	Burrowing suitability	Plant species present potentially utilised	General Bilby suitability	Image
Clay Pan	114 ha	Degraded due to over grazing	Long unburnt	Suitable	none	Unsuitable as seasonally inundated and highly disturbed. Any use likely to be occasional and sporadic such as during dispersal. A population could not persist in this habitat however maybe utilised for foraging and dispersal.	
Major Drainage Line	632 ha	Degraded due to over grazing	Long unburnt	Generally suitable however the habitat has been extensively grazed with various levels of impact	None recorded	Suitable, however some areas are highly disturbed limiting the use by Bilby. A population could persist in this habitat but only on the river banks; with flood zones	

Habitat type	Area (ha)	Condition	Fire evidence	Burrowing suitability	Plant species present potentially utilised	General Bilby suitability	Image
						and river bed not suitable.	
Minor Drainage Lines	84 ha	Degraded due to over grazing	Long unburnt	Generally suitable however the habitat has been extensively grazed with various levels of impact	Scattered *Acacia colei*	Suitable, however some areas are highly disturbed limiting the use by Bilby. A population could persist in this habitat but only on the river banks, flood zones and river bed is not suitable.	
Stony Plain	43 ha	Good, but areas are degraded via grazing especially those near water courses	Long unburnt	Generally unsuitable, other than in sandy patches, due to cap rock restricting burrow construction	Scattered *Acacia bivenosa*	Unsuitable as this area appears to have too much cap rock to allow burrowing by the Bilby. Any use likely to be occasional and sporadic such as during dispersal.	

5.2.2 Assessment of previous records

The old Bilby burrow identified by Biologic (2018) and inspected by GHD (2019) had not changed in status. Approximately two years later, it was determined by the same assessor that a monitor was utilising this same burrow and the monitor had recently dug new holes in the area. No evidence of Bilby was recorded at the burrow location. A 2 ha plot was also undertaken at this location with no Bilby evidence located.

5.2.3 Bilby

Of the 47, 2 ha search plots assessed (Appendix C) no evidence of the Bilby was recorded. The survey area and surrounds are heavily grazed by cattle as part of local pastoral activities. With habitats close to rivers, creeks and water holding areas the most affected. Additionally, camel and donkey were also recorded on most plots adding to the disturbances grazing ungulates cause. The data also showed the presence of feral predators within the survey area mainly dogs and cats. Of the 47 plots surveyed 26 had evidence of cat utilisation.

The Major drainage lines and sandplain to the east and north of the survey area has potentially suitable habitat (large plains of Triodia Hummock Grasslands) for Bilby to utilise. This habitat is in good condition, suitable for burrowing and has vegetation and flora species favoured by Bilby (both for cover and food plant species). Habitats to the south of the survey area become quite rocky with suitable habitat patchy within the local environment. Some areas of the habitats Mulga Woodland and Minor Drainage lines within the survey area are suitable for Bilby however due to existing disturbances in the region and impacts by grazing and feral species, the survey area is unlikely to support a Bilby population. Bilby could utilise the area opportunistically i.e. for dispersal but no evidence of use was recorded.

5.2.4 Data analysis and assessment of detectability and occupancy

The 47 plots were assessed using the method outlined by Southgate *et al.* (2018). The results of the data collected are presented in Appendix C as a composite summary. The method allows for assessment of each plots trackability of Bilby as well as plot other determining signs (ODS).

For plot trackability the mean score was 3.6. This equates to a moderately high degree of difficulty in the detectability of Bilby within the plots. In this case the high mean score was a factor of the ODS (which considers environmental factors impacting detectability) and the lack of visibly active species at the time of the survey. Despite the high trackability score no other signs of Bilby (i.e. burrows or digs) that persist in the environment were recorded. In this case the high trackability score did not reflect the result of the survey. Additionally, a high plot trackability score can be influenced by an area with low productivity (as in vertebrate species) or an area that is experiencing or has recently experienced drought.

The high plot trackability obtained for plots during this project did not appear to impact on the zoologist's ability to locate and identify more common species like rodents, species of skink (*Lerista sp*.), monitor (*Varanus sp*.), quail and bustard. The detection of other species in the plots suggests that despite the difficulties in the local environment, it is likely Bilby evidence would have been detected if present in the form of burrows, dig or tracks.

The ODS for this project ranged from 5.6 to 10.8 and was impacted by recent winds in the area (up to two days previous), current wind and harder soils (clay loams) in some plots. However sandy soils demonstrated a lower ODS due to having less impact on environmental conditions. This is likely due to the sandy soils allowing prints to be more pronounced and visible for longer. Also the increased abundance and diversity of species within this habitat type (Triodia hummock grassland) increases the likelihood of activity and therefore signs of species presence.

Tracks of small fauna (small birds, mammals and reptiles) were detected within a number of search plots indicating that had Bilby tracks been present, these would have also been detected, however due to the wind, searches were difficult and some evidence may have been missed. Bilby digs and burrows are a more permanent feature in the environment (with burrows known to persist for many years post use) therefore the environmental conditions experienced (winds) in the lead up to the survey were considered not enough to impact on these results if these features were present.

5.2.5 Other Conservation Significant Species

One burrow was recorded in the survey area near to Bilby search plot Bil-11. The burrow is likely that of the Brush-tailed Mulgara (*Dasycercus blythi*) due to its size, apron, number of entrances and prints present. The Brust-tailed Mulgara is listed as Priority 4 with the DBCA and is known to persist in the region. This burrow appeared active, had prints, multiple entrances and pop holes. No scats were visible around the burrow entrance however heavy winds had been experienced days previous and may have move scat around or eroded ones present. A location and image is provided in Table 7 and presented on Figure 2.

Table 7 Mulgara burrow location and images

Type	Easting	Northing	images
Mulgara burrow	51 K 214995 E Longitude 120°22’44’ E	7410266 S Latitude 23°22’11” S	 

5.2.6 Survey limitations

EPA Technical Guidance –Terrestrial Fauna Surveys (EPA 2020) states fauna and faunal assemblage survey reports for environmental impact assessment in Western Australia should contain a section describing the limitations of the survey methods used. The limitations and constraints associated with the fauna component of this field survey are discussed in Table 8.

Table 8 Survey limitations

Limitations	Constraints	Impact on survey outcomes
Scope, were target species sampling methods not able to be employed due to constraints i.e. weather conditions?	Minimal	The Bilby was the target species of this survey. The sampling method was able to be employed without constraint as demonstrated in the composite table of data in Appendix C. The plot assessment method used, allows for a quantifiable measure of Bilby detectability based on environmental factors affecting evidence visibility. Wind had the potential effect of reducing the detectability of Bilby, however other species were able to be detected, so any impact would be minimal.
Seasonal environmental conditions	Minimal	Bilby are not affected greatly by environmental conditions. However the detectability of Bilby can be affected by wind. Wind had occurred on the lead up to and during this survey however not enough to have impacted on the results of the survey.
Proportion of fauna identified, recorded and/or collected	Nil	All opportunistic fauna were identified however a general fauna survey was not the objective of this survey.
Proportion of the task achieved and further work which might be needed	Minimal	The survey was successful and achieved in terms of adequate coverage (Bilby search plots). For small survey areas (<1600 ha) 2 to 4 plots per 100 hectares or for larger projects 1 plot per 4 km intervals is recommended (Dziminski and Carpenter 2017). This survey was a considerably larger size (8839 ha) therefore it is recommended to undertake 1 plot per 4 km intervals. Based on this the 24 plots undertaken within the survey area (the remaining 23 were regional and outside of the survey area) were is above the recommended number of plots required (approximately 8) for this size of survey area. Due to the scale of the survey area extent and design of survey, a representative sub-set of potential habitat was searched with a much larger number of plots sampled than required under guideline.

Remoteness and/or access problems	Minimal	Via exploration in the region access and availability of habitat to sample was not a limitation for the survey coverage or results.
Personnel experience	Minimal	The Zoologists involved in the survey both have substantial experience (both over 25 years) having each worked on at least ten target Bilby assessments involving survey method design, field survey, habitat assessment, and data analysis. The lead Zoologist was a contributing author to the search method utilised in this survey (Southgate *et al.* 2018).

6. Summary

Historically Bilby are known from the general region with eight records of the species >40 km from the survey area, although there are no known Bilby records within the survey area and only one Bilby record within the government database search area (40 km buffer of the survey area). The most recent record was an old Bilby burrow approximately 5.6 km east of the survey area. This burrow was first recorded in 2018 (Biologic 2018), re-assessed in 2019 (GHD 2019) and again for this project with no change to the status of the burrow (no Bilby activity recorded). All other Bilby records are greater than 24 years old and general in location (i.e. roadhouse, indigenous communities or pastoral station), with only one being a confirmed location 57 km south east of the survey area.

In total 47 bilby plots were undertaken covering 94 ha with no Bilby evidence recorded during this assessment. Seven fauna habitats were identified (Mulga Woodland, Sandplain, Hillcrest/Hillslope, Clay Pan, Major Drainage Line, Minor Drainage Line and Stony Plain) with Sandplain being suitable to maintain a population of Bilby if present. This habitat is considered suitable to support the Bilby if present, as they exhibit key elements of suitable habitat such as substrate suitable for burrowing, presence of key plant species favoured by Bilby and/or reduced grazing pressures compared to other habitats within the survey area.

Mulga Woodland, Minor and Major Drainage Lines may also provide habitat for the species, however due to the grazing pressures in the region these areas are highly disturbed. Therefore, any Bilby use would be likely irregular and opportunistic. A population could persist in the Minor and Major Drainage Lines but only on the river banks; with flood zones and the river bed areas not suitable. The remaining habitats; Hillcrest/Hillslope, Clay Pan and Stony Plain are considered unsuitable because as the substrate is generally too rocky, however, patches of sandy soils may provide some digging potential. Any use likely to be occasional and sporadic such as during dispersal.

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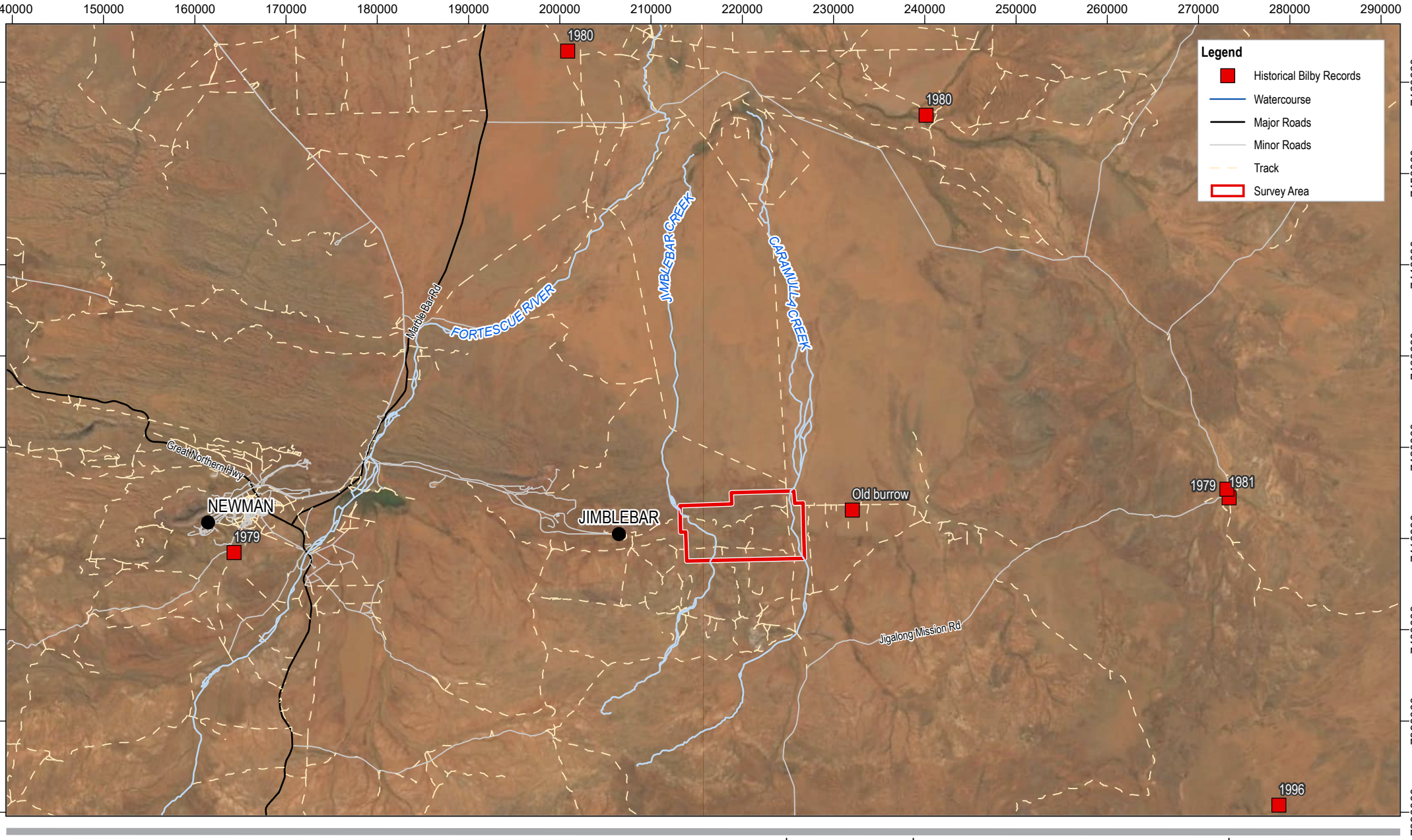
Appendices

Appendix A – Figures



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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 51

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GHD

BHP

JIMBLEBAR BILBY ASSESSMENT

Project No. **12534733**
Revision No. **0**
Date **17/02/2021**

Project Location

FIGURE 1

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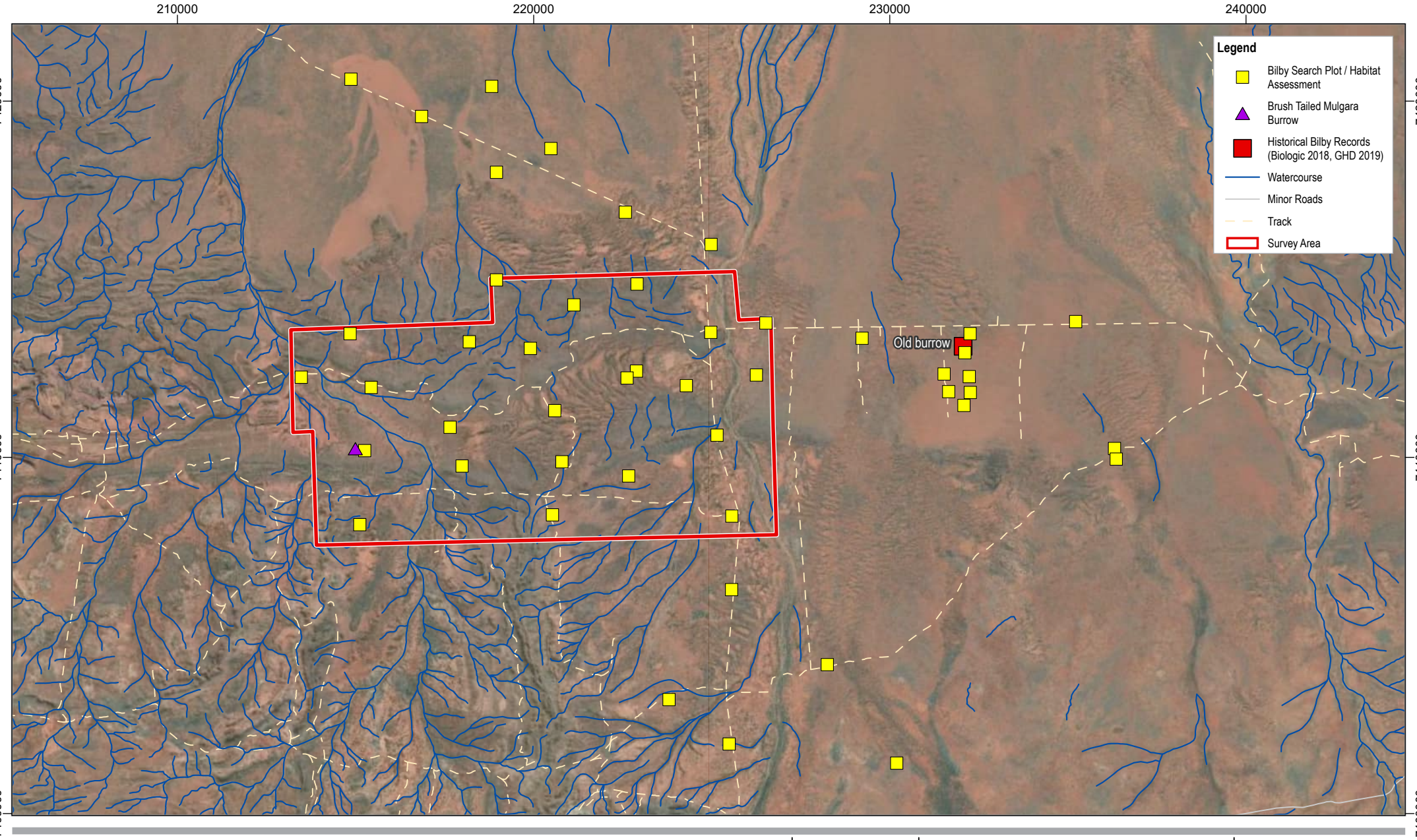

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GHD

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JIMBLEBAR BILBY ASSESSMENT

Project No. **12534733**
Revision No. **0**
Date **2/12/2021**

Methods and Results

FIGURE 2

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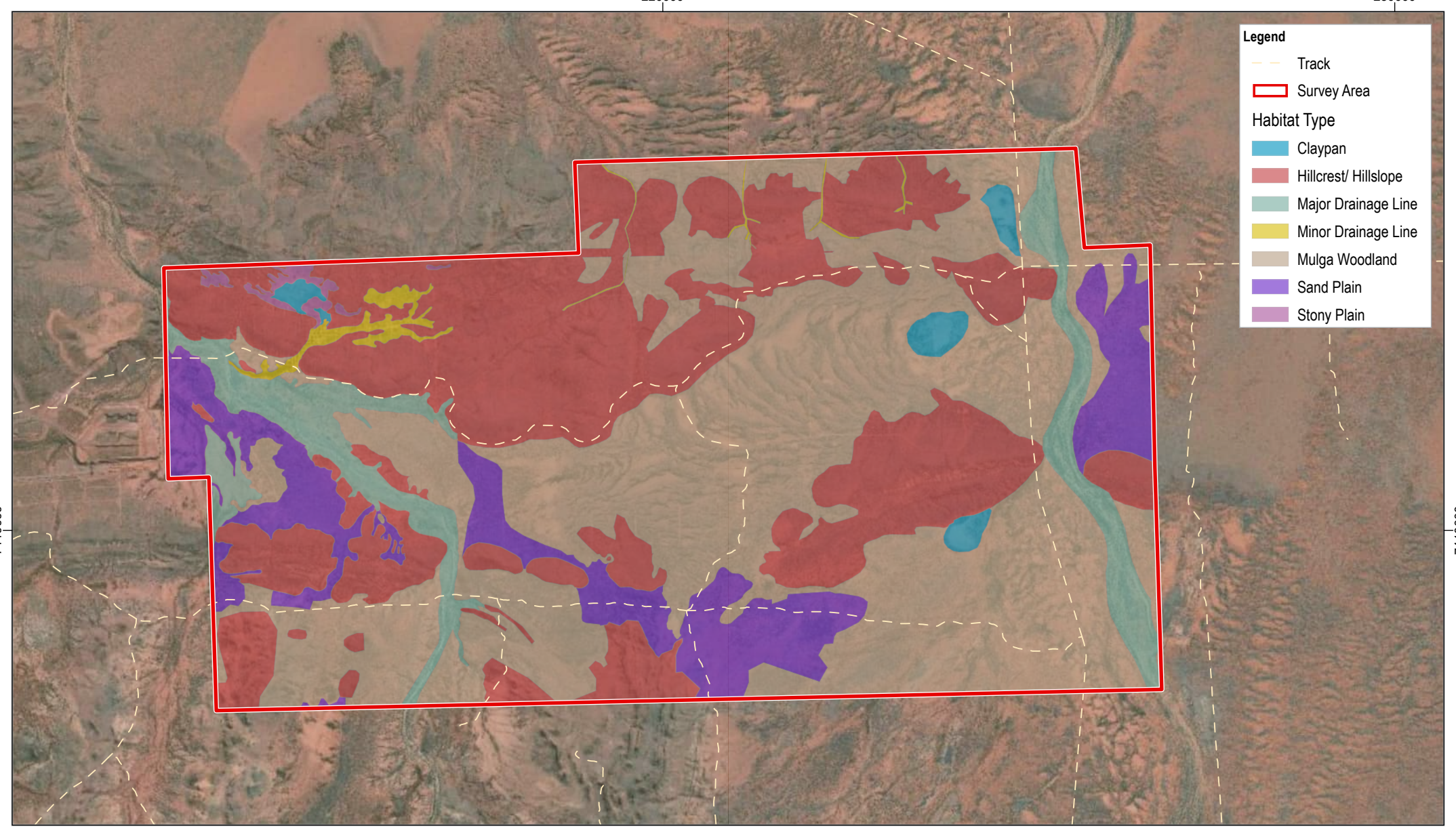

Paper Size ISO A4

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Kilometres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 51

BHP

JIMBLEBAR BILBY ASSESSMENT

Fauna Habitats

Project No. **12534733**
Revision No. **0**
Date **15/02/2021**

FIGURE 3

G:\61\12534733\GIS\Maps\Working\12534733\12534733_SeptReport.aprx
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Data source: Landgate: Roads; GHD: Habitats(2020); World Imagery: Earthstar Geographics. Created by: mmikkonen

Appendix B – Relevant legislation, background information and conservation codes

Relevant legislation to Fauna

Federal *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Federal Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the EPBC Act as Matters of National Environmental Significance (MNES).

The biological aspects listed as MNES include nationally Threatened flora and fauna species, and ecological communities, and Migratory species.

A person must not undertake an action that has, will have, or is likely to have a significant impact (direct or indirect) on MNES, without approval from the Federal Minister for the Environment.

The EPBC Act is administered by the Department of Agriculture, Water and the Environment (DAWE).

State *Environmental Protection Act 1986*

The *Environmental Protection Act 1986* (EP Act) is the primary legislative Act dealing with the protection of the environment in Western Australia. The Act allows the Environmental Protection Authority (EPA), to prevent, control and abate pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing. Part IV of the EP Act is administered by the EPA and makes provisions for the EPA to undertake environmental impact assessment of significant proposals, strategic proposals and land use planning schemes.

State *Biodiversity and Conservation Act 2016*

The *Biodiversity Conservation Act 2016* (BC Act) provides for the conservation and protection of biodiversity and biodiversity components, as well as the promotion of the ecologically sustainable use of biodiversity components in Western Australia. The BC Act replaces both the repealed *Wildlife Conservation Act 1950* (WC Act) and the *Sandalwood Act 1929* (Sandalwood Act), as well as their associated regulations. To attain the objectives of the BC Act, principles of ecological sustainable development have been established:

- Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations
- If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation
- The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations
- The conservation of biodiversity and ecological integrity should be a fundamental consideration indecision-making
- Improved valuation, pricing and incentive mechanisms should be promoted.

The BC Act is administered by the Department of Biodiversity Conservation and Attractions (DBCA).

Fauna Conservation codes

Conservation listed fauna

The Federal conservation level of fauna species and their significance status is assessed under the EPBC Act. The significance levels for fauna used in the EPBC Act align with the International Union for Conservation of Nature (IUCN) Red List criteria, which are internationally recognised as providing best practice for assigning the conservation status of species. The EPBC Act also protects land and migratory species that are listed under International Agreements. The list of migratory species established under section 209 of the EPBC Act comprises:

- Migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II)
- Migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China–Australia Migratory Bird Agreement (CAMBA)
- Native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the republic of Korea–Australia Migratory Bird Agreement (ROKAMBA).

The State conservation level of fauna species and their significance status also follows the IUCN Red List criteria. Under the BC Act fauna can be listed as Threatened, Extinct and as Specially Protected species.

Threatened species are those are species which have been adequately searched for and are deemed to be, in the wild, either rare, under identifiable threat of extinction, or otherwise in need of special protection, and have been gazetted as such. The assessment of the conservation status of Threatened species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria. Specially protected species meet one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as Threatened or Extinct species under the BC Act cannot also be listed as Specially Protected species.

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna List under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

For the purposes of this assessment, all species listed under the EPBC Act, BC Act and DBCA Priority species are considered conservation significant.

Conservation categories and definitions for EPBC Act and BC Act listed fauna species

Conservation category	Definition
Threatened species	
Critically Endangered (CR)	Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.
Endangered (EN)	Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines
Vulnerable (VU)	Threatened species considered to be "facing a high risk of extinction in the wild in the medium term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines.
Extinct species	
Extinct (EX)	Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).
Extinct in the Wild (EW)	Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).
Specially protected species	
Migratory (MI)	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species

Conservation category	Definition
Species of special conservation interest (conservation dependent fauna) (CD)	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
Other specially protected fauna (OS)	Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

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Appendix C – Field data

Composite summary of data of Bilby plots and transects

Habitat assessments (as per BHP WAIO standards)

Composite summary of data of Bilby plots and transects

	Bilby					dog	cat	cow	K. roo	Sm ma ml	Bust ard	Bird	varan.	rept.	Habitat								Descriptor of tracking conditions						Notes			
plot no.	trax	digs	bur	scat	Pres./ absen score	plot	plot	plot	plot	plot	plot	plot	plot	plot	Broad habitat	Ground_dom . Sp.	g% cov	lit% cov	Shrub dom. Sp.	Shrub %cov	Est. time since fire	Small animal det. plot	plot track ability	plot ODS	wind stren. 2 days prev.	rain 2 days prev.	wind at plot	rain ev. at plot		Date (2020)	start time	obs name
bil-2	0	0	0	0	0	1	1	1	1	1	1	1	1	1	Hum Gland	triodia	20	5	mix. shrub	10	3-5yrs	1	3.3	6.3	2	0	2	0	termiteria	15-Sep	8.15	gg rbc
bil-9	0	0	0	0	0	1	0	1	1	1	1	1	1	1	Hum Gland	triodia	20	5	mix. shrub	5	3-5yrs	1	3.4	6.4	2	0	2	0		15-Sep	8.45	gg rbc
bil5	0	0	0	0	0	0	0	1	1	1	1	1	1	1	Hum Gland	triodia	20	5	mix. shrub	5	3-5yrs	1	3.7	6.7	2	0	2	0	Good Habitat	15-Sep	9.20	gg rbc
bil-7	0	0	0	0	0	0	0	1	1	0	1	1	1	0	Hum Gland	triodia	20	5	mix. shrub	10	3-5yrs	1	3.7	6.7	2	0	2	0	Good Habitat	15-Sep	9.45	gg rbc
bil-8	0	0	0	0	0	1	0	1	1	1	1	1	1	1	Hum Gland	triodia	20	5	mix. shrub	10	3-5yrs	1	3.7	6.7	2	0	2	0	Good Habitat	15-Sep	10.15	gg rbc
bil-1	0	0	0	0	0	0	1	1	1	0	1	1	1	1	Hum Gland	triodia	30	5	mix. shrub	10	3-5yrs	1	3.7	6.7	2	0	2	0		15-Sep	10.35	gg rbc
bil-14	0	0	0	0	0	0	1	1	1	0	1	0	1	1	Mulga Wland	triodia	50	10	mix. shrub	20	long unb.	1	3.4	6.4	2	0	2	0		15-Sep	11.10	gg rbc
bil-13	0	0	0	0	0	0	0	1	1	0	1	1	1	1	Mulga Wland	triodia	30	10	mix. shrub	20	long unb.	1	3.7	6.7	2	0	2	0		15-Sep	12.45	gg rbc
bil-3	0	0	0	0	0	0	0	1	1	1	1	0	1	1	Mulga Wland	triodia	20	10	mix. shrub	20	long unb.	1	3.7	6.7	2	0	2	0		15-Sep	1.15	gg rbc
bil-15	0	0	0	0	0	0	1	1	1	0	1	1	1	1	Mulga Wland	triodia	10	5	mix. shrub	20	long unb.	1	3.6	5.6	2	0	2	0	Seasonal inundated	15-Sep	1.45	gg rbc
bil-16	0	0	0	0	0	1	1	1	1	0	0	0	1	1	Mulga Wland	triodia	5	5	mix. shrub	20	long unb.	1	3.7	5.7	2	0	2	0	Cap rock	15-Sep	2.25	gg rbc
bil-17	0	0	0	0	0	1	1	1	1	0	1	1	1	1	Mulga Wland	triodia	10	5	mix. shrub	10	long unb.	1	3.6	6.6	2	0	1	0		15-Sep	3.10	gg rbc
bil-18	0	0	0	0	0	0	0	1	1	1	1	1	1	1	Mulga Wland	triodia	5	5	mix. shrub	10	long unb.	1	3.7	6.7	2	0	1	0	Cap rock	16-Sep	8.30	gg rbc
bil-19	0	0	0	0	0	1	1	1	1	1	0	1	1	1	Hum Gland	triodia	40	10	mix. shrub	10	long unb.	1	3.3	6.3	2	0	1	0		16-Sep	9.45	gg rbc
bil-20	0	0	0	0	0	1	1	1	1	0	0	1	1	0	Mulga Wland	herbs/grass	20	5	mix. shrub	30	long unb.	1	3.7	6.7	2	0	1	0	Degraded cattle	16-Sep	10.45	gg rbc
bil-21	0	0	0	0	0	1	1	1	1	1	0	1	1	1	Mulga Wland	herbs/grass	20	10	mix. shrub	40	long unb.	1	3.7	8.7	2	0	1	0		16-Sep	11.25	gg rbc
bil-22	0	0	0	0	0	0	0	1	1	0	0	0	1	0	Mulga Wland	herbs/grass	20	5	acacia	40	long unb.	1	3.8	10.8	2	0	1	0		16-Sep	11.55	gg rbc
bil-4	0	0	0	0	0	1	1	1	1	0	1	0	1	1	Mulga Wland	herbs/grass	20	10	acacia	40	long unb.	1	3.8	10.8	2	0	1	0		16-Sep	1.00	gg rbc
bil-23	0	0	0	0	0	1	1	1	1	0	1	1	1	1	Hum Gland	herbs/grass	30	10	mix. shrub	20	3-5yrs	1	3.4	9.4	2	0	1	0	Good Habitat	16-Sep	1.55	gg rbc
bil-24	0	0	0	0	0	0	0	1	1	0	0	1	1	1	Mulga Wland	herbs/grass	10	10	mix. shrub	30	long unb.	1	3.7	6.7	2	0	1	0		16-Sep	3.10	gg rbc
bil-6	0	0	0	0	0	1	1	1	1	0	1	1	1	0	Mulga Wland	herbs/grass	20	10	mix. shrub	30	long unb.	1	3.5	6.5	2	0	2	0	Seasonal inundated	17-Sep	8.15	gg rbc
bil-12	0	0	0	0	0	0	0	1	1	0	0	1	1	0	Mulga Wland	herbs/grass	20	10	mix. shrub	30	long unb.	1	3.6	6.6	2	0	2	0	Seasonal inundated	17-Sep	9.10	gg rbc
bil-25	0	0	0	0	0	1	1	1	1	1	1	1	1	1	Mulga Wland	triodia	20	10	mix. shrub	30	long unb.	1	3.7	6.7	2	0	2	0		17-Sep	9.50	gg rbc
bil-26	0	0	0	0	0	1	1	1	1	1	1	1	1	1	Hum Gland	herbs/grass	40	10	mix. shrub	30	long unb.	1	3.4	6.4	2	0	2	0		17-Sep	10.30	gg rbc
bil-27	0	0	0	0	0	0	0	1	1	0	0	1	1	0	Mulga Wland	triodia	40	10	mix. shrub	30	long unb.	1	3.7	7.7	2	0	2	0		17-Sep	11.00	gg rbc
bil-28	0	0	0	0	0	1	1	1	0	0	0	1	1	1	Mulga Wland	triodia	20	5	mix. shrub	30	long unb.	1	3.8	8.8	2	0	2	0		17-Sep	12.05	gg rbc
bil-29	0	0	0	0	0	0	0	1	1	0	0	0	1	0	Mulga Wland	triodia	10	5	mix. shrub	20	long unb.	0	3.8	8.8	2	0	2	0	Degraded cattle	17-Sep	12.55	gg rbc
bil-30	0	0	0	0	0	1	1	1	1	1	0	0	1	1	Mulga Wland	triodia	20	5	mix. shrub	20	long unb.	1	3.7	9.7	2	0	2	0	Degraded cattle	17-Sep	130	gg rbc
bil-31	0	0	0	0	0	0	0	1	1	0	0	0	1	1	Mulga Wland	triodia	10	5	acacia	20	long unb.	0	3.8	9.8	2	0	2	0	Cap rock	17-Sep	1.55	gg rbc
bil-32	0	0	0	0	0	0	0	1	1	0	0	1	1	1	Mulga Wland	herbs/grass	10	10	mix. shrub	20	3-5yrs	0	3.7	8.7	2	0	2	0	Degraded cattle	17-Sep	2.50	gg rbc
bil-11	0	0	0	0	0	1	1	1	1	1	1	1	1	1	Hum Gland	triodia	40	5	mix. shrub	5	long unb.	1	3.7	7.7	2	0	2	0		17-Sep	3.45	gg rbc
bil-10	0	0	0	0	0	0	0	1	1	0	1	1	1	0	Mulga Wland	triodia	20	5	acacia	20	long unb.	1	3.7	6.7	2	0	2	0		18 Sep	8.45	gg rbc
bil-33	0	0	0	0	0	1	1	1	1	1	1	1	1	1	Mulga Wland	triodia	30	5	acacia	20	long unb.	1	3.6	6.6	2	0	1	0		18 Sep	9.45	gg rbc
bil-34	0	0	0	0	0	0	0	1	1	1	1	1	1	0	Mulga Wland	triodia	20	10	acacia	30	long unb.	1	3.6	6.6	2	0	1	0		18 Sep	10.25	gg rbc
bil-35	0	0	0	0	0	0	0	1	1	0	0	0	1	0	Mulga Wland	triodia	10	5	acacia	30	long unb.	0	3.9	6.9	2	0	1	0	Degraded cattle	18 Sep	11.15	gg rbc
bil-36	0	0	0	0	0	0	0	1	1	0	1	1	1	1	Hum Gland	triodia	40	5	mix. shrub	10	long unb.	1	3.8	8.8	2	0	1	0	Cap rock	18 Sep	11.45	gg rbc
bil-37	0	0	0	0	0	1	1	1	1	1	0	1	1	1	Hum Gland	herbs/grass	30	5	mix. shrub	10	3-5yrs	1	3.6	8.6	2	0	1	0	Good Habitat	18 Sep	1.10	gg rbc
bil-38	0	0	0	0	0	0	0	1	1	0	1	1	1	1	Hum Gland	herbs/grass	40	5	mix. shrub	10	long unb.	1	3.7	7.7	2	0	1	0		18 Sep	2.15	gg rbc
bil-39	0	0	0	0	0	1	1	1	1	0	1	1	1	1	Hum Gland	triodia	40	5	mix. shrub	10	long unb.	1	3.7	7.7	2	0	1	0		18 Sep	3.00	gg rbc
bil-40	0	0	0	0	0	1	1	1	1	0	1	1	1	1	Hum Gland	herbs/grass	10	0	mix. shrub	10	1-2yrs	1	3.4	6.4	2	0	1	0		18 Sep	3.40	gg rbc
bil-41	0	0	0	0	0	0	0	1	1	0	0	0	1	0	Hum Gland	triodia	40	5	mix. shrub	10	long unb.	1	3.7	8.7	1	0	0	0		19 Sep	7.15	gg rbc
bil-42	0	0	0	0	0	1	1	1	1	1	1	1	1	1	Hum Gland	triodia	30	5	mix. shrub	10	long unb.	1	3.3	7.3	1	0	1	0	Good Habitat	19 Sep	8.30	gg rbc
bil-43	0	0	0	0	0	1	1	1	1	1	0	1	1	1	Hum Gland	triodia	30	5	mix. shrub	10	long unb.	1	3.4	7.4	1	0	1	0	Good Habitat	19 Sep	9.15	gg rbc
bil-44	0	0	0	0	0	1	1	1	1	0	1	0	1	1	Hum Gland	triodia	30	5	mix. shrub	10	long unb.	1	3.4	7.4	1	0	1	0	Good Habitat	19 Sep	10.00	gg rbc
bil-45	0	0	0	0	0	1	1	1	1	1	1	1	1	1	Hum Gland	herbs/grass	20	5	mix. shrub	5	1-2yrs	1	3.4	8.4	1	0	1	0	Good Habitat	19 Sep	11.05	gg rbc
bil-46	0	0	0	0	0	1	1	1	1	0	0	1	1	0	Mulga Wland	herbs/grass	20	5	mix. shrub	20	long unb.	0	3.7	8.7	1	0	1	0	Seasonal inundated	19 Sep	11.50	gg rbc
bil-47	0	0	0	0	0	0	0	1	1	0	1	1	1	0	Hum Gland	triodia	30	5	mix. shrub	5	long unb.	0	3.8	9.8	1	0	1	0	Cap rock	19 Sep	12.30	gg rbc

Key

0 = None recorded; 1 = Evidence present

Bilby presence/absence score = 0=no evidence, 1=possible or inconclusive evidence, 2=Bilby evidence but old, 3=Bilby evidence confirmed and fresh

surface plot tractability (a weighted equation based on species evidence recorded): 1=very good … 4=very poor

Small animals recorded = pigeon, quail, invertebrate, small bird, rodent, monitor

plot_ODS (a weighted equation based on environmental conditions recorded, includes light, sun angle, continuity): 4=very good … 13=very poor

Habitat assessments (as per BHP WAIO standards)

Site ID	Samp. Round Number	Sample Start Date	Sample End Date	Habitat Assessment Only	Target Search	Target Species	Other Sampling Method	Habitat Type	Landform	Aspect	Slope	Soil Type	Soil Availability	Amount of Outcropping	Outcropping Rock Type	Rock Size	Vegetation litter cover	Hollow Count	Time Since Last Fire	Disturbance 1	Disturbance: 2	Disturbance: 3	Easting	Northing
Bilby plot 13	2	15/09/2020	15/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Sand Plain	Flat	Flat	Sandy Clay Loam	Many Large Patches	Negligible	None Discernible	Negligible	Few Small Patches	2	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	236307	7410249
Bilby plot 3	2	14/09/2020	14/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Sand Plain	Flat	Flat	Sandy Clay Loam	Many Large Patches	Negligible	None Discernible	Negligible	Few Small Patches	0	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	236356	7409952
Bilby plot 6	2	17/09/2020	17/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Claypan	Flat	Flat	Sandy Clay Loam	Many Large Patches	Negligible	None Discernible	Negligible	Many Small Patches	1	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	222887	7412422
Bilby plot 4	2	16/09/2020	16/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Sand Plain	Flat	Flat	Sandy Clay Loam	Many Large Patches	Negligible	None Discernible	Negligible	Many Small Patches	1	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	220595	7411312
Bilby plot 18	2	16/09/2020	16/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Sand Plain	Flat	Flat	Sandy Clay Loam	Many Large Patches	Negligible	None Discernible	Gravel (1-4cm)	Few Small Patches	3	Old (6+ yr)	Cattle Grazing	Road/ Access Track	None Discernible	223801	7403199
Bilby plot 31	2	17/09/2020	17/09/2020	No	Yes	Bilby	2 ha plot search	Undulating Low Hills	Undulating Low Hills	South/ East	Moderate	Heavy Clay	None Discernible	Moderate Outcropping	BIF	Pebbles (5-10cm)	Scarce	0	Old (6+ yr)	Mining Exploration	None Discernible	Other	218194	7413245
Bilby plot 30	2	17/09/2020	17/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Stony Plain	Flat	Flat	Sandy Clay Loam	Many Small Patches	Negligible	None Discernible	Gravel (1-4cm)	Few Small Patches	0	Old (6+ yr)	Cattle Grazing	Road/ Access Track	Other	215440	7411963
Bilby plot 25	2	17/09/2020	17/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Sand Plain	Flat	Flat	Sandy Clay Loam	Many Large Patches	Negligible	None Discernible	Negligible	Many Small Patches	2	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	220795	7409876
Bilby plot 12	2	17/09/2020	17/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Claypan	Flat	Flat	Sandy Clay Loam	Many Large Patches	Negligible	None Discernible	Gravel (1-4cm)	Many Small Patches	0	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	222623	7412228
Bilby plot 29	2	17/09/2020	17/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Stony Plain	Flat	Flat	Sandy Clay Loam	Many Large Patches	Negligible	None Discernible	Gravel (1-4cm)	Few Small Patches	0	Old (6+ yr)	Cattle Grazing	Road/ Access Track	Other	214848	7413472
Bilby plot 27	2	17/09/2020	17/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Sand Plain	Flat	Flat	Sandy Clay Loam	Many Small Patches	Negligible	None Discernible	Negligible	Few Small Patches	2	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	217654	7410845
Bilby plot 22	2	15/09/2020	16/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Sand Plain	Flat	Flat	Sandy Clay Loam	Many Large Patches	Negligible	None Discernible	Negligible	Many Small Patches	1	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	224287	7412014
Bilby plot 28	2	16/09/2020	17/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Sand Plain	Flat	Flat	Sandy Clay Loam	Many Large Patches	Negligible	None Discernible	Negligible	Few Small Patches	0	Old (6+ yr)	Cattle Grazing	Weed Invasion	None Discernible	213477	7412250
Bilby plot 20	2	16/09/2020	15/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Sand Plain	Flat	Flat	Sandy Clay Loam	Many Large Patches	Negligible	None Discernible	Negligible	Many Small Patches	1	Old (6+ yr)	Cattle Grazing	Weed Invasion	None Discernible	225565	7408351
Bilby plot 19	2	16/09/2020	16/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Loamy Sand	Many Small Patches	Negligible	None Discernible	Negligible	Many Small Patches	1	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	230193	7401415
Bilby plot 26	2	17/09/2020	17/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Loamy Sand	Many Small Patches	Negligible	None Discernible	Negligible	Few Small Patches	0	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	217991	7409756
Bilby plot 23	2	16/09/2020	16/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Loamy Sand	Many Small Patches	Negligible	None Discernible	Negligible	Few Small Patches	0	Moderate (3 to 5 yr)	Cattle Grazing	None Discernible	None Discernible	220528	7408385
Bilby plot 11	2	17/09/2020	17/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Sandy Loam	Many Small Patches	Negligible	None Discernible	Negligible	Few Small Patches	0	Old (6+ yr)	None Discernible	None Discernible	None Discernible	215258	7410189
Bilby plot 32	2	17/09/2020	17/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Stony Plain	East	Low	Sandy Clay Loam	Many Large Patches	Negligible	None Discernible	Negligible	Few Small Patches	0	Old (6+ yr)	Cattle Grazing	Other	None Discernible	215120	7408110

Site ID	Samp. Round Number	Sample Start Date	Sample End Date	Habitat Assessment Only	Target Search	Target Species	Other Sampling Method	Habitat Type	Landform	Aspect	Slope	Soil Type	Soil Availability	Amount of Outcropping	Outcropping Rock Type	Rock Size	Vegetation litter cover	Hollow Count	Time Since Last Fire	Disturbance 1	Disturbance. 2	Disturbance. 3	Easting	Northing
Bilby plot 24	2	16/09/2020	16/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Sand Plain	Flat	Flat	Sandy Clay Loam	Many Large Patches	Negligible	None Discernible	Gravel (1-4cm)	Many Small Patches	1	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	222668	7409477
Bilby plot 21	2	16/09/2020	16/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Sand Plain	Flat	Flat	Sandy Clay Loam	Many Large Patches	Negligible	None Discernible	Negligible	Many Small Patches	1	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	225149	7410622
Bilby plot 17	2	14/09/2020	14/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Sandy Loam	Many Large Patches	Negligible	None Discernible	Negligible	Few Small Patches	0	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	225557	7406286
Bilby plot 16	2	15/09/2020	14/09/2020	No	Yes	Bilby	2 ha plot search	Sandy/ Stony Plain	Sand Plain	Flat	Flat	Sandy Clay Loam	Many Large Patches	Limited Outcropping	Granite	Gravel (1-4cm)	Few Small Patches	0	Old (6+ yr)	Cattle Grazing	Mining Exploration	None Discernible	225488	7401952
Bilby plot 15	2	15/09/2020	14/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Sand Plain	Flat	Flat	Sandy Clay Loam	Many Large Patches	Negligible	None Discernible	Negligible	Many Small Patches	1	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	228245	7404180
Bilby plot 9	2	14/09/2020	14/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Loamy Sand	Many Large Patches	Negligible	None Discernible	Negligible	Few Small Patches	0	Moderate (3 to 5 yr)	Cattle Grazing	Frequent Fire	None Discernible	231523	7412341
Bilby plot 7	2	14/09/2020	14/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Loamy Sand	Many Large Patches	Negligible	None Discernible	Negligible	Few Small Patches	0	Moderate (3 to 5 yr)	Cattle Grazing	Frequent Fire	None Discernible	232080	7411458
Bilby plot 5	2	14/09/2020	14/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Loamy Sand	Many Large Patches	Negligible	None Discernible	Negligible	Few Small Patches	0	Moderate (3 to 5 yr)	Cattle Grazing	Frequent Fire	None Discernible	231652	7411845
Bilby plot 2	2	15/09/2020	15/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Loamy Sand	Many Large Patches	Negligible	None Discernible	Negligible	Few Small Patches	1	Moderate (3 to 5 yr)	Cattle Grazing	Frequent Fire	None Discernible	232107	7412938
Bilby plot 14	2	14/09/2020	14/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Sandy Clay Loam	Few Small Patches	Negligible	None Discernible	Negligible	Few Small Patches	1	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	232253	7413472
Bilby plot 1	2	14/09/2020	14/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Loamy Sand	Many Large Patches	Negligible	None Discernible	Negligible	Few Small Patches	0	Moderate (3 to 5 yr)	Cattle Grazing	Frequent Fire	None Discernible	232229	7412267
Bilby plot 8	2	13/09/2020	13/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Loamy Sand	Many Large Patches	Negligible	None Discernible	Negligible	Few Small Patches	0	Moderate (3 to 5 yr)	Cattle Grazing	Frequent Fire	None Discernible	232259	7411822
Bilby plot 33	2	18/09/2020	18/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Sandy Clay Loam	Many Large Patches	Negligible	None Discernible	Negligible	Few Small Patches	0	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	226521	7413772
Bilby plot 38	2	18/09/2020	18/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Sandy Clay Loam	Many Small Patches	Negligible	None Discernible	Negligible	Few Small Patches	0	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	226254	7412311
Bilby plot 40	2	18/09/2020	18/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Clay Loam Sandy	Many Large Patches	Negligible	None Discernible	Negligible	Scarce	0	Recent (0 to 2 yr)	Cattle Grazing	None Discernible	None Discernible	235217	7413812
Bilby plot 36	2	18/09/2020	18/09/2020	No	Yes	Bilby	2 ha plot search	Sandy/ Stony Plain	Sandy/ Stony Plain	Flat	Flat	Sandy Clay Loam	Many Small Patches	Negligible	None Discernible	Gravel (1-4cm)	Few Small Patches	0	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	218957	7414982
Bilby plot 39	2	18/09/2020	18/09/2020	No	Yes	Bilby	2 ha plot search	Undulating Low Hills	Undulating Low Hills	North	Low	Sand	Many Large Patches	Negligible	None Discernible	Gravel (1-4cm)	Few Small Patches	0	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	229221	7413344
Bilby plot 10	2	18/09/2020	18/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Sand Plain	Flat	Flat	Sandy Clay Loam	Many Small Patches	Negligible	None Discernible	Negligible	Few Small Patches	0	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	224975	7413510
Bilby plot 34	2	18/09/2020	18/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Stony Plain	Flat	Flat	Sandy Clay Loam	Many Large Patches	Limited Outcropping	Other	Gravel (1-4cm)	Few Small Patches	0	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	222904	7414866

Site ID	Samp. Round Number	Sample Start Date	Sample End Date	Habitat Assessment Only	Target Search	Target Species	Other Sampling Method	Habitat Type	Landform	Aspect	Slope	Soil Type	Soil Availability	Amount of Outcropping	Outcropping Rock Type	Rock Size	Vegetation litter cover	Hollow Count	Time Since Last Fire	Disturbance 1	Disturbance. 2	Disturbance. 3	Easting	Northing
Bilby plot 35	2	18/09/2020	18/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Undulating Low Hills	East	Low	Sandy Clay Loam	Few Small Patches	Limited Outcropping	Other	Gravel (1-4cm)	Few Small Patches	0	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	221130	7414280
Bilby plot 44	2	19/09/2020	19/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Clayey Sand	Many Small Patches	Negligible	None Discernible	Negligible	Few Small Patches	0	Old (6+ yr)	None Discernible	None Discernible	None Discernible	220485	7418670
Bilby plot 42	2	19/09/2020	19/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Clayey Sand	Many Small Patches	Negligible	None Discernible	Negligible	Scarce	0	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	218957	7418004
Bilby plot 47	2	19/09/2020	19/09/2020	No	Yes	Bilby	2 ha plot search	Undulating Low Hills	Undulating Low Hills	West	Low	Clay Loam	Many Small Patches	Limited Outcropping	Other	Gravel (1-4cm)	Few Small Patches	0	Old (6+ yr)	Cattle Grazing	Mining Exploration	None Discernible	224982	7415977
Bilby plot 46	2	19/09/2020	19/09/2020	No	Yes	Bilby	2 ha plot search	Mulga Woodland	Sand Plain	Flat	Flat	Clayey Sand	Many Large Patches	Negligible	None Discernible	Negligible	Few Large Patches	0	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	222575	7416883
Bilby plot 43	2	19/09/2020	19/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Clayey Sand	Many Small Patches	Negligible	None Discernible	Negligible	Scarce	0	Old (6+ yr)	None Discernible	None Discernible	None Discernible	218823	7420415
Bilby plot 41	2	18/09/2020	18/09/2020	No	Yes	Bilby	2 ha plot search	Undulating Low Hills	Undulating Low Hills	North	Low	Medium Clay	Many Small Patches	Limited Outcropping	BIF	Gravel (1-4cm)	Scarce	0	Old (6+ yr)	Cattle Grazing	None Discernible	None Discernible	219909	7413060
Bilby plot 45	2	19/09/2020	19/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Sand	Many Large Patches	Negligible	None Discernible	Negligible	Scarce	0	Recent (0 to 2 yr)	Frequent Fire	Cattle Grazing	None Discernible	214872	7420617
Bilby plot 37	2	18/09/2020	18/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Sand	Many Large Patches	Negligible	None Discernible	Negligible	Scarce	0	Moderate (3 to 5 yr)	Frequent Fire	Cattle Grazing	None Discernible	216855	7419571
Mulgara burrow1	2	17/09/2020	17/09/2020	No	Yes	Bilby	2 ha plot search	Sand Plain	Sand Plain	Flat	Flat	Sandy Loam	Many Small Patches		None Discernible	Negligible	Many Small Patches	0	Old (6+ yr)	None Discernible	None Discernible	None Discernible	214995	7410267

GHD

Perth Office, Level 10
999 Hay St, Perth, 6000
T: 6222 8222 F: 61 8 6222 8555 E: permail@ghd.com

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