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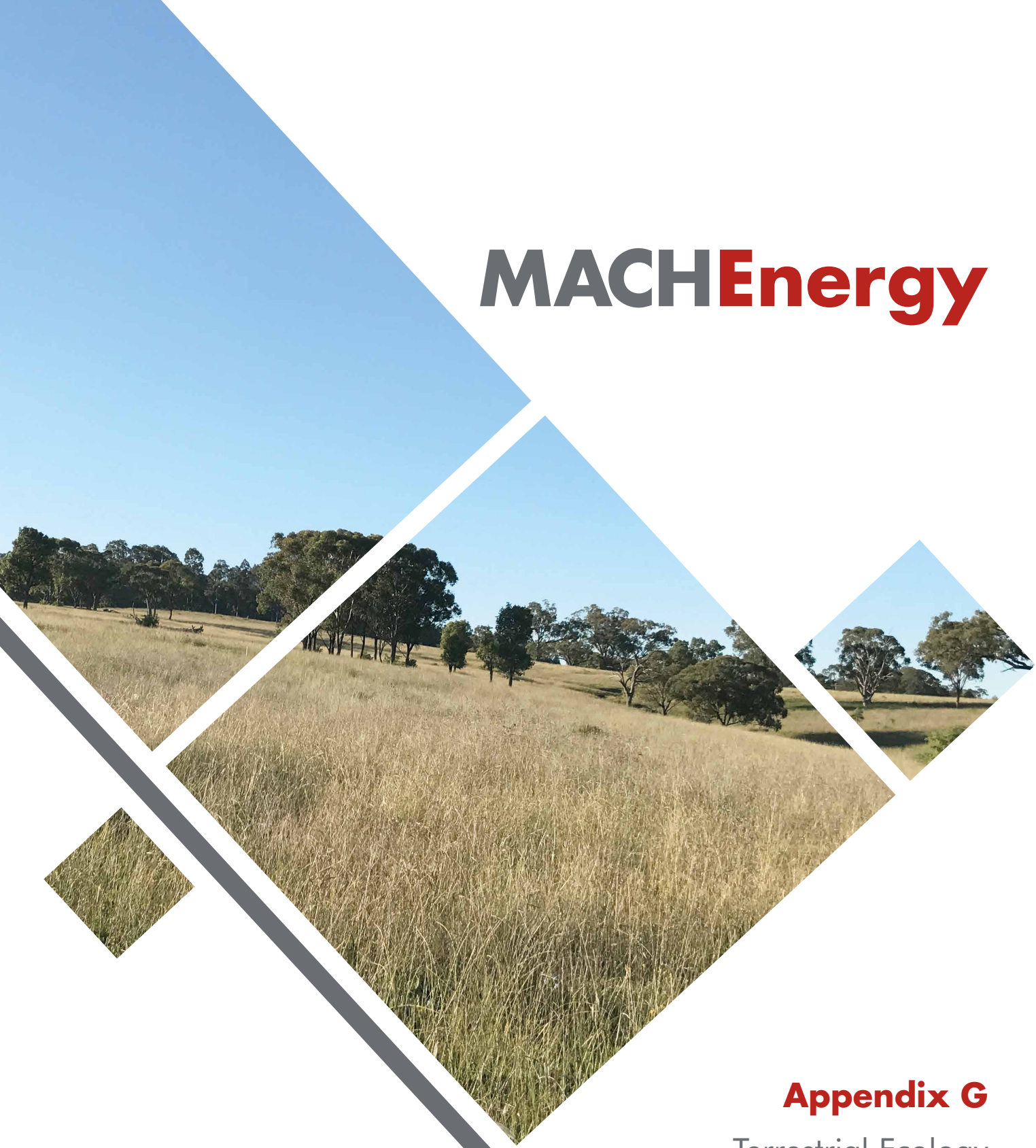

Appendix G

Terrestrial Ecology Assessment

MOUNT PLEASANT OPERATION RAIL MODIFICATION

TERRESTRIAL ECOLOGY ASSESSMENT

PREPARED BY
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DECEMBER 2017

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1 INTRODUCTION

1.1 Overview of the Mount Pleasant Operation

MACH Energy Australia Pty Ltd (MACH Energy) acquired the Mount Pleasant Operation (MPO) from Coal and Allied Operations Pty Ltd (Coal & Allied) on 4 August 2016. MACH Energy commenced construction activities at the MPO in November 2016, in accordance with Development Consent DA 92/97 and the *Environmental Protection and Biodiversity Conservation Act, 1999* (EPBC Act) (EPBC 2011/5795).

The approved MPO includes the construction and operation of an open cut coal mine and associated rail spur and product coal loading infrastructure. The mine is approved to produce up to 10.5 million tonnes per annum of run-of-mine coal. Up to approximately nine trains per day of thermal coal product from the MPO will be transported by rail to the port of Newcastle for export or to domestic customers for use in electricity generation.

1.2 Overview of the Modification

MACH Energy is seeking a modification (the Modification) to the approved MPO under section 75W of the New South Wales (NSW) *Environmental Planning and Assessment Act, 1979.* The MPO Development Consent DA 92/97 was granted on 22 December 1999. The MPO was also approved under the EPBC Act in 2012 (EPBC 2011/5795).

The ultimate extent of the approved Bengalla Mine open cut intersects the approved MPO rail spur. While the intersection of the Bengalla Mine open cut with the approved MPO rail infrastructure is still some years away, MACH Energy is proposing a Modification to obtain approval for future rail and/or conveyor product transport facilities to manage this future interaction.

The Modification would primarily comprise:

- duplication of the approved rail spur, rail loop, conveyor and rail load-out facility and associated services;
- duplication of the Hunter River water supply pump station, water pipeline and associated electricity supply that currently follows the rail spur alignment; and
- demolition and removal of the redundant approved infrastructure within the extent of the Bengalla Mine, once the new rail, product loading and water supply infrastructure has been commissioned and is fully operational.

The Modification would not alter the number of approved train movements on the rail network or operational workforce of the MPO.

Components of the Modification traverse existing approved disturbance areas (i.e. within the approved extent of the MPO[1]). These areas are excluded from the additional disturbance areas assessed as part of this assessment. The components of the Modification being considered in this assessment are presented in Figures 1 and 2.

As part of the Modification, MACH Energy is relinquishing its approval in relation to a portion of the South West Out of Pit Emplacement footprint (Figure 3) to restrict the area used for major infrastructure. This area is considered in further detail in Section 2.

[1] As permitted by Development Consent DA 92/97, including areas nominally depicted in Appendix 1 of DA 92/97 and/or the approved Mining Operations Plan.

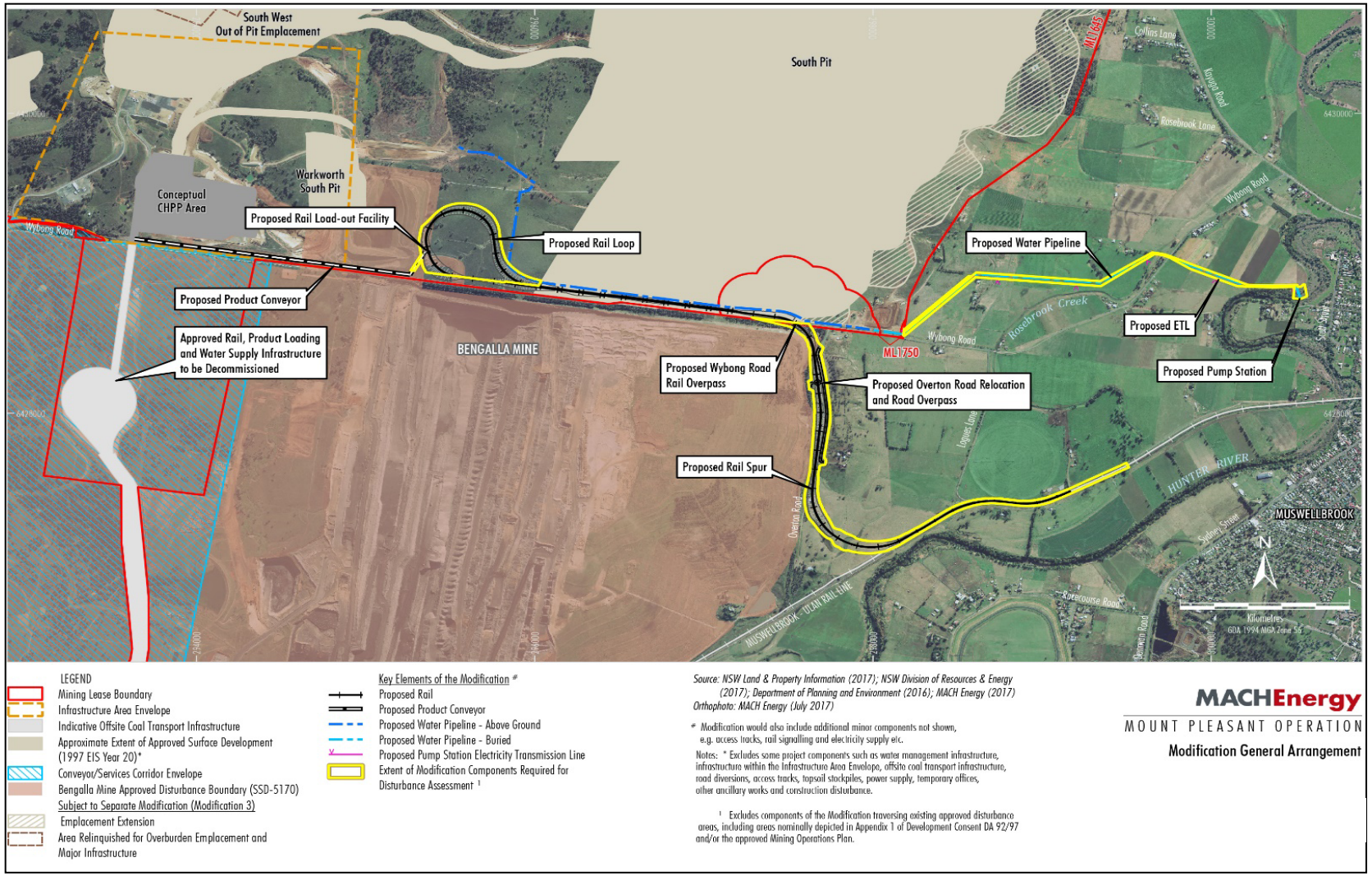

Figure 1 Modification General Arrangement

Figure 2 The Modification Disturbance Areas overlaid on 1953 aerial photo

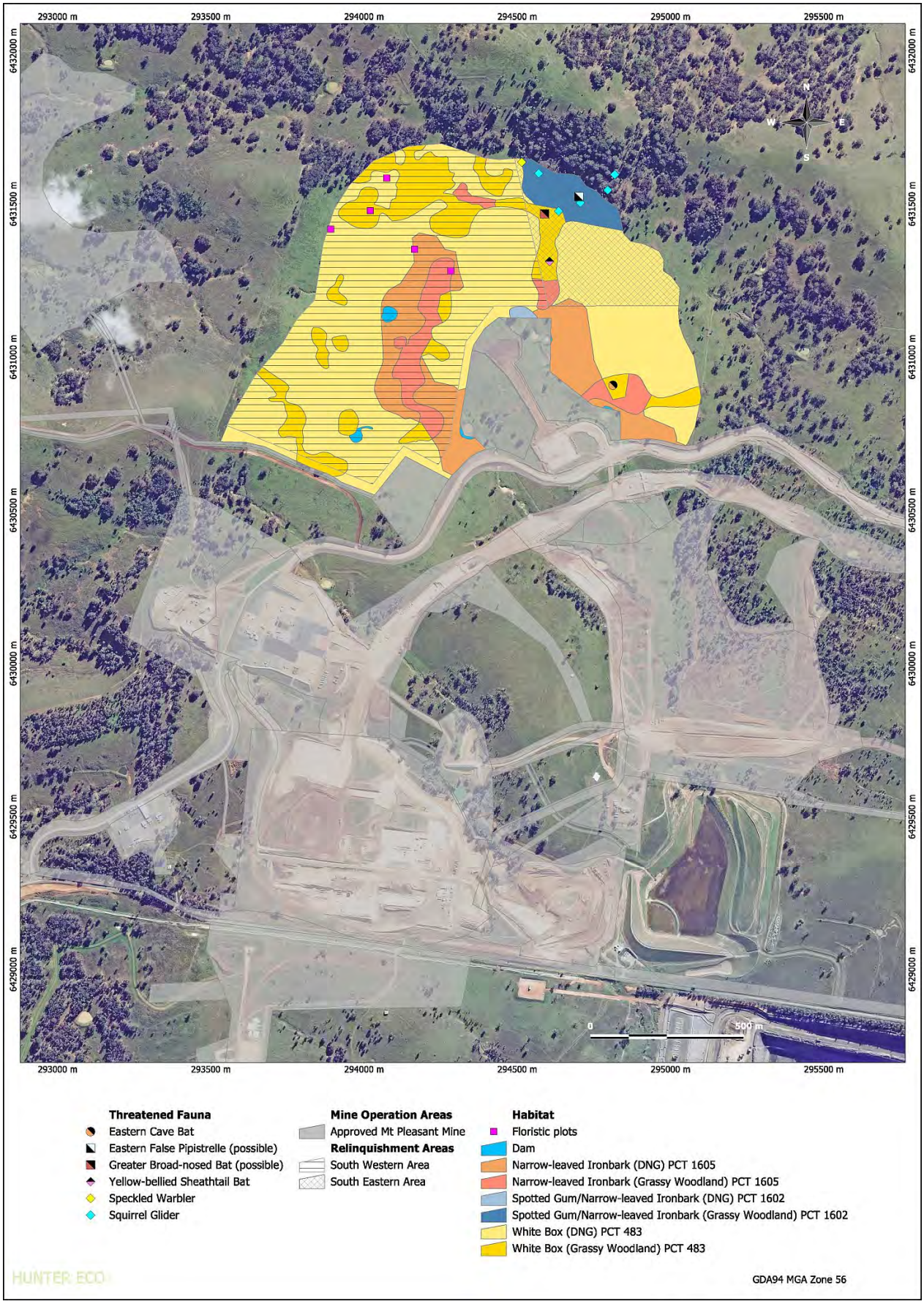

Figure 3 Vegetation Communities Mapped Across the South Western Out of Pit Relinquishment Areas, Fauna Survey Sites, Fauna Recorded and Floristic Plots

2 DESCRIPTION OF MODIFICATION AREA AND RELINQUISHMENT AREA

2.1 Modification Area

One of the key components of the Modification consists of a rail loop that is located on derived native grassland with scattered trees. The rail line continues east from the loop north of Wybong Road for approximately 2 kilometres (km) through a portion of the already approved MPO and/or the adjacent public road infrastructure. At Overton Road the rail line turns south through a corner of the Bengalla Mine approved disturbance area onto agricultural land for a further 3 km until it connects to the existing Muswellbrook-Ulan Rail Line.

The rail loop is located on elevated land (approximately 220 m Australian Height Datum [AHD]) with the rail spur running across gradually sloping land to an elevation of approximately 150 m AHD, at which point it drops onto the Hunter Floodplain for the last 1.5 km.

The water pipeline taking water from the Hunter River will be buried underground for approximately 2.8 km beneath agricultural land on the Hunter Floodplain, where the vegetation is a mix of grazing pasture and cultivated crops. It then continues west on the surface crossing lands associated with the approved MPO. An overhead powerline supplying the pumps at the Hunter River will be generally located beside the pipeline.

The Modification lies within:

- Muswellbrook Local Government area;
- Hunter Local Land Services area;
- Sydney Basin Bioregion, Hunter sub-region;
- Central Western Slopes Botanical Division; and
- Central Hunter Foothills and Upper Hunter Channels and Floodplain Mitchell landscapes.

Clearing of Hunter Valley vegetation commenced in the early 1800's. The earliest available aerial photographs from 1953 (Figure 2) show that the Modification area and surrounds was almost totally cleared and was in much the same condition (with regard to remnant vegetation) as it is in 2017. It can be concluded that all of the land associated with the Modification has been subject to previous clearance activities, and used for agricultural purposes in excess of 60 years, and most likely much longer.

2.2 Relinquishment Area

The eastern portion of the South West Out of Pit Emplacement consists of a mosaic of derived native grassland with patches of woodland and scattered paddock trees, with the main species being White Box (*Eucalyptus albens*), and Narrow-leaved Ironbark (*Eucalyptus crebra*) along with Spotted Gum (*Corymbia maculata*). In this region White Box are often referred to as White Box-Coastal Grey Box (*Eucalyptus moluccana*) hybrids (Grey Box x White Box).

The South West Out of Pit Emplacement is presented in Figures 3 and 4.

Figure 4 Vegetation Communities mapped across Relinquishment Area and Fauna Survey sites

3 REGIONAL VEGETATION MAPPING

There are two regional vegetation mapping projects that include the Modification area: the Hunter Remnant Vegetation Project (Peake, 2006) and the Hunter Native Vegetation Mapping (Sivertsen et al., 2011). Peake (2006) does not show any mapped remnant native vegetation in or near the Modification area. Sivertsen et al. (2011) maps the Modification area as non-native vegetation, other than for the riparian habitat located along the Hunter River (Figure 5).

Based on these local and regional studies, vegetation in the vicinity of the Modification is a highly disturbed combination of exotic pastures, derived grassland, plantings, scattered mature trees and predominantly exotic riparian vegetation along the Hunter River.

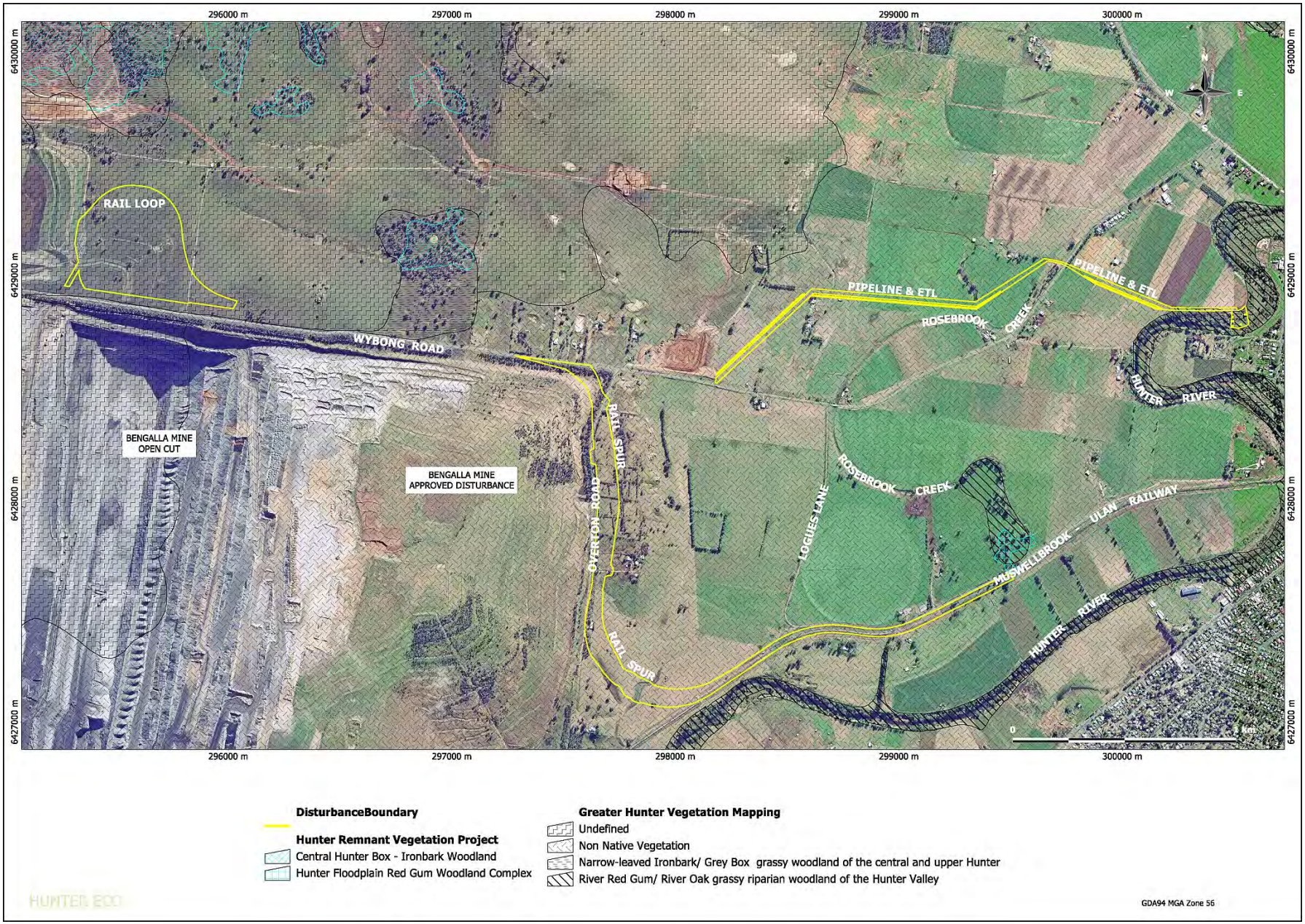

Figure 5 Regional vegetation mapping across the Modification Disturbance Area

4 METHODS

As a guide for targeted surveying, threatened species, communities and populations known or predicted to occur within the Hunter Central Rivers Catchment Management Authority – Hunter sub-catchment were extracted from the NSW BioNET database. Further data was obtained from the Commonwealth Protected Matters Search Tool from within a 10 km radius of the MPO area. The initial data extracts were filtered to remove any marine or aquatic habitat species and communities (addressed in the separate Aquatic Ecology Assessment), as well as any for which the immediate MPO region is considered outside of their geographic range.

All potentially occurring threatened species, populations and communities were assessed for their likelihood of occurring in or near the Modification disturbance area.

4.1 Plant Community Types

In principle, Plant Community Types (PCT) are determined by comparing PCT descriptors in BioNET with floristic content compiled from sample plots and transects strategically placed across the disturbance area.

Floristic plots consisted of a 20 metre (m) x 20 m plot nested in a 50 m x 20 m plot. Although not the assessment pathway relevant to the Modification, data were collected according to the requirements of the NSW Biodiversity Assessment Methodology (BAM). All flora species present in the 20 m x 20 m plot were identified and their percentage foliage cover was scored. The number of individuals present for each flora species was also estimated for species with a cover score of 5% or less. Diameter at Breast Height (DBH) was recorded for any trees within the 50 m x 20 m plot and tallied against the following intervals: <5, 5–9, 10–19, 20–29, 30–49, 50–79, and 80+ centimetres (cm). Percentage litter cover was determined in five one metre square plots evenly located across the 50m x 20m plot.

4.2 Flora

All flora species were recorded in the floristic sample plots along with their exotic or native status and the growth form of all native species; threatened status was also assessed. A list of the flora species recorded within the Modification disturbance area is provided in Appendix 1.

Flora surveys and vegetation mapping within the eastern portion of the South West Out of Pit Emplacement were undertaken recently for a separate modification application to the MPO, and is therefore relied on for the purposes of this assessment (Hunter Eco, 2016). A list of the flora species recorded within the South West Out of Pit Emplacement is provided in Appendix 2.

The threatened flora, populations and ecological communities and their likelihood of occurrence within the Modification disturbance area is provided in Appendix 3. Specifically, it was assessed that the habitat was unsuitable for ground orchids because of the long-term grazing history, no connectivity with any known populations, the large areas of pasture and cropping land, and the results (no orchids recorded) of targeted orchid surveys in adjacent similar habitat (in October 2016) by Eco Logical Australia (ELA) (ELA, 2017a).

4.3 Fauna

A fauna survey was conducted by ELA and the report can be found in Appendix 4.

Additional fauna surveys within the eastern portion of the South West Out of Pit Emplacement area were also undertaken by ELA. A copy of the results is provided in Appendix 5.

5 RESULTS

With the landscape being highly modified there were no areas of vegetation that could be clearly classified as discrete vegetation communities. Consequently, habitat types are described with notes about inferred communities where applicable.

5.1 Modification Disturbance Area

5.1.1 Habitat Types

Within and around the Modification disturbance area five habitat types were assessed. These are mapped in Figure 6 and described in the following sections. Figure 6 also shows the location of the 13 floristic sample plots collected for this assessment. Due to similarities, two of the habitat types (Railway easement and Agriculture) are described and assessed as a single habitat type, although mapped separately in Figure 6.

Native Grassland (21.97 ha)
Located entirely within the rail loop this area contained mixed cover of native tussock gasses and weeds. From four floristic plots there were 19 weed species and 17 native species. Native species were dominated by the grasses Purple Wiregrass (*Aristida ramosa*) and Red Grass (*Bothriochloa decipiens*) with weed species dominated by Galenia (*Galenia pubescens*), Saffron Thistle *(Carthamus lanatus*), Coolatai Grass (*Hyparrhenia hirta*) and Cretan Weed (*Hedypnois rhagadioloides*). There were four High Threat Weed species including *Galenia pubescens*, *Carthamus lanatus*, *Hyparrhenia hirta* and Common Prickly Pear (*Opuntia stricta*).

Scattered within the rail loop area were nine large (DBH 50-80 or 80+ cm) Narrow-leaved Ironbark (*Eucalyptus crebra*) trees and the presence of these trees indicated that a likely appropriate PCT was PCT1605 *Narrow-leaved Ironbark - Native Olive shrubby open forest of the central and upper Hunter*. Pepper Trees (*Schinus molle*) and Kurrajong (*Brachychiton populneus*) were also located within the rail loop area. Six trees were observed to contain hollows, providing potential habitat for threatened fauna species (in particular bats and birds). These trees collectively provide ~0.1 ha of threatened fauna habitat.

Planted Trees (2.90 ha)
This was a part of the habitat in the rail spur corridor area. This habitat consisted of a portion of rehabilitation associated with the Bengalla Mine at the corner of Wybong and Overton Roads, along with windbreaks in the paddocks east of Overton Road. The Bengalla rehabilitation was dominated by Sugar Gum (*Eucalyptus cladocalyx*), a South Australian species planted widely in the Hunter Valley along with Mugga Ironbark (*Eucalyptus sideroxylon*), Slender-leaved Mallee (*Eucalyptus leptophylla*), Cooba (*Acacia salicina*) and Swamp Oak (*Casuarina glauca*). The windbreaks were dominated by *Schinus molle*, *Eucalyptus cladocalyx* and Silky Oak (*Grevillea robusta*). These were single lines of trees in a rectangular mosaic. There were also several Sugar Gum (*Eucalyptus cladocalyx)* paddock trees in the area.

There was no remnant native vegetation in or near the Modification disturbance area that would assist with confirming which PCT may have been present prior to clearing.

Although mostly non-endemic, this habitat is considered to provide potential habitat for some threatened bird and bat species, albeit marginal and not likely to be critical for survival of any species.

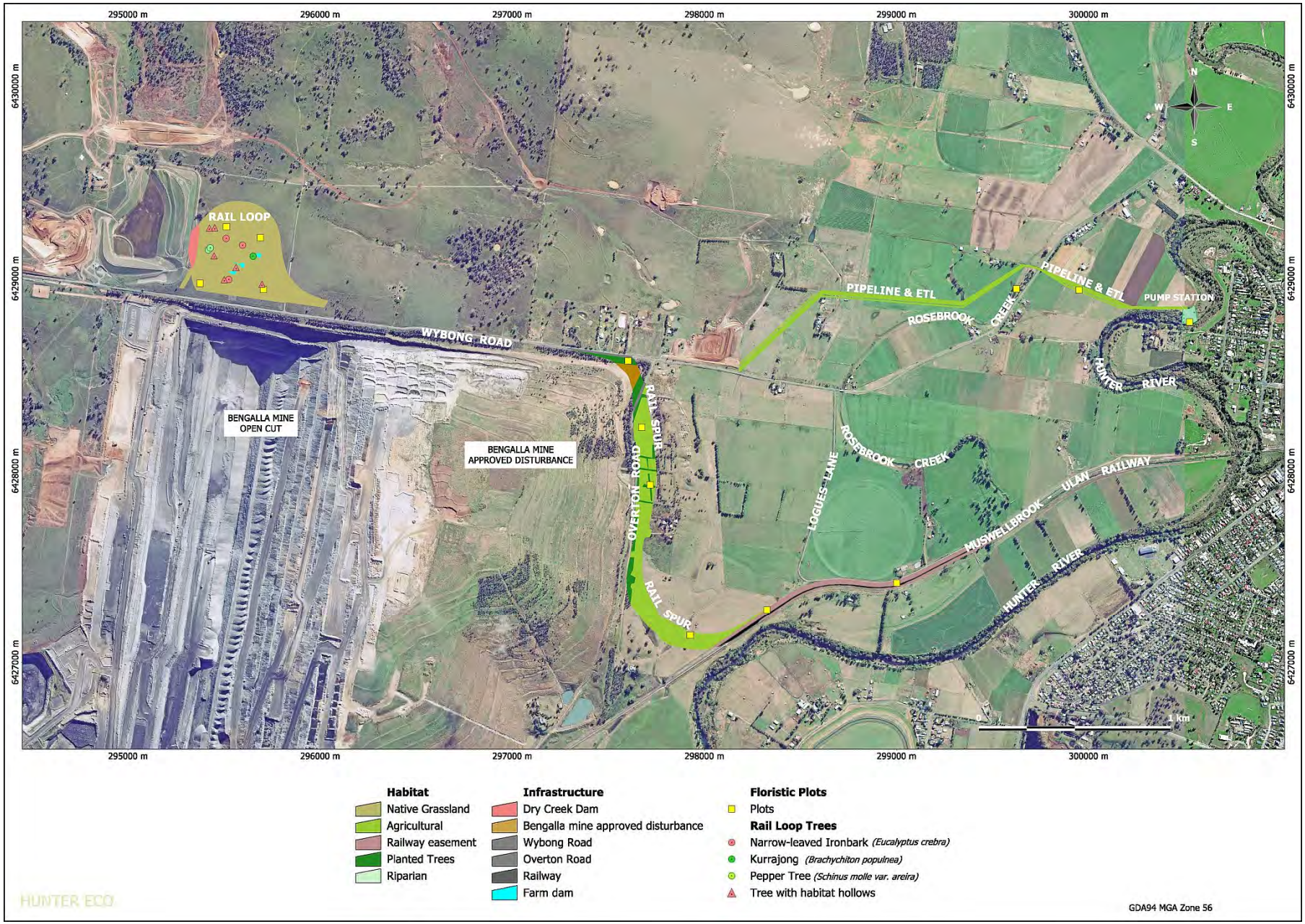

Figure 6 Various habitat areas mapped across the Modification Disturbance Area

Agricultural Land and Rail Infrastructure (21.45 ha)
This was a part of the habitat in the rail spur corridor area and the water pipeline/electricity transmission line (ETL) alignment (agricultural land only). The agricultural land consisted of grazed pasture and cultivated crops such as Lucerne or Oats. The rail infrastructure area is the narrow strip of land between the railway line and the fenced agricultural land. The strip consists in part of a formed vehicular track, access points, small buildings and drainage ways. All of the area is part of the rail construction zone and does not consist of the original land form. The results from five floristic plots in this habitat type showed that out of thirty species recorded, only two were native species (Tarvine [*Boerhavia dominii*] and Pigweed [*Portulaca oleracea*]), both present as isolated individuals. There were several exotic Hackberry (*Celtis occidentalis*) trees scattered along the rail infrastructure area. The vegetation within these areas is of a highly disturbed nature and is in extremely poor condition. This habitat is not currently considered to provide habitat for threatened flora or fauna species.

Riparian (0.56 ha)
The location for the Hunter River Pump Station, this habitat takes in an area from the Hunter River high bank to the water. Results from a floristic plot and meander survey showed that the vegetation almost entirely consisted of weeds and exotic trees. There were small numbers of River Oak (*Allocasuarina cunninghamiana*) and a group of White Cedar (*Melia azedarach*). The river margin was dominated by Weeping Willow (*Salix* sp.) behind which were Lombardy Poplar (*Populus nigra 'italica'*), *Schinus molle* and Large-leaved Privet (*Ligustrum lucidum*). There were several large patches of Giant Reed (*Arundo donax*) and Green Cestrum (*Cestrum parqui*). Dominant ground species were the grasses Red Natal Grass (*Melinis repens*), Sterile Brome (*Bromus sterilis*) and Vasey Grass (*Paspalum urvillei*), along with Lady Ragweed (*Ambrosia tenuifolia*), Paterson's Curse (*Echium plantagineum*), Blue Heliotrope (*Heliotropium amplexicaule*) and Trad (*Tradescantia fluminensis*). A large amount of Balloon Vine (*Cardiospermum grandiflorum*) was draped over much of the tree canopy. There were six High Threat Weed species. Figure 7 shows a detailed map of the vegetation within the riparian habitat.

West of the pump station area the vegetation consisted of dense Black Locust (*Robinia pseudoacacia*) trees and African Boxthorn (*Lyceum ferocissimum*) while to the east, upstream, the vegetation was similar to that within the pump station area.

Comparing the species content and riparian location at the pump station site with descriptions of PCTs in the NSW BioNET database indicates that the closest match for this habitat type is PCT1714 *River Oak – White Cedar grassy riparian forest* of the Dungog area and Liverpool Ranges. This PCT is noted as containing similar exotic species content to that found at the pump station site (along with River Oak and White Cedar) as well as occurring in the Central Hunter Alluvial Plains landscape. PCT1714 is not a listed threatened ecological community.

The vegetation within the riparian area is of a highly disturbed nature and is in extremely poor condition. Notwithstanding, the Modification would avoid the clearance of mature River Oak and exotic Weeping Willow and Poplar in the vicinity of the proposed pump station. This avoids clearing potential marginal camp habitat for flying foxes.

The area of this habitat to be disturbed by the Modification is therefore not considered to provide threatened species habitat.

Figure 7 The vegetation of the pump station area

5.1.2 Flora Species

Appendix 1 provides a list of flora species recorded within the Modification disturbance area, including a breakdown of the species identified within each of the above-described broad habitat types.

No threatened flora species or populations were recorded.

5.1.3 Fauna Species

A fauna survey was conducted by ELA, and a copy of their report is provided in Appendix 4. Bat call analysis was undertaken by Greg Richards and Associates and the results are presented in Appendix 6. In summary, the surveys undertaken for the Modification recorded several threatened bats and a threatened bird in the Modification disturbance area, including:

- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) – vulnerable (BC Act);
- Eastern Freetail-bat (*Mormopterus norfolkensis*) – vulnerable (BC Act); and
- Speckled Warbler (*Chthonicola sagittata*) – vulnerable (BC Act).

Surveys also conservatively identified possible records of other threatened bats, although the records were not able to be confidently confirmed as these species. These bats include Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*) and Greater Broad-nosed Bat (*Scoteanax rueppellii*) (all listed as vulnerable under the BC Act) (Appendix 6).

Several additional bat calls were not identifiable between bentwing and forest bats. These calls could belong to one of a few different species however given the definite records of the Eastern Bentwing-bat they are assumed to belong to that species (Appendix 6).

5.2 Relinquishment Area

5.2.1 Habitat Type

As described in Section 1, as part of the Modification MACH Energy is further restricting the area in the South West Out of Pit Emplacement footprint used for major infrastructure (Figure 3).

Vegetation communities mapped across the wider South West Out of Pit Emplacement area (including the eastern portion being considered as part of this assessment) include the following (Hunter Eco, 2016):

- Narrow-leaved Ironbark (grassy woodland and derived native grassland);
- Spotted Gum/Narrow-leaved Ironbark (grassy woodland and derived native grassland); and
- White Box (grassy woodland and derived native grassland).

The assignment of derived grassland communities was made according to the nearest paddock tree species. Figure 3 shows the vegetation communities mapped across a portion of the South West Out of Pit Emplacement.

Table 1 lists the vegetation communities within the eastern portion of the South West Out of Pit Emplacement footprint being relinquished.

Table 1
Relinquishment Area Vegetation Community

Community	Condition	Status	Area	
Narrow-leaved Ironbark PCT 1605	DNG	-	0.1	**0.4**
	Grassy Woodland	Listed EPBC Act, CE: Central Hunter Valley Eucalypt Forest and Woodland	0.3	
Spotted Gum/Narrow-leaved Ironbark PCT 1602	DNG	-	0.00	**3.9**
	Grassy Woodland	Listed TSC Act, E: Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions; Listed EPBC Act, CE: Central Hunter Valley Eucalypt Forest and Woodland	3.9	
White Box PCT 483	DNG	Listed TSC Act, E: White Box Yellow Box Blakely's Red Gum Woodland; Listed EPBC Act, CE: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	9.1	**10.8**
	Grassy Woodland	Listed TSC Act, E: White Box Yellow Box Blakely's Red Gum Woodland; Listed EPBC Act, CE: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	1.7	
			Total	**15.1**

5.2.2 Flora Species

Appendix 2 provides a list of flora species recorded within the wider South West Out of Pit Emplacement area (including the eastern portion being considered as part of this assessment). Flora surveys conducted in grassland through the western portion of South West Out of Pit Emplacement footprint showed 3.5 times the native species diversity compared with that of the grassland in the rail loop in the current proposal (Mean 28 versus 8 native species per plot).

No threatened flora species or populations were recorded.

5.2.3 Fauna Species

A fauna survey within the eastern portion of the South West Out of Pit Emplacement was conducted by ELA, and a copy of their report is provided in Appendix 5. Bat call analysis was undertaken by Greg Richards and Associates and the results are presented in Appendix 6. In summary, the surveys undertaken within the relinquishment area recorded several threatened species, including:

- Speckled Warbler (*Chthonicola sagittata*) – vulnerable (BC Act);
- Squirrel Glider (*Petaurus norfolcensis*) – vulnerable (BC Act);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) – vulnerable (BC Act) (possible record);
- Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*) – vulnerable (BC Act);and
- Greater Broad-nosed Bat (*Scoteanax rueppellii*) – vulnerable (BC Act) (possible record).

The surveys also recorded Eastern Cave Bat (*Vespadelus troughtoni*) (vulnerable - BC Act) nearby the relinquishment area. Considering that no known caves are located in the vicinity it is expected that this species uses the area for foraging.

Although not recorded during the current surveys, the area is also considered to provide potential habitat (due to the presence of foraging and roosting [hollows] habitat) for several other threatened terrestrial fauna species, including the threatened bats recorded (and possibly recorded) in the vicinity of the rail spur alignment.

6 IMPACT ASSESSMENT

6.1 Habitat for Threatened Species

Tables 2 and 3 present the relative areas of threatened terrestrial fauna habitat present within the Modification disturbance area and also the eastern portion of the South West Out of Pit Emplacement footprint being relinquished via the Modification.

The eastern portion of the South West Out of Pit Emplacement footprint being relinquished contains approximately 9 ha of grassland and 6 ha of woodland with mature trees providing foraging, nesting and roosting habitat for threatened fauna. This area is contiguous with the western portion of South West Out of Pit Emplacement footprint.

The eastern portion of the South West Out of Pit Emplacement footprint being relinquished also contains 15 ha of threatened ecological communities (Table 3).

In summary, when comparing the area to be disturbed and the area being relinquished[2], the Modification would have the following ecological gains:

- 12 ha less threatened fauna species habitat disturbed (15 ha versus 3 ha); and
- 15 ha less BC Act listed threatened ecological community disturbed (15 ha versus 0 ha).

Table 2
Comparison of Threatened Terrestrial Species Habitat

Potential Threatened Terrestrial Fauna Habitat	Area to be Disturbed (ha)	Eastern Portion of South West Out of Pit Emplacement (ha)
Grassland	0	9.2
Planted Trees/Woodland	3.0[1]	5.9
Total	**3.0**	**15.1**

[1.] Consists solely of planted trees used as a visual screen of the Bengalla Emplacement at the corner of Wybong Road and Overton Road and trees planted as part of the Overton Orchard (total 2.9 ha), as well as six hollow trees in the rail loop (approximately 0.1 ha).

Table 3
Comparison of BC Act Listed Threatened Ecological Communities

Threatened Ecological Community		Area to be Disturbed (ha)	Eastern Portion of South West Out of Pit Emplacement (ha)
Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions	Grassy Woodland	0	3.9
White Box Yellow Box Blakely's Red Gum Woodland	Derived Native Grassland	0	9.1
	Grassy Woodland	0	1.7
	Total	**0**	**14.7**

[2] Relinquishment excludes more flexible and relatively minor infrastructure such as light vehicle roads, disturbance associated with water management structures and other ancillary infrastructure.

6.2 Threatened Species

The impact of the Modification on threatened species was assessed for those species known to occur, or considered as possibly occurring in or near the Modification. Appendix 3 provides a list of potential threatened flora and assesses their potential to occur in the Modification disturbance area. No threatened flora species, populations or communities are present or considered potential occurrences. Appendix 4 includes an assessment of the potential for threatened fauna to occur within the Modification disturbance area. Threatened birds and bats are considered potential occurrences and are assessed in the sections below. Birds considered as possible itinerant visitors were not assessed. Assessment of threatened bird and bat species was conducted using the seven factor test from section 5A of the EP&A Act, on the basis that this Modification enjoys the benefit of the savings provision contained in clause 28 of the *Biodiversity Conservation (Savings and Transitional) Regulation, 2017*.

6.2.1 Birds

Scientific Name	Common Name
Nocturnal Raptors	
Ninox connivens	Barking Owl
Tyto novaehollandiae	Masked Owl
Ninox strenua	Powerful Owl
Diurnal Raptors	
Falco subniger	Black Falcon
Hieraaetus morphnoides	Little Eagle
Circus assimilis	Spotted Harrier
Honeyeaters	
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)
Grantiella picta	Painted Honeyeater
Anthochaera phrygia	Regent Honeyeater
Robins and Warblers	
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)
Petroica boodang	Scarlet Robin
Chthonicola sagittata	Speckled Warbler
Parrots and Lorikeets	
Lathamus discolor	Swift Parrot
Neophema pulchella	Turquoise Parrot
Glossopsitta pusilla	Little Lorikeet
Finches	
Stagonopleura guttata	Diamond Firetail
Treecreepers and Sittellas	
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)
Daphoenositta chrysoptera	Varied Sittella
Babblers	
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)
Woodswallows	
Artamus cyanopterus cyanopterus	Dusky Woodswallow

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

There is marginal foraging habitat for the nocturnal and diurnal raptors which they may use sporadically as part of a much larger home range. There were no suitably large hollows for roosting or breeding by the nocturnal raptors. Some tall trees in the rail loop could be suitable nesting trees for the diurnal raptors, however no nests were present.

The planted tree habitat was considered suitable for other threatened birds with a pair of Speckled Warbler recorded on the corner of Wybong and Overton Roads. 14 ha of planted tree habitat would remain including the majority of the vegetation planted by Bengalla along the south side of Wybong Road. There is also a large amount of connected woodland to the west and north-west of the Modification. With respect to the Speckled Warbler any local population would extend into the immediate region to include more birds than the pair recorded. Diamond Firetails are generally sedentary species so their absence suggests that there is not a viable local population using the Modification habitat. The remainder of these birds are generally wintering species to the area meaning that there is unlikely to be a viable local population present. The Modification would not place a viable local population of any of these threatened birds at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

No endangered population of this species has been listed.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not applicable

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

18% of the planted trees habitat would be removed leaving 14 ha.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The planted tree habitat is linear in form with the narrow rail spur (up to 90 m wide) cutting through parts. This would not create habitat fragmentation for these birds.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

The planted tree habitat is mostly in low condition as a consequence of being in a grazing landscape. At best it is likely to be part of a larger foraging area for these birds, other than for the Speckled Warbler.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No critical habitat was present.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

The Modification would not increase losses of these birds. In fact consistent with recovery plan principles, in combination with the associated disturbance relinquishment area, there would be net conservation of bird habitat.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

6.2.2 Bats

Scientific Name	Common Name
Microbats	
Nyctophilus spp.	
Mormopterus norfolkensis	Eastern Freetail-bat
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat
Vespadelus troughtoni	Eastern Cave Bat
Falsistrellus tasmaniensis	Eastern False Pipistrelle
Scoteanax rueppellii	Greater Broad-nosed Bat
Myotis macropus	Southern Myotis
Miniopterus australis	Little Bentwing-bat
Saccolaimus flaviventris	Yellow-bellied Sheath-tailed Bat/ Yellow-bellied Pouched Bat
Megabats	
Pteropus poliocephalus	Grey-headed Flying-fox

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

The insectivorous Microbats variously forage through or over woodland and open grassland. They roost in caves, man-made structures, tree hollows or under loose bark. The Modification is unlikely to displace any of these bats or restrict foraging habitat. Any viable local population would not be placed at risk of extinction.

The Grey-headed Flying Fox is a wide-ranging forager travelling up to 20 km from a roost site to feed on blossom and fruit. Several of the planted and natural tree species when in blossom would provide a food source for these bats. In the context of a 20 km foraging range the loss of the few trees to be cleared by the Modification would not place a viable local population at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

No endangered population of this species has been listed.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not applicable

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Potential Microbat roosting habitat might be removed for one or more of these threatened bats with the loss of paddock trees in the rail loop. Stag watching recorded bats leaving some hollows but the species using them was not determined. Aerial foraging habitat would not be substantially restricted. Surveys have found numerous hollows in the eastern portion of the South West Out of Pit Emplacement footprint being relinquished.

No potential roosting habitat for the Grey-headed Flying-fox would be lost due to the Modification proceeding.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The Modification would not fragment foraging habitat for these bats.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

Negligible habitat for these bats would be removed by the Modification

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No critical habitat was present.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

The Modification would not increase losses of these bats. In fact consistent with recovery plan principles, in combination with the associated disturbance relinquishment area, there would be net conservation of bat habitat.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Modification occurs on predominantly non-native vegetation. However it does involve (for example) the clearing of some native vegetation, including some hollows.

6.2.3 Marsupials

Scientific Name	Common Name
Marsupials	
Dasyurus maculatus	Spotted-tailed Quoll

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

The Spotted-tailed Quoll has very large home ranges, 750 ha for females and 3500 ha for males. Preferred habitat is a variety of vegetation types and the open, disturbed habitat in the Modification would be marginal at best for the species. A viable local population would not be placed at risk of extinction by the Modification proceeding.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

No endangered population of this species has been listed.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not applicable

(d) in relation to the habitat of a threatened species, population or ecological community:

In response to the following three parts, the habitat in the Modification is already almost entirely cleared with some highly fragmented post-clearing planted areas. The Modification will not alter the existing state.

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No critical habitat was present.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Consistent with recovery plan principles, in combination with the associated disturbance relinquishment area, there would be a reduction in disturbance of more suitable habitat.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Modification occurs on predominantly non-native vegetation. However it does involve (for example) the clearing of some native vegetation, including some hollows.

7 SUMMARY

The Modification disturbance area is highly disturbed with little to no resemblance to its pre-clearing natural communities. Remaining vegetation is in very poor condition and provides limited habitat for threatened species. No threatened ecological communities or populations occur. The Modification includes the relinquishment of a portion of the South West Out of Pit Emplacement, which provides higher quality vegetation and habitat compared to the area to be disturbed.

The Modification would result in a net benefit to terrestrial ecology.

8 REFERENCES

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APPENDIX 1

Modification Disturbance Area Floristic List (Recorded in Each Habitat Type)

Habitat	Native Grassland				Planted Trees		Agriculture and Infrastructure						Riparian
Family and Scientific Names	**171004P1**	**171004P2**	**171004P3**	**171004P4**	**171108P2**	**171108P3**	**171108P1**	**171108P4**	**171108P7**	**171110P1**	**171108P5**	**171108P6**	**171108P8**
Adiantaceae (now Pteridaceae)													
Cheilanthes sieberi		4	0.1			0.1							
Aizoaceae													
***Galenia pubescens*	30	40	60	4	80	50	50			0.1		0.1	
Anacardiaceae													
**Schinus molle*					30								
Apiaceae													
**Foeniculum vulgare*										20	40	40	
Asclepiadaceae (now Apocynaceae)													
**Gomphocarpus fruticosus*	0.1			0.1									
Asteraceae													
***Carthamus lanatus*	70	20			8		20	6					
***Xanthium spinosum*										0.1			
**Ambrosia tenuifolia*													6
**Carduus pycnocephalus*										0.2			
**Cirsium vulgare*		0.1										0.1	
**Hedypnois rhagadioloides*	10	70	10	6									
**Hedypnois rhagadioloides* subsp. *cretica*													0.1
**Hypochaeris radicata*				0.1									
**Senecio madagascariensis*	0.1	0.1	0.1	0.1									0.1
**Sonchus asper*	0.1	0.1	0.1	0.1									0.1
**Taraxacum officinale*				6									
**Tragopogon porrifolius*												0.5	
Calotis lappulacea					0.1								

Habitat	Native Grassland				Planted Trees		Agriculture and Infrastructure						Riparian
Chrysocephalum semipapposum		6	0.1										
Vittadinia gracilis						0.1							
Boraginaceae													
***Echium plantagineum*													6
**Heliotropium amplexicaule*													10
Brassicaceae													
**Rapistrum rugosum*								0.1					
Lepidium pseudohyssopifolium					0.1								
Lepidium sp.	0.1	0.1											
Cactaceae													
***Opuntia stricta*				0.1		0.1							
Caryophyllaceae													
**Petrorhagia nanteuilii*	0.1												
Casuarinaceae													
Casuarina cunninghamiana													10
Casuarina glauca						0.1							
Chenopodiaceae													
Enchylaena tomentosa						0.1							
Maireana microphylla	0.2	0.3											
Commelinaceae													
***Tradescantia fluminensis*					0.1								8
Convolvulaceae													
Convolvulus erubescens			0.1		0.1								
Cucurbitaceae													
**Citrullus lanatus*												0.5	

Habitat	Native Grassland				Planted Trees		Agriculture and Infrastructure						Riparian
Cyperaceae													
Fimbristylis dichotoma						0.1							
Fabaceae (Mimosoideae)													
Acacia salicina						8							
Gentianaceae													
**Centaurium erythraea*													0.2
Geraniaceae													
**Geranium molle*											0.1		
Erodium crinitum	20		0.1		8								
Linaceae													
**Linum trigynum*	0.1												
Lomandraceae													
Lomandra confertifolia	15		25	25									
Lomandra filiformis subsp. *filiformis*	4	10				0.2							
Lomandra longifolia			0.1										
Lomandra multiflora subsp. *multiflora*				7									
Malvaceae													
**Malva parviflora*							5	7					
**Pavonia hastata*											0.2	0.1	
**Sida rhombifolia*	4		0.1		25	0.5	6						
Sida corrugata						0.1							
Meliaceae													
Melia azedarach													35
Myrtaceae													
Eucalyptus cladocalyx						15							

Habitat	Native Grassland				Planted Trees		Agriculture and Infrastructure						Riparian
Eucalyptus sideroxylon						0.2							
Nyctaginaceae													
Boerhavia dominii								0.2			0.1		
Oxalidaceae													
**Oxalis pes-caprae*								0.1	0.1				
Papaveraceae													
**Eschscholzia californica*													0.2
Phormiaceae													
Dianella longifolia			0.1										
Plantaginaceae													
**Plantago lanceolata*	4	20			1	10				2	10		0.2
Poaceae													
***Chloris gayana*													0.1
***Hyparrhenia hirta*			25	10									
***Paspalum dilatatum*										0.1			
**Avena sativa*									15	0.2	10	50	0.5
**Bromus catharticus*									20	0.1			
**Bromus molliformis*	0.1	0.1		0.1			6						
**Cynodon dactylon*					80	0.1	80	95		80	20	6	1
**Hordeum leporinum*							1	0.1					
**Lolium perenne*	0.1	0.1	0.1	0.1	0.1		10	0.1	50	8			2
**Melinis repens*													50
**Paspalum dilatatum*									50				
**Paspalum urvillei*												40	10
**Sorghum halepense*											30		

Habitat	Native Grassland				Planted Trees		Agriculture and Infrastructure						Riparian
**Urochloa panicoides*								6					
Aristida ramosa	90	40	80	45									
Austrostipa scabra	15	20	0.3										
Austrostipa sp.						6							
Bothriochloa decipiens var. *decipiens*		40		45									
Chloris ventricosa	0.2	0.2											
Cymbopogon refractus	0.1	0.1											
Eragrostis alveiformis					0.1								
Rytidosperma sp.						1							
Sporobolus creber					3	40							
Polygonaceae													
**Emex australis*										1			
**Polygonum aviculare*										0.1	0.1		
Portulacaceae													
Portulaca oleracea								0.5					
Primulaceae													
**Lysimachia arvensis*										0.1			0.2
Proteaceae													
**Grevillea robusta*					10								
Rubiaceae													
**Galium aparine*												0.1	
Salicaceae													
***Populus nigra 'Italica'*													3
Sapindaceae													
***Cardiospermum grandiflorum*													30

Habitat	Native Grassland				Planted Trees		Agriculture and Infrastructure						Riparian
Scrophulariaceae													
Myoporum montanum						0.1							
Solanaceae													
***Cestrum parqui*													10
***Lycium ferocissimum*	0.1				0.2								
Solanum cinereum	0.1												
Verbenaceae													
**Verbena bonariensis*	0.1	0.3	0.1	0.3						1	0.1		0.2

* Weeds ** High Threat Weeds.
Values are % cover as per the NSW Biodiversity Assessment Method.

APPENDIX 2

South West Out of Pit Emplacement Area Floristic List

Acanthaceae
Brunoniella australis
Adiantaceae
Cheilanthes sieberi
Aizoaceae
**Galenia pubescens*
Asclepiadaceae
**Gomphocarpus fruticosus*
Asteraceae
**Carthamus lanatus*
**Cirsium vulgare*
**Senecio madagascariensis*
Chrysocephalum semipapposum
Brassicaceae
Lepidium pseudohyssopifolium
Campanulaceae
Wahlenbergia luteola
Chenopodiaceae
Einadia polygonoides
Maireana microphylla
Commelinaceae
Commelina cyanea
Cyperaceae
**Cyperus aggregatus*
Euphorbiaceae
Phyllanthus virgatus
Fabaceae (Faboideae)
**Medicago polymorpha*
**Trifolium* sp.
Glycine clandestina
Glycine tabacina
Lomandraceae
Lomandra glauca
Malvaceae
**Modiola caroliniana*
**Sida rhombifolia*

Sida corrugata
Sida hackettiana
Oxalidaceae
Oxalis perennans
Plantaginaceae
**Plantago lanceolata*
Poaceae
**Cynodon dactylon*
**Panicum antidotale*
**Paspalum dilatatum*
**Setaria parviflora*
**Urochloa panicoides*
Aristida ramosa
Austrostipa scabra subsp. *falcata*
Bothriochloa decipiens
Dichanthium sericeum
Digitaria brownii
Enteropogon acicularis
Eragrostis alveiformis
Eragrostis leptostachya
Eriochloa pseudoacrotricha
Panicum queenslandicum
Paspalidium constrictum
Rytidosperma bipartitum
Sporobolus caroli
Sporobolus creber
Polygonaceae
Rumex brownii
Portulacaceae
Portulaca oleracea
Solanaceae
Solanum cinereum
Verbenaceae
**Verbena rigida*
Zygophyllaceae
Tribulus micrococcus

APPENDIX 3

Threatened Flora, Populations and Communities Likelihood of Occurrence within the Modification Disturbance Area

Threatened Flora

Scientific Name	Common Name	Status BC Act	Status EPBC Act	Likelihood of Occurrence
Diuris tricolor	Pine Donkey Orchid	V	-	**None**. No suitable habitat and impacted by long-term grazing.
Prasophyllum sp. Wybong	A leek-orchid	E	CE	**None**. No suitable habitat and impacted by long-term grazing.
Thesium australe	Austral Toadflax	V	V	**None**. No suitable habitat and impacted by long-term grazing.

V = vulnerable, E = endangered, CE = critically endangered

Threatened Populations

Endangered Population	Likelihood of Occurrence
Acacia pendula population in the Hunter catchment	**None**. No *Acacia pendula* present.
Cymbidium canaliculatum population in the Hunter Catchment[1]	**None.** No *Cymbidium canaliculatum* present.
Diuris tricolor population in the Muswellbrook local government area	**None**. No suitable orchid habitat.

Threatened Communities

Community	Status BC Act	Status EPBC Act	Likelihood of Occurrence
Central Hunter Grey Box-Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions	E	-	**None**. No native woodland present.
Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions	E	-	**None**. No native woodland present.
Central Hunter Valley Eucalypt Forest and Woodland	-	CE	**None**. No native woodland present.
Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions	E	-	**None**. No native woodland present.
Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions	E	-	**None**. No native woodland present.
Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion	V	-	**None**. No native woodland present.
Hunter Valley Weeping Myall Woodland in the Sydney Basin Bioregion	CE	CE	**None**. No native woodland present.
Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion	E	-	**None**. No native woodland present.
White Box Yellow Box Blakely's Red Gum Woodland	E	CE	**None**. No native woodland present.

APPENDIX 4

Mount Pleasant Operation Rail Modification – Terrestrial Fauna Survey Report
(Eco Logical Australia, 2017b)

Mount Pleasant Operation Rail Modification

Terrestrial Fauna Survey Report

Prepared for
MACH Energy Australia Pty Ltd

12 December 2017

DOCUMENT TRACKING

Item	Detail
Project Name	Mount Pleasant Operation Rail Modification – Terrestrial Fauna Survey Report
Project Number	17MUD/8820
Project Manager	Kalya Abbey 02 4302 1238 Level 1, 79 Market St MUDGEE NSW 2850
Prepared by	Tom Schmidt, Kalya Abbey
Reviewed by	Daniel Magdi, Martin Sullivan
Approved by	Daniel Magdi
Status	FINAL
Version Number	5
Last saved on	12 January 2018
Cover photo	Narrow-leaved Ironbark in derived native grassland in the rail loop area (ELA 2017)

This report should be cited as 'Eco Logical Australia 2017. *Mount Pleasant Operation Rail Modification – Terrestrial Fauna Survey Report*. Prepared for MACH Energy Australia Pty Ltd.'

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Resource Strategies Pty Ltd.

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Abbreviations

Abbreviation	Description
BC Act	NSW *Biodiversity Conservation Act, 2016*
DA	Development Application
ELA	Eco Logical Australia Pty Ltd
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*
ha	hectare
km	Kilometre
m	Metre
MACH Energy	MACH Energy Australia Pty Ltd
Mtpa	million tonnes per annum
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
ROM	run-of-mine
SEPP 44	State Environmental Planning Policy No. 44 - Koala Habitat Protection

1 Introduction

Eco Logical Australia Pty Ltd (ELA) was engaged by MACH Energy Australia Pty Ltd (MACH Energy) to undertake targeted terrestrial fauna surveys for the proposed Rail Modification (the Modification) at the Mount Pleasant Operation. The fauna surveys have been undertaken to inform the potential presence of threatened fauna listed under the New South Wales (NSW) *Biodiversity Conservation Act, 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act), and habitat in the vicinity of the Modification.

The Mount Pleasant Operation Development Consent DA 92/97 was granted on 22 December 1999. The Mount Pleasant Operation was also approved under the EPBC Act in 2012 (EPBC 2011/5795).

The approved Mount Pleasant Operation includes the construction and operation of an open cut coal mine and associated rail spur and product coal loading infrastructure located approximately three kilometres (km) north-west of Muswellbrook in the Upper Hunter Valley of NSW.

The mine is approved to produce up to 10.5 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal. Up to approximately nine trains per day of thermal coal products from the Mount Pleasant Operation will be transported by rail to the port of Newcastle for export or to domestic customers for use in electricity generation.

1.1 The Modification

The ultimate extent of the approved Bengalla Mine open cut intersects the approved Mount Pleasant Operation rail spur.

While the intersection of the Bengalla Mine open cut with the approved Mount Pleasant Operation rail infrastructure is still some years away, MACH Energy is proposing a Rail Modification to obtain approval for rail and/or conveyor product transport facilities to manage this future interaction.

The Modification would primarily comprise:

- duplication of the approved rail spur, rail loop, conveyor and rail load-out facility and associated services;
- duplication of the Hunter River water supply pump station, water pipeline and associated electricity supply that currently follows the rail spur alignment; and
- demolition and removal of the redundant approved infrastructure within the extent of the Bengalla Mine, once the new rail, product loading and water supply infrastructure has been commissioned and is fully operational.

The Modification would not alter the number of approved train movements on the rail network or operational workforce of the Mount Pleasant Operation.

The current proposed layout of the Modification is shown in **Figure 1**.

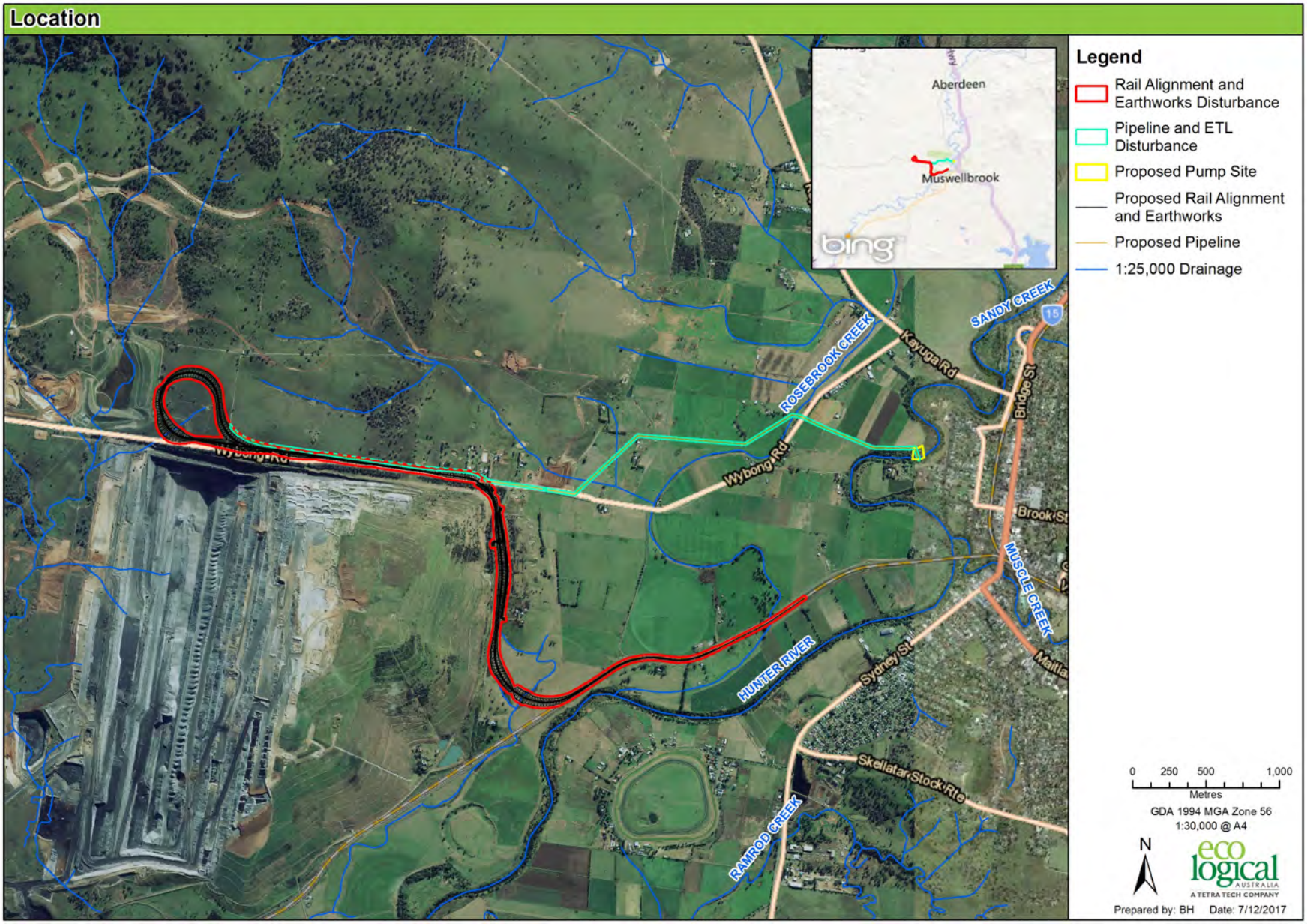

Figure 1: Proposed MOD 4 layout and study area

1.2 Study Area

The study area for the field survey includes the extent of additional disturbance (i.e. disturbance not already approved) associated with the rail loop and spur, water supply pipeline, electricity transmission line to the pump station, and other supporting infrastructure. A detailed description of the Modification is provided in the main text of the Modification Environmental Assessment.

The study area is shown in **Figure 1**.

While the extent of disturbance will be limited where possible, it has been conservatively assessed that the entire study area may be subject to potential impacts.

1.3 Objectives

The fauna survey has been undertaken to provide the following information:

- a description of the fauna habitat characteristics of the study area and surrounds;
- identification of threatened fauna species within the study area;
- identification of habitat corridors and linkages between areas of remnant native vegetation that assist fauna movement through the area; and
- an assessment against the *State Environmental Planning Policy No. 44 - Koala Habitat Protection* (SEPP 44).

2 Methods

2.1 Data Audit

Searches of the following databases were undertaken for the study area:

- BioNet Atlas of NSW Wildlife (Office of Environment and Heritage [OEH] 2017a) for the area bound by coordinates North: -32.16 West: 150.72 East: 150.99 South: -32.37 (Datum GDA94), a radius of 10 km from all study area elements.
- EPBC Protected Matters Search Tool (DoEE 2017a) using a 10 km buffer around coordinates -32.259886 150.881013, -32.268015 150.875005, -32.276143 150.853548, -32.273458 150.850114, -32.261628 150.851745, -32.257927 150.826768, -32.252047 150.828313, -32.260467 150.852689, -32.259886 150.880842, -32.259886 150.881013 (Datum GDA94).
- the Species Credit Species list generated from the BioBanking Credit Calculator (OEH 2017c) for the study area.

Threatened species identified in the database searches together with an assessment of the likelihood of occurrence for each species is provided in **Appendix A**. Each species' likelihood of occurrence was determined by reviewing records in the area, considering the habitat available and using expert knowledge of the species ecology.

Five terms for the likelihood of occurrence of species are used in this report, as defined below:

- "yes" = the species was or has been recorded on the site (i.e. the species is known to occur);
- "likely" = a medium to high probability that a species uses the site;
- "potential" = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely, or unlikely to occur;
- "unlikely" = a very low to low probability that a species uses the site; and
- "no" = habitat on site and in the vicinity is unsuitable for the species.

2.2 Field Survey

The study area was surveyed over six days by ELA ecologists Tom Schmidt and Timothy Henderson. Field survey was undertaken from the 8th to the 10th November 2017, with collection of remaining field monitoring equipment (songmeters and remote cameras) on the 13th November 2017. Temperatures were cool to warm, ranging from 4.6 degrees Celsius (°C) to 27.6 °C, with light to moderate winds. No rainfall was recorded during the survey. Weather records were collected from the nearest public weather station in Scone (Bureau of Meteorology 2017) (**Table 1**).

Table 1: Weather Conditions During the Field Survey*

Date	Minimum Temperature (°C)	Maximum Temperature (°C)	Rainfall (mm)	Wind speed (3pm) (km/h)
8 November 2017	12.5	22.8	0	30
9 November 2017	4.6	26.1	0	31
10 November 2017	5.5	27.3	0	24
11 November 2017	6.4	27.5	0	33
12 November 2017	7.7	27.6	0	24
13 November 2017	12.5	22.8	0	13

*Weather observations were taken from www.bom.gov.au, for Scone (station 061363).

The field survey was designed to target those Species Credit Species generated from the BioBanking Credit Calculator and their habitats (including, for example, tree hollows and native tussock grasses) identified from the data audit as potential, likely or known to occur within the study area.

The sugvnb rvey design was informed by and consistent with, relevant NSW and Commonwealth survey guidelines, including the NSW *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft)* (DEC 2004), *Survey Guidelines for Australia's Threatened Birds* (Department of Environment, Water, Heritage and the Arts [DEWHA] 2010a), *Survey Guidelines for Australia's Threatened Bats* (DEWHA 2010b), *Survey Guidelines for Australia's Threatened Mammals* (Department of Sustainability, Environment, Water, Population and Communities [SEWPaC] 2011a) and *Survey Guidelines for Australia's Threatened Reptiles* (SEWPaC 2011b). The survey consisted of:

- fauna habitat mapping and recording of habitat values (including hollow-bearing trees and a Koala (*Phascolarctos cinereus*) habitat assessment infomed by SEPP 44);
- diurnal bird surveys;
- microbat detection devices (Songmeter SM2);
- remote camera surveys (Reconyx Hyperfire);
- nocturnal mammal and reptile surveys (spotlighting, active searches and call playback);
- active reptile searches;
- stag watching; and
- opportunistic fauna sightings recorded throughout the study area.

Fauna survey methods, the corresponding guidelines and survey effort justification are detailed below in **Table 2**.

Figure 2 shows the field survey locations.

Table 2: Fauna Survey Methods

Fauna Group	Survey Type	Timing	Guideline Suggested Survey Effort	Survey Method	Justification
Reptiles	Habitat search	Nov- March	30 minute search on two separate days targeting specific habitat per 100 hectare (ha) stratification unit (DEC 2004). Methods for the Pink-tailed Worm-lizard (*Aprasia parapulchella*) typically include: • Searches restricted to an area of relatively homogeneous habitat within each site and a search beneath all rocks that can be turned is made. • Rock cover density rather than fixed area size determines a plot, and 150 to 200 rocks need to be turned to be reasonably confident of determining the species' presence or absence (DSEWPC 2011b). Methods for the Striped Legless Lizard (*Delma impar*) typically include: • In areas with surface rock, artificial shelter site surveys or rock turning should be the primary technique. Active searching (checks under surface rock and debris and around tussocks) can generally be undertaken throughout the year as long as any limitations with respect to this survey technique are clearly outlined (DSEWPC 2011b). • In areas with little to no rocky habitat, artificial shelter site surveys or pitfall trapping should be used in conjunction with hand searches around tussocks. Artificial shelter sites should be installed at least three months prior to the initial survey/checks. They should typically be placed in vegetated areas. Tile grids should consist of 50 tiles, at five metre (m) spacing between tiles, arranged in a grid of 10 tiles by five, preferably positioned on a northerly aspect. As a minimum, two tile grids should be used for sites less than 2 ha in size, one grid per 3 ha for sites up to 30 ha, and 10 grids for sites greater than 30 ha in size. Artificial shelter sites should be checked at least twice a month, and ideally once a week during spring to early summer (that is, between early September to December). Shelter sites should not be checked more than once a week as this may lead to Striped Legless Lizards abandoning the artificial shelters (DSEWPC 2011b).	Two active searches of at least 30 minutes on two separate days in potential habitat. Including rock, log and debris turning, and searching around tussocks. Surveys undertaken in mornings during November. Passive observations also made while travelling around the study area. Two 1 hour spotlighting surveys were also undertaken targeting suitable habitat for reptiles.	Surveys focused on highest quality habitat in the study area, and utilised suggested methods, except for tile grids and pitfalls which were unsuitable due to timeframes. Active searches of surface rock, logs and debris were undertaken. Rock and tussock habitat within the study area was sufficient to undertake active searches. The targeted species for this survey were the Pink-tailed Worm-lizard and the Striped Legless Lizard.
	Pitfall traps	Nov- March	24 trap nights preferably using six traps per 100 ha stratification unit (DEC 2004).		
	Spotlight search	Nov- March	30 minute search on two separate nights targeting specific habitat (DEC 2004).		

Fauna Group	Survey Type	Timing	Guideline Suggested Survey Effort	Survey Method	Justification
Birds	Area search	All year	20 minute, 1 ha (200 m x 500 m) search per stratification unit -time curve approach (DEC 2004). Methods for the Regent Honeyeater (*Anthochaera phrygia*) involves area searches in suitable habitat, preferably in the morning but other times may also be appropriate. Detection by call is possible when birds are most vocal (outside the breeding season). Otherwise, detection is by sighting. Targeted searches of woodland patches with heavily flowering trees is useful, especially around water points such as dams and creek lines (DEWHA 2010a).	20 minute diurnal bird surveys were undertaken within the proposed modification area during the morning and afternoon on two separate days. One further survey was also completed by a single ecologist. Five locations were surveyed as part of this survey. Total survey effort approximately 13 person hours.	The target woodland species for this survey were the Regent Honeyeater, and the Painted Honeyeater (*Grantiella picta*). Other threatened woodland birds and raptors were also covered using this method. No suitable wetland habitat is present.
	Water source census	All year	20 minute survey at dawn or dusk at each water source (DEC 2004).		
	Wetland census	All year	1 hour census for each wetland at dawn or dusk (DEC 2004).		
Terrestrial and Arboreal mammals	Small Elliott traps	All year	100 trap nights over three to four consecutive nights per stratum up to 50 ha (DEC 2004).	Four remote cameras were set up on bait stations for five nights (17 survey nights), targeting the threatened Spotted-tailed Quoll (*Dasyurus maculatus*) within best available habitat in the study area. Two 1 hour nocturnal spotlighting surveys were conducted targeting suitable habitat for mammals within potential fauna habitat. This method was used to target the Squirrel Glider (*Petaurus norfolcensis*) and Koala. No trapping was undertaken within the survey area due to a lack of potential habitat, scattered nature of vegetation and the site being dominated by grassland (native and exotic).	Targeted species were the Spotted-tailed Quoll, Squirrel Glider and Koala. Remote cameras are being used more readily to replace methods such as pitfall traps and hair tubes as a less invasive survey method. Remote cameras, spotlighting and call-playback were considered the most suitable technique given the limited, open habitat in the study area.
	Large Elliott	All year	100 trap nights over three to four consecutive nights per stratum up to 50 ha (DEC 2004).		
	Arboreal Elliott traps	All year	24 trap nights over three to four consecutive nights per stratum up to 50 ha (DEC 2004).		
	Wire cage traps	All year	24 trap nights over three to four consecutive nights per stratum up to 50 ha (DEC 2004).		
	Pitfall traps with drift nets	All year	24 trap nights over three to four consecutive nights per stratum up to 50 ha (DEC 2004).		
	Hair tubes	All year	10 large and 10 small in pairs for four days and four nights (DEC 2004).		
	Arboreal hair tubes	All year	Three tubes in each of 10 habitat trees up to 100 ha four days and four nights (DEC 2004).		
	Spotlighting on foot	All year	2 x 1 hour and 1 km, up to 200 ha of stratum unit (DEC 2004).		
	Call playback	All year	Two sites per stratum, up to 200 ha, plus additional site per additional 100 ha above 200 ha (DEC 2004).		
	Stag-watching	All year	Potential roost hollows 30 minutes before, and 60 minutes after sunset (DEC 2004).		

Fauna Group	Survey Type	Timing	Guideline Suggested Survey Effort	Survey Method	Justification
	Search for scats and signs	All year	30 minutes at each relevant habitat (DEC 2004).	Call playback was completed at two sites targeting the Squirrel Glider. Stag watching was also undertaken at one site on one evening.	
	Collection of predator scats	All year	Opportunistic collection.		
	Remote Cameras	All year	Baited camera traps may be of use in confirming the presence and to identity the Spotted-tailed Quoll (SEWPaC 2011a).		
Bats	Harp trapping / Mist Netting	October-March	Effort per 100 ha of preferred habitat – four trap nights over two consecutive nights (DEC 2004). For the Large-eared Pied Bat (*Chaninolobus dwyeri*), it is recommended that harp trapping / mist netting is undertaken for a total survey effort of 16 detector nights over a minimum of four night period (DEWHA 2010b). For the Corben's Long-eared Bat (*Nyctophilius corbeni*), it is recommended that harp trapping / mist netting be undertaken for a total survey effort of 20 detector nights over a minimum of five night period (DEWHA 2010b).	Four bat call detection devices were placed in potential habitat for threatened microbats (i.e. hollow-bearing trees and flyways) over five consecutive nights (20 bat call detection nights). Two 1 hour nocturnal spotlighting surveys were conducted targeting suitable habitat for mammals within potential fauna habitat.	Bat call detection devices will identify most threatened species that may occur within the Modification area (including the Large-eared Pied Bat), apart from *Nyctophilus* sp. which are hard to identify from bat call detection devices. Threatened bats unable to be positively identified by calls alone will be conservatively assumed to be present, based on its genus being recorded, and subject to expert consideration. Spotlighting targeted the Grey-headed Flying-fox.
	Call recording	October-March	Effort per 100 ha of preferred habitat – two recording devices for two nights (DEC 2004). For the Large-eared Pied Bat, it is recommended that unattended bat detectors are in place for a total survey effort of 16 detector nights over a minimum of four night period (DEWHA 2010b).		
	Habitat search	All year	Search for bats and bat excreta (DEC 2004). For the Grey-headed Flying-fox (*Pteropus poliocephaslus*), daytime searches are the primary method for determining the presence of unrecorded day roosts. Flying-foxes are recognised easily from a distance while they roost or are in flight, and have distinctive audible calls that are heard most frequently in the early morning or under sunny conditions. Other signs include their distinctive odour and droppings. Both the ground and foliage should be examined for flying fox scats. Night time surveys can be undertaken by walking transects (100 m apart) looking for feeding and flying bats (DEWHA 2010b).		
Amphibians	Tadpole search and nocturnal survey	September-May	200 m transect per water body for two hours on two separate nights (DEC 2004).	Not undertaken during survey.	No threatened amphibian species are likely or have the potential to occur in the study area.

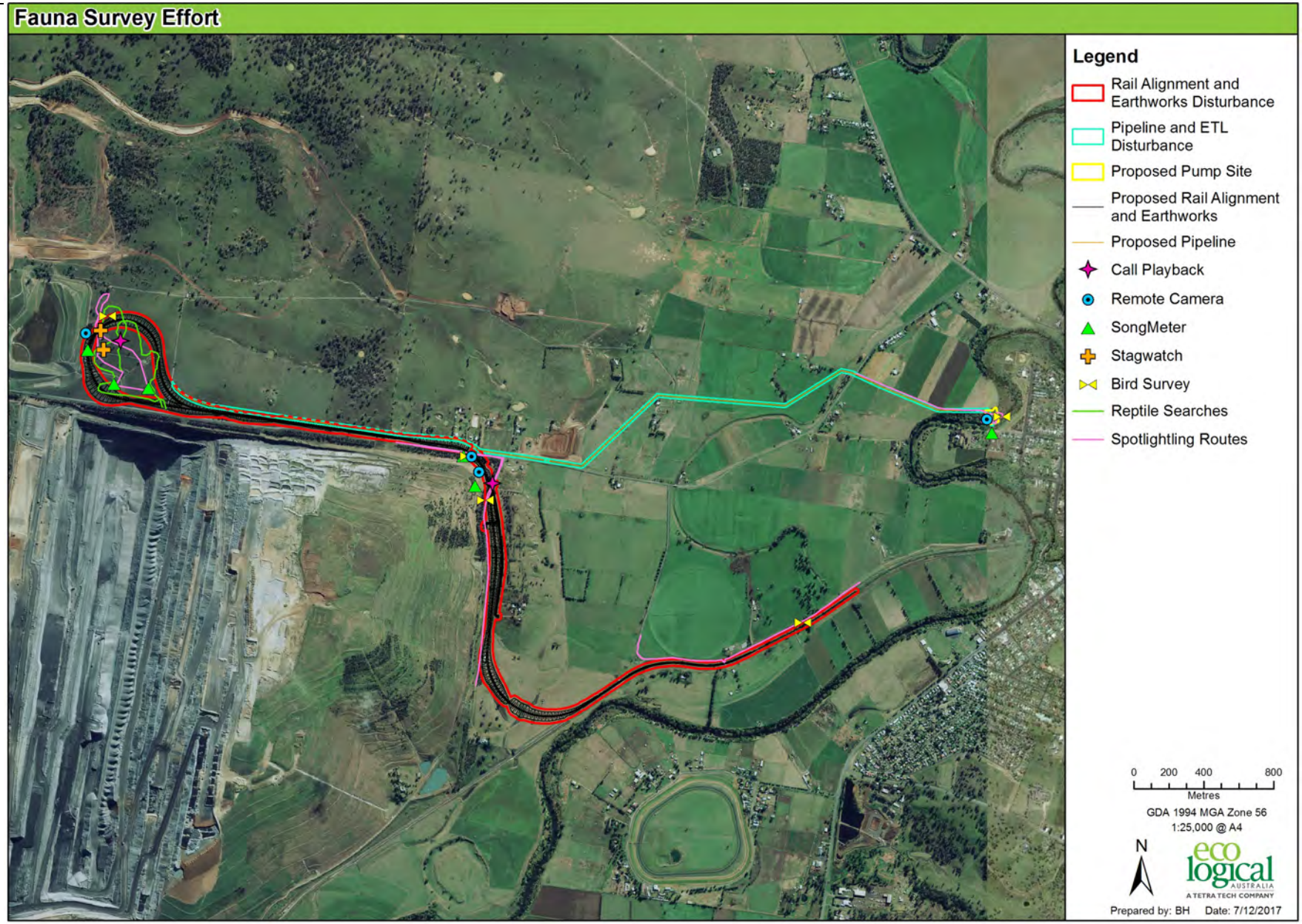

Figure 2: Fauna survey effort

2.2.1 Diurnal Bird Surveys

Diurnal bird surveys were conducted by performing 20 minute point counts at five different locations across the study area by two ecologists during the morning and afternoon (one further survey was conducted by a single ecologist on 13th November). The survey locations were positioned in a representative sample of fauna habitats present within the study area (see **Figure 2**). All five sites were each surveyed four times on two mornings and two afternoons, resulting in approximately 13 person hours of bird survey in total. Bird species were identified using both visual and acoustic cues. Opportunistic bird observations were conducted while travelling around the study area.

2.2.2 Microbat Surveys

Microbat surveys were conducted using songmeters set to detect ultrasonic bat calls. The songmeters were placed at six separate locations across the study area (see **Figure 2**) targeting potential habitat, in particular hollow-bearing trees and flyways among planted vegetation. At two locations, the songmeter was set for the five nights, and at other locations songmeters were moved after two nights and left in place at other locations for the remaining three nights of the survey. Stag watching (see **Section 2.2.4**) also attempted to identify any microbats exiting from potential roost sites in tree hollows. Calls were analysed by expert Dr Greg Richards, from Greg Richards and Associates.

2.2.3 Reptile Surveys

Reptile surveys consisted of both passive and active searches within the study area. Opportunistic (passive) observations of reptiles were recorded while walking and driving throughout the study area, during both day and night. Active searches involved hand searching of micro-habitat including log, rock and debris turning, as well as searching around grass tussocks. Active searches were undertaken by two ecologists for half an hour (one person hour) during mid-morning (9.00 am – 11.00 am), and opportunistically throughout the survey. Active reptile searches focused on areas of most suitable habitat for target threatened reptiles including the Striped Legless Lizard and Pink-tailed Worm Lizard. Two searches were completed on separate days, and a total of approximately 150 different logs, rocks and pieces of debris were inspected, as well as tussock searches (**Figure 2**).

2.2.4 Terrestrial and Arboreal Mammal Surveys

Remote cameras were positioned at four sites (see **Figure 2**) over five nights for a combined survey effort of 17 nights (one camera, at the Hunter River, was removed after two nights). The remote cameras were baited with a chicken drumstick and tinned tuna with the aim of targeting Spotted-tailed Quoll.

Spotlighting surveys were conducted for at least one hour by two ecologists on each of the two nights (8 and 9 of November 2017), targeting suitable habitat for nocturnal mammals and reptiles in the study area. Total survey effort for spotlighting was four person hours.

Call playback was completed at two sites. Calls of Squirrel Glider were broadcast using a loud speaker for five minutes, followed by a 15 minute period of quiet listening and spotlighting.

Stag watching was undertaken at one site on one evening. Two observers watched hollows in different trees for approximately half an hour before dusk, until half an hour after dusk, in an attempt to observe nocturnal fauna emerging. Stag watching was followed by spotlighting of the area.

Areas of potential habitat for the Koala were spotlighted and inspected for signs of Koala such as scats and scratch marks on tree trunks.

3 Results

3.1 Fauna Habitats

The study area is largely cleared, consisting of open paddocks with a mixed native/exotic grassland and some scattered remnant trees, or agricultural land under grazing or cropping. Other habitats in the study area include plantings of both native and exotic trees and shrubs, and disturbed areas dominated by weeds.

3.1.1 Mixed Native/Exotic Derived Grassland

The rail loop in the west of the study area contains derived native grassland with large, scattered remnant trees (mostly Narrow-leaved Ironbark [*Eucalyptus crebra*]), many of which (approximately six trees) contain numerous hollows (**Photograph 1**). A small number of regenerating saplings are present close to some of the isolated paddock trees, however the area is otherwise devoid of shrubs and mid-storey vegetation. The area includes native tussock-forming grasses (*Austrostipa* spp.), with significant weed cover, in particular Galenia (*Galenia pubescens*), Saffron Thistle (*Carthamus lanatus*) and Narrow-leaved Cotton Bush (*Gomphocarpus fruticosus*).

Ground disturbance associated with both historical and recent construction of contour banks also covers a portion of this area, and *Galenia pubescens* dominates the recently disturbed areas (**Photograph 2**). Surface rock is sparse and usually deeply embedded, with the majority of loose surface rock occurring along disturbed contours. Logs and farm debris (scraps of metal) are also scattered across the area. Significant disturbance from foraging Feral Pig (*Sus scrofa*) covers much of the grassland area, and a group of eight Feral Pigs was regularly observed in this area during surveys (**Photograph 3**).

Photograph 1: Derived native grassland in the study area, with scattered Narrow-leaved Ironbark (*Eucalyptus crebra*), including some with hollows.

Photograph 2: Disturbed ground in contour bank dominated by *Galenia pubescens*.

Photograph 3: Surface disturbance (centre of photograph in inter-tussock spaces) from Feral Pigs in derived native grassland.

Small farm dams are present in the rail loop area; however, they contain no aquatic or fringing vegetation. The hollow-bearing trees in this area contain potential roosting habitat for hollow-dependent microbat species. No large hollows suitable for owl species or arboreal mammals are present. Poor connectivity and a lack of mid-storey vegetation limit the suitability of the habitat in this area for arboreal mammals such as the Squirrel Glider.

3.1.2 Plantings

Plantings in the study area consist of planted native species associated with mine rehabilitation and screening, and farm plantings of mostly exotic species. An area of Bengalla Mine land in the corner of Wybong and Overton Roads consists of planted native (indigenous and non-indigenous) woodland trees and shrubs, approximately 15–20 years old (**Photograph 4**). Flowering Eucalypt species present a foraging resource for nectarivorous birds and the presence of mid-storey vegetation makes this area the only real habitat in the study area for woodland birds. Lack of mature, hollow-bearing trees and limited connectivity to areas of higher quality habitat reduce the likelihood of this area providing important habitat for any threatened fauna species.

Other plantings mostly consist of rows of exotic or non-indigenous trees and shrubs (**Photograph 5**). These areas present limited habitat features suitable to support significant fauna species.

Photograph 4: Planted native vegetation (15-20 years old) adjacent to Wybong and Overton Roads.

Photograph 5: Other plantings among heavily grazed agricultural land.

3.1.3 Agricultural Land

Areas in the east of the study area are on the Hunter River floodplain and consist mostly of agricultural land that is either heavily grazed or cropped (**Photograph 6**). These areas generally contain no trees with a disturbed ground layer dominated by exotic species. These areas present low quality fauna habitat and are considered unlikely to provide important habitat for any threatened fauna species in the study area.

Photograph 6: Agricultural land on Hunter River floodplain showing grazed and cropped areas.

3.1.4 Hunter River Riparian Area

The Hunter River riparian area is highly disturbed, consisting mainly of exotic vegetation. Exotic weed trees Willow (*Salix* sp.) dominate the immediate riparian area and overhang the river, with patches of exotic Poplar (*Populus* sp.) present further from the river. Some native River Oak (*Casuarina cunninghamiana*) were regenerating close to the river in this area, however these trees would be avoided by the Modification. The ground layer is dominated by exotic grasses and herbs, with limited habitat features for fauna such as fallen timber and log (**Photograph 7**).

The riparian habitat in the study area does not contain other significant features such as hollow-bearing trees or nectar resources and is considered low quality habitat for other threatened fauna species.

Photograph 7: Hunter River riparian area with disturbed ground layer, exotic *Salix* sp. and *Populus* sp., and a regenerating native *Casuarina cunninghamiana*.

3.1.5 Disturbed Areas

Portions of the study area within the existing rail corridor mostly consist of highly disturbed land with much of the ground impacted by emplaced ballast rock and vegetation dominated by weed species (**Photograph 8**). These areas present low quality fauna habitat and are considered unlikely to provide important habitat for any threatened fauna species in the study area.

Photograph 8: Disturbed rail corridor dominated by exotic ground layer.

3.1.6 Koala Habitat

The areas containing designated Koala 'Feed tree species' as listed under Schedule 2 of SEPP 44 have been identified within the study area. The scheduled Koala 'Feed tree species' present within the study area is River Red Gum (*Eucalyptus camaldulensis*).

Potential Koala habitat is defined in section 4 of SEPP 44 as being 'Feed tree species' that constitute at least 15% of the total number of trees. River Red Gum occurs in the rail corridor in the south east of the study area (**Photograph 9**), although trees in this area will not be removed. No evidence of Koalas (sightings, scratches or scats) was recorded in the study area, and no part of the study area qualifies as core Koala habitat due to the absence of evidence of attributes such as breeding females, or recent sightings, as per the definition in section 4 of SEPP 44.

Photograph 9: Red River Gum (*Eucalyptus camaldulensis)* in rail corridor (trees will not be removed in this area, proposed works involve signal trenching only).

3.2 Fauna Species

A total of 93 fauna species were recorded within the study area during the field survey period. This consisted of 65 birds (60 native, five introduced), 10 non-flying mammals (four native and six introduced), 15 native microbats (not listed in Appendix B), and three native reptiles (**Appendix B**).

Three threatened species were recorded during the field survey (**Figure 3**):

- *Chthonicola sagittata* (Speckled Warbler) – vulnerable (BC Act);
- *Miniopterus schreibersii (orianae) oceanensis* (Eastern Bentwing-bat) – vulnerable (BC Act); and
- *Mormopterus norfolkensis* (Eastern Freetail-bat) – vulnerable (BC Act).

Surveys also conservatively identified possible records of three other threatened bats, although the records were not able to be confidently confirmed as these species. These bats include *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat) and *Scoteanax rueppellii* (Greater Broad-Nosed Bat) (all listed as vulnerable under the BC Act).

Threatened species previously recorded within 10 km of the study area are shown in **Figure 4**.

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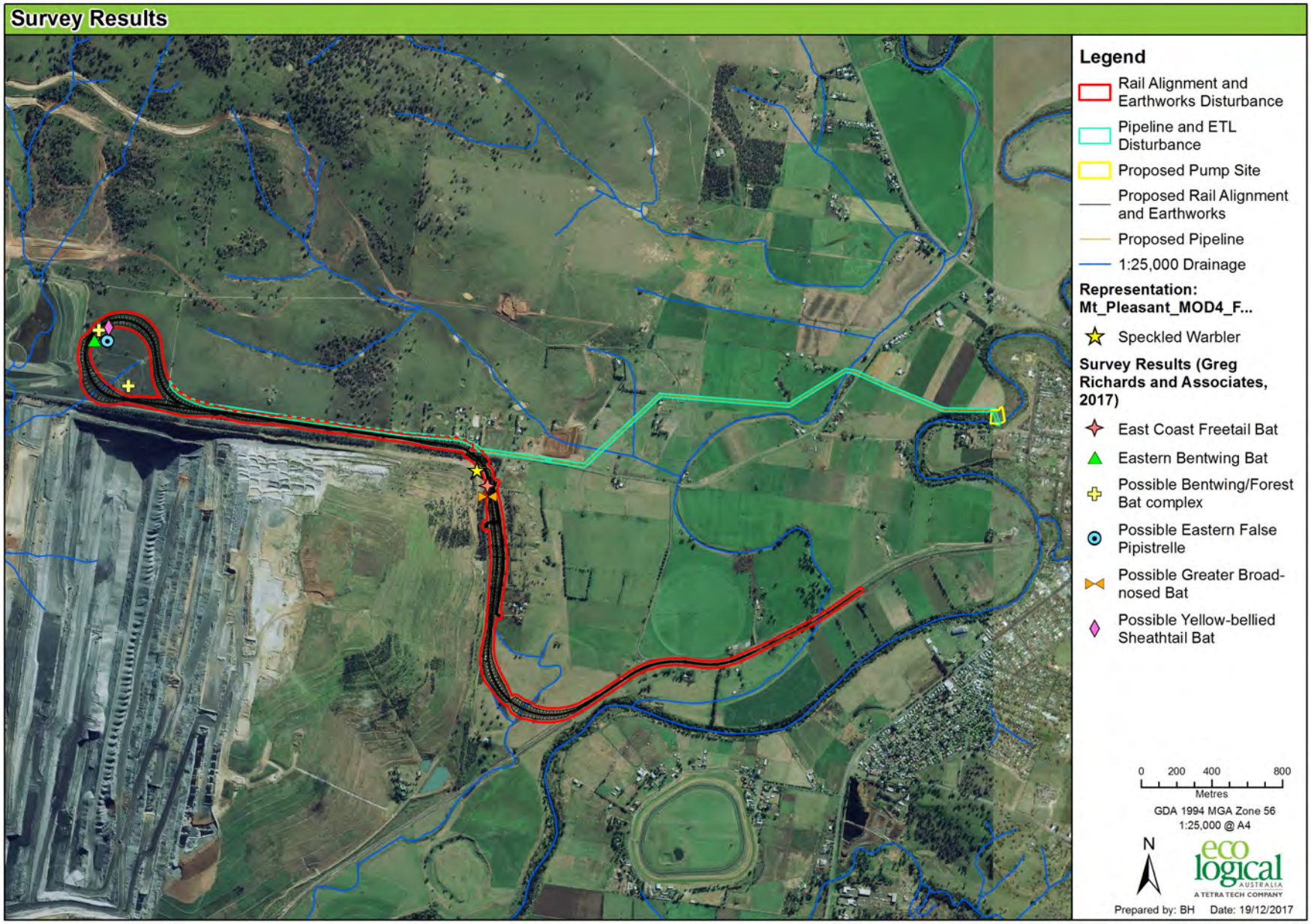

Figure 3: Fauna survey results

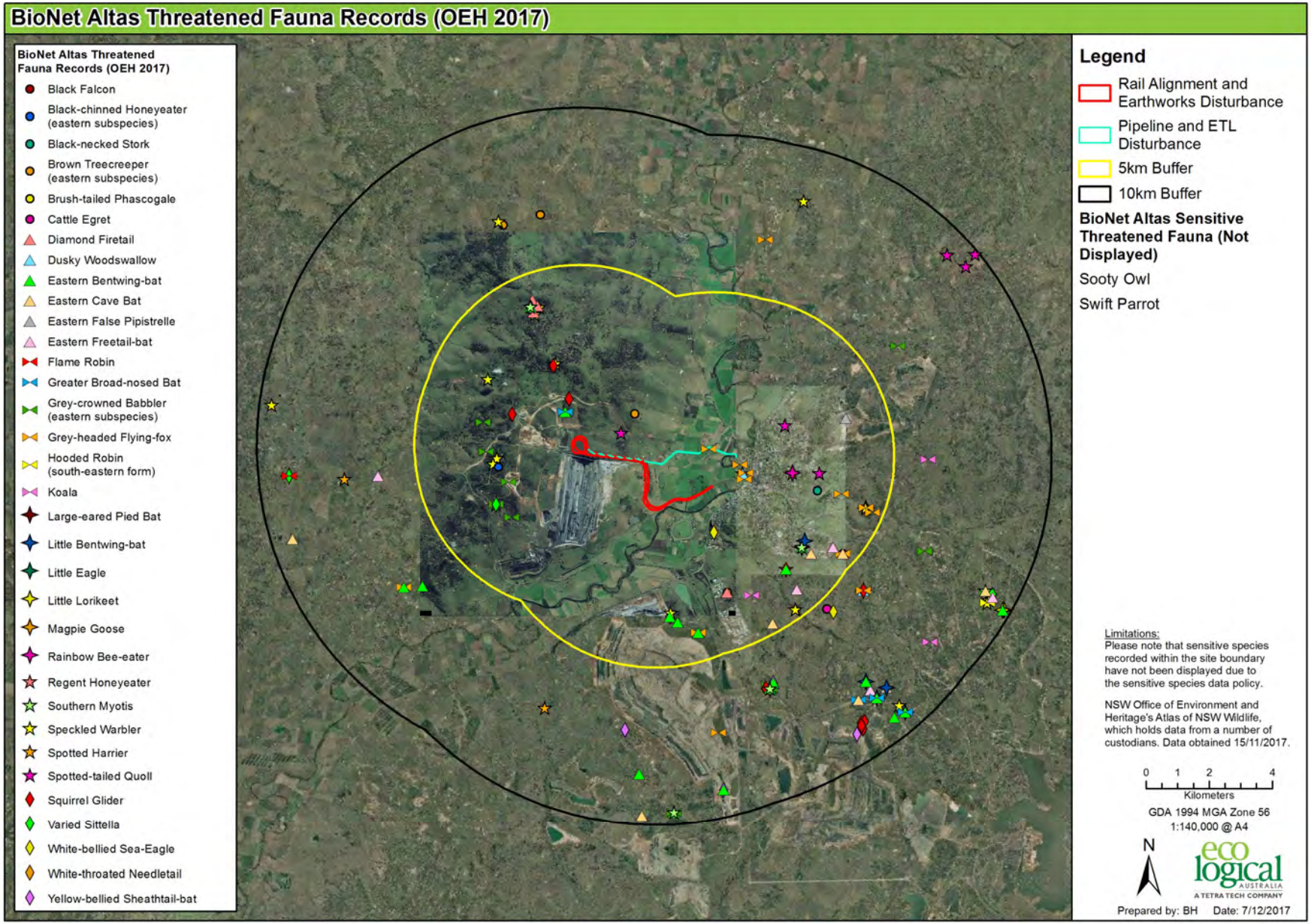

Figure 4: Threatened Species Database Records (OEH 2017a)

No further threatened species were recorded. A further 26 species listed under the BC Act and/or EPBC Act were considered potential (24) or likely (two) to occur in the study area as a result of the data audit (**Appendix A**). Most species assessed as having potential to occur in the study area are mobile species such as woodland birds and raptors, which are considered unlikely to regularly use the study area however may occur in marginal habitats present on occasion while moving between higher quality habitats in the region. *Circus assimilis* (Spotted Harrier) and *Glossopsitta pusilla* (Little Lorikeet) were assessed as likely to occur in the study area (**Appendix A**) and are discussed below.

3.2.1 Diurnal Birds

Sixty-three (63) diurnal bird species were recorded during the field survey, including one threatened species - *Chthonicola sagittata* (Speckled Warbler), listed as vulnerable under the BC Act. Speckled Warbler was recorded from within planted woodland vegetation (**Figure 3**), with a maximum of two individuals recorded. It is considered likely that this species breeds in the study area as the Speckled Warbler is a sedentary species, and a pair was regularly recorded in the same territory among suitable breeding habitat during the survey which took place during the breeding season (August-January) (OEH 2017b).

Target threatened species Regent Honeyeater and Painted Honeyeater were not recorded during the field survey. A small amount of low quality habitat is present for these species in the study area and although these mobile species have the potential to occur in the study area, it is considered unlikely they would regularly visit the study area or be reliant on its resources for breeding. A number of other threatened bird species, mostly woodland birds and raptors, are considered to have the potential to occur in the study area on occasion (**Appendix A**).

Spotted Harrier is a mobile raptor that occupies a variety of habitats including open woodland and agricultural land and is considered likely to occur in the study area as part of a wide home range, as this species is highly mobile and the study area contains suitable habitat for the species (OEH 2017b). Little Lorikeet is a nomadic, nectar forager that utilises flowering Eucalypts (OEH 2017b). The species is considered likely to occur in the study area when eucalypts are in flower as suitable foraging habitat is present in both remnant *Eucalyptus crebra* and planted vegetation and the species is mobile and known to occur in the region. Little Lorikeet typically nests in hollows of smooth-barked Eucalypts, of which none are present in the study area.

Cattle Egret (*Ardea ibis*) and Rainbow Bee-eater (*Merops ornatus*), both listed as a Marine species under the EPBC Act, were recorded in the study area during the survey. Both species are common and widespread occupying a variety of habitats including cleared areas and farmlands.

3.2.2 Nocturnal Birds

Two (2) nocturnal bird species, Tawny Frogmouth (*Podargus strigoides*) and Barn Owl (*Tyto alba*) were recorded during the field survey. No threatened nocturnal bird species were recorded during the current survey and no large hollows suitable for nesting by threatened large forest owls Barking Owl (*Ninox connivens*) and Powerful Owl (*Ninox strenua*) are present in the study area.

3.2.3 Reptiles

Three (3) native reptile species were recorded in the study area. No listed threatened reptile species were recorded.

Suitable habitat for Striped Legless Lizard is present in derived native grassland of the study area (rail loop area). This area contains key habitat requirements including tussock grasslands and some surface debris (DoEE 2017b; OEH 2017b), however existing disturbance reduces the quality of the habitat and the likelihood of occurrence. Historic earthworks occurred over much of this area in the late 1960's (evidenced by historic aerial photography), and recent earthworks for contour banks have also impacted some of this habitat. Current foraging activity of Feral Pigs is causing significant ground disturbance in much of the study area, reducing the quality of potential habitat for reptiles such as Striped Legless Lizard. Targeted active searches focused on areas of most suitable habitat and did not record the species, as such, Striped Legless Lizard is considered unlikely in the study area.

Pink-tailed Worm-lizard was targeted during the survey based on the results of the data audit. No suitable habitat for Pink-tailed Worm-lizard is present in the study area due to the absence of naturally occurring loose surface rock.

3.2.4 Bats

Microbat calls recorded during the surveys undertaken across the study area were analysed by Dr Greg Richards of Greg Richards and Associates. The microbat surveys recorded a total of 3,271 call sequences, of which 2,979 (91%) were able to be analysed. Definite calls for two threatened species listed under the BC Act were recorded species as follows (Greg Richards and Associates 2017):

- Eastern Bentwing-bat (*Miniopterus schreibersii [orianae] oceanensis)* – vulnerable (BC Act); and
- Eastern Freetail-bat (*Mormopterus norfolkensis)* – vulnerable (BC Act).

Surveys also conservatively identified possible records of three other threatened bats, although the records were not able to be confidently confirmed as these species. These bats include Eastern False Pipistrelle, Yellow-bellied Sheathtail-bat and Greater Broad-Nosed Bat (all listed as vulnerable under the BC Act) (Greg Richards and Associates 2017).

While microbats were observed flying during stag watching (**Figure 3**), it was unclear whether these bats emerged from hollows within the study area. Nevertheless, it is considered likely that hollows within this area are used by hollow-dependent microbat species.

No Large-eared Pied Bats were recorded in the study area. This species is found mainly in areas containing extensive cliffs and caves, among well-timbered areas with gullies, and its morphology suggests it forages below the forest canopy (OEH 2017b). Habitat for this species in the study area is therefore considered to be marginal at best and only one record exists from within 10 km of the study area. The majority of records for this species occur south and west of the study area in high quality habitats associated with remnant forests and sandstone escarpments (ALA 2017). This species is considered unlikely to occur in the study area based on the paucity of suitable habitat and distribution of records.

No Grey-headed Flying-foxes were recorded during spotlighting. A Flying-fox camp is known adjacent to the Hunter River in Muswellbrook, within 1 km of the study area (DoEE 2017c). It is likely that some Grey-headed Flying-foxes from this camp would visit the study area for foraging resources on occasions when Eucalypts are in flower, including those located in planted vegetation and remnant *Eucalyptus crebra* in the rail loop area. Potential roosting habitat for this species is limited to trees in the Hunter River riparian area, although none of this habitat will be removed for the Modification.

3.2.5 Terrestrial and Arboreal Mammals

Four native mammal species (excluding bats) were recorded; Eastern Grey Kangaroo (*Macropus giganteus*), Red-neck Wallaby (*Macropus rufogriseus*), Swamp Wallaby (*Wallabia bicolor*), and Common Brushtail Possum (*Trichosurus vulpecula*). Six introduced mammal species were recorded. No threatened mammal species (excluding bats) were recorded during the targeted fauna survey.

Targeted spotlighting and call-playback did not detect any Squirrel Gliders in the study area. The Squirrel Glider is considered unlikely to occur in the study area based on the poor connectivity of the hollow-bearing trees that are present, and an absence of any habitat areas with both hollow-bearing trees and suitable midstorey foraging resources.

Targeted survey using baited remote cameras did not record Spotted-tailed Quoll in the study area. The open habitat in the study area is unlikely to provide important habitat for Spotted-tailed Quoll which prefers wooded areas, however the species does occupy large home ranges, up to 3,500 ha (OEH 2017b), and may utilise parts of the study area on occasion as part of a large home range centred on higher quality habitats to the north and west of the study area. The study area contains no suitable den site habitat for Spotted-tailed Quoll.

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Appendix A Likelihood of Occurrence – Fauna Species

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution* overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	# of records within 5 km of study area	# of records within 10 km of study area	Likelihood of occurrence, and potential habitat
Heleioporus australiacus	Giant Burrowing Frog	V	V	South eastern NSW and Victoria, in two distinct populations: a northern population in the sandstone geology of the Sydney Basin as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria.	No	None	Yes	No	0	0	No
Litoria aurea	Green and Golden Bell Frog	E	V	Since 1990, recorded from ~50 scattered sites within its former range in NSW, from the north coast near Brunswick Heads, south along the coast to Victoria. Records exist west to Bathurst, Tumut and the ACT region.	Yes	Marginal	Yes	No	0	0	Unlikely
Litoria booroolongensis	Booroolong Frog	E	E	Restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. Several populations have recently been recorded in the Namoi catchment.	Yes	None	No	No	0	0	No
Litoria brevipalmata	Green-thighed Frog	V	-	Isolated localities along the coast and ranges from just north of Wollongong to south-east QLD.	Yes	None	Yes	No	0	0	No

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution* overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	# of records within 5 km of study area	# of records within 10 km of study area	Likelihood of occurrence, and potential habitat
Aprasia parapulchella	Pink-tailed Worm-lizard	V	V	In NSW, only known from the Central and Southern Tablelands, and the South Western Slopes.	Yes	None	No	No	0	0	No
Delma impar	Striped Legless Lizard	V	V	In NSW, occurs in the Southern Tablelands, the South West Slopes and possibly on the Riverina.	Yes	Marginal	Yes	No	0	0	Unlikely
Hoplocephalus bitorquatus	Pale-headed Snake	V	-	In NSW, it occurs from the coast to the western side of the Great Divide as far south as Tuggerah. Historically recorded west to Mungindi and Quambone on the Darling Riverine Plains, across the North West Slopes, and the New England Tablelands.	Yes	None	Yes	No	0	0	No
Hoplocephalus stephensii	Stephens' Banded Snake	V	-	Coast and ranges from Southern QLD to Gosford in NSW.	Yes	None	Yes	No	0	0	No
Anseranas semipalmata	Magpie Goose	V	-	In NSW, found in central and northern parts of the state, with vagrants as far as south-eastern NSW.	Yes	None	Yes	No	0	1	Unlikely
Stictonetta naevosa	Freckled Duck	V	-	Inland river systems, occurring as far as coastal NSW in times of drought.	Yes	None	Yes	No	0	0	No
Ephippiorhynchus asiaticus	Black-necked Stork	E	-	Coastal and subcoastal northern and eastern Australia, south to central-eastern NSW and with vagrants recorded further south and inland.	Yes	None	Yes	No	1	1	No
Botaurus poiciloptilus	Australasian Bittern	E	E	Found over most of NSW except for the far north-west.	Yes	None	Yes	No	0	0	No

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution* overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	# of records within 5 km of study area	# of records within 10 km of study area	Likelihood of occurrence, and potential habitat
Ardea ibis	Cattle Egret	-	-	Widespread and common across NSW.	Yes	Good	Yes	Yes	2	4	Yes, in grassland, agricultural lands.
Falco subniger	Black Falcon	V	-	Sparsely distributed in NSW, occurring mostly in inland regions.	Yes	Good	Yes	No	1	1	Potential, open grasslands.
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	Distributed along the coastline of mainland Australia and Tasmania, extending inland along some of the larger waterways, especially in eastern Australia.	Yes	None	Yes	No	2	4	Unlikely
Circus assimilis	Spotted Harrier	V	-	Found throughout the Australian mainland, except in densely forested or wooded habitats, and rarely in Tasmania.	Yes	Good	Yes	No	2	4	Likely, forages over open grasslands.
Erythrotriorchis radiatus	Red Goshawk	CE	V	In NSW, extends to ~30°S. Recent records confined to the Northern Rivers region north of the Clarence River.	No	None	No	No	0	0	No
Lophoictinia isura	Square-tailed Kite	V	-	In NSW, it is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast.	Yes	Marginal	Yes	No	0	0	Unlikely

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution* overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	# of records within 5 km of study area	# of records within 10 km of study area	Likelihood of occurrence, and potential habitat
Hieraaetus morphnoides	Little Eagle	V	-	Throughout the Australian mainland, with the exception of the most densely-forested parts of the Dividing Range escarpment.	Yes	Marginal	Yes	No	0	1	Potential, may forage over all habitats in study area.
Burhinus grallarius	Bush Stone-curlew	E	-	In NSW, found sporadically in coastal areas, and west of the divide throughout the sheep-wheat belt.	Yes	Marginal	Yes	No	0	0	Unlikely
Rostratula australis	Australian Painted Snipe	E	E	In NSW, most records are from the Murray-Darling Basin. Other recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys.	Yes	None	Yes	No	0	0	No
Numenius madagascariensis	Eastern Curlew	-	CE, M	Summer migrant to Australia. Primarily coastal distribution in NSW, with some scattered inland records.	Yes	None	Yes	No	0	0	No
Calidris ferruginea	Curlew Sandpiper	E	CE, M	Occurs along the entire coast of NSW, and sometimes in freshwater wetlands in the Murray-Darling Basin.	Yes	None	Yes	No	0	0	No
Ptilinopus superbus	Superb Fruit-Dove	V	-	Principally from north-eastern QLD to north-eastern NSW. Further south, it is confined to pockets of suitable habitat, and occurs as far south as Moruya.	Yes	None	Yes	No	0	0	No
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	In NSW, widespread along coast and inland to the southern tablelands and central western plains, with a small population in the Riverina.	Yes	None	Yes	No	0	0	No

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution* overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	# of records within 5 km of study area	# of records within 10 km of study area	Likelihood of occurrence, and potential habitat
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	In NSW, distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. Isolated records known from as far north as Coffs Harbour and as far west as Mudgee.	Yes	None	Yes	No	0	0	No
Glossopsitta pusilla	Little Lorikeet	V	-	In NSW, found from the coast westward as far as Dubbo and Albury.	Yes	Marginal	Yes	No	2	8	Likely, paddock trees and planted vegetation.
Neophema pulchella	Turquoise Parrot	V	-	Occurs along the length of NSW from the coastal plains to the western slopes of the Great Dividing Range.	Yes	Marginal	Yes	No	0	0	Potential, paddock trees and planted vegetation.
Lathamus discolor	Swift Parrot	E	CE	Migrates from Tasmania to mainland in Autumn-Winter. In NSW, the species mostly occurs on the coast and South West Slopes.	Yes	Marginal	Yes	No	0	4	Potential, paddock trees and planted vegetation.
Tyto tenebricosa	Sooty Owl	V	-	Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands.	Yes	None	Yes	No	0	1	No
Tyto novaehollandiae	Masked Owl	V	-	Recorded over approximately 90% of NSW, excluding the most arid north-western corner. Most abundant on the coast but extends to the western plains.	Yes	Marginal	Yes	No	0	0	Potential, paddock trees, planted vegetation and riparian areas.

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution* overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	# of records within 5 km of study area	# of records within 10 km of study area	Likelihood of occurrence, and potential habitat
Ninox strenua	Powerful Owl	V	-	In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains.	Yes	Marginal	Yes	No	0	0	Potential, paddock trees, planted vegetation and riparian areas.
Ninox connivens	Barking Owl	V	-	Wide but sparse distribution in NSW, avoiding the most central arid regions. Core populations exist on the western slopes and plains and in some north-east coastal and escarpment forests.	Yes	Marginal	Yes	No	0	0	Potential, paddock trees and planted vegetation.
Hirundapus caudacutus	White-throated Needletail	-	M	All coastal regions of NSW, inland to the western slopes and inland plains of the Great Divide.	Yes	Marginal	Yes	No	1	3	Unlikely
Merops ornatus	Rainbow Bee-eater	-	-	Distributed across much of mainland Australia, including NSW.	Yes	Good	Yes	Yes	1	2	Yes, may forage over vegetated areas and open country.
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	From eastern through central NSW, west to Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell.	Yes	Marginal	Yes	No	5	9	Potential, planted vegetation or paddock trees when moving between higher quality habitats.

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution* overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	# of records within 5 km of study area	# of records within 10 km of study area	Likelihood of occurrence, and potential habitat
Chthonicola sagittata	Speckled Warbler	V	-	From south-eastern QLD, the eastern half of NSW and into Victoria, as far west as the Grampians, mostly on hills and tablelands of the Great Dividing Range and rarely on the coast.	Yes	Good	Yes	Yes	13	22	Yes, planted vegetation.
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	Widespread in NSW from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. Also, Richmond and Clarence River areas and a few scattered sites in the Hunter, Central Coast and Illawarra regions.	Yes	Marginal	Yes	No	1	1	Potential, planted vegetation and paddock trees.
Anthochaera phrygia	Regent Honeyeater	CE	CE	Inland slopes of south-east Australia, and less frequently in coastal areas. In NSW, most records are from the North-West Plains, North-West and South-West Slopes, Northern Tablelands, Central Tablelands and Southern Tablelands regions. The Lower Hunter and Central Coast have also seen many records in recent years.	Yes	Marginal	Yes	No	1	1	Potential, planted vegetation and paddock trees.
Grantiella picta	Painted Honeyeater	V	V	Widely distributed in NSW, predominantly on the inland side of the Great Dividing Range but avoiding arid areas.	Yes	Marginal	Yes	No	0	0	Potential, planted vegetation and paddock trees.

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution* overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	# of records within 5 km of study area	# of records within 10 km of study area	Likelihood of occurrence, and potential habitat
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-	Found throughout much of inland NSW, with the exception of the extreme north-west, where it is replaced by subspecies *picata.*	Yes	Marginal	Yes	No	0	1	Potential, planted vegetation and paddock trees.
Petroica phoenicea	Flame Robin	V	-	In NSW, breeds in upland areas, and in winter many birds move to the inland slopes and plains, or occasionally to coastal areas. Likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands.	Yes	None	Yes	No	0	1	Unlikely
Petroica boodang	Scarlet Robin	V	-	In NSW, it occurs from the coast to the inland slopes.	Yes	Marginal	Yes	No	0	0	Potential, paddock trees, riparian area and planted vegetation.
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	In NSW, occurs on the western slopes of the Great Dividing Range, and as far as Louth and Balranald on the western plains. Also occurs in woodlands in the Hunter Valley and in some locations on the north coast.	Yes	Marginal	Yes	No	5	12	Potential, paddock trees and planted vegetation.
Daphoenositta chrysoptera	Varied Sittella	V	-	Distribution in NSW is nearly continuous from the coast to the far west.	Yes	Marginal	Yes	No	1	4	Potential, paddock trees and planted vegetation.

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution* overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	# of records within 5 km of study area	# of records within 10 km of study area	Likelihood of occurrence, and potential habitat
Rhipidura rufifrons	Rufous Fantail	-	M	Coastal and near coastal districts of northern and eastern Australia, including on and east of the Great Divide in NSW.	Yes	Marginal	Yes	No	0	0	Potential, riparian area and planted vegetation.
Monarcha melanopsis	Black-faced Monarch	-	M	In NSW, occurs around the eastern slopes and tablelands of the Great Divide, inland to Coutts Crossing, Armidale, Widden Valley, Wollemi National Park and Wombeyan Caves. It is rarely recorded farther inland.	Yes	Marginal	Yes	No	0	0	Potential, riparian habitat or planted vegetation.
Myiagra cyanoleuca	Satin Flycatcher	-	M	In NSW, widespread on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains.	Yes	Marginal	Yes	No	0	0	Potential, riparian area and planted vegetation.
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	Widespread in NSW from coast to inland including the western slopes of the Great Dividing Range and farther west. Species have also been recorded in southern and southwestern Australia.	Yes	Marginal	Yes	No	2	4	Potential, paddock trees, riparian area, and planted vegetation.
Motacilla flava	Yellow Wagtail	-	M	Regular summer migrant to mostly coastal Australia. In NSW recorded Sydney to Newcastle, the Hawkesbury and inland in the Bogan LGA.	Yes	Marginal	Yes	No	0	0	Unlikely

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution* overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	# of records within 5 km of study area	# of records within 10 km of study area	Likelihood of occurrence, and potential habitat
Stagonopleura guttata	Diamond Firetail	V	-	Widely distributed in NSW, mainly recorded in the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina, and less commonly found in coastal areas and further inland.	Yes	Marginal	Yes	No	5	5	Potential, grassland, paddock trees and planted vegetation.
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern QLD.	Yes	Marginal	Yes	No	3	6	Potential, grasslands and planted vegetation.
Phascogale tapoatafa	Brush-tailed Phascogale	V	-	In NSW it is mainly found east of the Great Dividing Range although there are occasional records west of the divide.	Yes	None	Yes	No	0	1	Unlikely
Planigale maculata	Common Planigale	V	-	Occurs in coastal north-eastern NSW, and reported from as far south as the central NSW coast west of Sydney.	Yes	Marginal	No	No	0	0	Unlikely
Phascolarctos cinereus	Koala	V	V	In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. There are sparse and possibly disjunct populations in the Bega District, and at several sites on the southern tablelands.	Yes	Marginal	Yes	No	1	3	Unlikely

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution* overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	# of records within 5 km of study area	# of records within 10 km of study area	Likelihood of occurrence, and potential habitat
Cercartetus nanus	Eastern Pygmy-possum	V	-	In NSW it extends from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes.	Yes	None	Yes	No	0	0	No
Petaurus norfolcensis	Squirrel Glider	V	-	Widely though sparsely distributed on both sides of the Great Dividing Range in eastern Australia, from northern QLD to western Victoria.	Yes	Marginal	Yes	No	4	15	Unlikely
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	In NSW they occur from the QLD border in the north to Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit.	Yes	None	Yes	No	0	0	No
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Along the eastern coast of Australia, from Bundaberg in QLD to Melbourne in Victoria.	Yes	Marginal	Yes	No	9	13	Potential foraging. No Roosting.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	There are scattered records of this species across the New England Tablelands and North West Slopes. Rare visitor in late summer and autumn to south-western NSW.	Yes	Good	Yes	Yes	1	5	Potential, occurs in most habitats with and without trees.
Mormopterus norfolkensis	Eastern Freetail-bat	V	-	Found along the east coast from southern QLD to southern NSW.	Yes	Marginal	Yes	No	4	14	Yes, riparian area, paddock trees and planted vegetation.

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution* overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	# of records within 5 km of study area	# of records within 10 km of study area	Likelihood of occurrence, and potential habitat
Miniopterus australis	Little Bentwing-bat	V	-	East coast and ranges south to Wollongong in NSW.	Yes	Marginal	Yes	No	1	5	Potential, riparian area and planted vegetation.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	In NSW it occurs on both sides of the Great Dividing Range, from the coast inland to Moree, Dubbo and Wagga Wagga.	Yes	Good	Yes	Yes	8	24	Yes, wide-ranging species recorded from most habitats including open areas.
Nyctophilus corbeni	Corben's Long-eared Bat	V	V	Distribution coincides approximately with the Murray Darling Basin; the Pilliga Scrub region is the distinct stronghold for this species.	Yes	None	Yes	No	0	0	Unlikely
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Recorded from Rockhampton in QLD south to Ulladulla in NSW. Largest concentrations of populations occur in the sandstone escarpments of the Sydney basin and the NSW north-west slopes.	Yes	Marginal	Yes	No	1	1	Unlikely
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	South-east coast and ranges of Australia, from southern QLD to Victoria and Tasmania. In NSW, records extend to the western slopes of the Great Dividing Range.	Yes	None	Yes	No	1	6	Potential

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution* overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	# of records within 5 km of study area	# of records within 10 km of study area	Likelihood of occurrence, and potential habitat
Myotis macropus	Southern Myotis	V	-	In NSW, found in the coastal band. It is rarely found more than 100 km inland, except along major rivers.	Yes	Marginal	Yes	Yes	2	5	Potential, riparian area.
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Both sides of the great divide, from the Atherton Tableland in QLD to north-eastern Victoria, mainly along river systems and gullies. In NSW it is widespread on the New England Tablelands.	Yes	Marginal	Yes	No	1	4	Potential, riparian area, paddock trees and planted vegetation.
Vespadelus troughtoni	Eastern Cave Bat	V	-	Found in a broad band on both sides of the Great Dividing Range south to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT.	Yes	Marginal	Yes	No	3	7	Potential, riparian area, paddock trees and planted vegetation. Foraging only.
Pseudomys novaehollandiae	New Holland Mouse	-	V	Fragmented distribution across eastern NSW.	Yes	None	Yes	No	0	0	No

Note: * - distributions for threatened species gathered from threatened species profiles (OEH 2017b) and Atlas of Living Australia records (ALA 2017).

Appendix B Fauna Species Recorded During Field Survey of Study Area between 8 and 13 November 2017

Common Name	Scientific Name	Status		Diurnal Bird Census	Remote Camera	SongMeter	Spotlighting	Reptile Search	Incidental
		BC Act	EPBC Act						
Reptiles									
Wood Gecko	*Diplodactylus vittatus*	-	-				x		
Tree Skink	*Egernia striolata*	-	-					x	
Eastern Brown Snake	*Pseudonaja textilis*	-	-					x	
Birds									
Brown Quail	*Coturnix ypsilophora*	-	-	x					
Straw-necked Ibis	*Threskiornis spinicollis*	-	-	x					
Cattle Egret	*Bubulcus ibis*	-	-	x					
Great Cormorant	*Phalacrocorax carbo*	-	-	x					
Nankeen Kestrel	*Falco cenchroides*	-	-	x					
Brown Falcon	*Falco berigora*	-	-	x					
Black-shouldered Kite	*Elanus axillaris*	-	-	x					
Black Kite	*Milvus migrans*	-	-	x					
Wedge-tailed Eagle	*Aquila audax*	-	-	x					
Crested Pigeon	*Ocyphaps lophotes*	-	-	x					
Bar-shouldered Dove	*Geopelia humeralis*	-	-	x					
Spotted Dove*	*Spilopelia chinensis*	-	-	x					
Galah	*Eolophus roseicapilla*	-	-	x					
Little Corella	*Cacatua sanguinea*	-	-	x					
Sulphur-crested Cockatoo	*Cacatua galerita*	-	-	x					
Rainbow Lorikeet	*Trichoglossus haematodus moluccanus*	-	-	x					
Crimson Rosella	*Platycercus elegans*	-	-	x					
Eastern Rosella	*Platycercus eximius*	-	-	x					
Red-rumped Parrot	*Psephotus haematonotus*	-	-	x					

Common Name	Scientific Name	Status		Diurnal Bird Census	Remote Camera	SongMeter	Spotlighting	Reptile Search	Incidental
		BC Act	EPBC Act						
Australian King-parrot	*Alisterus scapularis*	-	-	x					
Pacific Koel	*Eudynamys orientalis*	-	-	x					
Barn Owl	*Tyto alba*	-	-						x
Tawny Frogmouth	*Podargus strigoides*	-	-				x		
Dollarbird	*Eurystomus orientalis*	-	-	x					
Laughing Kookaburra	*Dacelo novaeguineae*	-	-	x					
Sacred Kingfisher	*Todiramphus sanctus*	-	-	x					
Rainbow Bee-eater	*Merops ornatus*	-	-	x					
Speckled Warbler	*Chthonicola sagittata*	V	-	x					
Superb Fairy-wren	*Malurus cyaneus*	-	-	x					
White-browed Scrubwren	*Sericornis frontalis*	-	-	x					
Buff-rumped Thornbill	*Acanthiza reguloides*	-	-	x					
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	-	-	x					
Yellow Thornbill	*Acanthiza nana*	-	-	x					
Yellow-faced Honeyeater	*Lichenostomus chrysops*	-	-	x					
White-plumed Honeyeater	*Lichenostomus penicillatus*	-	-	x					
Noisy Miner	*Manorina melanocephala*	-	-	x					
Noisy Friarbird	*Philemon corniculatus*	-	-	x					
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	-	-	x					
Red Wattlebird	*Anthochaera carunculata*	-	-	x					
Scarlet Honeyeater	*Myzomela sanguinolenta*	-	-	x					
Rufous Whistler	*Pachycephala rufiventris*	-	-	x					
Grey Fantail	*Rhipidura albiscapa*	-	-	x					
Willie Wagtail	*Rhipidura leucophrys*	-	-	x					
Magpie-lark	*Grallina cyanoleuca*	-	-	x					
Pied Butcherbird	*Cracticus nigrogularis*	-	-	x					
Australian Magpie	*Cracticus tibicen*	-	-	x	x				
Pied Currawong	*Strepera graculina*	-	-	x					
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	-	-	x					

Common Name	Scientific Name	Status		Diurnal Bird Census	Remote Camera	SongMeter	Spotlighting	Reptile Search	Incidental
		BC Act	EPBC Act						
Olive-backed Oriole	*Oriolus sagittatus*	-	-	x					
Australian Raven	*Corvus coronoides*	-	-	x	x				
White-winged Chough	*Corcorax melanorhamphos*	-	-	x					
Common Blackbird*	*Turdus merula*	-	-	x					
Common Starling*	*Sturnus vulgaris*	-	-	x					
Common Myna*	*Acridotheres tristis*	-	-	x					
Welcome Swallow	*Hirundo neoxena*	-	-	x					
Fairy Martin	*Petrochelidon ariel*	-	-	x					
Tree Martin	*Petrochelidon nigricans*	-	-	x					
Silvereye	*Zosterops lateralis*	-	-	x					
Brown Songlark	*Megalurus cruralis*	-	-	x					
House Sparrow*	*Passer domesticus*	-	-	x					
Golden-headed Cisticola	*Cisticola exilis*	-	-	x					
Australasian Pipit	*Anthus novaeseelandiae*	-	-	x					
Red-browed Finch	*Neochmia temporalis*	-	-	x					
Zebra Finch	*Taeniopygia guttata*	-	-	x					
Double-barred Finch	*Taeniopygia bichenovii*	-	-	x					
Mammals									
Common Brushtail Possum	*Trichosurus vulpecula*	-	-		x		x		
Eastern Grey Kangaroo	*Macropus giganteus*	-	-		x		x		x
Red-necked Wallaby	*Macropus rufogriseus*	-	-				x		x
Swamp Wallaby	*Wallabia bicolor*	-	-		x				
Black Rat*	*Rattus rattus*	-	-		x		x		
Red Fox*	*Vulpes vulpes*	-	-		x		x		
Feral Cat*	*Felis catus*	-	-		x				x
European Hare*	*Lepus europaeus*	-	-		x		x		x
European Rabbit*	*Oryctolagus cuniculus*	-	-		x		x		x
Feral Pig*	*Sus scrofa*	-	-		x				x

*introduced species

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APPENDIX 5

Mount Pleasant Operation Rail Modification – Portion of South West Out of Pit Emplacement – Terrestrial Fauna Survey Report (Eco Logical Australia, 2017b)

Mount Pleasant Operation Rail Modification – Portion of South West Out of Pit Emplacement

Terrestrial Fauna Survey Report

Prepared for
MACH Energy Australia Pty Ltd

18 December 2017

DOCUMENT TRACKING

Item	Detail
Project Name	Portion of South West Out of Pit Emplacement – Terrestrial Fauna Survey Report
Project Number	17MUD/8820
Project Manager	Kalya Abbey 02 4302 1238 Level 1, 79 Market St MUDGEE NSW 2850
Prepared by	Tom Schmidt, Kalya Abbey
Reviewed by	Daniel Magdi, Martin Sullivan
Approved by	Daniel Magdi
Status	Final
Version Number	2
Last saved on	12 January 2018
Cover photo	Grassland, scattered trees and forest in the study area (ELA 2017)

This report should be cited as 'Eco Logical Australia 2017. *Mount Pleasant Operation Rail Modification – Portion of South West Out of Pit Emplacement – Terrestrial Fauna Survey Report*. Prepared for MACH Energy Australia Pty Ltd.'

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Resource Strategies Pty Ltd.

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Abbreviations

Abbreviation	Description
BC Act	NSW Biodiversity Conservation Act 2016
DEC	NSW Department of Environment and Conservation
DoEE	Commonwealth Department of the Environment and Energy
ELA	Eco Logical Australia Pty Ltd
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
MACH Energy	MACH Energy Australia Pty Ltd
OEH	NSW Office of Environment and Heritage
SEPP 44	State Environmental Planning Policy No. 44 - Koala Habitat Protection

1 INTRODUCTION

Eco Logical Australia Pty Ltd (ELA) was engaged by MACH Energy Australia Pty Ltd (MACH Energy) to undertake terrestrial fauna surveys at the Mount Pleasant Operation. The surveys were undertaken in a currently approved infrastructure area, which although approved, has not yet been constructed. MACH Energy are seeking to relinquish a portion of the area as part of the Rail Modification.

The fauna surveys have been undertaken to inform the potential presence of threatened fauna listed under the New South Wales (NSW) *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and habitat in the vicinity of the Rail Modification.

1.1 Study Area

The study area for the field survey component of the fauna assessment covers approximately 35 hectares (ha) and is shown in **Figure 1**.

1.2 Objectives

The fauna survey has been undertaken to provide the following information:

- a description of the fauna habitat characteristics of the study area and surrounds;
- identification of threatened fauna species within the study area;
- identification of habitat corridors and linkages between areas of remnant native vegetation that assist fauna movement through the area; and
- an assessment against the *State Environmental Planning Policy No. 44 - Koala Habitat Protection* (SEPP 44).

Figure 1: Study area

2 METHODS

2.1 Target Species

The field survey was designed to target threatened species identified as potentially occurring in the study area, with a focus on those species identified during fauna surveys undertaken for the Rail Modification (ELA 2017):

- Speckled Warbler (*Chthonicola sagittata*) – vulnerable (BC Act);
- Eastern Freetail-bat (*Mormopterus norfolkensis*) – vulnerable (BC Act); and
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) – vulnerable (BC Act).

Searches of the following databases were undertaken for the study area:

- BioNet Atlas of NSW Wildlife (Office of Environment and Heritage [OEH] 2017a) for the area bound by coordinates North: -32.14 West: 150.71 East: 150.93 South: -32.30 (Datum GDA94), a buffer of 10 kilometres (km) from the study area.
- EPBC Protected Matters Search Tool (Department of the Environment and Energy [DoEE] 2017a) using a 10 km buffer around the approximate centre point of the study area at -32.23751 150.82158 (Datum GDA94).
- The Species Credit Species list generated from the BioBanking Credit Calculator (OEH 2017b) for the Mount Pleasant Operation Rail Modification study area.

Threatened species identified in the database searches together with an assessment of the likelihood of occurrence for each species is provided in **Appendix A**. Each species' likelihood of occurrence was determined by reviewing records in the area, considering the habitat available and using knowledge of the species ecology.

Five terms for the likelihood of occurrence of species are used in this report, as defined below:

- "yes" = the species was or has been recorded on the site (i.e. the species is known to occur);
- "likely" = a medium to high probability that a species uses the site;
- "potential" = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely, or unlikely to occur;
- "unlikely" = a very low to low probability that a species uses the site; and
- "no" = habitat on site and in the vicinity is unsuitable for the species.

2.2 Field Survey

The study area was surveyed over six days (5th to the 11th December 2017) by ELA ecologists Tom Schmidt and Mitchell Scott. Temperatures were mild to hot, ranging from 11.7 degrees Celsius (°C) to 36.4 °C, with light to moderate winds, and some rainfall during the survey. Weather records were collected from the nearest public weather station in Scone (Bureau of Meteorology 2017) (**Table 1**).

Table 1: Weather conditions during the field survey*

Date	Minimum Temperature (°C)	Maximum Temperature (°C)	Rainfall (mm)	Wind speed (3pm) (km/h)
5 December 2017	16.7	27.6	0	30
6 December 2017	13.2	29.4	5.4	31
7 December 2017	12.4	34.1	0	24
8 December 2017	13.7	36.4	0	33
9 December 2017	17.5	28.4	1	24
10 December 2017	12.3	30.9	0	13
11 December 2017	11.7	33.6	0	15

*Weather observations were taken from www.bom.gov.au, for Scone (station 061363).

mm = millimetres, km/h = kilometres per hour.

The survey design was informed by the relevant NSW and Commonwealth survey guidelines, including the *NSW Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft)* (Department of Environment and Conservation 2004), *Survey Guidelines for Australia's Threatened Birds* (Department of Environment, Water, Heritage and the Arts [DEWHA] 2010a), *Survey Guidelines for Australia's Threatened Bats* (DEWHA 2010b), *Survey Guidelines for Australia's Threatened Mammals* (Department of Sustainability, Environment, Water, Populations and Communities [SEWPaC] 2011a) and *Survey Guidelines for Australia's Threatened Reptiles* (SEWPaC 2011b). The survey consisted of:

- fauna habitat mapping and recording of habitat values (including a Koala [*Phascolarctos cinereus*] habitat assessment infomed by SEPP 44);
- diurnal bird surveys;
- microbat detection devices (Song Meter SM2) and harp trapping;
- remote camera surveys (Reconyx Hyperfire HC600);
- nocturnal mammal surveys (spotlighting and stag watching); and
- opportunistic fauna sightings recorded throughout the study area.

Figure 2 shows the field survey locations.

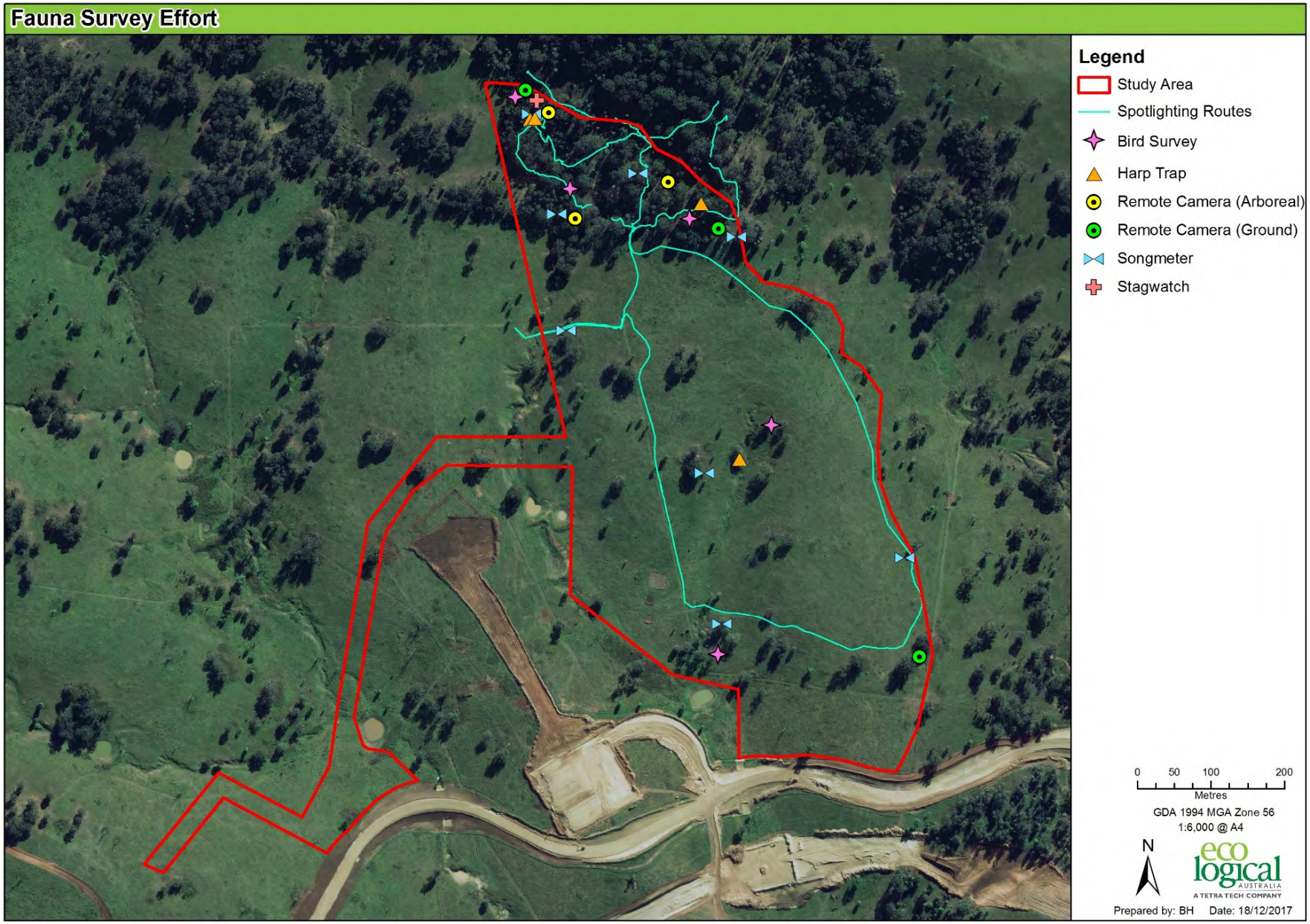

Figure 2: Fauna survey effort

2.2.1 Diurnal Bird Surveys

Diurnal bird surveys were conducted by performing 20 minute point counts at five different locations across the study area by two ecologists during the morning and afternoon. The survey locations were positioned in a representative sample of fauna habitats present within the study area (see **Figure 2**). All five sites were each surveyed four times on two mornings and two afternoons, resulting in approximately 13 person hours of bird survey in total. Bird species were identified using both visual and acoustic cues. Opportunistic bird observations were conducted while travelling around the study area.

2.2.2 Microbat Surveys

Microbat surveys were conducted using song meters set to detect ultrasonic bat calls. The song meters were placed at eight separate locations across the study area for four nights (**Figure 2**) targeting potential habitat, in particular hollow-bearing trees and flyways in native vegetation. Call data was downloaded and provided for analysis by Dr Greg Richards, from Greg Richards and Associates. This report does not include the results of the analysis.

Harp trapping was conducted using four harp traps on two nights resulting in a survey effort of eight trap nights. Harp traps were set in flyways among suitable habitat to target the greatest number of bat captures (**Figure 2**).

2.2.3 Terrestrial and Arboreal Mammal Surveys

Remote cameras were positioned at six sites (see **Figure 2**) over six nights for a combined survey effort of 36 nights. To target Spotted-tailed Quoll (*Dasyurus maculatus*), three remote cameras were set near ground level and baited with chicken necks and sardines. To target Squirrel Glider (*Petaurus norfolcensis*), three remote cameras were set in trees and baited with a peanut butter, oats and honey mixture and the tree bait sprayed with a honey water solution

Spotlighting surveys were conducted for at least one hour by two ecologists on each of the two nights (5th and 6th of December 2017), targeting suitable habitat for nocturnal mammals in the study area. Total survey effort for spotlighting was four person hours.

Stag watching was undertaken at one site on one evening. Two observers watched a hollow for approximately half an hour before dusk, until half an hour after dusk, in an attempt to observe nocturnal fauna emerging. Stag watching was followed by spotlighting of the area.

Areas of potential habitat for the Koala were spotlighted and inspected for signs of Koala such as scats and scratch marks on tree trunks.

3 RESULTS

3.1 Fauna Habitats

The southern part of the study area is largely cleared, consisting of open paddocks with a mixed native/exotic grassland and occasional scattered remnant trees and stags. In the north of the study area an area of forest is present, and this area has connectivity with a larger mosaic of forest and woodland further to the north. The study area ranges from approximately 230 metres (m) to 300 m above sea level, and slopes moderately from north to south. Ephemeral drainage lines are present and there is evidence of erosion.

3.1.1 Native Spotted Gum and White Box Forests

The northern portion of the study area contains remnant forest communities. The canopy is dominated by Spotted Gum (*Corymbia maculata*) in the east (**Photograph 1**) and White Box (*Eucalyptus albens*) in the west (**Photograph 2**), with Kurrajong (*Brachychiton populneus*) and Narrow-leaved Ironbark (*Eucalyptus crebra*) also present. The sparse midstorey includes Large Mock-olive (*Notelaea longifolia*), Blackthorn (*Bursaria spinosa*), Kangaroo Thorn (*Acacia paradoxa*) and regenerating canopy species. The grassy understorey contains native Speargrasses *Austrostipa* spp. and Barbed Wire Grass (*Cymbopogon refractus*). Mistletoes (*Notothixos* spp.) are also present in the canopy. One small dam is present within the forest area, although it was dry during the current survey.

The native forest within the study area provides high quality habitat for a variety of native species, including threatened species. This area contains large amounts of fallen timber and woody debris, many hollow bearing trees and foraging resources.

Photograph 1. Spotted Gum (*Corymbia maculata*) Forest in the north east of the study area.

Photograph 2. White Box (*Eucalyptus albens*) Forest in the north west of the study area.

3.1.2 Mixed Native/Exotic Derived Grassland

The majority of the study area consists of derived native grassland with large, scattered remnant trees (**Photograph 3**). A small number of regenerating saplings are present close to isolated paddock trees (**Photograph 4**), however the area is generally devoid of shrubs and mid-storey vegetation. The area includes native *Austrostipa* spp. with weed cover, in particular Saffron Thistle (*Carthamus lanatus*), Narrow-leaved Cotton Bush (*Gomphocarpus fruticosus*), African Boxthorn (*Lycium ferocissimum*) and Galenia (*Galenia pubescens*). The area contains limited other habitat features such as surface rock, and fallen timber is restricted to areas around paddock trees. Notwithstanding, the habitat value of this area is significantly greater than the majority of the area to be disturbed by the Rail Modification.

Photograph 3. Mixed native/exotic grassland in the study area with scattered paddock trees.

Photograph 4. Saplings indicating regeneration around some of the paddock trees.

3.1.3 Paddock Trees and Stags

Paddock trees are scattered throughout the grassland of the study area. These include isolated trees, patches with multiple trees and dead stags. Many of the paddock trees and stags are large, containing numerous hollows (**Photographs 5 and 6**), providing potential habitat for hollow dependent threatened bird and bat species in particular.

Photograph 5. Patch of paddock trees White Box (*Eucalyptus albens*) and stag with hollows.

Photograph 6. Patch of paddock trees including some with hollows.

3.1.4 Koala Habitat

The areas containing designated Koala 'Feed tree species' as listed under Schedule 2 of SEPP 44 have been mapped across the study area (**Figure 3**). The scheduled Koala 'Feed tree species' White Box (*Eucalyptus albens*) is present in the study area.

Potential Koala habitat is defined in section 4 of SEPP 44 as being that 'Feed tree species' constitute at least 15% of the total number of trees. Within the study area (including consideration of the land surrounding), potential Koala habitat is present in White Box (*Eucalyptus albens*) forest in the north west of the study area (**Photograph 2**), scattered White Box (*Eucalyptus albens*) also occur as paddock trees throughout the rest of the study area. No evidence of Koalas (sightings, scratches or scats) was recorded in the study area, and the study area does not qualify as core Koala habitat due to the absence of evidence of attributes such as breeding females, and recent sightings, as per the definition in section 4 of SEPP 44.

3.2 Fauna Species

A total of 61 fauna species were recorded within the study area during the field survey period. This consisted of 46 birds (45 native, one introduced), nine non-flying mammals (seven native and two introduced), four native microbats, and two native reptiles (**Appendix B**).

Two threatened species were recorded during the field survey (**Figure 3)**:

- Speckled Warbler – vulnerable (BC Act); and
- Squirrel Glider – vulnerable (BC Act).

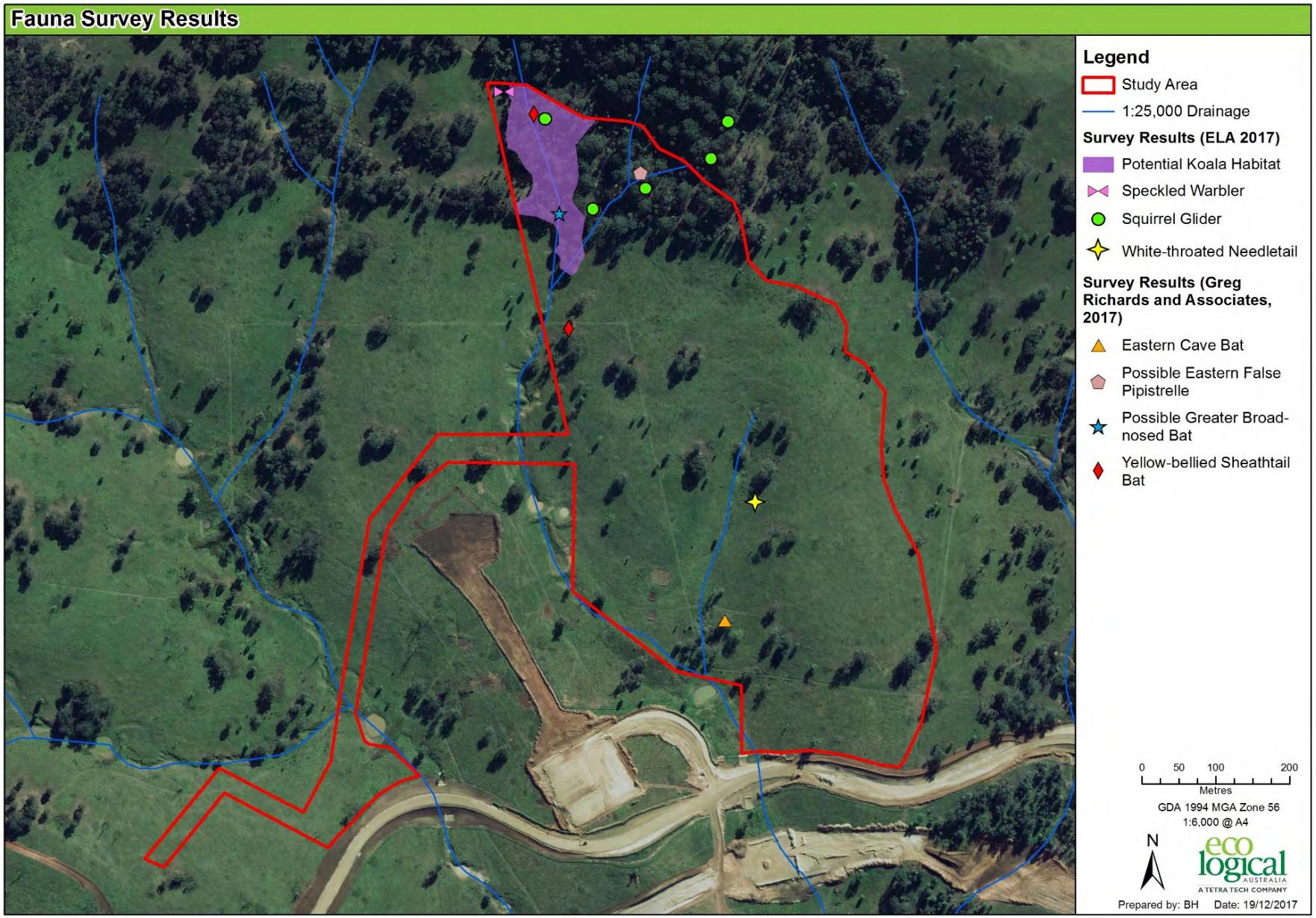

Figure 3: Fauna survey results

Threatened bat species recorded (Greg Richards and Associates, 2017) in the Study Area included:

- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) – vulnerable (BC Act) (possible record);
- Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*) – vulnerable (BC Act);
- Greater Broad-nosed Bat (*Scoteanax rueppellii*) – vulnerable (BC Act) (possible record); and
- Eastern Cave Bat (*Vespadelus troughtoni*) (vulnerable - BC Act).

A further 31 species listed under the BC Act and/or EPBC Act were considered potential (26) or likely (five) (with one foraging only) to occur in the study area as a result of the data audit, habitat assessment and survey results (**Appendix A**). Most species assessed as having potential to occur in the study area are mobile species such as birds and bats, which may occur seasonally in forest areas when resources are abundant such as blossoming Eucalypts, or pass through marginal habitats such as paddock trees when moving between higher quality habitats in the region. Eastern Bentwing-bat, Grey-headed Flying-fox (*Pteropus poliocephalus*) (foraging only), Spotted Harrier (*Circus assimilis*); Little Lorikeet (*Glossopsitta pusilla*) and Rainbow Bee-eater (*Merops ornatus*) were assessed as likely to occur in the study area (**Appendix A**) and are discussed below.

3.2.1 Diurnal Birds

Forty-four (44) diurnal bird species were recorded during the field survey, including one threatened species, Speckled Warbler, listed as vulnerable under the BC Act. Speckled Warbler was recorded from within White Box Woodland vegetation in the north west of the study area (**Figure 3**), with a maximum of three individuals recorded. It is considered likely that this species breeds in or adjacent the study area as the Speckled Warbler is a sedentary species, and the group was regularly recorded in the same territory among suitable breeding habitat during the survey which took place during the breeding season (August-January) (OEH 2017c).

Regent Honeyeater (*Anthochaera phrygia*) and Painted Honeyeater (*Grantiella picta*) were not recorded during the field survey. Suitable habitat for these species is present in the study area, primarily in the forest area and in paddock trees to a lesser extent. Although not recorded during targeted surveys, both species are highly mobile and are considered to have potential to occur in the study area, however it is unlikely they would regularly visit the study area or be reliant on its resources for breeding. Several other threatened bird species, mostly woodland birds and raptors, are considered to have the potential to occur in the study area on occasion (**Appendix A**).

Spotted Harrier is a mobile raptor that occupies a variety of habitats including open woodland, grasslands and agricultural land (OEH 2017c), and is considered likely to occur in the study area as part of a wide home range, as this species is highly mobile and the study area contains suitable habitat for the species. Little Lorikeet is a nomadic, nectar forager that utilises flowering Eucalypts (OEH 2017c). The species is considered likely to occur in the study area when eucalypts are in flower as suitable foraging habitat is present in both forest areas and paddock trees and the species is mobile and known to occur in the region. Spotted Gum (*Corymbia maculata*) Forest in the study area also provides potential breeding habitat for Little Lorikeet within hollow-bearing Spotted Gums (*Corymbia maculata*).

White-throated Needletail (*Hirundapus caudacutus*), listed as a Migratory and Marine species under the EPBC Act, was recorded flying over the study area during the survey (**Figure 3**). This species is a non-breeding migrant, widespread in eastern Australia occupying a variety of habitats including cleared areas and farmlands (DoEE 2017b). Rainbow Bee-eater, listed as a Marine species under the EPBC Act, is a common and wide spread species occupying a variety of habitats including cleared areas and farmlands, and is also considered likely to occur in the study area (**Appendix A**).

3.2.2 Nocturnal Birds

Two (2) nocturnal bird species, Australian Owlet-nightjar (*Aegotheles cristatus*) and White-throated Nightjar (*Eurostopodus mystacalis*) were recorded during the field survey. Targeted surveys (call-playback) for threatened nocturnal bird species were not undertaken during the assessment and no threatened nocturnal birds were recorded during spotlighting. Large hollows suitable for nesting by threatened large forest owls Barking Owl (*Ninox connivens*), Powerful Owl (*Ninox strenua*) and Masked Owl (*Tyto novaehollandiae*) are present in the forest area of the study area, and these species are therefore considered to have potential to occur in the study area.

3.2.3 Reptiles

Two (2) native reptile species were recorded in the study area Bearded Dragon (*Pogona barbata*) and Lace Monitor (*Varanus varius*). No threatened reptile species were recorded. Based on condition of available habitat in the study area and species distributions, threatened reptile species are considered unlikely to occur.

3.2.4 Bats

Microbat surveys consisted of ultrasonic call recording using song meters and harp trapping.

A total of 15 bats were captured in harp traps representing four species, none of which are listed as threatened species. These consisted of ten Lesser Long-eared Bat (*Nyctophilus geoffroyi*), three Little Forest Bat (*Vespadelus vulturnus*), one Inland Broad-nosed Bat (*Scotorepens balstoni*), and one Southern Freetail-bat (*Mormopterus planiceps*).

Large hollow bearing trees and stags are present throughout the study area in both the forest area and in scattered paddock trees. It is considered likely that some hollows within the study area are regularly used by hollow-dependent microbat species.

Call data recorded during the surveys has been provided for analysis by Dr Greg Richards, of Greg Richards and Associates. Threatened bat species recorded in the Study Area included:

- Eastern False Pipistrelle – vulnerable (BC Act) (possible record);
- Yellow-bellied Sheathtail Bat – vulnerable (BC Act);
- Greater Broad-nosed Bat – vulnerable (BC Act) (possible record); and
- Eastern Cave Bat – vulnerable (BC Act).

The study area contains suitable habitat for all of the targeted threatened bats, which occupy a variety of habitats including open woodlands and grasslands (Churchill 2009).

No Grey-headed Flying-fox were recorded during spotlighting. A Flying-fox camp is known adjacent to the Hunter River in Muswellbrook, approximately 6 km south east of the study area (DoEE 2017c). The study area does not provide roosting habitat for Grey-headed Flying-fox, however forest areas and paddock trees provide potential foraging resources for this species.

3.2.5 Terrestrial and Arboreal Mammals

Seven native and two introduced mammal species (excluding bats) were recorded in the study area (**Appendix B**). One threatened mammal species, Squirrel Glider, was recorded.

Squirrel Glider was recorded in forest areas in the north of the study area (**Photograph 7**; **Figure 3**). This forest area provides high quality habitat for the Squirrel Glider, with abundant hollows, foraging resources and habitat connectivity. Scattered paddock trees in the remainder of the study area are unlikely to support Squirrel Glider due to poor connectivity and are considered unsuitable habitat.

Photograph 7. Squirrel Glider in the study area.

Squirrel Glider can potentially be confused with the similar non-threatened Sugar Glider (*Petaurus breviceps*). Gliders recorded during the spotlighting survey were identified as Squirrel Glider based on their large size, and thick, bushy tails. Squirrel Glider have been previously recorded in close proximity to the study area (**Figure 4**).

Targeted survey using baited remote cameras did not record Spotted-tailed Quoll in the study area. The Spotted-tailed Quoll prefers wooded areas, and can occupy large home ranges, up to 3,500 ha (OEH 2017c). Forest habitat in the north is considered the most suitable area for the species in the study area, and although the species was not recorded during the targeted survey, it is considered that the study area could potentially form part of a large home range for a Spotted-tailed Quoll in the area.

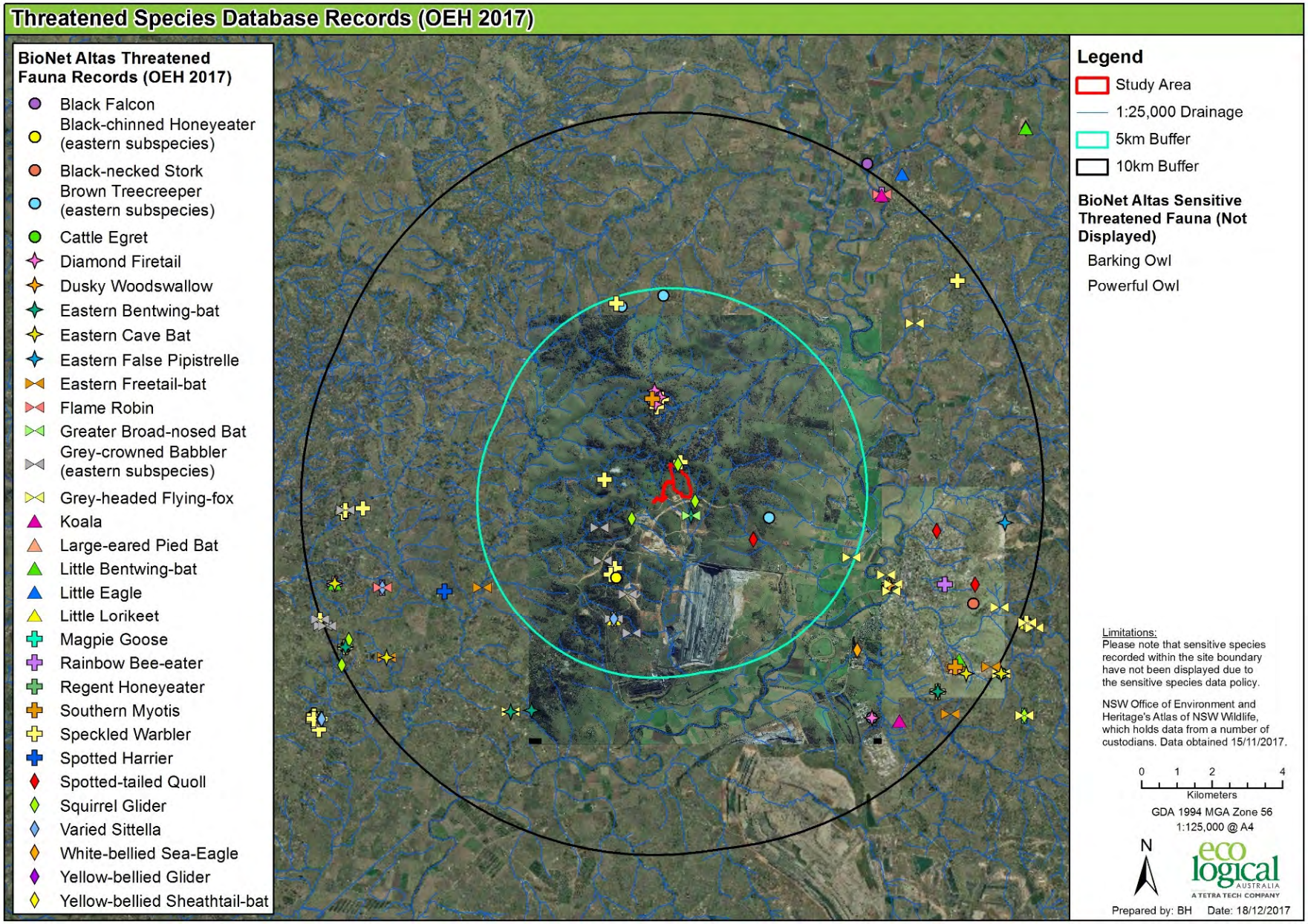

Figure 4: Threatened Species Database Records (OEH 2017a)

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APPENDIX A LIKELIHOOD OF OCCURRENCE – FAUNA SPECIES

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	Likelihood of occurrence, and potential habitat
Litoria aurea	Green and Golden Bell Frog	E	V	Since 1990, recorded from ~50 scattered sites within its former range in NSW, from the north coast near Brunswick Heads, south along the coast to Victoria. Records exist west to Bathurst, Tumut and the ACT region.	Yes	None	Yes	No	No
Litoria booroolongensis	Booroolong Frog	E	E	Restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. Several populations have recently been recorded in the Namoi catchment.	Yes	None	Yes	No	No
Litoria brevipalmata	Green-thighed Frog	V	-	Isolated localities along the coast and ranges from just north of Wollongong to south-east QLD.	Yes	None	Yes	No	No
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	In NSW, only known from the Central and Southern Tablelands, and the South Western Slopes.	Yes	None	Yes	No	No
Delma impar	Striped Legless Lizard	V	V	In NSW, occurs in the Southern Tablelands, the South West Slopes and possibly on the Riverina.	Yes	None	Yes	No	No
Hoplocephalus bitorquatus	Pale-headed Snake	V	-	In NSW, it occurs from the coast to the western side of the Great Divide as far south as Tuggerah. Historically recorded west to Mungindi and Quambone on the Darling Riverine Plains, across the North West Slopes, and the New England Tablelands.	Yes	None	Yes	No	No

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	Likelihood of occurrence, and potential habitat
Hoplocephalus stephensii	Stephens' Banded Snake	V	-	Coast and ranges from Southern QLD to Gosford in NSW.	Yes	None	Yes	No	No
Anseranas semipalmata	Magpie Goose	V	-	In NSW, found in central and northern parts of the state, with vagrants as far as south-eastern NSW.	Yes	None	Yes	No	No
Ephippiorhynchus asiaticus	Black-necked Stork	E	-	Coastal and subcoastal northern and eastern Australia, south to central-eastern NSW and with vagrants recorded further south and inland.	Yes	None	Yes	No	No
Botaurus poiciloptilus	Australasian Bittern	E	E	Found over most of NSW except for the far north-west.	Yes	None	Yes	No	No
Ardea ibis	Cattle Egret	-	-	Widespread and common across NSW.	Yes	Marginal	Yes	No	Potential
Falco subniger	Black Falcon	V	-	Sparsely distributed in NSW, occurring mostly in inland regions.	Yes	Marginal	Yes	No	Potential, all areas.
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	Distributed along the coastline of mainland Australia and Tasmania, extending inland along some of the larger waterways, especially in eastern Australia.	Yes	None	Yes	No	Unlikely
Circus assimilis	Spotted Harrier	V	-	Found throughout the Australian mainland, except in densely forested or wooded habitats, and rarely in Tasmania.	Yes	Good	Yes	No	Likely, grassland areas.
Erythrotriorchis radiatus	Red Goshawk	CE	V	In NSW, extends to ~30°S. Recent records confined to the Northern Rivers region north of the Clarence River.	No	None	No	No	No
Lophoictinia isura	Square-tailed Kite	V	-	In NSW, it is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast.	Yes	Marginal	Yes	No	Unlikely

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	Likelihood of occurrence, and potential habitat
Hieraaetus morphnoides	Little Eagle	V	-	Throughout the Australian mainland, with the exception of the most densely-forested parts of the Dividing Range escarpment.	Yes	Marginal	Yes	No	Potential, all areas.
Burhinus grallarius	Bush Stone-curlew	E	-	In NSW, found sporadically in coastal areas, and west of the divide throughout the sheep-wheat belt.	Yes	Marginal	Yes	No	Unlikely
Rostratula australis	Australian Painted Snipe	E	E	In NSW most records are from the Murray-Darling Basin. Other recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys.	Yes	None	Yes	No	No
Numenius madagascariensis	Eastern Curlew	-	CE, M	Summer migrant to Australia. Primarily coastal distribution in NSW, with some scattered inland records.	Yes	None	Yes	No	No
Calidris ferruginea	Curlew Sandpiper	E	CE, M	Occurs along the entire coast of NSW, and sometimes in freshwater wetlands in the Murray-Darling Basin.	Yes	None	Yes	No	No
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	In NSW, widespread along coast and inland to the southern tablelands and central western plains, with a small population in the Riverina.	Yes	None	Yes	No	No
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	In NSW, distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. Isolated records known from as far north as Coffs Harbour and as far west as Mudgee.	Yes	None	Yes	No	No
Glossopsitta pusilla	Little Lorikeet	V	-	In NSW, found from the coast westward as far as Dubbo and Albury.	Yes	Good	Yes	No	Likely, forest and paddock trees.

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	Likelihood of occurrence, and potential habitat
Neophema pulchella	Turquoise Parrot	V	-	Occurs along the length of NSW from the coastal plains to the western slopes of the Great Dividing Range.	Yes	Marginal	Yes	No	Potential, forest and paddock trees.
Lathamus discolor	Swift Parrot	E	CE	Migrates from Tasmania to mainland in Autumn-Winter. In NSW, the species mostly occurs on the coast and south west slopes.	Yes	Good	Yes	No	Potential, forest and paddock trees.
Tyto novaehollandiae	Masked Owl	V	-	Recorded over approximately 90% of NSW, excluding the most arid north-western corner. Most abundant on the coast but extends to the western plains.	Yes	Marginal	Yes	No	Potential, forest area and paddock trees.
Ninox strenua	Powerful Owl	V	-	In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains.	Yes	Good	Yes	No	Potential, forest areas.
Ninox connivens	Barking Owl	V	-	Wide but sparse distribution in NSW, avoiding the most central arid regions. Core populations exist on the western slopes and plains and in some northeast coastal and escarpment forests.	Yes	Good	Yes	No	Potential, forest areas.
Hirundapus caudacutus	White-throated Needletail	-	M	All coastal regions of NSW, inland to the western slopes and inland plains of the Great Divide.	Yes	Marginal	Yes	Yes	Yes, all areas.
Merops ornatus	Rainbow Bee-eater	-	-	Distributed across much of mainland Australia, including NSW.	Yes	Good	Yes	No	Likely, forest areas, paddock trees and open areas.
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	From eastern through central NSW, west to Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell.	Yes	Good	Yes	No	Potential, forest area.

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	Likelihood of occurrence, and potential habitat
Chthonicola sagittata	Speckled Warbler	V	-	From south-eastern QLD, the eastern half of NSW and into Victoria, as far west as the Grampians, mostly on hills and tablelands of the Great Dividing Range and rarely on coast.	Yes	Good	Yes	Yes	Yes, forest areas.
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	Widespread in NSW from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. Also Richmond and Clarence River areas and a few scattered sites in the Hunter, Central Coast and Illawarra regions.	Yes	Marginal	Yes	No	Potential, forest and paddock trees.
Anthochaera phrygia	Regent Honeyeater	CE	CE	Inland slopes of south-east Australia, and less frequently in coastal areas. In NSW, most records are from the North-West Plains, North-West and South-West Slopes, Northern Tablelands, Central Tablelands and Southern Tablelands regions. The Lower Hunter and Central Coast have also seen many records in recent years.	Yes	Good	Yes	No	Potential, forest and paddock trees.
Grantiella picta	Painted Honeyeater	V	V	Widely distributed in NSW, predominantly on the inland side of the Great Dividing Range but avoiding arid areas.	Yes	Marginal	Yes	No	Potential, forest area.
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-	Found throughout much of inland NSW, with the exception of the extreme north-west, where it is replaced by subspecies *picata*.	Yes	Marginal	Yes	No	Potential, forest areas and paddock trees.
Petroica phoenicea	Flame Robin	V	-	In NSW, breeds in upland areas, and in winter many birds move to the inland slopes and plains, or occasionally to coastal areas. Likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands.	Yes	Marginal	Yes	No	Potential, forest areas.

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	Likelihood of occurrence, and potential habitat
Petroica boondang	Scarlet Robin	V	-	In NSW, it occurs from the coast to the inland slopes.	Yes	Marginal	Yes	No	Potential, forest and paddock trees.
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	In NSW, occurs on the western slopes of the Great Dividing Range, and as far as Louth and Balranald on the western plains. Also occurs in woodlands in the Hunter Valley and in some locations on the north coast.	Yes	Good	Yes	No	Potential, forest areas.
Daphoenositta chrysoptera	Varied Sittella	V	-	Distribution in NSW is nearly continuous from the coast to the far west.	Yes	Good	Yes	No	Potential, forest and paddock trees.
Rhipidura rufifrons	Rufous Fantail	-	M	Coastal and near coastal districts of northern and eastern Australia, including on and east of the Great Divide in NSW.	Yes	Marginal	Yes	No	Potential, forest area.
Monarcha melanopsis	Black-faced Monarch	-	M	In NSW, occurs around the eastern slopes and tablelands of the Great Divide, inland to Coutts Crossing, Armidale, Widden Valley, Wollemi National Park and Wombeyan Caves. It is rarely recorded farther inland.	Yes	Marginal	Yes	No	Potential, forest areas.
Myiagra cyanoleuca	Satin Flycatcher	-	M	In NSW, widespread on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains.	Yes	Marginal	Yes	No	Potential, forest area.
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	Widespread in NSW from coast to inland including the western slopes of the Great Dividing Range and farther west. Species have also been recorded in southern and southwestern Australia.	Yes	Good	Yes	No	Potential, forest areas and paddock trees.
Motacilla flava	Yellow Wagtail	-	M	Regular summer migrant to mostly coastal Australia. In NSW recorded Sydney to Newcastle, the Hawkesbury and inland in the Bogan LGA.	Yes	Marginal	Yes	No	Unlikely

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	Likelihood of occurrence, and potential habitat
Stagonopleura guttata	Diamond Firetail	V	-	Widely distributed in NSW, mainly recorded in the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina, and less commonly found in coastal areas and further inland.	Yes	Good	Yes	No	Potential, forest areas and paddock trees.
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern QLD.	Yes	Good	Yes	No	Potential, all areas.
Phascogale tapoatafa	Brush-tailed Phascogale	V	-	In NSW it is mainly found east of the Great Dividing Range although there are occasional records west of the divide.	Yes	Good	Yes	No	Potential, forest area.
Planigale maculata	Common Planigale	V	-	Occurs in coastal north-eastern NSW, and reported from as far south as the central NSW coast west of Sydney.	Yes	Marginal	No	No	Unlikely
Phascolarctos cinereus	Koala	V	V	In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. There are sparse and possibly disjunct populations in the Bega District, and at several sites on the southern tablelands.	Yes	Marginal	Yes	No	Potential, White Box forest.
Cercartetus nanus	Eastern Pygmy-possum	V	-	In NSW it extends from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes.	Yes	Marginal	Yes	No	Unlikely
Petaurus australis	Yellow-bellied Glider	V	-	Along the eastern coast to the western slopes of the Great Dividing Range, from southern QLD to Victoria.	Yes	None	Yes	No	No

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	Likelihood of occurrence, and potential habitat
Petaurus norfolcensis	Squirrel Glider	V	-	Widely though sparsely distributed on both sides of the Great Dividing Range in eastern Australia, from northern QLD to western Victoria.	Yes	Good	Yes	Yes	Yes, forest areas.
Petauroides volans	Greater Glider	-	V	Along the eastern coast to the western slopes of the Great Dividing Range, from northern QLD to western Victoria.	Yes	None	Yes	No	No
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	In NSW they occur from the QLD border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit.	Yes	None	Yes	No	No
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Along the eastern coast of Australia, from Bundaberg in QLD to Melbourne in Victoria.	Yes	Marginal	Yes	No	Likely, foraging habitat in forest areas and forest trees. No roosting habitat.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	There are scattered records of this species across the New England Tablelands and North West Slopes. Rare visitor in late summer and autumn to south-western NSW.	Yes	Good	Yes	Yes	Yes, all habitats.
Mormopterus norfolkensis	Eastern Freetail-bat	V	-	Found along the east coast from south QLD to southern NSW.	Yes	Marginal	Yes	No	Potential, forest areas.
Miniopterus australis	Little Bentwing-bat	V	-	East coast and ranges south to Wollongong in NSW.	Yes	Marginal	Yes	No	Potential, forest areas.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	In NSW it occurs on both sides of the Great Dividing Range, from the coast inland to Moree, Dubbo and Wagga Wagga.	Yes	Good	Yes	No	Likely, all areas.

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution	Distribution overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	Likelihood of occurrence, and potential habitat
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Recorded from Rockhampton in QLD south to Ulladulla in NSW. Largest concentrations of populations occur in the sandstone escarpments of the Sydney basin and the NSW north-west slopes.	Yes	Marginal	Yes	No	Unlikely
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	South-east coast and ranges of Australia, from southern QLD to Victoria and Tasmania. In NSW, records extend to the western slopes of the Great Dividing Range.	Yes	Marginal	Yes	Yes	Yes, forest areas
Myotis macropus	Southern Myotis	V	-	In NSW, found in the coastal band. It is rarely found more than 100 km inland, except along major rivers.	Yes	None	Yes	No	No
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Both sides of the great divide, from the Atherton Tableland in QLD to north-eastern Victoria, mainly along river systems and gullies. In NSW it is widespread on the New England Tablelands.	Yes	Marginal	Yes	Yes	Yes, all habitats.
Vespadelus troughtoni	Eastern Cave Bat	V	-	Found in a broad band on both sides of the Great Dividing Range south to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT.	Yes	Marginal	Yes	Yes	Yes, forest areas and paddock trees. Foraging only.
Pseudomys novaehollandiae	New Holland Mouse	-	V	Fragmented distribution across eastern NSW.	Yes	None	Yes	No	No
Nyctophilus corbeni	Corben's Long-eared Bat	V	V	Distribution coincides approximately with the Murray Darling Basin; the Pilliga Scrub region is the distinct stronghold for this species.	Yes	Marginal	Yes	No	Unlikely

Note: * - distributions for threatened species gathered from threatened species profiles (OEH 2017b) and Atlas of Living Australia records (ALA 2017).

APPENDIX B FAUNA SPECIES RECORDED DURING FIELD SURVEY OF STUDY AREA BETWEEN 5 AND 11 DECEMBER 2017

Common Name	Scientific Name	Status		Diurnal Bird Census	Remote Camera	SongMeter	Spotlighting	Harp Trap	Incidental
		BC Act	EPBC Act						
Reptiles									
Bearded Dragon	*Pogona barbata*	-	-						x
Lace Monitor	*Varanus varius*	-	-		x				x
Birds									
Nankeen Kestrel	*Falco cenchroides*	-	-	x					
Wedge-tailed Eagle	*Aquila audax*	-	-	x					
Crested Pigeon	*Ocyphaps lophotes*	-	-	x					
Galah	*Eolophus roseicapilla*	-	-	x					
Little Corella	*Cacatua sanguinea*	-	-	x					
Eastern Rosella	*Platycercus eximius*	-	-	x					
Sulphur-crested Cockatoo	*Cacatua galerita*	-	-	x					
King Parrot	*Alisterus scapularis*	-	-	x					
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	-	-	x					
Channel-billed Cuckoo	*Scythrops novaehollandiae*	-	-	x					
White-throated Nightjar	*Eurostopodus mystacalis*	-	-				x		
Australian Owlet-nightjar	*Aegotheles cristatus*	-	-				x		
White-throated Needletail	*Hirundapus caudacutus*	-	M	x					
Laughing Kookaburra	*Dacelo novaeguineae*	-	-	x					
Sacred Kingfisher	*Todiramphus sanctus*	-	-	x					
White-throated Treecreeper	*Cormobates leucophaea*	-	-	x					
Superb Fairy-wren	*Malurus cyaneus*	-	-	x					

Common Name	Scientific Name	Status		Diurnal Bird Census	Remote Camera	SongMeter	Spotlighting	Harp Trap	Incidental
		BC Act	EPBC Act						
Spotted Pardalote	*Pardalotus punctatus*	-	-	x					
Striated Pardalote	*Pardalotus striatus*	-	-	x					
Speckled Warbler	*Chthonicola sagittata*	V	-	x					
Weebill	*Smicrornis brevirostris*	-	-	x					
White-throated Gerygone	*Gerygone olivacea*	-	-	x					
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	-	-	x					
Yellow Thornbill	*Acanthiza nana*	-	-	x					
Striated Thornbill	*Acanthiza lineata*	-	-	x					
Noisy Miner	*Manorina melanocephala*	-	-	x					
Brown-headed Honeyeater	*Melithreptus brevirostris*	-	-	x					
Noisy Friarbird	*Philemon corniculatus*	-	-	x					
Golden Whistler	*Pachycephala pectoralis*	-	-	x					
Rufous Whistler	*Pachycephala rufiventris*	-	-	x					
Grey Fantail	*Rhipidura albiscapa*	-	-	x					
Willie Wagtail	*Rhipidura leucophrys*	-	-	x					
Magpie-lark	*Grallina cyanoleuca*	-	-	x					
Leaden Flycatcher	*Myiagra rubecula*	-	-	x					
Grey Butcherbird	*Cracticus torquatus*	-	-	x					
Pied Butcherbird	*Cracticus nigrogularis*	-	-	x					
Australian Magpie	*Cracticus tibicen*	-	-	x					
Pied Currawong	*Strepera graculina*	-	-	x					
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	-	-	x					
Australian Raven	*Corvus coronoides*	-	-	x	x				
White-winged Chough	*Corcorax melanorhamphos*	-	-	x					
Common Starling*	*Sturnus vulgaris*	-	-	x					
Welcome Swallow	*Hirundo neoxena*	-	-	x					
Fairy Martin	*Petrochelidon ariel*	-	-	x					

Common Name	Scientific Name	Status		Diurnal Bird Census	Remote Camera	SongMeter	Spotlighting	Harp Trap	Incidental
		BC Act	EPBC Act						
Tree Martin	*Petrochelidon nigricans*	-	-	x					
Mistletoebird	*Dicaeum hirundinaceum*	-	-	x					
Bats and Mammals									
Short-beaked Echidna	*Tachyglossus aculeatus*	-	-						x
Squirrel Glider	*Petaurus norfolcensis*	V	-				x		
Common Brushtail Possum	*Trichosurus vulpecula*	-	-		x		x		
Common Wallaroo	*Macropus robustus*	-	-						x
Eastern Grey Kangaroo	*Macropus giganteus*	-	-		x		x		x
Red-necked Wallaby	*Macropus rufogriseus*	-	-				x		x
Swamp Wallaby	*Wallabia bicolor*	-	-		x				
South-eastern/Southern Freetail Bat	*Mormopterus (Ozimops) planiceps*	-	-					x	
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	-	-					x	
Inland Broad-nosed Bat	*Scotorepens balstoni*	-	-					x	
Little Forest Bat	*Vespadelus vulturnus*	-	-					x	
Red Fox*	*Vulpes vulpes*	-	-		x		x		
Feral Pig*	*Sus scrofa*	-	-						x

*Introduced species

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AS/NZS 4801:2001 Occupational Health and Safety Management

ISO 9001 Quality Management

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APPENDIX 6

Threatened Bat Call Analysis Results (Greg Richards and Associates, 2017)

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18 December 2017

RE: Mount Pleasant Operation Rail Modification – Analysis of Bat Calls

The following provides summary results of analysing two sets of ball calls collected by Ecological Australia. This summary is limited to threatened species and can be expanded on if requested.

Call Set 1: Disturbance Area.

- Data collected November 2017.

- Data collected at four sites.

- Total number of calls 2979.

Threatened Species Identified:

- *Miniopterus orianae* (*schreibersii*) *oceanensis* (Eastern Bentwing-Bat) – vulnerable (Biodiversity Conservation Act).
- *Mormopterus norfolkensis* (East Coast Freetail Bat) – vulnerable (Biodiversity Conservation Act Act). There appears to be an error in the listing Act whereby the common name for *M. norfolkensis* is listed as the Eastern Freetail Bat, which is actually *M. petersi*.

Possible records of other threatened bats (vulnerable).

- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle).
- *Saccolaimus flaviventris* (Yellow-bellied Sheath-tailed Bat).
- *Scoteanax rueppellii* (Greater Broad-Nosed Bat).

Several additional bat calls were not identifiable between bentwing and forest bats. These calls could belong to one of a few different species (*Miniopterus/Vespadelus* complex) however given the definite records of the Eastern Bentwing-Bat they are assumed to belong to that species

Call Set 2: Potential Relinquishment Area and Surrounds.

- Data collected December 2017.

- Data collected at eight sites.

- Total number of calls 6244.

Threatened Species Identified:

- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail Bat) – vulnerable (Biodiversity Conservation Act Act).
- *Vespadelus troughtoni* (Eastern Cave Bat) – vulnerable (Biodiversity Conservation Act Act).

Possible records of other threatened bats.

- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle) – vulnerable (Biodiversity Conservation Act Act) (possible record).
- *Scoteanax rueppellii* (Greater Broad-nosed Bat) – vulnerable (Biodiversity Conservation Act Act) (possible record).

per .....
(G.C. Richards, Director)

Greg Richards and Associates Pty Ltd