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BROCKMAN RESOURCES MARILLANA IRON ORE PROJECT

ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

ASSESSMENT ON PRELIMINARY DOCUMENTATION

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ASSESSMENT ON PRELIMINARY DOCUMENTATION

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ACRONYMS

AS/NZS	Australian Standard and New Zealand Standard
BHPB	BHP Billiton
CAMBA	China-Australia Migratory Bird Agreement
CP	Closure Plan
DEC	Department of Environment and Conservation
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (formerly DEWHA)
DEWHA	Department of Water, Heritage and the Arts
DIA	Department of Indigenous Affairs
DMP	Department of Mines and Petroleum
DoH	Department of Health
DoW	Department of Water
EMB	Environmental Management Branch (DEC)
EMP	Environmental Management Plan
EPA	Environmental Protection Authority
EPBC	*Environment Protection and Biodiversity Conservation Act* 1950

ERA	Environmental Risk Assessment
FMG	Fortescue Metals Group
GWMP	Groundwater Management Plan
Ha	Hectare
ICMM	International Council on Mining and Minerals
JAMBA	Japan-Australia Migratory Bird Agreement
MIB	Martu Idja Banyjima
Mtpa	Million tonnes per annum
NES	Matters of National Environmental Significance
PEC	Priority Ecological Community
PER	Public Environmental Review
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
SoEP	Shire of East Pilbara
SWMP	Surface Water Management Plan
TEC	Threatened Ecological Community
TMP	Topsoil Management Plan

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EXECUTIVE SUMMARY

Brockman Resources Limited (Brockman) proposes to develop and operate an open pit iron ore mine (the Project) at its Marillana Mining Lease M47/1414, located approximately 100 km north-west of Newman in the Pilbara region of Western Australia. The Project was approved by the Western Australian Minister for Environment (statement number 855) in February 2011 in accordance with Section 38(1) of the *Environmental Protection Act* 1986 (WA). Mining Lease M47/1414 spans approximately 16 km along the base of the Hamersley Range, and sits within the Fortescue Valley which covers an area of approximately 96 million ha.

The Project will have a significant beneficial impact on the Pilbara region, bringing revenue and jobs to the area. The Project is a capital investment of over $1 billion into Western Australia's regional and state economies and will provide a positive contribution to indigenous training and business opportunities in the region.

Brockman is proposing to clear up to 3,785 ha of vegetation to mine detrital iron ore deposits at a rate of 37.5 Million tonnes per annum (Mtpa) with transport to Port Hedland by rail. After rehabilitation, the long-term cleared footprint will be around 60 ha which represents the final pit void. All other disturbances will be rehabilitated to the satisfaction of the Western Australian Environmental Protection Authority (EPA), Department of Environment and Conservation (DEC) and Department of Mines and Petroleum (DMP). Brockman anticipates commencing the clearing of mining and infrastructure footprints in the fourth quarter of 2011, with mining and processing to begin in the third quarter of 2012.

Brockman have engaged *ecologia* Environment (*ecologia*) to prepare the Preliminary Documentation (this document) required to assess the Project under the *Environmental Protection and Biodiversity Conservation Act* 1999 (Cth). This Preliminary Documentation addresses the request for information provided to Brockman by the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC), dated 6th May 2011.

This document is to be viewed in conjunction with the referral documents (EPBC 2011/5892), receipted by DSEWPaC on 23rd March 2011, including its attachments, to address the request for information.

An *Environmental Protection and Biodiversity Conservation Act* 1950 (EPBC) Protected Matters (Matters of National Environmental Significance (NES)) search of the Study area was undertaken by *ecologia* in March 2011. The search indicated that:

- No threatened ecological communities (TEC's) of Commonwealth significance occur in the vicinity of the Mining Lease.
- One flora species, *Lepidium catapycnon* may potentially occur within the Mining Lease.
- The Northern Quoll *(Dasyurus hallucatus)* may potentially occur within the Mining Lease.
- The Night Parrot *(Pezoporus occidentalis)* may potentially occur within the Mining Lease.
- The Pilbara Leaf-nosed Bat *(Rhinonicteris aurantia)* may potentially occur within the Mining Lease.
- The Greater Bilby *(Macrotis lagotis)* may potentially occur within the Mining Lease.

- The Pilbara Olive Python *(Liasis olivaceus barroni)* may potentially occur within the Mining Lease.

Brockman commissioned *ecologia* to undertake a two-phase, level two assessment of the vegetation and flora (conducted June / September 2008), and a two-phase level two vertebrate fauna assessment (conducted April / August 2008) within the Mining Lease. Survey results indicate that no known populations of *EPBC Act* listed fauna or flora are resident within the Project disturbance area, however migratory and transient or foraging fauna may pass through the various habitats.

Based on the surveys undertaken and the habitat preferences of *Lepidium catapycnon*, it is considered this species may potentially occur within the Project area (see Referral Documents).

The greatest potential impact to fauna species of NES is the removal of potential habitat. Any impact to fauna species of NES is unlikely, indirect, and short term. Impacts are of the nature that species will not be able to colonise disturbed areas until mine rehabilitation has occurred (as no species were observed to be resident).

Indirect vegetation impacts, such as that resulting from dewatering, were also considered. Hydrological investigations and groundwater modelling have concluded that the groundwater drawdown cone will not reach the Fortescue Marsh, and thus impacts to any habitat in proximity to the Marsh is not anticipated by the Project. Monitoring conditions regarding vegetation, groundwater and surface water within the M47/1414 and around the Fortescue Marsh have been imposed under Ministerial Statement 855. Other general environment local impacts, both direct and indirect, are able to be managed through implementation of Brockman policy, plans and procedures.

Project impacts were also assessed in a regional context to obtain a cumulative sense of potential impacts to matters of NES. The habitats within the Mining Lease are well represented within a 50 km radius of the Project, and within the greater Pilbara region. The risk of fragmentation of habitats is low, and it is anticipated that ecological processes will not be impacted by the Project.

Rigorous risk assessment, biological assessments and hydrological assessments have been conducted for the Project, and the gathered knowledge has been integrated within the management processes. Brockman have developed, and are further developing a number of environmental management tools. Brockman have developed an Environmental Management System (EMS) for its operations, and within this system are key documents including:

- a Project Environmental Management Plan (EMP);
- a Project Surface Water Management Plan (SWMP);
- a Project Topsoil Management Plan (TMP);
- a Groundwater Management Plan (GWMP); and
- a Project Closure Plan (CP).

Prior to undertaking Project works, as per the statutory conditions of Ministerial Statement 855 and further to the above listed Plans, Brockman will develop:

- a Compliance Assessment Plan; and
- a Monitoring Schedule for the Project.

These will be based on the advice of Western Australian Departments where relevant, including the DEC, EPA, and the Department of Water (DoW), to a standard accepted by the Chief Executive Officer (CEO) of the Western Australian Office of the EPA.

To mitigate the general environmental impacts of the Project, Brockman has developed and agreed to an offset plan for the Project with the Western Australian government. This plan details a contribution of $580,000 to conservation projects, research and environmental management over the life of the project. The plan has been developed in consultation with the DEC, and it provides consideration towards achieving long-term conservation outcomes given the scale and intensity of the operation. Environmental considerations are in addition to social and economic considerations regarding the impacts and benefits of implementing the Project. Principles of environmental protection and of sustainable development have been applied to the project, and Brockman continues to engage with stakeholders throughout each stage of the Project.

There is no evidence to suggest that the Project will have or is likely to have a significant impact on any NES matters. In particular there are no NES impacts that would require offsets beyond those already proposed by the offset plan for the Project. Rehabilitation of the site on closure will address any residual potential impacts on species of NES. Therefore, Brockman proposes that *EPBC Act* approval conditions reaffirm the implementation of Ministerial Statement 855, and no further conditions will be required to manage impacts to matters of NES.

To assist in navigating the information provided, the following checklist references the requested information from DSEWPaC with the information source.

INFORMATION	SOURCE
1) Matters of National Environmental Significance (NES) Identify *EPBC Act* listed threatened and migratory species potentially present on or off-site that could be affected, directly or indirectly, as a consequence of the proposal. This must include, but is not limited to: - Night Parrot *(Pezoporus occidentalis)* - endangered and migratory; - Greater Bilby *(Macrotis lagotis)* – vulnerable; - Great Egret (*Ardea alba*) – migratory; - Olive Python (Pilbara subspecies) (*Liasis olivaceus barroni)* - vulnerable*;* - Northern Quoll (*Dasyurus hallucatus)* – endangered; and - Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia* (Pilbara form)) – vulnerable. For each matter of species, the following information must be provided:	
i) information on the distribution, ecology, and habitat preferences of the species;	Section 1 Referral Document Attachments C and D
ii) a detailed discussion of known threats and population trends in the Pilbara;	Section 1 Referral Document Attachments C and D
iii) information on the presence of the species in conservation reserves;	Section 1
iv) both local and regional maps showing the location of known records, including those from databases and all surveys previously conducted for the proposal. A copy of the surveys	Section 1

should be included in the assessment information;	
v) both local and regional maps highlighting the potential habitat for the species, including within and in the vicinity of the proposed site. These maps must highlight habitat components important for each relevant species, such as breeding habitat, wetlands, vine forests, rock outcrops, etc;	Section 1
vi) information on the survey methodology used, including any limitations of the methodology and data collected for each species, as well as a justification for the survey methodology and survey sites employed;	Referral Document Attachments C and D
vii) information on the scientific reliability of survey investigations and conclusions, including the degree of certainty or statistical confidence where appropriate; and	Referral Document Attachments C and D
viii) using the local and regional maps as a reference, provide a detailed analysis, including judgments of qualified fauna experts, to determine the importance of the populations of listed species present and/or habitat present at the proposed development site.	Section 1 Section 3 Referral Document Attachments C and D
2) Construction Timeframes Provide detailed construction timeframes for all components of the proposed action.	
	Section 2
3) Relevant impacts Provide a description of the relevant impacts, including:	
i) a description of the potential and likely short-term and long-term impacts of the action on listed species, including: - habitat loss; - edge effects; - habitat fragmentation; - direct mortality during construction and operation; - incursion of vertebrate pests; - noise and other disturbances, in particular the likely impact of lighting and noise on listed migratory species; - changes to surface and groundwater quality and levels leading to changes in vegetation health; and - cumulative impacts as a result of the presence of other activities including mines/quarries, roads and rail infrastructure.	Section 3

ii) the description must detail direct, indirect, cumulative and facilitated impacts;	Section 3
iii) numerical quantities of habitat for listed species likely to be impacted and maps highlighting these areas;	Table 3.3 Section 1 Figures (All)
iv) a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible;	Section 3.1
v) analysis of the potential magnitude of the relevant impacts;	Section 3 Table 3.2 Table 3.3
vi) if not already provided in the referral information, any technical data and other information used or needed to make a detailed assessment of the relevant impacts; and	Referral Document Attachments (All)
vii) information on the scientific reliability of investigations and conclusions drawn, including the degree of certainty or statistical confidence where appropriate. This must include any assumptions or limitations of any models used to make predictions.	Referral Document Attachments (All)
4) Proposed safeguards and mitigation measures Provide a description of the proposed safeguards and mitigation measures that will be implemented prior to and during construction, and during and post operation, including:	
i) a description and an assessment of the expected or predicted effectiveness of the mitigation measures for listed species;	Section 4.5
ii) any scientific, statutory or policy basis for the mitigation measures;	Section 4
iii) an outline of an environmental management plan (or plans) that set out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the proposed action (both on and off-site), including any provisions for independent environmental auditing;	Section 4.5
iv) the plan(s) must allow for the collection of baseline environmental data, and ongoing monitoring, management and mitigation for the duration of the action and subsequent mine rehabilitation;	Section 4.5

v) a description of the environmental aspects that will be studied as part of an environmental monitoring program, during pre-construction, construction, operation and post-operation stages of the mine. Include in this section details of the timing, scope and duration of the proposed environmental monitoring program. This section should also describe how the principles of adaptive management will inform the mitigation of impacts throughout the project life, including the development of trigger values and response measures where appropriate;	Section 4.5
vi) the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program;	Table 4.2
vii) a consolidated list of mitigation measures proposed to be undertaken to prevent, minimise or compensate for the relevant impacts of the proposed action, including mitigation measures proposed to be taken by State governments, local governments or the proponent; and	Section 4.5 Appendix A - F
viii) details of any contingency measures that may be required in the future to mitigate the risk of serious or irreversible environmental harm on matters of NES.	Section 4.5
5) Proposed offset measures Where impacts cannot be avoided or managed, provide a description of proposed offset measures. Offsets may include the long-term protection of habitat for listed species, rehabilitation of degraded habitat, land management actions and contributions to fund research. Any proposed strategy must:	
i) demonstrate how it will achieve certain and long-term conservation outcomes; and	Section 5 Appendix F - G
ii) have regard to the scale and intensity of impact from the development on the site.	Section 5.2 Appendix F - G
6) Social and Economic Matters Provide a description of the benefits and/or detrimental impacts of the proposed action on relevant social and economic matters.	
	Section 6
7) Ecologically sustainable development Provide a description of the proposed action in relation the ecologically sustainable development principles, including:	

i) the long-term and short-term economic, environmental, social and equitable considerations;	Section 7
ii) 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;	Section 7
iii) the principle of inter-generational equity—that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations;	Section 7
iv) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making; and	Section 7
v) improved valuation, pricing and incentive mechanisms should be promoted.	Section 7
8) Other approvals and conditions Information given must include:	
i) a description of any approval that has been obtained from a State, Territory or Commonwealth agency or authority (other than an approval under the Act), including any conditions that apply to the proposed action;	Section 8
ii) a statement identifying any additional approval that is required; and	Section 8
iii) a description of the monitoring, enforcement and review procedures that apply, or are proposed to apply, to the action.	Section 8 Appendix A - G
9) Information sources Information given must state:	
i) the source of the information;	Section 9
ii) how recent the information is;	Section 9
iii) how the reliability of the information was tested;	Section 9
iv) what uncertainties/limitations (if any) are in the information; and	Section 9.3 Referral Document Attachments C and D
v) the qualifications and experience of the study team.	Section 9.2

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1 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (NES)

1.1 EPBC ACT LISTED THREATENED SPECIES

1.1.1 Hamersley Lepidium/Hamersley Catapycnon *(Lepidium catapycnon)*

Conservation Status: *EPBC Act* Vulnerable

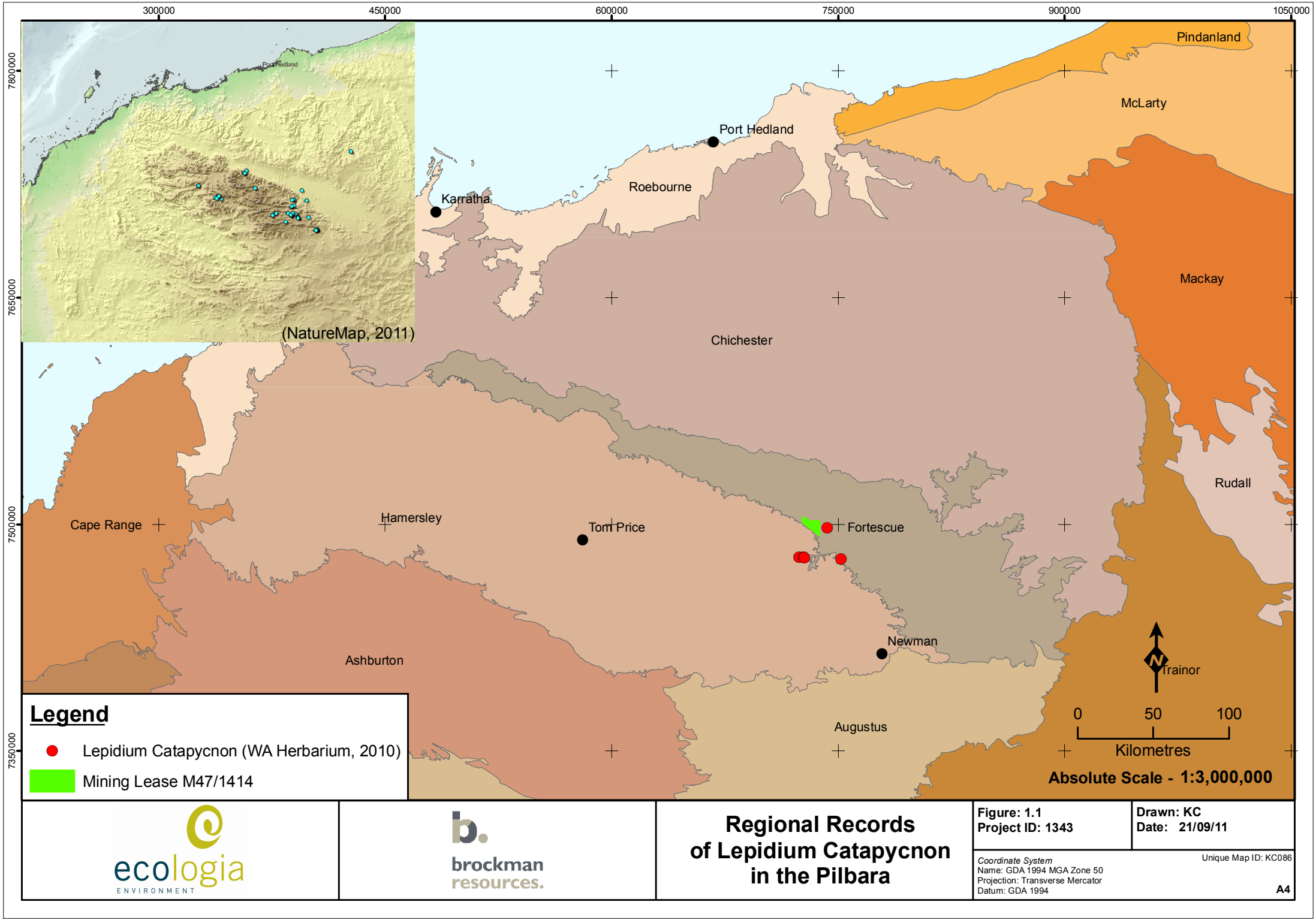
Distribution and Habitat: *Lepidium catapycnon* is known to occur on the Hamersley Range, in the Pilbara region of Western Australia. Twenty three populations are known to exist over an estimated 10,280 km^2 area, however insufficient data exists to map the species distribution (EPBC 2008). *Lepidium Catapycnon* grows in skeletal soils on hillsides in hummock grassland with an over-storey of Snappy Gum (*Eucalyptus leucophloia*) and *Acacia* species (Mattiske & Assoc., 1995).

Ecology: Threats to the species include clearing, and weeds such as Ruby Dock, which may prevent *L. Catapycnon* from establishing a foundation (Mattiske & Assoc., 1995). Many of the identified populations have been found on the Mining Lease (DEC 2008), which exposes the species to risks presented by mining processes.

Regional Records: Population trends are unknown due to the lack of data available on the species. Approved conservation advice was issued by the then Department of Environment, Water, Heritage and the Arts (DEWHA, now DSEWPaC) in 2008 under s266B of the *EPBC Act*, which identified research priorities as well as regional and local priority actions for the species.

Likelihood of Occurrence: Due to the habitat requirements of the species, the likelihood of their occurrence in the survey area is low (ecologia 2009b).

No declared rare flora species were recorded within the Mining Lease.



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Regional Records of Lepidium Catapycnon in the Pilbara

Figure: 1.1
Project ID: 1343

Drawn: KC
Date: 21/09/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: KC086

A4

1.1.2 Night Parrot *(Pezoporus occidentalis)*

Conservation Status: *EPBC Act* Critically Endangered/Migratory

Distribution and Habitat: Historical evidence indicates that Night Parrots were distributed over much of semi-arid and arid Australia (Garnett and Crowley 2000). Extremely secretive and hard to flush, there are only 6 accepted records of Night Parrots since 1935, with two from the Pilbara region (1980 and 2005) (DEWHA 2008b). Preferred habitat is thought to be spinifex grasslands or samphire and chenopod shrublands on claypans, floodplains or the margins of salt lakes, creeks or other water bodies (Johnstone and Storr 1998; Higgins 1999; DEWHA 2008b).

Ecology: The Night Parrot is a rarely encountered, nocturnal parrot that spends much of its time on the ground. It is thought that the Night Parrot roosts during the day under dense vegetation such as spinifex clumps, in caves or even burrows (Higgins 1999). They are thought to be granivorous, particularly feeding on seeding spinifex, but may also eat some herbage. The presence of soil in the upper mandible of museum specimens also suggests that they may dig for roots or tubers (Higgins 1999).

The species has been variously described as sedentary but with large home ranges, nomadic, and seasonally migratory in response to conditions.

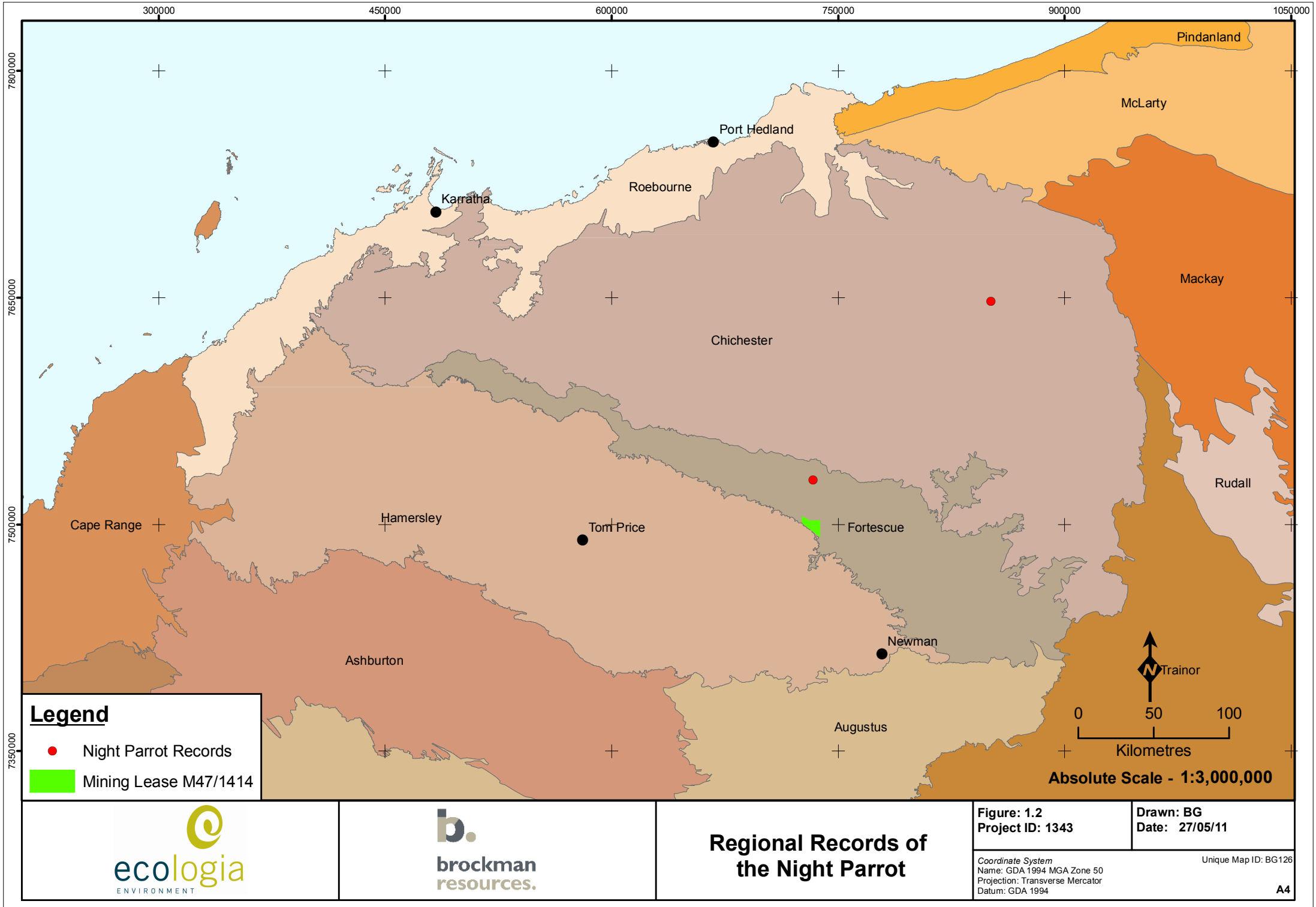
The apparent decline of the Night Parrot is most likely attributable to predation by cats and foxes, competition with introduced herbivores (livestock, rabbits, camels), degradation of water holes by livestock and altered fire regimes (Higgins 1999).

Regional Records: Regional records of the Night Parrot since 1980 are mapped in Figure 1.2. Records were sourced from *ecologia* internal database, previous surveys conducted by other companies, DEC's Naturebase (DEC 2011) and Global Biodiversity Information Facility (GBIF 2011). The most recent regional record is from Minga Well, recorded in April 2005 during a fauna survey at Cloudbreak (Bamford 2005). Two Night Parrots were observed drinking at Minga Well (Bamford 2005). Minga Well is located approximately 27 kilometres from the Project (733729 e, 7529764 s, Zone 50K), on the northern side of the Fortescue Marsh. It is thought that the Night Parrot inhabits the samphire and lignum community and fringing hummock grassland of the Fortescue Marsh (S. van Leeuwin DEC, pers. comm.).

Likelihood of Occurrence: The likelihood of Night Parrots occurring in the Mining Lease is difficult to estimate, as the species is unlikely to be recorded even in areas where it may be common. As a result of the 2005 sightings, annual surveys of the Fortescue Marsh for Night Parrots have been conducted by Bamford Consulting Ecologists (Bamford 2006; 2007; 2009; 2010). These surveys have employed a range of techniques to locate additional birds, including call playback, mist netting, waterhole observations, camera traps, and searching for feathers in the nests of other birds. To date no further sightings of individuals have been made, although potential Night Parrot calls have been heard around wells and on the edge of the Fortescue Marsh (Bamford Consulting Ecologists 2009, 2010). Due to the extremely cryptic nature of the species it is difficult to attribute the lack of sightings to a lack of birds or to the inadequacy of the survey methods for detecting such a cryptic species.

Based on the predicted preferred habitat for the species, potential suitable habitat within the Mining Lease is associated with areas of hummock grassland (Figure 1.3). On a regional basis, potential suitable habitat for the Night Parrot (based on occupancy of Urandy, Divide, Calcrete, Cowra, Bonney, Mckay, Rocklea and Adrian land systems) can be seen in Figure 1.4. These areas typically consist of hummock grassland, with some patches of samphire or chenopod shrublands.

The Night Parrot may potentially occur within close proximity to the Mining Lease. This is evidenced by a confirmed sighting in 2005 at the nearby Fortescue Marsh, 30 km from the Project Area.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7350000
Pindanland
McLarty
Port Hedland
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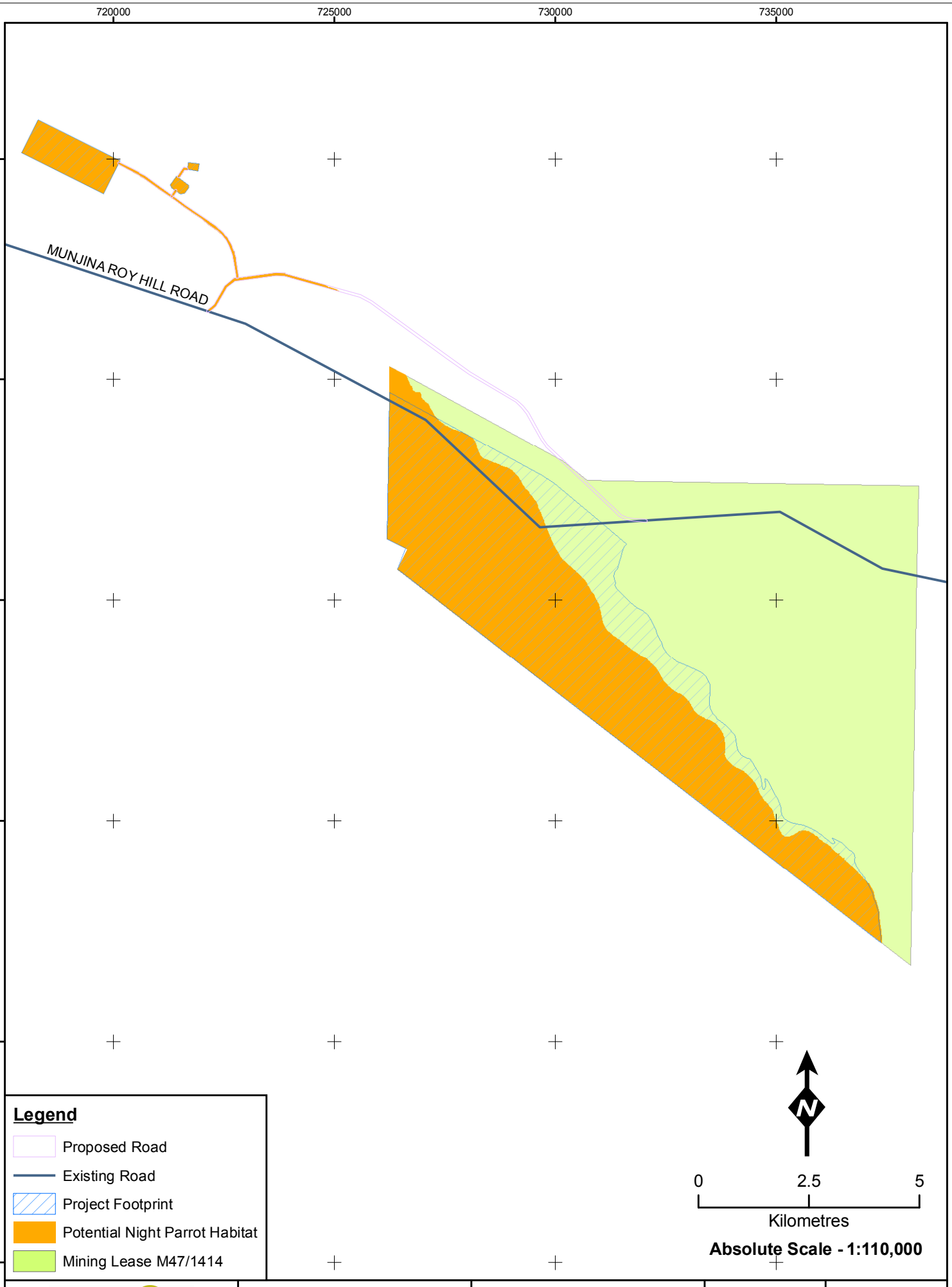
Karratha
Mackay
Chichester
Rudall
Cape Range
Hamersley
Tom Price
Fortescue
Ashburton
Newman
Augustus
Trainor
0
50
100
Kilometres
Absolute Scale - 1:3,000,000
Legend
Night Parrot Records
Mining Lease M47/1414
ecologia
ENVIRONMENT
brockman
resources.
Regional Records of the Night Parrot
Figure: 1.2
Project ID: 1343
Drawn: BG
Date: 27/05/11
Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994
Unique Map ID: BG126
A4



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Potential Night Parrot Habitat Impacted by Project Footprint

Figure: 1.3
Project ID: 1343

Drawn: KC
Date: 12/09/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: KC064

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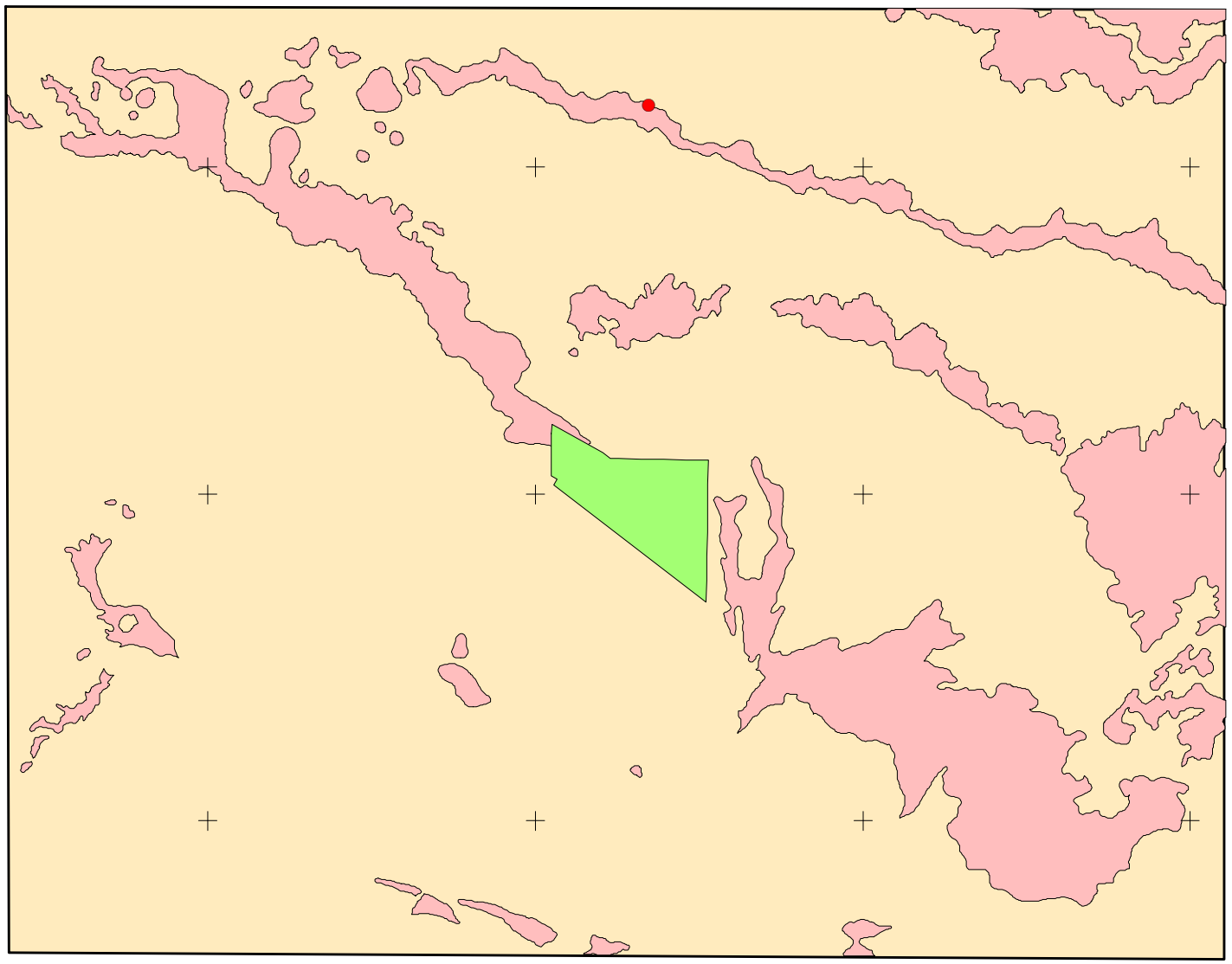

Legend

- Night Parrot Records
- Potential Nesting and Foraging Habitat
- Regional Habitat Area (~50 km Buffer from Project Area)
- Mining Lease M47/1414

N

0 10 20

Kilometres

Absolute Scale - 1:500,000

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Potential Regional Night Parrot Habitat

Figure: 1.4
Project ID: 1343

Drawn: BG
Date: 27/06/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: BG166

A4

1.1.3 Northern Quoll *(Dasyurus hallucatus)*

Conservation Status: *EPBC Act* Endangered

Distribution and Habitat: The Northern Quoll occurs across northern Australia from the Pilbara region in Western Australia to south-eastern Queensland. A 75% range reduction occurred during the 20th century; the species is now only relatively common in the Pilbara and northern Kimberley in Western Australia and a few discreet populations across the Northern Territory and eastern Queensland (Braithwaite and Griffiths 1994). Causes for this decline include loss of habitat, cane toads and exotic disease. Northern Quolls are most common on dissected rocky escarpments, but are also found in eucalypt forest and woodland (Oakwood 2008).

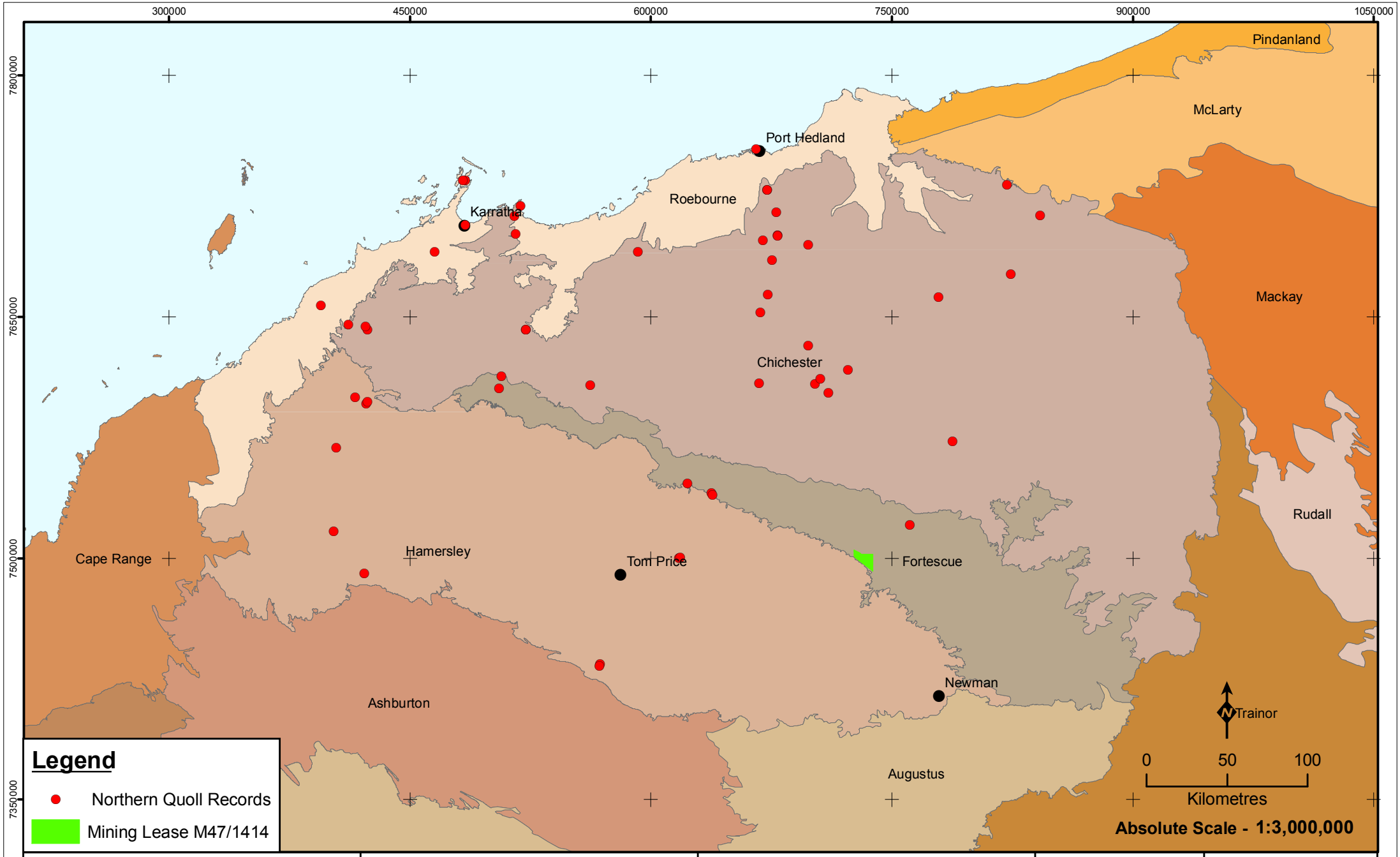
Ecology: Northern Quolls are the smallest of the Australian quolls. They are both arboreal and terrestrial and use a variety of den sites including rock crevices, tree hollows, logs, termite mounds, house roofs and goanna burrows (Oakwood 2008). Northern Quolls are nocturnal and opportunistic omnivores feeding primarily on small vertebrates, large insects and soft fruits.

The most common cause of adult mortality is predation by dingoes, feral cats, snakes, owls and kites (Maxwell *et al.* 1996; Oakwood 2008). Other causes of mortality include domestic dogs, motor vehicles and pesticide poisoning. The level of predation is increased through the removal of groundcover by fire.

Regional Records: Regional records of the Northern Quoll are mapped in Figure 1.5. Records were sourced from *ecologia* internal database, previous surveys, DEC's Naturebase (DEC 2011) and Global Biodiversity Information Facility (GBIF 2011). As shown in Figure 1.5 there are very few records of this species from the southern Chichester region, although there is one record of an individual from north of the Fortescue Marsh, approximately 40 kilometers from the Mining Lease (NatureMap 2010).

Likelihood of Occurrence: No individuals or secondary evidence such as scats were recorded during the level two vertebrate fauna assessment completed in 2008. There is no suitable denning habitat within the Mining Lease and as such it is expected that no Northern Quolls are resident. However the riverine habitat associated with Weeli Wolli creek, which passes through the Mining Lease, could be utilised as a dispersal route and for temporary residency. This represents the only potential suitable habitat for Northern Quolls within the Mining Lease (Figure 1.6).

Figure 1.7 displays the potential regional habitat for Northern Quolls in relation to the Mining Lease (based on occupancy of Newman and River land systems). Potential denning and foraging habitat can be seen to the south of the Mining Lease within the Hamersley Ranges. The Hamersley Ranges provide suitable habitat for Northern Quoll in the form of rocky gullies and breakaways providing ample boulder piles. This habitat type is associated with the Newman land system which does not occur within the Mining Lease (Figure 3.1). Due to the lack of nearby records and little potential habitat within the Mining Lease, there is low likelihood Northern Quolls may occur.



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Regional Records of the Northern Quoll

Figure: 1.5
Project ID: 1343

Drawn: BG
Date: 27/05/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: BG127

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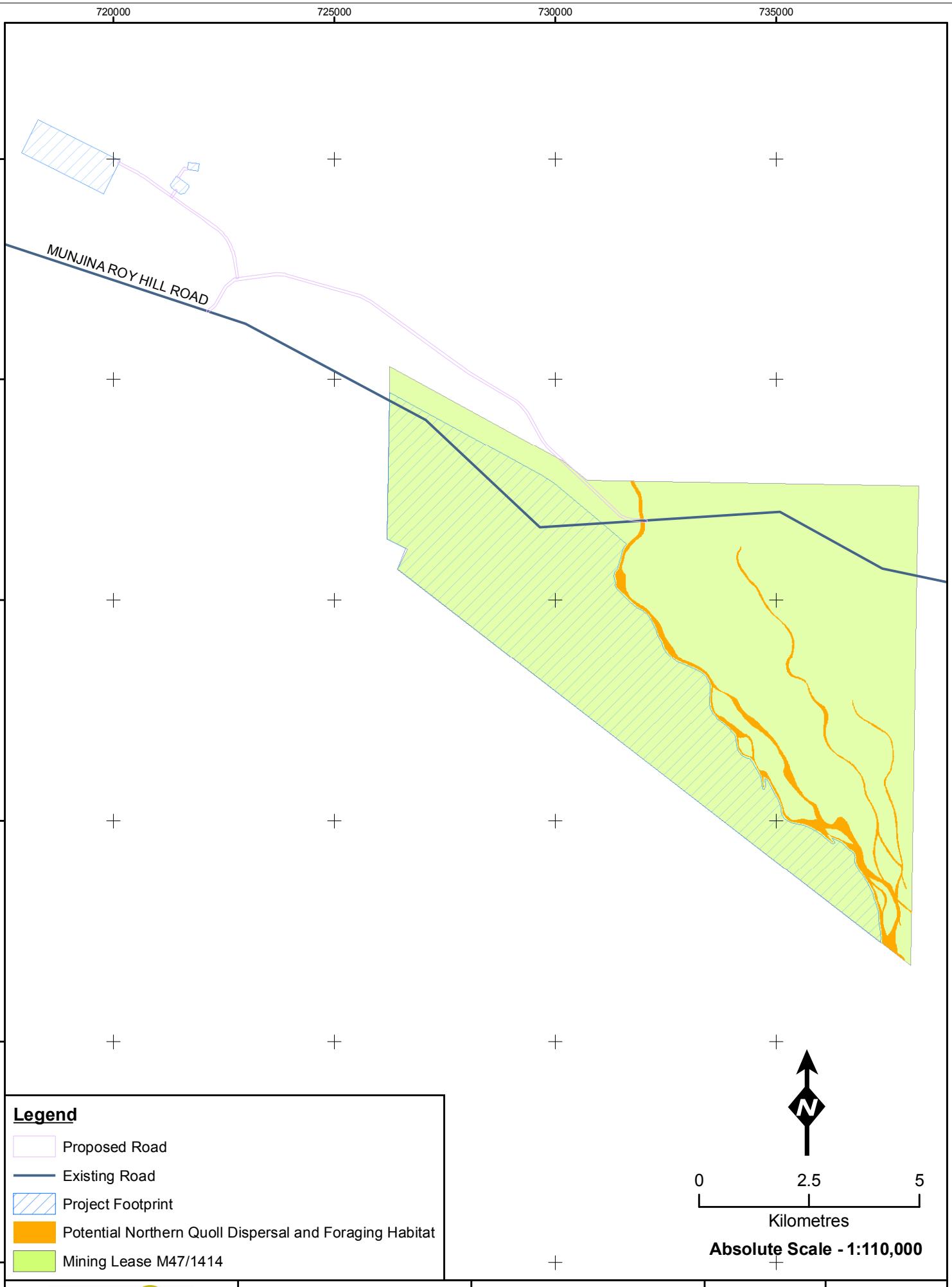

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Potential Northern Quoll Habitat Impacted by Project Footprint

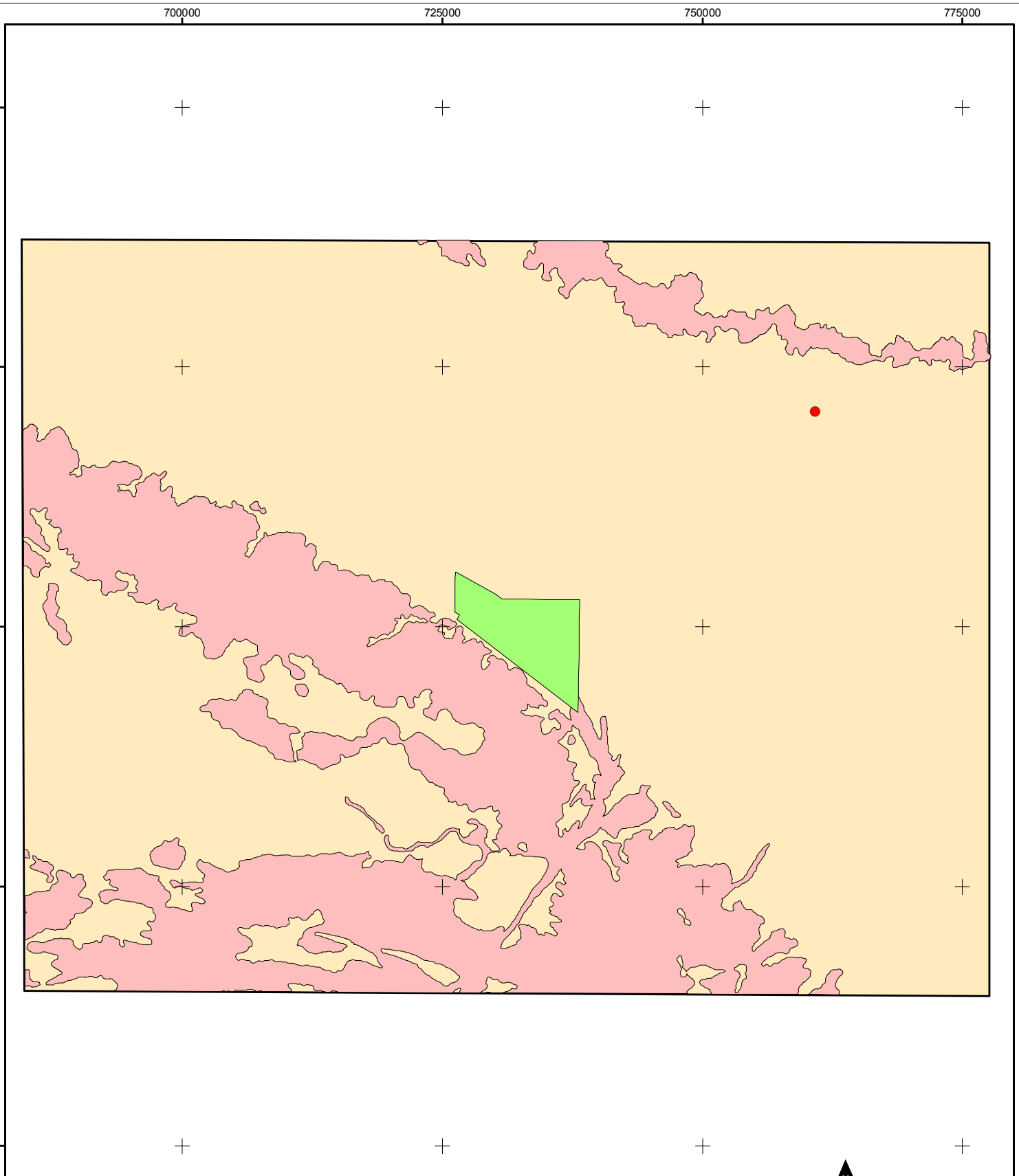
Figure: 1.6
Project ID: 1343

Drawn: KC
Date: 12/09/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: KC069

A4



Legend

- Northern Quoll Records
- Potential Denning and Foraging Habitat
- Regional Habitat Area (~50 km Buffer from Project Area)
- Mining Lease M47/1414

N

0 10 20

Kilometres

Absolute Scale - 1:500,000

ecologia ENVIRONMENT

brockman resources.

Potential Regional Northern Quoll Habitat

Figure: 1.7
Project ID: 1343

Drawn: BG
Date: 27/06/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: BG167

A4

1.1.4 Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*)

Conservation Status: *EPBC Act* Vulnerable

Distribution and Habitat: The Pilbara Leaf-nosed Bat is the Pilbara form of the Orange Leaf-nosed Bat (*Rhinonicteris aurantia*). While it is considered a separate form, formal reclassification has been hampered by the small sample size of the Pilbara population (Armstrong 2008).

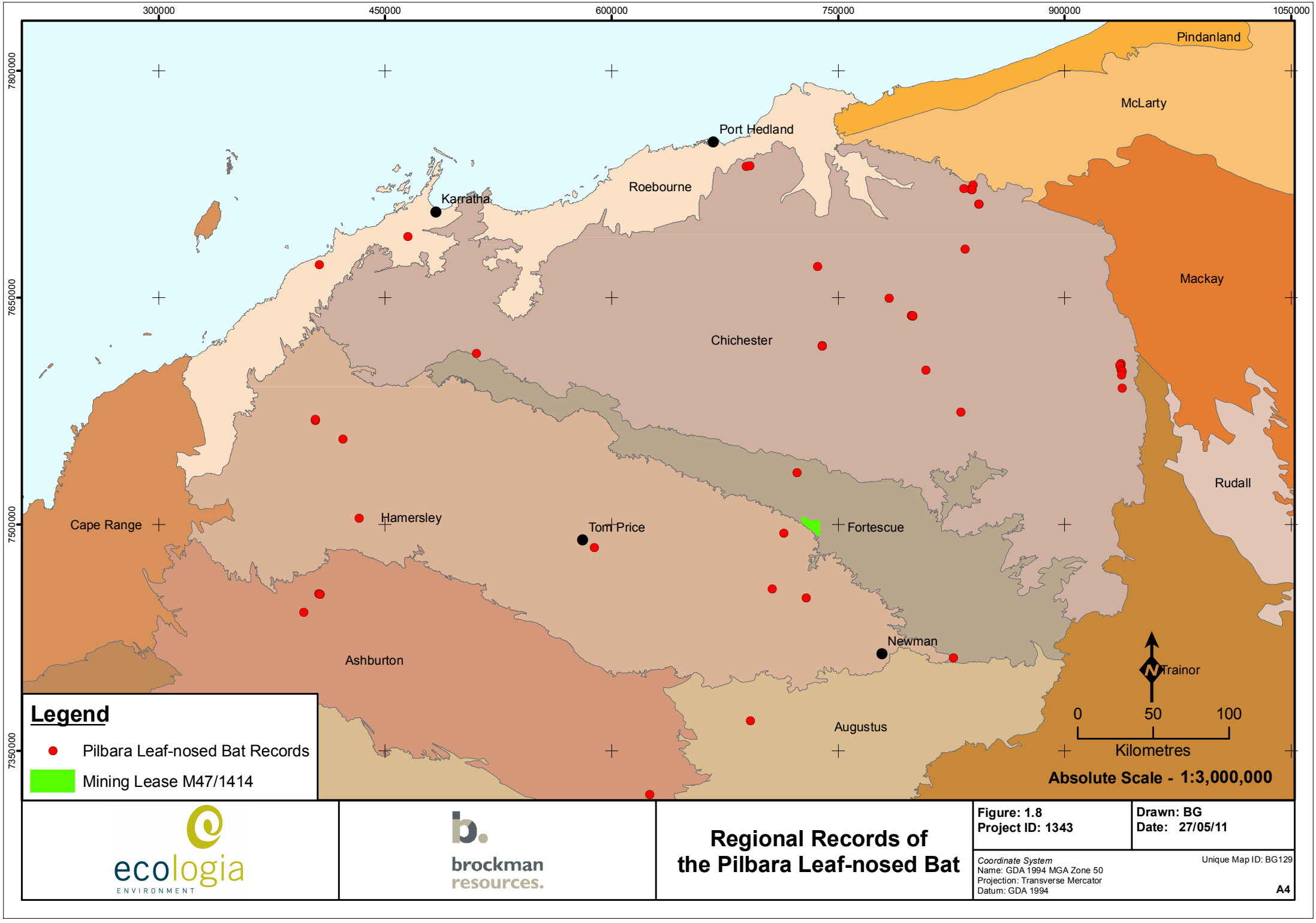
Recent evidence suggests two main stronghold areas for the Pilbara Leaf-nosed Bat; in the western Pilbara and north of Marble Bar (Armstrong 2008). In the western Pilbara, they roost in caves formed in gorges that dissect siliceous sedimentary geology. They are most often observed in flight over waterholes in gorges, although they are rare even in the Hamersley Ranges where this habitat is common (Armstrong 2008). The Pilbara Leaf-nosed Bat roosts in disused mines and areas of high relief with gorges and watercourses (Armstrong 2001). Suitable roosting habitat comprises hot humid caves with temperatures of 28-32^{o} C and a relative humidity of 96-100% (Churchill 2008). They are unlikely to occur in the shallow 'breakaway' caves that occur along mesas and strike ridges.

Ecology: At dusk Pilbara Leaf-nosed Bats emerge from their roosting sites to forage in gorges, small gullies and large watercourses for insects (Van Dyck and Strahan 2008). They are susceptible to disturbance and will abandon roost caves if disturbed. Colonies in mines in the eastern Pilbara are subject to several pressures including human visitation and the collapse and flooding of disused mines (Armstrong 2008; DEWHA 2008c).

Regional Records: Regional records of the Pilbara Leaf-nosed Bat are shown in Figure 1.8 and consist of records from *ecologia* internal database, previous surveys, DEC's Naturebase (DEC 2011) and Global Biodiversity Information Facility (GBIF 2011). Figure 1.8 displays two nearby records. The closest record is from 2008 and located in the Hamersley Ranges approximately 15 kilometres south of the Mining Lease (*ecologia* internal database). The second record is from Thieves Well, north of the Fortescue Marsh approximately 30 kilometres from the Mining Lease (*ecologia* internal database). Additional records are seen to the south of the Mining Lease, within the Hamersley Range area.

Likelihood of Occurrence: No individuals were recorded during the level two vertebrate fauna assessment (see Referral Documents) and no suitable habitat for roosting caves exists within the Mining Lease. However, the riverine system and eucalypt trees of Weeli Wolli creek could potentially be utilised for roost sites by Pilbara Leaf-nosed Bats during the wet season (pers. comm. Bob Bullen). In addition the stony spinifex plains in the Mining Lease could be utilised as foraging habitat by Pilbara Leaf-nosed Bats that roost within the nearby Hamersley Ranges (Figure 1.9). The potential regional habitat of the Pilbara Leaf-nosed Bat, based on occupancy of the Newman, River, Platform, Boolgeeda, McKay and Robe land systems, (Figure 1.10) shows this species is associated with the rocky areas associated with the Hamersley Ranges. Areas close by can also be utilised as foraging habitat.

Due to the relatively close proximity of the Mining Lease to the Hamersley Ranges and based on nearby records, it is considered that the Pilbara Leaf-nosed Bat may occasionally utilise areas of the Mining Lease as foraging habitat. The riverine habitat in the Mining Lease may very rarely provide roost habitat. Therefore there is a medium likelihood of this species occurring within the Mining Lease.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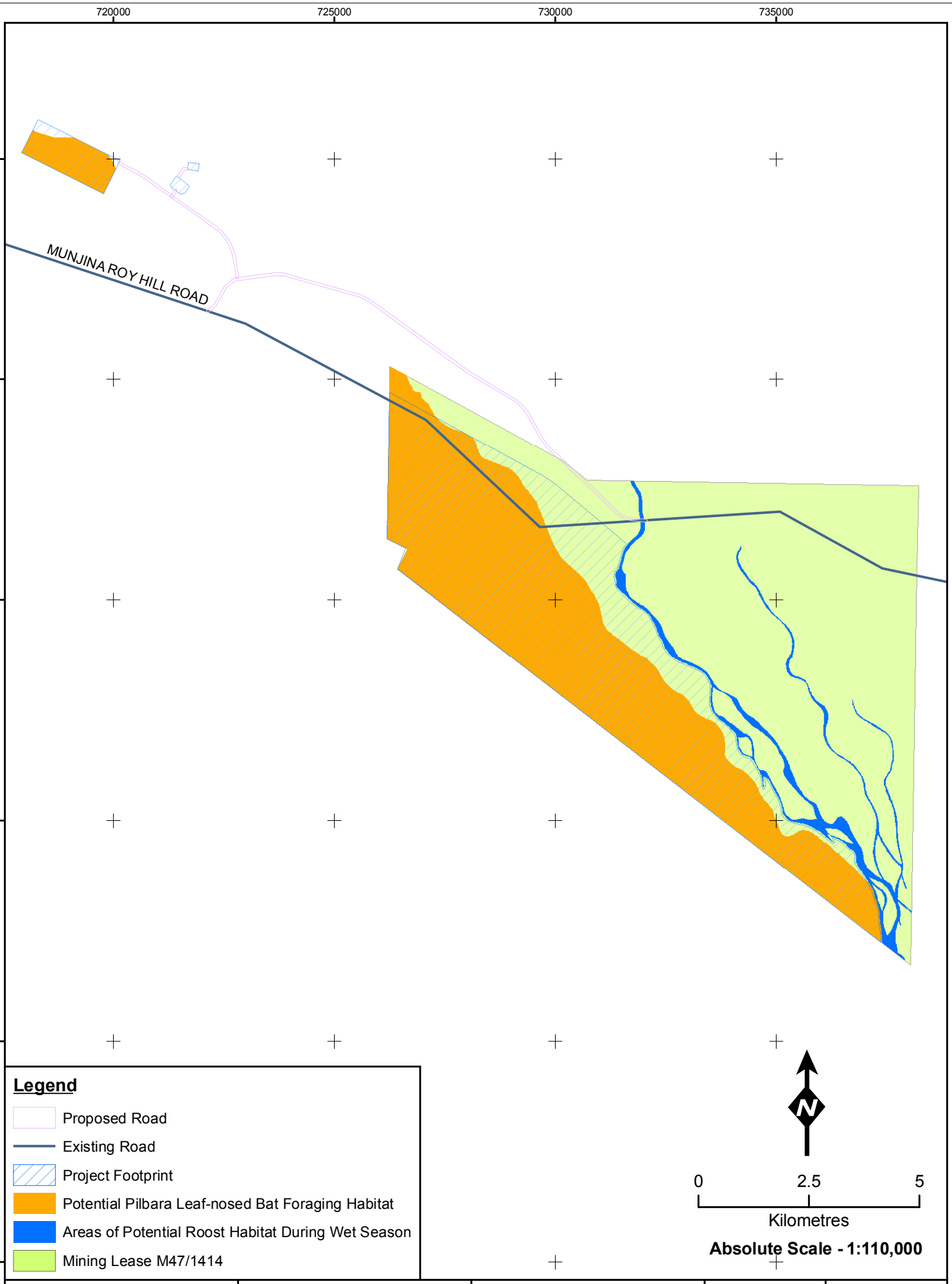
Port Hedland
Roebourne
Karratha
Mackay
Chichester
Rudall
Cape Range
Hamersley
Tom Price
Fortescue
Ashburton
Newman
Augustus
Trainor
0
50
100
Kilometres
Absolute Scale - 1:3,000,000
Legend
Pilbara Leaf-nosed Bat Records
Mining Lease M47/1414
ecologia
ENVIRONMENT
brockman
resources.
Regional Records of
the Pilbara Leaf-nosed Bat
Figure: 1.8
Project ID: 1343
Drawn: BG
Date: 27/05/11
Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994
Unique Map ID: BG129
A4



ecologia ENVIRONMENT

brockman resources.

Potential Pilbara Leaf-nosed Bat Habitat Impacted by Project Footprint

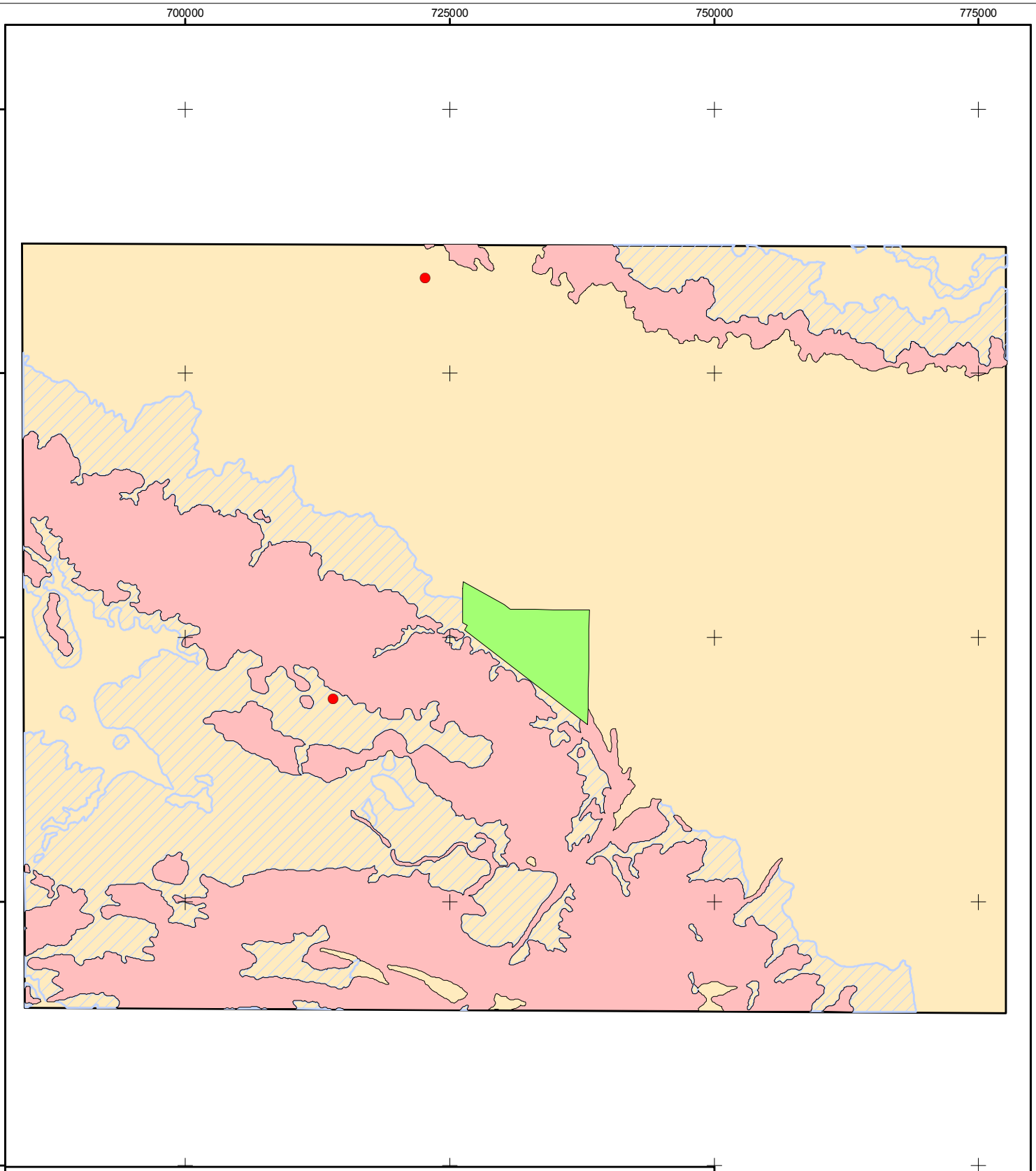
Figure: 1.8
Project ID: 1343

Drawn: KC
Date: 12/09/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: KC071

A4



Legend

- Pilbara Leaf-nosed Bat Records
- Potential Foraging and Roost Site Habitat
- Low Quality Areas that may Contain Patches of Roosting & Foraging Habitat
- Regional Habitat Area (~50 km Buffer from Project Area)
- Mining Lease M47/1414

N

0 10 20

Kilometres

Absolute Scale - 1:500,000

ecologia ENVIRONMENT

brockman resources.

Potential Regional Leaf-nosed Bat Habitat

Figure: 1.10
Project ID: 1343

Drawn: BG
Date: 27/06/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: BG169

A4

1.1.5 Greater Bilby *(Macrotis lagotis)*

Conservation Status: *EPBC Act* Vulnerable

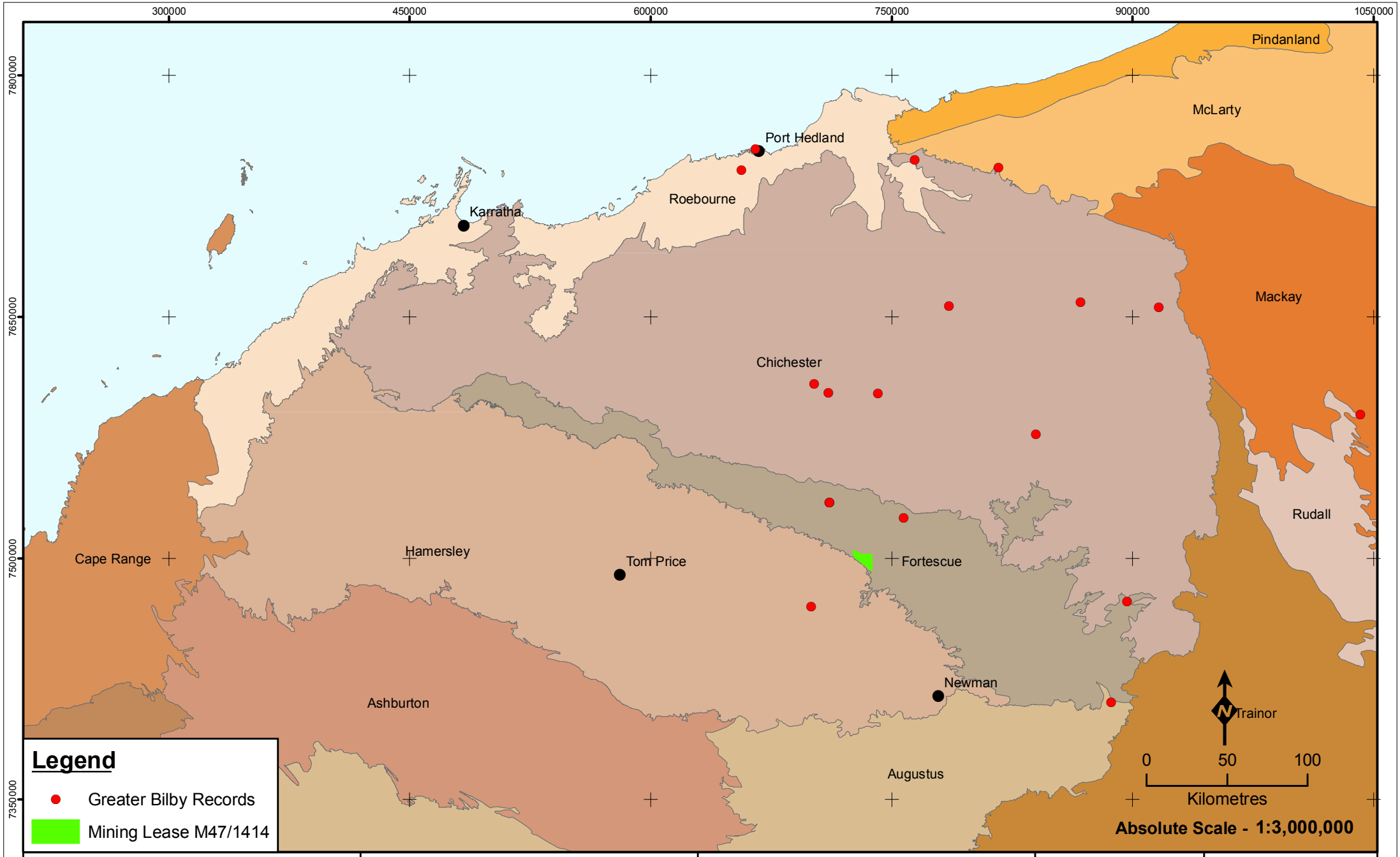
Distribution and Habitat: Once common over 70% of mainland Australia's arid and semiarid regions, Greater Bilbies are currently patchily distributed through the Tanami, Great Sandy and Gibson Deserts (Maxwell *et al.* 1996). There are scattered records from within the Pilbara region, with areas surrounding the Fortescue Marsh appearing to represent the western extremity of their range (DEC 2011). Bilbies occur in a variety of habitats, including spinifex grassland on sandy soils, acacia shrubland, open woodland, and cracking clays (Maxwell *et al.* 1996; Johnson 2008).

Ecology: The Bilby is mainly a solitary omnivorous marsupial. As with all bandicoot species, the Bilby are generalists in their diet and very effective opportunists, exploiting their environment by their wide choice of food, fast growth and rapid reproduction, particularly when conditions are favourable (Tyndale-Biscoe 2005). Their typical diet consists of insects and larvae, seeds, bulbs, fruit and fungi (Van Dyck and Strahan 2008). It uses its strong forelimbs and claws to construct an extensive tunnel system of up to 3 metres long and 1.8 metres deep in which it shelters during the day (Johnson 2008).

Regional Records: Figure 1.11 displays regional records of the Bilby. Records were sourced from *ecologia* internal database, previous surveys, DEC's Naturebase (DEC 2011) and Global Biodiversity Information Facility (GBIF 2011). Figure 1.11 shows there are three relativley close (all approximately 45 kilometers) records to the Mining Lease. The north-west record consisted of a dead individual found in 2004 near Kardardarrie well on Mulga Downs station (Biota 2005). The record to the north-east consisted of seven active burrows in the vicinity of Cockeye Bore (Bamford 2005) while the southern record is from 1995 and consisted of three burrows located in close proximity to a creekline (Ninox 1995).

Likelihood of Occurrence: The Bilby was not recorded during the level two fauna assessment within the Mining Lease, and no secondary evidence such as burrows was recorded. However the spinifex covered sand dunes within the Mining Lease could provide a small amount of suitable denning and foraging habitat (Figure 1.12). In addition, small patches of suitable habitat may be found in areas of acacia woodland and habitat along Weeli Wolli creek within the Mining Lease. It should be noted that a specimen was found in 1995 along a creekline which joins to Weeli Wolli creek, indicating Bilbies potentially may use this river system and others in the area as dispersal routes.

Figure 1.13 displays potential regional Bilby habitat based on occupancy of the Divide, Cowra, Brockman, Marillana, Fan, Turee, Calcrete, River, Fortescue, Jamindie, Coolibah and Christmas land systems which occur in the region. Typically this species is restricted to habitats of soft soil substrate to facilitate its extensive burrowing, potentially within the acacia woodlands that are found extensively in the region. Due to only a small area of quality potential habitat existing within the Mining Lease, and the lack of primary or secondary evidence of occupancy, it is considered there is a low likelihood of Bilbies occurring within the Mining Lease.



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brockman resources.

Regional Records of the Greater Bilby

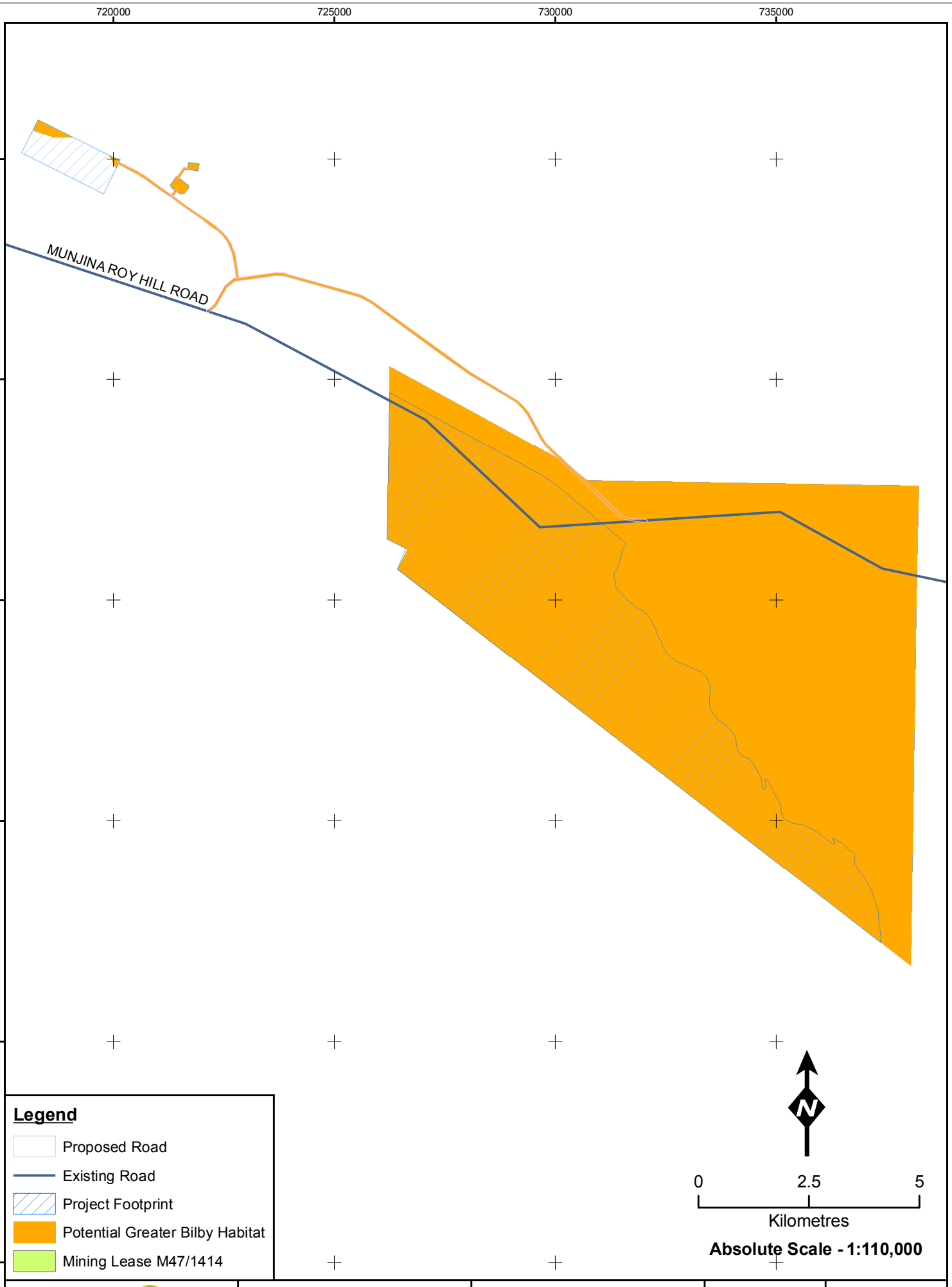
Figure: 1.11
Project ID: 1343

Drawn: BG
Date: 27/05/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: BG128

A4



ecologia ENVIRONMENT

brockman resources.

Potential Greater Bilby Habitat Impacted by Project Footprint

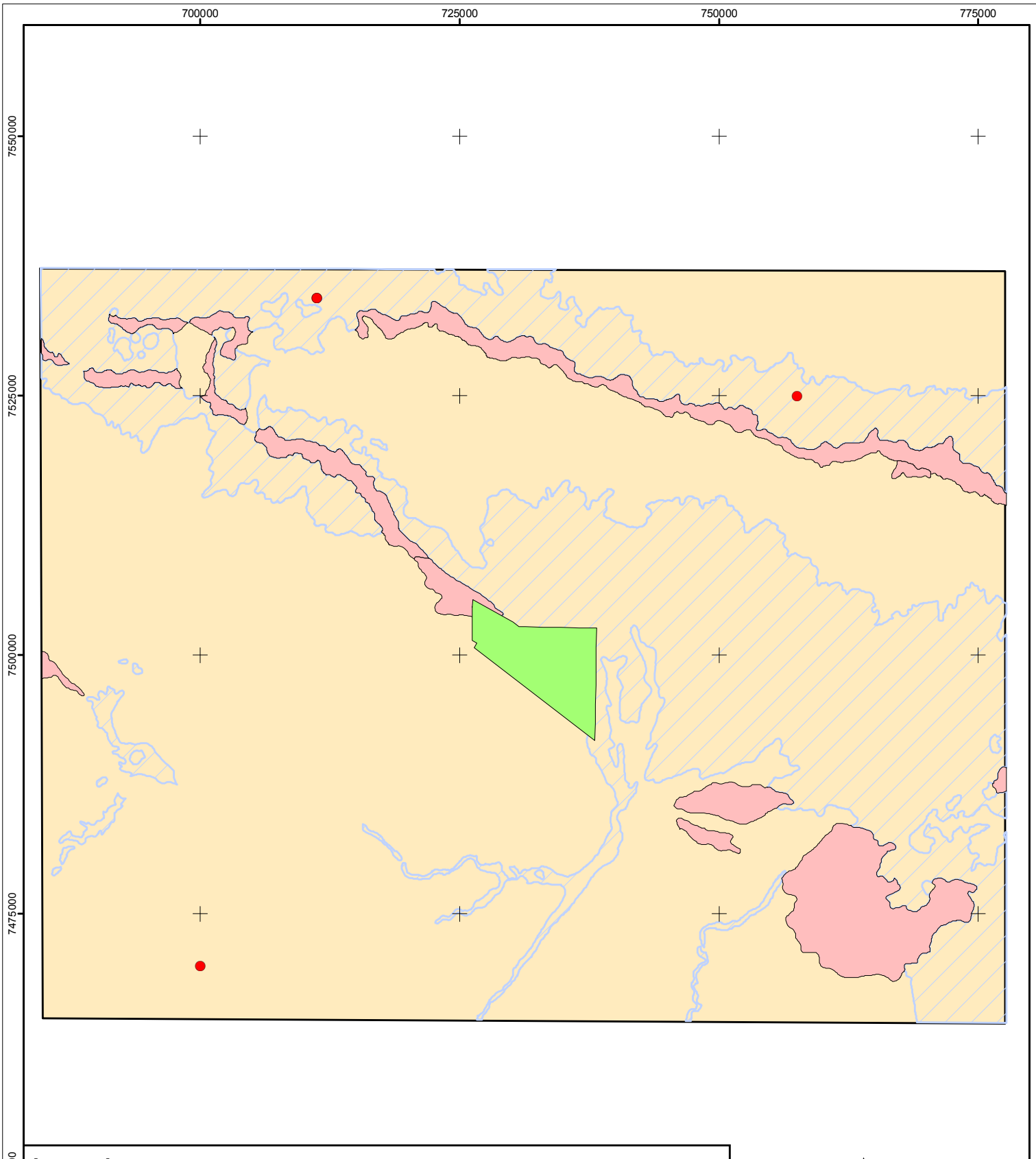
Figure: 1.12
Project ID: 1343

Drawn: KC
Date: 12/09/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: KC065

A4



Legend

- Greater Bilby Records
- Potential Burrowing and Foraging Habitat
- Low Quality Areas that may Contain Patches of Burrowing & Foraging Habitat
- Regional Habitat Area (~50 km Buffer from Project Area)
- Mining Lease M47/1414

N

0 10 20

Kilometres

Absolute Scale - 1:500,000

ecologia ENVIRONMENT

brockman resources.

Potential Regional Greater Bilby Habitat

Figure: 1.13
Project ID: 1343

Drawn: BG
Date: 27/06/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: BG164

A4

1.1.6 Brush-tailed Mulgara (*Dasycercus blythi*)

Conservation Status: *EPBC Act* Vulnerable

Distribution and Habitat: The Brush-tailed Mulgara (*Dasycercus blythi*) has only recently been reclassified and separated from the genetically and morphologically distinct Crest-tailed Mulgara (*Dasycercus cristicauda*) (Woolley 2006), however both species are currently still grouped together and listed as Vulnerable under the *EPBC Act*.

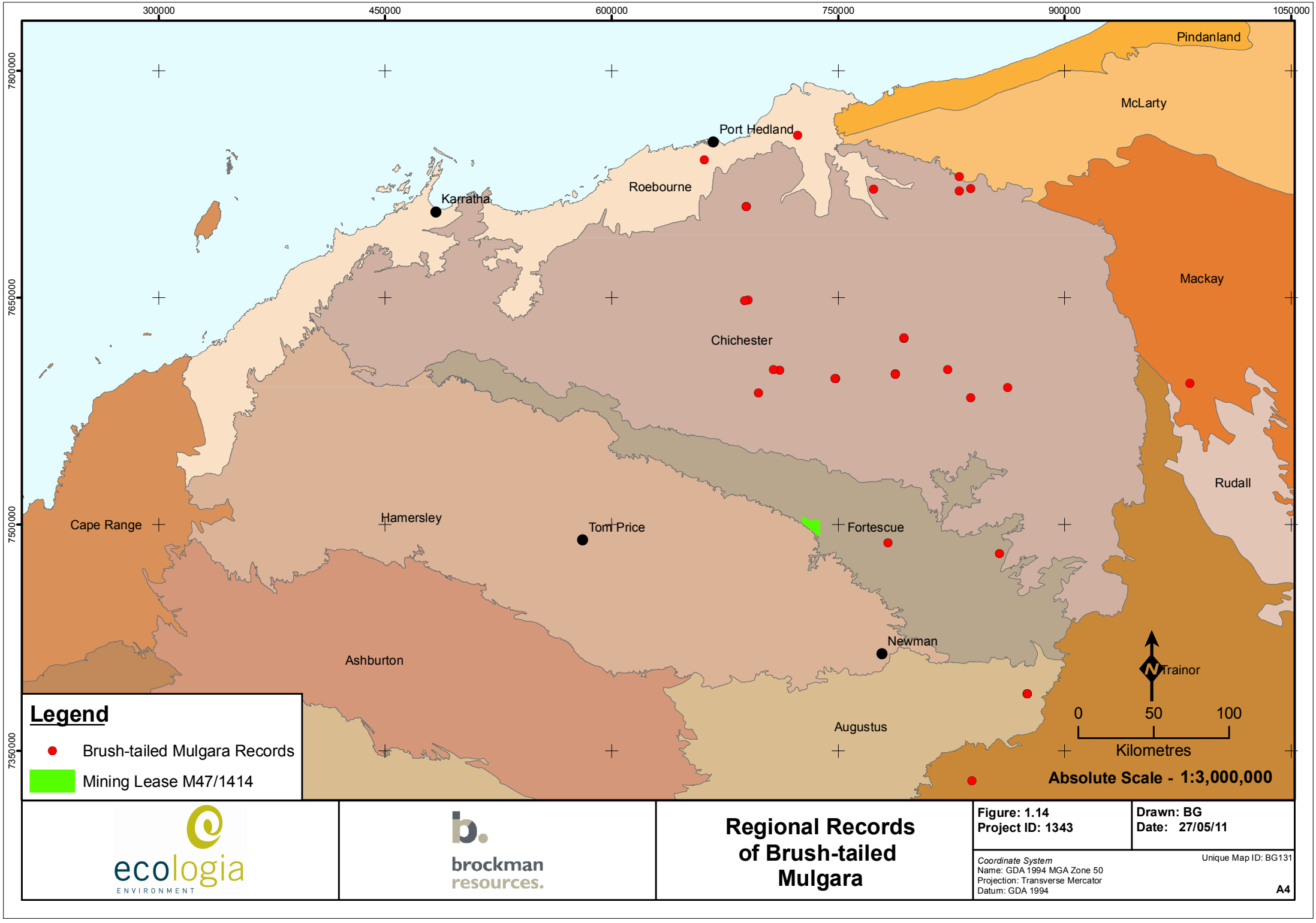
The more widespread Brush-tailed Mulgara is distributed throughout arid Western Australia and Northern Territory whilst the Crest-tailed Mulgara is more restricted to arid southern Northern Territory and northern South Australia (Masters 2008; Woolley 2008). In respect to this assessment, all records and discussion relate to the Brush-tailed Mulgara. The Brush-tailed Mulgara is currently listed as Priority 4 (fauna in need of monitoring) on the DEC Priority and Threatened Fauna list (2008) and it is anticipated the Brush-tailed Mulgara will not be listed under the *EPBC Act* 1999 in the future. Brush-tailed Mulgara occur in spinifex grasslands throughout much of the arid zone, digging burrows in flats between low sand dunes (Woolley 2008).

Ecology: Believed to be generally solitary, Brush-tailed Mulgara construct several single entranced, multi-tunnelled burrows within their home range (Woolley 2008). According to Koertner *et al.* (2007), home ranges and burrows encompass both mature spinifex and open regrowth areas, of which Brush-tailed Mulgara do not prefer one of either habitat type. Brush-tailed Mulgara are nocturnal hunters, feeding on arthropods and small vertebrates. Breeding is believed to occur in late winter to spring (Woolley 2008).

Regional Records: Figure 1.14 shows previous surrounding records, with the closest record approximately 50 kilometers to the east of the Mining Lease. The majority of regional records of the Mulgara are located approximately 100 km north of the Mining Lease, where more suitable habitat is present.

Liklihood of Occurrence: Figure 1.15 shows the area of potential habitat impact within the Mining Lease. This potential habitat is restricted to the sandy areas of the spinifiex plains and hillslope habitat, where the Brush-tailed Mulgara could construct its burrows. The potential regional habitat for Brush-tailed Mulgara (Figure 1.16), (based on occupancy of the Divide, Cowra and Urandi land systems) is restricted to habitats with a relatively soft soil substrate. This allows the Brush-tailed Mulgara to construct its burrows. These habitats are generally located in close proximity to the Fortescue Marsh and associated floodplains, where moisture of the soil is generally greater than the surrounding landscape.

Due to the lack of surrounding records and the small size of the area of potential habitat within the Mining Lease, it is considered low likelihood that Brush-tailed Mulgaras occur in the Mining Lease.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Karratha
Mackay
Chichester
Rudall
Cape Range
Hamersley
Tom Price
Fortescue
Newman
Ashburton
Augustus
Trainor
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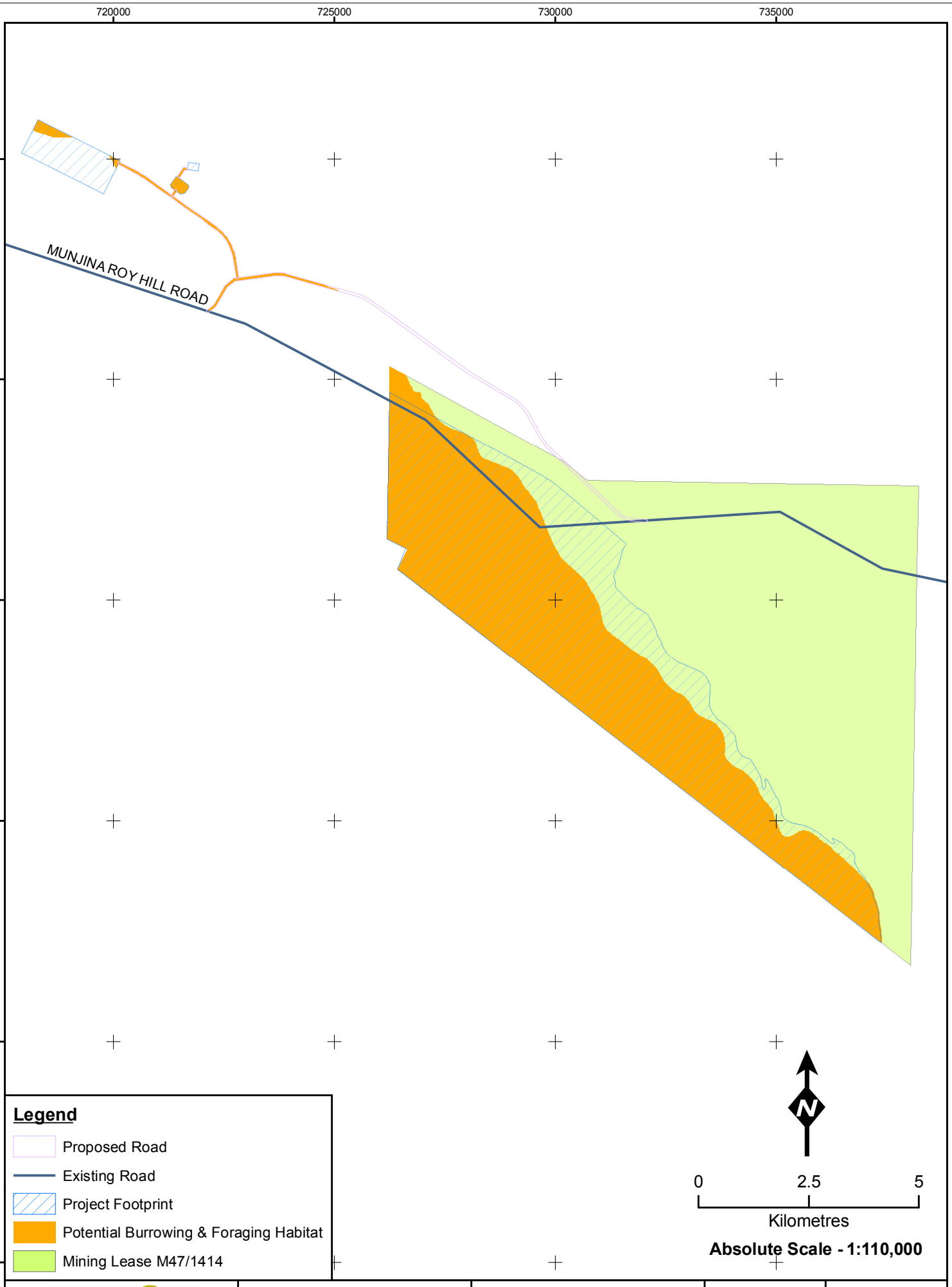
Kilometres
Absolute Scale - 1:3,000,000
Legend
Brush-tailed Mulgara Records
Mining Lease M47/1414
ecologia
ENVIRONMENT
brockman
resources.
Regional Records of Brush-tailed Mulgara
Figure: 1.14
Project ID: 1343
Drawn: BG
Date: 27/05/11
Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994
Unique Map ID: BG131
A4



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brockman resources.

Potential Brush-tailed Mulgara Habitat Impacted by Project Footprint

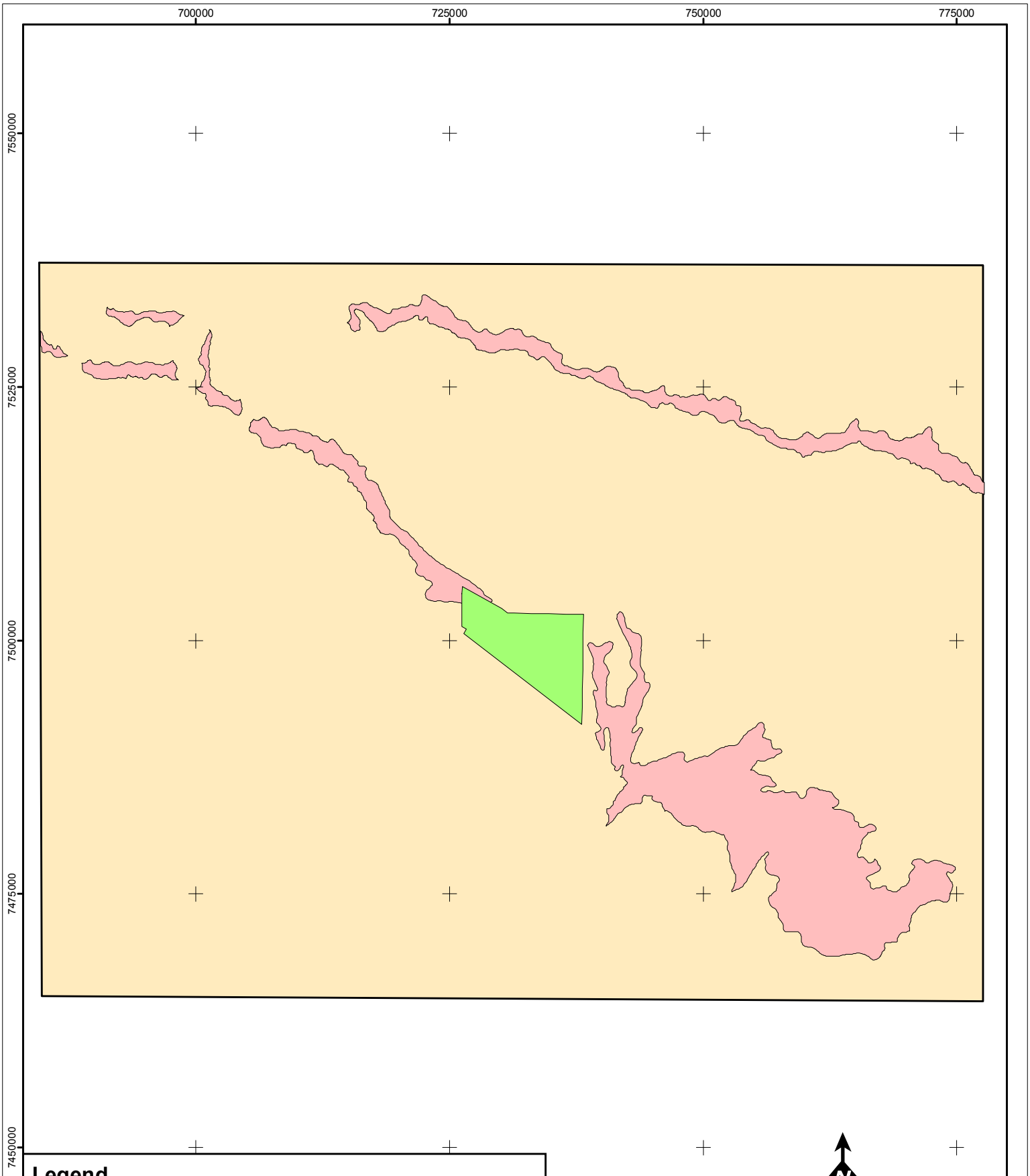
Figure: 1.15
Project ID: 1343

Drawn: KC
Date: 12/09/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: KC064

A4



Legend

- Brush-tailed Mulgara Records (zero records)
- Potential Burrowing and Foraging Habitat
- Regional Habitat Area (~50 km Buffer from Project Area)
- Mining Lease M47/1414

N

0 10 20

Kilometres

Absolute Scale - 1:500,000

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brockman resources.

Potential Regional Mulgara Habitat

Figure: 1.16
Project ID: 1343

Drawn: BG
Date: 30/5/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: BG134

A4

1.1.7 Pilbara Olive Python (*Liasis olivaceus barroni*)

Conservation Status: *EPBC Act* Vulnerable

Distribution and Habitat: The Pilbara Olive Python is found throughout the Pilbara with the extremities of its range bounded by the Tropic of Capricorn in the South, the North West Coast Highway in the West, the Indian Ocean in the North, and the Great Sandy Desert in the East. In the Pilbara it inhabits watercourses, riverine woodland, and areas of permanent water in rocky gorges and gullies (Pearson 2006). It is often found directly adjacent to pools of water, usually among rocks and water plants, and sometimes even submerged. Permanent water is thought to be important for attracting prey species. Though primarily found in close proximity to water, overburden heaps and railway embankments may also be utilised.

Ecology: This subspecies is an adept swimmer, often hunting in water, feeding on a variety of vertebrates including rock wallabies, fruit bats, ducks, and pigeons. Individuals spend the cooler winter months sheltering in caves and rock crevices. In the warmer months the pythons can distribute extensively, usually in close proximity to water and rock outcrops (DEWHA 2008a). In late winter or early spring males will travel large distances to find and mate with females.

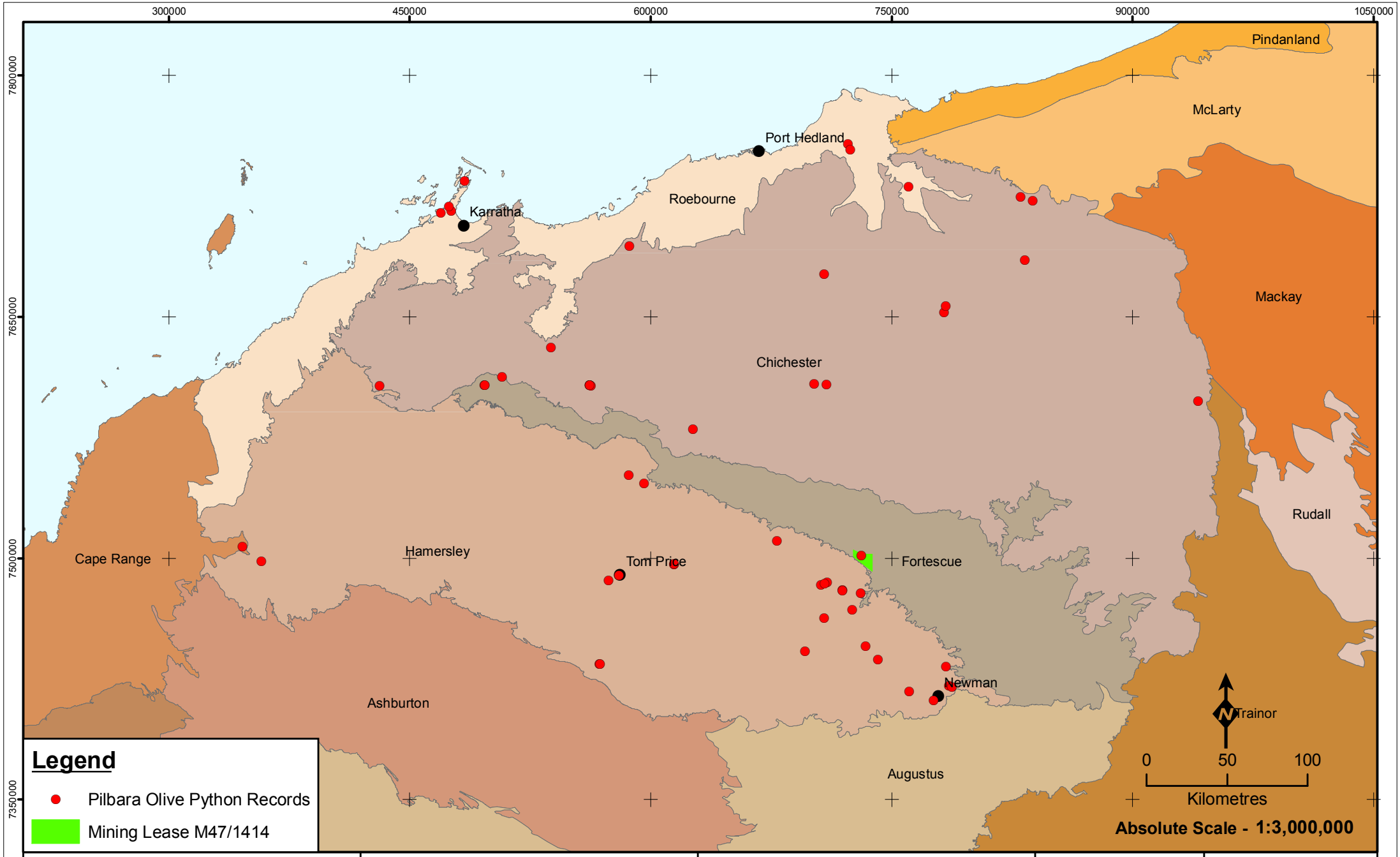
Radiotelemetry has found that individuals spend the cooler winter months sheltering in caves and rock crevices, often some distance from permanent water. In the warmer months the pythons can move widely, usually in close proximity to water and rock outcrops (TSSC 2008).

Regional Records: A Pilbara Olive Python was recorded in the Mining Lease in 2008 (ENV Australia 2008). The individual was freshly killed by a large Perentie (goanna) and is thought to have been dug up from below a signal control box on the railway corridor. In addition to this record within the Mining Lease, there are numerous records to the south of the Mining Lease (Figure 1.17) within the Hamersley Ranges.

Likelihood of Occurrence: Pilbara Olive Pythons were not recorded during the level two fauna assessment within the Mining Lease. However, a previous survey recorded one individual thus confirming that the Pilbara Olive Python occurs within the Mining Lease.

This species prefers to inhabit rocky gorges and escarpments more typically found in the nearby Hamersley Range, but may be attracted to the Weeli Wolli Creek for hunting, or as a conduit to dispersal, when water is present. As such the riverine habitat in the Mining Lease can be considered as dispersal habitat (Figure 1.18). Figure 1.19 displays the potential regional habitat (based on occupancy of the Robe, River, Newman and Platform land systems) for Pilbara Olive Pythons. The rocky ranges south of the Mining Lease throughout the Hamersley Ranges represent potential habitat for this species and the numerous records in this area confirms the suitability of this area for the Pilbara Olive Python (Figure 1.17).

Due to an absence of typically rocky habitat within the Mining Lease, for most of the year the species is unlikely to occur within the Mining Lease. The recording of an individual within the Mining Lease confirms that the Pilbara Olive Python does utilise areas within the Mining Lease with Weeli Wolli Creek providing suitable habitat. Hence the Pilbara Olive Python is considered a medium likelihood of occurring within the Mining Lease.



ecologia ENVIRONMENT

brockman resources.

Regional Records of the Pilbara Olive Python

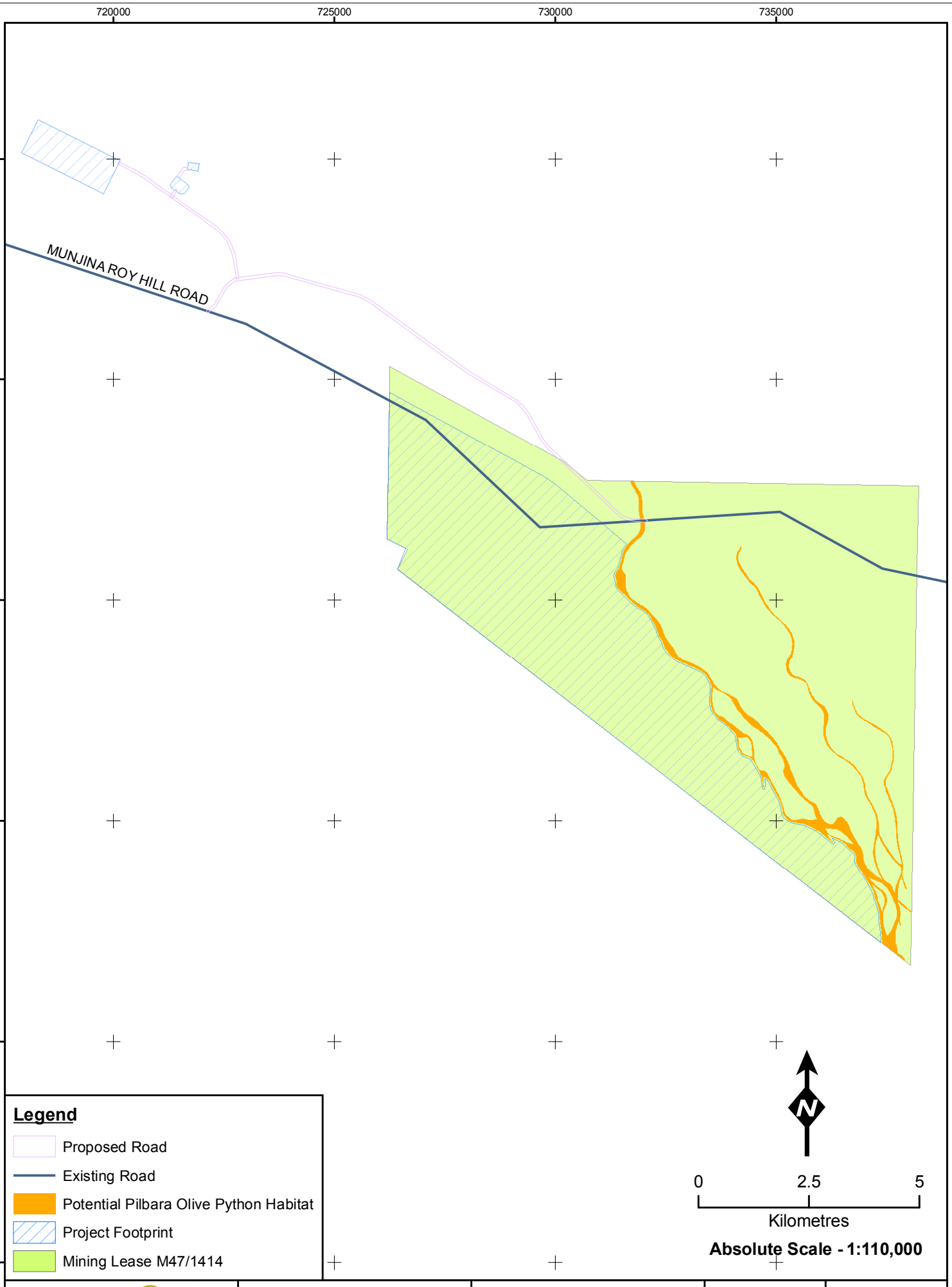
Figure: 1.17
Project ID: 1343

Drawn: BG
Date: 27/05/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: BG130

A4



ecologia ENVIRONMENT

brockman resources.

Potential Olive Python Habitat Impacted by Project Footprint

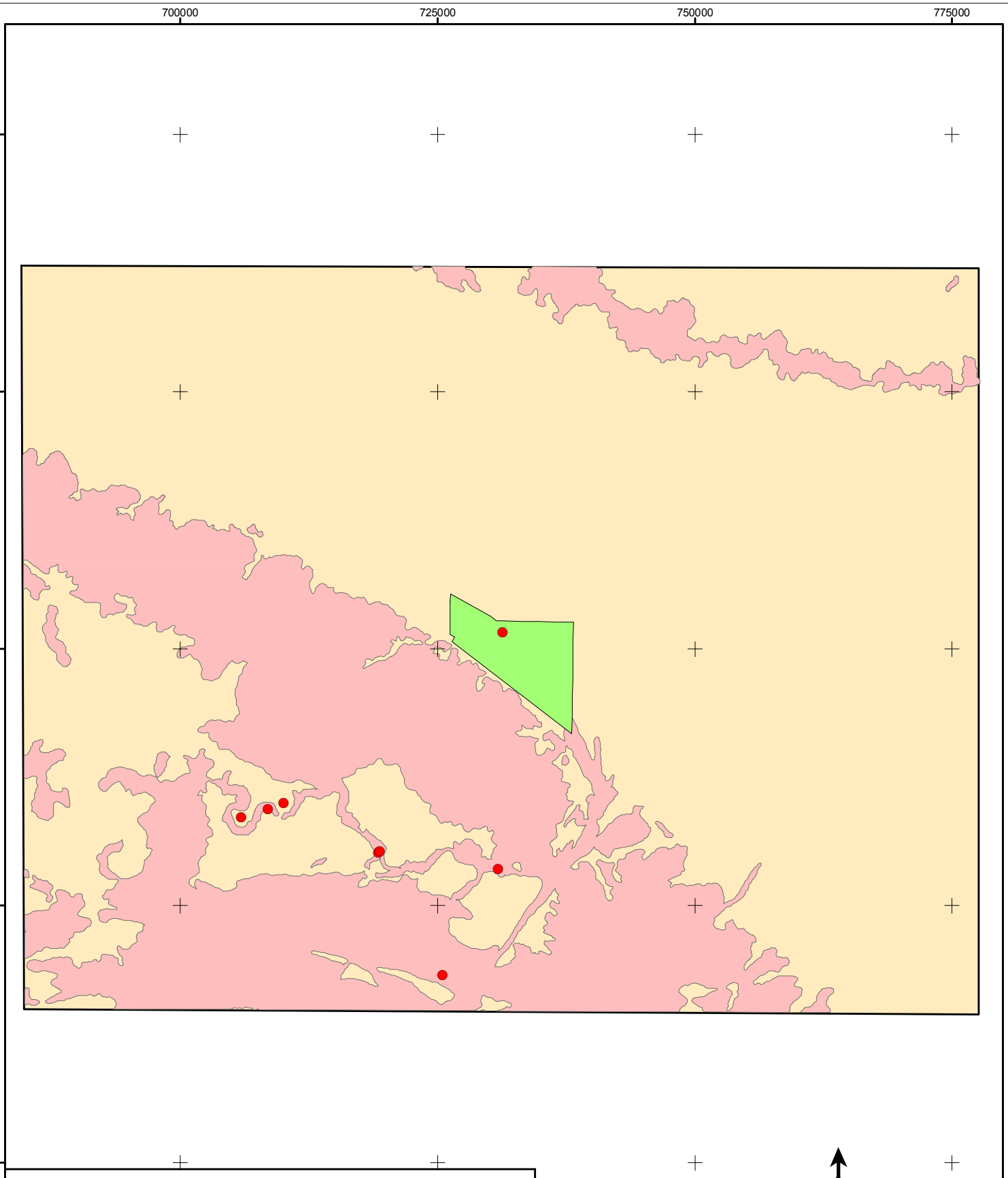
Figure: 1.18
Project ID: 1343

Drawn: KC
Date: 12/09/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: KC070

A4



Legend

- Pilbara Olive Python Records
- Potential Olive Python Habitat
- Regional Habitat Area (~50 km Buffer from Project Area)
- Mining Lease M47/1414

N

0 10 20

Kilometres

Absolute Scale - 1:500,000

ecologia ENVIRONMENT

brockman resources.

Potential Regional Pilbara Olive Python Habitat

Figure: 1.19
Project ID: 1343

Drawn: BG
Date: 27/06/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: BG168

A4

1.1.8 EPBC Act Listed Migratory Species

1.1.9 Night Parrot

Refer to section 1.1.2.

1.1.10 Rainbow Bee-eater (*Merops ornatus*)

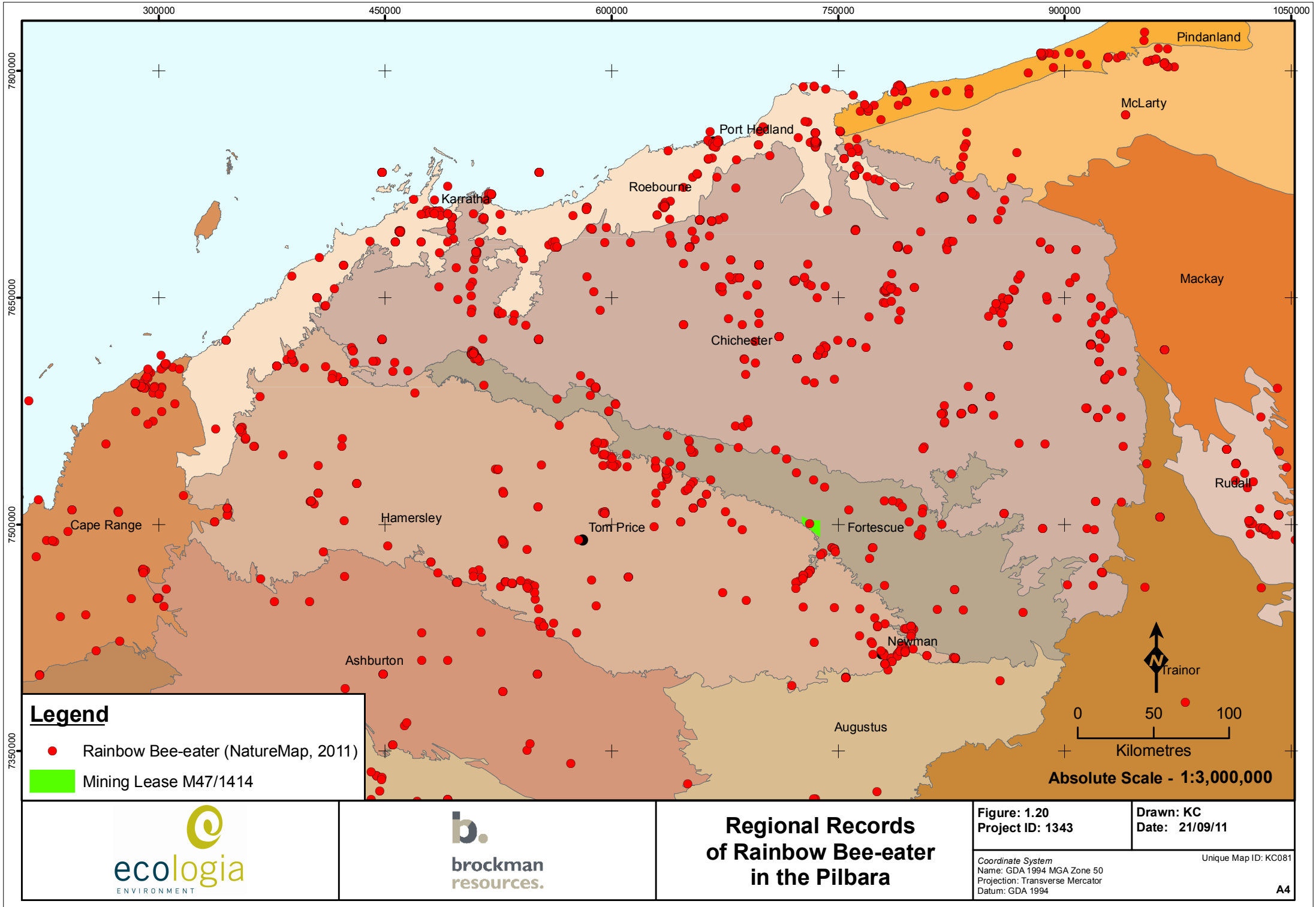
Conservation Status: *EPBC Act* Migratory

Distribution and Habitat: The Rainbow Bee-eater is scarce to common throughout much of Western Australia, except for the arid interior, preferring lightly wooded, preferably sandy country near water (Johnstone and Storr 1998).

Ecology: In Western Australia the Rainbow Bee-eater can occur as a resident, breeding visitor, post-nuptial nomad, passage migrant or winter visitor. It nests in burrows usually dug at a slight angle on flat ground, sandy banks or cuttings, and often at the margins of roads or tracks (Simpson and Day 2004). Eggs are laid at the end of the metre long burrow from August to January (Boland 2004). Due to their nesting characteristics, Bee-eaters are very susceptible to predation.

Regional Records: A total of thirteen observations of the Rainbow Bee-eater were made during the level two fauna assessment within the Mining Lease (*ecologia* 2008). The locations of the sightings were mainly distributed along Weeli Wolli creek, which represents suitable habitat for the Rainbow Bee-eater. The species is a regularly recorded and widespread species throughout the Pilbara and Western Australia. Figure 1.20 shows previous records of this species throughout the Pilbara (DEC 2011). In addition the Rainbow Bee-eater was recorded on 65 previous surveys in the Pilbara (*ecologia* internal database).

Likelihood of Occurrence: The Rainbow Bee-eater was recorded during the level two fauna assessment and was sighted in numerous surrounding and regional surveys. There is a high likelihood of this species occurring within the Mining Lease (Figure 1.21).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Mackay
Chichester
Rudall
Cape Range
Hamersley
Tom Price
Fortescue
Newman
Ashburton
Augustus
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Absolute Scale - 1:3,000,000
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Rainbow Bee-eater (NatureMap, 2011)
Mining Lease M47/1414
ecologia
ENVIRONMENT
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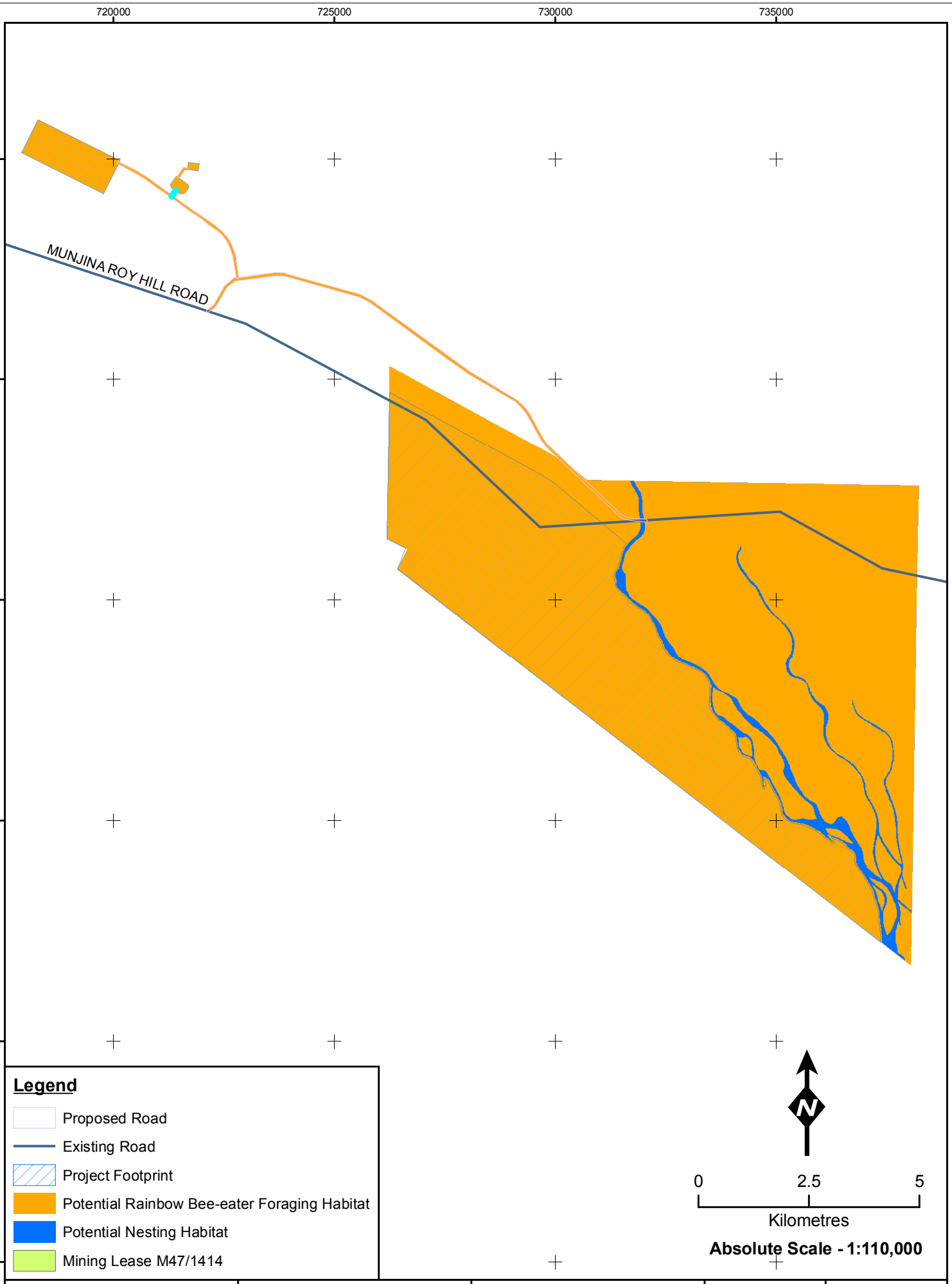
resources.
Regional Records
of Rainbow Bee-eater
in the Pilbara
Figure: 1.20
Project ID: 1343
Drawn: KC
Date: 21/09/11
Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994
Unique Map ID: KC081
A4



ecologia ENVIRONMENT

brockman resources.

Potential Rainbow Bee-eater Habitat Impacted by Project Footprint

Figure: 1.21
Project ID: 1343

Drawn: KC
Date: 12/09/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: KC072

A4

1.1.11 Fork-tailed Swift (*Apus pacificus*)

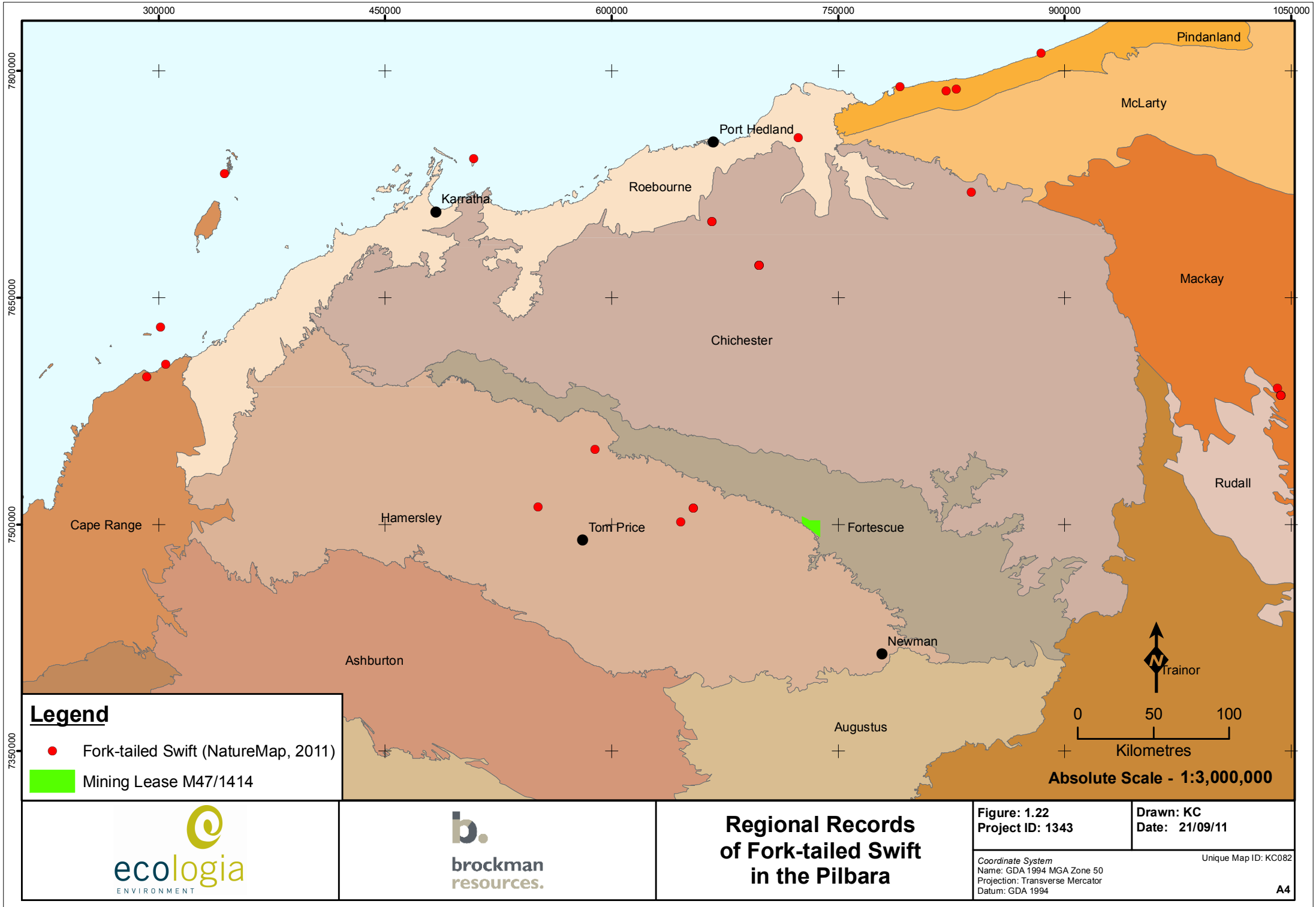
Conservation Status: *EPBC Act* Migratory

Distribution and Habitat: The Fork-tailed Swift is distributed from central Siberia and throughout Asia, breeding in north-east and mid-east Asia, and wintering in Australia and south New Guinea. It is a relatively common trans-equatorial migrant from October to April throughout mainland Australia (Simpson and Day 2004). In Western Australia the species begins to arrive in the Kimberley in late September, the Pilbara in November and in the South-west by mid-December (Johnstone and Storr 1998). In Western Australia, the Fork-tailed Swift is considered uncommon to moderately common near the north-west, west and south-east coasts, common in the Kimberley and rare or scarce elsewhere (Johnstone and Storr 1998).

Ecology: Fork-tailed Swifts are nomadic in response to broad-scale weather pattern changes. They are attracted to thunderstorms where they can be seen in flocks, of occasionally up to 2,000 birds. They rarely land, living almost exclusively in the air and feeding entirely on aerial insects, especially nuptial swarms of beetles, ants, termites and native bees (Simpson and Day 2004).

Regional Records: NatureMap lists a number of records in surrounding areas to the Mining Lease (Figure 1.22). In addition the *ecologia* internal database includes records of the Fork-tailed Swift from 11 previous surveys throughout the Pilbara, with the closest records approximately 50 km of the Mining Lease.

Likelihood of Occurrence: Due to the highly nomadic nature of the Fork-tailed Swift, it is likely to occasionally overfly the Mining Lease. Therefore there is a medium likelihood of the Fork-tailed Swift occurring in the Mining Lease.



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Regional Records of Fork-tailed Swift in the Pilbara

Figure: 1.22
Project ID: 1343

Drawn: KC
Date: 21/09/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: KC082

A4

1.1.12 White-bellied Sea-Eagle (*Haliaeetus leucogaster*)

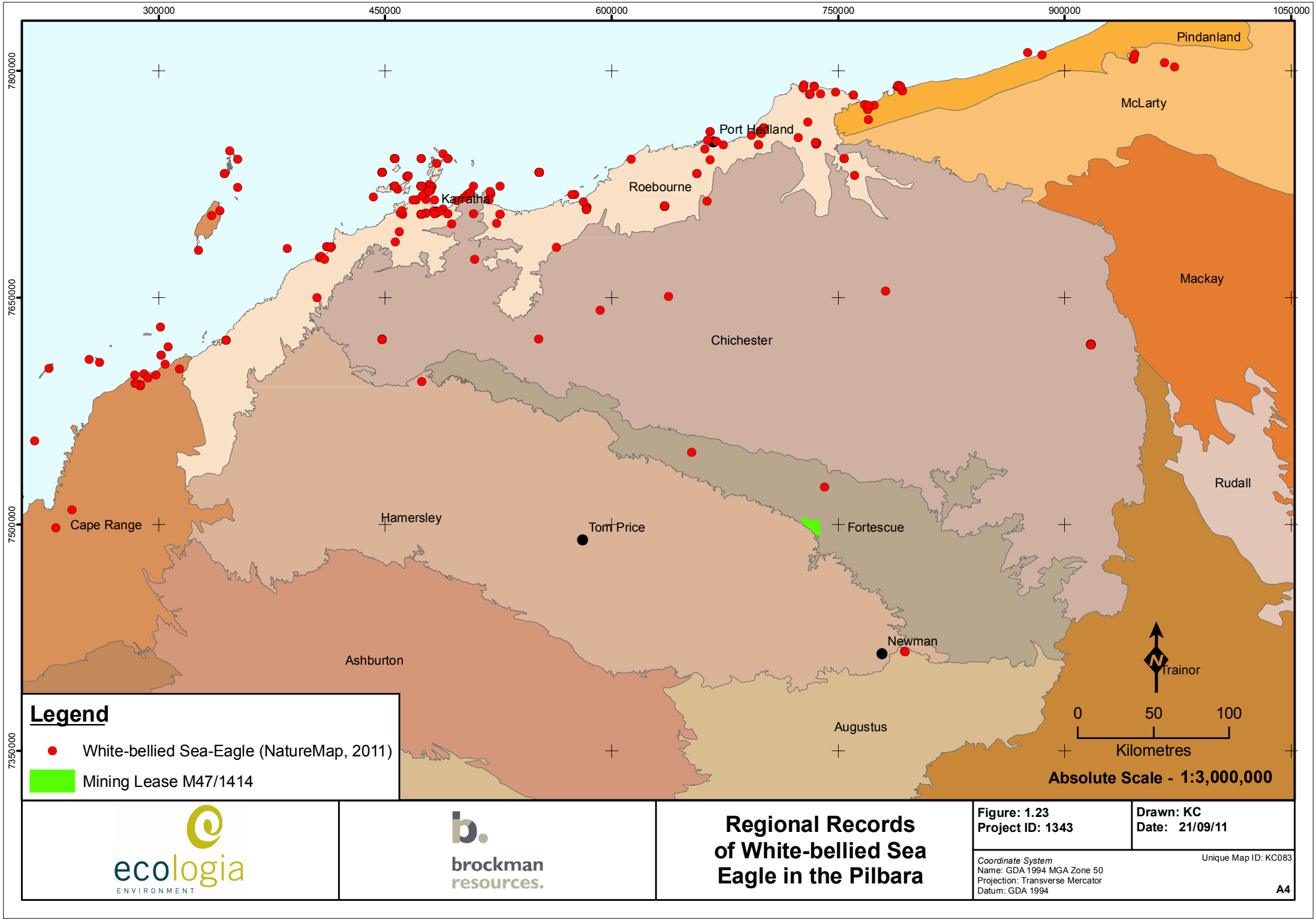
Conservation Status: *EPBC Act* Migratory

Distribution and Habitat: The White-bellied Sea-Eagle is found throughout coastal Australia, New Guinea, Indonesia, China, south-east Asia and India. White-bellied Sea-eagles occur in coastal and near coastal areas across Australia inhabiting most types of habitats except closed forest. They are also found along large rivers, fresh and saline lakes and reservoirs (Simpson and Day 2004).

Ecology: The White-bellied Sea-Eagle feeds mainly off aquatic animals such as fish, turtles and sea snakes, but it also may predate birds and mammals. It breeds almost exclusively on islands, building a large stick nest which is used for many seasons in succession (Johnstone and Storr 1998; RPS 2008). The breeding season ranges from May to September in Australia's north and across winter and spring in Australia's south (Morcombe 2000).

Regional Records: NatureMap shows the White-bellied Sea-Eagle is predominately recorded along the Pilbara coast; however there are scattered records further inland in the proximity of the Fortescue Marsh and the Mining Lease (Figure 1.23). This species has also been previously recorded at Minga Well (*ecologia* internal database), approximately 27 kilometres from the Mining Lease. Generally there is limited regional suitable habitat for this species throughout the inland Pilbara region.

Likelihood of Occurrence: The White-bellied Sea-Eagle is known to occur at times in the vicinity of the Fortescue Marsh within 30 km of the Mining Lease, and may forage in the creekline habitat following heavy rainfall (Figure 1.25). However due to an absence of suitable habitat in the form of a large river system it is considered low likelihood that the White-bellied Sea-Eagle occurs within the Mining Lease.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White-bellied Sea-Eagle (NatureMap, 2011)
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Regional Records of White-bellied Sea Eagle in the Pilbara
Figure: 1.23
Project ID: 1343
Drawn: KC
Date: 21/09/11
Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994
Unique Map ID: KC083
A4

1.1.13 Eastern Great Egret (*Ardea modesta / Ardea Alba*)

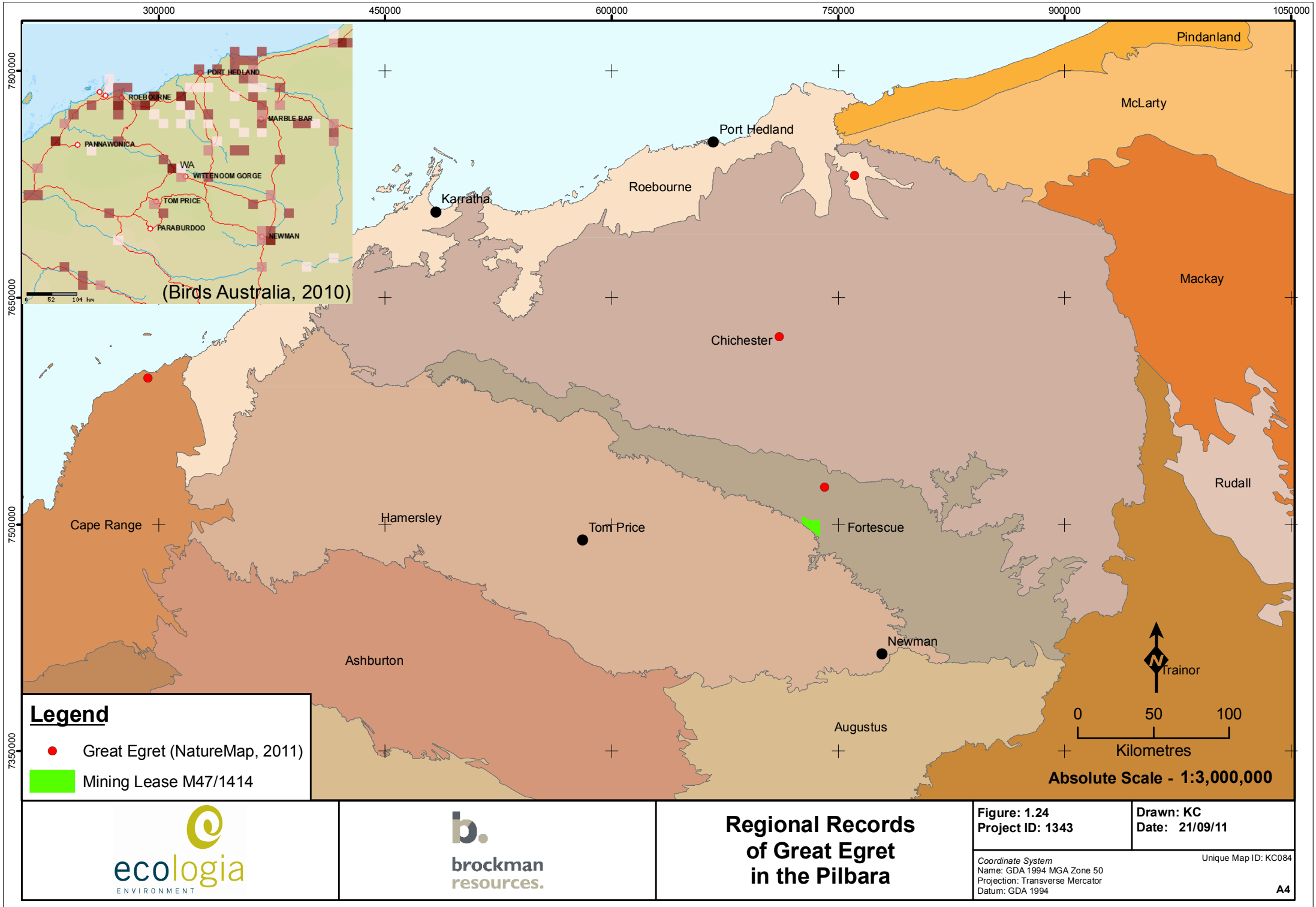
Conservation Status: *EPBC Act* Migratory

Distribution and Habitat: Eastern Great Egrets mainly inhabit shallow water bodies; both fresh (lakes, lagoons, swamps and floodwaters) and saline (mangrove creeks, estuaries and tidal pools) (Johnstone and Storr 1998). They occur across a large part of Western Australia, including the south-west, Kimberley and Pilbara (Johnstone and Storr 1998).

Ecology: An Eastern Great Egret diet consists predominantly of small fish and crustaceans. They breed in colonies in trees that stand around wooded swamps and river pools, 4-13 m above water (Morcombe 2000). The nest is built as a rough, loose, shallow platform. Four eggs are laid in summer in the Kimberley and during the spring in regions further south (Johnstone and Storr 1998).

Regional Records: NatureMap lists only four records of the Eastern Great Egret (*Ardea Alba*); however Birdata reveals many records throughout the Pilbara (Figure 1.24). In addition, 12 previous surveys in the Pilbara recorded this species (*ecologia* internal database).

Likelihood of Occurrence: Following periods of heavy rainfall, there is potential for the Eastern Great Egret to occur within the Fortescue Marsh and surrounding tributaries and catchment. Riverine habitat in relation to Weeli Wolli creek in the Mining Lease may provide suitable habitat during these times of high rainfall (Figure 1.25). Due to the spasmodic nature of high rainfall events in the region, and relatively few surrounding records, the Eastern Great Egret can be considered as a low likelihood of occurrence in the Mining Lease.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Great Egret (NatureMap, 2011)
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Regional Records
of Great Egret
in the Pilbara
Figure: 1.24
Project ID: 1343
Drawn: KC
Date: 21/09/11
Coordinate System
Name: GDA 1994 MGA Zone 50
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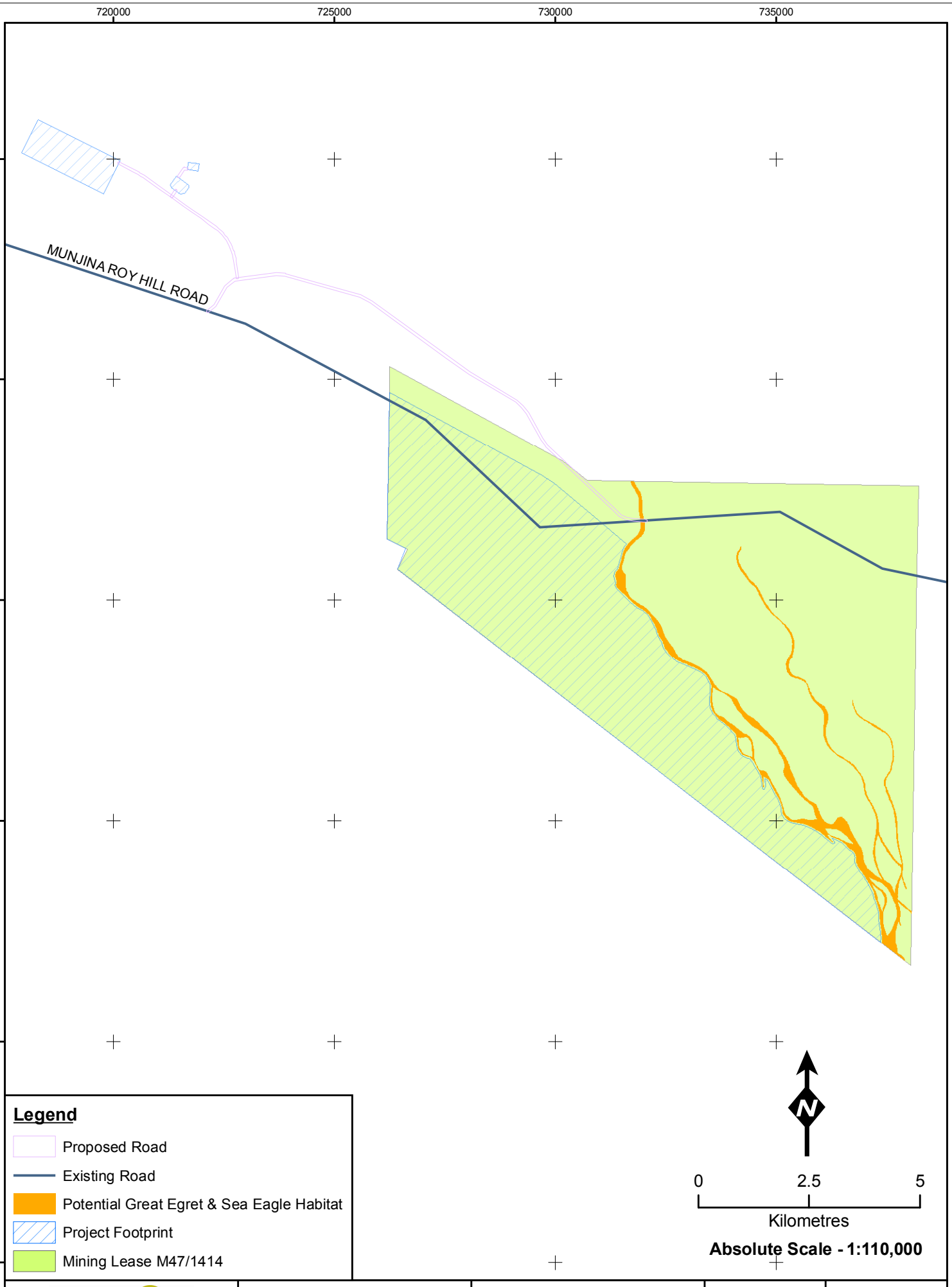

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Potential Great Egret & Sea Eagle Habitat Impacted by Project Footprint

Figure: 1.25
Project ID: 1343

Drawn: KC
Date: 12/09/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: KC068

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1.1.14 Cattle Egret (*Ardea ibis*)

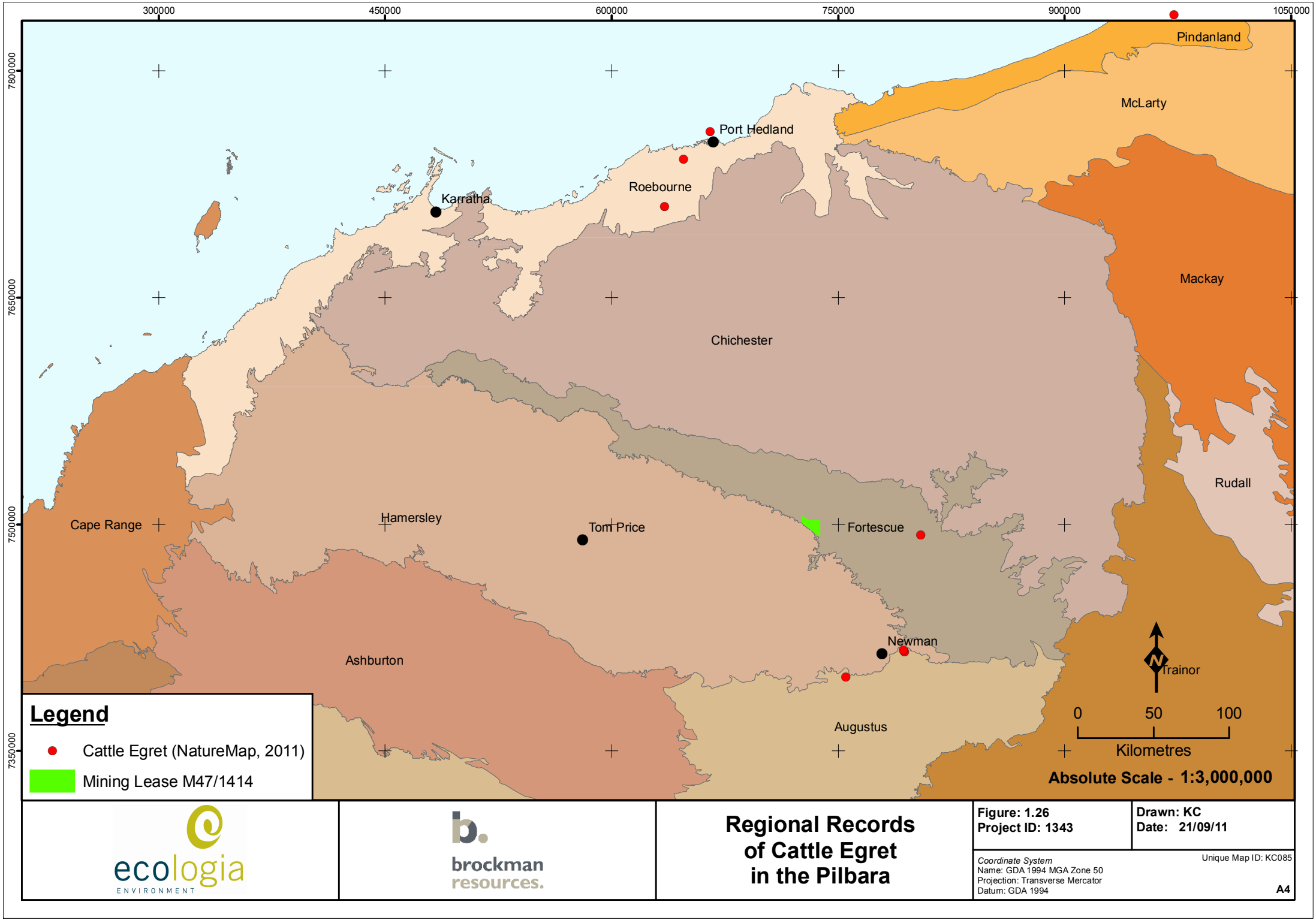
Conservation Status: *EPBC Act* Migratory

Distribution and Habitat: The Cattle Egret has a worldwide distribution, occurring across India, south-east Asia, Papua New Guinea, Australia and New Zealand (Johnstone and Storr 1998; McKilligan 2005; Seedikkoya et al. 2005). The Cattle Egret is a partial migrant occurring in the better-watered areas of Australia. In Western Australia they are casual visitors to the Kimberley and occasionally to south west corner, principally in autumn with few records through the Pilbara (Johnstone and Storr 1998).

Ecology: Cattle Egrets occur typically in small flocks in grassy habitats and wetlands, particularly damp pastures, and are usually found in the company of cattle or other livestock (Johnstone and Storr 1998; Seedikkoya et al. 2005). Unlike most herons, it feeds largely on insects, such as grasshoppers but also eats many other invertebrates. Cattle Egrets breed in colonies, usually with other waterbirds. Their nests, a rough, loose platform of sticks, can be found in trees and bushes in wetland areas (Morcombe 2000; RPS 2008).

Regional Records: There are very few records of the Cattle Egret in the Pilbara (Figure 1.26), with only one record from NatureMap in relatively close proximity to the Mining Lease.

Likelihood of Occurrence: Due to an absence of suitable habitat within the Mining Lease, and lack of surrounding records, there is a low likelihood of occurrence for the Cattle Egret in the Mining Lease.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Cattle Egret (NatureMap, 2011)
Mining Lease M47/1414
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Regional Records
of Cattle Egret
in the Pilbara
Figure: 1.26
Project ID: 1343
Drawn: KC
Date: 21/09/11
Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994
Unique Map ID: KC085
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1.1.15 Migratory Shorebirds

Conservation Status: *EPBC Act* Migratory

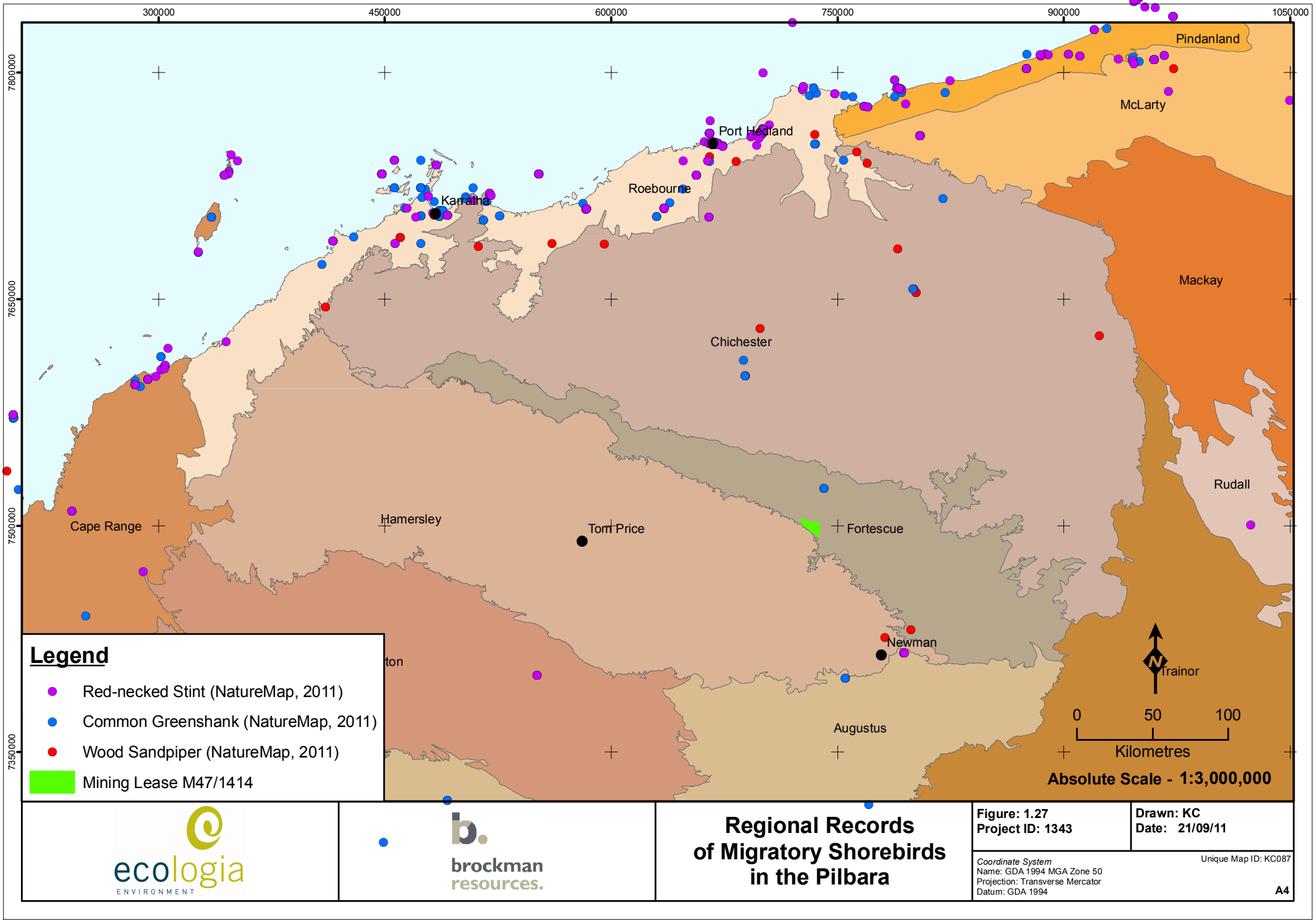
Three species of wading birds of conservation significance potentially occur in the region of the Mining Lease: Wood Sandpiper (*Tringa glareola),* Common Greenshank (*Tringa nebularia*), and Red-necked Stint (*Calidris ruficollis*).

Distribution and Habitat: Wading migratory shorebirds mainly inhabit shallow water bodies; both fresh (lakes, lagoons, swamps and floodwaters) and saline (mangrove creeks, estuaries and tidal pools) (Johnstone and Storr 1998). Most species of wading bird occur across a large part of Western Australia, including the south-west, Kimberley and Pilbara (Johnstone and Storr 1998).

Ecology: The waders' diet consists predominantly of invertebrate, small fish and crustaceans. Preferred habitat consists of shallow wooded fresh or brackish water, lakes, flooded pasture and occasionally in mangroves (Morcombe 2000).

Regional Records: All three species were recently recorded in 2008 in the Fortescue Marsh after a period of heavy rain (Bamford 2009). There are very few records of any migratory shorebirds throughout the rest of the Pilbara.

Likelihood of Occurrence: No suitable habitat exists within the Mining Lease for these species and therefore there is a low likelihood of these species occurring within the Mining Lease.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Legend
Red-necked Stint (NatureMap, 2011)
Common Greenshank (NatureMap, 2011)
Wood Sandpiper (NatureMap, 2011)
Mining Lease M47/1414
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resources.
Regional Records
of Migratory Shorebirds
in the Pilbara
Figure: 1.27
Project ID: 1343
Drawn: KC
Date: 21/09/11
Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994
Unique Map ID: KC087
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2 CONSTRUCTION TIMEFRAMES

Brockman anticipates the commencement and clearing of mining and infrastructure footprints in the fourth quarter of 2011, with mining and processing to begin in the third quarter of 2012. Table 2.1 illustrates the Project development timeframes.

Table 2.1 – Project Development Timeframes

STAGE	ACTIVITIES	TIMEFRAME
Project Planning	Feasibility assessment, technical studies, approvals.	Q4 2008 – Q4 2011
Construction	Mine pre-strip, earthworks, erection of infrastructure, commissioning.	Q1 2012 – Q1 2014
Operation	Mining and processing of ore, transport of ore off-site, progressive rehabilitation.	Q2 2014 – 2039
Decommissioning	Contaminated site assessment, removal or burying of infrastructure, landform rehabilitation and revegetation.	2040

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3 RELEVANT IMPACTS

3.1 POTENTIAL THREATS

Potential threats to *EPBC Act* listed species may include habitat loss, edge effects, habitat fragmentation, direct mortality, introduction of vertebrate pests, noise and lighting impacts, changes to surface and groundwater quality or groundwater levels.

The Project will result in the removal of approximately 3,785 ha of native vegetation from within the Fortescue, Turee, Fan, Boolgeeda, Divide and River land systems (*ecologia* 2009). After rehabilitation, the long-term cleared footprint will be around 60 ha which represents the final pit void. All other disturbances will be rehabilitated to the satisfaction of the Western Australian EPA, DEC and DMP. As demonstrated in Table 3.1 and Figure 3.1, these land systems are well represented outside the Mining Lease. The impacts, both direct and indirect, have been assessed at a project level, and in a cumulative sense (see Table 3.2).

The main potential impacts to the vegetation and flora of the Project area are:

- Direct impacts from clearing of vegetation.
- Indirect impacts from infrastructure and ongoing practices *e.g.*, degradation of areas due to alteration of surface water flow, alteration to groundwater levels, dust from tracks, further weed infestation, and human activities.

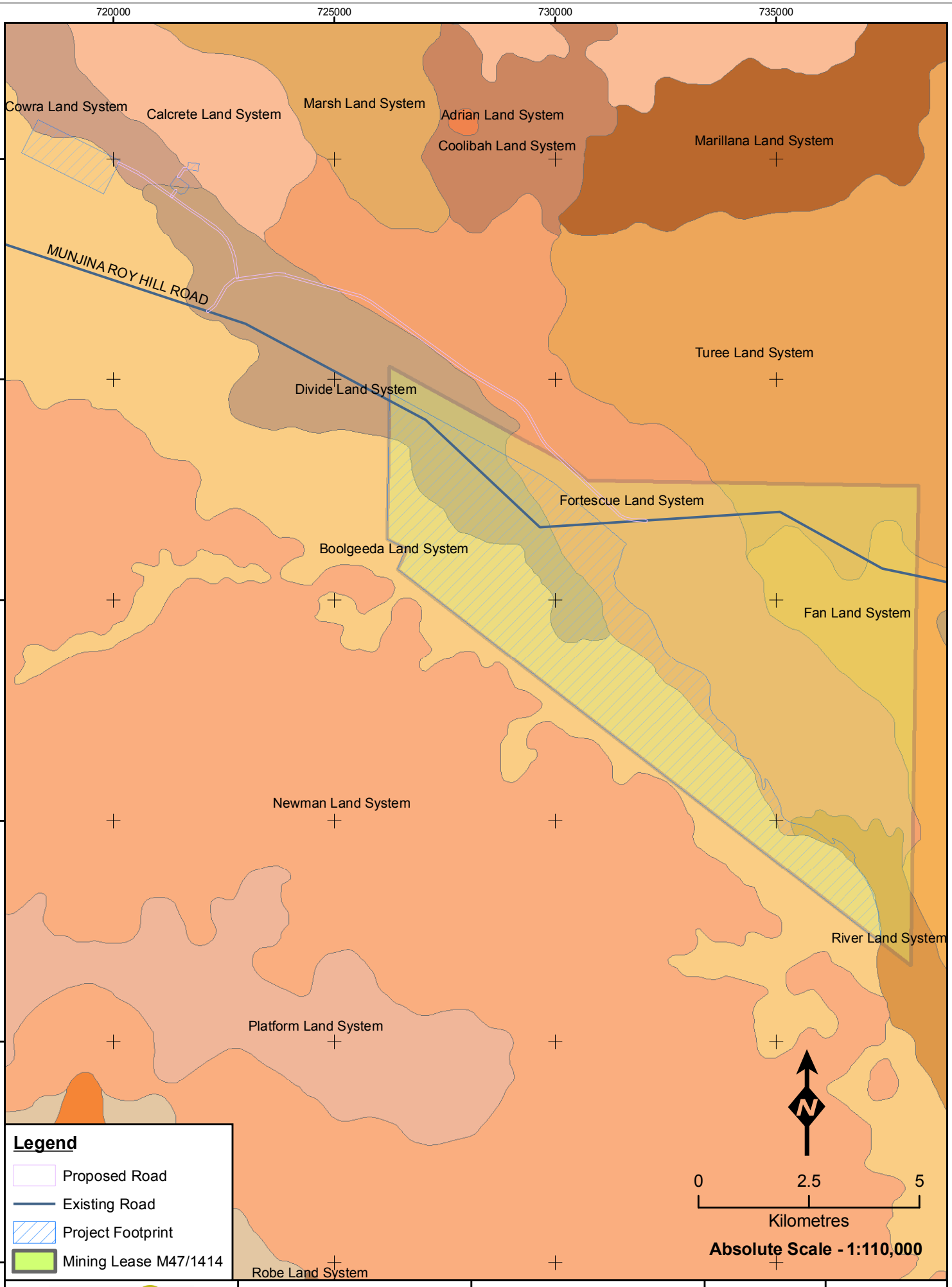
Rigorous risk assessment, biological assessments and hydrological assessments have been conducted for the Project, and management procedures reflect the gathered data. Therefore it is unlikely that unknown, unpredictable or irreversible impacts to matters of NES will result from the Project.

Table 3.1 – Land Systems of the Project Area.

Land system	Habitat	Project Footprint (ha)	Clearing Impact (ha)	Total Area in Pilbara (ha)	% Impact in the Pilbara
Fortescue	Alluvial plains and floodplains supporting patchy grassy woodlands, shrublands and tussock grasslands	3250	618	50,400	1.225
Turee	Stony alluvial plains with gilgaied and non-gilgaied surfaces supporting tussock grasslands and grassy shrublands of mulga and snakewood	571	0	58,100	0.000
Fan	Wash plains and gilgai plains supporting groved mulga shrublands and minor tussock grasslands	1047	0	148,200	0.000
Boolgeeda	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands	2215	2212	774,800	0.285
Divide	Sandplains and occasional dunes supporting shrubby hard spinifex grasslands	1047	891	529,300	0.168

Land system	Habitat	Project Footprint (ha)	Clearing Impact (ha)	Total Area in Pilbara (ha)	% Impact in the Pilbara
River	Active floodplains and major rivers supporting grassy Eucalyptus spp. woodlands, tussock grasslands and soft spinifex grasslands	345	28	408,800	0.007
Cowra	Plains fringing the Marsh land system supporting snakewood and mulga shrublands with some halophytic undershrubs.	33	33	20,300	0.158
Calcrete	Low calcrete platforms and plains supporting shrubby hard spinifex grasslands.	5	5	144,400	0.003

Information in columns 2 and 5 sourced from Van Vreeswyk *et al*. (2004).



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Land Systems of Mining Lease M47/1414

Figure: 3.1
Project ID: 1343

Drawn: KC
Date: 27/09/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: KC088

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Table 3.2 – Potential Impacts Context Summary

Potential Impact	Local Context	Regional Context
Direct Vegetation	Removal of approximately 3,785 ha of vegetation. No Threatened Ecological Communities (TECs) impacted by the Project.	Vegetation Units well represented outside of the impact area.
Indirect Vegetation	• Edges effects at disturbance perimeter • No fragmentation or isolation of individual land systems • 0.01% of River Land system impacted • Disturbance areas are susceptible to weed invasion • Dewatering and surface water changes	• Vegetation Units well represented outside of the impact area. • Drawdown insignificant beyond Mining Lease • Drawdown cone is not extensive beyond the project. Closest major dewatered project is approx 20km away (BHP Billiton (BHPB) Yandi).
Direct Mortality	Increased vehicle traffic	Increased vehicle traffic
Direct Noise and Lighting	Local mechanised plant	Typical of Pilbara Mining Operations

3.1.1 Direct Loss of Vegetation and Flora

The most substantial environmental impacts of the Project will result from the clearing of native vegetation. The most significant impact will be to the Divide and Boolgeeda land systems which support hard and soft spinifex grasslands and mulga shrublands. Calculated impacts to each matter of NES are shown in Table 3.3.

The *Acacia dictyophleba* tall shrubland over *Triodia schinzii* open hummock grassland is mapped on the dunes of the Divide land system in the north-west of the Mining Lease. It forms part of a Priority 3 Priority Ecological Community (PEC) and has high regional and local conservation significance as it is a rare physiographic unit and is susceptible to threatening processes.

These dunes will not be impacted by the proposed works as they are located outside of the proposed infrastructure footprint.

3.1.2 Indirect Loss of Vegetation and Flora

Flora habitats may be impacted indirectly by dewatering activities, or by the resultant dust, fire and spread of weeds after increased activity in an area. Erosion and soil compaction can result from off - road driving, and the use of saline water in construction and ongoing operations can affect the health of vegetation. Further impacts to vegetation may occur as a result of alterations to surface water flow and ground water levels.

3.1.2.1 Damage to Vegetation from Dust

Excessive dust can impact plant health by clogging stomata. Occurring particularly at track edges, the clogging of plant stomata may affect respiration and transpiration, leading to localised deaths. Dust suppression techniques are effective in minimising this impact.

3.1.2.2 Accidental Fires

Fires are a frequent occurrence in Australia's arid zone. Spot fires are known to occur during the summer months, sparked predominantly from lightning strikes.

Whilst native flora is adapted to, and in many instances dependant on fire for seed germination, unnaturally frequent or hot bushfires can result in detrimental changes to the composition and diversity of the vegetation. This may lead to the extinction of local vulnerable species.

The risk of fire as a result of mining activities can be minimised by implementing appropriate fire control measures (see Appendix B).

3.1.2.3 Introduction and Spread of Weed Species

Implementation of the Project has the potential to introduce new weed species or spread weed species already in the area. This could result from increased vehicle movements, increased ground disturbance, disposal of water from drilling and dust suppression operations. Ten general environmental weeds with potential to spread were recorded during survey, and these were: **Aerva javanica, *Argemone ochroleuca* subsp*. ochroleuca, *Cenchrus ciliaris, *Cenchrus setiger, *Chloris virgata, *Datura leichhardtii, *Malvastrum americanum, *Portulaca oleracea, *Setaria verticillata* and **Vachellia farnesiana*. Strict weed hygiene procedures will be implemented during the construction and life of the Project through the Environmental Management Plan (Appendix B).

3.1.2.4 Erosion and Compaction from Off-road Driving

Water can flow preferentially in areas where vehicles have driven and this can cause erosion. Soil compaction results from off-road driving and plants often cannot re-establish easily in these areas. The risk of damage to the vegetation can be avoided by prohibiting off-road driving (see Appendix B).

3.1.2.5 Use of Saline Water in Dust Suppression

The use of saline water in dust suppression along haul roads is common practice at mine sites across Western Australia. Salts in the water help to bind the soil and further reduce the dust particles released into the environment from vehicle movement.

As many plant species are damaged by saline water, its release into the environment must be tightly managed to ensure damage to vegetation does not occur. Regular testing of the groundwater to be used for dust suppression will reduce the potential for damage to vegetation from saline water.

3.1.2.6 Altered Surface Water Flow and Quality

Surface water flow is important for vegetation generally and mulga in particular. Drainage and water flow will need to be managed to maintain surface water flow to minimise the effects on mulga in and beyond the Mining Lease. Many small creeks flow down the escarpment and feed into the Weeli Wolli Creek that flows from the south-east to the north-west of the Mining Lease. Water flow in the Creek will need to be managed appropriately, especially as it feeds into the Fortescue Marsh which is approximately 15 km away from the Mining Lease.

Surface water quality will be managed appropriately through implementing the Surface Water Management Plan (Appendix C), as increased sediment load could be transported into the Weeli Wolli Creek and potentially affect the vegetation growing along the creek and further downstream.

With management, no impacts to surface water quality at the Fortescue Marsh are anticipated from the Project. Monitoring requirements and contingency actions for surface water management are provided for in Ministerial Statement 855 (see Referral Documents).

3.1.2.7 Altered Groundwater Levels

Vegetation dependent on groundwater for all or part of the year can be adversely affected by lowered groundwater levels. The effects depend on the timing and modification of water abstraction, and the magnitude and rate of drawdown. Pumping of water for the proposed works will need to be managed appropriately so that the phreatophytic vegetation on the banks of the Weeli Wolli creek is not irreversibly affected by changes in groundwater levels.

Current groundwater modelling indicates that five years from the start of the project drawdown will result in groundwater levels being 5 m to 10 m lower than pre-mining levels. By 20 years from the start of the project groundwater levels are predicted to be approximately 20 m lower than pre-mining levels. While these figures are based on the worst-case scenario, changes to groundwater levels will nevertheless need to be managed. For example, the risk to Groundwater Dependant Ecosystems may be lowered considerably by avoiding periods of peak environmental demand and allowing adaptation of dependent biota to a lower water table. For example, if the annual decline in groundwater level was restricted to the maximum rate of downward growth of the roots of those plants dependent on groundwater, they would still be able to access the water in the capillary fringe above the water table as the water table drops.

The River land system covers 2.3% of the Pilbara, and only 0.08% of its area occurs within Brockman's Marillana Mining Lease. Therefore the regional impact to the vegetation of this land system would be low if the vegetation was affected by changes in groundwater levels. Nevertheless, water pumping should be managed appropriately to try to maintain the health of the vegetation during the life of the mine, as the death of vegetation along the creek channels of the Mining Lease could have knock on effects such as reduced soil stability in those areas and increased sedimentation in the Weeli Wolli Creek.

With management, no impacts to groundwater levels at the Fortescue Marsh are anticipated from the Project. Monitoring requirements and contingency actions for groundwater management are provided for in Ministerial Statement 855 (See Referral Documents) and the Groundwater Management Plan (Appendix D).

3.2 IMPACTS ON FAUNA HABITATS

Five fauna habitats were recognised in the Mining Lease: Spinifex Plains and Hill-slopes (consisting of sandy Spinifex grassland and stony Spinifex plains), creekline, longitudinal sand dune and mulga woodland. These habitats are shown in Figure 3.2 and Figure 3.3.

3.2.1 Spinifex Plains and Hill-slopes

3.2.1.1 Sandy Spinifex Grassland

The sandy spinifex plains habitat is concentrated on the Divide land system and supports thick, well-established spinifex clumps.

Some disturbance to this habitat is expected during implementation of mining infrastructure and the Divide land system (south of the Weeli Wolli Creek), which includes this habitat, is likely to be impacted by the proposed project.

Minimising disturbance to this habitat would reduce potential impacts to Night Parrot (*Pezoporus occidentalis*), which is thought to inhabit areas of mature spinifex.

3.2.1.2 Stony Spinifex Plains

This habitat is the most likely to be affected by the proposed Project. 'Open Plains' habitat incorporates some of the Divide land system and most of the Boolgeeda land system which is formed from the detrital alluvial deposits brought down from the Hamersley Ranges. Mining operations are concentrated within this area.

This habitat is very common in the surrounding region and as such impacts from the Project are not thought to be regionally significant.

3.2.2 Creekline

The Weeli Wolli Creek system dissects the entire Mining Lease and constitutes the majority of the creekline habitat. It is located in the Fortescue Land System. Of the six land systems that occur in the Marillana Mining Lease, the Fortescue land system is the least represented in the Fortescue Plains (PIL2) bioregion. It has the largest proportion of its total area in the Mining Lease (8.31%) and stretches from the north-west corner towards the south-east.

With management, Mining operations are not expected to affect the Weeli Wolli Creek and therefore impacts to the Fortescue land system and associated habitats are expected to be minimal (see Appendix C, D, and Referral Documents).

3.2.3 Longitudinal Sand Dune with Spinifex

A Longitudinal Sand Dune, situated in the north-west, is a unique habitat within the Mining Lease and surroundings. Like the Sandy Spinifex Grassland, it is located in the Divide land system and supports thick, well-established spinifex hummocks as well as moderately dense, low shrubs. It is suitable habitat for many mammal, bird and reptile species including, potentially, the Night Parrot. Mining activity will not impact this habitat as per the conditions of Ministerial Statement 855.

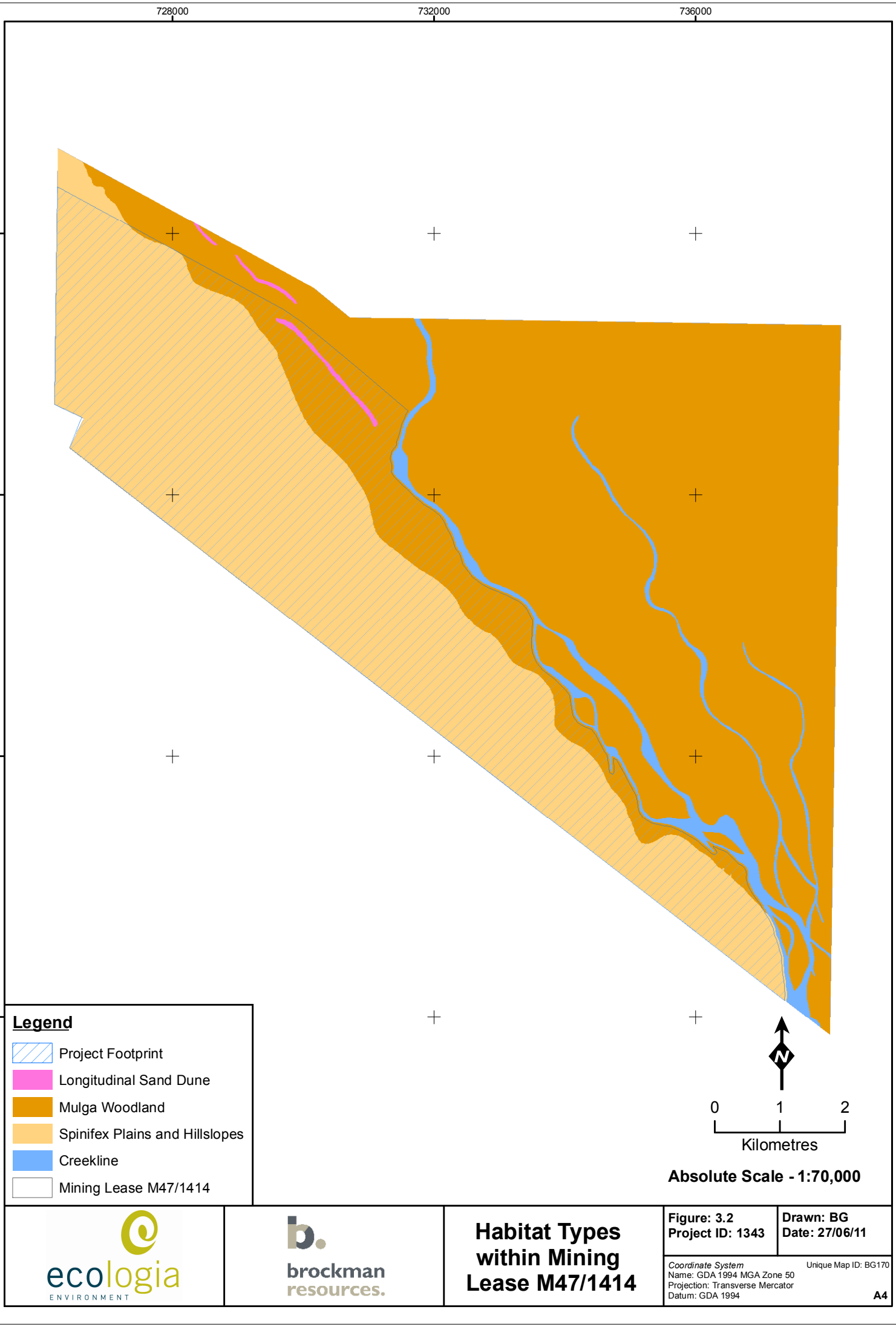
3.2.4 Mulga Woodland and Shrubland

Mulga woodland is scarce and patchy throughout the Mining Lease. Surrounding areas of this habitat are heavily disturbed by pastoral activity, thus reducing the value of this habitat to fauna species. There is no mining activity planned in this fauna habitat.

Table 3.3 – Potential Habitat Disturbance Areas for Species

Species	Potential Habitat	Total Habitat in Project	Habitat Clearing Footprint	Likelihood of Occurrence (ecologia, 2008)
Night Parrot	Spinifex Plains and Hill-slopes	3128 ha	3090 ha	Undetermined
Greater Bilby	All Habitats	8363 ha	4869 ha	Low
Olive Python	Creekline	266 ha	0 ha	Medium
Northern Quoll	Creekline	266 ha	0 ha	Low
Brush-tailed Mulgara	Spinifex Plains and Hill-slopes	2968 ha	2930 ha	Low
Pilbara Leaf-nosed Bat	Spinifex Plains and Hill-slopes / Creekline	3315 ha	3011 ha	Low
Rainbow Bee-eater	All Habitats	8504 ha	3782 ha	High – Recorded
Great Egret and Sea Eagle	Creekline	266 ha*	0 ha	Low
Wading Birds	Creekline	266 ha*	0 ha	Low
Fork-tailed Swift	None Suitable	0 ha	0 ha	Medium – Overflying Only

* May use creek lines for short periods during the year whilst they hold water.



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brockman resources.

Habitat Types within Mining Lease M47/1414

Figure: 3.2
Project ID: 1343

Drawn: BG
Date: 27/06/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: BG170

A4

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700000 720000 740000 760000 780000 800000

7540000

7520000

7500000

Creekline

Spinifex plains and hillslopes

Eucalypt woodland

Rocky escarpment

Halophyte shrubland

Fortescue floodplain

Sand dunes with spinifex

Mulga shrubland/woodland

Spinifex on edge of Marsh

Spinifex on calcrete

Legend

- Mining Lease M47/1414
- Creekline
- Eucalypt woodland
- Fortescue floodplain
- Halophyte shrubland
- Mulga shrubland/woodland
- Rocky escarpment
- Spinifex plains and hillslopes
- Sand dunes with spinifex
- Spinifex on calcrete
- Spinifex on edge of Marsh

N

0 10 20

Kilometres

Absolute Scale - 1:300,000

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Habitat Types in Proximity to the Fortescue Marsh

Figure: 3.2
Project ID: 1343

Drawn: AH
Date: 08/06/11

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: AH341

A3

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3.3 IMPACTS ON FAUNA ASSEMBLAGES

3.3.1 Biodiversity

The diversity of fauna assemblages of the Fortescue Plains (PIL3) Interim Biogeographic Regionalisation of Australia (IBRA) sub-region as a whole is unlikely to be significantly affected by the project. Most terrestrial fauna are expected to be able to move to adjacent areas of suitable habitat. However, sedentary fauna, e.g. burrowing species or species using leaf-litter or wood to shelter in, are likely to be impacted.

Vegetation communities may also experience secondary impacts from the mining activity, such as fire, dust and weeds, reducing the quality of local fauna habitats available and thereby reducing local diversity in the short term.

In the case of fire, there is the potential for large areas to be affected.

Weeds may be a problem in terms of over-competition for resources, leading to a reduction of biodiversity. For instance Buffel Grass (**Cenchrus ciliaris*) is readily spread by cattle, forming a single-species ground layer, and potentially with time excluding the recruitment of larger shrubs and trees.

Ultimately, biodiversity and ecological function are expected to recover as vegetation communities regenerate in rehabilitated areas and stabilise, allowing native fauna to re-colonise from adjacent areas. However, adequate weed management, including regular monitoring for exotic weeds, is important for revegetation to succeed in re-creating some of the original fauna habitats present prior to the Project.

Those vegetation types that take the longest to fully regenerate are the ones containing mature eucalypts with hollows. In the Mining Lease these occur primarily along the Weeli Wolli Creek which as a whole is not expected to be impacted by mining.

3.3.2 Ecological Function

Localised reduction in ecological function can be expected as a result of habitat loss, fragmentation, traffic, noise, and pollution. However, ecological function at the regional scale is not expected to be significantly impacted, principally due to the small size of the impact area and the continuity of the fauna habitats with those in surrounding areas.

3.3.3 Noise and Light Pollution

Mining operations and associated vehicle traffic creates noise and light pollution, which has the potential to impact upon local fauna populations. Noise can adversely affect wildlife by interfering with communication, masking predator and prey sounds, and causing stress or avoidance reactions. In some extreme cases, noise can potentially cause hearing loss. Light is known to disrupt nocturnal bird species and have negative impact to amphibians. Research into the effect of noise and light on faunal assemblages in Australia is scarce (Department of Environment, 1998); most has been undertaken in Europe and America.

Research has indicated that wildlife show negative responses to new stimuli (Larkin 1996, Radle 1998). An experiment by Fletcher and Busnel (1978) revealed that exposure to noise impulses throughout the night time sleeping period of animals can lead to poorer daytime performance of tasks. However, Busnel (1978) believes that unusual noise, in combination with proximity to visual

stimulation, is enough to disturb and subsequently cause panic to either an animal or a human. Busnel states that any sudden and unexpected stimuli can produce a startled reaction but concludes that it is not always known what is due specifically to noise alone.

It is known that large breeding birds do not usually tolerate continuous disturbance however, very few studies have been undertaken around the Fortescue Marsh to determine the behaviour of birds, particularly during floods and after major rainfall events. Brockman commissioned an assessment of noise to the Fortescue Marsh (Appendix H) which concluded that noise levels from the Project will be below the background noise levels which currently exist, and fauna would quickly adapt to any noise produced. This is consistent with noise monitoring undertaken by Lloyd Acoustics in 2005 for the FMG Cloud Break Mine. The noise monitoring report concluded that there is likely to be some short term disturbance to faunal assemblages in and around the mine lease and nearby Fortescue Marsh, but that birds are quick to adapt to changing environments and would most likely resume their natural activities within short periods of time.

A large number of animals have adapted to the presence of humans and human-generated noise. Animals are known to inhabit noisy environments such as marine species in busy shipping waterways, rats under bridges and birds living and breeding in airfield surroundings. While it is assumed that increased noise and motor vibrations in wetlands may impact amphibian breeding choruses, it is also known that many amphibian species are surprisingly tolerant of vehicle noise (Kaseloo and Tyson 2004). It is not expected that there will be any impact to species located in the Fortescue Marsh, as the Marillana Mine Lease is located approximately 15 km away.

Light pollution can potentially disrupt bird migrations, particularly with nocturnal species, if environmental conditions constrain them to flying lower to the ground at night (Longcore and Rich, 2004). It is known that amphibians are less tolerant of increased light levels, but studies into specific species are not known. It is expected that individuals will move away from light and noise sources and thus, reduce potential impact from light.

While it is understood from general research that wildlife react negatively to new stimuli, it is not yet understood how much of this reaction is due to noise or light specifically. A study by Lloyd Acoustics for the FMG Cloud Break Mine indicates that while noise may have some impact, it is predominantly local impact, and that those bird species affected are most likely to adapt to the changing environment within a short period of time. It must be taken into account the lack of research in Australia on the effect of light and noise on specific species, particularly those based around the Fortescue Marsh in Western Australia. Based on the information known, it is assumed that the impact of noise and light from the Marillana Mine Lease on species located in the Fortescue Marsh is relatively low, with the main factor being that the Fortescue Marsh is located 15 km from the area of interest.

3.4 ASSESSMENT OF SIGNIFICANT IMPACTS TO EPBC ACT LISTED THREATENED SPECIES

Impacts to *EPBC Act* listed threatened species have been assessed and commented on using the Significant Impact Criteria (DSEWPaC 2009). These criteria are used to determine what constitutes a 'significant impact' under the *EPBC Act* 1999.

3.4.1 Night Parrot

The Night Parrot is considered a low likelihood to occur within the Mining Lease (see Section 1.1) and as such no impacts are anticipated. Groundwater modelling shows that there will be no impacts, cumulative or otherwise, to the Fortescue Marsh from dewatering activities (see Referral Documents). The likely level of impact to the Night Parrot is further described in Table 3.4.

Table 3.4 – Relevance of the Significant Impact Criteria to the Night Parrot (DEWHA 2009)

Significant Impact Criteria	Comment
Long-term decrease in the size of a population	No direct or indirect mortality expected.
Reduction in the area of occupancy of the species	No parrots were identified as occupants during L2 surveys.
Fragmentation of an existing population into two or more populations	No resident population was identified during L2 surveys.
Adverse affect to habitat critical to the survival of a species	No critical habitat will be impacted on.
Disruption to the breeding cycle of a population	No resident population was identified during L2 surveys.
Modification, destruction, removal, isolation or reduction to the availability or quality of habitat to the extent that the species is likely to decline	No resident population was identified during L2 surveys.
Establishment of invasive species that are harmful to an endangered species in the endangered species' habitat	Feral fauna are already well established within the region.
Introduction of disease that may cause the species to decline	No diseases are expected to be introduced.
Interference with the recovery of the species	No resident population was identified during L2 surveys.

3.4.2 Northern Quoll

No primary or secondary evidence of the Northern Quoll was identified during the level two survey, and in addition, no suitable habitat for the Northern Quoll was identified within the Mining Lease during the level 2 fauna survey (Ecologia, 2008).

Due to the low likelihood of Northern Quolls occurring within the Mining Lease, no impacts to the species are anticipated. Comment against significant impact criteria is made in Table 3.5.

Table 3.5 – Relevance of the Significant Impact Criteria to the Northern Quoll (DEWHA 2009)

Significant Impact Criteria	Comment
Long-term decrease in the size of a population	Quolls unlikely to be resident within the Mining Lease. No long term decrease in of population size is expected.
Reduction in the area of occupancy of the species	No resident population was identified during L2 surveys.
Fragmentation of an existing population into two or more populations	No resident population was identified during L2 surveys.
Adverse affect to habitat critical to the survival of a species	No critical habitat will be impacted on.
Disruption to the breeding cycle of a population	Construction and operation of this Project is not expected to disrupt the breeding cycle of this species. No suitable quoll habitat. No identified population.
Modification, destruction, removal, isolation or reduction to the availability or quality of habitat to the extent that the species is likely to decline	Only a very small area of foraging habitat will be impacted by the project, therefore loss of this habitat is not expected to cause this species to decline.
Establishment of invasive species that are harmful to an endangered species in the endangered species' habitat	Feral fauna are already well established within the region.
Introduction of disease that may cause the species to decline	No diseases are expected to be introduced.
Interference with the recovery of the species	No suitable quoll habitat. No identified populations.

3.4.3 Pilbara Leaf-nosed Bat

Pilbara Leaf-nosed Bats were not recorded within the Study area during *ecologia*'s surveys, nor was any roosting or breeding habitat identified. Suitable hunting habitat is present throughout the Mining Lease. There is the potential for a negligible constraint through the loss of hunting territory; however the small size of the impact area, and the ability of the species to hunt across a wide area, means the Project is not anticipated to impact Pilbara Leaf-nosed Bats on either a local or regional scale. Comment against significant impact criteria is made in Table 3.6.

Table 3.6 – Relevance of the Significant Impact Criteria to the Pilbara Leaf-nosed Bat (DEWHA 2009)

Significant Impact Criteria	Comment
Long-term decrease in the size of a population	No roosting or breeding habitat identified. No resident population identified.
Reduction in the area of occupancy of the species	No roosting or breeding habitat identified. No resident population identified.
Fragmentation of an existing population into two or more populations	No roosting or breeding habitat identified. No resident population identified.
Adverse affect to habitat critical to the survival of a species	No roosting or breeding habitat identified. No resident population identified.
Disruption to the breeding cycle of a population	No roosting or breeding habitat identified. No resident population identified.

Significant Impact Criteria	Comment
Modification, destruction, removal, isolation or reduction to the availability or quality of habitat to the extent that the species is likely to decline	Only a very small area of habitat will be impacted by the project, therefore loss of this habitat is not expected to cause this species to decline.
Establishment of invasive species that are harmful to an endangered species in the endangered species' habitat	Feral fauna are already well established within the proposal area.
Introduction of disease that may cause the species to decline	No diseases are expected to be introduced.
Interference with the recovery of the species	If present, the species appears to be relatively uncommon in the region.

3.4.4 The Greater Bilby

The Greater Bilby was not recorded during the level two fauna assessment within the Mining Lease and no secondary evidence such as burrows was recorded.

Due to the low likelihood of the Greater Bilby occurring within the Mining Lease, no impacts to the species are anticipated. Comment against significant impact criteria is made in Table 3.7.

Table 3.7 – Relevance of the Significant Impact Criteria to the Greater Bilby (DEWHA 2009)

Significant Impact Criteria	Comment
Long-term decrease in the size of a population	Bilbies unlikely to be resident within the Mining Lease. No long term decrease in of population size is expected.
Reduction in the area of occupancy of the species	No identified populations.
Fragmentation of an existing population into two or more populations	No identified populations.
Adverse affect to habitat critical to the survival of a species	No critical habitat will be impacted on.
Disruption to the breeding cycle of a population	Construction and operation of this Project is not expected to disrupt the breeding cycle of this species. Bilbies are opportunistic breeders in response to environmental conditions.
Modification, destruction, removal, isolation or reduction to the availability or quality of habitat to the extent that the species is likely to decline	Habitat well represented outside the impact area.
Establishment of invasive species that are harmful to an endangered species in the endangered species' habitat	Feral fauna are already well established within the region.
Introduction of disease that may cause the species to decline	No diseases are expected to be introduced.
Interference with the recovery of the species	No suitable bilby habitat. No identified populations.

3.4.5 Mulgara

Mulgara were not recorded during the level two fauna assessments within the Mining Lease.

Due to the lack of surrounding records and the small size of the area of potential denning habitat within the Mining Lease, it is considered low likelihood that Brush-tailed Mulgara occur in the Mining Lease. Comment against significant impact criteria is made in Table 3.8.

Table 3.8 – Relevance of the Significant Impact Criteria to the Mulgara (DEWHA 2009)

Significant Impact Criteria	Comment
Long-term decrease in the size of a population	Mulgara are unlikely to be resident within the Mining Lease. No long term decrease in of population size is expected.
Reduction in the area of occupancy of the species	No identified populations.
Fragmentation of an existing population into two or more populations	No identified populations.
Adverse affect to habitat critical to the survival of a species	No critical habitat will be impacted on.
Disruption to the breeding cycle of a population	Construction and operation of this Project is not expected to disrupt the breeding cycle of this species. Bilbies are opportunistic breeders in response to environmental conditions.
Modification, destruction, removal, isolation or reduction to the availability or quality of habitat to the extent that the species is likely to decline	Loss of habitat from the construction of this project is not expected. The Project is not expected to cause further decline to this species.
Establishment of invasive species that are harmful to an endangered species in the endangered species' habitat	Feral fauna are already well established within the region.
Introduction of disease that may cause the species to decline	No diseases are expected to be introduced.
Interference with the recovery of the species	Little suitable mulgara habitat. No identified populations.

3.4.6 Pilbara Olive Python

Pilbara Olive Pythons were not recorded during the level two fauna assessments within the Mining Lease.

Pilbara Olive Pythons are widespread in the Pilbara and the impact to the regional population is expected to be negligible due to the small size of the development and the ability of individuals to relocate. Comment against significant impact criteria is made Table 3.5.

Table 3.9 – Relevance of the Significant Impact Criteria to the Pilbara Olive Python (DEWHA 2009)

Significant Impact Criteria	Comment
Long-term decrease in the size of a population	Pilbara Olive Python populations are not expected to decrease over the long term due to impacts from this Project. Impacts are concentrated within a small footprint and suitable habitat exists away from the Mining Lease.
Reduction in the area of occupancy of the species	Due to the nature of the Project, impacts are not expected to be sufficient to reduce the area of occupancy of this species.
Fragmentation of an existing population into two or more populations	The Project is not expected to form a barrier that will fragment existing populations. Individual Pythons are expected to be able to pass through the Mining Lease.
Adverse affect to habitat critical to the survival of a species	Preferred habitat along Weeli Wolli Creek will not be impacted and will be an exclusion zone. While this habitat in the Mining Lease is suitable to this species it is not thought to be "critical habitat", with similar habitat present in surrounding areas.
Disruption to the breeding cycle of a population	Construction and operation of this Project is not expected to cause any disruptions to the breeding cycle of Pilbara Olive Pythons as individuals are expected to be able pass through the Project when searching for mates.
Modification, destruction, removal, isolation or reduction to the availability or quality of habitat to the extent that the species is likely to decline	Construction and operation of this Project is not expected to impact suitable habitat to the extent that the Pilbara Olive Python populations will decline. Suitable habitat extends away from the Mining Lease.
Establishment of invasive species that are harmful to an endangered species in the endangered species' habitat	Feral fauna are already well established within the region.
Introduction of disease that may cause the species to decline	No diseases are expected to be introduced.
Interference with the recovery of the species	Construction and operation of this project is not expected to significantly impact habitat or populations and therefore the recovery of this species.

3.5 ASSESSMENT OF SIGNIFICANT IMPACTS TO EPBC ACT LISTED MIGRATORY SPECIES

3.5.1 Night Parrot

Refer to section 3.1 (d).

3.5.2 Rainbow Bee Eater

Little impact is anticipated to this species due to the presence of similar habitat surrounding the Mining Lease and throughout Western Australia.

The most likely place for this species to breed within the Mining Lease would be at Weeli Wolli Creek, where ideal sandy embankments occur. Neither the creek nor longitudinal sand dune is under threat from the Project. No regional impacts to this species are anticipated. Comment against significant impact criteria is made in Table 3.10.

Table 3.10 – Relevance of Significant Impact Criteria to the Rainbow Bee-eater (DEWHA 2009)

Significant Impact Criteria	Comment
Long-term decrease in the size of a population	No direct or indirect mortality to species is expected.
Reduction in the area of occupancy of the species	Habitat well represented regionally.
Fragmentation of an existing population into two or more populations	Habitat will not be fragmented.
Adverse affect to habitat critical to the survival of a species	No critical habitat will be impacted on.
Disruption to the breeding cycle of a population	Construction and operation of this Project is not expected to disrupt the breeding cycle of this species.
Modification, destruction, removal, isolation or reduction to the availability or quality of habitat to the extent that the species is likely to decline	Habitat well represented regionally.
Establishment of invasive species that are harmful to an endangered species in the endangered species' habitat	Feral fauna are already well established within the region.
Introduction of disease that may cause the species to decline	No diseases are expected to be introduced.
Interference with the recovery of the species	Habitat well represented regionally.

3.5.3 White-Bellied Sea Eagle

Any impacts to large rivers may reduce the amount of hunting habitat available to the species; however no impact to the Weeli Wolli Creek system is anticipated from the Project, and sea-eagles are uncommon in the Mining Lease. Therefore, no local or regional impacts are anticipated. Comment against significant impact criteria is made in Table 3.11.

Table 3.11 – Relevance of the Significant Impact Criteria to the White-bellied Sea-eagle (DEWHA 2009)

Significant Impact Criteria	Comment
Long-term decrease in the size of a population	No direct or indirect mortality to species is expected.
Reduction in the area of occupancy of the species	Habitat well represented regionally.
Fragmentation of an existing population into two or more populations	Habitat will not be fragmented.
Adverse affect to habitat critical to the survival of a species	No critical habitat will be impacted on.
Disruption to the breeding cycle of a population	Construction and operation of this Project is not expected to disrupt the breeding cycle of this species.

Significant Impact Criteria	Comment
Modification, destruction, removal, isolation or reduction to the availability or quality of habitat to the extent that the species is likely to decline	No Habitat.
Establishment of invasive species that are harmful to an endangered species in the endangered species' habitat	Feral fauna are already well established within the region.
Introduction of disease that may cause the species to decline	No diseases are expected to be introduced.
Interference with the recovery of the species	Habitat well represented regionally.

3.5.4 Fork-Tailed Swift

The species is entirely aerial and highly nomadic and thus will not be impacted by the development of the project. Comment against significant impact criteria is made in Table 3.12.

Table 3.12 – Relevance of Significant Impact Criteria to the Fork-tailed Swift (DEWHA 2009)

Significant Impact Criteria	Comment
Long-term decrease in the size of a population	No direct or indirect mortality to species is expected.
Reduction in the area of occupancy of the species	Habitat well represented regionally.
Fragmentation of an existing population into two or more populations	Habitat will not be fragmented.
Adverse affect to habitat critical to the survival of a species	No critical habitat will be impacted on.
Disruption to the breeding cycle of a population	Construction and operation of this Project is not expected to disrupt the breeding cycle of this species.
Modification, destruction, removal, isolation or reduction to the availability or quality of habitat to the extent that the species is likely to decline	No habitat.
Establishment of invasive species that are harmful to an endangered species in the endangered species' habitat	Feral fauna are already well established within the region.
Introduction of disease that may cause the species to decline	No diseases are expected to be introduced.
Interference with the recovery of the species	Habitat well represented regionally.

3.5.5 Wading Birds

Three species of wading birds of conservation significance may occur in the region of the proposal area: Eastern Great Egret, Cattle Egret, and Oriental Plover.

The Weeli Wolli Creek is dry except after cyclonic flooding events and wading birds are not expected to inhabit the Mining Lease, instead utilising the nearby Fortescue Marsh. As a result no impacts to these species are anticipated. Comment against significant impact criteria is made in Table 3.13.

Table 3.13 – Relevance of Significant Impact Criteria to Wading Birds (DEWHA 2009)

Significant Impact Criteria	Comment
Long-term decrease in the size of a population	No direct or indirect mortality to species is expected.
Reduction in the area of occupancy of the species	Habitat well represented regionally.
Fragmentation of an existing population into two or more populations	Habitat will not be fragmented.
Adverse affect to habitat critical to the survival of a species	No critical habitat will be impacted on.
Disruption to the breeding cycle of a population	Construction and operation of this Project is not expected to disrupt the breeding cycle of this species.
Modification, destruction, removal, isolation or reduction to the availability or quality of habitat to the extent that the species is likely to decline	Habitat well represented regionally.
Establishment of invasive species that are harmful to an endangered species in the endangered species' habitat	Feral fauna are already well established within the region.
Introduction of disease that may cause the species to decline	No diseases are expected to be introduced.
Interference with the recovery of the species	Habitat well represented regionally.

4 PROPOSED SAFEGUARDS AND MITIGATION MEASURES

4.1 BROCKMAN ENVIRONMENTAL POLICY

Brockman maintain an Environmental Policy which guides their environmental conduct across all aspects of their operations.

Brockman's Environmental Policy outlines the following objectives:

- Abide by and comply with the *Environmental Protection Act* 1986 and all other applicable environmental laws, regulations, policies, standards and codes of practice.
- Establish the Company's Environmental Management System to conform to the requirements of the International Standard ISO 14001.
- Provide employees with the necessary training, education and resources to fulfil their environmental responsibilities and ensure that operations are performed with appropriate respect for the environment.
- Specify the need for all contractors to perform work in accordance with this policy and to supervise such compliance.
- Conduct regular review of the Company's environmental performance and act on the results.

4.2 LEGISLATION, POLICY AND GUIDELINES

The proposal is subject to compliance with both Federal and State legislation during construction and operational phases. Legislation applicable to this Proposal includes, although not limited to, those described in Table 4.1 below.

Table 4.1 – Legislation Applicable to the Proposal

Legislation	Responsible Agency	Aspect Relevant to the proposal
Commonwealth Legislation		
Environmental Protection and Biodiversity Conservation Act 1999	Department of Sustainability, Environment, Water, Population and Communities	Environmental and heritage matters of national significance
National Greenhouse and Energy Reporting Act 2007	Department of Climate Change and Energy Efficiency	Greenhouse gas emissions
Native Title Act 1993	National Native Title Tribunal	Community, group or individual rights and interests of Aboriginal peoples or Torres Strait Islanders in relation to land or waters
Protection of Movable Cultural Heritage Act 1986	Department of Sustainability, Environment, Water, Population and Communities	Protection of movable cultural artefacts

Legislation	Responsible Agency	Aspect Relevant to the proposal
State Government Legislation		
Aboriginal Heritage Act 1972	Department of Indigenous Affairs	Archaeological and ethnographic heritage
Agricultural and Related Resources Protection Act 1976	Department of Agriculture and Food	Weeds and pest animals
Bush Fires Act 1954	Fire and Emergency Services Authority	Wild fire control
Conservation and Land Management Act 1984	Department of Environment and Conservation / Conservation Commission	Conservation Reserves
Contaminated Sites Act 2003	Department of Environment and Conservation	Management of contaminated lands
Country Areas Water Supply Act 1947	Department of Water	Water supply
Dangerous Goods Safety Act 2004	Department of Mines and Petroleum	Explosives and dangerous goods, transport and management
Environmental Protection Act 1986	Department of Environment and Conservation	Environmental impact assessment and management
Health Act 1911	Department of Health	Human health management
Local Government Act 1995	Department of Local Government / Shire of East Pilbara	Local Government approvals
*Local Government (Miscellaneous Provisions) Act 1*960	Department of Local Government / Shire of East Pilbara	Community infrastructure, buildings, facilities
Occupational Safety and Health Act 1984	Department of Commerce	Occupational health and safety
Main Roads Act 1930	Main Roads Western Australia	Construction, maintenance and supervision of main roads
Mines Safety and Inspection Act 1994	Department of Mines and Petroleum	Personnel safety on mine sites
Public Works Act 1902	Department of Treasury and Finance	Land access and operation of public work
Railway Safety Act 1998	Department of Transport	Railway safety and management
Rights in Water and Irrigation Act 1914	Department of Water	Access to and use of water resources
Soil and Land Conservation Act 1945	Department of Agriculture and Food	Protection of soil resources

Legislation	Responsible Agency	Aspect Relevant to the proposal
State Government Legislation (Continued)		
*Waterways Conservation Act 1*976	Department of Water	Protection of defined surface water management areas
Wildlife Conservation Act 1950	Department of Environment and Conservation	Protection of indigenous wildlife, including items of state significance.

International agreements which may apply to the proposal include:

- The Japan-Australia Migratory Bird Agreement (1974) (JAMBA);
- The Republic of Korea-Australia Migratory Bird Agreement (2007) (ROKAMBA);
- The China-Australia Migratory Bird Agreement (1986) (CAMBA); and
- Convention on the Conservation of Migratory Species of Wild Animals (The Bonn Convention) (1979).

4.3 ENVIRONMENTAL IMPACT ASSESSMENT AND APPROVAL PROCESSES

4.3.1 State Assessment Process

The Project was referred to the Western Australian EPA in February 2009 before being assessed at a Public Environmental Review (PER) level (EPA Assessment No. 1781). The Project was subsequently approved by the Western Australian Minister for Environment in February 2011, with the issue of Ministerial Statement 855 (see Referral Documents).

4.3.2 Commonwealth Assessment Process

Brockman referred the proposal to the DSEWPaC, under the *Environmental Protection and Biodiversity Conservation Act* 1999 (*EPBC Act* 1999).

The Project is currently being assessed as a controlled action by way of Preliminary Documentation (this document).

4.4 ENVIRONMENTAL INVESTIGATIONS

The following environmental investigations have been undertaken for the Project to identify threats to *EPBC Act* listed species;

- Level two vegetation and flora assessment (See Referral Documents);
- Two-phase level two vertebrate fauna assessment (See Referral Documents); and
- Hydrological Investigation and Report (See Referral Documents).

4.5 ENVIRONMENTAL MANAGEMENT

The following management tools outline the management measures to be utilised to prevent or mitigate the potential impacts identified in Section 3 of this document. It is considered that these tools are sufficient to ensure that all potential direct and indirect impacts to habitat are managed so that conservation values in regard to matters of NES will be maintained.

4.5.1 Ministerial Statement 855

The Project was approved by the Western Australian Minister for Environment (statement number 855) in February 2011 in accordance with Section 38(1) of the *Environmental Protection Act* 1986.

It is considered that the potential threats to matters of NES, other than the direct clearing of potential habitat, are directly related to the ongoing health of vegetation both at the Project and in vicinity to the Fortescue Marsh, and maintenance of natural groundwater levels around the Marsh. Evidence suggests that the potential for matters of NES to be impacted by clearing is limited, mainly because the species have been shown to be generally absent from the site. However, through indirect means, habitat outside of the Mining Lease may be impacted through dewatering activities. In relation to groundwater and vegetation, Ministerial Statement 855 provides for compliance reporting, monitoring, setting of triggers, and contingency planning through the implementation of remedial actions should trigger levels be reached. These matters will be overseen by the Western Australian Office of the EPA, DEC, DMP and DOW.

4.5.2 Risk Assessment, Management Systems and Plans

Brockman have undertaken a qualitative environmental risk assessment (ERA) based upon the methodology in Risk Management Standard AS/NZS 4360 and Standards Australia Hand Book 203:2000. The full results of the risk assessment are presented within the Project Environmental Management Plan. Brockman have also developed an Environmental Management System (EMS) for its operations (Appendix A). Under this management system, key documents providing for environmental management have or will be developed. These include;

- a Project Environmental Management Plan (EMP) (Appendix B);
- a Project Surface Water Management Plan (SWMP) (Appendix C);
- a Groundwater Management Plan (GWMP) (Appendix D)
- a Project Topsoil Management Plan (TMP) (Appendix E); and
- Project Closure Plan (CP) (Appendix F).

Prior to undertaking Project works, as per the statutory conditions of Ministerial Statement 855 (see Referral Documents), further to the above listed Plans, Brockman will develop:

- a Compliance Assessment Plan; and
- a Monitoring Schedule for the Project,

to the satisfaction of the CEO of the Western Australian Office of the EPA on the advice of other Western Australian Departments where relevant, including the DEC and DOW.

The various management plans are approved or endorsed by various state authorities, which are described in Table 4.2.

Table 4.2 – Agencys' Responsibilities

Management Tool	Responsible Agency / Legislation	Approval / Acceptance	Aspect Relevant to the proposal
EMP	Department of Environment and Conservation (EPA) / *Environmental Protection Act* 1986	Acceptance	Environmental impact assessment and management
SWMP	CEO of the Office of the EPA / Environmental Protection Act 1986	Approval	Aspect Management
TMP	Department of Environment and Conservation (EPA) / *Environmental Protection Act* 1986	Acceptance	Closure and Rehabilitation
CP	CEO of the Office of the EPA on advice of the Department of Environment and Conservation and Department of Mines and Petroleum / *Environmental Protection Act* 1986 Department of Mines and Petroleum / *Mining Act* 1978	Approval	Closure and Rehabilitation

4.5.3 Rehabilitation and closure

The greatest potential impact to fauna species of NES is the removal of potential habitat, however only in the sense that species will not be able to colonise these disturbed areas until mine rehabilitation has occurred (as they were not observed to be resident), thus rendering any impact indirect and short term.

Ministerial Statement 855 requires both:

- progressive rehabilitation, with percentage cover and species diversity of living self sustaining native vegetation to be comparable to that of undisturbed natural analogue sites , with completion criteria approved by the CEO of the Office of the EPA on advice of the DEC, with rehabilitation activities continuing until those criteria are met to the satisfaction of the CEO of the Office of the EPA on advice of the DMP (Ministerial Statement 855 condition 9); and
- preparation of a Closure Plan to the requirements of the CEO of the Office of the EPA on advice of the DEC and DMP, in accordance with the:
    - ANZMEC/MCA (2000) Strategic Framework for Mine Closure Planning; and
    - Department of Industry, Tourism and Resources (2006) Mine Closure and Completion (Leading Practice Sustainable Development Program for the Mining Industry),

  including any subsequent revisions, and then implementation in accordance with that Closure Plan.

These rehabilitation and closure requirements will therefore comprehensively address any potential residual impact to species of NES as a result of habitat removal. It is anticipated that all but 60 ha

(area of the final pit void) of the 3,785 ha disturbance footprint will be considered in the rehabilitation programme of the Closure Plan.

5 PROPOSED OFFSET MEASURES

Brockman has developed and agreed to an offset plan for the Project (Appendix G), which will be implemented. The potential residual impact (after implementation of the proposed on-site management measures) to potential habitat for matters of NES is from clearing of vegetation which will be addressed by rehabilitation and decommissioning. Other impacts, as described in section 3, will be managed and mitigated through the management measures outlined in section 4.5.

The offset plan has been developed in collaboration the DEC, with consideration to achieving long-term conservation outcomes and to the scale and intensity of the operation.

Rehabilitation of the site on closure will address any residual potential impacts on species of NES. There are no residual matters of NES impacts that would require additional offsets beyond those already proposed by the offset plan for the Project.

5.1 ACHIEVING LONG-TERM CONSERVATION OUTCOMES

Brockman has considered the DSEWPaC Draft Policy Statement for the use of environmental offsets under the *Environment Protection and Biodiversity Conservation Act* 1999, which states:

> *"The Australian Government's position is that:*
>
> *1. Environmental offsets should be targeted to the matter protected by the EPBC Act that is being impacted.*
>
> *2. A flexible approach should be taken to the design and use of environmental offsets to achieve long-term and certain conservation outcomes which are cost effective for proponents.*
>
> *3. Environmental offsets should deliver a real conservation outcome.*
>
> *4. Environmental offsets should be developed as a package of actions - which may include both direct and indirect offsets.*
>
> *5. Environmental offsets should, as a minimum, be commensurate with the magnitude of the impacts of the development and ideally deliver outcomes that are 'like for like'.*
>
> *6. Environmental offsets should be located within the same general area as the development activity.*
>
> *7. Environmental offsets should be delivered in a timely manner and be long lasting.*
>
> *8. Environmental offsets should be enforceable, monitored and audited.*

5.2 SCALE AND INTENSITY OF IMPACT FROM THE DEVELOPMENT

Investigations have been conducted by Brockman for all aspects of the Project to gather baseline data and to determine the types and degree of environmental impacts of the Project (see Section 4.4). Agreement from relevant agencies was obtained for the investigation methods as part of the proposal's consultation process. Advice has been sought from DEC Environmental Management Branch regarding offset opportunities relating to the risk and impacts of the Project, and this was incorporated into the offset plan.

Brockman have undertaken a qualitative environmental risk assessment (ERA) based upon the methodology in AS/NZS 4360 and HB 203:2000. The full results of the risk assessment are presented within the EMP (Appendix B). Importantly, this process will be undertaken on at least an annual basis as Project activities change and new legislation and/or biological information is developed or identified.

Scale and intensity was determined as a function of the sensitivity of the receiving environment and the magnitude of the impact. In assessing the significance of environmental impacts potentially resulting from this proposal, Brockman considered the following:

- relevant legislation, standards and guidelines;
- biological assessments of the Project area;
- the EPA's Principle's of Environmental Protection; and
- input from government and community-based stakeholders.

It is estimated that 3,785 ha of native vegetation, the majority being in moderate to significantly disturbed condition, will be cleared for mining activities over the 20 year life of the Project. The vegetation condition assessment (see Referral Documents) noted within the Mine Lease 45% in poor condition (significant disturbance); 44% in good condition (moderate disturbance) and 11% in excellent condition (minimal disturbance).

6 SOCIAL AND ECONOMIC MATTERS

6.1 STAKEHOLDER ENGAGEMENT

Consultation has focused on how best to realise the Project with acceptable outcomes for the local community, local indigenous groups and the environment at large.

Key outcomes from the consultation process to-date are:

- Brockman has incorporated stakeholder feedback into the design of investigations and where required, commissioned additional investigations to provide appropriate information to inform the Projects approvals processes.
- Brockman has formed partnerships with Martu Idja Banyjima (MIB) and Nyiyaparli Native Title groups and will continue to collaborate on cultural heritage matters throughout the life of the Project.
- Brockman has addressed all issues and concerns raised by stakeholders within the scoping phase of the Project.
- Brockman has proactively sought advice and input from government departments and knowledgeable individuals.
- Brockman has ensured that the appropriate guidelines and 'best practice' techniques have been incorporated into the design of this Project.

Brockman will continue to engage with and consult relevant stakeholders and key interest groups throughout the construction, operation and decommissioning phases of the Project.

Table 6.1 – Summary of Stakeholder Consultation

ISSUE	STAKEHOLDER	OUTCOMES
Subterranean Fauna		
Sampling regime (troglofauna)	DEC (EMB, Brad Durrant)	Sampling requirements met and exceeded although capture rate is very low. Off Mining Lease sampling could not be undertaken.
Sampling regime (stygofauna)	DEC (EMB, Brad Durrant)	Sampling requirements met. Off Mining Lease sampling also undertaken.
Troglofauna habitat boundaries and percentage impact	DEC (EMB, Brad Durrant)	Reasonable approach adopted to quantify level of impact.
Subterranean fauna sampling, access	FMG, BHP Billiton Iron Ore, Rio Tinto, Marillana Station	No useful access arrangements could be negotiated.
Groundwater		
Modelling	DoW (Head office, Pilbara region)	The proposed approach was

ISSUE	STAKEHOLDER	OUTCOMES
		accepted by the DoW.
Potential water disposal options	DoW (Head office, Pilbara region)	The proposed approach was accepted by the DoW.
Groundwater abstraction, water use, management	DoW	DoW is comfortable with level of understanding exhibited to date.
Groundwater abstraction, water use, management	DEC (EMB)	The proposed approach was explained to the DEC.
Surface Water		
Surface water diversions	DEC	The proposed approach was explained to the DEC.
Waste water disposal	DEC, Department of Health (DoH)	Department of Health guidelines incorporated into Wastewater Treatment design. Disposal
Mine Planning and Closure		
Positioning of infrastructure	DEC	The justification was explained to the DEC.
Accommodation village, waste water treatment plant, road re-alignment, traffic considerations	Shire of East Pilbara (SoEP)	The appropriate process will be followed regarding seeking approval of works from the local shire.
Pit backfilling	DoW, DEC	The proposed approach was explained to the DEC and DoW.
Acid Rock Drainage potential	DMP, DEC	Appropriate guidelines have been addressed. Classed as NAF.
Indigenous Heritage		
Botanical (bush tucker) surveys	MIB, Nyiyaparli	No surveys conducted
Heritage surveys, Cultural Heritage Management Plan.	Department of Indigenous Affairs (DIA), MIB, Nyiyaparli	Interim Cultural Heritage Management Plan (CHMP) will be presented in PER, with a full plan under development in liaison with Native Title Claimants.
Native Title agreement. Heritage sites, surveys	MIB, Nyiyaparli	Native Title Claimants undertook heritage surveys. No sites identified. CHMP to be developed.

6.2 ECONOMIC CONSIDERATIONS

Australia is the world's largest exporter and the world's third largest producer of iron ore (17%) after China (21%) and Brazil (20%). Although iron ore resources occur in all the Australian States and Territories, almost 90% of identified resources occur in Western Australia.

Iron ore, the raw material used to produce iron and steel provides the foundation for one of Australia's major export industries. Iron Ore is Australia's fourth largest mineral export (IOMA, 2009). Western Australia dominates the iron ore industry, accounting for 97% of total production. The Pilbara region of Western Australia is particularly significant with 85% of Australia's total identified resources and 92% of its production (Geoscience Australia, 2008).

Western Australia's economy is heavily dependent on mineral resources, and its future growth and development rely on the continued viability of resource development projects. The nearby town of Newman has developed as a result of mineral exploitation, and requires ongoing resource projects to provide revenue to the community. The development of the Project will provide financial and social benefits for the area through employment and flow-on effects to the non-mining sector.

The Project will have a significant beneficial impact on the Pilbara region, bringing revenue and jobs to the area.

The Project will result in further substantial regional and state benefits, including:

- Investment of up to $1 billion of capital into Western Australia's regional and state economies;
- Positive contribution to indigenous training and business opportunities in the region;
- Increasing demands for goods and services creating business and employment opportunities;
- Additional Commonwealth and State Government revenues through collection of additional royalties, taxation and other charges;
- Provide employment opportunities and general financial support for traditional land owners; and
- Provide permanent employment (on a Fly in Fly Out basis) for an estimated 500 employees.

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7 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

7.1 ENVIRONMENTAL CONSIDERATIONS

Having obtained State of Western Australia approval for the Project under the *Environmental Protection Act* 1986, Brockman seeks approval from the Commonwealth Minister for Environment to implement the Project as described in the referral documents.

The *Environmental Protection and Biodiversity Conservation Act* 1999 provides for the protection of matters of national significance. A protected matters database search identified a number of *EPBC Act* listed species may potentially exist within the proposed disturbance area.

Brockman referred the Project to the Department of Sustainability, Environment, Water, Population and Communities in March 2011. The DSEWPaC determined that the proposal constitutes a controlled action. The level of assessment was set at Assessment on Preliminary Documentation (PD).

Table 7.1 outlines Brockman's considerations of the principals of environmental protection in regard to the Project.

Table 7.1 – Principles of Environmental Protection

PRINCIPLE	RELEVANT YES / NO	CONSIDERATION
The Precautionary Principle Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In application of this precautionary principle, decisions should be guided by: (a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and (b) an assessment of the risk-weighed consequences of various options.	Yes	Brockman's Environmental Policy states that Brockman will apply the principle of assessing the actual and potential impact on the environment of all activities and taking appropriate action to minimize any risk. Brockman has commissioned biological work to ascertain the level of likely impact to key environmental aspects and has undertaken a risk assessment on which appropriate management plans have been based. Brockman has undertaken the requisite surveys and risk assessments to inform the planning and design process.

PRINCIPLE	RELEVANT YES / NO	CONSIDERATION
The Principle of Inter-generational Equity The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.	Yes	Brockman have developed a Conceptual Mine Closure Plan which outlines strategies to ensure that rehabilitation achieves a long-term safe, stable and functioning landform that is consistent with the surrounding landscape and other environmental values. This plan will be updated throughout the life of the mine, including estimated costing to a +/- 15% accuracy and finalised into a full Closure Plan at least two years prior to mine closure. Greenhouse gas emissions will result from the Project and Brockman will continue to assess options for reducing and/or offsetting these emissions, including options for the use of LNG in lieu of distillate for power generation. Energy efficiency will be a key consideration in the design of project infrastructure.
The Principle of the Conservation of Biological Diversity and Ecological Integrity The conservation of biological diversity and ecological integrity should be a fundamental consideration.	Yes	The Project will result in new clearing of 3,785 ha of native vegetation. Appropriate flora and fauna surveys have been undertaken to identify options for avoidance or mitigation of environmental impacts. Where clearing is necessary rehabilitation commitments have been made.
Principles relating to improved valuation, pricing and incentive mechanisms (a) Environmental factors should be included in the valuation of assets and services; (b) The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance and abatement; (c) The user of goods and services should pay prices based on the life cycle of providing goods and services, including the use	Yes	Project impacts and associated environmental management costs have been considered during the planning stages of the Project and will be developed further during the Bankable Feasibility Study (BFS). Management measures to avoid, mitigate or offset adverse impacts have been developed and will be implemented for the life of the Project in line with Brockman's Environmental Policy.

PRINCIPLE	RELEVANT YES / NO	CONSIDERATION
of natural resources and assets and the ultimate disposal of any waste; (d) Environmental goals, having been established, should be pursued in the most effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solution and responses to environmental problems.		
The Principle of Waste Minimisation All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge to the environment.	Yes	This has been addressed in the Project EMS and EMP. Integrated environmental management will be implemented across all operations.

7.2 SUSTAINABILITY

The Western Australian Government has released a Sustainability Strategy for Western Australia: *Hope for the Future: the Western Australian State Sustainability Strategy* (Government of Western Australia, 2003). The strategy includes a vision for the State's mining industry and some key future actions are:

- work towards assessment of projects using sustainability criteria;
- foster local community involvement (particularly Aboriginal communities, pastoralists and local shires);
- establish a transparent process to enable community awareness of the day-to-day regulatory system for the resources industry; and
- implement strategies that support the use of local employment in mining ventures, particularly using regional centres as employment hubs and encouraging mining companies to maximise their purchasing of goods and services within regions.

The International Council on Mining and Minerals (ICMM) lists 10 principles of sustainable development, which are:

- implement and maintain ethical business practices and sound systems of corporate governance;
- integrate sustainable development considerations within the corporate decision-making process;
- uphold fundamental human rights and respect cultures, customs and values in dealings with employees and others who are affected by our activities;
- implement risk management strategies based on valid data and sound science;
- seek continual improvement of our health and safety performance;
- seek continual improvement of our environmental performance;
- contribute to conservation of biodiversity and integrated approaches to land use planning;
- facilitate and encourage responsible product design, use, re-use, recycling and disposal of our products;
- contribute to the social, economic and institutional development of the communities in which we operate; and
- implement effective and transparent engagement, communication and independently verified reporting arrangements with our stakeholders.

Brockman will address these principles of sustainability in a number of ways including:

- establishing sustainability principles in purchasing and contracting;
- ensuring efficient energy and water use;
- minimising waste and encouraging recycling; and
- providing for industry and community partnerships.

8 OTHER APPROVALS AND CONDITIONS

8.1 APPROVAL UNDER PART IV OF THE EP ACT 1999

The Project was approved with conditions by the Western Australian Minister for Environment (statement number 855) in February 2011 in accordance with Section 38(1) of the *Environmental Protection Act* 1999 (see Referral Documents). Brockman will use that legislations Section 45 C process to reflect the non substantial changes to the Project since approval, including the increase in footprint from the approved 2,985 ha.

8.2 OTHER APPROVALS AND LICENCES

Various Works Approvals and Licences will be required for construction and operation of prescribed premises under Part V of the *Environmental Protection Act* 1986. These applications have commenced.

Approval under the *Mining Act* 1978 will also be required in the form of a Mining Proposal which will be required from the DMP prior to the commencement of construction.

A Development Application / Planning Consent and building permit applications may need to be made to the SoEP which typically take around one month to process. Section 5C bore licenses will need to be applied for at the DoW.

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9.2 QUALIFICATIONS AND EXPERIENCE OF THE STUDY TEAM

Garry Connell – Director and Manager Major Projects

Garry has over 20 years experience in environmental management within the resources industry. His experience spans over the biological sciences sector with 15 years of zoological survey experience. Garry's environmental management experience has seen him involved in some of the largest resource development projects in Western Australia.

Projects including BHP Rapid Growth Projects and Port Hedland Port Authority.

Carol Macpherson – Principal Botanist

Carol has 19 years experience as a consulting botanist, with 18 years as Principal Botanist and Director at e*cologia*. Carol's experience includes the involvement of over 350 major environmental projects resulting in technical reports and scientific journal publications.

Carol has undertaken and managed many flora surveys in the Pilbara, Murchison, southwest and Perth Metropolitan areas, including HPPL Roy Hill, HPPL Murray's Hill, SMC Weld Range, MML Jack Hills and OPR Port and Rail.

Dr. Lázaro Roque-Albelo – Principal Zoologist

Lazaro has over 20 years of experience as an invertebrate zoologist and has been involved in over 100 major environmental projects in Australia and overseas resulting in technical reports and scientific journal publications. He has extensive experience applying statistical modelling to biological assessments projects. Lazaro has undertaken and managed many invertebrate surveys throughout the Pilbara including the HPPL Roy Hill SRE Project, FMG Christmas Creek and Cloudbreak SRE Desktop Study, Giralia Mt Webber SRE Project, HPPL Murray's Hill troglofauna project and Millennium Minerals Stygofauna and Stygofauna projects.

Damien Cancilla – Senior Vertebrate Zoologist

Damien has 7 years experience in the zoological field, with over 5 years experience as a fauna consultant. Damien has successfully managed the completion of projects such as the OPR rail project, Weld Range Iron Ore Project (SMC), Robinson Range Iron Ore Project (SMC), Jack Hills Iron Ore Project (SMC), Eneabba Coal Project (Aviva), Solomon Project (Fortescue), Chichester Range rail deviation (BHPBIO). Prior to starting consulting Damien assisted researchers studying Woylie and Sandalwood interactions and assisted the DEC with several targeted Chuditch surveys including surveys in the Julimar State forest.

Dr. Elizabeth Fox – Senior Vertebrate Zoologist

Elizabeth has been an active ornithologist for the past 15 years, with over 3 years experience as a fauna consultant. Elizabeth has successfully managed the completion of the HPPL Roy Hill project, Brockman's Marillana project, SMC's Jack Hills project, and several targeted conservation significant fauna surveys. Prior to starting consulting Elizabeth researched the effects of revegetation on bird populations, bird nesting behaviour, bird song and carried out targeted surveys for the Western Bristlebird in association with the DEC.

9.3 LIMITATIONS

The content of this report has been informed by published and publicly available information (Section 9.1), research and reports prepared by *ecologia* Environment and the professional experience of the study team (Section 9.2).

For the purposes of this report, potential regional habitat has been mapped for species based on land systems. A detailed habitat analysis was conducted by *ecologia* within the Mining Lease during investigations (Sections 3.2 and 4.4), which may redefine habitat boundaries within the Mining Lease from those illustrated using Land systems.

Limitations regarding biological reports are detailed with-in those reports (see Referral Documents).

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APPENDIX

The following appendices have been included as .pdf files on compact disk, located on the rear cover page of this document.

APPENDIX A	ENVIRONMENTAL MANAGEMENT SYSTEM
APPENDIX B	MARILLANA ENIVRONMENTAL MANAGEMENT PLAN
APPENDIX C	MARILLANA SURFACE WATER MANAGEMENT PLAN
APPENDIX D	MARILLANA GROUNDWATER STUDY AND MANAGEMENT PLAN
APPENDIX E	MARILLANA TOPSOIL MANAGEMENT PLAN
APPENDIX F	MARILLANA CLOSURE PLAN
APPENDIX G	MARILLANA OFFSET PLAN
APPENDIX H	ASSESSMENT OF NOISE AT THE FORTESCUE MARSH
APPENDIX I	CONCEPTUAL SITE PLAN

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