TERRESTRIAL ECOSYSTEMS

2019-0085-003-st

28 January 2020

Kathryn Forrest
Senior Environmental Adviser
Pilbara Minerals
Level 2
88 Colin Street
West Perth WA 6005

Re: Northern Quoll survey on mining tenement M45/1266

Dear Kathryn

Terrestrial Ecosystems is pleased to provide the outcomes of a Northern Quoll (*Dasyurus hallucatus*) camera trapping survey on mining tenement M45/1266. The objective of this survey was to determine whether Northern Quoll were present in the mining tenement. It was important to determine whether they were present as this species is listed as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* and *Biodiversity Conservation Act 2016* and potential impacts on the species require additional regulatory assessment and management procedures.

Background

The Northern Quoll is found in east and north Queensland, northern parts of the Northern Territory, the Kimberley and the Pilbara. In the Northern Territory, and to a lesser extent in north-eastern Australia, Northern Quoll populations have declined significantly due to their predation on Cane Toads. Oakwood (2008) suggested that they were most abundant in broken country, rocky areas and open eucalypt forest within 150km of the coast.

Males weigh between 400-900g and females between 300-500g (Oakwood 2008). Northern Quolls' diet consists mostly of invertebrates, but they also eat small reptiles and soft fruits (Dunlop *et al*. 2017). It is thought that most males in savannah areas die after breeding (Braithwaite and Griffiths 1994, Oakwood 2000), but in captivity, if breeding activity is restricted, males will live to breed in subsequent years. Many females also die after raising their first litter, but about a quarter survive to produce a litter in the second year. In rocky areas, Braithwaite and Griffiths (1994) reported the Northern Quoll living for 2-3 years, whereas, in savannah areas they rarely live beyond the first mating. Mating occurs in winter, with young being carried by the female for 8-10 weeks after birth, after which the young stay with their mother until they are able to fend for themselves.

In many parts of their range, the Northern Quoll occurs in small, fragmented populations according to habitat (Pollock 1999, Turpin and Bamford 2015). Core habitat includes rugged rocky areas that follow waterways, ironstone ranges, and uprisings of survey granite outcrops (Molloy *et al*. 2017). Commonly recorded habitats are not evenly spaced through the landscape, and often occur as rocky 'islands' separated by expansive spinifex grasslands. Rocky habitat provides a greater number of denning sites, provides greater refuge from fire, supports greater food resources, productivity and floristic diversity, and typically is not used for livestock grazing (Moro *et al*. 2019).

They are reported to den in hollow tree trunks but will use other spaces such as rock crevices and openings in old termite mounds. In the Pilbara, the geographic distribution of Northern Quolls is considered fragmented (Molloy *et al*. 2015), with its numbers in decline.

King (1989) reported activity areas for Northern Quoll ranged from 5-1109 ha, and the longest movement was 3.5km over seven days in the Pilbara. Home range for females in the savannah areas of Kakadu National Park was about 35ha, with some overlap in foraging areas when population densities were 3-4 females/km^2, but at 1-2 females/km^2 there was no overlap (Oakwood 2002). Male home ranges were similar to females during the non-breeding season, but increased to in excess of 100ha when they are searching for females. Scats are often

placed in prominent positions to mark territories. Terrestrial Ecosystems (unpublished data) have recorded daily movements of radio-tracked individuals greater than 5km between rocky areas in the Pilbara.

Braithwaite and Griffiths (1994) reported their range reduction might be associated with cattle grazing and exotic disease. The Cane Toad may also contribute to their range reduction. Moore *et al*., (2019) also report altered fire regimes and predation as threatening processes responsible for their range reductions.

Rankmore *et al*. (2008) reported on a very successful translocation of Northern Quolls from mainland Northern Territory to Pobassoo Island (74-fold increase from 19 individuals) and Astell Island (142-fold increase from 45 individuals) off north-eastern Arnhem Land. Prior to the translocation, these islands were not inhabited by quolls. These translocated populations showed little loss of genetic diversity in the short-term, and a high survival rate.

Methods

The Commonwealth Government's Northern Quoll referral guidelines (Department of the Environment 2016) indicate:

> Northern Quoll occupies a variety of habitats across its current range including rocky areas, eucalypt forest and woodlands, dry rainforests and vine thickets, sandy lowlands and beaches, shrublands, grasslands and deserts. Habitat usually includes some form of rocky area or structurally diverse woodland or forest used for shelter purposes with surrounding vegetated habitats used for foraging and dispersal. Shelter habitat is important for breeding and refuge from fire and/or predation. Little is understood about the characteristics of foraging or dispersal habitat for the northern quoll.

Ecologia Environment (2019) mapped seven different fauna habitats in the project area. The rocky hills habitat type contained numerous overhangs, crevices and rock piles, but no large boulder piles or deep caves. The rocky hills habitat was mapped as a fragmented habitat type which has a north-south alignment across tenement M45/1266. The most common habitat type in the project area was the low exposed hills. This habitat is characterised by hills that do not feature ridges, water sources, caves or gorges. It is our experience that in the Pilbara, if Northern Quoll are present, then they will be predominantly found on rocky ridges, and outcrops and rises, but they may also occur in a variety of other habitats.

Tenement M45/1266 has a series of rocky ridges/breakaways running approximately north-south through the tenement and this habitat type may provide suitable habitat for Northern Quoll if they are present. As the purpose of the survey was to determine the presence of Northern Quoll, the rocky ridges were selected as the focus of the camera trap survey. A field habitat assessment was used to determine the location of camera traps instead of desktop habitat mapping provided by Ecologia Environment (2019).

Dr Scott Thompson (Terrestrial Ecosystems) with assistance from Kathryn Forrest and Ryan Donegan (Pilbara Minerals) set up 30 Reconyx (HC600) camera traps on 23 and 24 September 2019 across the rocky ridges in M45/1266 (Figure 1). All cameras were set up with non-reward lures made of peanut butter, oats, sardines and fish oil. The camera traps were collected by Pilbara Minerals staff on 11 and 12 November 2019. and images were reviewed by Terrestrial Ecosystems staff.

Results

Twenty-six of the camera traps were positioned in the 'rocky hills' habitat type as mapped by Ecologia Environment (2019). Small areas of rocky habitat were also identified by Dr Scott Thompson in the field that were not mapped by Ecologia Environment (2019). The remaining four camera traps were in the 'low exposed hills' as mapped by Ecologia Environment (2019), however, these were considered rocky habitat by Dr Scott Thompson.

Twelve camera traps recorded Northern Quoll (Table 1) and all of these records were in the rocky hills habitat type along the north-south rocky ridge line. Northern Quoll were the most commonly recorded species followed by Rothchild's Rock-wallaby (*Petrogale rothschildi*) and the Common Rock Rat (*Zyzomys argugus)*. Plates 1-35 show some of the fauna that were recorded. It was not possible to determine the population of Northern Quoll based on spot patterns (Hohnen et al. 2012, Austin et al. 2016), however, it was clear that there were multiple individuals of both sexes and some individuals were recorded on multiple cameras.

Discussion

Northern Quoll are regularly encountered in appropriate habitats in the Pilbara, so it is not surprising that they are present in M45/1266. Northern Quoll have been recorded in multiple locations within 75km of the project area including the Aurizon railway (Terrestrial Ecosystems 2013), FMG railway (ATA Environmental 2007), Roy Hill railway (Terrestrial Ecosystems 2011), Hope Downs railway (Biota Environmental Sciences 2002), Wodgina (Bamford Consulting Ecologists 2008, Outback Ecology Services 2009, 2010, 2012, 2013) and many other projects.

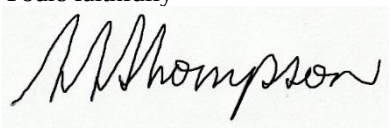
Ecologia Environment (2019) recorded scats from five locations in the rocky hills and one location in a small rocky outcrop in the footslopes habitat type. These scat locations correspond to the location of Northern Quolls in the camera trap images.

The Commonwealth Government's (Department of the Environment 2016) referral guidelines on Northern Quoll indicate habitat critical to the Northern Quolls survival includes ranges, escapements, mesas, gorges, breakaways, boulder fields, major drainage lines, treed creek lines, structurally diverse woodlands or forest area containing large diameter trees, termite mounds or hollow logs. Dispersal and foraging habitat, and habitat that connects area of 'critical habitat' is also considered important. When this interpretation is applied to tenement M45/1266, the rocky ridges, breakaways, treed creek lines and adjoining corridors plus a suitable buffer zone of approximately 500m would constitute important habitat critical to the Northern Quoll survival.

Northern Quoll can be impacted by multiple factors during mining and infrastructure development. These include: habitat fragmentation, altered fire regimes, dust, road fauna deaths, noise, vibration and light spillage, introduced predators and feral animals, uncapped drill holes, putrescible waste, and increased availability of permanent surface water. When mining and infrastructure development plans are available a vertebrate fauna management plan can be developed identifying management and mitigation strategies.

Please do not hesitate to contact the undersigned on 0407 385 239 or Dr Graham Thompson (0438 491 227) should you have any queries.

Yours faithfully



Dr Scott Thompson
Principal Zoologist and Partner

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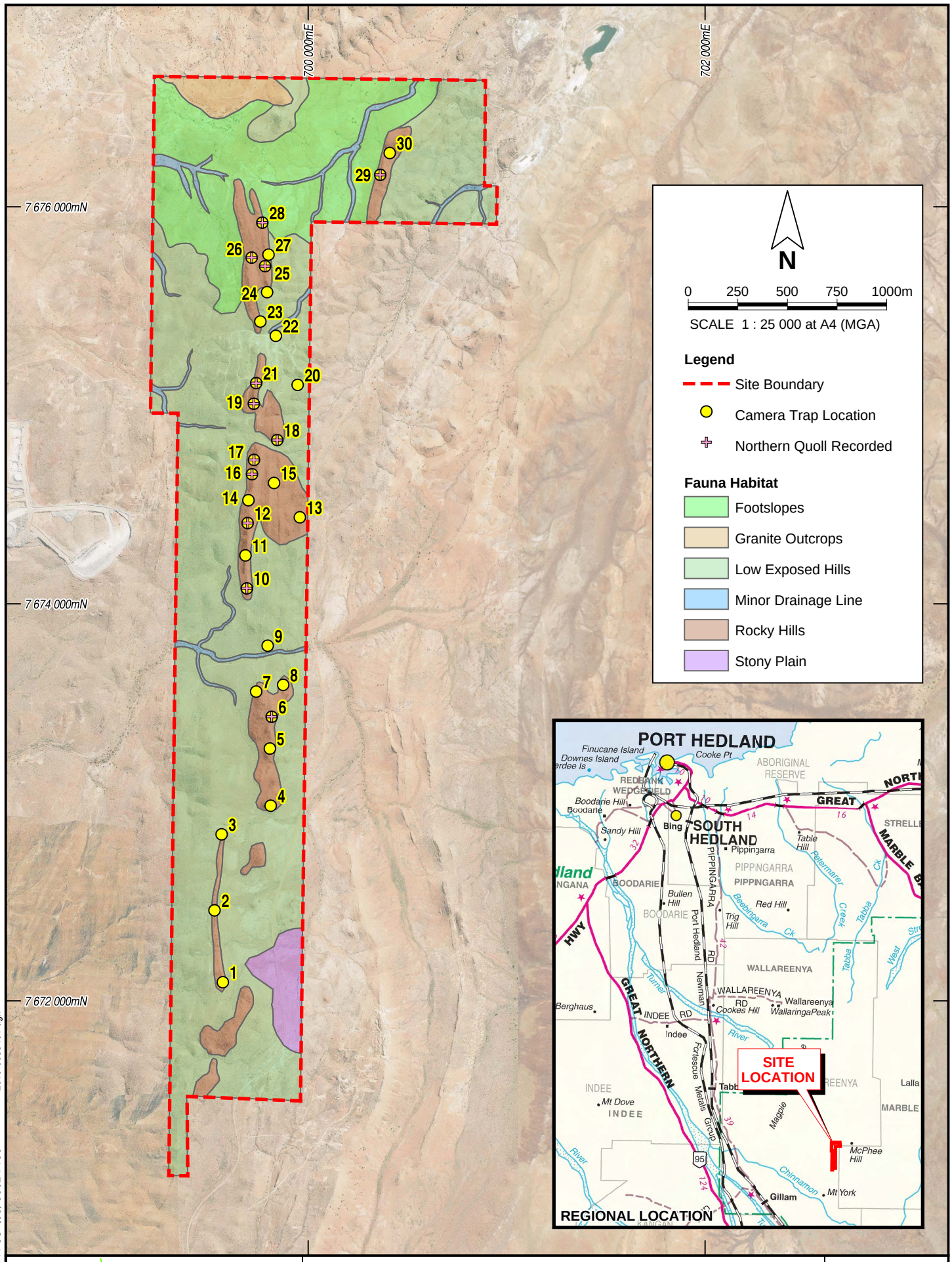

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TERRESTRIAL ECOSYSTEMS

Drawn: S. Thompson

Date: 25 Jan 2020

Pilbara Minerals Ltd
PILGANGOORA NORTHERN QUOLL SURVEY
TENEMENT M45/1266

NORTHERN QUOLL SURVEY

Figure 1

Job: 2019-0085

Plate 1 – Pilbara Rock Monitor

Tree No 2 – Spinifex Pigeon

Plate 3 – Dingo/dog

Plate 4– Northern Quoll

Plate 5– Rothchild's Rock-wallaby

Plate 6- Cat

Plate 7 – Pied Butcherbird

Plate 8– Rothchild's Rock-wallaby

Plate 9- Cat

Plate 10 – Rothchild's Rock-wallaby

Plate 11– Northern Quoll

Plate 12– Pied Butcherbird

Plate 13– Northern Quoll

Plate 14 – Dingo/dog

Plate 15– Rothchild's Rock-wallaby

Plate 16– Rothchild's Rock-wallaby

Plate 17– Northern Quoll

Plate 18– Northern Quoll

Plate 19 – Willie Wagtail

Plate 20– Northern Quoll

Plate 21– Northern Quoll

Plate 22 -Euro

Plate 23– Northern Quoll

Plate 24– Rothchild's Rock-wallaby

Plate 25 – Common Rock rat

Plate 26 - Euro

Plate 27– Rothchild's Rock-wallaby

Plate 28 – Northern Quoll

Plate 29 – Pilbara Grasswren

Plate 30 - Perentie

Plate 31 - Cat

Plate 32– Northern Quoll

Plate 33– Northern Quoll (with young)

Table 1. Vertebrate fauna images on camera traps

	Camera number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Species	Common name							nil						nil										nil	nil						nil
Canis lupis	Dingo/Dog																											x	x		
Dasyurus hallucatus	**Northern Quoll**						**x**				**x**		**x**				**x**	**x**	**x**	**x**		**x**				**x**	**x**		**x**	**x**	
Felis catus	Cat	x			x																		x								
Macropus robustus	Euro	x	x		x																										
Petrogale rothschildi	Rothschild Rock-wallaby									x	x	x	x			x	x	x	x	x		x								x	
Zyzomys argugus	Rock Rat			x		x	x			x			x				x			x							x		x	x	
Ctenophorus caudicintus	Ring-tailed Dragon																	x													
Varanus giganteus	Perentie																					x									
Varanus pilbarensis	Pilbara Rock Monitor								x				x																		
Aegotheles cristatus	Owlet Nightjar																													x	
Amytornis whitei	Pilbara Grasswren																			x		x						x		x	
Anthus novaeseelandiae	Australian Pipit	x																													
Cracticus nigrogularis	Pied Butcher bird			x	x																										
Emblema pictum	Painted Firetail (Finch)																													x	
Falco berigora	Brown Falcon												x																		
Geophaps plumifera	Spinifex Pigeon	x			x												x						x				x		x		
Lichenostomus keartlandi	Grey Headed Honeyeater																										x				
Rhipidura leucophrys	Willie Wagtail																					x									