NATIONAL SIGNIFICANCE

THE ECOLOGICAL VALUES OF PILLIGA EAST FOREST AND THE THREATS POSED BY COAL SEAM GAS MINING 2011-2012

NATIONAL SIGNIFICANCE

A report prepared for the Northern Inland Council for the Environment and the Coonabarabran and Upper Castlereagh Catchment and Landcare Group

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Northern Inland Council for the Environment

THE WILDERNESS SOCIETY

Black Cypress Pine and Scribbly Gum, small mammal trapping Site L, Falcon Trail. Photo Carmel Flint

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Pilliga Mouse woodland habitat in flower. Photo Hugh Nicholson

SUMMARY

The Pilliga Forest is the largest remaining unfragmented block of temperate dry forest and woodland in eastern Australia. It functions as a key flora and fauna refuge in a landscape largely cleared for agriculture and is recognised as part of a National Biodiversity Hotspot and as a globally significant Important Bird Area. It supports several endangered ecological communities and core populations of many threatened flora and fauna species. The latter include populations of a number of declining woodland bird species, virtually the entire population of the Pilliga Mouse *Pseudomys pilligaensis*, one of the largest NSW populations of the Koala *Phascolarctos cinereus* and one of only three significant populations of the South-eastern Long-eared Bat *Nyctophilus corbeni*. The Pilliga Forest also provides important seasonal habitat for a suite of nomadic and migratory bird species as a key part of the eastern Australian bird migration system.

An 85,000ha section of the eastern Pilliga Forest, termed the Project Area, was recently placed under threat from an application to develop it as a major coal seam gas field. Due to the likelihood of significant impacts from this proposal on the area's biodiversity, a survey targeting threatened plants, vertebrates and ecological communities was undertaken in October 2011 by a group of ecologists with relevant expertise. Shortly after this survey was completed the development application was withdrawn, but it is expected that another application for development of possibly an even larger area will be lodged in the near future.

The targeted survey employed systematic methods at sites stratified across the Project Area and resulted in records of four threatened species, one migratory species and one endangered ecological community listed under the Commonwealth's *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*. These comprised one vulnerable plant species, *Rulingia procumbens*, the critically endangered ecological community White Box-Yellow Box-Blakely's Red Gum grassy woodland and derived native grassland, three vulnerable vertebrate species, the Koala, South-eastern Long-eared Bat and Pilliga Mouse, and the migratory Rainbow Bee-eater *Merops ornatus*. Seventeen additional threatened species that are listed under the NSW *Threatened Species Conservation (TSC) Act 1995* were also recorded during the survey. They included the endangered Black-striped Wallaby *Macropus dorsalis* and vulnerable Pale-headed Snake *Hoplocephalus bitorquatus*, Turquoise Parrot *Neophema pulchella*, Barking Owl *Ninox connivens*, Grey-crowned Babbler *Pomastomus temporalis*, Eastern Pygmy-possum *Cercartetus nanus* and Yellow-bellied Sheath-tailed Bat *Saccolaimus flaviventris*.

The survey results provided substantial new information on the distribution of some threatened species in the Project Area, with 21 individual South-eastern Long-eared Bats captured at eight sites and 25 individuals of the Pilliga Mouse trapped at seven sites, including three sites where breeding was indicated by lactating females. The Pilliga Mouse records showed that this species occurs and breeds in a wider range of floristic associations than previously reported, although established key structural habitat attributes of a dense low shrub layer, sparse ground cover vegetation and a well-developed litter layer were consistent throughout. A rapid habitat assessment indicated that approximately 20% of the Project Area area represented potential Pilliga Mouse habitat.

The single record of the Koala reflected the significant decline in this species reported across the Pilliga Forest since 2000, reputedly from drought and frequent wildfires.

Six of the seven sedentary declining woodland bird species listed under the *TSC Act*

were observed although relatively high numbers of only two of these species, the Grey-crowned Babbler and Speckled Warbler *Chthonicola sagittata*, were recorded. Other threatened bird species observed in numbers were the Glossy Black-cockatoo *Calyptorhynchus lathami* and Turquoise Parrot,

The survey resulted in an overall total of 176 vertebrate species consisting of 13 frog, 11 reptile, 119 bird and 33 mammal species, with groups such as diurnal raptors, parrots, honeyeaters and microchiropteran bats well represented. A number of species were recorded at or close to the limits of their ranges including Bibron's Toadlet *Pseudophryne bibroni*, the Eastern Pygmy-possum and Eastern Horseshoe Bat *Rhinolophus megaphyllus* at their eastern limits, and the Wood Mulch Slider *Lerista muelleri,* Spotted Nightjar *Eurostopodus argus* and Crested Bellbird *Oreoica gutturalis* at their western limits. Migratory and nomadic bird species including cuckoos, woodswallows, lorikeets and honeyeaters and one nomadic mammal species, the Little Red Flying-fox *Pteropus scapulatus*, were prominent in assemblages and a number of declining woodland birds not currently listed under the TSC Act such as the White-browed Babbler P*omatostomus superciliosus*, Crested Shrike-tit *Falcunculus frontatus* and Red-capped Robin *Petroica goodenovii* were also recorded.

Overall, the survey provided clear evidence that the Project Area, and by extrapolation the Pilliga Forest, are of national significance for biodiversity conservation and demonstrate the need for conservation planning across all tenures to sustain these values.

Despite the current values, the Pilliga Forest is likely to have experienced a number of vertebrate extinctions following European settlement of surrounding areas that highlight the vulnerability of these forests and woodlands to vegetation loss, fragmentation and degradation. Coal seam gas operations in the area to date have resulted in substantial clearing of vegetation resulting in habitat loss, fragmentation and degradation that have increased edge effects and facilitated invasions of introduced mammals, together with the pollution of streams, groundwater and soils. The likely future expanded development of coal seam gas extraction in the area has the capacity to further impact on Matters of National Significance (under the *EPBC Act*) and result in extinctions of local populations.

A moratorium is proposed on coal seam gas extraction and exploration in the Project Area, and the Pilliga Forest generally, until it can be scientifically demonstrated that this will have no adverse effects on the maintenance of biodiversity conservation values. A number of actions are recommended to inform production of a comprehensive management plan for the Project Area as part of this process.

Threatened *Rulingia procumbens*, Falcon Trail. Photo Hugh Nicholson.

INTRODUCTION

In April 2011, Eastern Star Gas Ltd referred the Narrabri Coal Seam Gas Field Development component (the "Pilliga Project") of their proposed Narrabri Coal Seam Gas Project to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC) for consideration under the *Environment Protection and Biodiversity Conservation Act* 1999 (*EPBC Act*). The referral was prepared by Eco Logical Australia (2011), who found that there was a likelihood of significant impacts from the proposal on a range of ecological communities and species listed as Threatened under the *EPBC Act* (DSEWPAC 2011).

The Pilliga Project was then the largest proposed coal seam gas project in NSW. It comprised the drilling of 1,100 gas wells, clearing of at least 2,410 ha of native vegetation and fragmentation of 85,000 ha of high conservation value forest. This area included known or potential habitat for up to 23 species and five endangered ecological communities (EECs) listed under the *EPBC Act* (Tables 1-3).

Table 1 Threatened flora species listed under the *EPBC* and *TSC Acts* known from the Project Area or predicted to occur on the basis of modelled habitat

common name	scientific name	*EPBC Act* status	*TSC Act* status	NPWS Atlas record location in the Project Area	likely to occur	recorded this study
Broad-leaved Bertya	*Bertya opponens*	vulnerable	vulnerable		X	
Granite Boronia	*Boronia granitica*	vulnerable	vulnerable		X	
Painted Diuris	*Diuris tricolor*	vulnerable	vulnerable		X	
Winged Pepper-cress	*Lepidium monop-locoides*	endangered	endangered		X	
Large-leafed Monotaxis	*Monotaxis macro-phylla*	endangered	endangered	Pilliga East Aboriginal Area		
	Philotheca erici-folia	vulnerable	(previously vulner-able – delisted)		X	
Native Milkwort	*Polygala linariifolia*	endangered	endangered		X	
Cobar Greenhood Orchid	*Pterostylis coba-rensis*	vulnerable	vulnerable		X	
a rulingia	*Rulingia procum-bens*	vulnerable	vulnerable	Pilliga East State Conservation Area Pilliga East State Forest		X
Slender Darling-pea	*Swainsona mur-rayana*	vulnerable	vulnerable		X	
Narrow-leaved Tylophora	*Tylophora linearis*	endangered	endangered		X	
Total 11 species						

Table 2 Endangered Ecological Communities listed under the *EPBC* and *TSC Acts* known from the Project Area or predicted to occur on the basis of modelled habitat

community name *(EPBC Act/TSC Act)*	*EPBC Act* status	*TSC Act* status	likely to occur	recorded this study
Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregion (*TSC Act*)		endangered	X	
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions (*EPBC Act*); Coolibah - Black Box Woodland of the northern riverine plains in the Darling Riverine Plains and Brigalow Belt South Bioregions *(TSC Act*)	endangered	endangered	X	
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (*EPBC Act*); Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (*TSC Act*)	endangered	endangered	X	
Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensl and (*EPBC Act*)	critically endangered		X	
Weeping Myall Woodlands (*EPBC Act*); Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregions (*TSC Act*)	endangered	endangered	X	
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (*EPBC Act*);	critically endangered	endangered		X
Total 6 EECs				

Table 3 Threatened fauna species listed under the *EPBC Act* known from the Project Area or predicted to occur on the basis of modelled habitat

common name	scientific name	*EPBC Act* status	NPWS Atlas record	recorded this study	likely to occur	may occur
Malleefowl	*Leipoa ocellata*	vulnerable, migratory				X
Squatter Pigeon (southern)	*Geophaps scripta scripta*	vulnerable				X
Superb Parrot	*Polytelis swainsonii*	vulnerable			X	
Swift Parrot	*Lathamus discolor*	endangered			X	
Regent Honeyeater	*Anthochaera phrygia*	endangered, migratory			X	
Spotted-tailed Quoll (south-eastern mainland)	*Dasyurus maculatus maculatus*	endangered				X
Koala	*Phascolarctos cinereus*	vulnerable	X	X		
Brush-tailed Rock-wallaby	*Petrogale penicillata*	vulnerable				X
Grey-headed Flying-fox	*Pteropus poliocephalus*	vulnerable				X
Large-eared Pied Bat	*Chalinolobus dwyeri*	vulnerable			X	
South-eastern Long-eared Bat	*Nyctophilus corbeni*	vulnerable	X	X		
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable	X	X		
Total 12 species						

Due to the probability of significant impacts on matters of national significance, together with other likely adverse effects on biodiversity values (The Wilderness Society 2011), the Northern Inland Council for the Environment (NICE) and the Coonabarabran and Upper Castlereagh Catchment and Landcare Group (CUCLG) organised an independent flora and fauna survey of the Gas Field Development Project Area (Fig. 1) in October 2011. This survey targeted threatened flora and vertebrate fauna species and endangered ecological communities (EECs) listed under the *EPBC Act.*

However, since the acquisition of Eastern Star Gas Ltd by Santos Ltd in November 2011, the Pilliga Project application under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (*EPA Act*) has been withdrawn and only exploration works are currently being proposed. Nevertheless, it is expected that Santos Ltd will lodge another application under the *EPA Act* for coal seam gas production in the Pilliga area in the near future, and a further referral will be made under the *EPBC Act.*

1.1 OBJECTIVES

The aims of this report are to:

i) provide accurate scientific information to relevant State and Federal Ministers and agencies on the significance of the Pilliga Project Area and adjoining habitats for biodiversity conservation, particularly with regard to threatened species and communities listed under the EPBC Act, and also under the NSW *Threatened Species Conservation Act 1995* (*TSC Act*); and

ii) to examine potential detrimental impacts on these threatened species and

communities from activities expected from Santos Ltd's likely future coal seam gas production activities.

'The report is informed by past records from the Project Area and adjoining areas of similar habitat, and by the results of the survey undertaken by ecologists in October 2011.

1.2 STUDY AREA

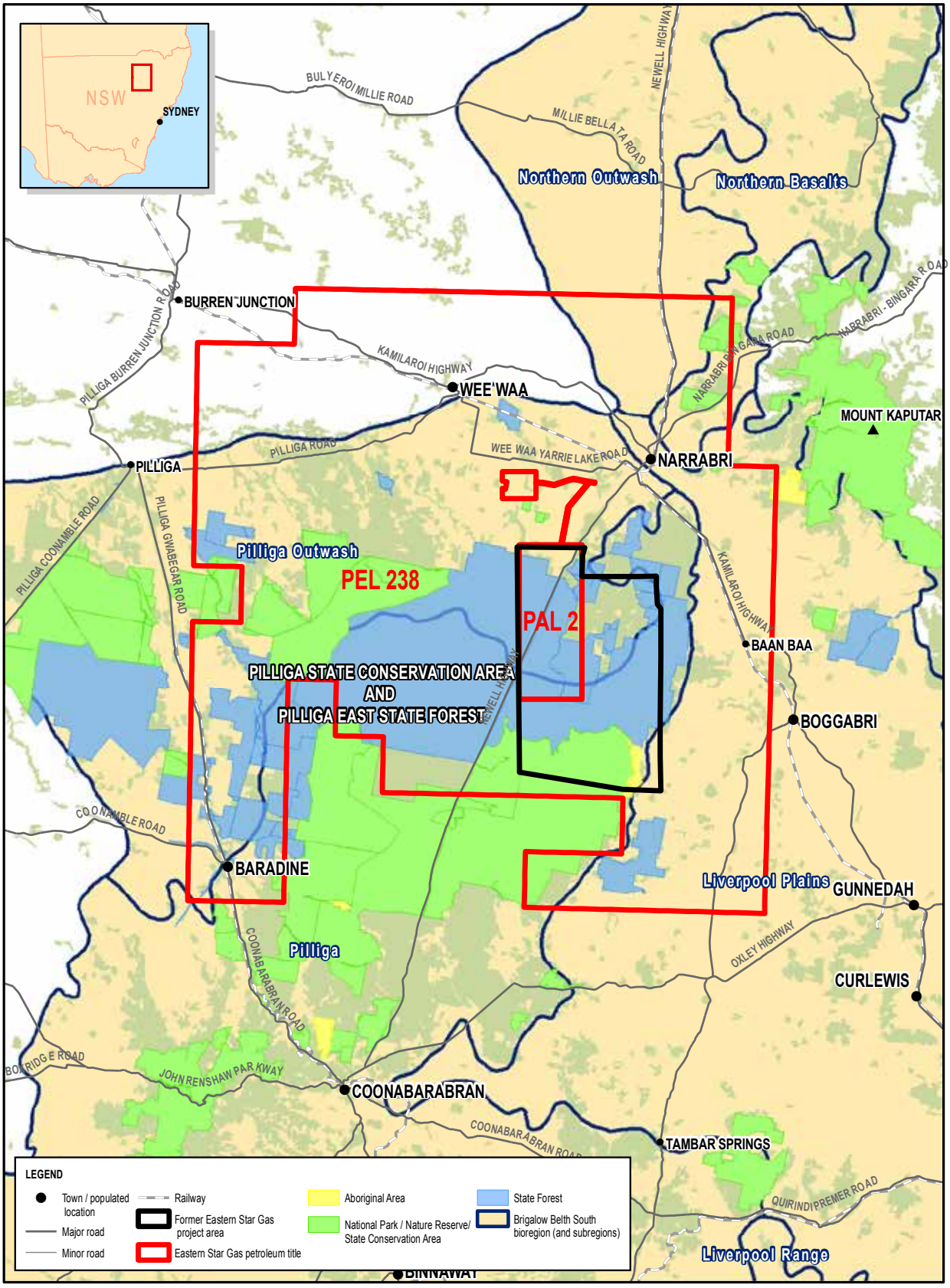
The Study Area covered by this report is defined by the boundaries of the former Eastern Star Gas proposal, termed the Pilliga Project Area (Fig. 1). This area lies mainly east of the Newell Highway to the south-west of Narrabri in the Pilliga Forest (Fig. 2). It falls within the Namoi Catchment Management Authority (CMA) region and encompasses Bibblewindi and parts of Jacks Creek and Pilliga East State Forests, Pilliga State Conservation and State Aboriginal Areas as well as some parcels of private and Crown land (Fig. 3). Its southern edge borders the Pilliga Nature Reserve.

At 500,000ha, the Pilliga Forest is the largest intact stand of temperate forest and woodland west of the Great Dividing Range in Eastern Australia. Key conservation attributes of the Pilliga Forest are its large size, un-fragmented condition and its function as a major flora and fauna refuge in a landscape largely cleared for agriculture and as a significant recharge area for the Great Artesian Basin. It is included within two biogeographical provinces (IBRA sub-regions; Department of Sustainability, Environment, Water, Populations and Communities website (Australia's bioregions) - accessed July 2012) characterised by different soil and vegetation types, the Pilliga Province and the Pilliga Outwash Province. The southern, central and eastern sections of the Pilliga Forest fall in the Pilliga Province, dominated by cypress pine (*Callitris glaucophylla, C. endlicheri*), ironbark (*Eucalyptus crebra, E. fibrosa*) and angophora (*Angophora floribunda, A. leiocarpa*) associations on relatively poor soils derived from coarse mesozoic sediments. However, the western and far northern sections, lying in the Pilliga Outwash Province, occur on higher nutrient sandy soils of alluvial origin and are dominated by cypress pine and ironbark associations interspersed by substantial stands of box eucalypts (*E. pilligaensis, E. albens, E. populnea*). Red gum (*E. blakelyi, E. chloroclada, E. dwyeri*) riparian associations occur throughout the Pilliga Forest along intermittent creeklines and old drainage channels.

The major unfragmented area of forest and woodland vegetation in the Project Area occurs in the southern section within the Pilliga Province, with smaller, partly fragmented stands falling mostly within the Pilliga Outwash Province occupying the northern section. Broad vegetation types, based on Lindsay types (Lindsay 1967) that occur in the Project Area and Province boundaries are shown in Fig. 4.

The biodiversity conservation values of the Pilliga Forest are well recognized. It forms a major component of the Brigalow Belt South Bioregion, recognized as a national Biodiversity Hotspot (Department of Sustainability, Environment, Water, Populations and Communities website (Biodiversity Hotspots) – accessed July 2012) and is a globally significant Important Bird Area (Birdlife Australia website (Important Bird Areas) – accessed July 2012). It supports over 240 species of birds, is a key refuge or stronghold for a relatively high number of threatened flora and fauna species and contains several EECs. The Pilliga Forest supports one of the largest populations of the Koala *Phascolarctos cinereus* in NSW, and the species was recently listed as vulnerable in NSW under the *EPBC Act*. Other Federally-listed vulnerable species with strongholds in the Pilliga Forest are the Large-eared Pied Bat *Chalinolobus dwyeri*, South-eastern Long-eared Bat *Nyctophilus corbeni* and Pilliga Mouse *Pseudomys pilligaensis* while the migratory Swift Parrot *Lathamus discolor* and nomadic Regent Honeyeater *Anthochaera phrygia* use the Pilliga Forest on an irregular basis depending on the availability of eucalypt nectar.

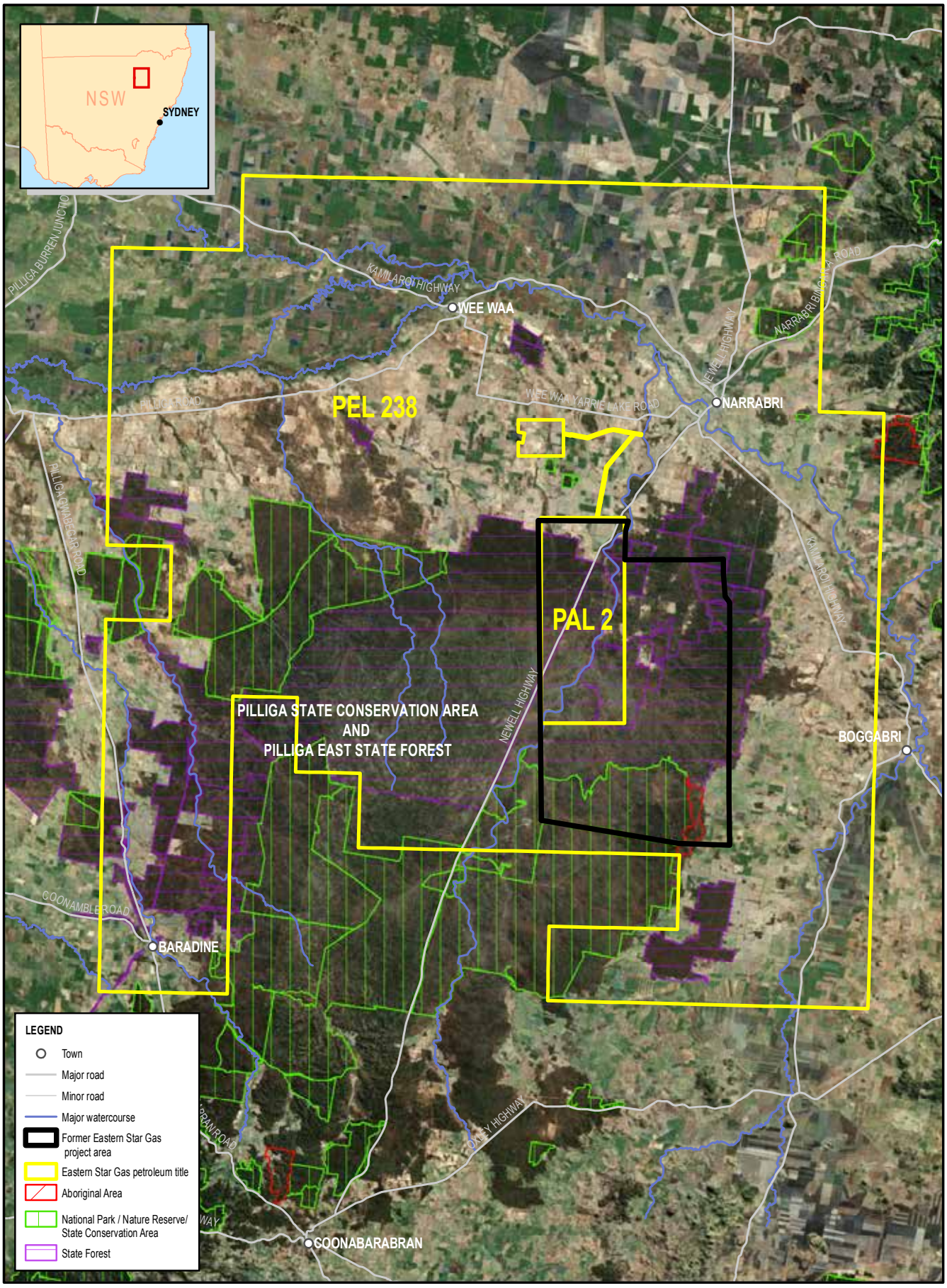
FIG 1



Reserves OEH and NSW Dept of Planning. Petroleum titles from NSW Dept of Primary Industries. Roads, railways, vegetation and towns from GEODATA TOPO250K. IBRA Bioreginns from DSEWPaC.	NORTH 0 km 20 1:800,000 at A4 23/09/2012	Location of the formerly proposed Pilliga Project Gas Field Development Area	Figure 1

Fig. 1 Location of the formerly proposed Pilliga Project Gas Field Development Area. The Project Area is outlined in black.

FIG 2



Reserves OEH and NSW Dept of Planning. Petroleum titles from NSW Dept of Primary Industries. Watercourses, roads and towns from GEODATA TOPO250K. Imagery from Bing.	NORTH 0 km 10 1:600,000 at A4 11/09/2012	Location of the formerly proposed Pilliga Project Gas Field Development Area superimposed on satellite imagery	Figure 2

FIG 3

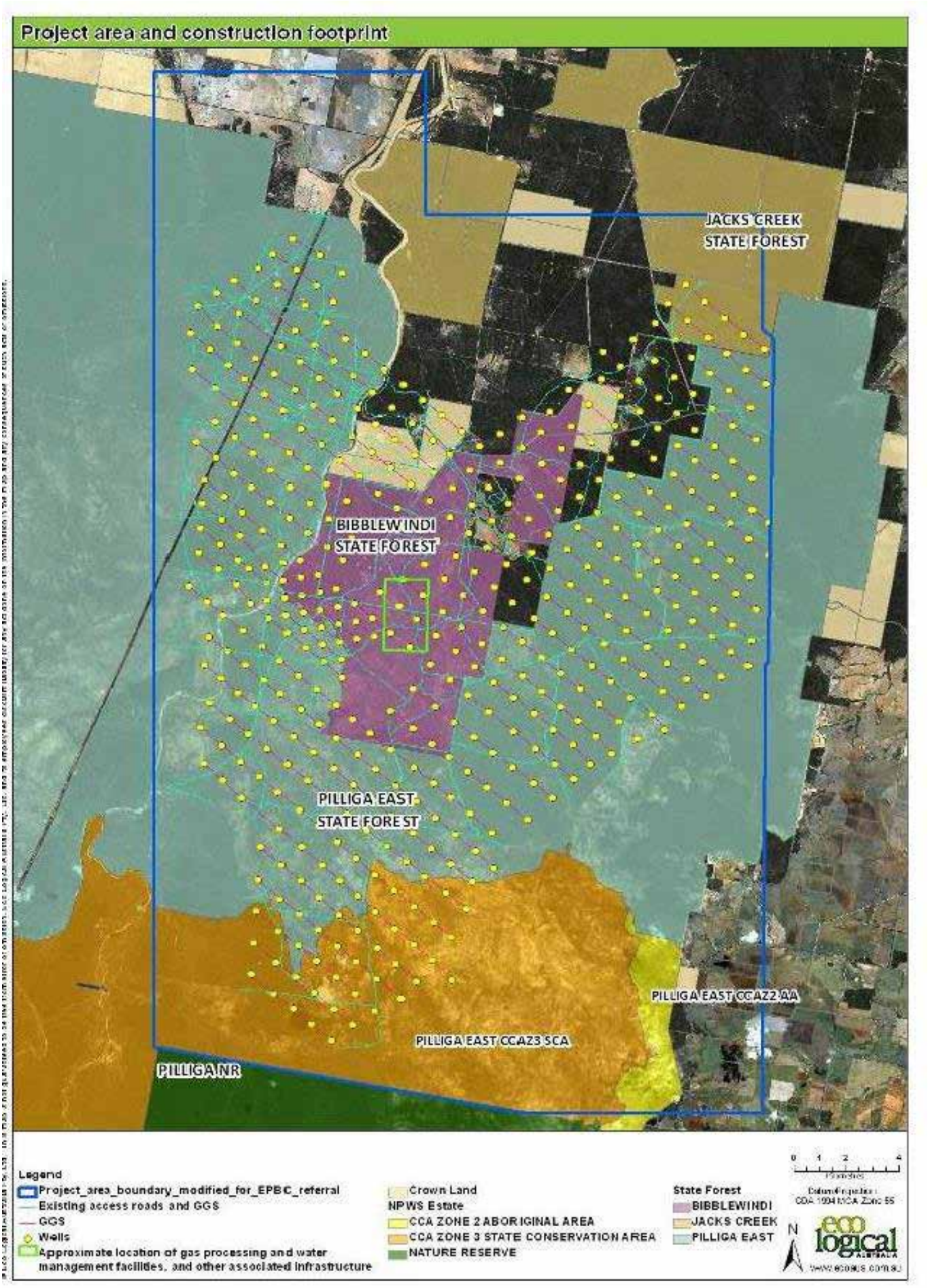
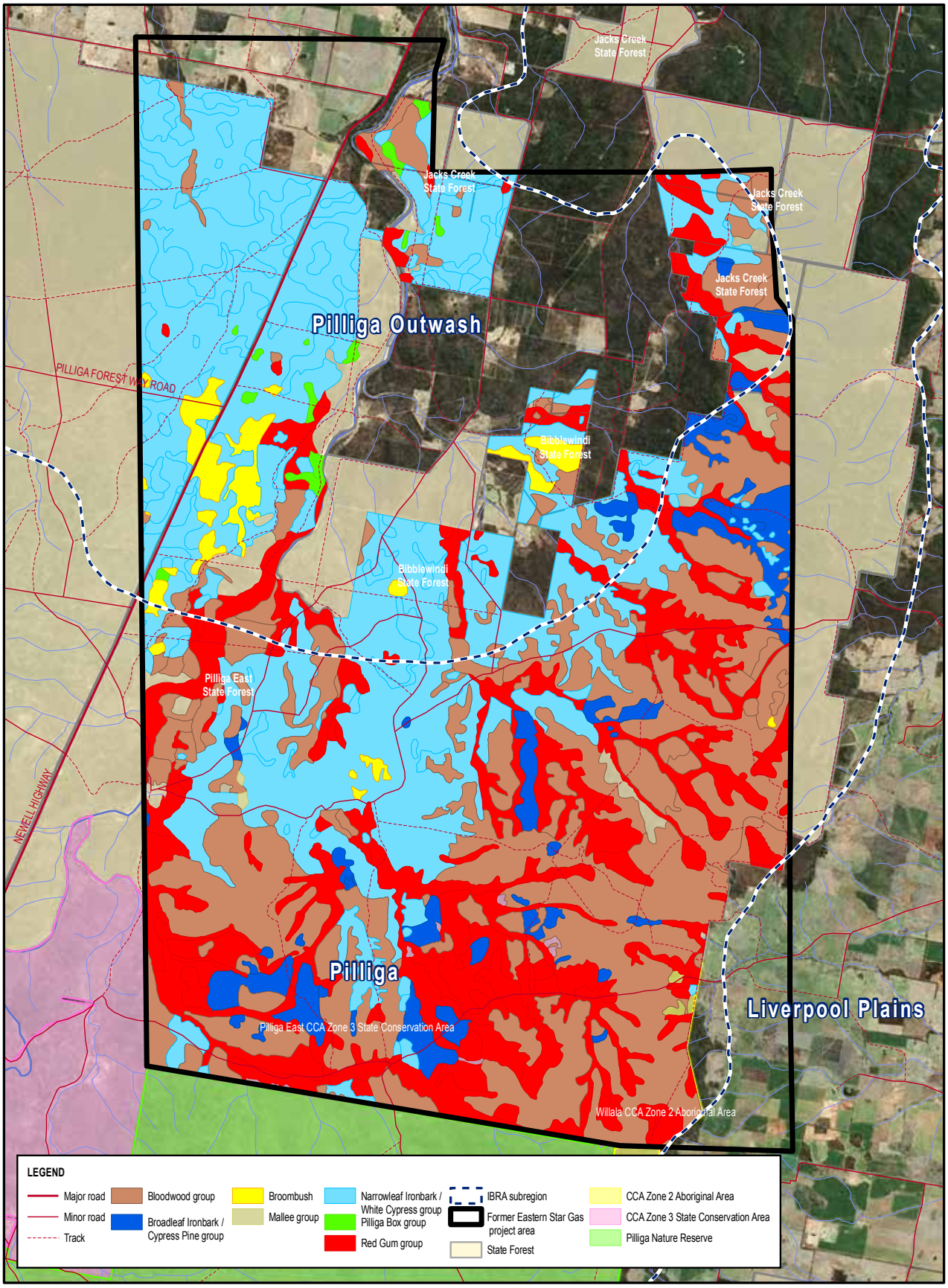


Fig. 3 The Pilliga Project Area showing the formerly proposed locations of gas wells, pipelines and processing infrastructure.

FIG 4



Reserves from NSW Dept of Planning and OEH.IBRA sub-regions from DSEWPaC. Vegetation groups from Lindsay, A.D. (1967) *Forest Types of the New South Wales Cypress Pine Zone Technical Paper No. 8. Forestry Commission of NSW.* Roads and watercourses from GEODATA TOPO250K. Imagery from Bing.	NORTH 0 km 4 1:175,000 at A4 11/09/2012	Broad vegetation types in the Project Area (derived from Lindsay 1967 types) showing sub-regional boundaries of IBRA bio-regions	Figure 4

For the Project Area alone, up to 23 threatened species and five EECs listed under the *EPBC Act* and 38 threatened species and five EECs listed under the *TSC Act* are known or have been predicted to occur there on the basis of modelled habitat (Tables 1-3, 5). These include:

i) the Black-striped Wallaby *Macropus dorsalis,* listed as endangered under the *TSC Act,* which occurs there at the southern limit of its distribution (NSW Department of Environment and Heritage Threatened Species Information website – accessed July 2012);

ii) a number of declining woodland bird species listed as vulnerable under the *TSC Act* for which the Pilliga Forest is a known stronghold, including the eastern races of the Brown Treecreeper *Climacteris picumnus*, Black-chinned Honeyeater *Melithreptus gularis* and Grey-crowned Babbler P*omastomus temporalis*, the south-eastern races of the Varied Sittella *Daphnoesitta chrysoptera* and Hooded Robin *Melanodryas cucullata* and the Speckled Warbler *Chthonicola sagittata* and Diamond Firetail S*tagonopleura guttata*; and

iii) important populations of other vulnerable fauna species listed under the TSC Act including the Pale-headed Snake *Hoplocephalus bitorquatus*, Glossy Black-cockatoo *Calyptorhynchus lathami*, Turquoise Parrot *Neophima pulchella*, Barking Owl *Ninox connivens,* Eastern Pygmy-possum *Cercartetus nanus,* Little Pied Bat *Chalinolobus picatus* and Eastern Cave Bat *Vespadelus troughtoni*.

The Study Area is vital to maintaining connectivity in the north-east of the Pilliga Forest as it provides a continuous forested link between the Pilliga Nature Reserve and other important areas of habitat to the north-west, north and north-east. This crucial connectivity not only increases the biodiversity values of all sectors but is essential for maintaining the long-term evolutionary potential of resident populations by facilitating genetic exchange. The Pilliga Nature Reserve Plan of Management (NSW National Parks and Wildlife Service 2003) states that.

"Land adjoining the Reserve to the north and west is administered by State Forests for a variety of purposes including timber production and bee keeping. These areas provide continuous uninterrupted habitat. ….The large size of the Reserve and its connection to adjacent forest make the Reserve an important habitat for a wide range of threatened species including nomadic species such as the Regent Honeyeater".

The latter reference highlights another significant attribute of the Pilliga Forest, its role in providing seasonal habitat for a suite of migratory and nomadic birds as part of the eastern Australian bird migration system (Nix 1976, 1993, Griffioen and Clarke 2002).

1.3 THREATENING PROCESSES RELEVANT TO THE PILLIGA FOREST AND COAL SEAM GAS PRODUCTION

The following threatening processes are particularly relevant to likely impacts from the development of coal seam gas production in the Pilliga Forest.

i) Loss of global climate change refugia Positioned as a large intact vegetation remnant in a substantially cleared agricultural landscape with highly variable rainfall, the Pilliga Forest's resilience and role as a major climate change refuge against drought, rising temperatures and increasing fire frequency is threatened by the vegetation loss, fragmentation and degradation and resultant perturbations associated with coal seam gas production.

ii) Loss of spatially dependent evolutionary potential The size and un-fragmented condition of the Pilliga Forest allows species with healthy populations to achieve their full evolutionary potential. Recent speciation of the Pilliga Mouse, which has close relatives to the north and east illustrates this capacity, a capacity that is compromised by the habitat reduction and fragmentation resulting from coal seam gas production.

iii) Loss of habitat for long-distance migrants The Pilliga Forest as part of the Brigalow Belt South Bioregion provides transit, over-wintering and breeding habitat for many long-distance migratory and nomadic bird species of open forests and woodlands and is recognised as forming part of the east Australian bird migration system (as noted above). Vegetation loss (particularly of prolific nectar and pollen producing ironbark and box eucalypts that flower in autumn and winter), degradation and, to a lesser extent fragmentation, from coal seam gas production threaten the viability of these bird species at critical times of their life cycles. Such threats have already been implicated in population reductions of the Superb Parrot *Polytelis swainsonii,* Swift Parrot and Regent Honeyeater elsewhere in their ranges (NSW National Parks and Wildlife Service 2003, Garnett et al. 2011).

iv) Disturbance and habitat loss at regional and local scales On-going disturbance regimes operating in the Pilliga Forest include small scale clearing, forestry operations and associated roading, grazing, frequent wildfire and impacts from introduced mammals such as the Feral Goat *Capra hircus*, Feral Pig *Sus scofa* and Red Fox *Vulpes vulpes*. Although recent conservation gains have reduced some pressures, the additional clearing, roading, burning and associated impacts resulting from coal seam gas production will have a cumulative effect and are likely to result in further perturbations that could exceed survival thresholds for many species and communities.

v) Pollution of drainage systems and underground aquifers The potential for broad-scale pollution of drainage systems, underground aquifers and groundwater-dependent ecosystems from coal seam gas production is a new threat to the Pilliga Forest and surrounds, with large volumes of highly saline water containing other toxic chemicals likely to endanger ephemeral aquatic systems (including ecologically significant gilgais), adjoining wetlands and infiltrate into the Great Artesian Basin.

vi) Loss of productivity in low-nutrient systems Much of the central and eastern Pilliga Forest has been progressively degraded in recent decades by successive extensive hot fires (Kavanagh and Barrott 2001, Milledge 2004), resulting in reduced primary productivity in an already low nutrient system (based on coarse mesozoic sediments). Continuing frequent fires likely to be associated with coal seam gas production will increase vegetation recovery times, slowing the production of food and shelter resources for fauna including foliage, nectar and tree hollows and also slowing decomposition rates (e.g. Nix and Mackey 2000).

2 METHODS

2.1 IDENTIFICATION OF SPECIES LISTED AS THREATENED UNDER THE *EPBC* AND *TSC ACTS*

The EPBC Act Protected Matters Search Tool (SEWPaC) was used to identify listed threatened flora and fauna species and ecological communities recorded from, or having the potential to occur within the Project Area. Records of *EPBC Act*-listed threatened flora and fauna species together with *TSC Act* listed threatened species were also obtained from the Atlas of NSW Wildlife. Atlas search areas were defined as Pilliga East, Bibblewindi and Jacks Creek State Forests, Pilliga East Aboriginal Area, Pilliga East State Conservation Area and Pilliga Nature Reserve to provide records of threatened species known from or adjacent to the Project Area.

2.2 SURVEY DESIGN AND SITE SELECTION

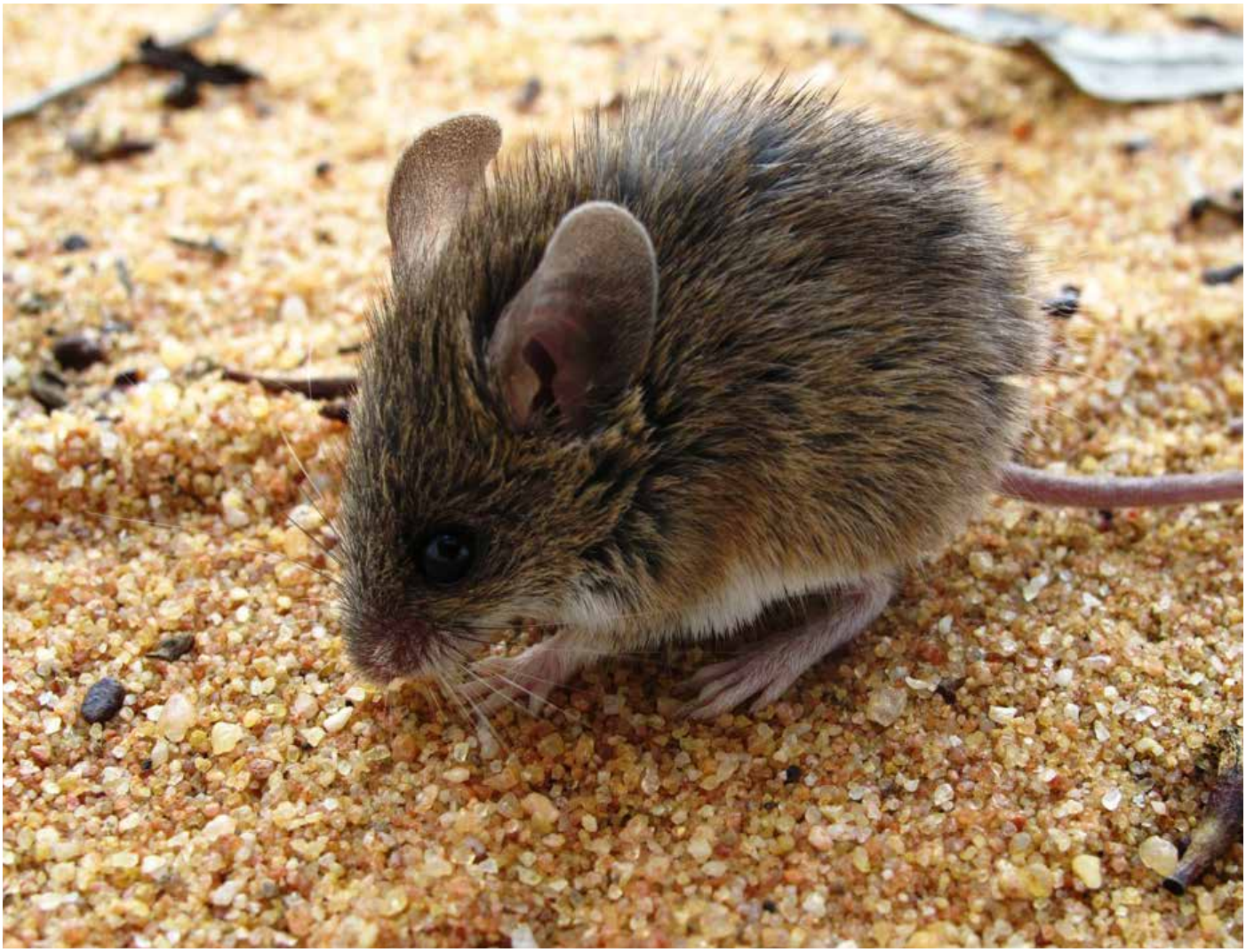
The field survey was designed to fill gaps in current knowledge of the occurrence in the Project Area of the 25 *EPBC Act*-listed threatened flora and fauna species and five *EPBC Act*-listed EECs known from or predicted as likely to occur there (Tables 1-3). In particular, the South-eastern Long-eared Bat and Pilliga Mouse were targeted in areas and habitats in the Project Area not covered by past systematic surveys (RACAC 2000, 2002, NCC 2002, Date and Paull 2000, Eco Logical Australia 2011, Flint 2011). The occurrence of migratory species listed under the *EPBC Act* (Table 4) and additional threatened species and EECs listed under the *TSC Act* (Tables 4, 5) were also sought, but these were not specifically targeted apart from several largely nocturnal, cryptic species. The latter comprised the Pale-headed Snake, Barking Owl, Koala, Eastern Pygmy-possum, Black-striped Wallaby and Large-eared Pied Bat.

The surveys undertaken during this study were confined to the State Forest and a freehold property within the Project Area, apart from one bird survey site, four sites trapped for microchiropteran bats and some opportunistic searches carried out along the eastern boundary of Pilliga East State Forest adjacent to the Project Area's eastern boundary (Figs 5-7).

Threatened South-eastern Long-eared Bat. Photo David Milledge

Table 4 Migratory fauna species listed under the *EPBC Act* known from the Project Area or predicted to occur on the basis of modelled habitat

common name	scientific name	EPBC Act status	NPWS Atlas record	recorded this study	likely to occur	may occur
Malleefowl	*Leipoa ocellata*	vulnerable, migratory				X
White-throated Needletail	*Hirundapus caudacutus*	migratory	x			
Fork-tailed Swift	*Apus pacificus*	migratory			X	
Eastern Great Egret	*Ardea modesta*	migratory			X	
Cattle Egret	*Ardea ibis*	migratory			X	
White-bellied Sea-eagle	*Haliaeetus leucogaster*	migratory	X			
Latham's Snipe	*Gallinago hardwickii*	migratory				X
Rainbow Bee-eater	*Merops ornatus*	migratory	x	x		
Regent Honeyeater	*Anthochaera phrygia*	endangered, migratory			X	
Total 9 species						



Threatened Pilliga Mouse. Photo Justin McDowell

Table 5 Threatened fauna species listed under the *TSC Act* known from the Project Area or predicted to occur on the basis of modelled habitat

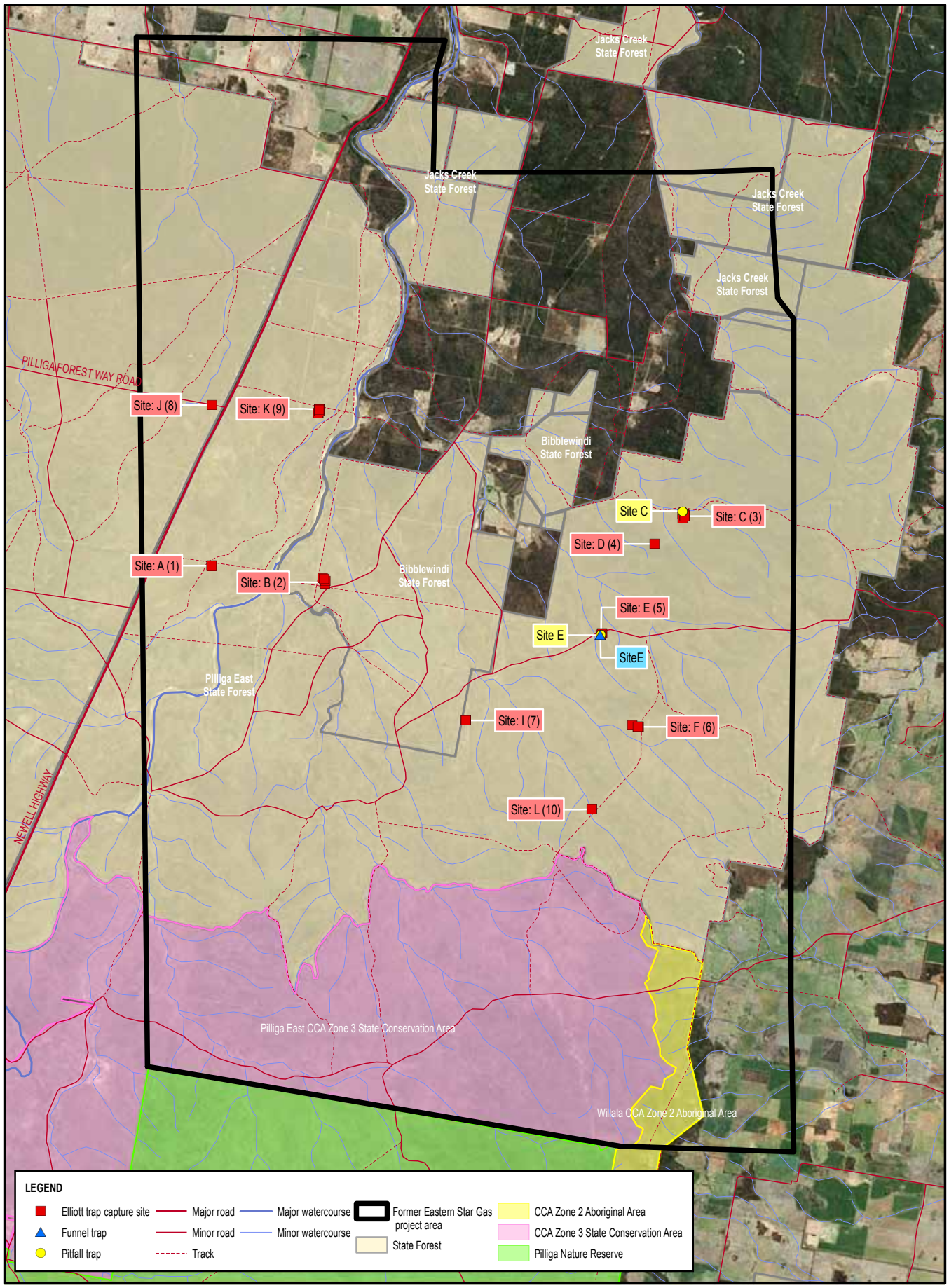
common name	scientific name	*TSC Act* status	NPWS Atlas record	recorded this study	likely to occur	may occur
Pale-headed Snake	*Hoplocephalus bitorquatus*	vulnerable	X	X		
Malleefowl*	*Leipoa ocellata*	endangered				X
Squatter Pigeon (southern)*	*Geophaps scripta scripta*	endangered				X
Square-tailed Kite	*Lophoictinia isura*	vulnerable			X	
Black-breasted Buzzard	*Hamirostra melanosternon*	vulnerable			X	
Spotted Harrier	*Circus assimilis*	vulnerable	X			
Little Eagle	*Hieraaetus morphnoides*	vulnerable	X	X		
Bush Stone-curlew	*Burhinus grallarius*	endangered	X			
Glossy Black-cockatoo	*Calyptorhynchus lathami*	vulnerable	X	X		
Little Lorikeet	*Glossopsitta pusilla*	vulnerable	X	X		
Superb Parrot*	*Polytelis swainsonii*	vulnerable			X	
Swift Parrot*	*Lathamus discolor*	endangered			X	
Turquoise Parrot	*Neophema pulchella*	vulnerable	X	X		
Barking Owl	*Ninox connivens*	vulnerable	X	X		
Masked Owl	*Tyto novaehollandiae*	vulnerable	X			
Brown Treecreeper (eastern)	*Climacteris picumnus victoriae*	vulnerable	X	X		
Speckled Warbler	*Chthonicola sagittata*	vulnerable	X	X		
Regent Honeyeater*	*Anthochaera phrygia*	endangered, migratory			X	
Black-chinned Honeyeater (eastern)	*Melithreptus gularis gularis*	vulnerable	X			
Painted Honeyeater	*Grantiella picta*	vulnerable	X			
Grey-crowned Babbler (eastern)	*Pomastomus temporalis temporalis*	vulnerable	X	X		
Varied Sittella (south-eastern)	*Daphoenositta chrysoptera chrysoptera*	vulnerable	X	X		
Hooded Robin (south-eastern)	*Melanodryas cucullata cucullata*	vulnerable	X	X		
Diamond Firetail	*Stagonopleura guttata*	vulnerable	X	X		
Spotted-tailed Quoll (south-eastern mainland)*	*Dasyurus maculatus maculatus*	endangered				X
Koala*	*Phascolarctos cinereus*	vulnerable	X	X		
Eastern Pygmy-possum	*Cercartetus nanus*	vulnerable	X	X		
Squirrel Glider	*Petaurus norfolcensis*	vulnerable	X	X		
Black-striped Wallaby	*Macropus dorsalis*	endangered		X		

Brush-tailed Rock-wallaby*	*Petrogale penicillata*	endangered				X
Grey-headed Flying-fox*	*Pteropus poliocephalus*	vulnerable				X
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	vulnerable	X	X		
Eastern Bent-winged Bat	*Miniopterus schreibersii*	vulnerable	X			
Large-eared Pied Bat*	*Chalinolobus dwyeri*	vulnerable			X	
Little Pied Bat	*Chalinolobus picatus*	vulnerable	X	X		
Eastern Cave Bat	*Vespadelus troughtoni*	vulnerable	X			
South-eastern Long-eared Bat*	*Nyctophilus corbeni*	vulnerable	X	X		
Pilliga Mouse*	*Pseudomys pilligaensis*	vulnerable	X	X		
Total 38 species						

* also listed under the *EPBC Act*

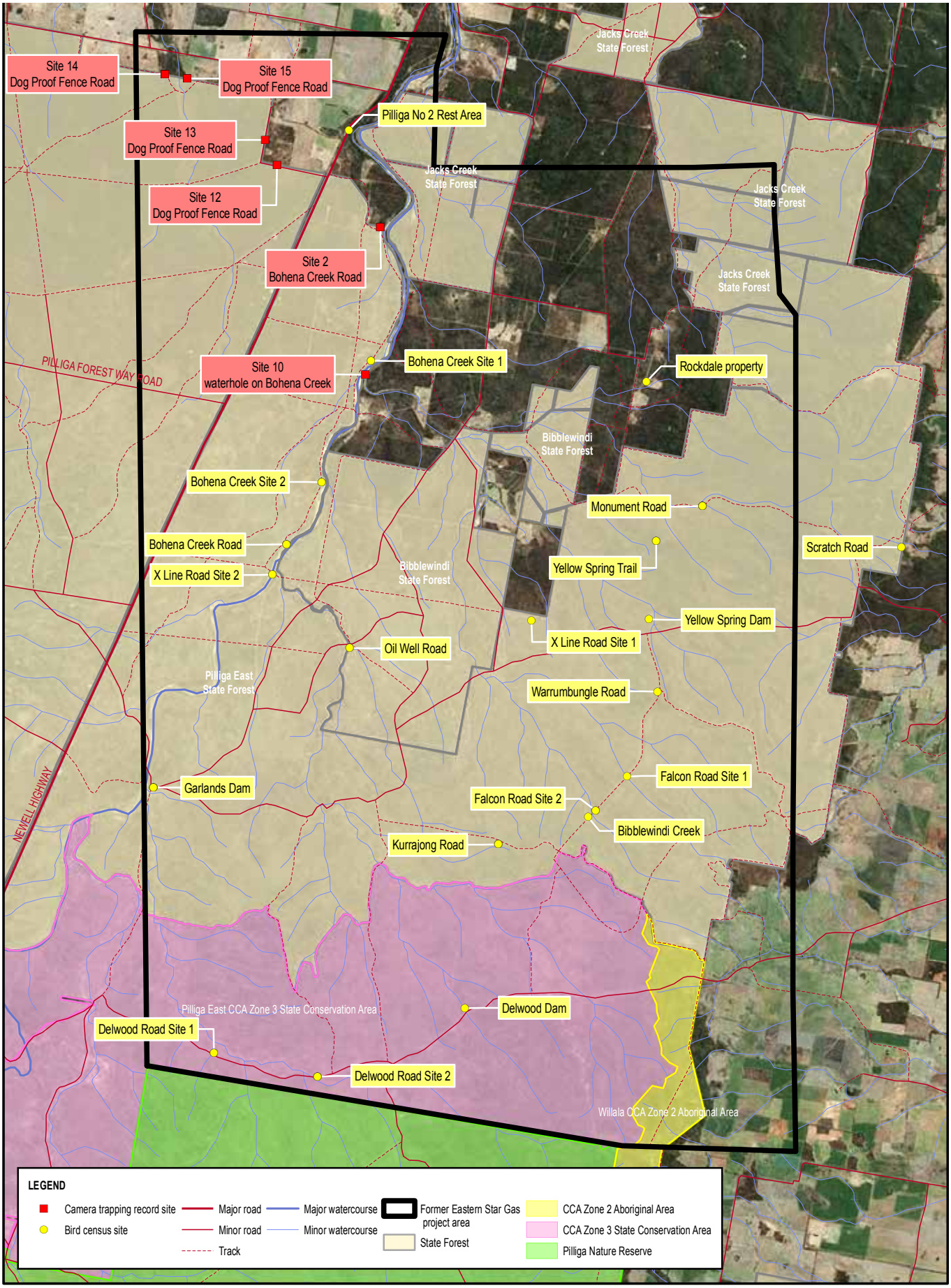
Threatened Pale-headed Snake, funnel trapping Site E, Warrumbungle Trail. Photo Phil Spark

FIG 5



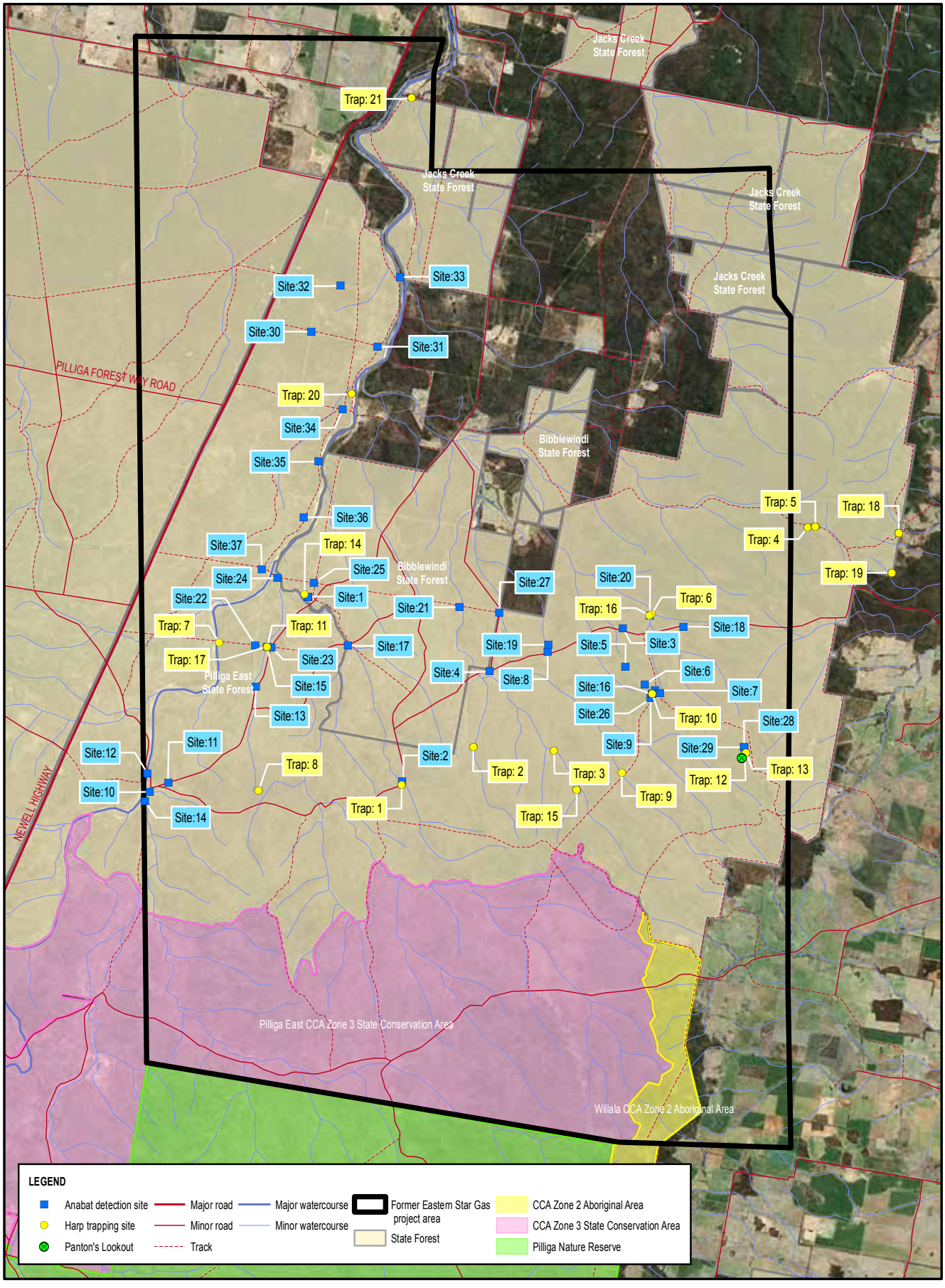
Reserves from NSW Dept of Planning and OEH. Trap locations from Landmark Ecological Services.Roads and watercourses from GEODATA TOPO250K. Imagery from Bing.	NORTH 0 km 4 1:175,000 at A4 11/09/2012	Locations of targeted survey sites in the Project Area, October 2011 – pitfall trapping, funnel trapping and Elliott trapping sites	Figure 5

FIG 6



Reserves from NSW Dept of Planning and OEH. Census and trap locations from Landmark Ecological Services.Roads and watercourses from GEODATA TOPO250K. Imagery from Bing.	NORTH 0 km 4 1:175,000 at A4 11/09/2012	Locations of targeted survey sites in the Project Area, October 2011 – bird census and camera trapping record sites	Figure 6

FIG 7



Reserves from NSW Dept of Planning and OEH. Trap locations and Anabat locations from Landmark Ecological Services.Roads and watercourses from GEODATA TOPO250K. Imagery from Bing.	NORTH 0 km 4 1:175,000 at A4 12/09/2012	Locations of targeted survey sites in and adjoining the Project Area, October 2011 – harp trapping and Anabat detection sites	Figure 7

2.3 SURVEY METHODS

All surveys and opportunistic searches for species and communities were undertaken in the Project Area from 8-15 October 2011, with some opportunistic records made later in the month.

2.3.1 Plant species: Opportunistic searches for plant species listed under the *EPBC Act* and predicted as likely to occur in the Project Area (Table 1) were undertaken by driving roads and trails throughout the area to detect potential habitat, with follow-up intensive ground searches.

2.3.2 Plant communities: EECs listed under the *EPBC Act* and predicted as likely to occur in the Project Area (Table 2) were also targeted by road-based searches. Once detected, a potential EEC was assessed for conformity with the formal description provided on the Department of Sustainability, Environment, Water, Population and Communities' (SEWPAC) website. In the field this involved obtaining information on the community's patch size and a detailed description of the species composition of the upper, mid and ground-cover vegetation strata. These data were then used to follow the flowchart of eligibility criteria provided on the SEWPAC website.

2.3.3 Amphibians: Nocturnal spotlight searches for amphibians were focused on dams and standing water in creek beds, and were undertaken at 4 sites on 5 nights. Pitfall traps with metal drift fences were used at small mammal trapping sites C and E (Appendix 3, Fig. 5), which targeted amphibians generally.

Opportunistic records of amphibians were made throughout the Project Area whenever species were observed or heard.

2.3.4 Reptiles: A targeted survey for the TSC Act-listed Pale-headed Snake and other small to medium-sized reptiles was undertaken at small mammal trapping site E (Appendix 3, Fig. 5), where reptile funnel traps were employed. As with amphibians, the pitfall traps with drift fences that were used at small mammal trapping sites C and E (Appendix 3, Fig. 5) generally targeted small to medium-sized reptiles.

Opportunistic visual searches for all reptile species were made when driving along roads and by turning over rocks, bark and other large debris when these were encountered throughout the Project Area.

2.3.5 Birds: Systematic surveys for diurnal birds were undertaken at 21 one ha sites stratified across the Project Area to obtain a representative sample of the habitats present (Fig. 6, Appendix 4). Records were made of all species observed or heard within a site from the central point during a 20 min period and numbers of all *EPBC/TSC Act*-listed species were also recorded.

Nocturnal call playback targeting the Barking Owl was used opportunistically at a number of locations in the northern section of the Project Area (within the Pilliga Outwash Province).

Opportunistic records of bird species were recorded whenever these were encountered while traversing the Project Area.

2.3.6 Mammals: Systematic trapping surveys for microchiropteran bats (targeting the South-eastern Long-eared Bat) and small mammals (targeting the Pilliga Mouse) were undertaken at 21 and 10 sites respectively throughout the Project Area (Figs 7 and 5; Appendices 5 and 8), with sites selected on the basis of known habitat preferences of the target species. Microchiropteran bats were also surveyed using the Anabat ultrasonic call detection system at 37 sites in the Project Area (Fig. 7; Appendix 7).

Microchiropteran bats were trapped at sites using a single 2 or 3-bank harp trap (apart from two sites where two traps were used, Sites 10, 15) with the trap placed across a road, track or dry creek bed, although traps at a few sites were placed about pools in creeks or against small cliff faces. Traps were set for one or two full nights per site apart from at two sites (Site 10 and one trap at Site 15), where the trap was closed after two hours.

Microchiropteran bat calls were recorded and identified throughout the Project Area using Anabat SD1 bat detectors with AnalookW version 3.8m software. Detectors were set and left unattended at 21 sites, while hand held detectors used in conjunction with a PDA display of calls in real time at 17 sites. Bat calls were analysed and identified by Harry Parnaby.

Small mammals were trapped at each site using two parallel lines of 25 A-size Elliott traps (total of 50 traps) placed 10m apart per line, with lines spaced 50m apart. Traps were set for three or four nights (Appendix 8) and baited with a mixture of peanut butter and oats flavoured with truffle oil.

A series of traverses along roads and trails through the Project Area were undertaken by an expert observer to identify potential Pilliga Mouse habitat (Fig. 8). Potential habitat was determined using a series of vegetation parameters including the presence of a dense low understorey with a high diversity of heathy shrub species regenerated after relatively recent fire, a well-developed litter layer and the absence of a continuous tall shrub layer. The identification of potential habitat was also informed by the trapping results from the current survey.

A targeted survey for the Black-striped Wallaby, incorporating a dusk visual search, was undertaken on three nights in the Brandon's Road area in the north of the Project Area. The Eastern Pygmy-possum was targeted at small mammal trapping sites C and E (Appendix 3, Fig. 5), where pitfall traps and metal drift fences were employed, and the Large-eared Pied Bat was targeted with harp traps 12 and 13 placed near and against a cliff face at Panton's Lookout (Fig. 7).

Diurnal Koala faecal scat and sign searches were undertaken in riparian vegetation along Cowallah and Bohena Creeks, with scat searches targeting the bases of Blakely's Red Gum *Eucalyptus blakelyi* and Baradine Red Gum *E. chloroclada* and scratch marks searched for on the trunks of smooth-barked eucalypts.

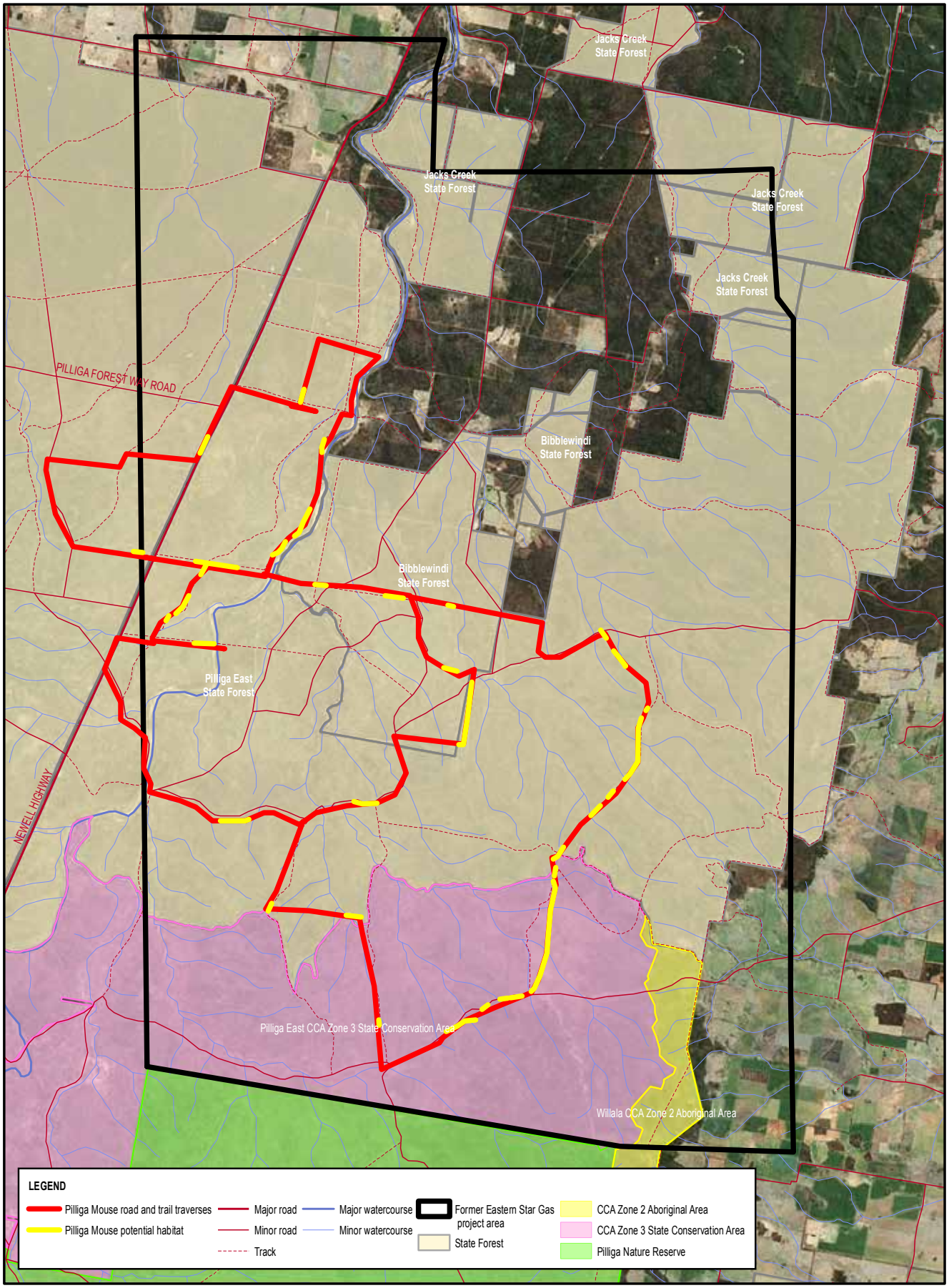
Seventeen camera traps were set on trails and at gaps along the dog-proof fence and near waterholes in the northern section, and at Panton's Lookout in the eastern section of the Project Area (Fig. 6), targeting medium and large-sized terrestrial mammals.

Opportunistic diurnal and nocturnal road-based searches for arboreal and medium to large-sized ground mammals were made throughout the Project Area. Nocturnal spotlight searches were concentrated in areas of box eucalypts *(Eucalyptus pilligaensis, E. albens)* and red gums *(Eucalyptus blakelyi, E. chloroclada)* along creeks, and in stands of flowering Baradine Red Gum to maximise records of arboreal species.

After the surveys were completed and the results compiled, an expert workshop was held to interpret the results and their significance. A workshop was held at the University of New England with seven experts from relevant fields and the outcomes have been included in this report where appropriate.

Broad-leaved Ironbark, Deldam Trai. Photo Hugh Nicholson

FIG 8



Reserves from NSW Dept of Planning and OEH. Pilliga Mouse transects from C.Flint. Roads and watercourses from GEODATA TOPO250K. Imagery from Bing.	NORTH 0 km 4 1:175,000 at A4 11/09/2012	Pilliga Mouse habitat assessment road and trail traverses	Figure 8

3 RESULTS

3.1 VEGETATION AND FLORA

3.1.1 Previous records of threatened species and communities listed under the *EPBC* and *TSC Acts*

A total of 11 threatened plant species (listed under the *EPBC* and *TSC Acts*) were previously recorded in the Project Area or were predicted as likely to occur there (Table 1). Species previously recorded were the endangered Large-leafed Monotaxis *Monotaxis macrophylla* and a vulnerable rulingia *Rulingia procumbens*.

Five EECs listed under the *EPBC Act* (including one not listed under the *TSC Act*) and five EECs listed under the *TSC Act* (including one not listed under the *EPBC Act*), resulted in a total of six EECs that were predicted as likely to occur in the Project Area (Table 2).

3.1.2 Threatened species and communities recorded by current survey

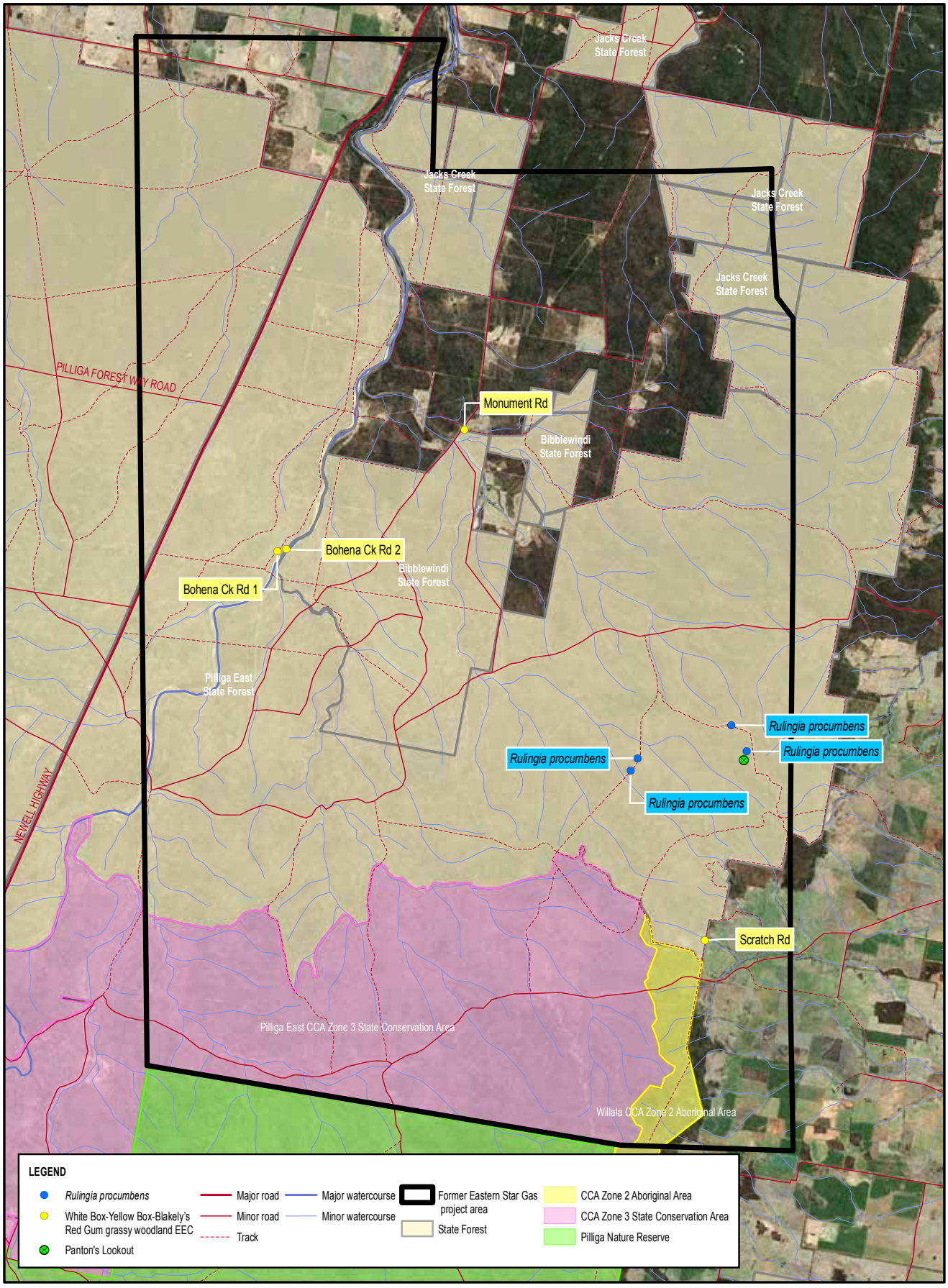
One threatened plant species, *Rulingia procumbens,* listed as vulnerable under both the *EPBC* and *TSC Acts*, was recorded during the current survey. Small populations of one to ten plants of this rare species (PlantNET-NSW FloraOnline website, accessed July 2012) were identified in the central eastern section of the Project Area to the west and north-west of Panton's Lookout (Fig. 9, Appendix 1), indicating that the Pilliga Forest represents a stronghold for this species.

One EEC, White Box-Yellow Box-Blakely's Red Gum grassy woodland and derived native grassland, listed as Critically endangered under the *EPBC Act* and endangered under the *TSC Act*, was recorded at four locations within the Project Area. These locations fell within the northern and south-eastern sections of the Project Area (Fig. 9, Appendix 2).

This EEC appears to be widespread along drainage lines throughout the Project Area and the four locations (above) were selected as representative samples to test that the community fitted the description given under the *EPBC Act* listing (Appendix 2). These findings demonstrate the importance of the Project Area for conservation of this community, which has been predominantly cleared within its range for agriculture (Department of Sustainability, Environment, Water, Population and Communities – Threatened species and communities website, accessed July 2012).

Seven Dwarfs Grevillea, small mammal trapping site A. Photo Hugh Nicholson

FIG 9



Reserves from NSW Dept of Planning and OEH. *Rulingia procumbens* and Box-Gum Woodland locations from Landmark Ecological Services. Roads and watercourses from GEODATA TOPO250K. Imagery from Bing.	NORTH 0 km 4 1:175,000 at A4 11/09/2012	Locations of *Rulingia procumbens* and White Box-Yellow Box-Blakely's Red Gum grassy woodland and derived native grassland Endangered Ecological Community	Figure 9

3.2 VERTEBRATES

3.2.1 Previous records of threatened and migratory species listed under the *EPBC* and *TSC Acts*

A total of 12 threatened vertebrate species and 9 migratory bird species listed under the *EPBC Act* were found to have been previously recorded from, or were considered likely to occur in the Project Area, based on a search of *EPBC Act* Protected Matters and Atlas of NSW Wildlife records (Tables 3, 4). Vulnerable species previously recorded were the Koala, South-eastern Long-eared Bat and Pilliga Mouse (Figs 11-13) and migratory species comprised the White-throated Needletail *Hirundapus caudacutus,* White-bellied Sea Eagle *Haliaeetus leucogaster* and Rainbow Bee-eater *Merops ornatus*.

An additional 26 vertebrate species listed under the TSC Act were also found to have been recorded from the Project Area or predicted to occur there on the basis of modelled habitat (Table 5). The former included the endangered Bush Stone-curlew B*urhinus grallarius* and vulnerable Barking Owl, Masked Owl *Tyto novaehollandiae,* Painted Honeyeater *Grantiella picta,* Squirrel Glider *Petaurus norfolcensis,* Eastern Bent-winged Bat *Miniopterus schreibersii* and Eastern Cave Bat.

3.2.2 Threatened and migratory species recorded by current survey

A total of 20 threatened species and one migratory species (*EPBC* and *TSC Acts*) were recorded from the Project Area during the current survey (Tables 6-11). These included the Koala, South-eastern Long-eared Bat and Pilliga Mouse, listed as vulnerable under the *EPBC* and *TSC Acts*, the Rainbow Bee-eater, listed as a migratory species under the *EPBC Act,* and another 16 species listed under the *TSC Act*. The latter included the endangered Black-striped Wallaby and vulnerable declining woodland bird species such as the Brown Treecreeper, Speckled Warbler, Grey-crowned Babbler, Varied Sittella, Hooded Robin and Diamond Firetail. Other vulnerable species recorded included the Pale-headed Snake, Glossy Black-cockatoo, Turquoise Parrot, Barking Owl, Eastern Pygmy-possum, Squirrel Glider, Yellow-bellied Sheath-tailed Bat *Saccolaimus flaviventris* and Little Pied Bat.

Previous records existed in the Project Area for all threatened species detected in the current survey apart from the Black-striped Wallaby (Table 5), which is at the southern limit of its range in the Pilliga Forest. However, the survey results provided new distributional and abundance data from within the Project Area for a number of these species including the Pale-headed Snake, Eastern Pygmy-possum, South-eastern Long-eared Bat and Pilliga Mouse (Figs 10, 12 and 13).

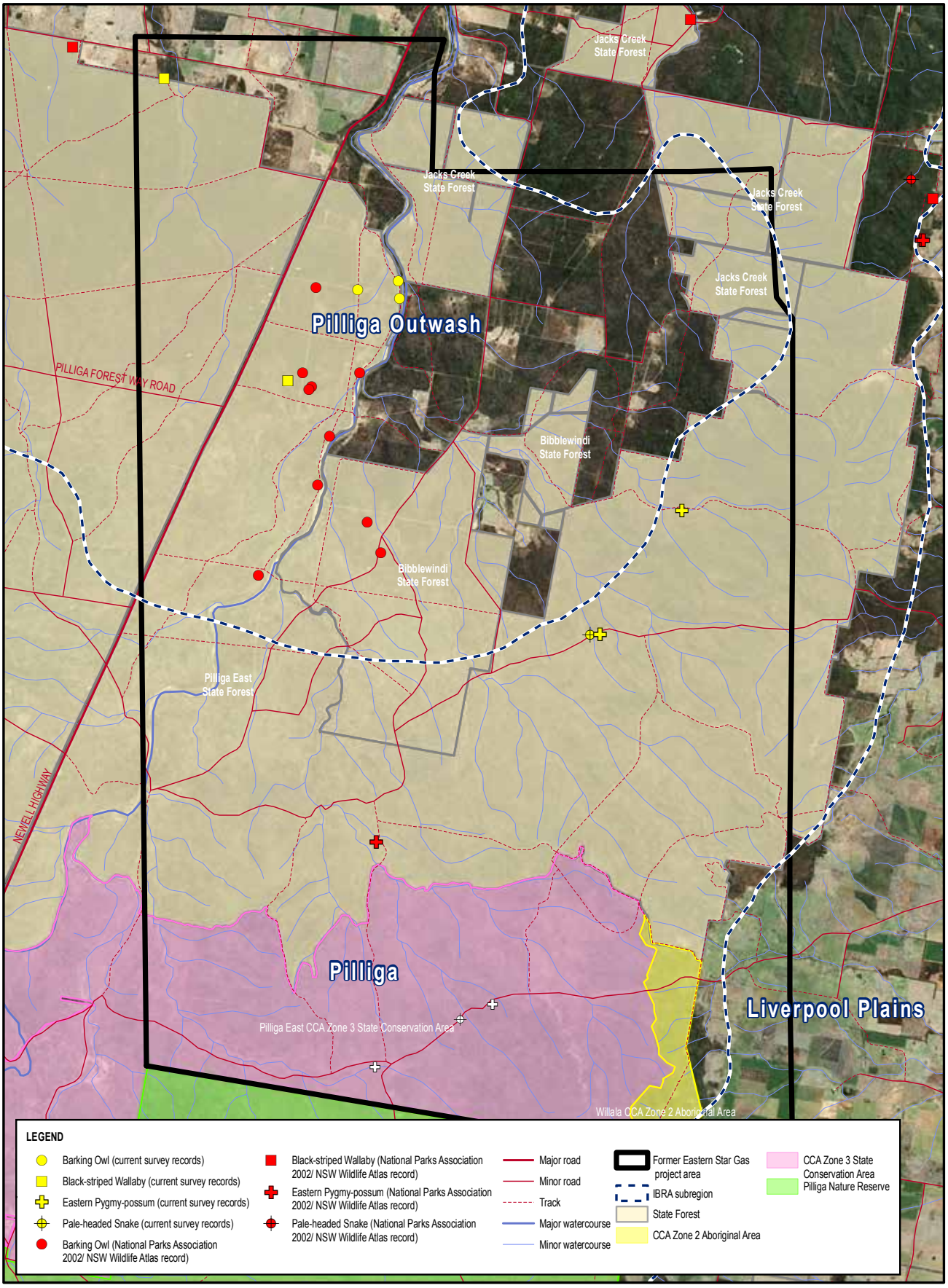
3.2.2.1 Koala Despite relatively extensive nocturnal spotlighting and diurnal faecal scat searches, only one record of the Koala was obtained during the current survey (Table 6, Fig. 11, Appendix 10). This contrasts with the 17 previous records of this species from the north and south of the Project Area (Fig. 11, Atlas of NSW Wildlife), although these were mostly obtained in the 1980s and 1990s (Atlas of NSW Wildlife records - accessed May 2012). The result parallels the overall substantial decline reported recently across the whole of the Pilliga Forest since the beginning of the 21st century (Paull in prep.). Reasons proposed for this decline include frequent extensive hot fires and prolonged drought over the past few decades (Kavanagh and Barrott 2001, Paull in prep.).

Past records of the Koala in the Project Area are concentrated in the north (within the Pilliga Outwash Province) and in the south-east on the edge of the Liverpool Plains (Fig. 11), where soil nutrient status is higher than that of the remainder, which falls within the Pilliga Province. This follows the pattern reported by Milledge (2004) of a distribution broadly similar to that of the Barking Owl, reflecting the occurrence of areas of higher productivity in the Pilliga Forests.

However, the Project Area contains extensive stands of riparian forest and woodland dominated by red gums (Fig. 4) and predominantly Blakely's Red Gum, an important Koala food tree in the Pilliga Forest (Paull in prep.). Baradine Red Gum, another important food

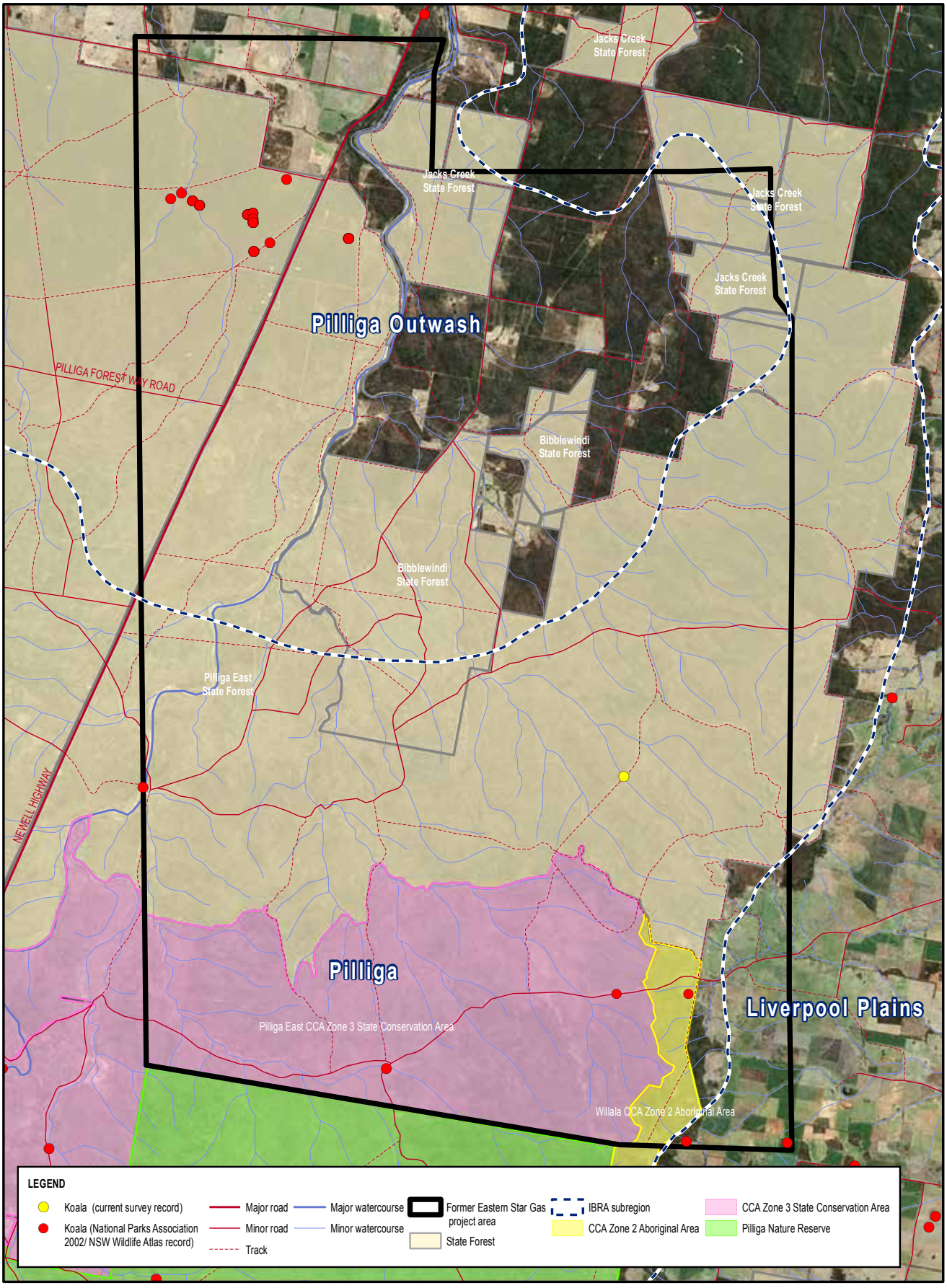
Threatened Hooded Robin. Photo David Milledge

FIG 10



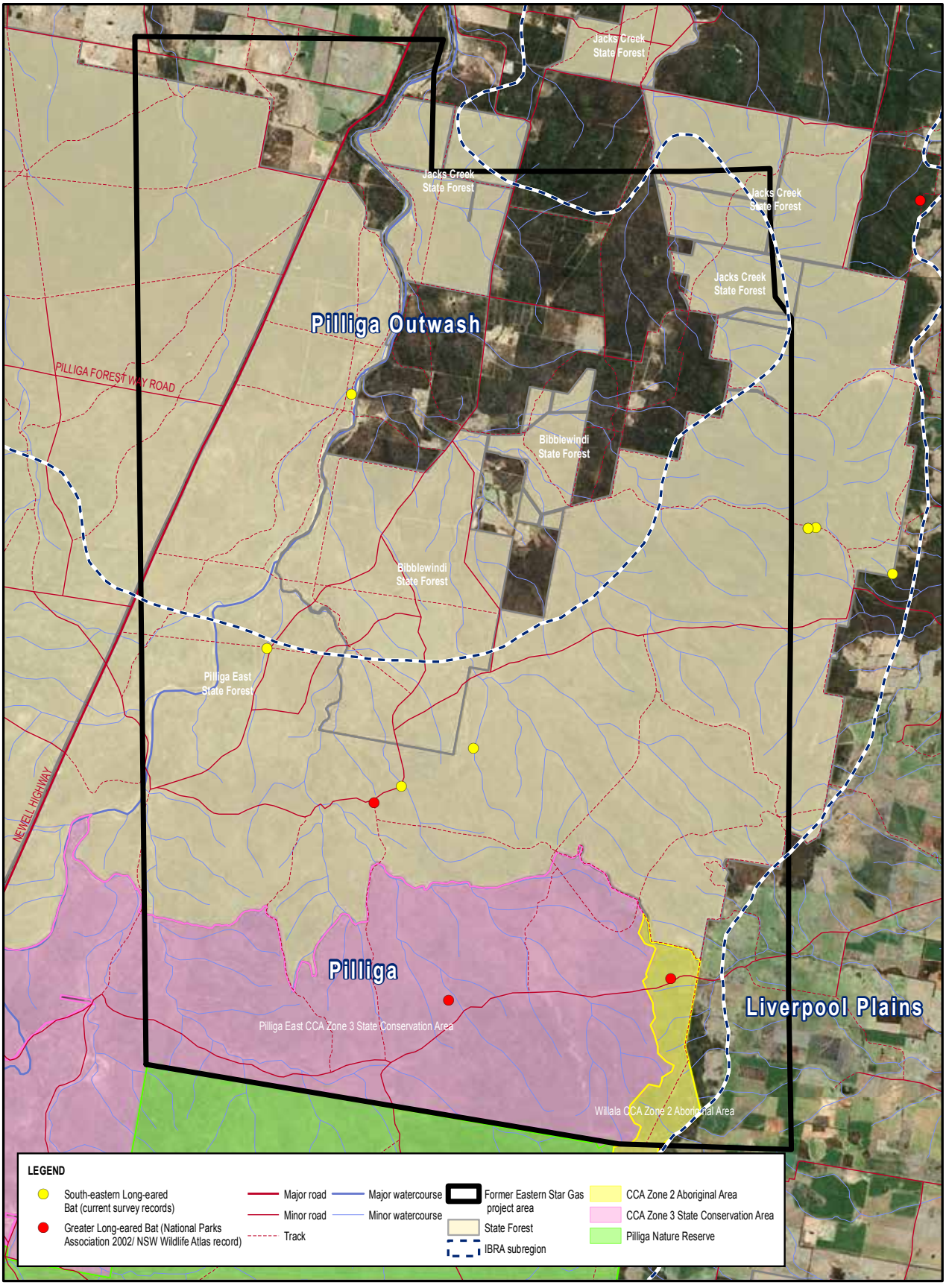
Reserves from NSW Dept of Planning. Threatened species records from Landmark Ecological Services. Roads and watercourses from GEODATA TOPO250K. Imagery from Bing.	NORTH 0 km 4 1:175,000 at A4 11/09/2012	Records of the Pale-headed Snake, Barking Owl, Eastern Pygmy-possum and Black-striped Wallaby in the Project Area	Figure 10

FIG 11



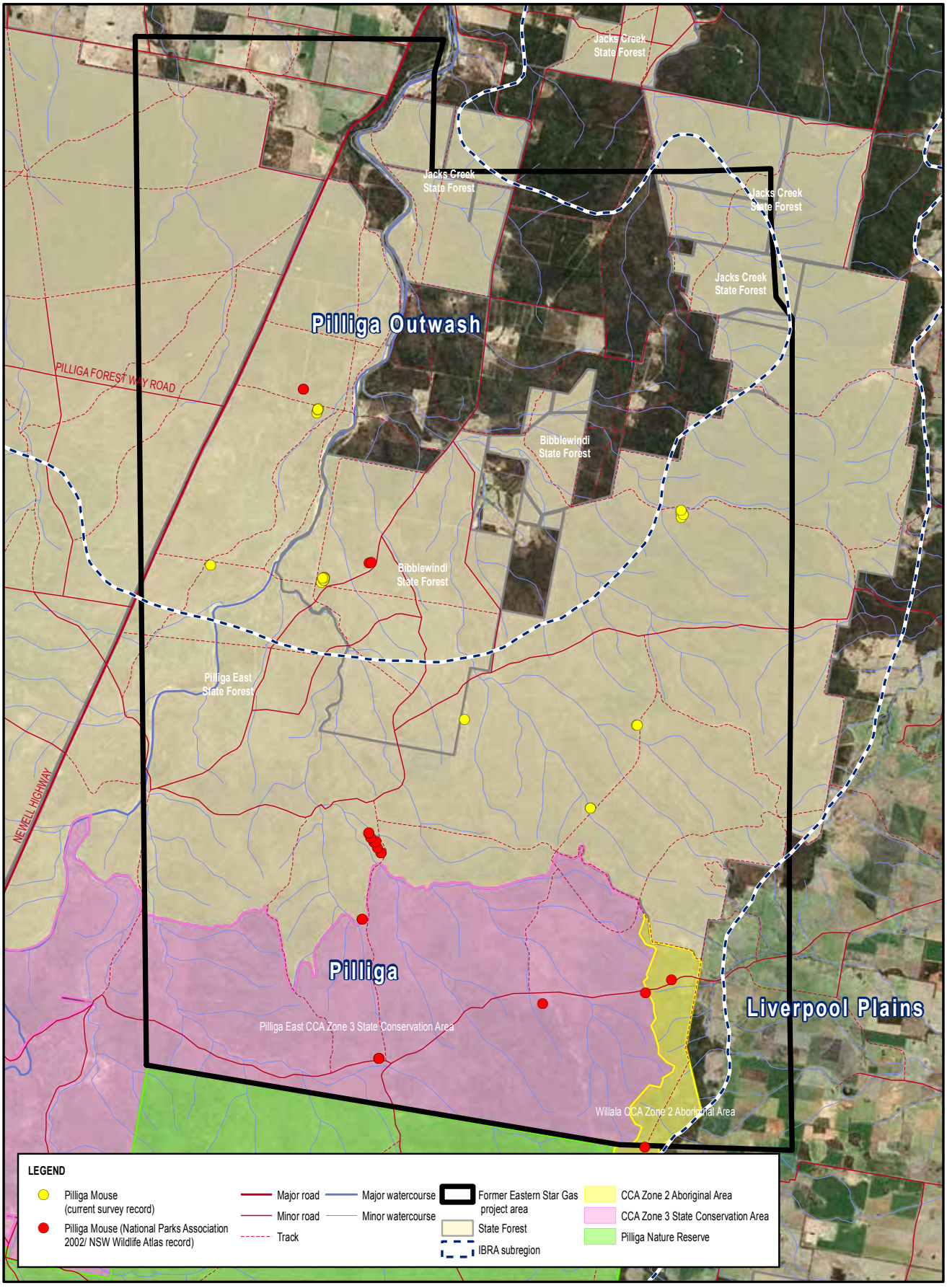
Reserves from NSW Dept of Planning and OEH. Koala records from Landmark Ecological Services. Roads and watercourses from GEODATA TOPO250K. Imagery from Bing.	NORTH 0 km 4 1:175,000 at A4 11/09/2012	Records of the Koala in the Project Area	Figure 11

FIG 12



Reserves from NSW Dept of Planning and OEH. South-eastern Long-eared Bat re from Landmark Ecological Services. Roads and watercourses from GEODATA TOPO250K. Imagery from Bing.	NORTH 0 km 4 1:175,000 at A4 11/09/2012	Records of the South-eastern Long-eared Bat in the Project Area	Figure 12

FIG 13



Reserves from NSW Dept of Planning and OEH. Pilliga Mouse records from Landmark Ecological Services. Roads and watercourses from GEODATA TOPO250K. Imagery from Bing.	NORTH 0 km 4 1:175,000 at A4 11/09/2012	Records of the Pilliga Mouse in the Project Area	Figure 13

tree (Paull in prep.), is a co-dominant with Narrow-leaved Ironbark *Eucalyptus crebra,* White Cypress Pine *Callitris glaucophylla* and Brown Bloodwood *Corymbia trachyphloia* in a number of other widespread associations (Fig. 4). As a consequence, the Project Area represents potentially suitable habitat for Koala recolonisation following a return to more favourable conditions.

3.2.2.2 South-eastern Long-eared Bat Prior to the current survey there were three records of the South-eastern Long-eared Bat in the Project Area (confined to the southern section), with a small number of records in adjacent areas (Fig. 12, Atlas of NSW Wildlife, Flint 2011). However, Pilliga East, a larger block enclosing the Project Area was identified by Turbill and Ellis (2006) as one of only three areas representing a "distinct stronghold" for the south-eastern form of the Greater Long-eared Bat *Nyctophilus timoriensis* (redescribed as the South-eastern Long-eared Bat *N. corbeni* by Parnaby 2009). This species appears to require large continuous (vegetation) remants to support high densities or core populations (Turbill and Ellis 2006). The results from the current survey support the finding of Pilliga East's importance for this species, with a total of 21 individuals captured at 8 sites throughout and adjoining the Project Area (Tables 6 and 8, Fig. 12). This included seven and eight individuals captured over two nights at two sites respectively (Appendix 6). The capture rate of 0.7 individuals per trap night (20 individuals for 30 trap nights, Table 8, Appendix 6), representing 8% of total bats captured (240 captures, Table 8) corresponds closely with the figures of 0.1-0.6 individuals per trap night and 7-9% of bat captures obtained by Turbill and Ellis (2006) for the species in

Table 6 Summary of records of threatened and migratory species obtained in the Project Area, 8-14 October 2011 – species and numbers of individuals

common name	scientific name	threatened status	no. sites	nos individuals
Pale-headed Snake	*Hoplocephalus bitorquatus*	vulnerable *(TSC Act)*	1	1
Little Eagle	*Hieraaetus morphnoides*	vulnerable *(TSC Act)*	2	2
Glossy Black-cockatoo	*Calyptorhynchus lathami*	vulnerable *(TSC Act)*	8	67+
Little Lorikeet	*Glossopsitta pusilla*	vulnerable *(TSC Act)*	1	2
Turquoise Parrot	*Neophema pulchella*	vulnerable *(TSC Act)*	15	24
Barking Owl	*Ninox connivens*	vulnerable *(TSC Act)*	3	3
Rainbow Bee-eater	*Merops ornatus*	migratory *(EPBC Act)*	12	36+
Brown Treecreeper	*Climacteris picumnus*	vulnerable *(TSC Act)*	12	16+
Speckled Warbler	*Chthonicola sagittata*	vulnerable *(TSC Act)*	15	28+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	37	112+
Varied Sittella	*Daphoenositta chrysoptera*	vulnerable *(TSC Act)*	3	9+
Hooded Robin	*Melanodryas cucullata*	vulnerable *(TSC Act)*	1	2
Diamond Firetail	*Stagonopleura guttata*	vulnerable *(TSC Act)*	3	6+
Koala	*Phascolarctos cinereus*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	1	1
Eastern Pygmy-possum	*Cercartetus nanus*	vulnerable *(TSC Act)*	2	3
Squirrel Glider	*Petaurus norfolcensis*	vulnerable *(TSC Act)*	1 +2*	1 +2*
Black-striped Wallaby	*Macropus dorsalis*	endangered *(TSC Act)*	2	8
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	vulnerable *(TSC Act)*	15	17+/-
South-eastern Long-eared Bat	*Nyctophilus corbeni*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	7 +1*	20 +1*
Little Pied Bat	*Chalinolobus picatus*	vulnerable *(TSC Act)*	1 +1*	1 +2*
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	7	25
Total 21 species				

* records outside Project Area

their three stronghold areas of Goonoo, Pilliga West and Pilliga East.

The South-eastern Long-eared Bat's ecological requirements and behaviour are poorly known (Schulz and Lumsden 2010, NSW Office of Environment and Heritage Threatened Species website – accessed July 2012) although Turbill and Ellis (2006) found that capture sites with highest densities were characterised by a "distinct" canopy and a dense "cluttered" understorey. The species' slow, highly manoeuvrable flight is likely to enable it to effectively exploit bark, branch and foliage substrates close to the ground in such habitat (Turbill and Ellis 2006), which predominates along drainage lines in the vegetation types of the Project Area and the East Pilliga block generally, and it is probable that these areas represent optimum foraging habitat for the species there.

3.2.2.3 Pilliga Mouse The Pilliga Mouse was known from a number of locations in the Project Area before the current survey, although the 19 records were concentrated in the southern section (Fig. 13), Atlas of NSW Wildlife, Flint 2011). A total of 25 Pilliga Mouse individuals were captured at 7 sites in the current survey, distributed throughout the Project Area (Fig. 13). These comprised 11 males, five females and seven subadults (plus two not sexed or aged, Tables 7 and 9; Paull *et al.* in prep.). Seven individuals were captured at two separate sites, and three females at three different sites were found to be lactating (Appendix 8), consistent with the previously reported October-April breeding season (Paull 2005, Tokushima *et al.* 2008). In addition, subadult individuals were captured at two of the latter sites plus another site (Appendix 8). An approximate density of 1.74 individuals per ha (n=24, range 1-7) was obtained from the Elliott trapping results (Paull *et al.* in prep.), which is also consistent with the previously reported breeding density of 1-2 individuals/ha (Paull 2005, Tokushima *et al.* 2008).

Threatened Black-striped Wallaby captured on camera trap during surveys

Table 7 Summary of results of pitfall and funnel trapping for small reptiles and mammals, targeting the Pale-headed Snake and Eastern Pygmy-possum in the Project Area, 10-14 October 2011 - species and numbers of captures

common name	scientific name	no. sites where captured	total nos captured	no. males captured	no. females captured
Ornate Burrowing Frog	*Limnodynastes ornatus*	1	1		
Wood Mulch-slider	*Lerista muelleri*	1	1		
Pale-headed Snake	***Hoplocephalus bitorquatus***	1	1		
Eastern Pygmy-possum	***Cercartetus nanus***	2	3	2	1
Pilliga Mouse	***Pseudomys pilligaensis***	1	1	1	
Total 5 species					

threatened species **bolded**

Table 8 Summary of results of harp trapping for microchiropteran bats in the Project Area, 10-14 October 2011 – species and numbers of captures

common name	scientific name	nos traps where captured	total nos captured#	no. males captured*	no. females captured*
Eastern Horseshoe Bat	*Rhinolophus megaphyllus*	1	1	1	
Gould's Wattled Bat	*Chalinolobus gouldii*	5 +2*	12 +12*	3	9 +12*
Chocolate Wattled Bat	*Chalinolobus morio*	5 +1*	12 +1*	5 +1*	7
Little Pied Bat	***Chalinolobus picatus***	1*	2*	2*	
South-eastern Long-eared Bat	***Nyctophilus corbeni***	6 +1*	19 +1*	5	14 +1*
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	6 +2*	13 +3*	2 +1*	11 +2*
Gould's Long-eared Bat	*Nyctophilus gouldi*	6 +1*	15 +1*	8 +1*	7
Inland Broad-nosed Bat	*Scotorepens balstoni*	6 +2*	10 +15*	7 +3*	3 +12*
Little Broad-nosed Bat	*Scotorepens greyii*	3 +2*	4 +7*	1 +2*	3 +5*
Little Forest Bat	*Vespadelus vulturnus*	17 +2*	82 +30*	16 +13*	44 +17*
Total 10 species					

threatened species **bolded**

* nos captured outside the Project Area

nos refer to captures (may include some retraps)

Table 9 Summary of results of Elliott trapping for small mammals, targeting the Pilliga Mouse in the Project Area, 10-14 October 2011 – species and numbers of captures

common name	scientific name	nos traps where captured	total nos captured	no. males captured	no. females captured	no. subads captured	no. prob. retraps
Nobbi	*Amphibolurus nobii*	2	2				
Striped Skink	*Ctenotus robustus*	1	1				
Pilliga Mouse	***Pseudomys pilligaensis***	7	24	10	5	7	7
House Mouse	*Mus musculus*	1	1				
Total 4 species							

threatened species **bolded**

Table 10 Summary of results of camera trapping for medium and large-sized terrestrial mammals in the Project Area, 9-14 October 2011 - species and numbers of individuals

common name	scientific name	no. sites where recorded	total nos recorded
Eastern Grey Kangaroo	*Macropus giganteus*	5	13
Black-striped Wallaby	***Macropus dorsalis***	1	1
Common Wallaroo	*Macropus robustus*	2	2
Red-necked Wallaby	*Macropus rufogriseus*	2	2
Swamp Wallaby	*Wallabia bicolor*	3	3
Feral Goat	*Capra hircus*	1	2
Red Fox	*Vulpes vulpes*	3	3
Feral Cat	*Felis catus*	1	1
European Brown Hare	*Lepus europaeus*	1	1
Total 9 species			

threatened species **bolded**

Table 11 Summary of threatened and migratory bird species recorded at 1ha/20min census sites in the Project Area, 8-14 October 2011

common name	scientific name	no. sites where recorded	total nos recorded
Little Eagle	*Hieraaetus morphnoides*	1	1
Little Lorikeet	*Glossopsitta pusilla*	1	2
Turquoise Parrot	*Neophema pulchella*	4	4
Rainbow Bee-eater	*Merops ornatus*	7	14+
Brown Treecreeper	*Climacteris picumnus*	2	2
Speckled Warbler	*Chthonicola sagittate*	9	18+
Grey-crowned Babbler	*Pomatostomus temporalis*	11	22+
Varied Sittella	*Daphoenositta chrysoptera*	2	6+
Hooded Robin	*Melanodryas cucullata*	1	2
Diamond Firetail	*Stagonopleura guttata*	1	1
Total 9 species			

All capture sites in the current survey were in heathy forest or woodland (15-40% canopy foliage cover), characterised by a dense, floristically diverse, low shrubby understorey, usually with a sparsely vegetated ground layer and well-developed leaf litter layer (Appendix 9, Paull *et al.* in prep.). Canopy or upper storey dominants or co-dominants at capture sites were mostly Brown Bloodwood, Baradine Red Gum and Broad-leaved Ironbark *E. fibrosa*, although Dwyer's Red Gum *E. dwyeri*, Scribbly Gum *E. rossii* and Rough-barked Angophora *Angophora floribunda* were co-dominant at one site each (Appendix 9). Commonly occurring plant species in the low understorey at capture sites were Common Fringe-myrtle *Calytrix tetragona* and Sandstone Boronia *Boronia glabra* (dominant at three sites) and Rhomb-leaved Bossiaea *Bossiaea rhombifolia* and Daphne Heath *Brachyloma daphnoides* (dominant at two sites) (Appendix 9). Common Fringe-myrtle has previously been recorded as characterising Pilliga Mouse capture sites (Paull 2009).

These records indicate that the Pilliga Mouse occurs and breeds in a wider range of floristic associations than previously reported (NCC 2002, Tokushima and Jarman 2008, Tokushima *et al.* 2008, Paull 2009, although anticipated by Paull 2009), particularly in associations co-dominated by Broad-leaved Ironbark and Baradine Red Gum. The species appeared to be absent from the sites with dense mid understories dominated by Spur-winged Wattle *Acacia triptera* and Broombush *Melaleuca uncinata* (Appendix 9).

The vehicular habitat traverses identified occurrences of potential Pilliga Mouse habitat across the Project Area, distributed both in forest and woodland on the lower nutrient soils of the Pilliga Province and the higher nutrient soils of the Pilliga Outwash Province (Fig. 8). Estimations based on these occurrences indicated that approximately 20% of the Project Area provides potentially suitable habitat for the species (Paull *et al.* in prep.).

The Pilliga Mouse has been shown to be irruptive during favourable conditions that result from relatively long-term climatic fluctuations such as la Nina events, contracting to refuges during unfavourable times (Paull 2005, Tokushima *et al.* 2008). However, breeding is not confined to periods of favourable conditions (Tokushima *et al.* 2008) and refuge habitat appears likely to be crucial for maintaining viable populations of the species.

3.2.2.4 Declining woodland bird species All but one of the seven species of sedentary woodland birds listed as threatened under the *TSC Act* were recorded during the current survey. These species have been identified in recent studies as key declining species under threat from habitat clearing, fragmentation, isolation and degradation (e.g. Barrett *et al.* 1994, Robinson and Traill 1996, Reid 1999, Ford *et al.* 2001). They comprised the Brown Treecreeper, Speckled Warbler, Grey-crowned Babbler, Varied Sittella, Hooded Robin and Diamond Firetail (Table 6). The Black-chinned Honeyeater, which was not detected, has previously been recorded from the Project Area (Atlas of NSW Wildlife, Flint 2011), although this species is considered rare in the Brigalow Belt South Bioregion (RACAC 2002).

The Project area was found to be a core area for the Speckled Warbler and Grey-crowned Babbler, with a substantial number of individuals recorded at numerous sites (Table 6, Fig. 14).

The declining woodland species listed above have been identified as requiring mature trees and grassy or patchy grassy and shrubby understoreys (Date *et al.* 2002), which are characteristic of much of the Pilliga Forest vegetation. However, despite the abundance of these elements and the large size of the Pilliga Forest block, which should militate against decline (e.g. Debus *et al.* 2006), these species are reported to be continuing to decline in the area due to disturbance regimes imposed by logging, frequent burning and grazing (Date *et al.* 2002). This trend may have been partly responsible for the relatively low numbers of the Varied Sittella, Hooded Robin and Diamond Firetail recorded in the current survey (Table 6).

3.2.2.5 Other significant threatened species The Pilliga Forest provides important habitat for a number of other species listed as threatened under the *TSC Act* and seven species were recorded during the current survey that are considered significant in this regard. These species comprise the vulnerable Pale-headed Snake, Glossy Black-cockatoo, Turquoise Parrot, Barking Owl, Eastern Pygmy-possum and Yellow-bellied Sheath-tailed Bat, and the endangered Black-striped Wallaby (Table 6).

One Pale-headed Snake was captured in a funnel trap in the central east of the Project Area in Broad-leaved Ironbark-Brown Bloodwood woodland with a dense low shrubby understorey (Table 7, Fig. 10). This record and a previous record in the south of the Project Area (Fig. 10) suggest that the Project Area

may support a population of this rare and poorly known species.

Flocks of up to 30 or more Glossy Black-cockatoos were recorded at sites along Bohena Creek and also in the eastern section of the Project Area (Appendix 12, Fig. 14), on occasions feeding on seeds of Belah *Casuarina cristata* and Heath Oak *Allocasuarina diminuta*. These records indicate that the Project Area provides extensive foraging habitat for an important population of this species close to the western limits of its range.

The survey results demonstrated that the Project Area provides core habitat for the Turquoise Parrot, with widely distributed records in a variety of forest and woodland associations at numerous sites (Appendix 12, Fig. 14). As with the Glossy Black-cockatoo, the species is close to its western limits in the area.

The Barking Owl population in the Pilliga Forest, concentrated in the Pilliga Outwash Province, appears to be the largest in southern Australia (Milledge 2002, Soderquist 2009, Soderquist and Milledge in prep.) and is highly significant as a core population west of the Great Dividing Range. Three records, probably representing two territories of the Barking Owl were detected during the survey (Table 6, Fig. 10). Records consisted of individuals calling and one observation, but owls were not responsive to call playback, probably being engaged in incubation of eggs or young at the time. Territories were located along Bohena Creek in the vicinity of territories determined by playback surveys in 2001 (Milledge 2002) and within the Pilliga Outwash Province.

A total of three Eastern Pygmy-possums, including a pregnant female, was captured in pitfall traps at two sites in the central eastern section of the Project Area (Table 7, Appendix 3, Fig. 10). Both sites were in woodland with a dense low shrubby understorey, one dominated by Broad-leaved Ironbark, Brown Bloodwood and Baradine Red Gum with Heath Bog-rush *Schoenus ericetorum,* Hoary Guinea-flower *Hibbertia obtusifolia* and a grass *Cymbopogon sp.* dominating the low understorey. The other site was dominated by Broad-leaved Ironbark and Brown Bloodwood with Common Fringe-myrtle, Small-leaf Bush-pea *Pultenaea foliolosa* and a tea tree *Leptospermum sp.* dominant in the low understorey. The Eastern Pygmy-possum occurs in the Pilliga Forest at the western limit of its distribution and the population appears to be isolated from others on the western slopes and may be genetically distinct (D. Paull pers. comm.). In the Pilliga Forest this species favours riparian habitat and vegetation dominated by myrtaceous shrubs (Paull 1998).

Up to seven Black-striped Wallabies were observed crossing a wide gas pipeline corridor in the north of the Project Area during a dusk watch on two consecutive days and another was recorded by camera trap in the far north (Tables 6 and 10, Fig. 10). Both locations fell within the Pilliga Outwash Province and indicate a small but core population in the area. This occurence is considered highly significant as the species is at the south-western limits of its range in the Pilliga Forest (above) and is declining towards extinction in NSW.

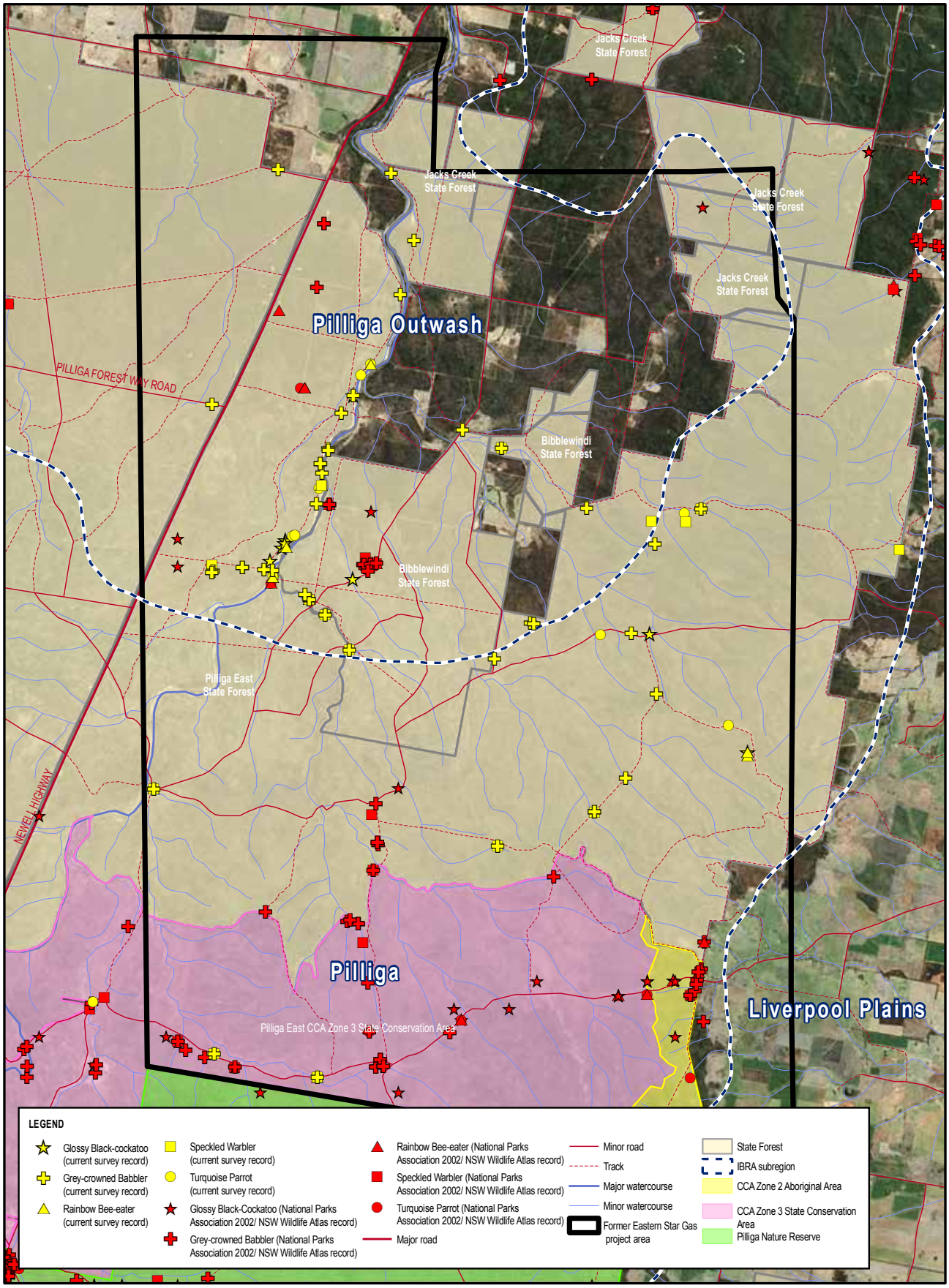
The Anabat detection results provided records of the Yellow-bellied Sheath-tailed Bat at 16 discrete sites (Appendix 7, Fig. 15) and while some of these may have involved records of the same individual at more than one site, it was evident that the species is widely distributed through the Project Area and it supports an important population. The Yellow-bellied Sheath-tailed Bat is likely to require large tree hollows for roost and maternity sites, which have been identified as a fast declining resource in the Pilliga Forest (Parnaby *et al.* 2011).

3.2.2.6 Migratory species Numerous records of the migratory (*EPBC Act* listed) Rainbow Bee-eater were obtained throughout the Project Area (Table 6, Fig. 14) and it clearly provides important habitat for this species, possibly for passage migrants moving north from breeding areas in southern Australia.

3.2.2.7 Threatened species not detected during current survey Seven threatened species (*TSC Act*) recorded from the Project Area (Atlas of NSW Wildlife, Flint 2011) but not detected during the current survey comprise the Spotted Harrier *Circus assimilis,* Bush Stone-curlew, Masked Owl, Black-chinned Honeyeater, Painted Honeyeater, Eastern Bent-winged Bat and Eastern Cave Bat (Table 5). These are primarily species lacking substantial suitable habitat in the Project Area or rare, patchily distributed, cryptic or nomadic species.

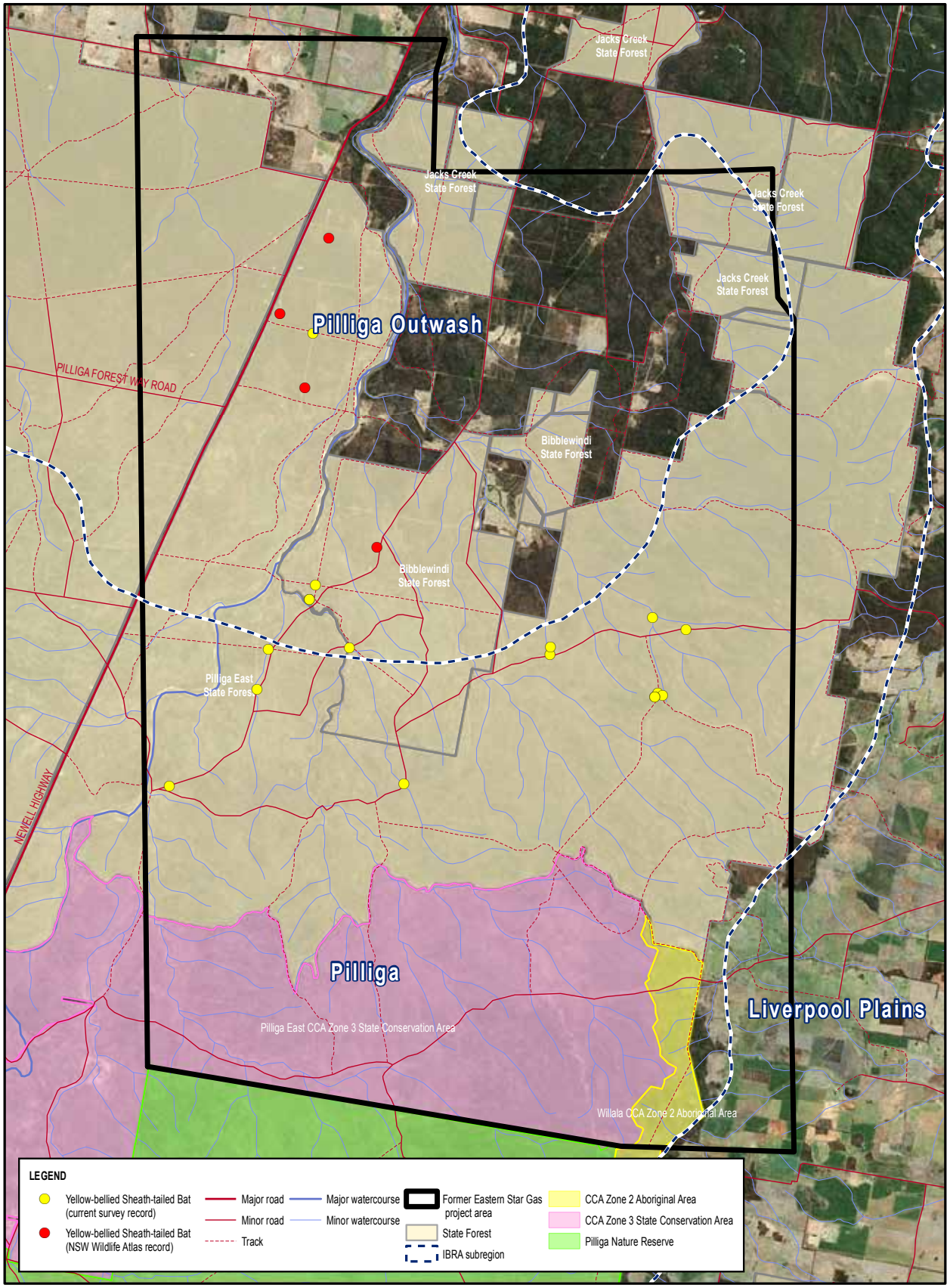
3.2.3 Total vertebrate species recorded by current survey An overall total of 176 vertebrate species was recorded from the Project Area during the current survey, comprising 13 frog, 11 reptile, 119 bird and 33 mammal species (Appendix 13). One additional mammal species, the Common Wombat *Vombatus ursinus,* was recorded (on the basis of faecal scats) at Willala Mountain, closely adjacent to the south-

FIG 14



Reserves from NSW Dept of Planning and OEH. Glossy Black-cockatoo, Turquoise Parrot, Rainbow Bee-eater, Speckled Warbler and Grey-crowned Babbler records from Landmark Ecological Services. Roads and watercourses from GEODATA TOPO250K. Imagery from Bing.	NORTH 0 km 4 1:175,000 at A4 11/09/2012	Records of the Glossy Black-cockatoo, Turquoise Parrot, Rainbow Bee-eater, Speckled Warbler and Grey-crowned Babbler in the Project Area	Figure 14

FIG 15



Reserves from NSW Dept of Planning and OEH. Yellow-bellied Sheath-tailed Bat records fromLandmark Ecological Services. Roads and watercourses from GEODATA TOPO250K. Imagery from Bing.	NORTH 0 km 4 1:175,000 at A4 11/09/2012	Records of the Yellow-bellied Sheath-tailed Bat in the Project Area	Figure 15

eastern boundary of the Project Area.

These results demonstrate that the Project Area supports rich assemblages of many bird and mammal groups including frogmouths and nightjars (four species recorded), hawks, eagles and falcons (eight species recorded), lorikeets and parrots (eight species recorded), cuckoos (five species recorded), Australian warblers or acanthizids (10 species recorded), honeyeaters (13 species recorded), macropods (five species recorded) and microchiropteran bats (14 species recorded).

3.2.3.1 Species recorded by targeted and systematic methods Five vertebrate species (one amphibian, two reptile and two small mammal species) were captured by pitfall and funnel trapping (Table 7), 10 microchiropteran bat species were captured in harp traps (Table 8), an additional four microchiropteran bat species were detected by Anabat (Appendix 7), four vertebrate species (two reptile and two small mammal species) were captured in Elliott traps (Table 9), and nine medium and large-sized mammal species were detected by camera traps (Table 10). Ten threatened and migratory bird species (EPBC and *TSC Acts)* were recorded during the 1ha/20min bird censuses (Table 11).

The species diversity and numbers of individuals of threatened (*TSC Act*) and migratory bird (*EPBC Act*) species (Table 11) and numbers of captures of microchiropteran bat species (Table 8) reinforce the importance of habitats in the Project Area for these groups.

3.2.3.2 Species with significant populations or at their distributional limits In addition to the threatened and migratory species (*EPBC* and *TSC Acts*) described above, other significant species recorded included species at or close to the limits of their ranges such as Bibron's Toadlet *Pseudophryne bibroni* (western limits), the Wood Mulch-slider *Lerista muelleri* (eastern limits), Spotted Nightjar *Eurostopodus argus* (eastern limits), Crested Bellbird *Oreoica gutturalis* (eastern limits), Eastern Horseshoe Bat *Rhinolophus megaphyllus* (western limits) and the Common Wombat (western limits) (Higgins 1999, Higgins and Peter 2002, Swan *et al.* 2004, Van Dyck and Strahan 2008, OEH 2012). Such records illustrate the Pilliga Forest's significance as a transition zone between Eyrean and Bassian faunas.

3.2.3.3 Additional declining woodland bird species A suite of woodland birds not formally listed as threatened but which have been identified as declining in a number of studies (e.g. Barrett *et al.* 1994, Reid 1999, Date *et al.* 2002, Watson *et al.* 2003, Debus *et al.* 2006) were also recorded in the Project Area and emphasise its importance for this group. These included the Emu *Dromaius novaehollandiae,* Peaceful Dove *Geopelia striata,* Painted Button-quail *Turnix varia,* Musk Lorikeet *Glossopsitta concinna,* White-browed Babbler *Pomatostomus superciliosus,* Spotted Quail-thrush *Cinclosoma punctatum,* Crested Shrike-tit *Falcunculus frontatus,* Crested Bellbird, White-browed Woodswallow *Artamus superciliosus,* Dusky Woodswallow *A. cyanopterus,* White-winged Chough *Corcorax melanorhamphos,* Red-capped Robin *Petroica goodenovii* and Double-barred Finch *Taeniopygia bichenovii.*

3.2.3.4 Migratory and nomadic bird species Nomadic and migratory bird species recorded during the current survey included Horsfield's Bronze-cuckoo *Chalcites basalis,* the Black-eared Cuckoo *C. osculans,* Pallid Cuckoo *Cuculus pallidus,* Fantailed Cuckoo *C. flabelliformis,* Dollarbird *Eurystomus orientalis,* Striated Pardalote *Pardalotus striatus*, White-bellied Cuckoo-shrike *Coracina papuensis,* Masked Woodswallow *Artamus personatus,* White-browed Woodswallow *A. superciliosus,* Dusky Woodswallow *A. cyanopterus,* Leaden Flycatcher *Myiagra rubecula,* Tree Martin *Petrochelidon nigricans*. These results illustrate the significance of the Project Area's location within the eastern Australian bird migration system (above) in providing passage habitats for a large and diverse group of open forest and woodland dependent bird species. In particular, these habitats cater for the group of species moving north from higher elevations and latitudes along the western side of the Great Dividing Range in autumn to overwintering habitats at lower elevations and latitudes, and returning south in spring (Nix and Mackey 2000).

3.2.3.5 Nectarivorous species Although only one eucalypt species, Baradine Red Gum, was flowering extensively during the survey period, a suite of nectarivorous species including the Musk Lorikeet *Glossopsitta concinna,* the vulnerable (*TSC Act*) Little Lorikeet, honeyeaters such as the Spiny-cheeked Honeyeater *Acanthagenys rufogularis,* Little Friarbird *Philemon citreogularis* and Striped Honeyeater *Plectorhyncha lanceolata* and the Sugar Glider *Petaurus breviceps,* vulnerable (*TSC Act*) Squirrel Glider and Little Red Flying-fox *Pteropus scapulatus* were recorded feeding at the flowers. These records underline the significance of the Pilliga Forest in providing a spring

(and autumn-winter) nectar resource for nomadic and migratory birds and flying-foxes.

3.2.4 Introduced mammals The current survey provided a number of records of four introduced mammal species, the Feral Goat *Capra hircus,* Feral Pig *Sus scrofa,* Red Fox V*ulpes vulpes* and Feral Cat *Felis catus* (Table 10,Appendix 13) that are considered invasive and constitute key threatenening processes under the *TSC Act.* Three other introduced mammals, the European Brown Hare *Lepus europaeus*, European Rabbit *Oryctolagus cuniculus* and House Mouse *Mus musculus* were also recorded in the Project Area (Tables 9 and 10, Appendix 13). Extensive vegetation browsing and soil disturbance attributable to the Feral Goat and Feral Pig respectively were noted throughout the Project Area and disturbance from Feral Pigs was observed around Pilliga Mouse burrow systems at two capture sites.

Threatened Eastern Pygmy-possum. Photo Phil Spark

4 DISCUSSION

4.1 SIGNIFICANCE OF SURVEY RESULTS

The results of the current survey have shown that the Project Area contains a number of significant populations of plants and vertebrate species listed on the schedules of the *EPBC* and *TSC Acts*. The survey has demonstrated that the Project Area:

i) contains an important population of the vulnerable (*EPBC*, *TSC Acts*) plant *Rulingia procumbens* and represents a stronghold for the critically endangered EEC (*EPBC Act*, endangered under the *TSC Act*) White Box-Yellow Box-Blakely's Red Gum grassy woodland and derived native grassland;

ii) supports a core population of the vulnerable (*EPBC, TSC Acts*) South-eastern Long-eared Bat within one of its only three known strongholds, supports a core population of the vulnerable (*EPBC, TSC Acts*) Pilliga Mouse, a regional endemic, and appears to provide suitable habitat for the regionally-significant population of the vulnerable (*EPBC, TSC Acts*) Koala;

iii) supports important populations of six of seven sedentary, vulnerable (*TSC Act*) declining woodland bird species, including core populations of the Speckled Warbler and Grey-crowned Babbler, as well as populations of many other identified declining woodland bird species;

iv) supports significant populations of other threatened (*TSC Act*) species including the Pale-headed Snake, Glossy Black-cockatoo, Turquoise Parrot, Barking Owl, Eastern Pygmy-possum, Black-striped Wallaby and Yellow-bellied Sheath-tailed Bat;

v) contains at least 176 vertebrate species and supports rich and diverse assemblages of a number of major Australian bird groups (including a high proportion of declining woodland bird species) and macropod and microchiropteran bat species, emphasising the importance of the Pilliga Forest as the largest temperate forest and woodland refuge west of the Great Dividing Range;

vi) contains a number of vertebrate species at or close to the western and eastern limits of their distributions, underlining the zoogeographical significance of the Pilliga Forest as an overlap zone between Bassian and Eyrean faunas;

vii) provides important passage habitat for nomadic and migratory bird species from higher elevations and latitudes that overwinter to the north at lower elevations and latitudes and return south to breed;

viii) provides a spring nectar resource for nomadic and migratory bird and flying-fox species together with arboreal marsupial species; and

ix) contains established populations of four invasive mammal species that currently pose a threat to the viability of populations of significant conservation-priority native vertebrates.

These results have substantially added to the distribution and population density information for threatened species in the Project Area that remained following past surveys (NCC 2002, RACAC 2002, Eco Logical Australia 2011), particularly for key threatened species such as the South-eastern Long-eared Bat and Pilliga Mouse (Figs 12 and 13).

They also provide clear evidence of the national significance of the Pilliga Forest for biodiversity conservation and highlight the need for conservation planning across all tenures to sustain its values.

Threatened Glossy Black-cockatoo, Pilliga East State Forest. Photo Phil Spark

4.2 ON-GOING SPECIES EXTINCTIONS IN THE PILLIGA FOREST AND ADJOINING FLOODPLAINS

Despite the present conservation significance of the Pilliga Forest, a pattern of bird and mammal extinction following European settlement is evident in surrounding lands, which is likely to have also affected species assemblages in the remaining Pilliga forests and woodlands.

For example, species that occurred east of the Pilliga on the Liverpool Plains up until the mid 1800's and that are now presumed regionally or totally extinct include the Western Quoll *Dasyurus geoffroii,* Western Barred Bandicoot P*erameles bougainville,* Bilby *Macrotis lagotis,* Brush-tailed Bettong *Bettongia penicillata,* Eastern Hare-wallaby *Lagorchestes leporides,* White-footed Rabbit Rat *Conilurus albipes,* Plains Mouse *Pseudomys australis,* Gould's Mouse *P. gouldii* and Long-haired Rat *Rattus villosissimus* (Dickman 1994, Paull and Date 1999, Date and Paull 2000, Short and Calaby 2001; Australian Museum collection database, pers. comm Sandy Ingleby March 2004). Species known to have disappeared from the Macintyre, Gwydir and Namoi floodplains to the north, south and west of the Pilliga Forest at the same time include the Star Finch *Noechima ruficauda,* Bridled Nail-tail Wallaby *Onychogloa fraenata,* Plains Mouse and Gould's Mouse (Morris *et al.* 1981, Paull and Date 1999, Date and Paull 2000, Short and Calaby 2001, Australian Museum collection database, pers. comm Sandy Ingleby March 2004).

More recently other species have apparently become regionally extinct in these areas, comprising the Black-throated Finch *Poephila cincta,* Australian Bustard *Ardeotis australis,* Narrow-nosed Planigale *Planigale tenuirostris,* Fat-tailed Dunnart *Sminthopsis crassicaudata,* Striped-faced Dunnart *S. macroura* and Long-nosed Bandicoot *Perameles nasuta* (Morris *et al.* 1981, Andren *et al.* in prep.).

The loss of so many bird and mammal species highlights the vulnerability of the vertebrate fauna of these dry temperate forest and woodland ecosystems to vegetation loss and associated pertubations. Although past impacts have predominantly involved vegetation clearing and fragmentation for agricultural development, edge effects, weed invasions and predation by introduced mammal species, most notably the Feral Cat and Red Fox (Dickman 1994, Short and Calaby 2001), have also been implicated.

Species known from the Pilliga Forest that presently appear to be approaching regional extinction include the Malleefowl *Leipoa ocellata,* Squatter Pigeon *Geophaps scripta,* Bush Stone-curlew *Burhinus grallarius,* Red-tailed Black-cockatoo *Calyptorhynchus banksii,* Rufous Bettong *Aepyprymnus rufescens* and Brush-tailed Rock-wallaby *Petrogale penicillata* (Date and Paull 2000, RACAC 2002, Ford and Aplin 2008, OEH 2012). Other as yet unidentified species detected in the Pillliga during recent surveys that may also fall into the above category comprise a quoll (probably the Spotted-tailed Quoll *Dasyurus maculatus*), a planigale Planigale sp., a dunnart *Sminthopsis sp.* and a hopping mouse *Notomys sp.* (Date and Paull 2000). Regional extinctions of some microchiropteran bat species have also been predicted by Parnaby *et al.* (2011) if current trends in hollow-bearing tree losses are not addressed.

All the above species have the potential to still be present in the Project Area, together with several additional threatened and cryptic species. The latter include microchiropteran bat species such as the Large-eared Pied Bat, known from Willala Mountain on the border of the Project Area, and Beccari's Free-tailed Bat *Mormopterus beccarii* and the Bristle-faced Free-tailed Bat *M. eleryi,* both predicted as likely to occur on the basis of the presence of suitable habitat.

Coal seam gas spill site

4.3 IMPACTS OF COAL SEAM GAS PRODUCTION IN THE PROJECT AREA

A wide range of known and potentially detrimental impacts from coal seam gas production are likely to occur in the Project Area. Observations of Eastern Star Gas' operations in extracting coal seam gas in the Project Area made during the current survey showed a series of direct and associated impacts that appeared to be having major detrimental impacts on the area's biodiversity conservation values. These included:

i) significant vegetation clearing throughout the Project Area for the construction of drill pads, wells and associated infrastructure, and widening of roads and construction of holding dams and pipeline corridors, all resulting in habitat loss, fragmentation and degradation, markedly increasing edge effects, increasing predation pressures and facilitating the establishment of invasive species;

ii) direct pollution of streams from waste water discharge probably causing habitat losses and food contamination resulting in deaths of aquatic vertebrates;

iii) increased salinity of ground water shown to have resulted in frog deaths at one site and possible vegetation death and dieback in other areas; and

iv) leakages from poorly maintained pipes that may have adversely affected vertebrates drinking pooled water, and contaminated soils and polluted drainage lines and ground water.

In particular, direct and indirect observations were made during the survey period of of widespread Feral Goat and Feral Pig activity in the Project Area, the former involving groups of animals seen traversing roads and foraging in native vegetation and the latter concerning heavily browsed shrubs and major soil disturbance in sensitive areas.

Other potential impacts from coal seam gas operations likely with future recommencement of production in the Project Area include:

i) additional vegetation clearing for protection of infrastructure from wildfires;

ii) the occurrence of unplanned fires;

iii) invasions of weed species, particularly introduced grasses resulting from vegetation disturbance and vehicle movements from outside the area;

iv) invasions of additional introduced vertebrate pest species such as the Common Myna *Acridotheres tristis* with increased habitat clearing and degradation;

Microchiropteran bats captured in a harp trap, Photo Hugh Nicholson

v) increased deaths of vertebrates from vehicle collisions as a result of increased human activity in the area.

4.3.1 Impacts on Matters of National Significance From the trapping results and survey of potential habitat (Figs 12 and 8), serious impacts on a Matter of National Significance (*EPBC Act*) are considered to have already occurred in the Project Area with respect to the Pilliga Mouse and Eastern Star Gas' past operations (Milledge 2011). These include:

i) the likely fragmentation of a population or metapopulation, based on the species' known contraction to a series of discrete refuges during unfavourable conditions (above), from road widening and pipeline corridor construction;

ii) the destruction of critical habitat from clearing for drill pad and well construction and associated infrastructure including pipeline corridors, based on habitat preferences and the occurrence of preferred habitat established during the current survey;

iii) disruption of the breeding cycle likely to have occurred from destruction, fragmentation and isolation of refuge habitat resulting from the clearing activities referred to above; and

iv) the increased establishment of invasive species such as the Feral Goat, Feral Pig, Red Fox and Feral Cat through substantial additional disturbance of refuge and favourable condition habitats.

Impacts on a Matter of National Significance from Eastern Star Gas' past operations are also likely to have occurred in the Project Area with respect to the South-eastern Long-eared Bat, through probable loss of foraging substrates (critical habitat) from the clearing referred to above and also the likely loss of hollow-bearing trees used as day-time and maternity roosts (disruption of the breeding cycle, Parnaby *et al.* 2011).

4.3.2 Impacts on other threatened species Another major impact on a threatened species observed during the survey period was the extensive clearing of endangered (*TSC Act*) Black-striped Wallaby resting and refuge habitat in the Brandons-Worombi Roads area in the north of the Project Area. This had involved clearing of several hectares of cypress-ironbark forest and woodland with a dense teatree *Leptospermum sp.* understorey for the construction of a large holding dam, road widening and a pipeline corridor.

Threatened Yellow-bellied Sheath-tailed Bat. Photo David Milledge

5 RECOMMENDATIONS

'There should be a moratorium on coal seam gas extraction and exploration in the Project Area, and the Pilliga Forest generally, until it can be scientifically demonstrated that it will have no adverse effects on the maintenance of the area's biodiversity values, particularly as a refuge for its characteristic dry temperate forest and woodland ecosystems and their constituent communities and species. This must include the development of a comprehensive, all-tenure management plan to ensure the viability of all threatened species and ecological communities, and other conservation-priority species that are resident or use the area regularly or on an intermittent basis.

Specific actions to inform production of the management plan with respect to the Project Area must include:

i) further surveys across all seasons to comprehensively establish the Pilliga Mouse's use of habitats in the Project Area (informed by habitat modelling) and to determine the locations of refuges, particularly those where breeding takes place, and the establishment of sites for long-term monitoring of these areas;

ii) surveys to establish the occurrence of stands of hollow-bearing trees that are likely to be used as roost and maternity sites by the South-eastern Long-eared Bat, and the establishment of sites for long-term monitoring of the population;

iii) research data undertaken in the Pilliga Forest by ForestsNSW on the South-eastern Long-eared Bat be made available to determine whether this can be used to assist identification of the species' foraging and breeding requirements;

iv) additional Koala surveys of the Project Area, particularly within the Pilliga Outwash Province, involving detailed faecal scat and spotlight searches to establish Koala use of the area and the establishment of sites for long-term monitoring of the Koala population;

v) research to determine the distribution and size of the the Black-striped Wallaby population in the Project Area and the establishment of sites for its long-term monitoring;

vi) permanent survey plots established throughout the Project Area to monitor population numbers of declining woodland bird species;

vii) investigations during appropriate conditions of the use of the Project Area by nomadic and migratory *EPBC Act* - listed bird species such as the Superb Parrot, Swift Parrot and Regent Honeyeater;

viii) targeted surveys to investigate the occurrence of cryptic species and threatened species not yet recorded in the Project Area such as the undetermined species of quoll, planigale, dunnart and hopping mouse, the Rufous Bettong, Beccari's Free-tailed Bat and the Bristle-faced Free-tailed Bat;

ix) monitoring surveys to determine the distribution and densities of the Feral Goat, Feral Pig, Red Fox and Feral Cat in the Project Area;

x) genetic studies to clearly establish the taxonomic status of the Pilliga Mouse and investigate the status of the Eastern Pygmy-possum population; and

xi) consideration of nomination of the Pilliga Forest for World Heritage listing, or listing on the Register of the National Estate.

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Dwyer's Red Gum, Deldam Trail. Photo Hugh Nicholson

APPENDICES

Appendix 1 Results of searches for threatened plant species listed under the *EPBC* and *TSC Acts* in the Project Area, 10-30 October 2011

common name	scientific name	threatened status	date	Easting GDA94 MGA55	Northing GDA94 MGA55	nos and location description
a rulingia	*Rulingia procumbens*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	12 Oct	763669	6601047	several plants adjoining Falcon Trail, 2.5km south of junction with Warrumbungle Trail
a rulingia	*Rulingia procumbens*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	12 Oct	763420	6600609	one plant adjoining Falcon Trail, 2.9km south of junction with Warrumbungle Trail
a rulingia	*Rulingia procumbens*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	12 Oct	767060	6602240	eight plants adjoining Warrumbungle Trail west of Panton's Lookout
a rulingia	*Rulingia procumbens*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	30th Oct	767617	6601291	10 plants adjoing road to Panton's Lookout

Elliott trap targeting Pilliga Mouse in potential habitat. Photo Phil Spark

Appendix 2 Results of searches for EECs listed under the EPBC and TSC Acts in the Project Area, 11-14 October 2011

EEC	White Box-Yellow Box-Blakely's Red Gum grassy woodland and derived native grasslands			
threatened status	critically endangered (*EPBC Act*), Endangered (*TSC Act*)			
location		Monument Road		Bohena Creek Road 2
co-ordinates GDA94 MGA55	E766113, N6594450			
upper stratum dominants[1]	*Eucalyptus albens* *Eucalyptus blakelyi*	*Eucalyptus blakelyi*	*Eucalyptus blakelyi*	*Eucalyptus blakelyi*
upper stratum subdominants	*Callitris endlicheri* *Corymbia trachyphloia* *Eucalyptus chloroclada*	*Eucalyptus chloroclada* *Eucalyptus conica* *Eucalyptus pilligaensis* *Callitris endlicheri*	*Angophora floribunda*	*Angophora floribunda* *Eucalyptus chloroclada* *Eucalyptus conica*
mid stratum species2	*Acacia* sp. *Brachychiton populneus*3 *Callitris endlicheri*3 *Dodonaea viscosa*3 *Eucalyptus blakelyi* *Geijera paniculata* *Geijera parviflora*3 *Notelaea microcarpa*3	*Acacia* sp. *Callitris endlicheri*3	*Acacia deanii*3 *Callitris verricosa* *Acacia polybotria*	*Acacia deanii*3
ground cover species2	*Ajuga australis*3 *Austrodanthonia bipartita* *Cassinia aculeata*3 *Chrysocephalum apiculatum3* *Cymbopogon* sp. *Dianella revoluta3* *Dichondra repens*3 *Melichrus urceolatus*3 *Notelaea microcarpa* *Pomax umbellata*3 *Stypandra glauca*3 *Themeda australis* *Vittadinia dissecta*3 *Wahlenbergia communis*3	*Acacia* sp. *Aristida* sp. *Austrostipa* sp. *Bracyscome* sp. *Cheilanthes* sp. *Chrysocephalum apiculatumv* *Cymbopogon* sp. *Dichondra repens*3 *Gahnia* sp. *Lomandra* sp. *Melichrus urceolatus*3 *Oxalis* sp. *Rumex brownii*3 *Themeda australis* *Wahlenbergia communis*3	*Aristida sp.* *Ajuga australis*3 *Chrysocephalum apiculatum*3 *Dianella revoluta*3 *Glycine clandestina*3 *Imperata cylindrica* *Lomandra leucophela* *Lomandra longifolia* *Lomandra multiflora* *Melichrus urceolatus*3 *Wahlenbergia communis*3	*Ajuga australis*3 *Austrostipa stipa* *Cheilanthes sieberi*3 *Chrysocephalum apiculatum*3 *Dichondra repens*3 *Gahnia sieberiana* *Glycine clandestina* *Imperata cylindrica*3 *Lomandra longifolia* *Lomandra multiflora* *Plantago debilis* *Pterostylis mutica* *Poa sieberiana* *Rumex brownii*3 *Swainsonii cadellii* *Vittadina falcata* *Wahlenbergia communisv*
important species2	*Ajuga australis*3 *Chrysocephalum apiculatum*3 *Dianella revoluta*3 *Stypandra glauca*3 *Themeda australis*	*Chrysocephalum apiculatum*3 *Rumex brownii*3 *Themeda australis*	*Ajuga australis*3 *Chrysocephalum apiculatum*3 *Dianella revoluta*3 *Glycine clandestina*3	*Ajuga australis*3 *Chrysocephalum apiculatum*3 *Glycine clandestina*3 *Rumex brownii*3

1 qualifying criteria under *EPBC Act* listing of EEC include presence of one or more of *Eucalyptus albens, E. melliodora* or *E. blakelyi* among most common overstorey species

2 qualifying criteria under *EPBC Act* listing of EEC include presence of 12 or more native understorey species (excluding grasses) and at least one "important" species

3 included in *EPBC Act* listing of EEC as indicative species

Appendix 3 Results of pitfall and funnel trapping for small reptiles and mammals, targeting the Pale-headed Snake and Eastern Pygmy-possum in the Project Area, 10-14 October 2011

site	location	trap type	date	Easting GDA94 MGA55	Northing GDA94 MGA55	scientific name	nos/ sex	notes
C	Monument Road				6610025	***Cercartetus nanus***	1m	
C	Monument Road				6610025	*Limnodynastes ornatus*	l	
C	Monument Road				6610025	***Pseudomys pilligaensis***	lm	
E	Warrumbungle Road				6605535	***Cercartetus nanus***	1f	pregnant
E	Warrumbungle Road				6605535	*Lerista muelleris*	1	
E	Warrumbungle Road				6605535	***Hoplocephalus bitorquatus***	1	
E	Warrumbungle Road				6605535	***Cercartetus nanus***	1m	

* Threatened species bolded

Harp trap at Pantons Lookout. Photo Georgia Beyer

Appendix 4 Threatened and migratory bird species recorded at 1ha/20min census sites in the Project Area, 8-14 October

site	date	Easting GDA94 MGA55	Northing GDA94 MGA55	common name	scientific name	nos
Bibblewindi Creek	8 Oct	761823	6598878	nil		
Falcon Road Site 1	8 Oct	763212	6600346	Grey-crowned Babbler	*Pomatostomus temporalis*	2+
Kurrajong Road	8 Oct	758576	6597903	Turquoise Parrot Speckled Warbler Grey-crowned Babbler	*Neophema pulchella* *Chthonicola sagittata* *Pomatostomus temporalis*	1 2+ 2+
Warrumbungle Road	8 Oct	764316	6603400	Grey-crowned Babbler	*Pomatostomus temporalis*	2+
X Line Road Site 1	8 Oct	759778	6605951	Grey-crowned Babbler	*Pomatostomus temporalis*	2+
X Line Road Site 2	9 Oct	750439	6607616	Rainbow Bee-eater Hooded Robin	*Merops ornatus* *Melanodryas cucullata*	2+ 2
Bohena Creek Road	9 Oct	750944	6608714	Speckled Warbler Grey-crowned Babbler Varied Sittella	*Merops ornatus Climacteris picumnus* *Stagonopleura guttata*	2+ 1 1
Monument Road	10 Oct	765931	6610091	Turquoise Parrot Rainbow Bee-eater Speckled Warbler Grey-crowned Babbler Varied Sittella	*Neophema pulchella* *Merops ornatus* *Chthonicola sagittata* *Pomatostomus temporalis* *Daphoenositta chrysoptera*	1 2+ 2+ 2+ 3+
Scratch Road	10 Oct	773116	6608603	Speckled Warbler	*Chthonicola sagittata*	2+
Yellow Spring Trail	10 Oct	764265	6608825	Grey-crowned Babbler Varied Sittella	*Pomatostomus temporalis* *Daphoenositta chrysoptera*	2+ 3+
Rockdale property	10 Oct	763914	6614571	nil		
Bohena Creek Site 1	11 Oct	753997	6615333	Turquoise Parrot Rainbow Bee-eater	*Neophema pulchella* *Merops ornatus*	1 2+
Bohena Creek Site 2	11 Oct	752216	6610947	Rainbow Bee-eater Speckled Warbler	*Merops ornatus Chthonicola sagittata*	2+ 2+
Garlands Dam	11 Oct	746141	6599960	Little Lorikeet Turquoise Parrot Rainbow Bee-eater Speckled Warbler Grey-crowned Babbler	*Glossopsitta pusilla* *Neophema pulchella* *Merops ornatus* *Chthonicola sagittata* *Pomatostomus temporalis*	2 1 2+ 2+ 2+
Delwood Road Site 1	12 Oct	748322	6590385	Speckled Warbler Grey-crowned Babbler	*Chthonicola sagittata* *Pomatostomus temporalis*	2+ 2+
Delwood Road Site 2	12 Oct	752061	6589534	Rainbow Bee-eater Speckled Warbler Grey-crowned Babbler	*Merops ornatus* *Chthonicola sagittata* *Pomatostomus temporalis*	2+ 2+
Delwood Dam	12 Oct	757367	6591993	nil		
Falcon Road Site 2	12 Oct	762085	6599123	Speckled Warbler Grey-crowned Babbler	*Chthonicola sagittata* *Pomatostomus temporalis*	2+ 2+
Oil Well Road	12 Oct	753214	6604971	Speckled Warbler Grey-crowned Babbler	*Chthonicola sagittata* *Pomatostomus temporalis*	2+ 2+
Yellow Spring Dam	12 Oct	764000	6606000	nil		
Pilliga No 2 Rest Area	13 Oct	753187	6623634	Little Eagle Brown Treecreeper	*Hieraaetus morphnoides* *Climacteris picumnus*	1 1
Total 21 sites						

* Recorded outside Project Area

Appendix 5 Results of harp trapping for microchiropteran bats by location in the Project Area, 10-14 October 2011

trap no.	location	date	Eastin GDA94 MGA55	Northing GDA94 MGA55	scientific name	sex/ nos#
1	Beehive Road, on logging track off road	10 Oct	755177	6599999	*Chalinolobus morio*	
1	Beehive Road, on logging track off road	10 Oct	755177	6599999	***Nyctophilus corbeni***	1m
1	Beehive Road, on logging track off road	10 Oct	755177	6599999	*Vespadelus vulturnus*	1f
1	Beehive Road, on logging track off road	11 Oct	755177	6599999	*Vespadelus vulturnus*	1f
2	Falnoo Trail 1, on logging track next to creek	10 Oct	757775	6601364	***Nyctophilus corbeni***	1f
2	Falnoo Trail 1, on logging track next to creek	10 Oct	757775	6601364	*Vespadelus vulturnus*	3f
2	Falnoo Trail 1, on logging track next to creek	11 Oct	757775	6601364	*Vespadelus vulturnus*	1f
3	Nooboo Trail, in dry creek bed	10 Oct	760701	6601258	*Nyctophilus gouldi*	1f
3	Nooboo Trail, in dry creek bed	10 Oct	760701	6601258	*Vespadelus vulturnus*	4f
4	Monument Road 1, on track	10 Oct	769914	6609364	*Chalinolobus gouldii*	2f
4	Monument Road 1, on track	10 Oct	769914	6609364	*Chalinolobus morio*	3m,3f
4	Monument Road 1, on track	10 Oct	769914	6609364	***Nyctophilus corbeni***	2m,2f
4	Monument Road 1, on track	10 Oct	769914	6609364	*Vespadelus vulturnus*	1m,9f
4	Monument Road 1, on track	11 Oct	769914	6609364	*Chalinolobus morio*	3f
5	Monument Road 2, on track	10 Oct	770191	6609373	***Nyctophilus corbeni***	1f
5	Monument Road 2, on track	10 Oct	770191	6609373	*Nyctophilus gouldi*	1f
5	Monument Road 2, on track	10 Oct	770191	6609373	*Nyctophilus gouldi*	1f
5	Monument Road 2, on track	11 Oct	770191	6609373	*Nyctophilus geoffroyi*	1f
5	Monument Road 2, on track	11 Oct	770191	6609373	*Chalinolobus morio*	1f
5	Monument Road 2, on track	11 Oct	770191	6609373	*Chalinolobus morio*	1f
5	Monument Road 2, on track	11 Oct	770191	6609373	*Chalinolobus morio*	1f
6	Yellow Spring Creek Dam 1, in dry creek bed	10 Oct	764248	6609373	*Chalinolobus morio*	1f
7	Blue Nobby Road, on creek bank	11 Oct	748548	6609373	*Chalinolobus morio*	1f
8	Carbee Trail, on track	11 Oct	749984	6609373	*Chalinolobus morio*	1f
8	Carbee Trail, on track	13 Oct	749984	6609373	*Chalinolobus morio*	1f
9	Falcon Trail 1, on track	11 Oct	763169	6609373	*Chalinolobus morio*	1f
10	Falconl/Warrumbungle Trails junction, on track (trap 1)	11 Oct	764265	6609373	*Chalinolobus morio*	1f
10	Falconl/Warrumbungle Trails junction, on track (trap 1)	11 Oct	764265	6609373	*Chalinolobus morio*	1f
10	Falcon/Warrumbungle Trails junction, on track (trap 1)	11 Oct	764265	6609373	*Chalinolobus morio*	1f
10	Falcon/Warrumbungle Trails junction, on track (trap 2)	11 Oct	764265	6603300	*nil*	nil
11	Oil Well Road 1, on road	11 Oct	750294	6605003	*Vespadelus vulturnus*	1f
11	Oil Well Road 1, on road	13 Oct	750294	6605003	***Nyctophilus corbeni***	1m
11	Oil Well Road 1, on road	13 Oct	750294	6605003	*Scotorepens greyii*	1f
11	Oil Well Road 1, on road	13 Oct	750294	6605003	*Vespadelus vulturnus*	7f
12	Panton's Lookout 1, against cliff-face	11 Oct	767620	6601147	*Rhinolophus megaphyllus*	1m

threatened species bolded * records outside the Project Area # nos refer to captures (may include some retraps)

Continued: Appendix 5 Results of harp trapping for microchiropteran bats by location in the Project Area, 10-14 October 2011

12	Panton's Lookout 1, against cliff-face	11 Oct	767620	6601147	*Vespadelus vulturnus*	1m
12	Panton's Lookout 1, against cliff-face	12 Oct	767620	6601147	*Nyctophilus geoffroyi*	1f
12	Panton's Lookout 1, against cliff-face	12 Oct	767620	6601147	*Nyctophilus gouldi*	1m
13	Panton's Lookout 2, on track adjacent to cliff	11 Oct	767669	6601184	*Chalinolobus gouldii*	1f
13	Panton's Lookout 2, on track adjacent to cliff	11 Oct	767669	6601184	*Nyctophilus gouldi*	1m
13	Panton's Lookout 2, on track adjacent to cliff	11 Oct	767669	6601184	*Vespadelus vulturnus*	2m,1f
13	Panton's Lookout 2, on track adjacent to cliff	12 Oct	767669	6601184	*Vespadelus vulturnus*	2m,1f
14	Cowallah Creek Dam, between two dam pools	12 Oct	751639	6606922	*Nyctophilus geoffroyi*	1f
15	Falnoo Trail 2, on track (trap 1)	12 Oct	761530	6599824	*Chalinolobus gouldii*	1m
15	Falnoo Trail 2, on track (trap 1)	12 Oct	761530	6599824	*Scotorepens balstoni*	1m
15	Falnoo Trail 2, on track (trap 1)	12 Oct	761530	6599824	*Vespadelus vulturnus*	4f
15	Falnoo Trail 2, on track (trap 2)	13 Oct	761530	6599824	*Chalinolobus gouldii*	2f
15	Falnoo Trail 2, on track (trap 2)	13 Oct	761530	6599824	*Vespadelus vulturnus*	2m,4f
16	Yellow Spring Creek Dam 2, at dam	12 Oct	764171	6606164	*Vespadelus vulturnus*	1f
17	Oil Well Road 2, at pool in creek	13 Oct	750278	6605029	*Nyctophilus gouldi*	1m
17	Oil Well Road 2, at pool in creek	14 Oct	750278	6605029	*Nyctophilus gouldi*	1f
17	Oil Well Road 2, at pool in creek	14 Oct	750278	6605029	*Scotorepens balstoni*	1f
17	Oil Well Road 2, at pool in creek	14 Oct	750278	6605029	*Scotorepens greyii*	1f
18	Scratch Road 1, on road	13 Oct	773225	6609144	*Chalinolobus gouldii**	2f*
18	Scratch Road 1, on road	13 Oct	773225	6609144	*Chalinolobus morio**	1m*
18	Scratch Road 1, on road	13 Oct	773225	6609144	***Chalinolobus picatus****	2m*
18	Scratch Road 1, on road	13 Oct	773225	6609144	*Nyctophilus geoffroyi**	1f*
18	Scratch Road 1, on road	13 Oct	773225	6609144	*Nyctophilus gouldi**	1m*
18	Scratch Road 1, on road	13 Oct	773225	6609144	*Scotorepens balstoni**	1,2f*
18	Scratch Road 1, on road	13 Oct	773225	6609144	*Scotorepens greyii**	1m,2f*
19	Scratch Road 1, on road	13 Oct	773225	6609144	*Vespadelus vulturnus**	9m,13f*
19	Scratch Road 2, on road	13 Oct	772967	6607712	*Chalinolobus gouldii**	10f*
19	Scratch Road 2, on road	13 Oct	772967	6607712	***Nyctophilus corbeni****	1f*
19	Scratch Road 2, on road	13 Oct	772967	6607712	*Nyctophilus geoffroyi**	1m,1f*
19	Scratch Road 2, on road	13 Oct	772967	6607712	*Scotorepens balstoni**	2m,10f*
19	Scratch Road 2, on road	13 Oct	772967	6607712	*Scotorepens greyii**	1m,3f*
19	Scratch Road 2, on road	13 Oct	772967	6607712	*Vespadelus vulturnus**	4m,4f*
20	Bohena Creek Road, on road	14 Oct	753354	6614194	*Chalinolobus morio*	2m
20	Bohena Creek Road, on road	14 Oct	753354	6614194	***Nyctophilus corbeni***	1m
20	Bohena Creek Road, on road	14 Oct	753354	6614194	*Nyctophilus geoffroyi*	1m,3f
20	Bohena Creek Road, on road	14 Oct	753354	6614194	*Nyctophilus gouldi*	2m,4f
20	Bohena Creek Road, on road	14 Oct	753354	6614194	*Scotorepens balstoni*	4m
20	Bohena Creek Road, on road	14 Oct	753354	6614194	*Vespadelus vulturnus*	
21	McCann's Road, on road	14 Oct	755525	6624943	*Chalinolobus morio*	1f
21	McCann's Road, on road	14 Oct	755525	6624943	*Nyctophilus geoffroyi*	1m,4f
21	McCann's Road, on road	14 Oct	755525	6624943	*Nyctophilus gouldi*	2m,2f
21	McCann's Road, on road	14 Oct	755525	6624943	*Scotorepens balstoni*	1m
21	McCann's Road, on road	14 Oct	755525	6624943	*Scotorepens greyii*	1m,1f
21	McCann's Road, on road	14 Oct	755525	6624943	*Vespadelus vulturnus*	4m,10f

threatened species bolded * records outside the Project Area # nos refer to captures (may include some retraps)

Appendix 6 Results of harp trapping for microchiropteran bats by species records in the Project Area, 10-14 October 2011

common name	scientific name	trap no.	location	total nos#	nos males#	nos fe-males#	no. nights
Eastern Horseshoe Bat	*Rhinolophus megaphyl-lus*	12	Panton's Lookout 1	1	1		2
Gould's Wattled Bat	*Chalinolobus gouldii*	4	Monument Road 1	2		2	2
Gould's Wattled Bat	*Chalinolobus gouldii*	13	Panton's Lookout 2	1		1	2
Gould's Wattled Bat	*Chalinolobus gouldii*	15	Falnoo Trail 2 (traps t1,t2)	3	1	2	2 (t2),
Gould's Wattled Bat	*Chalinolobus gouldii*	18	Scratch Road 1	2*		2*	(2hrs, t1)
Gould's Wattled Bat	*Chalinolobus gouldii*	19	Scratch Road 2	10*		10*	1
Gould's Wattled Bat	*Chalinolobus gouldii*	20	Bohena Creek Road	6	2	4	1
Chocolate Wattled Bat	*Chalinolobus morio*	1	Beehive Road	1		1	1
Chocolate Wattled Bat	*Chalinolobus morio*	4	Monument Road 1	6	3	3	2
Chocolate Wattled Bat	*Chalinolobus morio*	5	Monument Road 2	2		2	2
Chocolate Wattled Bat	*Chalinolobus morio*	18	Scratch Road 1	1*	1*		2
Chocolate Wattled Bat	*Chalinolobus morio*	20	Bohena Creek Road	2	2		1
Chocolate Wattled Bat	*Chalinolobus morio*	21	McCann's Road	1		1	1
Little Pied Bat	*Chalinolobus picatus*	18	Scratch Road 1	2	2		1
South-eastern Long-eared Bat	*Nyctophilus corbeni*	1	Beehive Road	1	1		1
South-eastern Long-eared Bat	*Nyctophilus corbeni*	2	Falnoo Trail 1	1		1	2
South-eastern Long-eared Bat	*Nyctophilus corbeni*	4	Monument Road 1	7	2	5	2
South-eastern Long-eared Bat	*Nyctophilus corbeni*	5	Monument Road 2	8		8	2
South-eastern Long-eared Bat	*Nyctophilus corbeni*	11	Oil Well Road 1	1	1		2
South-eastern Long-eared Bat	*Nyctophilus corbeni*	19	Scratch Road 2	1*		1*	2
South-eastern Long-eared Bat	*Nyctophilus corbeni*	20	Bohena Creek Road	1	1		1
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	5	Monument Road 2	1		1	1
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	10	Falcon/Warrum bungle Trails (trap 1)	1		1	2
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	12	Panton's Lookout 1	1		1	(2hrs)
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	14	Cowallah Dam	1		1	2
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	18	Scratch Road 1	1*		1*	1
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	19	Scratch Road 2	2*	1	1*	1
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	20	Bohena Creek Road	4	1	3	1
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	21	McCann's Road	5	1	4	1
Gould's Long-eared Bat	*Nyctophilus gouldi*	3	Nooboo Trail	1		1	1
Gould's Long-eared Bat	*Nyctophilus gouldi*	5	Monument Road 2	6	3	3	1
Gould's Long-eared Bat	*Nyctophilus gouldi*	12	Panton's Lookout 1	1	1		2
Gould's Long-eared Bat	*Nyctophilus gouldi*	13	Panton's Lookout 2	1	1		2
Gould's Long-eared Bat	*Nyctophilus gouldi*	17	Oil Well Road 2	2	1	1	2
Gould's Long-eared Bat	*Nyctophilus gouldi*	18	Scratch Road 1	1*	1*		2

Continued: Appendix 6 Results of harp trapping for microchiropteran bats by species records in the Project Area, 10-14 October 2011

Gould's Long-eared Bat	*Nyctophilus gouldi*	21	McCann's Road	4	2	2	1
Inland Broad-nosed Bat	*Scotorepens balstoni*	8	Carbee Trail	2	1	1	1
Inland Broad-nosed Bat	*Scotorepens balstoni*	10	Falcon/Warrum bungle Trails (trap 1)	1		1	2
Inland Broad-nosed Bat	*Scotorepens balstoni*		Falnoo Trail 2 (trap 1)	1	1		(2hrs)
Inland Broad-nosed Bat	*Scotorepens balstoni*	17	Oil Well Road 2	1		1	2
Inland Broad-nosed Bat	*Scotorepens balstoni*		Scratch Road 1	3*	1*	2*	1
Inland Broad-nosed Bat	*Scotorepens balstoni*		Scratch Road 2	12*	2*	10*	1
Inland Broad-nosed Bat	*Scotorepens balstoni*		Bohena Creek Road	4	4		1
Inland Broad-nosed Bat	*Scotorepens balstoni*	21	McCann's Road	1	1		1
Little Broad-nosed Bat	*Scotorepens greyii*	11	Oil Well Road 1	1		1	2
Little Broad-nosed Bat	*Scotorepens greyii*	17	Oil Well Road 2	1		1	2
Little Broad-nosed Bat	*Scotorepens greyii*		Scratch Road 1	3*	1*	2*	1
Little Broad-nosed Bat	*Scotorepens greyii*		Scratch Road 2	4*	1*	3*	1
Little Broad-nosed Bat	*Scotorepens greyii*	21	McCann's Road	2	1	1	1
Little Forest Bat	*Vespadelus vulturnus*	1	Beehive Road	2		2	2
Little Forest Bat	*Vespadelus vulturnus*	2	Falnoo Trail 1	3		3	2
Little Forest Bat	*Vespadelus vulturnus*	3	Nooboo Trail	4		4	1
Little Forest Bat	*Vespadelus vulturnus*	4	Monument Road 1	10	1	9	2
Little Forest Bat	*Vespadelus vulturnus*	5	Monument Road 2	5	1	4	2
Little Forest Bat	*Vespadelus vulturnus*	6	Yellow Spring Creek Dam 1	1		1	1
Little Forest Bat	*Vespadelus vulturnus*	7	Blue Nobby Road	1		1	1
Little Forest Bat	*Vespadelus vulturnus*	9	Falcon Trail 1	1		1	1
Little Forest Bat	*Vespadelus vulturnus*	10	Falcon/Warrum bungle Trails (trap 1)	1	1		(2hrs)
Little Forest Bat	*Vespadelus vulturnus*	11	Oil Well Road 1	8		8	2
Little Forest Bat	*Vespadelus vulturnus*	12	Panton's Lookout 1	1	1		2
Little Forest Bat	*Vespadelus vulturnus*	13	Panton's Lookout 2	6	4	2	2
Little Forest Bat	*Vespadelus vulturnus*	15	Falnoo Trail 2 (traps t1,t2)	10	2	8	2 (t2), (2hrs, t1)
Little Forest Bat	*Vespadelus vulturnus*	16	Yellow Spring Creek Dam 2	1		1	1
Little Forest Bat	*Vespadelus vulturnus*	18	Scratch Road 1	22*	9*	13*	1
Little Forest Bat	*Vespadelus vulturnus*	19	Scratch Road 2	8*	4*	4*	1
Little Forest Bat	*Vespadelus vulturnus*	20	Bohena Creek Road	14	2	12	1
Little Forest Bat	*Vespadelus vulturnus*	21	McCann's Road	14	4	10	1

threatened species bolded * records outside the Project Area # nos refer to captures (may include some retraps)

Appendix 7 Results of analysis of microchiropteran bat calls recorded by Anabat detector by location in the Project Area, 8-13 October 2011 – results for threatened species only

site no.	location	date	Easting GDA94 MGA55	Northing GDA94 MGA55	scientific name of threatened species detected	method#
1	Cowallah Creek Dam	8 Oct	751774	6606831	*Saccolaimus flaviventris*	passive
2	Beehive Road	9 Oct	755190	6600131	*Saccolaimus flaviventris*	passive
3	Beehive Road	9 Oct	762308	6605692		passive
4	Beehive Road	9 Oct	758361	6604144		passive
5	Warrumbungle Trail	9 Oct	763290	6604300		passive
6	Warrumbungle Trail	9 Oct	764003	6603654		passive
7	Warrumbungle Trail	9 Oct	764372	6603444	*Saccolaimus flaviventris*	passive
8	B and W Road	9 Oct	760469	6604834	*Saccolaimus flaviventris*	passive
9	Falcon Trail	9 Oct	764209	6603157		passive
10	Garlands Dam	10 Oct	746029	6599756		passive
11	Garlands Road	10 Oct	746703	6600074	*Saccolaimus flaviventris*	passive
12	Bohena Creek	10 Oct	745933	6600434		passive
13	Nickel Road	10 Oct	749872	6603574	*Saccolaimus flaviventris*	passive
14	Creaghs Road	10 Oct	745846	6599418		passive
15	Oil Well Road	10 Oct	750278	6605029	*Saccolaimus flaviventris*	passive
16	Warrumbungle Trail	11 Oct	764265	6603300	*Saccolaimus flaviventris*	passive
17	Self Camp Road	12 Oct	753222	6605060	*Saccolaimus flaviventris*	passive
18	Beehive Road	12 Oct	765394	6605739	*Saccolaimus flaviventris*	passive
19	B and W Road	12 Oct	760491	6605104	*Saccolaimus flaviventris*	passive
20	Yellow Spring Creek Dam	12 Oct	764174	6606160	*Saccolaimus flaviventris*	passive
21	X-Line Road	12 Oct	757271	6606461		passive
1	Cowallah Creek Dam	13 Oct	751774	6606831	*Saccolaimus flaviventris*	passive
1	Cowallah Creek Dam	13 Oct	751774	6606831	*Chalinolobus picatus*	passive
22	Nickel Road	8 Oct	749850	6605074		hand-held
23	Oil Well Road	8 Oct	750453	6605000		hand-held
24	X-Line Road	8 Oct	750660	6607516		hand-held
25	X-Line Road	8 Oct	751983	6607330	*Saccolaimus flaviventris*	hand-held
26	Warrumbungle Trail	9 Oct	764550	6603345	*Saccolaimus flaviventris*	hand-held
27	X-Line Road	9 Oct	758724	6606257		hand-held
16	Warrumbungle Trail	11 Oct	764265	6603300	*Saccolaimus flaviventris*	hand-held

Contiued: Appendix 7 Results of analysis of microchiropteran bat calls recorded by Anabat detector by location in the Project Area, 8-13 October 2011 – results for threatened species only

28	Panton's Lookout	12 Oct	767611	6601387	*Saccolaimus flaviventris*	hand-held
29	Yellow Spring Creek Dam	12 Oct	767611	6601387		hand-held
30	Apple Road	13 Oct	751897	6616448	*Saccolaimus flaviventris*	hand-held
31	Apple Road	13 Oct	754302	6615897		hand-held
32	Plumb Road	13 Oct	752946	6618124		hand-held
33	Maud's Road	13 Oct	755110	6618442		hand-held
34	Brandon's Road	13 Oct	753022	6613641		hand-held
35	Bohena Creek Road	13 Oct	752145	6611753		hand-held
36	Bohena Creek Road	13 Oct	751615	6609711		hand-held
37	Bohena Creek Road	13 Oct	750092	6607820		hand-held

passsive – detector set and unattended at a site, hand-held – detector used in conjunction with PDA in real time

Three additional non-threatened species detected at a number of sites but not trapped in harp traps (Table 8) comprised:

White-striped Free-tailed Bat *Tadarida australis*

Eastern Free-tailed Bat *Mormopterus ridei*

Southern Free-tailed Bat *Mormopterus sp.*4 (long penis)

Appendix 8 Results of Elliott trapping for small mammals, targeting the Pilliga Mouse, in the Project Area, 10-13 October 2011

site	location	date	Easting GDA94 MGA55	Northing GDA94 MGA55	scientific name	nos/ sex	notes
A (1)	X-Line Road	10 Oct	748237	6608034	***Pseudomys pilligaensis***	1f	trap A6, lactating
A (1)	X-Line Road	11 Oct	748238	6608050	***Pseudomys pilligaensis***	1f	trap A5, lactating, prob. retrap
A (1)	X-Line Road	12-13 Oct	748238	6608050	nil		
B (2)	X-Line Road	10 Oct	752363	6607588	***Pseudomys pilligaensis***	1subf	trap B49
B (2)	X-Line Road	11 Oct	752258	6607389	***Pseudomys pilligaensis***	1f	trap B6, lactating
B (2)	X-Line Road	11 Oct	752337	6607488	***Pseudomys pilligaensis***	1f	trap B38
B (2)	X-Line Road	11 Oct	752360	6607578	***Pseudomys pilligaensis***	1m	trap B48
B (2)	X-Line Road	12 Oct	752337	6607488	***Pseudomys pilligaensis***	1m	trap B38
B (2)	X-Line Road	12 Oct	752357	6607556	***Pseudomys pilligaensis***	1m	trap B45
B (2)	X-Line Road	13 Oct	752306	6607562	***Pseudomys pilligaensis***	1m	trap B15
C (3)	Monument Road	10 Oct	765339	6609912	nil		
C (3)	Monument Road	11 Oct	765339	6609912	***Pseudomys pilligaensis***	1subf	trap C5
C (3)	Monument Road	11 Oct	765271	6609916	***Pseudomys pilligaensis***	1	trap C31
C (3)	Monument Road	11 Oct	765284	6609753	***Pseudomys pilligaensis***	1subf	trap C42

Looking west from Panton's Lookout. Photo David Milledge

C (3)	Monument Road	12 Oct	765344	6609891	***Pseudomys pilligaensis***	1subf	trap C6, prob. retrap
C (3)	Monument Road	12 Oct	765356	6609865	***Pseudomys pilligaensis***	1f	trap C8, lactating
C (3)	Monument Road	13 Oct	765353	6609844	***Pseudomys pilligaensis***	1f	trap C9, lactating, prob. retrap
D (4)	Yellow Spring Road	11-13 Oct	764263	6608839	nil		
E (5)	Warrumbungle Road	11 Oct	762358	6605587	*Mus musculus*	1	trap E5
E (5)	Warrumbungle Road	12 Oct	762358	6605587	nil		
E (5)	Warrumbungle Road	13 Oct	762324	6605535	*Amphibolurus nobbii*	1	trap E28
F (6)	Falcon Road 1	11 Oct	763658	6602223	***Pseudomys pilligaensis***	1m	trap F36
F (6)	Falcon Road 1	12 Oct	763692	6602230	***Pseudomys pilligaensis***	1m	trap F32
F (6)	Falcon Road 1	12 Oct	763452	6602274	*Ctenotus robustus*	1	trap F24
F (6)	Falcon Road 1	13 Oct	763658	6602223	nil		
I (7)	Mt Pleasant Road	11 Oct	757437	6602451	nil		
I (7)	Mt Pleasant Road	12 Oct	757437	6602451	***Pseudomys pilligaensis***	1f	trap I36
I (7)	Mt Pleasant Road	13 Oct	757437	6602451	***Pseudomys pilligaensis***	1f	trap I36, prob. retrap
J (8)	Sparrow Road	10-13 Oct	748250	6613871	nil		
K (9)	Brandon's Road	10 Oct	752135	6613704	***Pseudomys pilligaensis***	1m	trap K9
K (9)	Brandon's Road	10 Oct	752127	6613643	***Pseudomys pilligaensis***	1subf	trap K15
K (9)	Brandon's Road	10 Oct	752105	6613586	***Pseudomys pilligaensis***	1 subf	trap K21, died (coll.)
K (9)	Brandon's Road	10 Oct	752084	6613550	***Pseudomys pilligaensis***	1m	trap K25
K (9)	Brandon's Road	11 Oct	752135	6613704	***Pseudomys pilligaensis***	1m	trap K9, prob. retrap
K (9)	Brandon's Road	11 Oct	752128	6613657	***Pseudomys pilligaensis***	1m	trap K14
K (9)	Brandon's Road	12 Oct	752127	6613643	***Pseudomys pilligaensis***	1m	trap K15, prob. retrap
K (9)	Brandon's Road	13 Oct	752134	6613703	*Amphibolurus nobbii*	1	trap K8
K (9)	Brandon's Road	13 Oct	752135	6613704	***Pseudomys pilligaensis***	1m	trap K9, prob. retrap
K (9)	Brandon's Road	13 Oct	752131	6613679	***Pseudomys pilligaensis***	2subm	trap K11
L (10)	Falcon Road 2	11 Oct	762000	6599237	nil		
L (10)	Falcon Road 2	12 Oct	762000	6599238	***Pseudomys pilligaensis***	1m	trap L41
L (10)	Falcon Road 2	13 Oct	762000	6599237	***Pseudomys pilligaensis***	1	trap L36

site	location*	upper storey	mid storey	lower storey	ground layer	nos other common species
A (1)	**X-Line Road (1)**	height 5-15m foliage cover 20% dominants *Corymbia trachyphloia Eucalyptus chloroclada*	height 1-3m foliage cover 20% dominants *Callitris endlicheri Cassinia arcuata Conospermum taxifolium*	height 0-1m foliage cover 50% dominants *Calytrix tetragona Grevillea floribunda Brachyloma daphnoides*	bare ground 40% leaf litter 30% foliage cover 30% dominants nil	18
B (2)	**X-Line Road (7)**	height 2-15m foliage cover 20% dominants *Angophora floribunda Eucalyptus chloroclada*	nil	height 0-1m foliage cover 50% dominants *Boronia glabra Dodonaea peduncularis Bossiaea rhombifolia*	bare ground 40% leaf litter 30% foliage cover 30% dominants nil	16
C (3)	**Monument Road (5)**	height 4-12m foliage cover 15% dominants *Eucalyptus fibrosa Corymbia trachyphloia Eucalyptus chloroclada*	height 0.2-2m foliage cover 50% dominants *Cassinia arcuata Brachyloma daphnoides Leptospermum parviflorum*	height 0-0.2m foliage cover 60% dominants *Schoenus ericetorum Hibbertia obtusifolia Cymbopogon* sp	bare ground 30% leaf litter 50% foliage cover 20% dominants nil	24
D (4)	Yellow Spring Road	height 2-10m foliage cover 10% *dominants* *Corymbia trachyphloia Eucalyptus fibrosa*	height 1-3m foliage cover 10% dominants *Eucalyptus fibrosa Corymbia trachyphloia*	height 0.2-1m foliage cover 60% dominants *Acacia triptera Calytrix tetragona Boronia bipinnate*	bare ground 50% leaf litter 35% foliage cover 15% dominants *Schoenus ericetorum Boronia bipinnate Aotus mollis*	1
E (5)	Warrumbungle Road	height 5-12m foliage cover 20% dominants *Eucalyptus fibrosa Corymbia trachyphloia*	height 1-4m foliage cover 20% dominants *Acacia triptera Allocasuarina dimunita Callitris glaucophylla*	height 0-1m foliage cover 50% dominants *Calytrix tetragona Pultenaea foliolosa Leotospermum* sp.	bare ground 5% leaf litter 65% foliage cover 30% dominants *Goodenia hederacea Pomax ubellata Dampiera adpressa*	21
F (6)	Falcon Road 1 (2)	height 3-10m foliage cover 20% dominants *Corymbia trachyphloia Eucalyptus fibrosa*	height 2-3m foliage cover 10% dominants *Leptospermum parviflorum Allocasuarina dimunita Brachyloma daphnoides*	height 0.2-2m foliage cover 40% dominants *Calytrix tetragona Platysace ericoides*	bare ground 10% leaf litter 65% foliage cover 25% dominants *Platysace ericoides Pomax ubellata Aristida* sp.	23
I (7)	Mt Pleasant Road (1)	height 7-15m foliage cover 5% dominants *Corymbia trachyphloia Eucalyptus dwyeri*	height 1-3m foliage cover 10% dominants *Allocasuarina dimunita Persoonia sericea Acacia gladiformis*	height 0-1m foliage cover 50% dominants *Calytrix tetragona Bossiaea rhombifolia Boronia glabra Dodonaea peduncularis*	bare ground 25% leaf litter 70% foliage cover 5% dominants *Pomax ubellata*	16
J (8)	Sparrow Road	height 4-12m foliage cover 10% dominants *Eucalyptus crebra*	height 0.5-2m foliage cover 60% dominants *Melaleuca uncinata Calytrix tetragona Westringia cheellii*	nil	bare ground 40% leaf litter 50% foliage cover 10% dominants nil	23

Appendix 9 Vegetation characteristics of sites trapped for small mammals in the Project Area, 10-13 October 2011

K (9)	**Brandon's Road (7)**	height 12m foliage cover 40% dominants *Eucalyptus chloro-clada*	height 0.5-2m foliage cover 10% dominants *Philotheca salsoli-folia* *Aotus mollis*	height 0-0.5m foliage cover 30% dominants nil	bare ground 10% leaf litter 60% foliage cover 30% dominants nil	11
L (10)	**Falcon Road 2 (2)**	height 5-15m foliage cover 40% dominants *Eucalyptus rossii* *Corymbia trachy-phloia* *Eucalyptus fibrosa*	height 2-5m foliage cover 10% dominants *Acacia pilligaensis*	height 0-2m foliage cover 40% dominants *Bossiaea rhombifolia* *Cassinia arcuata* *Boronia glabra*	bare ground 10% leaf litter 60% foliage cover 30% dominants nil	20

sites where the Pilliga Mouse was trapped are bolded
* nos of Pilliga Mice individuals captured in brackets

Botanists assessing ecosystems against guidelines, Photo Hugh Nicholson

Appendix 10 Results of Koala faecal scat search in the Project Area, 9-14 October 2011

location	date	Easting GDA94 MGA55	Northing GDA94 MGA55	notes
Falcon Trail	9 Oct	763217	6600367	2 scats at base of senescent Red Gum (probably *Eucalyptus blakelyi*)

Appendix 11 Results of camera trapping for medium and large-sized terrestrial mammals at sites where species were recorded in the Project Area, 9-14 October 2011

site	location	date	Easting-GDA94 MGA55	Northing GDA94 MGA55	common name	scientific name	nos
2	Bohena Creek Road	12 Oct	754320	6620147	Eastern Grey Kangaroo	*Macropus giganteus*	3
2	Bohena Creek Road	12 Oct	754320	6620147	Swamp Wallaby	*Wallabia bicolor*	1
2	Bohena Creek Road	12 Oct	754320	6620147	Red Fox	*Vulpes vulpes*	1
10	waterhole on Bohena Creek	12 Oct	753791	6614827	Red-necked Wallaby	*Macropus rufogriseus*	1
10	waterhole on Bohena Creek	12 Oct	753791	6614827	Feral Goat	*Capra hircus*	2
12	Dog Proof Fence Road	12 Oct	750603	6622369	Eastern Grey Kangaroo	*Macropus giganteus*	3
12	Dog Proof Fence Road	12 Oct	750603	6622369	Red Fox	*Vulpes vulpes*	1
13	Dog Proof Fence Road	12 Oct	750165	6623286	Eastern Grey Kangaroo	*Macropus giganteus*	1
14	Dog Proof Fence Road	12 Oct	746566	6625653	Eastern Grey Kangaroo	*Macropus giganteus*	2
14	Dog Proof Fence Road	12 Oct	746566	6625653	**Black-striped Wallaby**	***Macropus dorsalis***	1
14	Dog Proof Fence Road	12 Oct	746566	6625653	Common Wallaroo	*Macropus robustus*	1
14	Dog Proof Fence Road	12 Oct	746566	6625653	Red-necked Wallaby	*Macropus rufogriseus*	1
14	Dog Proof Fence Road	12 Oct	746566	6625653	Swamp Wallaby	*Wallabia bicolor*	1
14	Dog Proof Fence Road	12 Oct	746566	6625653	Feral Cat	*Felis catus*	1
14	Dog Proof Fence Road	12 Oct	746566	6625653	European Brown Hare	*Lepus europaeus*	1
15	Dog Proof Fence Road	12 Oct	747367	6625496	Eastern Grey Kangaroo	*Macropus giganteus*	4
15	Dog Proof Fence Road	12 Oct	747367	6625496	Common Wallaroo	*Macropus robustus*	1
15	Dog Proof Fence Road	12 Oct	747367	6625496	Swamp Wallaby	*Wallabia bicolor*	1
15	Dog Proof Fence Road	12 Oct	747367	6625496	Red Fox	*Vulpes vulpes*	1

threatened species bolded

Appendix 12 Records of threatened and migratory species obtained in the Project Area, 8-14 October 2011 species and numbers of individuals

common name	scientific name	threatened status	date	Easting GDA94 MGA55	Northing GDA94 MGA55	nos indiv-iduals
Pale-headed Snake	*Hoplocephalus bitorquatus*	vulnerable *(TSC Act)*	14 Oct	762300	6605535	1
Little Eagle	*Hieraaetus morphnoides*	vulnerable *(TSC Act)*	11 Oct	761778	6623634	1
Little Eagle	*Hieraaetus morphnoides*	vulnerable *(TSC Act)*	13 Oct	753187	6623634	1
Glossy Black-cockatoo	*Calyptorhynchus lathami*	vulnerable *(TSC Act)*	9 Oct	750343	6608218	2
Glossy Black-cockatoo	*Calyptorhynchus lathami*	vulnerable *(TSC Act)*	11 Oct	764079	6605577	12
Glossy Black-cockatoo	*Calyptorhynchus lathami*	vulnerable *(TSC Act)*	11 Oct	750910	6608949	2
Glossy Black-cockatoo	*Calyptorhynchus lathami*	vulnerable *(TSC Act)*	12 Oct	767617	6601291	10
Glossy Black-cockatoo	*Calyptorhynchus lathami*	vulnerable *(TSC Act)*	13 Oct	753343	6607558	2+
Glossy Black-cockatoo	*Calyptorhynchus lathami*	vulnerable (TSC Act)	13 Oct	750782	6608683	30+
Glossy Black-cockatoo	*Calyptorhynchus lathami*	vulnerable (TSC Act)	13 Oct	750875	6608857	5+
Glossy Black-cockatoo	*Calyptorhynchus lathami*	vulnerable *(TSC Act)*	14 Oct	753354	6614194	4
Little Lorikeet	*Glossopsitta pusilla*	vulnerable *(TSC Act)*	11 Oct	746141	6599960	2
Turquoise Parrot	*Neophema pulchella*	vulnerable *(TSC Act)*	8 Oct	751169	6609100	3
Turquoise Parrot	*Neophema pulchella*	vulnerable *(TSC Act)*	8 Oct	751770	6606818	1
Turquoise Parrot	*Neophema pulchella*	vulnerable *(TSC Act)*	8 Oct	758576	6597903	1
Turquoise Parrot	*Neophema pulchella*	vulnerable *(TSC Act)*	8 Oct	750476	6607617	2
Turquoise Parrot	*Neophema pulchella*	vulnerable *(TSC Act)*	8 Oct	750459	6607641	1
Turquoise Parrot	*Neophema pulchella*	vulnerable *(TSC Act)*	9 Oct	765339	6609912	2
Turquoise Parrot	*Neophema pulchella*	vulnerable *(TSC Act)*	10 Oct	751250	6609133	2
Turquoise Parrot	*Neophema pulchella*	vulnerable *(TSC Act)*	10 Oct	765931	6610091	1
Turquoise Parrot	*Neophema pulchella*	vulnerable *(TSC Act)*	11 Oct	753997	6615333	1
Turquoise Parrot	*Neophema pulchella*	vulnerable *(TSC Act)*	11 Oct	743943	6592243	1
Turquoise Parrot	*Neophema pulchella*	vulnerable *(TSC Act)*	11 Oct	746141	6599960	1
Turquoise Parrot	*Neophema pulchella*	vulnerable *(TSC Act)*	11 Oct	766932	6602264	1
Turquoise Parrot	*Neophema pulchella*	vulnerable *(TSC Act)*	12 Oct	752121	6610828	2
Turquoise Parrot	*Neophema pulchella*	vulnerable *(TSC Act)*	12 Oct	753638	6614940	2
Turquoise Parrot	*Neophema pulchella*	vulnerable *(TSC Act)*	14 Oct	762300	6605535	1
Turquoise Parrot	*Neophema pulchella*	vulnerable *(TSC Act)*	14 Oct	753354	6614194	2
Barking Owl	*Ninox connivens*	vulnerable *(TSC Act)*	12 Oct	755040	6618340	1
Barking Owl	*Ninox connivens*	vulnerable *(TSC Act)*	12 Oct	753555	6618004	1
Barking Owl	*Ninox connivens*	vulnerable *(TSC Act)*	12 Oct	755075	6617710	1
Rainbow Bee-eater	*Merops ornatus*	migratory *(EPBC Act)*	8 Oct	751770	6606818	2+
Rainbow Bee-eater	*Merops ornatus*	migratory *(EPBC Act)*	8 Oct	751770	6606818	2+
Rainbow Bee-eater	*Merops ornatus*	migratory *(EPBC Act)*	9 Oct	750944	6608714	2+
Rainbow Bee-eater	*Merops ornatus*	migratory *(EPBC Act)*	9 Oct	750439	6607616	2+
Rainbow Bee-eater	*Merops ornatus*	migratory *(EPBC Act)*	10 Oct	765931	6610091	2+
Rainbow Bee-eater	*Merops ornatus*	migratory *(EPBC Act)*	11 Oct	750448	6607623	6+
Rainbow Bee-eater	*Merops ornatus*	migratory *(EPBC Act)*	11 Oct	753997	6615333	2+
Rainbow Bee-eater	*Merops ornatus*	migratory *(EPBC Act)*	11 Oct	752216	6610947	2+
Rainbow Bee-eater	*Merops ornatus*	migratory *(EPBC Act)*	11 Oct	746141	6599960	2+
Rainbow Bee-eater	*Merops ornatus*	migratory *(EPBC Act)*	11 Oct	767617	6601291	4+
Rainbow Bee-eater	*Merops ornatus*	migratory *(EPBC Act)*	12 Oct	752061	6589534	2+
Rainbow Bee-eater	*Merops ornatus*	migratory *(EPBC Act)*	12 Oct	767620	6601147	8+

Appendix 12 Records of threatened and migratory species obtained in the Project Area, 8-14 October 2011 species and numbers of individuals

Rainbow Bee-eater	*Merops ornatus*	migratory *(EPBC Act)*	12 Oct	767617	6601291	2+
Brown Treecreeper	*Climacteris picumnus*	vulnerable *(TSC Act)*	8 Oct	751770	6606818	1
Brown Treecreeper	*Climacteris picumnus*	vulnerable *(TSC Act)*	8 Oct	750476	6607617	4+
Brown Treecreeper	*Climacteris picumnus*	vulnerable *(TSC Act)*	9 Oct	750944	6608714	1
Brown Treecreeper	*Climacteris picumnus*	vulnerable *(TSC Act)*	10 Oct	750440	6607870	1
Brown Treecreeper	*Climacteris picumnus*	vulnerable *(TSC Act)*	11 Oct	750448	6607623	2
Brown Treecreeper	*Climacteris picumnus*	vulnerable *(TSC Act)*	12 Oct	754027	6615395	1
Brown Treecreeper	*Climacteris picumnus*	vulnerable *(TSC Act)*	12 Oct	753638	6614940	1
Brown Treecreeper	*Climacteris picumnus*	vulnerable *(TSC Act)*	12 Oct	754823	6624520	1
Brown Treecreeper	*Climacteris picumnus*	vulnerable *(TSC Act)*	12 Oct	750640	6622370	1
Brown Treecreeper	*Climacteris picumnus*	vulnerable *(TSC Act)*	13 Oct	753187	6623634	1
Brown Treecreeper	*Climacteris picumnus*	vulnerable *(TSC Act)*	14 Oct	765800	6612341	1
Brown Treecreeper	*Climacteris picumnus*	vulnerable *(TSC Act)*	14 Oct	753354	6614194	1
Speckled Warbler	*Chthonicola sagittata*	vulnerable *(TSC Act)*	8 Oct	751770	6606818	2+
Speckled Warbler	*Chthonicola sagittata*	vulnerable *(TSC Act)*	8 Oct	752339	6606242	2
Speckled Warbler	*Chthonicola sagittata*	vulnerable *(TSC Act)*	8 Oct	751770	6606818	2+
Speckled Warbler	*Chthonicola sagittata*	vulnerable *(TSC Act)*	8 Oct	758576	6597903	2+
Speckled Warbler	*Chthonicola sagittata*	vulnerable *(TSC Act)*	10 Oct	773116*	6608603*	2+*
Speckled Warbler	*Chthonicola sagittata*	vulnerable *(TSC Act)*	10 Oct	765381	6609619	2
Speckled Warbler	*Chthonicola sagittata*	vulnerable *(TSC Act)*	10 Oct	765931	6610091	2+
Speckled Warbler	*Chthonicola sagittata*	vulnerable *(TSC Act)*	10 Oct	758712	6612276	1
Speckled Warbler	*Chthonicola sagittata*	vulnerable *(TSC Act)*	10 Oct	764137	6609648	1
Speckled Warbler	*Chthonicola sagittata*	vulnerable *(TSC Act)*	11 Oct	748237	6607977	2
Speckled Warbler	*Chthonicola sagittata*	vulnerable *(TSC Act)*	11 Oct	746141	6599960	2+
Speckled Warbler	*Chthonicola sagittata*	vulnerable *(TSC Act)*	11 Oct	752216	6610947	2+
Speckled Warbler	*Chthonicola sagittata*	vulnerable *(TSC Act)*	12 Oct	762085	6599123	2+
Speckled Warbler	*Chthonicola sagittata*	vulnerable *(TSC Act)*	12 Oct	752061	6589534	2+
Speckled Warbler	*Chthonicola sagittata*	vulnerable *(TSC Act)*	12 Oct	748322	6590385	2+
Speckled Warbler	*Chthonicola sagittata*	vulnerable *(TSC Act)*	12 Oct	753214	6604971	2+
Speckled Warbler	*Chthonicola sagittata*	vulnerable *(TSC Act)*	13 Oct	748255	6608047	2
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	8 Oct	751770	6606818	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	8 Oct	752339	6606242	5
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	8 Oct	751770	6606818	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	8 Oct	763212	6600346	4+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	8 Oct	758576	6597903	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	8 Oct	764316	6603400	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	8 Oct	749352	6607966	3+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	8 Oct	749343	6607979	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	8 Oct	759778	6605951	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	10 Oct	751622	6606987	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	10 Oct	750440	6607870	4+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	10 Oct	761799	6610119	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	10 Oct	748250	6613871	5+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	10 Oct	759890	6605937	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	10 Oct	764265	6608825	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	10 Oct	752925	6613549	2+

Appendix 12 Records of threatened and migratory species obtained in the Project Area, 8-14 October 2011 species and numbers of individuals

Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	10 Oct	752441	6612269	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	10 Oct	757314	6612951	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	10 Oct	758712	6612276	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	10 Oct	763422	6605598	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	10 Oct	765931	6610091	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	11 Oct	752029	6610262	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	11 Oct	752227	6611382	6+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	11 Oct	746141	6599960	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	12 Oct	752061	6589534	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	12 Oct	752179	6611719	3+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	12 Oct	750127	6607885	4+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	12 Oct	752459	6612186	4+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	12 Oct	748322	6590385	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	12 Oct	762085	6599123	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	12 Oct	755555	6619801	4+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	12 Oct	753214	6604971	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	12 Oct	750640	6622370	4+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	12 Oct	752168	6611727	4+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	12 Oct	748291	6607837	2+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	12 Oct	758460	6604655	4+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	13 Oct	754728	6622225	4+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	13 Oct	748242	6607768	4+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	14 Oct	762085	6599123	4+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	14 Oct	753354	6614194	4+
Grey-crowned Babbler	*Pomatostomus temporalis*	vulnerable *(TSC Act)*	14 Oct	755059	6617847	4+
Varied Sittella	*Daphoenositta chrysoptera*	vulnerable *(TSC Act)*	8 Oct	751770	6606818	3+
Varied Sittella	*Daphoenositta chrysoptera*	vulnerable *(TSC Act)*	10 Oct	764265	6608825	3+
Varied Sittella	*Daphoenositta chrysoptera*	vulnerable *(TSC Act)*	10 Oct	765931	6610091	3+
Hooded Robin	*Melanodryas cucullata*	vulnerable *(TSC Act)*	8 Oct	750459	6607641	1
Hooded Robin	*Melanodryas cucullata*	vulnerable *(TSC Act)*	8 Oct	750476	6607617	1
Hooded Robin	*Melanodryas cucullata*	vulnerable *(TSC Act)*	9 Oct	750439	6607616	2
Hooded Robin	*Melanodryas cucullata*	vulnerable *(TSC Act)*	11 Oct	750448	6607623	1
Diamond Firetail	*Stagonopleura guttata*	vulnerable *(TSC Act)*	9 Oct	750944	6608714	1
Diamond Firetail	*Stagonopleura guttata*	vulnerable *(TSC Act)*	11 Oct	750448	6607632	4
Diamond Firetail	*Stagonopleura guttata*	vulnerable *(TSC Act)*	15 Oct	750585	6607900	1
Koala	*Phascolarctos cinereus*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	9 Oct	763217	6600367	1
Eastern Pygmy-possum	*Cercartetus nanus*	vulnerable *(TSC Act)*	10 Oct	765287	6610025	1
Eastern Pygmy-possum	*Cercartetus nanus*	vulnerable *(TSC Act)*	13 Oct	762324	6605535	1
Eastern Pygmy-possum	*Cercartetus nanus*	vulnerable *(TSC Act)*	14 Oct	762324	6605535	1
Squirrel Glider	*Petaurus norfolcensis*	vulnerable *(TSC Act)*	11 Oct	753013	6613592	1
Squirrel Glider	*Petaurus norfolcensis*	vulnerable *(TSC Act)*	11 Oct	766757*	6595315*	1*
Squirrel Glider	*Petaurus norfolcensis*	vulnerable *(TSC Act)*	13 Oct	773490*	6613087*	1*
Black-striped Wallaby	*Macropus dorsalis*	endangered *(TSC Act)*	11 Oct	751039	6614721	1
Black-striped Wallaby	*Macropus dorsalis*	endangered *(TSC Act)*	12 Oct	751039	6614721	6
Black-striped Wallaby	*Macropus dorsalis*	endangered *(TSC Act)*	12 Oct	746566	6625653	1

Appendix 12 Records of threatened and migratory species obtained in the Project Area, 8-14 October 2011 species and numbers of individuals

Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	vulnerable *(TSC Act)*	8 Oct	751774	6606831	1+
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	vulnerable *(TSC Act)*	8 Oct	751983	6607330	1+
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	vulnerable *(TSC Act)*	9 Oct	755190	6600131	1+
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	vulnerable *(TSC Act)*	9 Oct	764372	6603444	1+
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	vulnerable *(TSC Act)*	9 Oct	760469	6604834	1+
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	vulnerable *(TSC Act)*	9 Oct	764550	6603345	1+
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	vulnerable *(TSC Act)*	10 Oct	746703	6600074	1+
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	vulnerable *(TSC Act)*	10 Oct	749872	6603574	1+
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	vulnerable *(TSC Act)*	10 Oct	750278	6605029	1+
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	vulnerable *(TSC Act)*	11 Oct	764265	6603300	1+
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	vulnerable *(TSC Act)*	11 Oct	764265	6603300	1+
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	vulnerable *(TSC Act)*	12 Oct	753222	6605060	1+
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	vulnerable *(TSC Act)*	12 Oct	765394	6605739	1+
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	vulnerable *(TSC Act)*	12 Oct	760491	6605104	1+
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	vulnerable *(TSC Act)*	12 Oct	764174	6606160	1+
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	vulnerable *(TSC Act)*	12 Oct	751897	6616448	1+
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	vulnerable *(TSC Act)*	13 Oct	751774	6606831	1+
South-eastern Long-eared Bat	*Nyctophilus corbeni*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	10 Oct	755177	6599999	1
South-eastern Long-eared Bat	*Nyctophilus corbeni*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	10 Oct	757775	6601364	1
South-eastern Long-eared Bat	*Nyctophilus corbeni*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	10 Oct	769914	6609364	4
South-eastern Long-eared Bat	*Nyctophilus corbeni*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	10 Oct	770191	6609373	8
South-eastern Long-eared Bat	*Nyctophilus corbeni*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	11 Oct	769914	6609364	3
South-eastern Long-eared Bat	*Nyctophilus corbeni*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	13 Oct	750294	6605003	1
South-eastern Long-eared Bat	*Nyctophilus corbeni*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	13 Oct	772967*	6607712*	1*
South-eastern Long-eared Bat	*Nyctophilus corbeni*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	14 Oct	753354	6614194	1
Little Pied Bat	*Chalinolobus picatus*	vulnerable *(TSC Act)*	13 Oct	751774	6606831	1+
Little Pied Bat	*Chalinolobus picatus*	vulnerable *(TSC Act)*	13 Oct	773225	6609144	2*
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	10 Oct	748237	6608034	1
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	10 Oct	752363	6607588	1
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	10 Oct	752135	6613704	1
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	10 Oct	752127	6613643	1
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	10 Oct	752105	6613586	1
Pilliga Mouse	Pseudomys pilligaensis	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	10 Oct	752084	6613550	1

Appendix 12 Records of threatened and migratory species obtained in the Project Area, 8-14 October 2011 species and numbers of individuals

Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	11 Oct	752258	6607389	1
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	11 Oct	752337	6607488	1
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	11 Oct	752360	6607578	1
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	11 Oct	765339	6609912	1
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	11 Oct	765271	6609916	1
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	11 Oct	765284	6609753	1
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	11 Oct	763658	6602223	1
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	11 Oct	752128	6613657	1
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	12 Oct	752337	6607488	1
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	12 Oct	752357	6607556	1
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	12 Oct	765356	6609865	1
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	12 Oct	763692	6602230	1
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	12 Oct	757437	6602451	1
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	12 Oct	762000	6599238	1
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	13 Oct	765287	6610025	1
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable (EPBC Act) vulnerable *(TSC Act)*	13 Oct	752306	6607562	1
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	13 Oct	752131	6613679	2
Pilliga Mouse	*Pseudomys pilligaensis*	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*	13 Oct	762000	6599237	1

- records outside Project Area

Appendix 13 Vertebrate species recorded in the Project Area, 8-14 October 2011

common name	scientific name	status
Amphibians		
Plains Froglet	*Crinia parinsignifera*	
Common Eastern Froglet	*Crinia signifera*	
Barking Frog	*Limnodynastes fletcheri*	
Ornate Burrowing Frog	*Limnodynastes ornatus*	
Salmon-striped Frog	*Limnodynastes salmini*	
Spotted Grass Frog	*Limnodynastes tasmaniensis*	
Bibron's Toadlet	*Pseudophryne bibroni*	
Smooth Toadlet	*Uperoleia laevigata*	
Wrinkled Toadlet	*Uperoleia rugosa*	
Green Tree Frog	*Litoria caerulea*	
Broad-palmed Rocket Frog	*Litoria latopalmata*	
Peron's Tree Frog	*Litoria peronii*	
Desert Tree Frog	*Litoria rubella*	
Total 13 species		
Reptiles		
Prickly Gecko	*Heternotia binoei*	
Litter Skink	*Carlia foliorum*	
Striped Skink	*Ctenotus robustus*	
Tree Skink	*Egernia striolata*	
Wood Mulch-slider	*Lerista muelleri*	
Eastern Blue-tongued Skink	*Tiliqua scincoids*	
Nobbi	*Amphibolorus nobbi*	
Eastern Bearded Dragon	*Pogona barbata*	
Sand Goanna	*Varanus gouldii*	
Lace Monitor	*Varanus varius*	
Pale-headed Snake	***Hoplocephalus bitorquatus***	vulnerable *(TSC Act)*
Total 11 species		
Birds		
Emu	*Dromaius novaehollandiae*	
Brown Quail	*Coturnix ypsilophora*	
Australian Wood Duck	*Chenonetta jubata*	
Pacific Black Duck	*Anas superciliosa*	
Australasian Grebe	*Tachybaptus novaehollandiae*	
Common Bronzewing	*Phaps chalcoptera*	
Crested Pigeon	*Ocyphaps lophotes*	
Peaceful Dove	*Geopelia striata*	
Bar-shouldered Dove	*Geopelia humeralis*	
Tawny Frogmouth	*Podargus strigoides*	
White-throated Nightjar	*Eurostopodus mystacalis*	
Spotted Nightjar	*Eurostopodus argus*	
Australian Owlet-nightjar	*Aegotheles cristatus*	
White-necked Heron	*Ardea pacifica*	

Black-shouldered Kite	*Elanus axillaris*	
Brown Goshawk	*Accipiter fasciatus*	
Collared Sparrowhawk	*Accipiter cirrocephalus*	
Wedge-tailed Eagle	*Aquila audax*	
Little Eagle	***Hieraaetus morphnoides***	vulnerable *(TSC Act)*
Nankeen Kestrel	*Falco cenchroides*	
Brown Falcon	*Falco berigora*	
Peregrine Falcon	*Falco peregrinus*	
Masked Lapwing	*Vanellus miles*	
Painted Button-quail	*Turnix varius*	
Glossy Black-cockatoo	***Calyptorhynchus lathami***	vulnerable *(TSC Act)*
Galah	*Eolophus roseicapillus*	
Sulphur-crested Cockatoo	*Cacatua galerita*	
Musk Lorikeet	*Glossopsitta concinna*	
Little Lorikeet	***Glossopsitta pusilla***	vulnerable *(TSC Act)*

Australian King-parrot	*Alisterus scapularis*	
Red-winged Parrot	*Aprosmictus erythropterus*	
Eastern Rosella	*Platycercus eximius*	
Australian Ringneck	*Barnardius zonarius*	
Red-rumped Parrot	*Psephotus haematonotus*	
Turquoise Parrot	***Neophema pulchella***	vulnerable *(TSC Act)*
Horsfield's Bronze Cuckoo	*Chalcites basalis*	
Black-eared Cuckoo	*Chalcites osculans*	
Shining Bronze-cuckoo	*Chalcites lucidus*	
Pallid Cuckoo	*Cacomantis pallidus*	
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	
Barking Owl	***Ninox connivens***	vulnerable *(TSC Act)*
Southern Boobook	*Ninox novaeseelandiae*	
Laughing Kookaburra	*Dacelo novaeguineae*	
Sacred Kingfisher	*Todiramphus sanctus*	
Rainbow Bee-eater	***Merops ornatus***	migratory *(EPBC Act)*
Dollarbird	*Eurystomus orientalis*	
White-throated Treecreeper	*Cormobates leucophaea*	
Brown Treecreeper	***Climacteris picumnus***	vulnerable *(TSC Act)*
Superb Fairy-wren	*Malurus cyaneus*	
Variegated Fairy-wren	*Malurus lamberti*	
Chestnut-rumped Heathwren	*Hylacola pyrrhopygia*	
Speckled Warbler	***Chthonicola sagittata***	vulnerable *(TSC Act)*
Weebill	*Smicrornis brevirostris*	
Western Gerygone	*Gerygone fusca*	
White-throated Gerygone	*Gerygone albogularis*	
Striated Thornbill	*Acanthiza lineata*	
Yellow Thornbill	*Acanthiza nana*	
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	

Chestnut-rumped Thornbill	*Acanthiza uropygialis*	
Buff-rumped Thornbill	*Acanthiza reguloides*	
Inland Thornbill	*Acanthiza apicalis*	
Spotted Pardalote	*Pardalotus punctatus*	
Striated Pardalote	*Pardalotus striatus*	
Yellow-faced Honeyeater	*Lichenostomus chrysops*	
White-eared Honeyeater	*Lichenostomus leucotis*	
Fuscous Honeyeater	*Lichenostomus fuscus*	
White-plumed Honeyeater	*Lichenostomus penicillatus*	
Noisy Miner	*Manorina melanocephala*	
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	
Red Wattlebird	*Anthochaera carunculata*	
Brown Honeyeater	*Lichmera indistincta*	
Brown-headed Honeyeater	*Melithreptus brevirostris*	
Blue-faced Honeyeater	*Entomyzon cyanotis*	
Noisy Friarbird	*Philemon corniculatus*	
Little Friarbird	*Philemon citreogularis*	
Striped Honeyeater	*Plectorhyncha lanceolata*	
Grey-crowned Babbler	***Pomatostomus temporalis***	vulnerable *(TSC Act)*
White-browed Babbler	*Pomatostomus superciliosus*	
Spotted Quail-thrush	*Cinclosoma punctatum*	
Varied Sittella	***Daphoenositta chrysoptera***	vulnerable *(TSC Act)*
Black-faced Cuckoo-Shrike	*Coracina novaehollandiae*	
White-bellied Cuckoo-shrike	*Coracina papuensis*	
White-winged Triller	*Lalage sueurii*	
Crested Shrike-tit	*Falcunculus frontatus*	
Golden Whistler	*Pachycephala pectoralis*	
Rufous Whistler	*Pachycephala rufiventris*	
Grey Shrike-thrush	*Colluricincla harmonica*	
Crested Bellbird	*Oreoica gutturalis*	
Olive-backed Oriole	*Oriolus sagittatus*	
Masked Woodswallow	*Artamus personatus*	
White-browed Woodswallow	*Artamus superciliosus*	
Dusky Woodswallow	*Artamus cyanopterus*	
Grey Butcherbird	*Cracticus torquatus*	
Pied Butcherbird	*Cracticus nigrogularis*	
Australian Magpie	*Cracticus tibicen*	
Pied Currawong	*Strepera graculina*	
Grey Fantail	*Rhipidura albiscapa*	
Willie Wagtail	*Rhipidura leucophrys*	
Australian Raven	*Corvus coronoides*	
Leaden Flycatcher	*Myiagra rubecula*	
Restless Flycatcher	*Myiagra inquieta*	
Magpie-lark	*Grallina cyanoleuca*	

White-winged Chough	Corcorax melanorhamphos	
Apostlebird	Struthidea cinerea	
Jacky Winter	Microeca fascinans	
Red-capped Robin	Petroica goodenovii	
Hooded Robin	***Melanodryas cucullata***	vulnerable *(TSC Act)*
Eastern Yellow Robin	*Eopsaltria australis*	
Rufous Songlark	*Cincloramphus mathewsi*	
Brown Songlark	*Cincloramphus cruralis*	
Silvereye	*Zosterops lateralis*	
Welcome Swallow	*Hirundo neoxena*	
Tree Martin	*Petrochelidon nigricans*	
Common Myna	*Sturnus tristis*	introduced
Mistletoebird	*Dicaeum hirundinaceum*	
Double-barred Finch	*Taeniopygia bichenovii*	
Red-browed Finch	*Neochimia temporalis*	
Diamond Firetail	***Stagonopleura guttata***	vulnerable *(TSC Act)*
Australasian Pipit	*Anthus novaeseelandiae*	
Total 119 species		
Mammals		
Koala	***Phascolarctos cinereus***	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*
Common Wombat*	*Vombatus ursinus*	
Eastern Pygmy-possum	***Cercartetus nanus***	vulnerable *(TSC Act)*
Sugar Glider	*Petaurus breviceps*	
Squirrel Glider	***Petaurus norfolcensis***	vulnerable *(TSC Act)*
Common Brushtail Possum	*Trichosurus vulpecula*	
Eastern Grey Kangaroo	*Macropus giganteus*	
Black-striped Wallaby	***Macropus dorsalis***	endangered *(TSC Act)*
Common Wallaroo	*Macropus robustus*	
Red-necked Wallaby	*Macropus rufogriseus*	
Swamp Wallaby	*Wallabia bicolour*	
Little Red Flying-fox	*Pteropus scapulatus*	
Eastern Horseshoe Bat	*Rhinolophus megaphyllus*	
Yellow-bellied Sheath-tailed Bat	***Saccolaimus flaviventris***	vulnerable *(TSC Act)*
Eastern Free-tailed Bat	*Mormopterus ridei*	
Southern Free-tailed Bat	*Mormopterus sp. 4 (long penis form)*	
White-striped Free-tailed Bat	*Tadarida australis*	
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	
Gould's Long-eared Bat	*Nyctophilus gouldi*	

South--eastern Long-eared Bat	***Nyctophilus corbeni***	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*
Gould's Wattled Bat	*Chalinolobus gouldii*	
Chocolate Wattled Bat	*Chalinolobus morio*	
Little Pied Bat	***Chalinolobus picatus***	vulnerable *(TSC Act)*
Inland Broad-nosed Bat	*Scotorepens balstoni*	
Little Broad-nosed Bat	*Scotorepens greyii*	
Little Forest Bat	*Vespadelus vulturnus*	
Pilliga Mouse	***Pseudomys pilligaensis***	vulnerable *(EPBC Act)* vulnerable *(TSC Act)*
House Mouse	*Mus musculus*	introduced
Feral Goat	*Capra hircus*	introduced
Feral Pig	*Sus scrofa*	introduced
Red Fox	*Vulpes vulpes*	introduced
Feral Cat	*Felis catus*	introduced
European Rabbit	*Oryctolagus cuniculus*	introduced
European Brown Hare	*Lepus europaeus*	introduced
Total 33 (34) species		

* recorded outside Project Area

Threatened South-eastern Long-eared Bat being released. Photo Matthew Taylor