Appendix 3

2014 Sub-tropical Rainforest Monitoring Abel Underground Coal Mine

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2014 Subtropical Rainforest Monitoring

Donaldson Coal Pty Ltd

Abel Underground Coalmine
1132 John Renshaw Drive
Black Hill NSW 2322

2 December 2014

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2014 Subtropical Rainforest Monitoring

Abel Underground Coalmine
1132 John Renshaw Drive
Black Hill NSW 2322

Kleinfelder Report Number: WBA14R07479

Project Number: 20153089

Prepared for:

DONALDSON COAL PTY LTD
PO BOX 2275
GREENHILLS NSW 2323

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Kleinfelder Australia Pty Ltd
64 Medcalf Street
Warners Bay, NSW 2282
Phone: 1300 881 869
Fax: 1300 881 035

ABN: 23 146 082 500

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EXECUTIVE SUMMARY

Background

Donaldson Coal Pty Ltd commenced operations at Abel Underground Coalmine at Black Hill in the lower Hunter Valley, New South Wales in 2008. To comply in part with conditions of consent a Flora and Fauna Management Plan (F&FMP) was prepared in 2007 by ecobiological (now Kleinfelder).

The F&FMP identified the need to establish a plan to monitor the subtropical rainforest areas of Long Gully Creek. While there are several areas of rainforest above the underground coal mine area, the most extensive and best developed lies along the Long Gully Creek system.

Annual monitoring has been conducted at Long Gully Creek for the past seven years (2008 to 2014). This area has been identified as susceptible to impacts from mine subsidence. The Subtropical Rainforest Monitoring Plan (SRMP) is designed to examine the stability of the rainforest/dry forest interface and floristic and faunal diversity. The current study has gathered information on the presence and status of threatened species at the site and will allow best practice measures to be incorporated into the mine's Subsidence Management Plan (SMP). The Subtropical Rainforest Monitoring Plan (SRMP) will continue until one year after mining has passed under the Long Gully and Blue Gum Creek catchments.

This document reports results of the seventh annual monitoring event since a baseline survey conducted by ecobiological in 2008. Changes in the assemblages of flora, fauna and threatened species over time are analysed to detect significant trends.

Flora

The area of transition between dry and moist forest at Transect 1 has expanded since the 2008 baseline survey, with the width of the moist forest increasing. Along Transect 1, particularly at the end of the transect, there has been in increase in the number of moist species recorded and a decline in the number of dry species within each 5 m segment. The forest transitional zones for Transect 2 occur in a similar location to that identified in the baseline study. Along both Transect 1 and Transect 2 there has been a decline in Foliage Projection Cover (FPC) since the original 2008 survey event. However, this is not an isolated occurrence in the current survey. When data from the 2014 survey are compared to that of the 2009 survey, the total FPC along both transects is relatively similar, with a few exceptions. Generally, along Transect 1 the midstorey foliage cover recorded during the

2014 survey was less than the 2008 and 2009 surveys. Possibly, this is due to the increase in the FPC of vines such as Cissus antarctica *(Kangaroo Vine) which can shade out and restrict the growth of the trees they sprawl over - causing a decline in midstorey FPC. The decline in shrub and midstorey cover along Transect 2 does not appear, at this stage, to have resulted in, or be caused by an increased FPC of another stratum. It is important to note that these changes are more likely to be due to the loss of single trees and natural decline in the shrub species rather than widespread tree decline. Light gaps are an expected in rainforest systems and are important to drive regeneration.*

Fauna

*In total, (i.e. at both forest types) 44 fauna species were recorded, comprising five arboreal mammal species, four terrestrial mammal species, eight bat species and 27 bird species. Two of these species, the Little Bentwing-bat (*Miniopterus australis*) and the Eastern Free-tail Bat (*Mormopterus norfolkensis*) are listed as threatened under the* Threatened Species Conservation Act 1995 (NSW) (TSC Act). *No amphibians or reptiles were recorded.*

In 2014 a total of 36 and 26 fauna species were recorded in the dry forest and rainforest habitats respectively. In 2014, almost all fauna classes recorded higher than, or on par with, the average number of species detected across all years. The notable exception is the decline in bird numbers observed in 2014 which lowered the overall species richness to 29, which is five below the average of 34. An interesting observation regarding the lack of large forest owl species in 2014 is that this year the highest number of arboreal mammal species was observed. In 2012 and 2013 when either one or both species of forest owls were detected, the arboreal mammal presence was lower. At this stage this is only an observation and further surveys will be required to determine if a pattern is emerging.

The annual monitoring continues to provide robust baseline information on the natural variation in the diversity of species in the Long Gully Creek system. The growing dataset will provide a valuable benchmark against which future underground mining impacts can be assessed.

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ABBREVIATIONS

EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (C'th)
GIS	Geographic Information System
ha	hectares
LGA	Local Government Area
TSC Act	*Threatened Species Conservation Act 1995* (NSW)

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1. INTRODUCTION

1.1 BACKGROUND

Donaldson Coal Pty Ltd (Donaldson) commenced mining in 2008 at a new underground mine (known as Abel Underground Coal Mine), located approximately 23 kilometres north-west of Newcastle. The mine is expected to extract up to 4.5 million tonnes of coal per year over 21 years using high productivity continuous miner based bord and pillar systems, and pillar extraction techniques. The seams to be mined are located under the rural residential and forested areas at Black Hill. Mine access and associated surface infrastructure is located within the existing Donaldson Coal mine open cut void at Beresfield, with transfer of coal to the existing Bloomfield Coal Handling and Preparation Plant (CHPP) immediately to the north for coal washing and rail transport to the Port of Newcastle.

Underground coal mining is often associated with adverse environmental impacts due to subsidence (Bell *et al.* 2000, Sidle *et al.* 2000). Subsidence can cause loss of productive land, damage to underground pipelines and above-ground structures, decreased stability of slopes and escarpments, contamination of groundwater by acid drainage and dewatering of streams and groundwater supplies (Sidle *et al.* 2000). The key environmental concern arising from the Abel mine is the effect of subsidence on local and regional hydrology. Surface and sub-surface cracking associated with mining subsidence can alter surface flow and create preferential flow paths, thus causing dewatering and rerouting of surface water and groundwater (Sidle *et al.* 2000). Alterations in channel and drainage morphology may also affect channel erosion, sediment delivery, and routing in streams and riparian habitat.

Development approval for the Abel coal mine imposed a number of conditions of consent. These conditions included a requirement for a Flora and Fauna Management Plan (F&FMP) which was prepared by ecobiological (now Kleinfelder) in 2007. The F&FMP, which forms part of a comprehensive Environmental Management System for the Abel mine, sets out a strategy to monitor the effectiveness of conservation measures proposed within the Environmental Assessment (EA) Statement of Commitments for the overall operation of the mine. Part of this strategy was to establish a Surface Ecological Monitoring Plan (SEMP) to monitor the effectiveness of the conservation measures proposed in the EA to mitigate against subsidence impacts on three distinct habitat areas: farm dams across the mine site;

subtropical rainforest areas within Long Gully Creek; and the wet swamp within Pambalong Nature Reserve.

The SEMP outlines a monitoring plan for each of these areas by which baseline and subsequent monitoring data are to be gathered to inform future management. This document reports results from the seventh annual monitoring event for the Subtropical Rainforest Monitoring and Management Plan (SRMP) since completion of the baseline study in 2008 and is part of the overall SEMP.

1.2 SUBTROPICAL RAINFOREST

Subtropical rainforests are characterised by a dense, multi-layered tree canopy approximately 20 - 40 m tall, and are generally comprised of large emergent trees and a sub-canopy of smaller trees (Keith 2004). Subtropical rainforests, along with tropical rainforests in Queensland, have the most diverse tree flora of any vegetation type in Australia (Floyd 2008). The understorey is typically open and consists of scattered saplings, shrubs and ferns. Vines and epiphytic orchids are also common. As subtropical rainforests have high plant species diversity as well as structural complexity and biomass, they subsequently also support diverse assemblages of native fauna.

In NSW, subtropical rainforests are scattered across coastal lowlands and escarpment foothills north from the Illawarra region to the Queensland border. They typically occur on south and east aspects in valleys and foothill gullies on fertile soils such as basalt derived soils or alluvial soils, which are high in nutrients (e.g. phosphorus and calcium). Rainforests can also occur in low nutrient sandstone such as at Long Gully Creek, Newcastle (Floyd 1990). Subtropical rainforests tend to occur in areas with warm temperatures and with an annual rainfall of 1300 mm or greater (Keith 2004; Floyd 2008).

The primary threats to subtropical rainforest include fire and weed invasion. Rainforests are not adapted to fire due to the relatively low frequency of fire events within these communities. As a result, only a low proportion of species present in rainforest possess mechanisms for tolerating or recovering from fire. Therefore, fire can strongly influence rainforest boundaries as it promotes the establishment of fire-adapted species and encourages the replacement of rainforest with sclerophyll forest. Invasion of exotic species is also a significant threat to subtropical rainforests. There is potential for vigorous woody exotic weeds such as Camphor Laurel (*Cinnamomum camphora*), Privet (*Ligustrum* sp.) and Lantana (*Lantana camara*) to

become established in rainforest systems particularly where there is high disturbance and natural succession processes are affected (Floyd 2008; Peel 2010). Where disturbance is lower, these exotic species are generally restricted to the edges of subtropical rainforests as demonstrated at Long Gully Creek.

1.3 LOCATION

The Abel Underground Mine is located within Newcastle, Cessnock and Maitland local government areas (LGAs). The majority of the underground mine and surface infrastructure is within the Cessnock LGA.

The location of the underground mine area and surface facilities is shown in **Figure 1**. The underground mine area is bounded to the east by the M1 Pacific Motorway (F3 Freeway); to the west and south by a tract of forest that extends south to the Central Coast and beyond to Hornsby and to the north by existing open cut coal mining activities within the Donaldson and Bloomfield mine leases.

The Abel underground mine area is approximately 2,750 ha and consists of low undulating forested hills with patches of cleared land occurring on 110 rural/residential properties. Large areas of land are owned by Donaldson, Coal and Allied and the Catholic Diocese of Maitland and Newcastle. Black Hill School, various local roads and other infrastructure are located in the area.

A ridgeline associated with Black Hill runs east-west through the underground mine area. Tributaries of Buttai Creek, Viney Creek/ Weakley's Flat Creek and Four Mile Creek drain northwards from this ridgeline. A wide catchment containing Long Gully and Blue Gum Creek drains from the ridgeline providing water to the wet swamp at Pambalong Nature Reserve. Some cliff-lines and steeper gullies are located along sections of the Black Hill ridge.

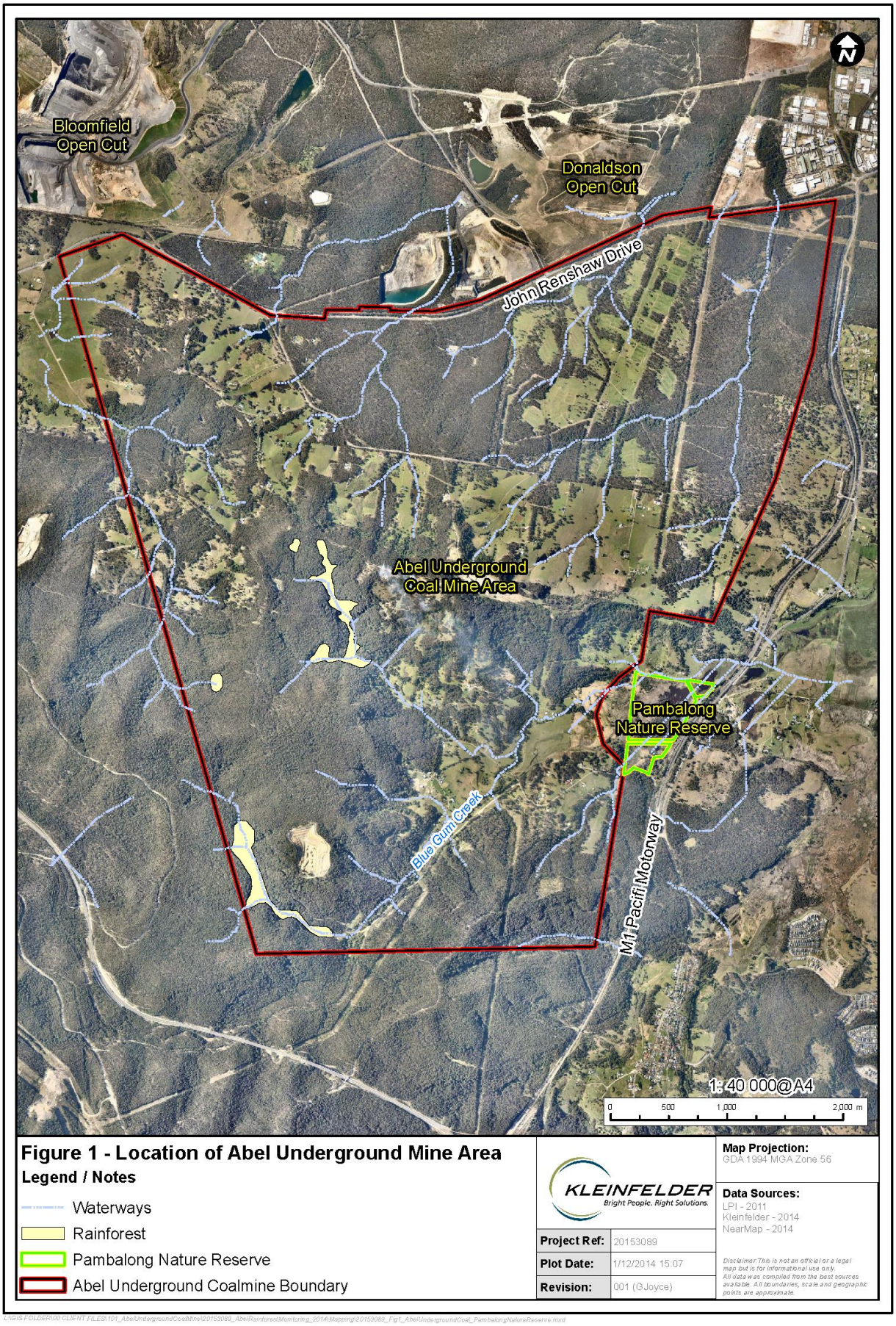

Figure 1 - Location of Abel Underground Mine Area

Legend / Notes

- Waterways
- Rainforest
- Pambalong Nature Reserve
- Abel Underground Coalmine Boundary

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Project Ref:	20153089
Plot Date:	1/12/2014 15:07
Revision:	001 (GJoyce)

Map Projection:
GDA 1994 MGA Zone 56

Data Sources:
LPI - 2011
Kleinfelder - 2014
NearMap - 2014

Disclaimer: This is not an official or a legal map but is for informational use only. All data was compiled from the best sources available. All boundaries, scale and geographic points are approximate.

2. METHODS

2.1 FLORA

Flora field sampling measures the spatial extent of the rainforest community in Long Gully Creek with the aim to determine if it is stable, expanding or contracting. Two transects spanning the width of the rainforest start and end in the adjoining dry forest (**Figure 2**). The lengths of Transects 1 and 2 are 70 m and 50 m respectively. Transects were divided into 5 m by 1 m consecutive quadrats. Flora surveys were conducted on 31 October 2014.

Information recorded in each quadrat is included:

- Total floristic content, with species recorded being classified as typically occurring in dry or moist forest habitats, and whether they formed part of the ground, shrub, midstorey or overstorey/ emergent stratum; and
- An estimate of the foliage projective cover (FPC) (Walker & Hopkins 1988) of vegetation in the ground, shrub, midstorey, overstorey and vine stratums. The estimated FPC was recorded for each quadrat for each structural layer.

A second order polynomial trend line was used to determine the transitional zones between moist and dry forest types. R^2 values were also calculated to determine how well the fitted lines explained the data. The closer the R^2 value is to 1, the higher confidence that the trend line fits the data.

For any plants where field identification is problematic a specimen is collected for later identification. Floristic identification and nomenclature is based on Harden (1992, 1993, 2000, 2002) with subsequent revisions as published on PlantNet (Royal Botanic Gardens and Domain Trust 2013). Plants of local conservation significance and/or listed by the ROTAP scheme (Briggs & Leigh 1996) were noted.

2.2 FAUNA

Field surveys for fauna are centred on two transects (separate from the flora transects) approximately 200 m long, one located in the rainforest and the other in the adjacent dry forest. Fauna surveys were conducted from 20 October to 11 November 2014.

Equal numbers and types of traps were used in each transect except for the number of Elliott B traps in trees (**Table 1**). Seven traps were placed in trees in the dry forest compared to three in the rainforest. The location of fauna survey activities is shown in **Figure 2**.

Table 1 Trapping statistics for the subject site

Trap type	Rainforest Transect	Dry Forest Transect	Nights	Trap nights
Elliott A (small)	20	20	4	160
Elliott B (large) Tree	3	7	4	40
Elliott B (large) Ground	5	5	4	40
Harp Trap	1	1	4	8
Hair tubes (in trees)	8	8	4	64

2.2.1 Arboreal Mammals

Elliott B traps and hair tubes were placed in trees at heights of 3 m or more along transects and baited with a mixture of rolled oats, honey, peanut butter and treacle. The trunks of trees containing the traps were sprayed with a mixture of honey and water. Traps were checked daily. Wafers from the hair tubes were collected after 4-nights and checked for hair samples. Hair identification methods followed those of Brunner *et al.* (2002) and are analysed in-house.

Spotlighting was conducted after dusk for one person hour at each transect and repeated on two separate nights (four person hours total). Trees hollows were watched at dusk to detect emerging nocturnal birds or mammals.

2.2.2 Terrestrial Mammals

Elliott A and B were baited with a mix of rolled oats, honey, peanut butter and treacle and placed on the ground at regular intervals along each transect. Traps were left in position for four consecutive nights and checked each morning.

Observations of indirect signs of terrestrial mammals such as diggings, droppings or scratch marks were noted and recorded.

2.2.3 Bats

Harp traps were erected across likely bat 'flyways' such as natural forest openings on each transect. The harp traps were left in position for four consecutive nights and checked each morning. Captured bats were identified in the field and then released into an artificial bat box tethered to a nearby tree. This provides shelter from predators during the day and allows the bats to exit the box on nightfall.

Anabat™ SD2 ultrasonic call detectors (Titley Electronics, Ballina) were used to record the calls of Microchiropteran bats feeding in the area. The units were set up at dusk and record for one hour at each transect and repeated on two separate nights (four hours total). Spotlight searches of blossoming trees were also undertaken to detect Megachiropteran bat species.

2.2.4 Birds

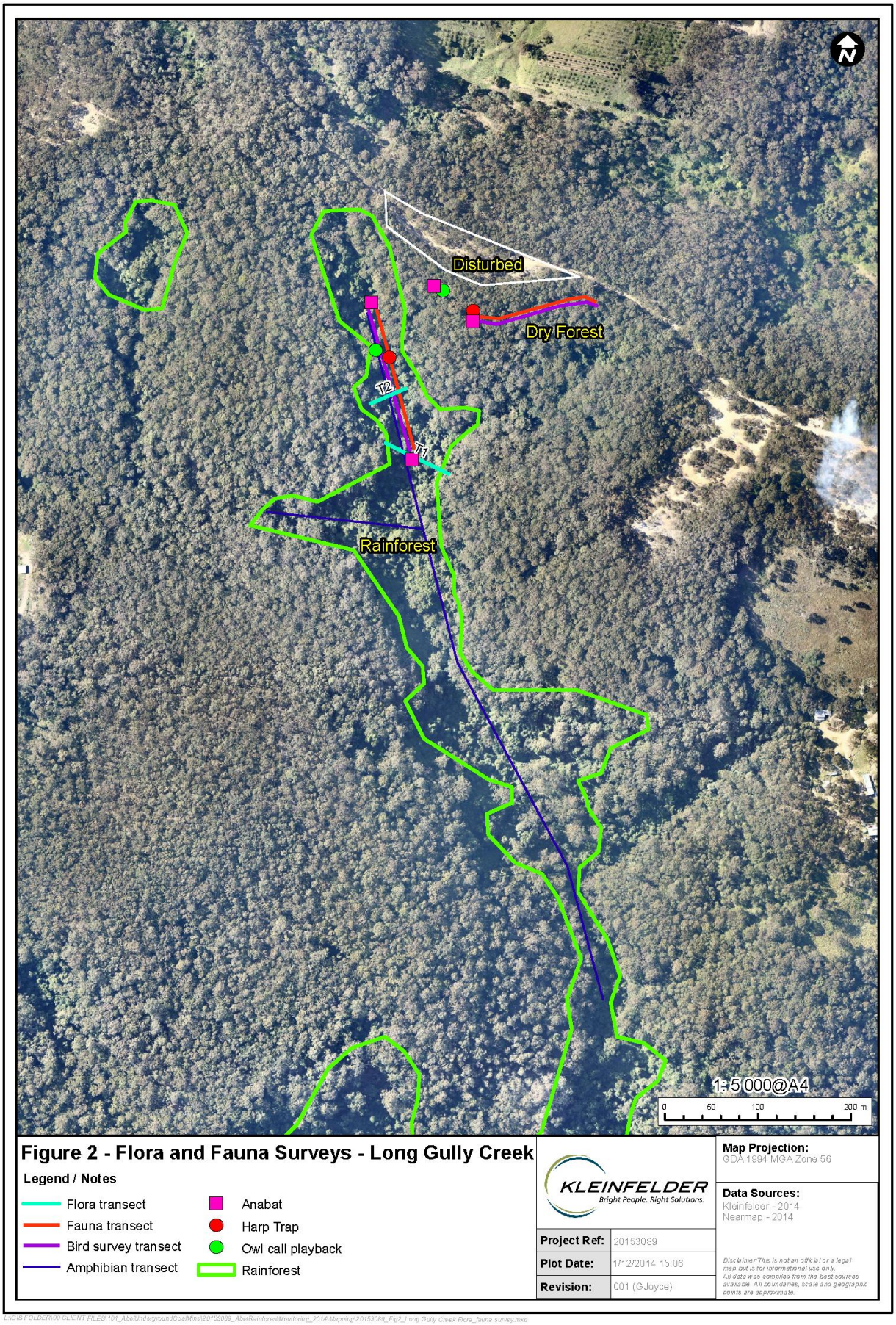
Each transect was walked for 20 minutes and birds detected within the immediate vicinity were recorded. Birds were identified either visually, with the aid of binoculars, or by call interpretation. Surveys were conducted in the morning when bird activity is highest (Bibby *et al.* 2000). Opportunistic sightings were also recorded and listed separately to results from systematic surveys.

After dark, the calls of threatened owl species (Powerful Owl, Masked Owl, Sooty Owl and Barking Owl) were broadcast over a loudspeaker in an attempt to encourage a call response. The size, shape and content of any owl regurgitation pellets found were analysed to determine the species of owl from which the pellet originated as well as the prey species the owl had been feeding on. Analysis methods followed those of Brunner *et al.* (2002) and Triggs (1996).

2.2.5 Amphibians

Searches for amphibians were conducted along a portion of the length of the Long Gully Creek rainforest. This involved diurnal habitat searches, nocturnal spotlight surveys and dip netting for tadpoles. Call playback was also conducted for two species of threatened barred river frogs (*Mixophyes balbus* and *M. iteratus*) in potential habitat.

Diurnal surveys involving dip netting and visual searches were carried out to detect tadpoles in water bodies. Nocturnal surveys involve walking lengths of suitable habitat and using head torches to search for frog eye shine or movement.


Disturbed
Dry Forest
T2
T1
Rainforest
1:5 000@A4
0
50
100
200 m
Figure 2 - Flora and Fauna Surveys - Long Gully Creek
Legend / Notes
Flora transect
Fauna transect
Bird survey transect
Amphibian transect
Anabat
Harp Trap
Owl call playback
Rainforest
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Project Ref: 20153089
Plot Date: 1/12/2014 15:06
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Map Projection:
GDA 1994 MGA Zone 56
Data Sources:
Kleinfelder - 2014
Nearmap - 2014
Disclaimer:This is not an official or a legal map but is for informational use only.
All data was compiled from the best sources available. All boundaries, scale and geographic points are approximate.

3. RESULTS

1.1 WEATHER CONDITIONS AND SURVEY ACTIVITY

The prevailing weather conditions during the trapping survey period were warm to mild with humid mornings. No rain occurred on site during the survey period. Temperatures ranged from cool in the mornings to warm days and evenings with some hot days. The temperature range was between 6.9 and 36º C. Data on weather conditions during the survey period are provided in **Table 2**.

Table 2: Weather conditions during the fauna survey period (Cessnock Airport)

Weather	Date							
	20/10/14	21/10/14	22/10/14	23/10/14	24/10/14	27/10/14	30/10/14	11/11/14
Temp. Min. (°C)	8.1	13.2	6.9	8.6	11.5	16.2	9.1	15.5
Temp Max. (°C)	21.3	18.6	25.1	32.0	29.8	36.0	32.8	22.7
Humidity 9am	67	66	68	66	72	66	62	64
Humidity 3pm	53	50	34	22	35	15	17	44
Rain	0	0.2	0	0	0	0	0	0
Barometric pressure 9am (hPa)	1026.9	1031.7	1026.7	1018.3	1020.3	1008.5	1015.6	1019.3
Barometric pressure 3pm (hPa)	1028.2	1029.6	1021.1	1014.3	1015.0	1003.0	1010.6	1017.7
Max wind gust (km/hr)	46	30	30	28	41	67	35	35
Wind direction	S	SE	NE	SSE	WSW	W	E	SE

3.1 FLORA DIVERSITY

Field surveys in 2014 recorded 44 flora species along both Transects 1 and 2 (**Appendix 1**). This is slightly less than the number of species found during the baseline study in 2008, in which 54 and 51 flora species were detected.

No flora species listed as threatened under the NSW *Threatened Species Conservation Act 1995* were recorded during surveys. One plant species *Eucalyptus fergusonii* subsp. *fergusonii* listed under ROTAP (Briggs and Leigh 1995) was recorded on Transect 2.

Flora species were grouped according to whether they are typically found in dry or moist forest habitat (see **Appendix 1**). **Figure 3** and **Figure 5** show the relationship between dry forest species (sclerophyllous species) and moist forest species (mesic or rainforest species) over the length of each transect in 2008. **Figure 4** and **Figure 6** show this relationship in 2014. The trend lines for Transect 1 have changed since the baseline survey indicating that the transition between dry and moist forest has expanded slightly over the past 6 years. At the start of the transect the transition from dry to moist forest commenced approximately 5 m in 2008, in the current survey this transition is not observed within the transect, however, based on the trend lines it is likely that this transition occurred close to 0 m. At the end of the transect the transition occurred at 50 – 55 m in 2008 and now it occurs at 65 - 70 m. This is a change of approximately 10 to 15 m since 2008.

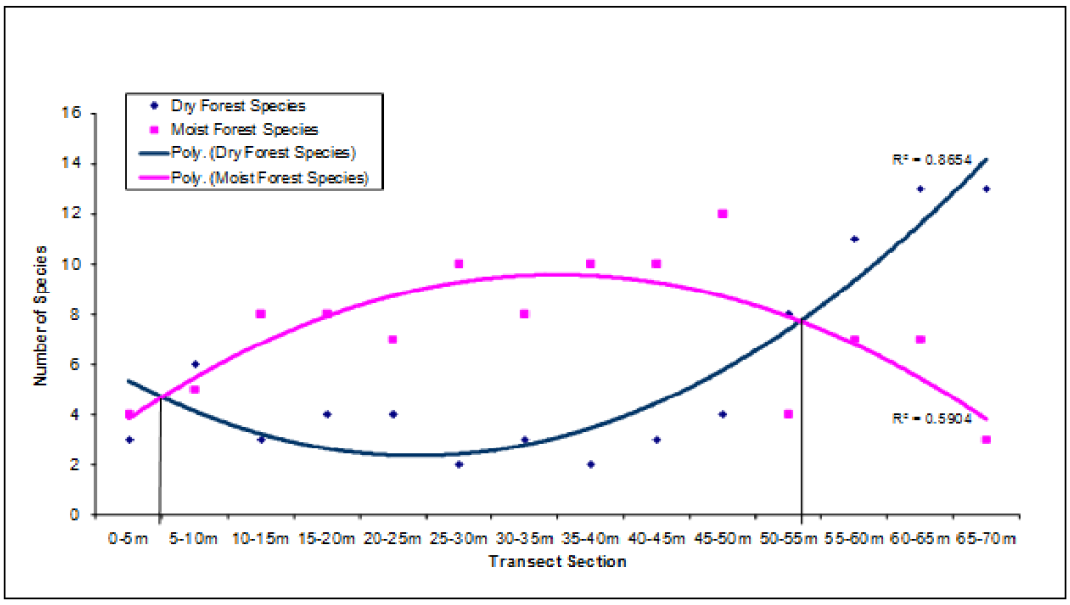

Figure 3 **Transect 1 forest species curves, showing the relationship between dry and moist forest species across the length of the transect in 2008. Black lines indicate the forest transition zones determined in 2008.**

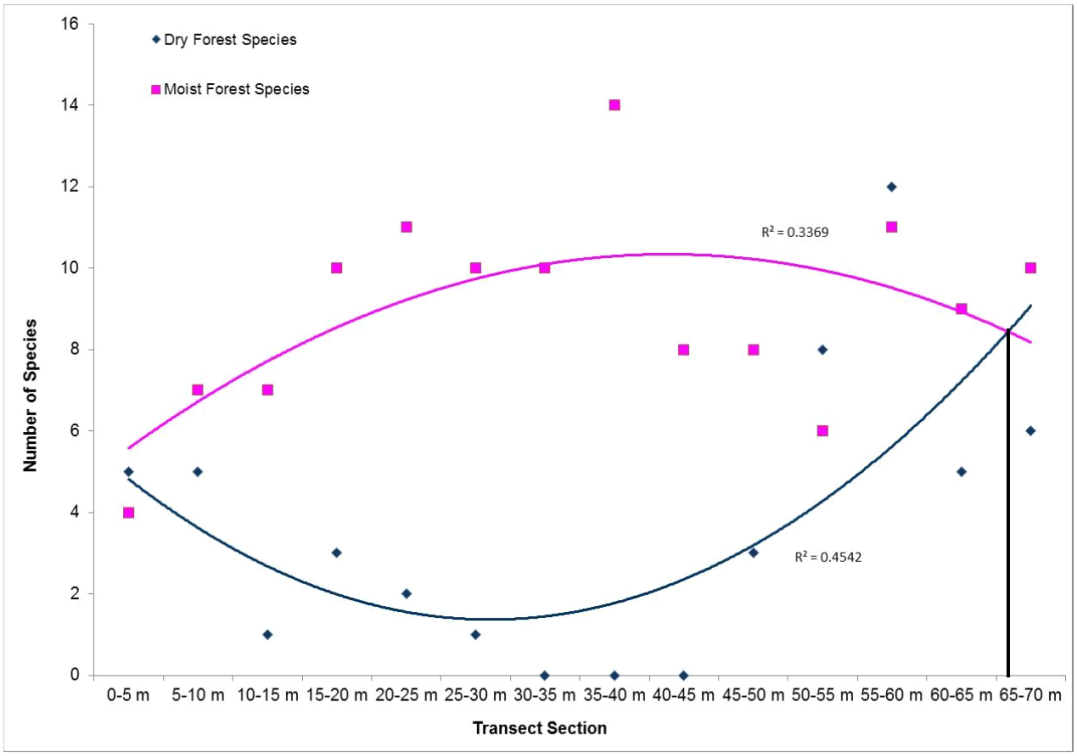

Figure 4 **Transect 1 forest species curves, showing the relationship between dry and moist forest species across the length of the transect in 2014. Black line indicates the forest transition zone determined in 2014.**

The trend lines for Transect 2 in 2014 remained similar to the baseline survey. The transition from dry forest to moist forest again commences at 5-10 m and from moist forest to dry forest at 40-45 m.

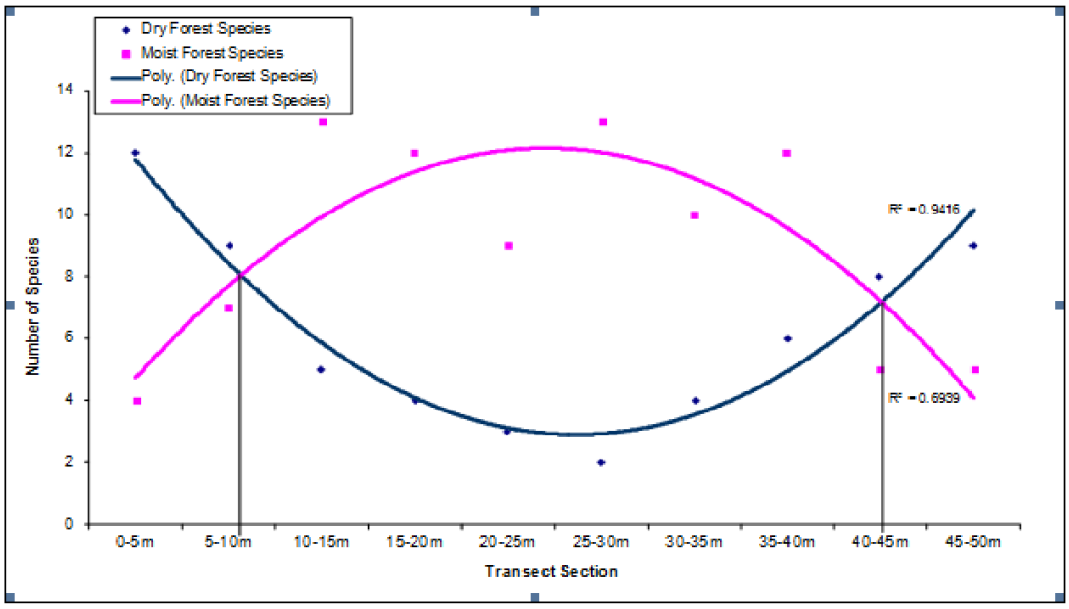

Figure 5 **Transect 2 forest species curves, showing the relationship between dry and moist forest species across the length of the transect in 2008. Black lines indicate the forest transition zones determined in 2008.**

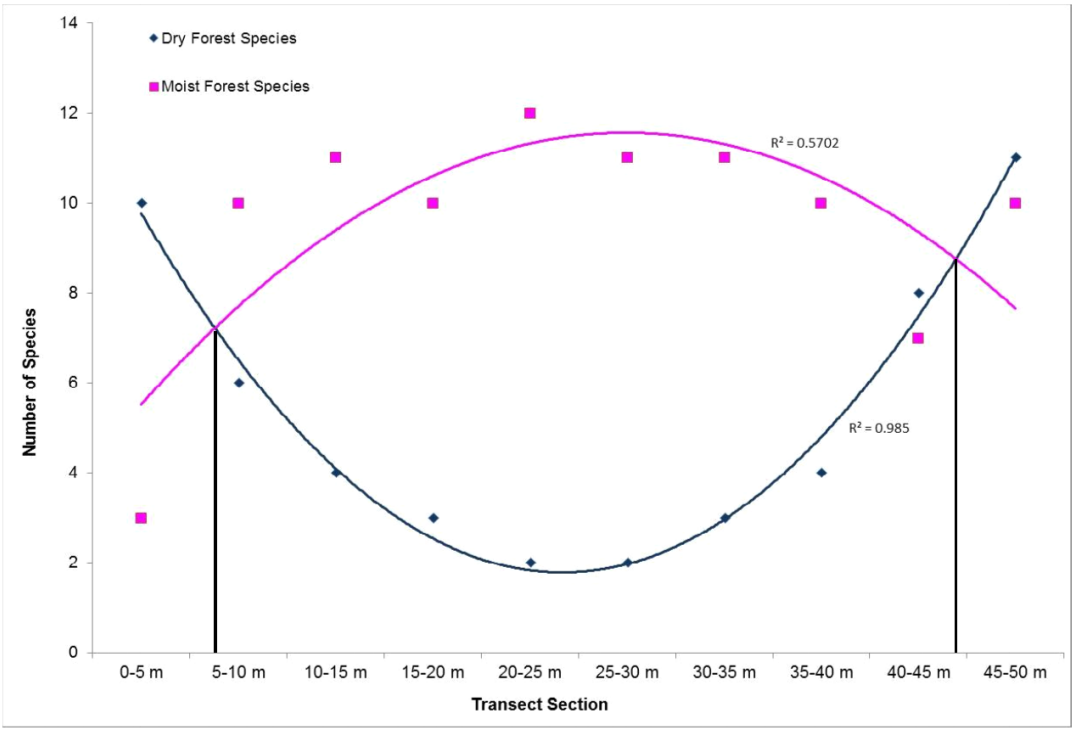

Figure 6 **Transect 2 forest species curves, showing the relationship between dry and moist forest species across the length of the transect in 2014. Black lines indicate the forest transition zones determined in 2014.**

3.2 STRUCTURAL LAYER FPC ESTIMATES

The estimated foliage projective coverage (FPC) has been separated into structural layers, including ground, shrub, midstorey, overstorey and vine layers (**Figures 7 and 8**). It should be noted that there is an inherent variability in the estimation of FPC. The estimation of FPC is not sensitive enough to detect slight changes over a single year; it is rather an indication of major changes over several years.

The total FPC for the ground, shrub and overstorey strata along Transect 1 is generally similar to the 2009 data, and for these strata both the 2009 and current survey have lower total FPC than the 2008 survey. The total FPC of midstorey species along Transect 1 in the current 2014 survey is lower than both the 2008 and 2009 data between 10 m and 45 m. The vine cover along Transect 1 is higher in both the 2009 and 2014 than the baseline survey between 5 m and 40 m.

Generally, the total FPC of all strata along Transect 2 in the 2009 and 2014 surveys are below the 2008 survey results, with the exception of the 2009 overstorey cover which is similar to the 2008 survey. The ground and vine cover recorded along Transect 2 in the 2009 and 2014 surveys are relatively similar along the transect. The shrub cover in the 2014 survey is similar to that of the 2009 survey for the majority of the transect, but is substantially lower at 40-45 m and at 45-50 m. The overstorey cover in the 2009 and 2014 surveys are also very similar along the transect except at two points, 10-15 m and 15-20 m. Generally, the midstorey cover recorded during the 2014 survey is lower than that of the 2009 survey.

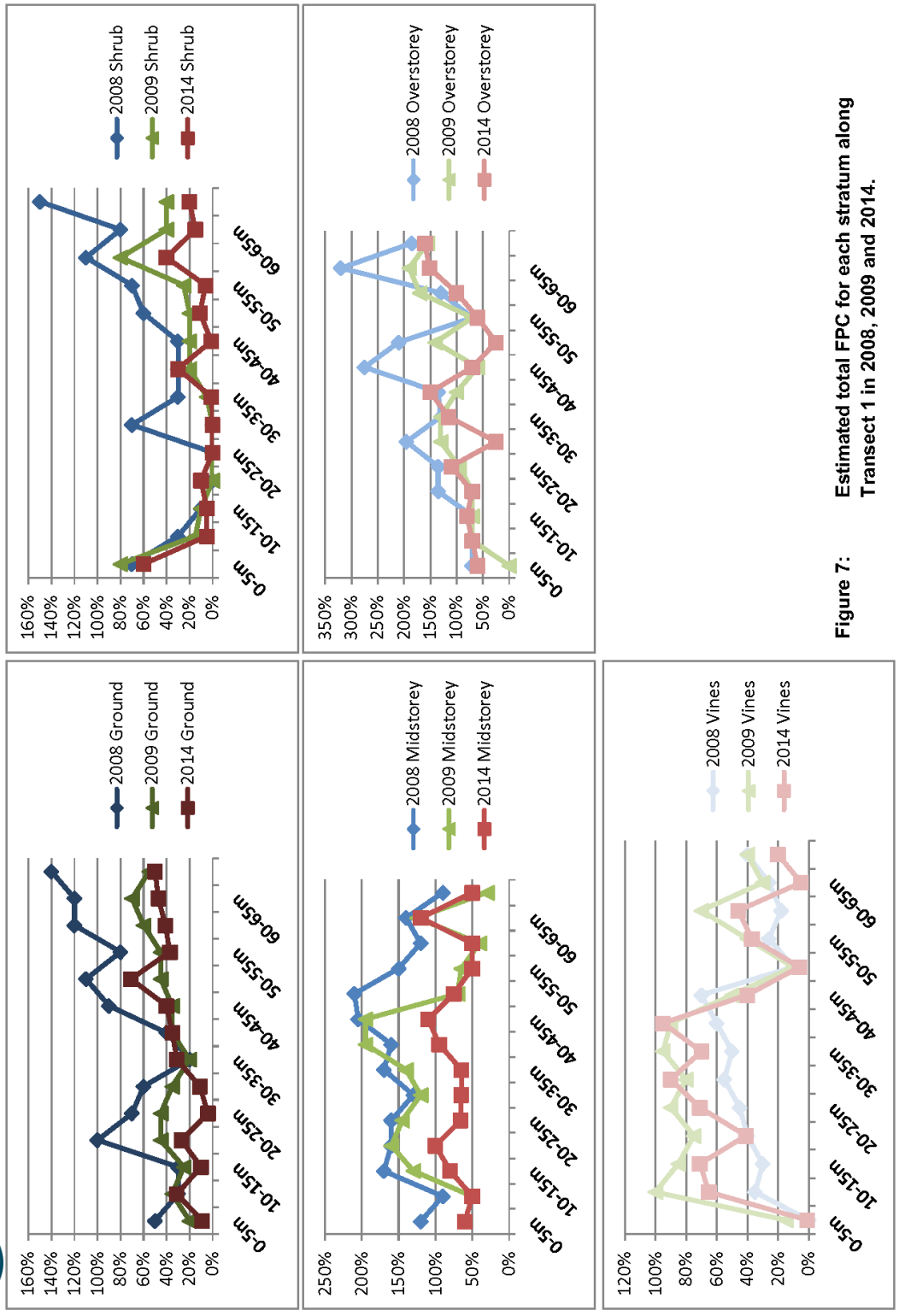

Figure 7: Estimated total FPC for each stratum along Transect 1 in 2008, 2009 and 2014.

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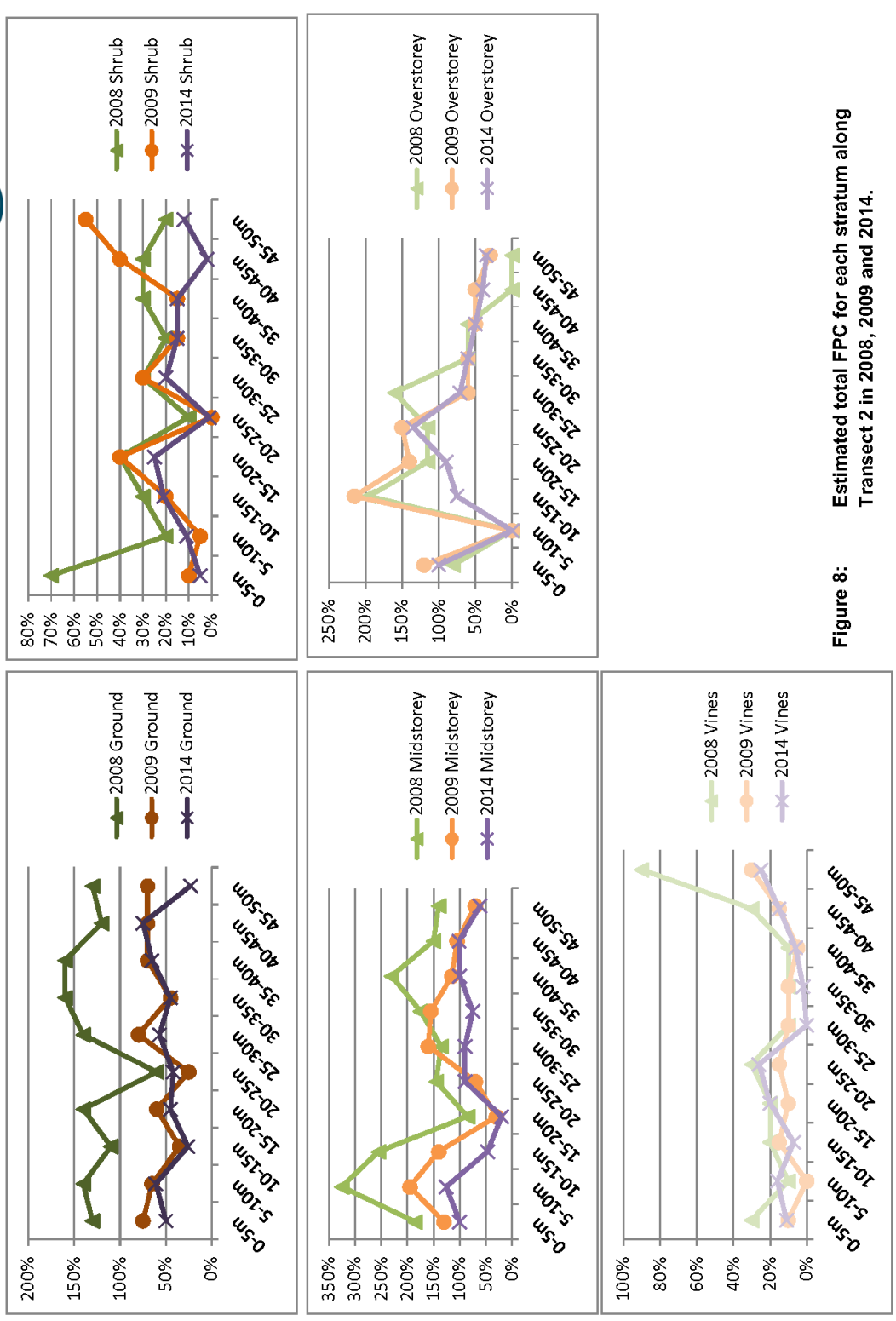

Figure 8: Estimated total FPC for each stratum along Transect 2 in 2008, 2009 and 2014.

2 December 2014

3.3 FAUNA SPECIES RICHNESS

In total, (i.e. at both forest types) 44 fauna species were recorded, comprising five arboreal mammal species, four terrestrial mammal species, eight bat species, 27 bird species (See **Appendix 2**). Two of these species, the Little Bentwing-bat (*Miniopterus australis*) and the Eastern Free-tail Bat (*Mormopterus norfolkensis*) are listed as threatened under the *Threatened Species Conservation Act 1995* (NSW) (TSC Act). No amphibians or reptiles were recorded. In 2014 a total of 36 and 26 fauna species were recorded in the Dry Forest and Rainforest habitats respectively. These results are slightly below the average number of species recorded across all years (38 in the Dry Forest and 32 in the Rainforest) (**Figure 9**).

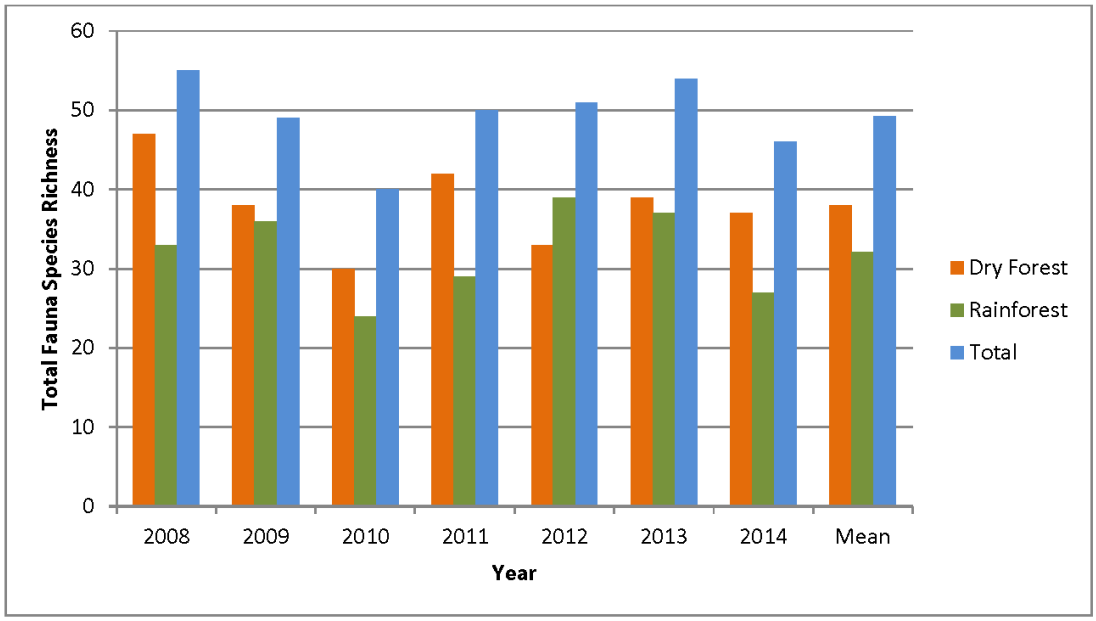

Figure 9 **Fauna Species Richness in Dry Forest and Rainforest transects from 2008 to 2014.**

Each fauna group is discussed in more detail below, with comparisons made between the current results and the data collated annually since the 2008 baseline study. Selected photographs of fauna species recorded during surveys of Long Gully Creek from all years are also provided in **Appendix 3**.

3.3.1 Arboreal Mammals

Five arboreal mammal species were recorded during the survey period. These included the Common Brushtail Possum (*Trichosurus vulpecula*), the Common Ringtail Possum (*Pseudocheirus peregrinus*), the Greater Glider (*Petauroides volans*), the Feathertail Glider (*Acrobates pygmaeus*) and the Sugar Glider (*Petaurus breviceps*). The number of arboreal mammal species recorded in the dry forest transect was higher in 2014 (n = 4) than in the 2013 surveys (n = 1). The number of arboreal mammals recorded in the rainforest transect in 2014 equalled the 2013 result (n = 2) which is the greatest recorded. The total number of species recorded in 2014 was higher than the average for all years (**Figure 10**).

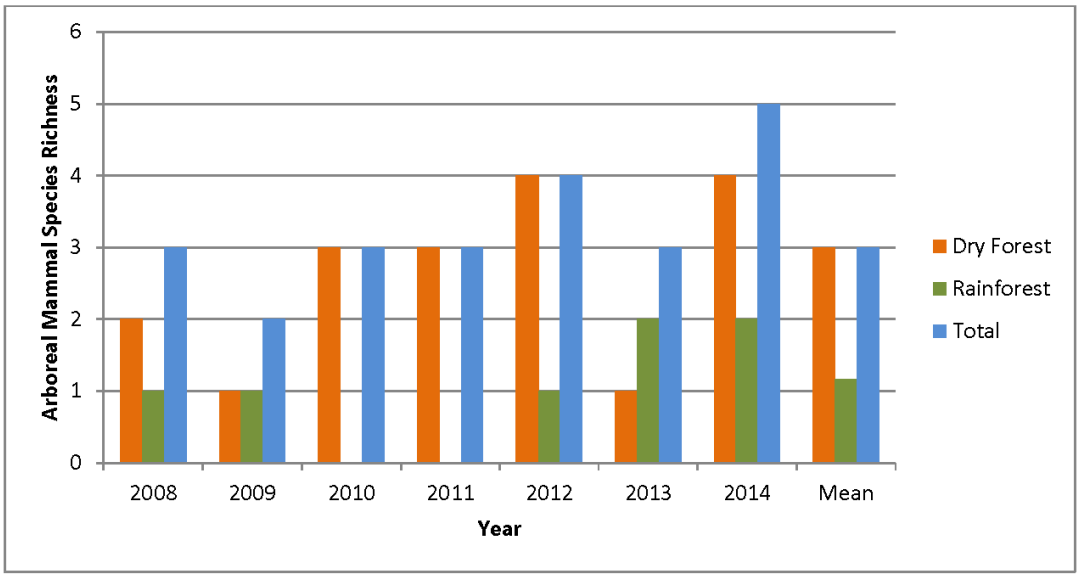

Figure 10 **Arboreal Mammal Species Richness within the Dry Forest and Rainforest transects from 2008 to 2014.**

3.3.2 Terrestrial Mammals

Four terrestrial mammal species were detected during the 2014 survey and included Brown Antechinus (*Antechinus stuartii*), Swamp Wallaby (*Wallabia bicolor*), Black Rat (*Rattus rattus*), and Red-necked Wallaby (*Macropus rufogriseus*). Terrestrial mammal species richness was equal to the 2013 results and is slightly below average for all years in both the dry forest and the rainforest transects (**Figure 11**).

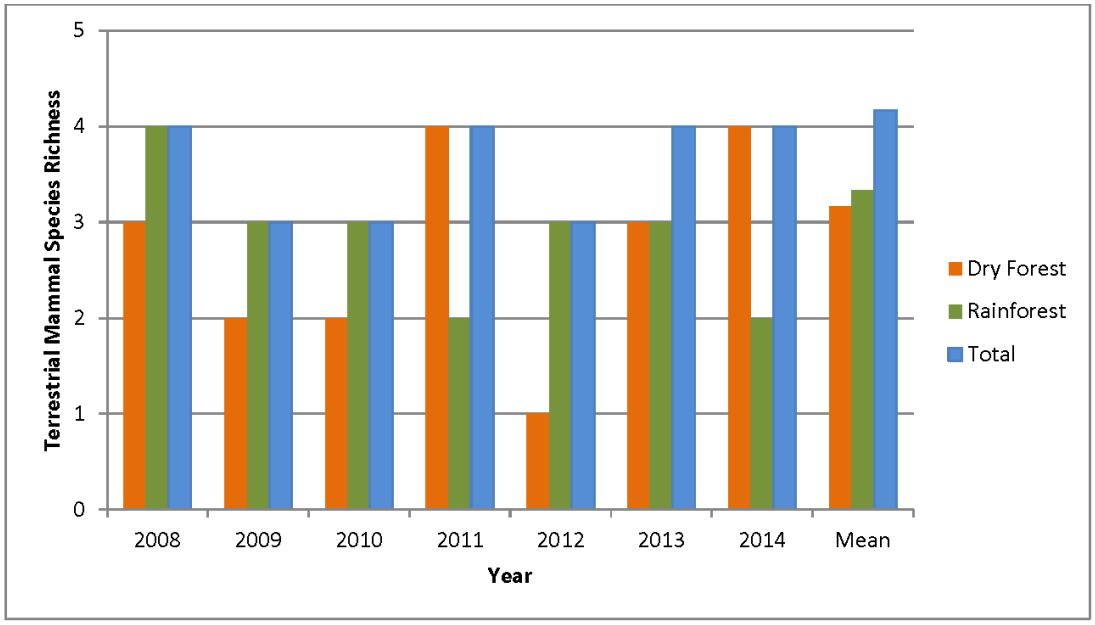

Figure 11 **Terrestrial Mammal Species Richness within the Dry Forest and Rainforest transects from 2008 to 2014.**

3.3.3 Bats

Eight species of insectivorous bat could be confirmed as occurring on the subject site during the 2014 survey with most being detected from Anabat™ ultrasonic call recordings. A Nyctophilus species could only be confidently identified to the genus level because of the difficulty in distinguishing the ultrasonic call recordings within this genus. Little Bentwing-bat (*Miniopterus australis*) was recorded in both dry forest and rainforest and is listed as threatened under the TSC Act 1995. The Eastern Free-tail Bat (*Mormopterus norfolkensis*) which is listed under the TSC Act 1995 was detected within the dry forest only.

The number of species recorded in 2014 is lower than the 2013 results (n = 8 and n = 9 respectively) however the 2014 results are above the average for all years (n = 7) (**Figure 12**).

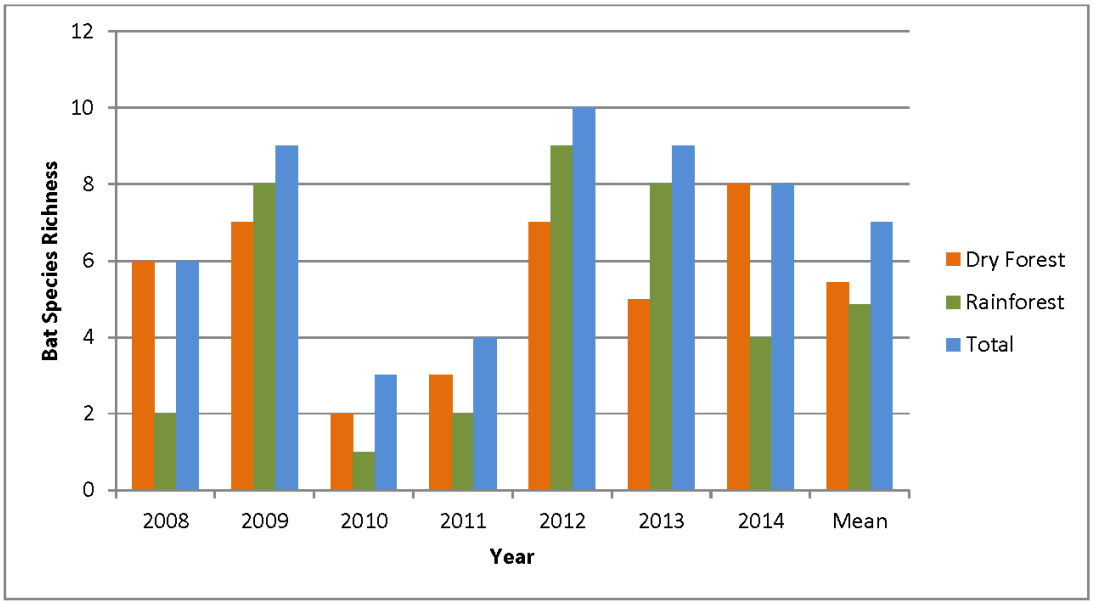

Figure 12 **Bat Species Richness within the Dry Forest and Rainforest transects from 2008 to 2014.**

3.3.4 Birds

Twenty-seven bird species were detected in 2014 which is the lowest recorded in any survey since 2008. This compares to 37 in 2013, 36 in 2011, 30 in 2010, and 35 in 2009 and 39 in 2008 (**Figure 13**). The 2014 results is also below the average (n = 34) for all surveys.

Previously recorded species not recorded from the 2014 surveys include the threatened Powerful Owl (*Ninox strenua*) and the Sooty Owl (*Tyto tenebricosa*) both of which have been recorded since 2010. Targeted pellet searches, call playback and spotlight searches failed to detect either of these species in 2014.

Bird species richness for the rainforest (19 species) was the lowest recorded, compared to a seven year average of 23 species. In 2014 bird species richness for both transects were below the average for all surveys to date.

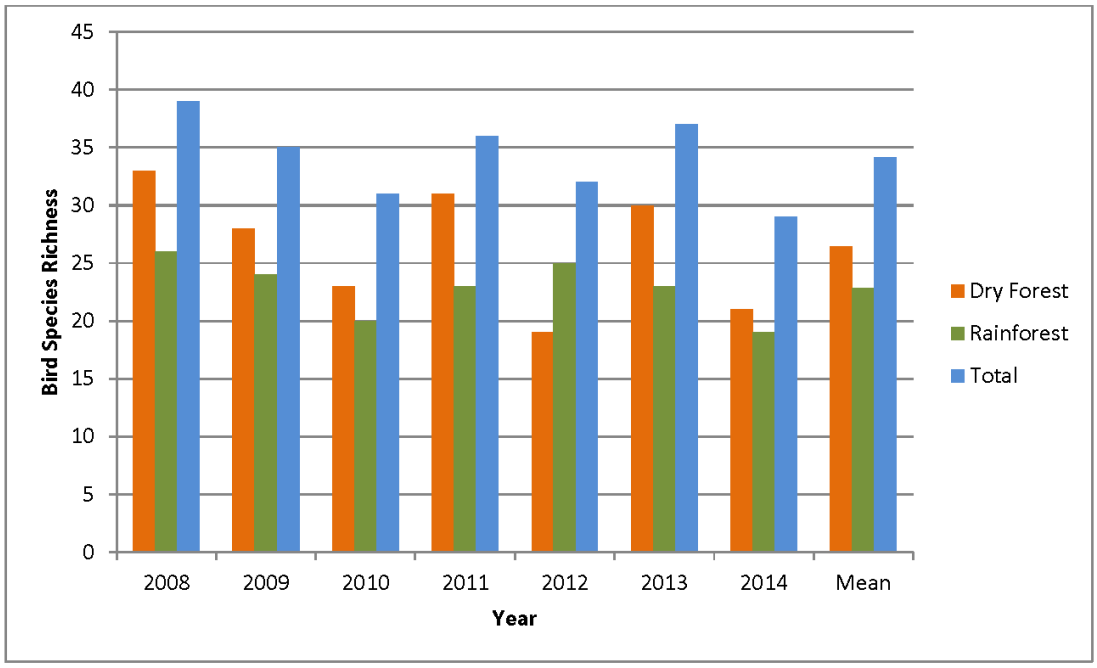

Figure 13 **Bird Species Richness within the Dry Forest and Rainforest transects from 2008 to 2014.**

3.3.5 Amphibians

No amphibian species were detected during the 2014 survey. Amphibian species richness has also been low in previous years of the survey (mean = 1) (**Figure 14**).

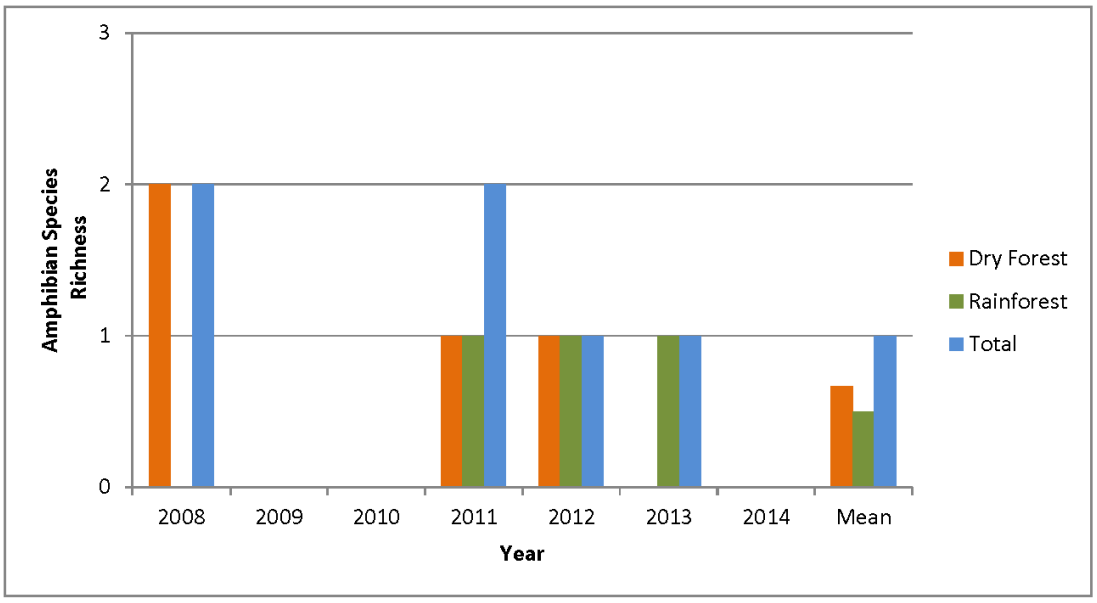

Figure 14 **Amphibian Species Richness within the Dry Forest and Rainforest transects from 2008 to 2014.**

3.3.6 Reptiles

Reptiles are not specifically targeted by the monitoring program; however any opportunistic sightings are noted. No reptile species were recorded in the 2014 survey.

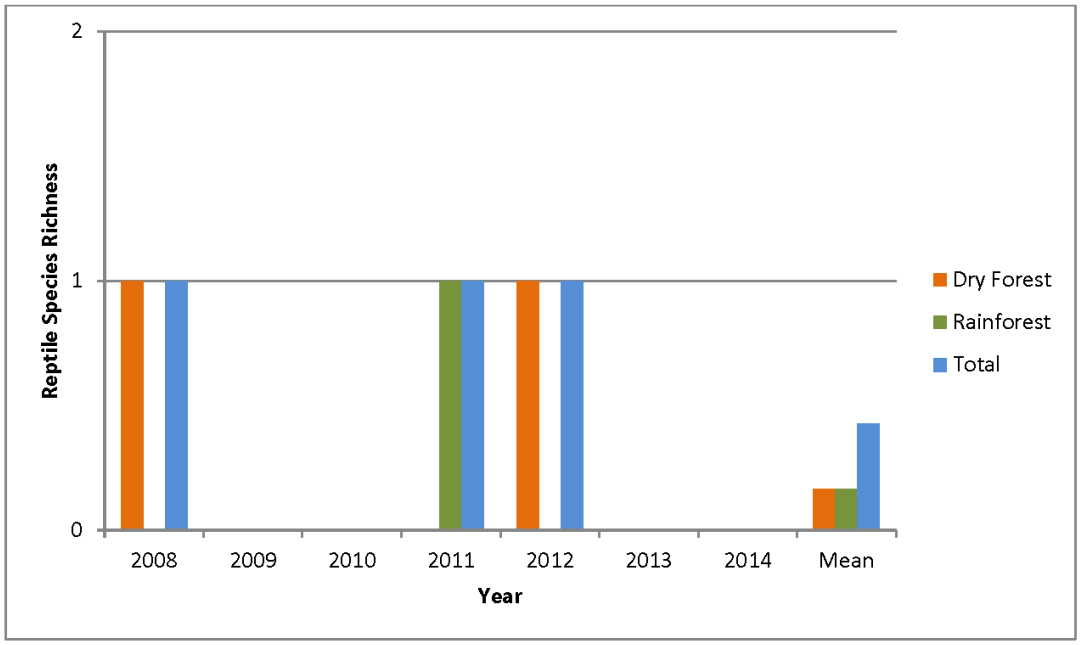

Figure 15 **Reptile Species Richness within the Dry Forest and Rainforest transects from 2008 to 2014.**

4. CONCLUSIONS

Monitoring of the subtropical rainforest area along Long Gully Creek has been undertaken in 2014 in accordance with the F&FMP for Abel Underground Coalmine (ecobiological 2007). This seventh annual monitoring report documents the current extent of the subtropical rainforest community and the species richness of flora and fauna inhabiting it. Future annual surveys will contribute to a growing dataset from which significant change may be identified.

A total of 44 flora species were recorded along both transects in the current survey. This represents a slight decline in floral species richness since the original 2008 survey. The area of transition between dry and moist forest at Transect 1 has expanded since the 2008 survey, with the width of the moist forest increasing. Along Transect 1, particularly at the end of the transect, there has been in increase in the number of moist species recorded and a decline in the number of dry species within each 5 m segment. This shift in the transition zone between the two forest types has been caused by an increase in the occurrence of moist species such as *Morinda jasminoides* (Sweet Morinda) and *Tetrastigma nitens,* and a decline in dry species such as *Cayratia clematidea* (Native Grape), *Hibiscus heterophyllus* (Native Rosella), *Croton verreauxii* (Green Native Cascarilla) and *Dioscorea transversa* (Native Yam). Additionally, there has been a reduction in the occurrence of *Lantana camara* (Lantana) along the transect which has also contributed to the reduction in dry species. The transitional zones of the dry and moist forest along Transect 2 are similar to that identified in the baseline study.

Along both Transect 1 and Transect 2 there has been a decline in FPC since the original 2008 baseline survey. However, this is not an isolated occurrence in the current survey. When data from the current survey are compared to that of the 2009 survey, the total FPC along both transects is relatively similar, with a few exceptions. Generally, along Transect 1 the midstorey foliage cover recorded during the current 2014 survey was less than the 2008 and 2009 surveys. Possibly, this is due to the increase in the FPC of vines such as *Cissus antarctica* (Kangaroo Vine) which can shade out and restrict the growth of the trees they sprawl over - causing a decline in midstorey FPC. The decline in shrub and midstorey cover along Transect 2 does not appear, at this stage, to have resulted in, or be caused by an increased FPC of another stratum. It is important to note that these changes are more likely to be due to the loss of single trees and natural decline in the shrub species

rather than widespread tree decline. Light gaps are expected in rainforest systems and are important to drive regeneration.

In total, (i.e. at both forest types) 44 fauna species were recorded, comprising five arboreal mammal species, four terrestrial mammal species, eight bat species, 27 bird species. Two of these species, the Little Bentwing-bat (*Miniopterus australis*) and the Eastern Free-tail Bat (*Mormopterus norfolkensis*) are listed as threatened under the TSC Act. No amphibians or reptiles were recorded.

In 2014, a total of 36 and 26 fauna species were recorded in the dry forest and rainforest habitats respectively. These results are slightly below the average number of species recorded across all years, which is 38 in the dry forest and 32 in the rainforest.

In 2014, almost all fauna classes recorded higher than, or on par with, the average number of species detected across all years. The notable exception is the decline in bird numbers seen in 2014 which lowered the overall species richness to 29, which is five below the average of 34.

An interesting observation regarding the lack of large forest owl species in 2014 is that this year the highest number of arboreal mammal species was observed. In 2012 and 2013 when either one or both species of the forest owls were detected, the arboreal mammal presence was lower (n=4 and n=3 respectively). Further surveys will be required to validate this observation.

The annual monitoring continues to provide valuable baseline information on the natural variation in the abundance and diversity of species in the Long Gully Creek system. The growing dataset will provide a sound benchmark against which future underground mining impacts can be assessed.

5. REFERENCES

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APPENDIX 1: FLORA SPECIES RECORDED: 2008 – 2014

Family	Scientific Name	Common Name	Forest Type	Stratum	Transect 1							Transect 2						
					2008	2009	2010	2011	2012	2013	2014	2008	2009	2010	2011	2012	2013	2014
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower	Dry	Ground	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Aphanopetalaceae	*Aphanopetalum resinosum*	Gum Vine	Dry	Vine	x	x	x	x	x	x								
Apocynaceae	*Marsdenia rostrata*	Common Milk Vine	Dry	Vine	x	x	x	x	x	x	x				x	x	x	x
Apocynaceae	*Parsonsia straminea*	Monkey Rope	Dry	Vine	x			x	x		x							x
Araceae	*Gymnostachys anceps*	Settlers Flax	Moist	Ground	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bignoniaceae	*Pandorea pandorana* subsp. *pandorana*	Wonga Wonga Vine	Dry	Vine	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Blechnaceae	*Blechnum patersonii* subsp. *patersonii*	Strap Water Fern	Moist	Ground								x	x					
Blechnaceae	*Doodia aspera*	Rasp Fern	Dry	Ground	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Boraginaceae	*Ehretia acuminata*	Koda	Moist	Overstorey								x	x	x	x	x	x	
Capparaceae	*Capparis arborea*	Native Pomegranate	Moist	Shrub	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Commelinaceae	*Aneilema acuminatum*		Moist	Ground				x	x			x	x	x	x	x		
Convolvulaceae	*Dichondra repens*	Kidney weed	Dry	Ground								x	x	x	x	x	x	x
Cornaceae	*Alangium villosum* subsp. *polyosmoides*	Muskwood	Moist	Overstorey	x	x	x	x	x	x	x							
Cunoniaceae	*Schizomeria ovata*	Crab Apple	Moist	Overstorey			x	x	x	x	x							
Cyperaceae	*Cyperus tetraphyllus*		Moist	Ground				x	x	x	x	x	x	x	x		x	x
Cyperaceae	*Gahnia aspera*		Dry	Ground						x		x	x					
Davalliaceae	*Arthropteris tenella*		Moist	Ground	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern	Moist	Ground	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Dioscoreaceae	*Dioscorea transversa*	Native Yam	Dry	Vine	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Ebenaceae	*Diospyros australis*	Black Plum	Moist	Overstorey	x	x	x	x	x	x	x	x	x				x	x
Elaeocarpaceae	*Elaeocarpus obovatus*	Blueberry Ash	Moist	Overstorey								x	x	x	x	x	x	x
Euphorbiaceae	*Alchornea ilicifolia*	Dovewood	Moist	Midstorey	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Euphorbiaceae	*Baloghia inophylla*	Brush Bloodwood	Moist	Midstorey	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Euphorbiaceae	*Croton verreauxii*	Green Native Cascarilla	Dry	Midstorey	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Fabaceae (Mimosoideae)	*Acacia longissima*	Long-leaf Wattle	Dry	Shrub								x	x	x	x	x	x	x
Fabaceae (Mimosoideae)	*Pararchidendron pruinosum* var. *pruinosum*	Snow Wood	Moist	Midstorey	x	x	x	x	x	x								
Flacourtiaceae	*Scolopia braunii*	Flintwood	Moist									x	x	x	x	x	x	x
Lamiaceae	*Clerodendrum tomentosum*	Hairy Clerodendrum	Moist	Midstorey	x													
Lamiaceae	*Plectranthus parviflorus*		Dry	Ground	x	x	x	x	x	x	x							
Lauraceae	*Cryptocarya microneura*	Murrogun	Moist	Overstorey	x	x	x	x	x	x	x							
Lauraceae	*Neolitsea australiensis*	Green Bolly Gum	Moist	Midstorey	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry	Dry	Vine	x	x	x	x	x	x								
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily	Dry	Vine	x	x	x	x	x	x	x	x	x	x	x	x	x	
Malvaceae	*Hibiscus heterophyllus*	Native Rosella	Dry	Midstorey	x	x	x	x	x	x		x	x	x	x	x	x	x
Meliaceae	*Synoum glandulosum* subsp. *glandulosum*	Scentless Rosewood	Dry	Shrub	x	x	x	x	x	x	x							
Meliaceae	*Toona ciliata*	Red Cedar	Moist	Overstorey								x	x	x	x	x	x	x

Family	Scientific Name	Common Name	Forest Type	Stratum	Transect 1							Transect 2						
					2008	2009	2010	2011	2012	2013	2014	2008	2009	2010	2011	2012	2013	2014
Menispermaceae	*Legnephora moorei*	Round-leaf Vine	Moist	Vine								x	x					
Menispermaceae	*Sarcopetalum harveyanum*	Pearl Vine	Moist	Vine		x	x	x	x	x								
Menispermaceae	*Stephania japonica* var. *discolor*	Snake vine	Moist	Vine	x													
Monimiaceae	*Doryphora sassafras*	Sassafras	Moist	Midstorey								x	x		x	x	x	
Monimiaceae	*Wilkiea huegeliana*	Veiny Wilkiea	Moist	Shrub								x	x	x	x	x	x	
Monimiaceae	*Wilkiea macrophylla*	Large-leaved Wilkiea	Moist	Midstorey								x	x	x	x	x	x	
Moraceae	*Ficus fraseri*	Sandpaper Fig	Moist	Midstorey	x													
Moraceae	*Ficus sp.*		Dry	Overstorey	x													
Moraceae	*Streblus brunonianus*	Whalebone Tree	Moist	Midstorey	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Moraceae	*Trophis scandens*	Burny Vine	Moist	Vine								x	x		x	x	x	x
Myrsinaceae	*Embelia australiana*		Moist	Vine														x
Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle	Moist	Overstorey	x	x	x	x	x	x	x							
Myrtaceae	*Eucalyptus acmenoides*	White mahogany	Dry	Overstorey								x	x	x	x	x	x	x
Myrtaceae	*Eucalyptus fergusonii* subsp. *fergusonii*	Grey Ironbark	Dry	Overstorey								x	x	x	x	x	x	x
Myrtaceae	*Melaleuca styphelioides*		Dry	Overstorey	x	x	x	x	x	x	x							
Myrtaceae	*Rhodamnia rubescens*	Scrub Turpentine	Dry	Midstorey	x													
Myrtaceae	*Syncarpia glomulifera*	Turpentine	Dry	Overstorey	x	x	x	x	x	x	x							
Oleaceae	*Notelaea longifolia*	Large Mock-olive	Dry	Shrub	x	x						x	x	x	x	x	x	
Oleaceae	*Olea paniculata*	Native Olive	Moist	Overstorey						x		x	x	x	x	x	x	
Orchidaceae	*Dendrobium* sp.		Dry	-	x	x	x	x	x	x	x						x	
Orchidaceae	*Sarcochilus falcatus*	Orange-blossom Orchid	Moist	-								x	x	x				
Oxalidaceae	*Oxalis perennans*		Dry	Ground														x
Phyllanthaceae	*Actephila lindleyi*	Actephila	Moist	Midstorey														x
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush	Moist	Shrub	x	x	x	x	x	x								
Pittosporaceae	*Pittosporum multiflorum*	Orange Thorn	Moist	Shrub	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Poaceae	*Oplismenus aemulus*	Basket Grass	Dry	Ground	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Podocarpaceae	*Podocarpus elatus*	Plum Pine	Moist	Overstorey										x	x	x	x	x
Polypodiaceae	*Pyrrosia confluens* var. *confluens*	Horse-shoe Felt Fern	Moist	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Pteridaceae	*Adiantum formosum*	Giant Maidenhair Fern	Moist	Ground	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Pteridaceae	*Adiantum hispidulum*	Rough Maidenhair Fern	Moist	Ground	x	x	x	x	x	x	x	x	x	x				
Pteridaceae	*Pellaea falcata*	Sickle Fern	Dry	Ground	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Ranunculaceae	*Clematis glycinoides*	Headache Vine	Dry	Vine							x							
Rhamnaceae	*Alphitonia excelsa*	Red Ash	Moist	Overstorey	x	x	x	x	x	x	x			x	x	x	x	x
Ripogonaceae	*Ripogonum album*	White Supplejack	Moist	Vine	x												x	
Rubiaceae	*Morinda jasminoides*	Sweet Morinda	Moist	Vine	x	x		x	x	x	x	x	x		x		x	x
Rutaceae	*Geijera salicifolia* var. *latifolia*		Moist	Midstorey								x	x					
Sapindaceae	*Alectryon subcinereus*	Native Quince	Moist	Midstorey	x	x	x	x	x	x	x	x	x	x	x	x	x	
Sapindaceae	*Diploglottis cunninghamii*	Native Tamarind	Moist	Midstorey														x
Sapindaceae	*Guioa semiglauca*		Moist	Midstorey	x	x	x	x	x	x		x	x					
Sapindaceae	*Mischocarpus australis*		Moist	Midstorey							x							x

Family	Scientific Name	Common Name	Forest Type	Stratum	Transect 1							Transect 2						
					2008	2009	2010	2011	2012	2013	2014	2008	2009	2010	2011	2012	2013	2014
Sapotaceae	*Planchonella australis*	Black Apple	Moist	Overstorey	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Solanaceae	*Solanum prinophyllum*	Forest Nightshade	Moist	Shrub										x	x	x	x	x
Solanaceae	*Solanum stelligerum*	Devil's Needles	Moist					x	x	x								
Urticaceae	*Dendrocnide excelsa*	Giant Stinging Tree	Moist	Overstorey	x	x	x	x	x	x	x	x	x	x	x	x	x	
Urticaceae	*Dendrocnide photinophylla*	Shiny-leaved Stinging Tree	Moist	Overstorey	x	x	x	x	x		x				x	x	x	
Verbenaceae	**Lantana camara*	Lantana	Dry	Shrub	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Vitaceae	*Cayratia clematidea*	Native Grape	Dry	Vine	x	x	x	x	x	x		x	x	x				
Vitaceae	*Cissus antarctica*	Water Vine	Moist	Vine	x	x	x	x	x	x	x	x	x					x
Vitaceae	*Tetrastigma nitens*		Moist	Vine	x	x	x	x	x	x	x			x	x	x	x	x
				Total	**54**	**48**	**47**	**52**	**52**	**51**	**44**	**51**	**51**	**45**	**47**	**45**	**49**	**44**

* Denotes introduced species

KLEINFELDER
Bright People. Right Solutions.

APPENDIX 2: FAUNA SPECIES RECORDED 2008 - 2014

Order	Family	Scientific Name	Common Name	Legal Status	Method	Dry forest							Rainforest						
						08	09	10	11	12	13	14	08	09	10	11	12	13	14
Amphibians																			
Anura	Hylidae	Litoria fallax	Eastern Dwarf Tree Frog	P	Opportunistic record	x				x						x	x	x	
		Litoria peronii	Peron's Tree Frog	P	Opportunistic record	x			x										
					Total	2	0	0	1	1	0	0	0	0	0	1	1	1	0
Reptiles																			
Squamata	Scincidae	Cyclodomorphus gerrardii	Pink-tongued Skink	P												x			
	Varanidae	Varanus varius	Lace Monitor	P	Opportunistic sighting	x				x									
					Total	1	0	0	0	1	0	0	0	0	0	1	0	0	0
Birds																			
Caprimulgiformes	Aegothelidae	Aegotheles cristatus	Australian Owlet-nightjar	P	Spotlighting	x	x				x		x					x	
Columbiformes	Columbidae	Leucosarcia picata	Wonga Pigeon	P	Bird survey	x	x		x		x				x	x		x	
		Lopholaimus antarcticus	Topknot Pigeon	P	Bird survey										x				
		Macropygia amboinensis	Brown Cuckoo-dove	P	Bird survey	x	x		x		x	x	x	x	x	x	x	x	x
Coraciiformes	Alcedinidae	Dacelo novaeguineae	Laughing Kookaburra	P	Bird survey		x		x		x						x		
		Todiramphus sanctus	Sacred Kingfisher	P	Bird survey	x	x	x	x	x			x					x	
	Coraciidae	Eurystomus orientalis	Dollarbird	P	Bird survey													x	
Cuculiformes	Centropodidae	Centropus phasianinus	Pheasant Coucal	P	Opportunistic record	x													
Cuculiformes	Cuculidae	Cacomantis flabelliformis	Fan-tailed Cuckoo	P	Bird survey	x		x				x				x			x
		Cacomantis variolosus	Brush Cuckoo	P	Opportunistic record	x			x		x								x
		Chalcites lucidus	Shining Bronze-Cuckoo	P	Bird survey		x						x						
		Scythrops novaehollandiae	Channel-billed Cuckoo	P	Bird survey				x	x	x						x		
Galliformes	Megapodiidae	Alectura lathami	Australian Brush-turkey	P	Opportunistic record								x						x
Passeriformes	Acanthizidae	Acanthiza lineata	Striated Thornbill	P	Bird survey	x		x	x		x	x				x			x
		Acanthiza pusilla	Brown Thornbill	P	Bird survey	x		x	x	x		x	x	x		x			
		Gerygone mouki	Brown Gerygone	P	Bird survey	x	x	x	x			x	x	x	x	x	x	x	x
		Sericornis citreogularis	Yellow-throated Scrubwren	P	Bird survey						x		x	x	x	x	x		x
		Sericornis frontalis	White-browed Scrubwren	P	Bird survey	x	x		x		x	x	x	x					
	Artamidae	Cracticus nigrogularis	Pied Butcherbird	P	Bird survey				x										
	Artamidae	Cracticus tibicen	Australian Magpie	P	Bird survey			x											
		Strepera graculina	Pied Currawong	P	Bird survey	x	x				x								
	Campephagidae	Coracina novaehollandiae	Black-faced Cuckoo-shrike	P	Bird survey		x				x								
		Coracina tenuirostris	Cicadabird	P	Opportunistic record	x				x	x								x

Order	Family	Scientific Name	Common Name	Legal Status	Method	Dry forest							Rainforest						
						08	09	10	11	12	13	14	08	09	10	11	12	13	14
	Climacteridae	Cormobates leucophaea	White-throated Treecreeper	P	Bird survey	x	x	x	x	x	x	x	x	x	x		x	x	
	Corvidae	Corvus coronoides	Australian Raven	P	Opportunistic record	x		x	x	x	x							x	
Passeriformes	Estrildidae	Neochmia temporalis	Red-browed Finch	P	Bird survey		x												
	Maluridae	Malurus cyaneus	Superb Fairy-wren	P	Bird survey		x							x		x	x		
		Malurus lamberti	Variegated Fairy-wren	P	Bird survey					x	x	x		x					
	Meliphagidae	Acanthorhynchus tenuirostris	Eastern Spinebill	P	Bird survey	x	x	x	x	x	x	x	x	x	x	x	x	x	
	Meliphagidae	Lichenostomus chrysops	Yellow-faced Honeyeater	P	Bird survey	x	x	x	x	x	x	x				x		x	
		Manorina melanophrys	Bell Miner	P	Bird survey	x			x		x	x							
		Meliphaga lewinii	Lewin's Honeyeater	P	Bird survey	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		Melithreptus lunatus	White-naped Honeyeater	P	Bird survey	x											x		
		Myzomela sanguinolenta	Scarlet Honeyeater	P	Bird survey	x	x	x	x			x	x	x	x	x			x
		Philemon corniculatus	Noisy Friarbird	P	Bird survey				x									x	
	Menuridae	Menura novaehollandiae	Superb Lyrebird	P	Bird survey												x		
	Monarchidae	Monarcha melanopsis	Black-faced Monarch	P	Bird survey	x	x	x	x			x	x	x	x	x	x	x	x
		Symposiachrus trivirgatus	Spectacled Monarch	P	Opportunistic record												x		
		Myiagra rubecula	Leaden Flycatcher	P	Bird survey	x	x		x				x						
	Nectariniidae	Dicaeum hirundinaceum	Mistletoebird	P	Bird survey						x								
	Oriolidae	Oriolus sagittatus	Olive-backed Oriole	P	Bird survey												x		
	Pachycephalidae	Colluricincla harmonica	Grey Shrike-thrush	P	Bird survey	x				x	x		x		x	x	x	x	
		Pachycephala pectoralis	Golden Whistler	P	Bird survey	x	x	x	x		x	x	x	x	x	x	x	x	x
Passeriformes	Pachycephalidae	Pachycephala rufiventris	Rufous Whistler	P	Bird survey	x		x	x		x	x	x	x	x	x		x	
	Pardalotidae	Pardalotus punctatus	Spotted Pardalote	P	Bird survey	x	x	x	x	x		x	x	x		x	x		x
	Petroicidae	Eopsaltria australis	Eastern Yellow Robin	P	Bird survey	x	x	x	x		x	x	x	x	x	x	x	x	x
	Pittidae	Pitta versicolor	Noisy Pitta	P	Bird survey					x				x	x		x		x
	Psophodidae	Cinclosoma punctatum	Spotted Quail-thrush	P	Bird survey	x	x							x					
		Psophodes olivaceus	Eastern Whipbird	P	Bird survey	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Ptilonorhynchidae	Ailuroedus crassirostris	Green Catbird	P	Bird survey					x				x		x	x		
		Ptilonorhynchus violaceus	Satin Bowerbird	P	Bird survey						x				x			x	x
		Sericulus chrysocephalus	Regent Bowerbird	P	Bird survey													x	
	Rhipiduridae	Rhipidura fuliginosa	Grey Fantail	P	Bird survey	x	x	x	x	x	x	x	x	x	x	x	x		
		Rhipidura rufifrons	Rufous Fantail	P	Bird survey			x		x	x		x					x	x
	Timaliidae	Zosterops lateralis	Silvereye	P	Bird survey	x	x	x	x	x			x	x	x	x	x		
Psittaciformes	Cacatuidae	Cacatua galerita	Sulphur-crested Cockatoo	P	Bird survey													x	
	Psittacidae	Alisterus scapularis	Australian King-Parrot	P	Bird survey		x		x		x		x					x	
	Psittacidae	Platycercus eximius	Eastern Rosella	P	Bird survey		x		x					x					
		Trichoglossus haematodus	Rainbow Lorikeet	P	Opportunistic record	x													
Strigiformes	Strigidae	Ninox strenua	Powerful Owl	V	Opportunistic record				x				x		x	x	x		

Order	Family	Scientific Name	Common Name	Legal Status	Method	Dry forest							Rainforest						
						08	09	10	11	12	13	14	08	09	10	11	12	13	14
	Strigidae	Ninox novaeseelandiae	Southern Boobook	P	Spotlighting			x						x					
	Tytonidae	Tyto tenebricosa	Sooty Owl	V	Spotlighting			x		x	x						x		
					Total	33	28	23	31	19	30	20	26	24	20	23	25	23	18
Arboreal Mammals																			
Diprotodonta	Acrobatidae	Acrobates pygmaeus	Feathertail Glider	P	Spotlighting	x		x	x			x							
	Petauridae	Petaurus breviceps	Sugar Glider	P	Spotlighting	x	x	x	x	x									x
	Phalangeridae	Trichosurus vulpecula	Common Brushtail Possum	P	Spotlighting			x	x	x		x		x			x	x	
	Pseudocheiridae	Petauroides volans	Greater Glider	P	Spotlighting					x	x	x	x						
	Pseudocheiridae	Pseudocheirus peregrinus	Common Ringtail Possum	P	Spotlighting					x		x						x	x
					Total	2	1	3	3	4	1	4	1	1	0	0	1	2	2
Terrestrial Mammals																			
Dasyuromorphia	Dasyuridae	Antechinus stuartii	Brown Antechinus	P	Trapping	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Dasyuridae	Antechinus swainsonii	Dusky Antechinus	P	Trapping				x										
	Muridae	Rattus fuscipes	Bush Rat	P	Trapping	x	x		x		x		x	x	x	x	x	x	
Rodentia	Muridae	Rattus rattus	Black Rat	U	Trapping							x					x		x
Peramelemorphia	Peramelidae	Perameles nasuta	Long-nosed Bandicoot	P	Trapping	x		x					x	x	x				
Diprotodonta	Macropodidae	Wallabia bicolor	Swamp Wallaby	P	Opportunistic				x			x	x					x	
	Macropodidae	Macropus rufogriseus	Red-necked Wallaby	P	Opportunistic							x							
					Total	3	2	2	4	1	2	4	4	3	3	2	3	3	2
Bats																			
Chiroptera	Molossidae	Mormopterus norfolkensis	Eastern Freetail-bat	V	Anabat analysis							x		x					
		Mormopterus sp. 2		P	Anabat analysis					x		x		x			x	x	x
Chiroptera	Molossidae	Tadarida australis	White-striped Free-tailed Bat	P	Anabat analysis					x							x	x	
	Pteropodidae	Pteropus poliocephalus	Grey-headed Flying-fox	V	Spotlighting	x													
	Rhinolophidae	Rhinolophus megaphyllus	Eastern Horseshoe Bat	P	Anabat analysis						x						x	x	
	Vespertilionidae	Chalinolobus gouldii	Gould's Wattled Bat	P	Anabat analysis	x	x					x		x			x		
		Chalinolobus morio	Chocolate Wattled Bat	P	Trapping & Anabat analysis	x	x		x			x				x			x
		Falsistrellus tasmaniensis / Scotorepens orion	Eastern False Pipistrelle / Eastern Broad-nosed Bat	P	Anabat analysis		x							x					
		Miniopterus australis	Little Bentwing-bat	V	Trapping & Anabat analysis	x	x	x		x	x	x	x	x		x	x	x	x
		Nyctophilus geoffroyi	Lesser Long-eared Bat	P	Trapping				x										
		Nyctophilus gouldi	Gould's Long-eared Bat	P	Trapping		x							x					
		Nyctophilus sp.		P	Anabat analysis					x		x							x
		Scoteanax rueppellii	Greater broad-nosed bat	V	Anabat analysis												x		
		Vespadelus pumilus	Eastern Forest Bat	P	Anabat analysis	x	x			x	x	x		x	x		x	x	
		Vespadelus troughtoni	Eastern Cave Bat	V	Anabat analysis					x							x		

Order	Family	Scientific Name	Common Name	Legal Status	Method	Dry forest							Rainforest						
						08	09	10	11	12	13	14	08	09	10	11	12	13	14
	Vespertilionidae	Vespadelus vulturnus	Little Forest Bat	P	Trapping & Anabat analysis	x	x	x	x	x		x	x	x			x	x	
		Vespadelus sp.			Anabat analysis						x							x	
					Total	6	7	2	3	7	5	8	2	8	1	2	9	8	4

V = Vulnerable, P = Protected, U = Unprotected (NSW TSC and NPWS Acts)

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APPENDIX 3: SELECTED PHOTOGRAPHS

Brown Antechinus (*Antechinus stuartii*)

Little Forest Bat (*Vespadelus vulturnus*)

Eastern Forest Bat (*Vespadelus pumilus*)

APPENDIX 4. STAFF CONTRIBUTIONS

The following Kleinfleder staff were involved in the compilation of this report.

Name	Qualification	Title/Experience	Contribution
Samara Schulz	BEnvSc & Mgt (Hons)	Ecologist	Flora survey and report writing
Luke Foster	BSc Env & Mgt MEnvSci&Mgt (Wildlife Ecology)	Ecologist (Mammologist)	Fauna surveys and report writing.
Aaron Mulcahy	BEnv Sc & Mgt	Ecologist	Flora survey
Feach Moyle	BSc (Hons), ADAS	Principal Ecologist	Fauna survey, fauna technical review and peer review
Gilbert Whyte	PhD	Senior Ecologist (Botanist)/Entomologist	Flora technical review
Kristy Peters	B.ParkMgt (Hons)	Senior Ecologist	Bird survey

APPENDIX 5. LICENSING

Kleinfelder employees involved in the current study are licensed or approved under the *National Parks and Wildlife Act 1974* (License Number: SL100730, Expiry: 31 March 2015) and the *Animal Research Act 1985* to harm/trap/release protected native fauna and to pick native plants for identification purposes.

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