



Offset Monitoring Program – Mount Emerald Wind Farm

RATCH Australia Corporation Limited

4 Elements Consulting Pty Ltd



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1.0 Introduction

1.1 Background

The Mount Emerald Wind Farm (MEWF) Offset Site (the site) is located within land described as Lot 22 SP210202, which comprises approximately 434.9 ha (**Figure 1**). It is located immediately to the south west of the MEWF site at Mutchilba within the Mareeba Shire Council Area at the end of Lemontree Drive. The lot tenure is freehold and the primary land use is vacant. The area fringes the Baldy Mountain Forest Reserve and the Herberton Range National Park, via the Herberton Range (Queensland Government 2016).

On 26 November 2016, approval under the provisions of the Environmental Protection and Biodiversity Conservation (EPBC) Act, was granted to RATCH Australia Corporation Limited (RACL). As a requirement of the EPBC Act approval 2011/6228, as issued by the Federal Department of the Environment and Energy (DoEE), a Biodiversity Offset Area was developed to compensate for the clearing of 73 ha of habitat on the MEWF Project Site.

This site has been protected as a Nature Reserve through a statutory process through consultation with the Queensland Department of Environment and Heritage.

The offset site lies completely within the wet tropics bioregion. The site is mountainous with narrow ridges and rocky terrain that are steeply dissected along three dominant ridge lines falling towards Lemontree Drive at the entrance to the site. The offsets site lies adjacent to the MEWF project site.

The majority of the site consists of remnant vegetation with approximately 192.89 ha consisting of Least Concern vegetation and the remaining 242 ha listed as Of Concern vegetation.

4 Elements Consulting was commissioned by RACL to conduct the annual ecological monitoring surveys on the MEWF Offsets Site and this report has been prepared to comply with the requirements outlined in the Mount Emerald Wind Farm Offset Area Management Plan (RPS, 2016), which details monitoring management actions. The data collected in 2016 provided baseline data for future monitoring to be compared against and enables targeted and adaptive management procedures to be implemented to ensure the biological integrity of the biodiversity area is maintained or improved and conserved into the future.

The actions required include:

- ▶ Targeted survey of threatened fauna species to determine changes to species diversity on site over time;
- ▶ Pest species presence/absence assessment;
- ▶ Photo-monitoring points to determine variation over time.
- ▶ Targeted weed surveys.

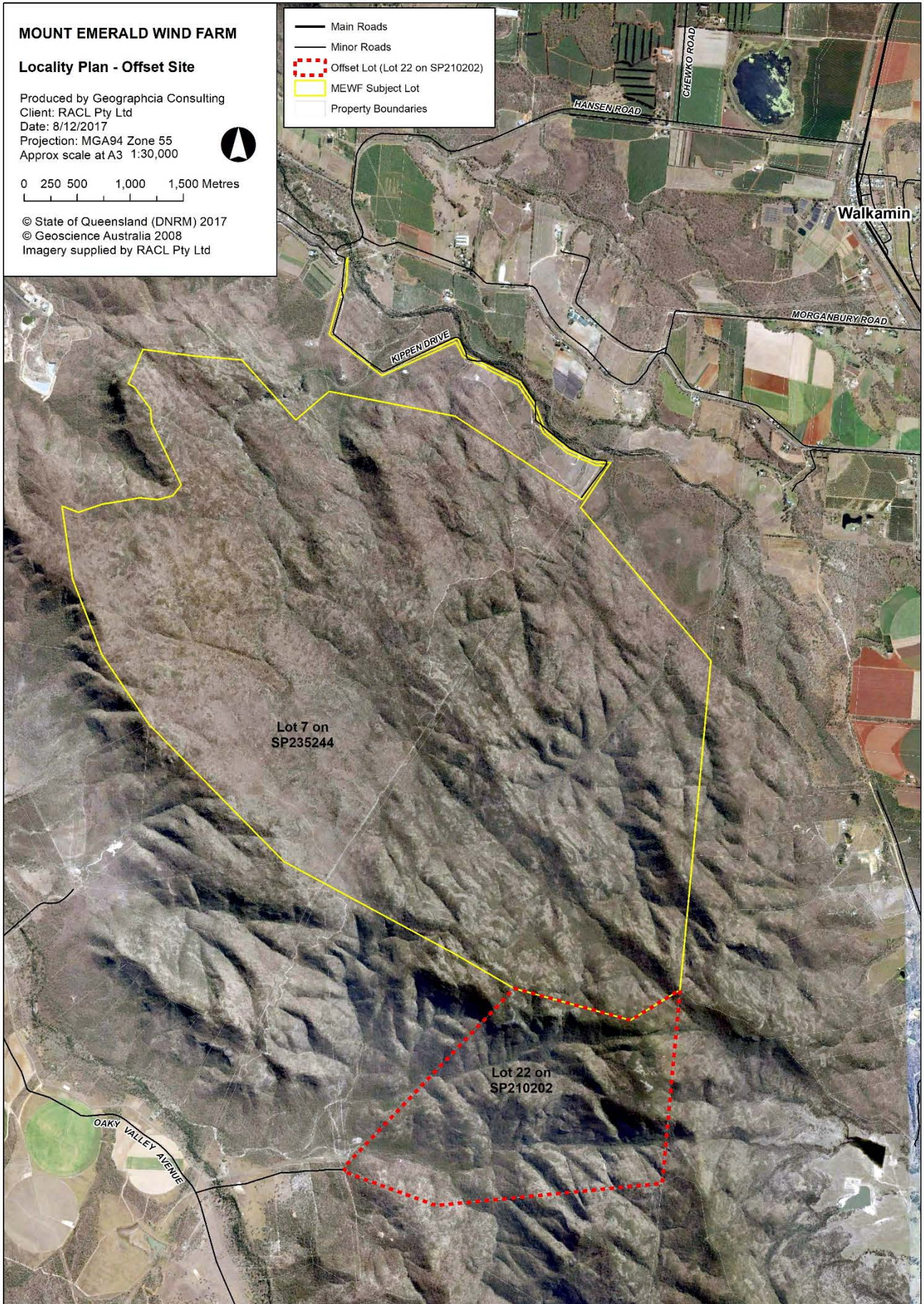


Figure 1 Project Location

1.2 Objectives and Outcomes

As identified in the Offset Area Management Plan (RPS, 2016), the offset area provides for the long-term protection of habitat for seven threatened species and through the implementation of adaptive management practices the quality of the habitat will be improved and maintained over time. The offset area is to be protected in perpetuity as a Nature Refuge. The management plan objectives and outcomes are to:

- ▶ Protect all vegetation within the offset area from future clearing;
- ▶ Protect all fauna within the offset area from introduced weeds and pests;
- ▶ Protect the site vegetation and fauna from un-prescribed burn and wildfire;
- ▶ Maintain the ecological condition of remnant of-concern and least concern vegetation within the Offset area where the BioCondition Class of 1 for each assessment unit does not change;
- ▶ Implement a translocation plan based on the criteria and guidelines detailed in the Guidelines for the translocation of threatened plants in Australia (Vallee et al, 2004) should be developed to identify MNES plant species appropriate for relocation as well as target and recipient sites.

This ecological monitoring report presents the methods and results of the 2017 ecological monitoring program at the MEWF Biodiversity Offset Area, including a discussion of the findings and comparisons with the results of the baseline data conducted in 2016. Management recommendations that relate to the current monitoring phase are documented in **Section 4.0**.

1.2.1 Regional Ecosystems:

The RE's mapped for the offset site are described in **Table 1** and shown on the mapping in **Figure 2**. Baseline surveys in 2016 identified that RE mapping was consistent with ground-truthed vegetation assessments.

Table 1 Regional Ecosystems Present Within the Proposed Offset Site

RE	RE Description	VMA ¹	Bio. ²	Area ³
7.3.26a	<i>Casuarina cunninghamiana</i> (river oak) woodland to open forest on alluvium fringing streams. Occurs on channel benches, levees and terraces on deep loamy sands or sandy clay loams (often with loose surface gravel). (BVG1M: 16a). Vegetation communities in this regional ecosystem include: 7.3.26a: Riverine wetland or fringing riverine wetland. <i>Casuarina cunninghamiana</i> , <i>Eucalyptus tereticornis</i> , <i>Lophostemon suaveolens</i> , <i>Melaleuca leucadendra</i> , <i>M. fluviatilis</i> , <i>Buckinghamia celsissima</i> , <i>Mallotus philippensis</i> woodland and forest with an understorey of <i>Melaleuca viminalis</i> and <i>Bursaria tenuifolia</i> . Fringing forests of larger streams. (BVG1M: 16a)□.	OC	E	2.63
7.12.7c	Simple to complex microphyll to notophyll vine forest, often with <i>Agathis robusta</i> (kauri pine) or <i>A. microstachya</i> (bull kauri). Granites and rhyolites of foothills and uplands, of the moist rainfall zone. (BVG1M: 5c). Vegetation communities in this regional ecosystem include: □7.12.7c: Simple notophyll semi-evergreen vine forest. Uplands of the dry rainfall zone. Rhyolite. (BVG1M: 5c)□.	LC	NCP	1.24
7.12.9	<i>Acacia celsa</i> (brown salwood) open forest to closed forest. Foothills, uplands and highlands on granites and rhyolites, of the very wet and wet rainfall zone. (BVG1M: 5d).	OC	OC	1.16
7.12.16a	Simple to complex notophyll vine forest, including small areas of <i>Araucaria bidwillii</i> (Bunya pine). Uplands and highlands on granites and rhyolites, of the cloudy wet to moist rainfall zones. (BVG1M: 6b). Vegetation communities in this regional ecosystem include: □7.12.16a: Simple notophyll vine forest (often with <i>Agathis microstachya</i>). Uplands of the cloudy wet to moist rainfall zones. Granite and rhyolite. (BVG1M: 6b)□.	LC	NCP	9.34

RE	RE Description	VMA ¹	Bio. ²	Area ³
7.12.26a	<i>Syncarpia glomulifera</i> (turpentine) +/- <i>Corymbia intermedia</i> (pink bloodwood) +/- <i>Allocasuarina</i> spp. (sheoaks) closed-forest to woodland, or <i>Lophostemon suaveolens</i> (swamp mahogany), <i>Allocasuarina littoralis</i> (black sheoak), <i>C. intermedia</i> shrubland, (or vine forest with these species as emergents). Exposed ridgelines or steep rocky slopes, on granite and rhyolite. □ 7.12.26a: <i>Syncarpia glomulifera</i> , <i>Allocasuarina torulosa</i> and/or <i>A. littoralis</i> open-forest and woodland. Uplands and highlands, often on steep slopes, of the wet rainfall zone. Granite and rhyolite. (BVG1M: 28e) □.	LC	NCP	4.41
7.12.26e	<i>Syncarpia glomulifera</i> (turpentine) +/- <i>Corymbia intermedia</i> (pink bloodwood) +/- <i>Allocasuarina</i> spp. (sheoaks) closed forest to woodland, or <i>Lophostemon suaveolens</i> (swamp mahogany), <i>Allocasuarina littoralis</i> (black sheoak), <i>C. intermedia</i> shrubland, (or vine forest with these species as emergents). Exposed ridgelines or steep rocky slopes, on granite and rhyolite. (BVG1M: 9d). □ Vegetation communities in this regional ecosystem include: □ 7.12.26e: <i>Syncarpia glomulifera</i> low open forest and low woodland. Uplands on steep rocky slopes, of the moist and dry rainfall zone. Granite and rhyolite. (BVG1M: 28e) □.	LC	NCP	8.99
7.12.29a	<i>Corymbia intermedia</i> (pink bloodwood) and/or <i>Lophostemon suaveolens</i> (swamp mahogany) open forest to woodland +/- areas of <i>Allocasuarina littoralis</i> (black sheoak) and <i>A. torulosa</i> (forest sheoak). Uplands, on granite and rhyolite. (BVG1M: 9c). Vegetation communities in this regional ecosystem include: □ 7.12.29a: <i>Corymbia intermedia</i> , <i>Eucalyptus tereticornis</i> , <i>E. drepanophylla</i> open forest to low open forest and woodland with <i>Allocasuarina torulosa</i> , <i>A. littoralis</i> , <i>Lophostemon suaveolens</i> , <i>Acacia cincinnata</i> , <i>A. flavescens</i> , <i>Banksia aquilonia</i> and <i>Xanthorrhoea johnsonii</i> . Uplands, on granite and rhyolite. (BVG1M: 9c) □.	LC	NCP	4.60
7.12.30d	<i>Corymbia citriodora</i> (lemon-scented gum) +/- <i>Eucalyptus portuensis</i> (white mahogany) woodland to open forest. Granite and rhyolite (often coarse-grained red earths and lithosols with much surface rock). (BVG1M: 10b). Vegetation communities in this regional ecosystem include: 7.12.30d: Open woodland to open forest (10-20m tall) mosaic with variable dominance, often including <i>Eucalyptus cloeziana</i> , <i>C. citriodora</i> , <i>E. portuensis</i> , <i>E. lockyeri</i> , <i>C. leichhardtii</i> , <i>E. atrata</i> , <i>E. pachyalyx</i> , <i>E. reducta</i> , <i>C. intermedia</i> and <i>E. shirleyi</i> . There is often a very sparse to mid-dense secondary tree layer of <i>C. abergiana</i> and/or <i>C. stockeri</i> . A very sparse to sparse tall shrub layer may be present and can include <i>Acacia flavescens</i> , <i>Persoonia falcata</i> , <i>Bursaria spinosa</i> subsp. <i>spinosa</i> , <i>Allocasuarina inophloia</i> , <i>Petalostigma pubescens</i> and <i>Grevillea glauca</i> . A sparse to dense lower shrub layer may include <i>Jacksonia thesioides</i> , <i>Acacia calyculata</i> , <i>Xanthorrhoea johnsonii</i> and <i>Grevillea glossadenia</i> . The ground layer may be dominated by species such as <i>Themeda triandra</i> , <i>Heteropogon triticeus</i> , <i>Mnesithea rottboellioides</i> , <i>Arundinella setosa</i> , <i>Cleistochloa subjuncea</i> , <i>Eriachne pallescens</i> var. <i>pallescens</i> , <i>Lepidosperma laterale</i> and <i>Xanthorrhoea johnsonii</i> . Rocky slopes on granite and rhyolite. (BVG1M: 9d).	LC	NCP	133.42
7.12.34	<i>Eucalyptus portuensis</i> (white mahogany) and/or <i>E. drepanophylla</i> (ironbark), +/- <i>C. intermedia</i> (pink bloodwood) +/- <i>C. citriodora</i> (lemon-scented gum), +/- <i>E. granitica</i> (granite ironbark) open woodland to open forest. Uplands on granite, of the dry rainfall zone. (BVG1M: 9d).	LC	NCP	23.76
7.12.57a	Shrubland and low woodland mosaic with <i>Syncarpia glomulifera</i> (turpentine), <i>Corymbia abergiana</i> (range bloodwood), <i>Eucalyptus portuensis</i> (white mahogany), <i>Allocasuarina littoralis</i> (black sheoak) and <i>Xanthorrhoea johnsonii</i> (grasstree). Uplands and highlands on granite and rhyolite, of the moist and dry rainfall zones. (BVG1M: 9d). Vegetation communities in this regional ecosystem include: 7.12.57a: Shrubland and low woodland mosaic with <i>Syncarpia glomulifera</i> , <i>Corymbia abergiana</i> , <i>Eucalyptus portuensis</i> , <i>Allocasuarina littoralis</i> and <i>Xanthorrhoea johnsonii</i> . Uplands and highlands on granite and rhyolite, of the moist and dry rainfall zones. (BVG1M: 9d).	OC	OC	58.60

RE	RE Description	VMA ¹	Bio. ²	Area ³
7.12.57c	Shrubland and low woodland mosaic with <i>Syncarpia glomulifera</i> (turpentine), <i>Corymbia abergiana</i> (range bloodwood), <i>Eucalyptus portuensis</i> (white mahogany), <i>Allocasuarina littoralis</i> (black sheoak) and <i>Xanthorrhoea johnsonii</i> (grasstree). Uplands and highlands on granite and rhyolite, of the moist and dry rainfall zones. (BVG1M: 9d). Vegetation communities in this regional ecosystem include: 7.12.57c: Shrubland/low woodland (1.5-9 m tall) mosaic with variable dominance, often including <i>Eucalyptus cloeziana</i> , <i>Corymbia abergiana</i> , <i>E. portuensis</i> , <i>E. reducta</i> , <i>E. lockyeri</i> , <i>C. leichhardtii</i> , <i>Callitris intratropica</i> , <i>E. atrata</i> , <i>E. pachycalyx</i> , <i>E. shirleyi</i> , <i>E. drepanophylla</i> and <i>Homoranthus porteri</i> , on rhyolite and granite. There is occasionally a very sparse to sparse secondary tree layer of <i>C. abergiana</i> and/or <i>C. stockeri</i> . A very sparse to sparse tall shrub layer may be present and can include <i>Persoonia falcata</i> , <i>Exocarpos cupressiformis</i> and <i>Melaleuca viridiflora</i> var. <i>viridiflora</i> . A sparse to dense lower shrub layer may include <i>Jacksonia thesioides</i> , <i>Acacia calyculata</i> , <i>Coelospermum reticulatum</i> , <i>Xanthorrhoea johnsonii</i> , <i>Acacia humifusa</i> , <i>Dodonaea lanceolata</i> var. <i>subsessilifolia</i> , <i>Grevillea dryandri</i> subsp. <i>dryandri</i> , <i>Grevillea glossadenia</i> , <i>Acacia umbellata</i> and Ericaceae spp. The ground layer may be dominated by species such as <i>Themeda triandra</i> , <i>Xanthorrhoea johnsonii</i> , <i>Eriachne pallescens</i> var. <i>pallescens</i> , <i>Cleistochloa subjuncea</i> , <i>Borya septentrionalis</i> , and <i>Eriachne</i> spp. Includes open rocky dominated by herbs and grasses. This RE includes areas of 7.12.65k (rocky areas with shrubby/herbaceous cover) which are too small to map. Rocky slopes on granite and rhyolite. (BVG1M: 9d).	OC	OC	107.32
7.12.58	<i>Eucalyptus reducta</i> woodland to open forest (6-18m tall). Common associated species include <i>E. granitica</i> , <i>Corymbia dimorpha</i> , <i>C. citriodora</i> , <i>E. cloeziana</i> and occasionally <i>C. intermedia</i> . There is often a sparse secondary tree layer of <i>C. abergiana</i> and/or <i>E. lockyeri</i> . There may be a very sparse tall shrub layer of species such as <i>Acacia flavescens</i> , <i>Persoonia falcata</i> , <i>Allocasuarina littoralis</i> and <i>Acacia simsii</i> , and a very sparse to dense lower shrub layer of <i>Acacia calyculata</i> , <i>Pultenaea millarii</i> , <i>Jacksonia thesioides</i> , <i>Grevillea glossadenia</i> , <i>Grevillea dryandri</i> subsp. <i>dryandri</i> , <i>Homoranthus porteri</i> and <i>Dodonaea lanceolata</i> var. <i>subsessilifolia</i> . The ground layer is often dominated by species such as <i>Themeda triandra</i> , <i>Eriachne</i> spp., <i>Cleistochloa subjuncea</i> , <i>Lomandra longifolia</i> , <i>Mnesithea rottboellioides</i> , <i>Xanthorrhoea johnsonii</i> , <i>Heteropogon triticeus</i> and <i>Coronidium newcastlianum</i> . Granite and rhyolite. (BVG1M: 9d).	OC	OC	72.45
7.12.65k	Rock pavements or areas of skeletal soil, on granite and rhyolite, mostly of dry western or southern areas, often with shrublands to closed forests of <i>Acacia</i> spp. (wattles) and/or <i>Lophostemon suaveolens</i> (swamp mahogany) and/or <i>Allocasuarina littoralis</i> (black sheoak) and/or <i>Eucalyptus lockyeri</i> subsp. <i>exuta</i> . (BVG1M: 28e). 7.12.65k: Granite and rhyolite rock outcrop, of dry western areas, associated with shrublands to closed forests of <i>Acacia</i> spp. and/or <i>Lophostemon</i> spp. and/or <i>Allocasuarina</i> spp. In the Mount Emerald area, shrubs may include <i>Acacia umbellata</i> , <i>Melaleuca borealis</i> , <i>Homoranthus porteri</i> , <i>Leptospermum neglectum</i> , <i>Melaleuca recurva</i> , <i>Melaleuca uxorum</i> , <i>Grevillea glossadenia</i> , <i>Corymbia abergiana</i> , <i>Eucalyptus lockyeri</i> , <i>Sannantha angusta</i> , <i>Pseudanthus ligulatus</i> subsp. <i>ligulatus</i> , <i>Acacia aulacocarpa</i> , <i>Leptospermum amboinense</i> , <i>Xanthorrhoea johnsonii</i> and <i>Jacksonia thesioides</i> . Ground-cover species may include <i>Borya septentrionalis</i> , <i>Lepidosperma laterale</i> , <i>Eriachne</i> spp., <i>Cleistochloa subjuncea</i> , <i>Boronia occidentalis</i> , <i>Cheilanthes</i> spp., <i>Coronidium newcastlianum</i> , <i>Schizachyrium</i> spp., <i>Tripogon loliiformis</i> , <i>Gonocarpus acanthocarpus</i> and <i>Eragrostis</i> spp. Dry western areas. Granite and rhyolite. (BVG1M: 29b).	LC	OC	7.03
9.5.8	Woodland to open-woodland of <i>Eucalyptus cullenii</i> (Cullen's ironbark) and/or <i>E. leptophleba</i> (Molloy red box) +/- <i>Corymbia erythrophloia</i> (red bloodwood) +/- <i>Erythrophleum chlorostachys</i> (Cooktown ironwood). <i>Eucalyptus tardecidens</i> (box) may also occur as a subdominant in northern extent of this regional ecosystem. A sparse shrub layer includes <i>Petalostigma</i> spp., <i>Melaleuca</i> spp., <i>Grevillea</i> spp., <i>Alphitonia pomaderroides</i> and <i>Maytenus cunninghamii</i> (yellowberry bush). The sparse to dense ground layer is dominated by <i>Heteropogon contortus</i> (black speargrass) and <i>Sarga plumosum</i> (plume sorghum). Occurs on undulating plains in valleys in ranges on Tertiary/Quaternary soils overlying granite and metamorphic geologies. (BVG1M: 13a)	LC	NCP	0.01

RE	RE Description	VMA ¹	Bio. ²	Area ³
9.5.9a	<p>Woodland to open-woodland of <i>Corymbia clarksoniana</i> (Clarkson's bloodwood) and/or <i>Eucalyptus leptophleba</i> (Molloy red box) and/or <i>E. platyphylla</i>. A sparse to mid-dense shrub layer including <i>Melaleuca</i> spp., <i>Grevillea</i> spp., and <i>Planchonia careya</i> (cocky apple) can occur. The ground layer is dominated by <i>Themeda triandra</i> (kangaroo grass) and <i>Heteropogon</i> spp. Occurs on plains, undulating plains and outwash deposits and Tertiary to Quaternary locally consolidated high-level alluvium and colluvium. Major vegetation communities include:</p> <p>9.5.9a: Woodland to open-woodland of <i>Corymbia clarksoniana</i> (Clarkson's bloodwood) +/- <i>Eucalyptus platyphylla</i> (poplar gum) +/- <i>E. leptophleba</i> (Molloy red box) +/- <i>C. tessellaris</i> (Moreton Bay ash) with a distinct to sparse sub-canopy layer often including <i>Melaleuca viridiflora</i> (broad-leaved paperbark), <i>Grevillea glauca</i> (bushman's clothes peg), <i>Petalostigma pubescens</i> (quinine) and <i>Alphitonia pomaderroides</i> (soapbush). An open to sparse shrub layer includes <i>Melaleuca</i> spp., <i>Persoonia falcata</i>, <i>Grevillea</i> spp. and <i>Petalostigma pubescens</i> (quinine). The sparse to mid-dense ground layer is dominated by <i>Themeda triandra</i> (kangaroo grass), <i>Aristida</i> spp., <i>Heteropogon contortus</i> (black speargrass), <i>H. triticeus</i> (giant speargrass), and <i>Sarga plumosum</i> (plume sorghum). Occurs on undulating plains. (BVG1M: 9e)□.</p>	LC	NCP	
9.12.7a	<p>Woodland to low open-woodland of <i>Eucalyptus cullenii</i> (Cullen's ironbark) +/- <i>Erythrophleum chlorostachys</i> (Cooktown ironwood) +/- <i>C. leichhardtii</i> (yellowjacket) +/- <i>Corymbia erythrophloia</i> (red bloodwood). The mid-layer is generally absent but a subcanopy and/or shrub layer can occur. The ground layer is sparse to dense and dominated by <i>Heteropogon contortus</i> (black speargrass) and <i>Themeda triandra</i> (kangaroo grass). Occurs on predominantly felsic volcanic rocks, on rolling to steep hills. Major vegetation communities include:</p> <p>9.12.7a: Woodland to open-woodland of <i>Eucalyptus cullenii</i> (Cullen's ironbark) +/- <i>Corymbia erythrophloia</i> (red bloodwood) +/- <i>Erythrophleum chlorostachys</i> (Cooktown ironwood) +/- <i>C. dallachiana</i> (Dallachy's gum). An open to mid-dense subcanopy can occur and includes a variety of species. The shrub layer is absent to open and dominated by <i>Maytenus cunninghamii</i> (yellowberry bush), <i>Alphitonia pomaderroides</i> (soapbush), <i>Petalostigma</i> spp., and <i>Acacia</i> spp. The ground layer is sparse to dense and dominated by <i>Heteropogon contortus</i> (black speargrass), <i>H. triticeus</i> (giant speargrass), <i>Themeda triandra</i> (kangaroo grass) and <i>Sarga plumosum</i> (plume sorghum) with a <i>Xanthorrhoea</i> sp. (grasstree) occurring in some areas. Occurs on rhyolite hills. (BVG1M: 13a)□.</p>	LC	NCP	0.01
9.12.40	<p>Low open-woodland to low woodland of <i>Melaleuca citrolens</i> (scrub teatree) +/- <i>Terminalia platyptera</i> (yellow-wood) +/- <i>Corymbia dallachiana</i> (Dallachy's gum) +/- <i>Erythrophleum chlorostachys</i> (Cooktown ironwood). The sparse shrub layer consists of <i>Petalostigma banksii</i> (smooth-leaved quinine), <i>M. citrolens</i> and <i>Gardenia vilhelmii</i> (breadfruit). The ground layer is frequently bare, with patches of short grasses including <i>Eriachne</i> spp., <i>Aristida</i> spp. and <i>Schizachyrium</i> spp. (firegrass). This community also occurs as short open-tussock grassland wooded with low trees and shrubs of <i>Melaleuca citrolens</i> +/- <i>Terminalia</i> spp. Occurs on gentle slopes, footslopes, rolling hills and colluvial low slopes. (BVG1M: 21b).</p>	LC	NCP	
Non-rem	Non-remnant: modified land, roads, clearings and tracks.			0.08
<p>¹ Status under Vegetation Management Act 1999: OC - Of Concern; LC - Least Concern.</p> <p>² Biodiversity management status: E - Endangered; OC - Of Concern, NCP - No Concern at Present.</p> <p>³ Area - total area in hectares of RE type within offset site.</p> <p>Conservation status of EVNT species: <i>Acacia purpureopetala</i> (CE - EPBC Act, V - NCA); <i>Grevillea glossadenia</i> (V- EPBC Act, V - NCA); <i>Homoranthus porteri</i> (V - EPBC Act, V - NCA); <i>Melaleuca uxorum</i> (E - NCA); <i>Plectranthus amoenus</i> (V - NCA); <i>Prostanthera albobirta</i> (CE - EBC Act, E - NCA); <i>Prostanthera clotteniana</i> (CE - EBC Act, E - NCA).</p>				

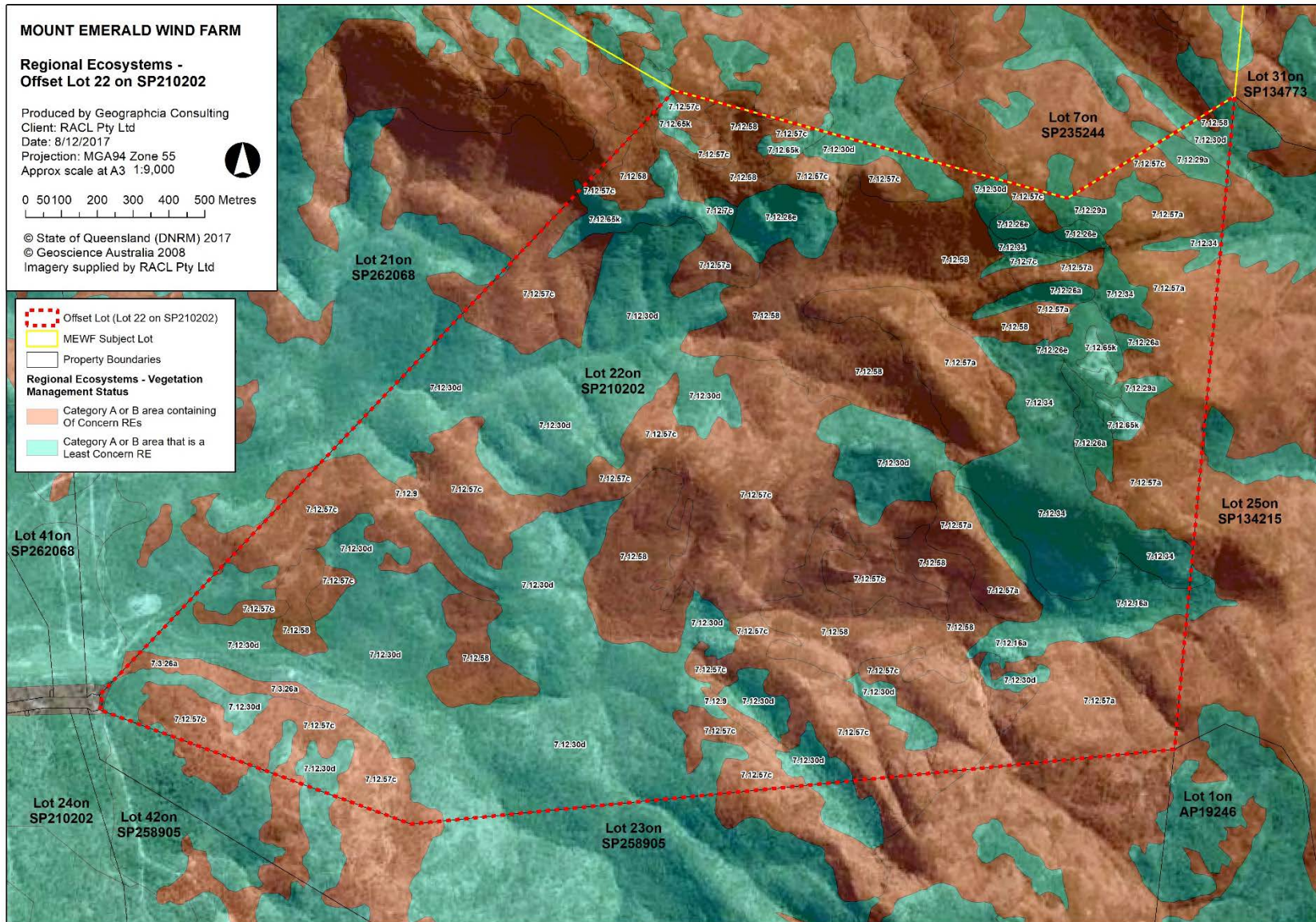


Figure 2 MEWF Regional Ecosystems on Offset Lot

2.0 Methods

The following sections detail the methods employed for the 2017 ecological offset area monitoring program. The methods employed as part of this monitoring program are consistent with those outlined in the MEWF Offset Area Management Plan (RPS, 2016).

Field surveys were conducted on site between 24 October -10 November 2017.

Total rainfall across the Mount Emerald range was recorded as 58 mm over that period. Minimum temperatures were 11 °C and maximum temperatures were 35 °C with average nightly temperature falling to 17 °C. Daily temperatures averaged 29.2 °C. Winds were calm until day 10 when speeds increased to 19 knots ESE for the final four days of survey.

2.1 Targeted Fauna Surveys for Conservation Significant Fauna

2.1.1 Northern Quoll (*Dasyurus hallucatus*)

2.1.1.1 Methods

Camera Traps

The most suitable method for determining the presence of Northern Quoll is by undertaking a Camera Trapping Survey. This method follows that of Eyre *et al* (2014). Survey sites replicated those of the 2016 surveys conducted by RPS (2016) and shown in **Figure 3**.

A total of 18 camera traps (Reconyx visible flash units) were used for the camera trapping survey. At each survey site a single camera trap was attached horizontally to the trunk of a tree with a 'dbh' (diameter at breast height) of at least 15 cm with a metal angle bracket, at ~1 m above the ground so the camera faced the ground. Directly beneath the camera, a bait holder, consisting of a Rain Harvesting™ PVC toilet vent pipe cap with a 50 mm PVC pipe insert, baited with two chicken necks, was affixed to the ground with a 30 cm, 5 mm diameter tent peg.

Each camera was set at the medium-level trigger sensitivity. All loose vegetation (e.g. grass stalks, forbs and shrub branches) within the field of view of each camera were removed to minimize false triggers. Camera traps were active for a period of 14 days.

Habitat Assessments

Habitat assessments were conducted at each site.

Measurements of habitat will also be made. Parameters monitored:

- ▶ Evidence of fire;
- ▶ Nature and extent of erosion;
- ▶ Extent of weed species;
- ▶ Presence of feral animals;
- ▶ Type of groundcover;
- ▶ Structure and floristics of vegetation cover; and
- ▶ Number of habitat trees.

2.1.2 Spectacled Flying Fox (*Pteropus conspicillatus*)

2.1.2.1 Methods

Diurnal searches for roosts and feeding signs were undertaken over a large proportion of the project site per Eyre *et al* (2014). Surveys followed meandering transects while completing camera trapping, and targets surveys concentrated on regional ecosystems with a high likelihood of flowering myrtaceous

species. A botanical assessment of the presence of feed trees and the percentage currently flowering (during this survey) across the site was undertaken by a qualified botanist.

As with previous surveys the terrain on the site is extremely rugged and hazardous with large cliff overhangs. The total number of spot-lighting transects as recommended by DoEE (2014b) were unachievable (i.e. 5 hours per 50 ha/night = a total of 365 hrs of spotlighting) under these conditions. Observers conducted a total of 39 hours spotlighting.

2.1.3 Bare-rumped Sheath-tail Bat (*Saccolaimus saccolaimus nudicluniatatus*)

2.1.3.1 Methods

Five ultrasonic bat call detectors (Wildlife Acoustics SM2+BAT fitted with a SM-UX microphone) were placed across the site (**Figure 3**), to determine presence and species composition of bats within the Offset Site. The bat call detectors were programmed to turn on automatically at 6 pm each evening and record for a 12 hour period.

All call analysis was conducted by Kelly Matthews from Green Tape Solutions, Brisbane. Ms Matthews is a recognised expert on bat call analysis and has an extensive library of reference calls from the FNQ Bioregion. Survey limitations identified bat detectors failures preventing recording across the full site during the full fortnight duration. Functioning bat detectors identified large numbers of bat calls.

2.2 Targeted Weed Surveys

The weed assessment of the offset site concentrated on the access track from Lemontree Drive to the small clearing adjacent to a tributary of Oak Creek. The entire length of the track was traversed on foot. Additional spot observations of weed presence in remnant, undisturbed vegetation were undertaken in 2016 and during the 2017 survey. The full survey results including site recommendations are detailed in **Appendix A**.

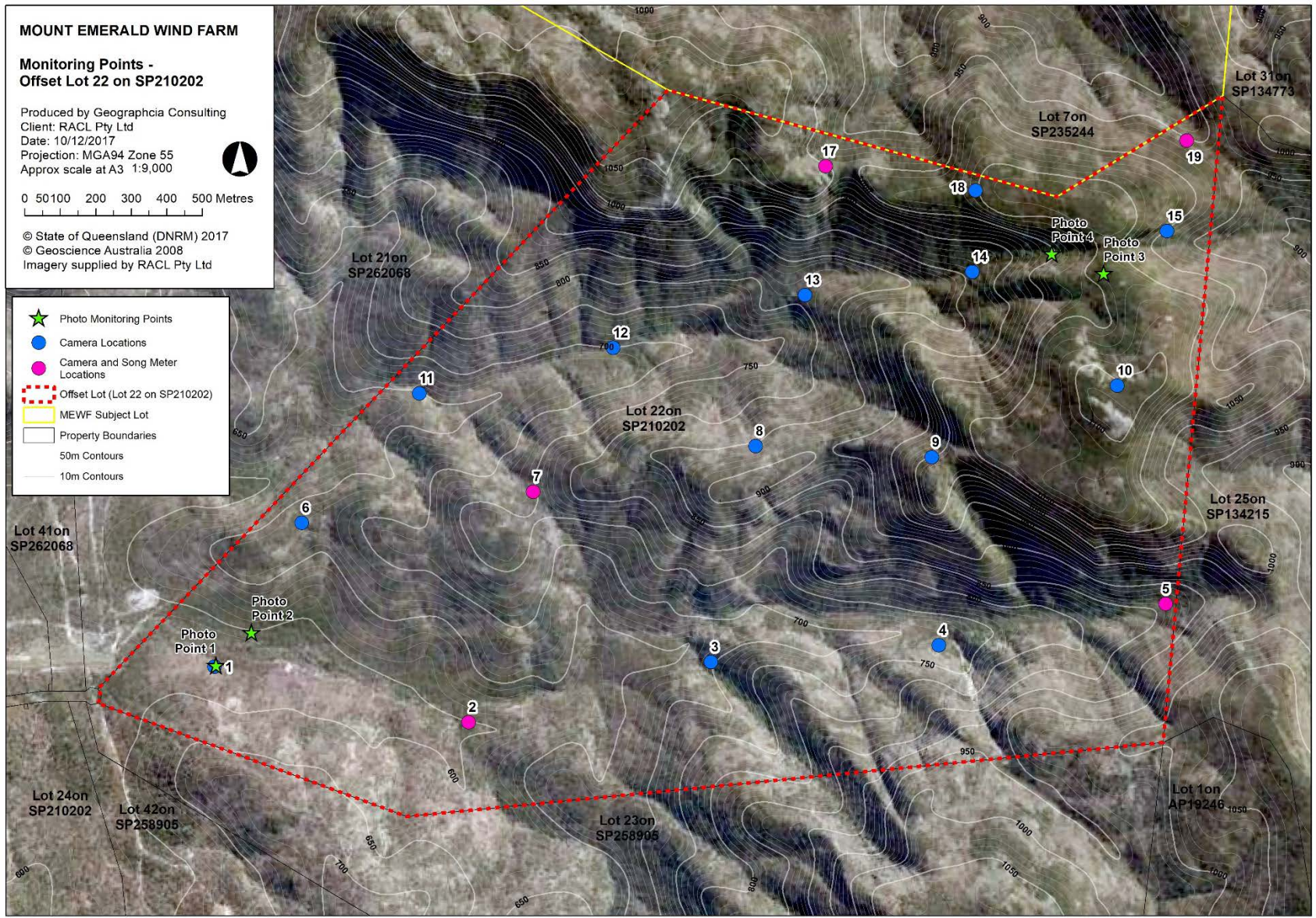


Figure 3 Monitoring Points on Offset Lot

2.3 Opportunistic Assessment

Fauna were monitored at 18 sites. Parameters monitored:

- ▶ Diurnal bird, herpetofauna, terrestrial mammal; and
- ▶ Threatened species presence.

2.4 Photo-monitoring points

Four photo monitoring points were established within the offset area to enable a visual assessment of changes over time (**Figure 3**). Each point was:

- ▶ Marked with flagging tape and the GPS points recorded;
- ▶ Annual photographs in north, south east and west directions.

Maintain a record of the photographs, including GPS co-ordinates, date and time of each photograph, the direction in which the photograph was taken; and the height above the ground at which the photograph was taken.

2.5 Pest Vertebrate Assessment

2.5.1 Camera trap Locations

Secondary monitoring data was achieved from camera traps set at 18 Quoll monitoring traps (refer to **Section 2.1**). Pigs, feral dogs and cats are all known to be attracted to this bait.

Data collection included:

Species identification (feral pigs and other animals);

- ▶ Number of each species;
- ▶ Age class of feral pigs;
- ▶ Sex of feral pigs.

2.5.2 Spotlight Monitoring for Feral Cat and Dog

Spotlighting was completed on four nights across the offset site at a total of 36 hours. Spot lighting commenced approximately 30 minutes after sunset. Transects were walked across the site, and where possible roads were traversed at speeds of 10 km/hr. The observer held the spotlight at eye level searching into the vegetation surrounding the site. When an animal was sighted the team stopped and recorded the species and number of each species.

Further visual assessments were conducted of pest species from, scats, tracks, evidence of damage and incidentals sightings across the site.

2.6 Results and Discussion

2.6.1 Northern Quoll

A total of 252 camera trap nights were conducted on the offsets site and all of the units captured images. Ten Northern Quolls were recorded during the camera trapping survey and many of the quolls revisited the same site on multiple nights. Eight of 10 animals were in good condition however there were two animals with severe hair loss at sites 5 and 17. From experience at the MEWF site these are most likely to be persistent males at the end of their breeding season. Three animals were located at multiple monitoring locations, identified from the spot marking on their back.

Site 11 recorded the highest number of species of the sites surveyed. This was at high altitude with a large number of hollows and available habitat.

Thirteen Northern Quolls were detected across the Offset site during baseline surveys in 2016 (RPS, 2016). This monitoring survey was conducted several months after the baseline surveys therefore it is expected there will be fewer animals due to male die off following breeding (Burnett *et al*, 2013). Numbers are still comparative to 2016. The distribution of the population across the offset site is similar to 2016, with the majority of monitoring sites recording quoll activity in both sampling years regardless of vegetation composition.



Plate 1 Northern Quoll

The Offset Site has maintained its integrity and the habitat was observed to be high quality with large refugial areas of rock outcrops, tree hollows and fallen logs for Northern Quoll. The seasonal creeks from the Mt Emerald massif contained a large number of rocky pools this dry season with abundant fish and insect fauna. Quoll scats were evident from adults and juveniles at a number of these locations (7).

2.6.2 Spectacled Flying-fox

Three Spectacled Flying-fox (SFF) and an unidentified (Little Red or Black Flying Fox sp.) were identified foraging on site. SFF were located on the northern ridge line as identified in **Figure 4**, whereas the unidentified species foraged in the creek line.

Targeted search for the SFF concentrated search effort in areas where vegetation was either in fruit or flower. The creek lines were considered the most likely location as they contained flowering Pink Poplar (*Euroschinus falcatus*) and fruiting Burdekin Plum (*Peigynium timorense*). The SFF is difficult to locate however, where the noted plant species were found individuals were often recorded during survey.

Single locations of flowering Eucalypt trees were also recorded during other survey work. The ridgelines did contain some flowering Northern Ironbark (*Eucalyptus crebra*). These individual trees were used as locations to sit and wait for any Flying Fox activity.

Approximately 15% of available foraging trees were flowering or commencing flowering across the site due to recent rainfall and were of high quality. As identified the OAMP (RPS, 2016) foraging habitat is available across the offset site and is considered in moderate to high quality. It is highly likely each species will utilise the site widely when available vegetation is flowering.

Baselines surveys in 2016 identified the presence of habitat trees however, no SFF or similar species were sighted due to lack of flowering. The timing of these surveys was better suited for spotting SFF however, the species would be best identified later in the wet season.

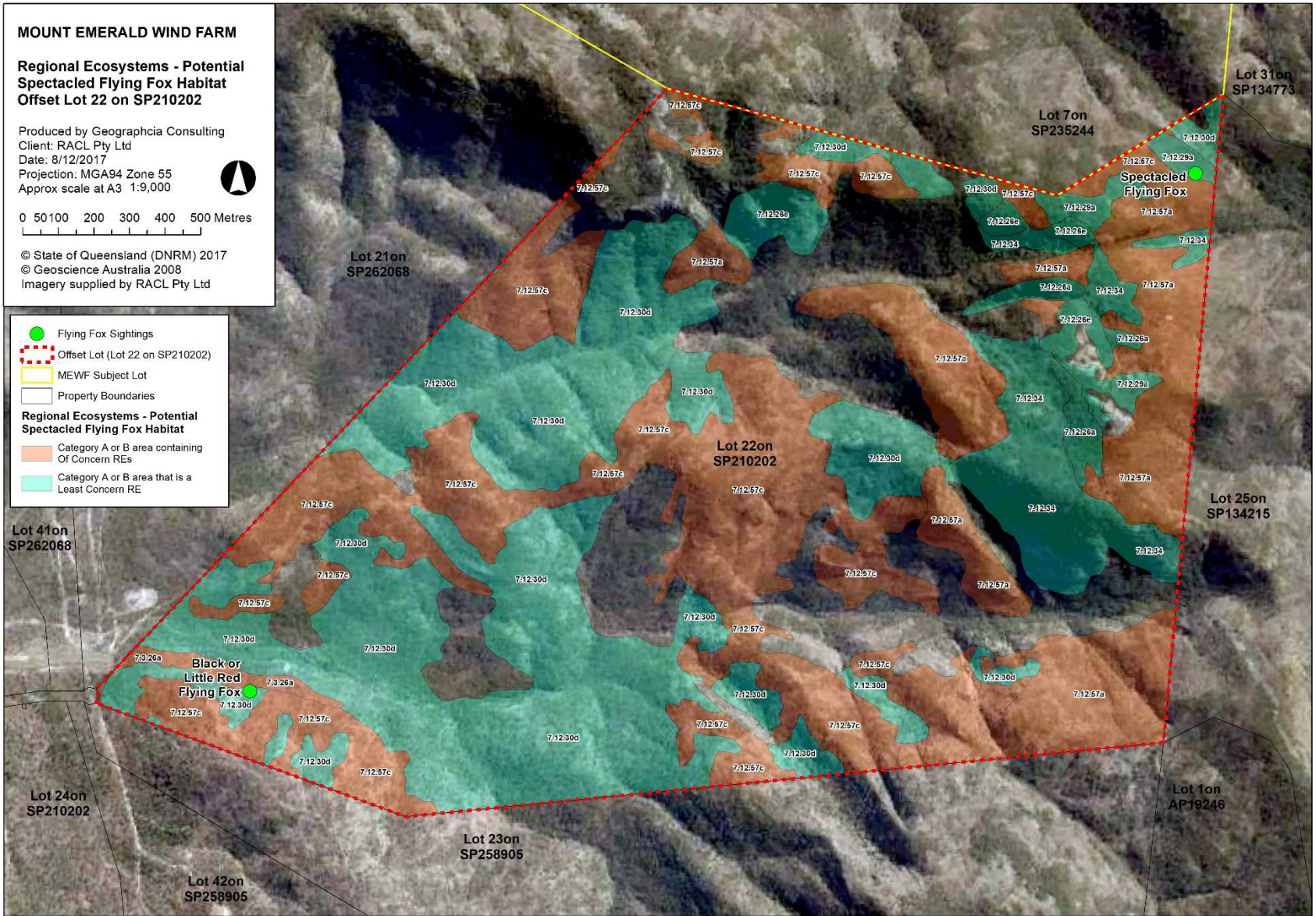


Figure 4 Potential Spectacled Flying Fox Habitat on Offset Lot

2.6.3 Bare-rumped Sheathtail Bat (*S. saccolaimus*)

A total of 35 detector nights of microchiropteran bat call surveys were conducted within the project site between late October and Early November.

A total of 10 microbat species were detected occurring within the site. A total of seven (7) microbat species were potentially/probably recorded on site (**Table 2**).

The presence of Bare-rumped Sheathtail Bat (BRSB), listed as Endangered under NC Act, and listed as Vulnerable under EPBC Act, was analysed. This species could not be definitely confirmed due the similarity in call with sympatric species and overlap in their distribution. This species also presents a number of call variations which makes it difficult to confirm its presence using only echolocation techniques. However, a number of calls presented harmonics that could highly likely be attributed to BRSB and therefore, we would consider BRSB is highly likely to occur within the surveyed area (**Appendix B**).

Characteristic call attributes of BRSB include:

- ▶ A dominant harmonic with characteristic frequency around 22-25 kHz;
- ▶ At least 3 and up to five distinct harmonics at approximately 13 kHz intervals (1 below and up to 3 above the dominant harmonic); and
- ▶ Call pulses sometimes in “triplet” sets with pulse intervals of approximately 10-20 ms between first and second pulses and 20-40 ms between second and third pulses and an inter-triplet interval of about 80-100 ms (**Appendix B**).

In both 2016 and 2017, calls were recorded at Site 19 which is the high altitude *Corymbia citriodora* (lemon-scented gum) +/- *Eucalyptus portuensis* (white mahogany) woodland to open forest aspect of the site.

All bats identified on the site were expected to be present within the region. Bat activity levels at the site are considered to be similar compared to other surveys within similar areas in the surrounding region. Six further species were identified during this monitoring season than during the baselines surveys in 2016, each with strong call signatures. Weather conditions were with low wind, good insect availability due to recent rain were good for collecting bat data survey during this survey period.

Table 2 summarises the Call Analysis.

Table 2 Summary of Call Analysis

Species	Status EPBC	Status NCA	Confidence
<i>Austronomus australis</i>	Least Concern	NOC	Definite
<i>Chaerophon jobensis</i>	Least Concern	NOC	Definite
<i>Chalinobus picatus</i>	Least Concern	NOC	Definite
<i>Chalinobus nigrogiseus</i>	Least Concern	NOC	Definite
<i>Miniopterus australis</i>	Least Concern	NOC	Definite
<i>Miniopterus oriana oceanensis</i>	Least Concern	NOC	Definite
<i>Mormopterus lumsdenae</i>	Least Concern	NOC	Definite
<i>Mormopterus ridei</i>	Least Concern	NOC	Definite
<i>Nyctophilus geoffroyi</i>	Least Concern	NOC	Possible
<i>Nyctophilus gouldi</i>	Least Concern	NOC	Possible
<i>Nyctophilus bifax</i>	Least Concern	NOC	Possible
<i>Rhinolophus megaphyllus</i>	Least Concern	NOC	Definite
<i>Saccolaimus flaviventris</i>	Least Concern	NOC	Possible
<i>Saccolaimus saccolaimus</i>	Vulnerable	Endangered	Possible
<i>Scotorepens orion</i>	Least Concern	Least Concern	Possible
<i>Taphozous troughtoni</i>	Least Concern	Least Concern	Possible
<i>Vespadelus pumilus</i>	Least Concern	Least Concern	Definite

2.7 General Fauna

From a combination of spotlighting, diurnal, camera trap and opportunistic sightings a total of 54 species were able to be positively identified with three of these species listed under the EPBC and NC Act as those targeted: Northern Quoll, Spectacled Flying Fox and the Bare-rumped Sheath-tail Bat. No other threatened species were identified. This consisted of 28 birds, 15 mammals, 6 reptiles and 5 frogs (**Appendix C**). A total of 71 species were identified on site.

The birds included species such as the Pheasant Coucal (*Centropus phasianinus*) and Noisy Friarbird (*Philemon corniculatus*). Red-backed Buttonquail (*Turnix maculosus*) Australian golden whistler (*Pachycephala pectoralis*). Nocturnal surveys located Boobook Owl (*Ninox boobook*) and the Tawny Frogmouth (*Podargus strigoides*).

The cryptic Mareeba Rock-wallaby (*Petrogale mareeba*) was identified on the lower mountain slopes at site 11 at a similar location to 2016 therefore a den location must be in close proximity. The Echidna *Tachyglossus aculeatus* and Melomys (*Melomys burtoni*) were distributed in multiple locations across the site.

A total of five lizards were identified in camera traps:

- ▶ 2 monitors (*Varanus tristis* and *V. varius*),
- ▶ 1 gecko (*Gehyra dubia*,
- ▶ 1 Rainbow Skink (*Liburnascincus mundivensis*) and
- ▶ 2 Lined Dragon (*Diporiphora bilineata*).

An Eastern brown snake (*Pseudonaja textilis*) was also located.

With the exception of the Cane Toad (*Rhinella marina*), all frogs identified in the creek during spotlighting surveys were *Litoria* species. (*L. rubella*; *L. inermis*; *L. atopalmata*; *L. wilcoxii*). No amphibians were located in 2016 due to the lack of rainfall during the dry season.

A complete list of fauna species is provided in **Appendix C**.

3.0 Pest Vertebrate Monitoring

The availability of freshwater pools throughout the site appears to have influenced the presence of large feral animals in the 2017 monitoring season. Evidence of pig (*Sus scrofa*) activity was found at the entry to the site off Lemontree Drive along the creek bed where these water pools remained.

Feral pig observations are provided in **Table 3** below.

Table 3 Evidence of Feral Pigs on Offset Site

Survey	Location	Species	Number
Spotlighting	Nil detected	0	0
Camera Trapping	18	Pig	1
Scats	Site 5, 7, 16, 18	Pig	4
Visual Observation	Site 18, front gate, creek and gully tree roots and dugouts located.	Pig	7

Feral cat and dog observations are reported in **Table 4** below. The only evidence of these species on site were single observations at a camera trap (cat) and scat (dog). The dog scat is most likely to be from a neighbouring yard as they have been known to utilise the creek for swimming. This scat showed signs of being from a domestic animal due to its content.


Table 4 Evidence of Feral Cat and Dogs on Offset Site


Survey	Location	Species	Number
Spotlighting	-	-	0
Camera Trapping	# 13	Cat	1
Scats	# 2 (may not be feral as close to houses)	Dog	1
Visual Observation	-	-	0

3.1 Photo-monitoring Points


A visual assessment was undertaken at four photo monitoring points. These locations were selected based on habitat quality, Regional Ecosystem attribute and location. **Table 5** below summarises the characteristics of these sites where photographs are oriented towards the North, South-east and West facing directions. Whilst the photo will aid in the broad comparisons over time, they are best used in combination with floristic data (Gleed, 2017) as they are unlikely to show fine scale changes on their own.

Table 5 Photo Monitoring Points

Site ID	Description	Photograph from North, South east, West
<p>Photo Point 1 Location :0327999, 8096486</p>	<p>Mapped as RE 7.3.26a Site only partially conforms to mapped RE absence of <i>Allocasuarina cunninghamii</i> in community however some key associates were present in canopy and shrub layer. Alluvial sandy loam on riverine wetland. Canopy of <i>Eucalyptus tereticornis</i>, <i>Corymbia Leichardtii</i> with a sparse shrub layer containing <i>Lophostemon grandiflorus</i>, <i>Bursaria tenuifolia</i>, <i>Exocarpus cupressiformis</i>, <i>Callitris intratropica</i>, <i>Acacia spp.</i> with a ground layer containing <i>Heteropogon triticeus</i>, <i>Sarga spp.</i> and <i>Themada triandra</i>. Weeds present <i>Stylo guianensis</i></p>	 <p>The photographs show three different directions from the monitoring point: North, South East, and West. Each image displays a forest with a mix of tree species and a ground layer of grass. A yellow marker is placed in the foreground of each photo for orientation.</p>

Site ID	Description	Photograph from North, South east, West
<p>Photo Point 2</p> <p>Location: 0328099, 8096579</p>	<p>Mapped 7.12.30d</p> <p>Site conforms to RE containing dominant canopy and key lower level associates.</p> <p>Rocky slopes on granite and rhyolite. Canopy <i>Eucalyptus cloeziana</i>, <i>Corymbia leichardtii</i> and <i>Eucalyptus crebra</i> with a very sparse shrub layer containing <i>Petalostigma pubescens</i>, <i>Coelospermum reticulatum</i>, <i>Persoonia falcata</i>, <i>Grevillea parrallela</i> and a ground layer containing <i>Heteropogon triticeus</i>, <i>Sarga spp.</i> and <i>Themada triandra</i>.</p> <p>Weeds present <i>Melenis repens</i></p>	 <p>The photographs show a forest with tall, thin trees and a grassy ground layer. The top photo is labeled '30D N', the middle '30D SE', and the bottom '30D W'. Each photo has a yellow marker in the foreground.</p>

Site ID	Description	Photograph from North, South east, West
<p>Photo Point 3 Location 0330501, 8097591</p>	<p>Site conforms to RE containing low open woodland to shrubland containing key canopy and lower level associates.</p> <p>High uplands slopes on granite and rhyolite. Tall shrub/ low tree layer <i>Syncarpia glomulifera</i>, <i>Corymbia abergiana</i>, <i>Eucalyptus portuensis</i>, <i>Eucalyptus crebra</i>, <i>Allocasuarina littoralis</i>. <i>Banksia aquilonia</i>. Ground layer <i>Xanthorrea johnsoni</i>, <i>Themeda triandra</i>, <i>Imperata cylindrical</i>, <i>Pteridium esculentum</i>,</p>	 <p>The 'Photograph from North, South east, West' column contains three vertically stacked photographs. Each photograph shows a different perspective of a woodland area. The top photograph, labeled '57A N', shows a dense stand of trees with a yellow marker on the ground. The middle photograph, labeled '57A W', shows a similar view from a different angle. The bottom photograph, labeled '57A SE', shows a wider view of the woodland. The trees are tall and thin, with a canopy of green leaves. The ground is covered with grass and other vegetation.</p>

Site ID	Description	Photograph from North, South east, West
<p>Photo Point 4 Location: 0330355, 8097647</p>	<p>Mapped as RE 7.12.7a</p> <p>Site conforms to mapped RE containing simple to complex notophyll vine forest with emergent <i>Agathis microstachya</i> on granite and rhyolite in the uplands of the moist rainfall zone.</p> <p>Closed vine forest with emergent <i>Agathis microstachya</i> lower level associates include <i>Alectryon semicinereus</i>, <i>Guioa acutifolia</i>, <i>Mallotus phillipensis</i>, <i>Wilkea pubescens</i>, <i>Polyscias elegans</i>, <i>Psychotria lonciceroides</i>, <i>Pipturus argenteus</i>, <i>Smilax australis</i>, Ground layer <i>Dicranopteris linearis</i>, <i>Adiantum diaphanum</i></p>	

4.0 Management Actions

4.1 Comparison to Baseline Monitoring

Since the baseline monitoring collection in 2016 the conditions of the site have changed very little. The absence of fire has improved the condition of some habitat on the site in combination with availability of freshwater pools has increased the availability of resources and mobility for some species. Fauna distribution and population of target species is very similar and although no statistical analysis could be undertaken, there was no indication of a population decline in Northern Quoll, Spectacled Flying-fox, or Bare-rumped Sheath-tail Bat due to habitat impacts on the offset site.

4.2 Biodiversity management issues

Several minor biodiversity management issues were identified during monitoring. These include the state of the access track, and signs of feral fauna within the Biodiversity Offset Area.

4.2.1 Access Track

Since the baseline monitoring data was collected in 2016, the conditions of access tracks within the Biodiversity Offset Site are to be improved through the securing perimeter fencing. The tracks were showing signs of rill erosion, as well as disturbance by unauthorised vehicular access (primarily motorbikes). Unauthorised access by vehicles should stop with fencing however, these tracks will continue to be scoured by water runoff, resulting in rill erosion. The track may require remediation to prevent excess sediment loading of the nearby ephemeral drainage line if tracks continue to be utilised to the 50x50 m pad.

4.2.2 Pest Species

The biodiversity offset area is considered to contain a low density of pest fauna species, predominately pigs. This is based on the observations of tracks and scats sightings starting within the creek at Lemontree Drive. Aerial baiting and the MEWF pest management plan should target this offset site in the next round of pest management activities.

Camera traps should be selectively used to record feral pig activity across the site. This will give an indication of the proportion of pigs which are impacting the habitat. The employment of bait stations will assist in obtaining more accurate records of feral pig visitation rates.

4.2.3 Timing

It is recommended further monitoring surveys be conducted in April at the end of the wet season to encompass full flowering of plants to ensure feeds trees are available and fauna are most mobile throughout their range.

5.0 Summary

Th ecological surveys undertaken in the MEWF offset site during 2017 provide the first round of annual monitoring data that can be directly compared with the baseline data collected in 2016. The ecological monitoring surveys include information that will be used with weed survey information to fulfil obligations to include in the annual reporting required for the conservation agreement with DoEE and DEH.

A total of three threatened species were recorded in the MEWF Offset site in 2017:

- ▶ Northern Quoll (*Dasyurus hallucatus*)
- ▶ Spectacled Flying Fox (*Pteropus conspiculatus*)
- ▶ Bare-rumped Sheathtail Bat (*Saccolaimus saccolaimus*).

Fauna habitat resources remain abundant within the MEWF offset site and the habitat is of high quality.

The site has a high density of the large hollows that several nocturnal birds of prey, bat and large mammal species require for breeding. In addition, small mammals (terrestrial and arboreal), which are the respective prey of a number of predatory species, were identified throughout the site. Canopy tree species and understorey shrubs within the site provide abundant foraging resources such as foliage, seeds, pollen, nectar and invertebrates for variety of species on a seasonal basis and may potentially influence the occurrence and abundance of arboreal mammal species and birds.

Groundcover has improved since baselines surveys due to increased rainfall and rehabilitation since a fire event therefore small reptiles and amphibians have increasingly utilised a wider distribution of the offsets site.

Feral pigs, dogs and cats are evident on the site however only pigs are at a stage that management actions require appropriate measures.

Weed surveys described that although there are currently no priority listed weed species on site, vigilance will be require along the access track and road entry to ensure there are no access points for these threats. Management measures to remove weeds from tracks and external site boundaries will reduce the risks significantly.

The ecological condition of the MEWF Offset site has been maintained since baselines surveys were conducted in 2016.

6.0 References

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Appendix A Offset Site Weed Survey



Mt Emerald Wind Farm Offset Site Weed Survey 2017



Report prepared for 4 Elements Consulting for the Mt
Emerald Wind Farm

S. Gleed, January 2018

Mt Emerald Wind Farm Offset Site Weed Survey 2017

Mt Emerald Wind Farm

Simon Gleed

18th January 2018

Report prepared for 4 Elements Consulting for the Mt Emerald Wind Farm

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Simon Gleed undertook the fieldwork and preparation of this document in accordance with specific instructions from 4 Elements Consulting, to whom this document is addressed. This report has been prepared using information and data supplied by the Mt Emerald Wind Farm, 4 Elements Consulting and other information sourced by the author.

The conclusions and recommendations contained in this document reflect the professional opinion of the author based on the data and information supplied and available at the time of the work. The author has used reasonable care and professional judgment in the interpretation and analysis of the data. The conclusions and recommendations must be considered within the agreed scope of work, and the methodology used to perform the work, both of which are outlined in this report.

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1.0 INTRODUCTION

The Mt Emerald Wind Farm offset site is located on land described as Lot 22 on SP210202 and by road is accessed via Lemontree Drive. The offset site has an area of 434.9 ha and is entirely covered by remnant vegetation in near-pristine condition (see **Figure 1**).

A survey was undertaken in the offset site of the areas where invasive or problematic weeds are likely to occur. Additional information regarding species of weeds and their distribution in remnant vegetation in remote areas of the property was derived from previous investigations of the site undertaken in 2016.

The primary area of weed infestation is from the entry into the property on Lemontree Drive and along an informal track which was constructed some years ago (date unknown), which provides access to a small clearing in remnant vegetation adjacent to a tributary of Oaky Creek

The survey of the track section of the property was completed in December 2017 approximately two weeks after rain had fallen. The recent rainfall had triggered growth in many weed species, which allowed for easy identification. It is expected the results of this survey of weeds are indicative of the main weed component of the offset site.

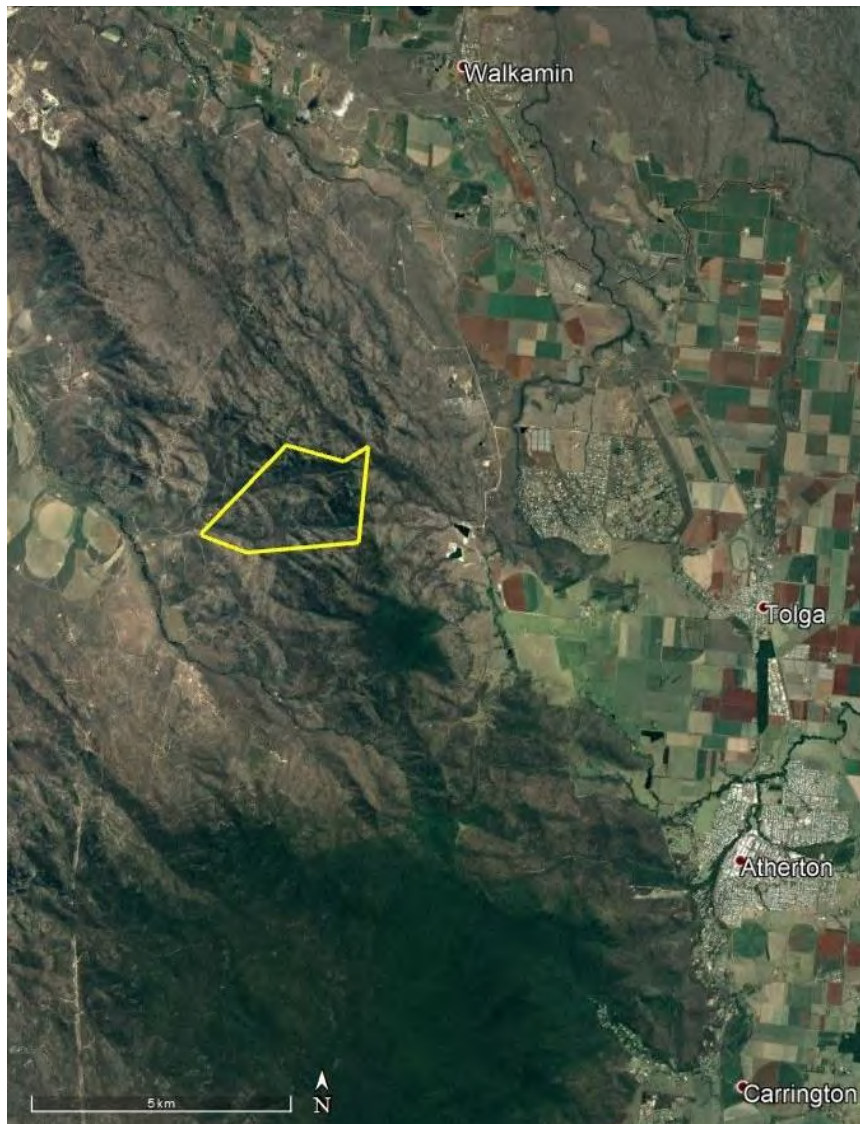


Figure 1. Regional location of the Mt Emerald Wind Farm offset site (within yellow line), showing the site's mountainous setting and remnant vegetation cover.

2.0 AIMS and METHODS

The aim of the survey was to assess and describe the current status of weeds on the offset site through ground-based surveys; and to inform the Mt Emerald Wind Farm management interests of the priority weed species requiring control and management.

A brief assessment of weeds adjacent to the roads leading to the offset site was completed whilst driving, and is therefore not inclusive or detailed. The weed assessment of the offset site concentrated on the access track from Lemontree Drive to the small clearing adjacent to a tributary of Oaky Creek. The entire length of the track was traversed on foot. Additional spot observations of weed presence in remnant, undisturbed vegetation were undertaken in 2016 and during the 2017 survey.

3.0 RESULTS OF WEED SURVEY

3.1 Regional Setting and Road Access

The offset site is located at the end of Lemontree Drive and is positioned among contiguous tracts of sclerophyll woodlands occurring on steep rocky and dissected hills of rhyolite rock with soils of low fertility. Oaky valley (e.g. the roads Oaky Valley Avenue and Lemontree Drive) has flatter topography and soils with higher fertility – hence its agricultural and farming setting. The valley harbours a higher proportion of weeds, which primarily occupy property boundaries and the verges of roads and tracks.

From the township of Walkamin, access to the offset site is via the following sealed roads: Hansen Road, Springmount Road, Oaky Valley Avenue and ultimately Lemontree Drive, where the entrance to the offset site is located. These roads, although sealed, are lined in places by invasive weeds – mostly grasses. A brief overview of the weed status along these roads is given in **Table 1**. Weeds not listed in the table is not an indication a particular species is absent from the section of road.

Table 1. Weeds of concern found along the main roads leading to the site.

Road section	Problematic weeds (inclusive survey not undertaken of roads)
Hansen Road	Japanese Sunflower (<i>Tithonia diversifolia</i>), Grader Grass (<i>Themeda quadrivalvis</i>), Thatch Grass (<i>Hyparrhenia rufa</i>), Stinking Passion Flower (<i>Passiflora foetida</i>), Guinea Grass (<i>Megathyrsus maximus</i>), Rhodes Grass (<i>Chloris gayana</i>), Signal Grass (<i>Urochloa decumbens</i>), Red Natal Grass (<i>Melinis repens</i>).
Springmount Road	Grader Grass, Rubber Vine (<i>Cryptostegia grandiflora</i>), Light Blue Snakeweed (<i>Stachytarpheta jamaicensis</i>), Stinking Passion Flower, Guinea Grass, Signal Grass, Red Natal Grass.
Oaky Valley Avenue	Red Natal Grass, Signal Grass.
Lemontree Drive	Red Natal Grass, Rhodes Grass, Signal Grass.

3.2 Current Condition and Weed Status of Offset Site

The condition of the offset site is very high in terms of remnant vegetation cover, its structure and plant species integrity. Previous surveys in 2016 recorded significant levels of natural integrity and very low weed presence. Where weeds were encountered (during the 2016 and December 2017 surveys), they were invariably associated with vehicle tracks and associated small areas of vegetation clearing.

Elsewhere on the site, weeds are limited to isolated occurrences of Praxelis (*Praxelis clematidea*), which has a tendency to favour rocky habitats; Molasses Grass (*Melinis minutiflora*), where small swards are typically found in more sheltered woodlands; and Red Natal Grass (*M. repens*), which has a similar diffuse distribution pattern as Praxelis, and can also favour rocky habitats. None of these species were observed to be problematic on the offset site where they occur in natural, undisturbed remnant vegetation.

At the entrance gate into the property on Lemontree Drive (**Figure 2**), common weeds of roadsides are present, which include Wynn Cassia (*Chamaecrista rotundifolia*), Praxelis, Stylo (*Stylosanthes scabra*), Red Natal Grass, Hyptis (*Hyptis suaveolens*), Signal Grass (*Urochloa decumbens*), Flannel Weed (*Sida cordifolia*) and Common Sida (*S. rhombifolia*).



Figure 2. The entrance to the offset site through the gate and to the right of picture. The bitumen provides a useful barrier to weed growth, rendering the access to the property relatively easily managed in terms of weed control.

The largest area of weed concentration is along both sides of the access track to the tributary of Oaky Creek (**Figures 3 & 4**). Here, the main weeds are Stylo, Praxelis, Red Natal Grass and small patches of Molasses Grass. They are all associated with prior disturbance and have most likely been introduced into the area on vehicles and machinery used to grade the track.



Figure 3. The track (green line) from Lemontree Drive is 1.3 km long and terminates at a circular clearing near a tributary of Oaky Creek. Weeds are concentrated along the track, becoming more diffuse away from the track.

An area of dense weed infestation is found at the cleared area presently used for turning vehicles around at the end of the track described above (**Figure 5**). Invasive grasses, most notably Rhodes Grass (*Chloris gayana*) have established and co-occur with native grasses such as Black Speargrass (*Heteropogon contortus*). Other weeds in this area include Stylo, Wynn Cassia, Signal Grass, Molasses Grass, Hyptis and Beggar's Ticks (*Bidens bipinnata*).



Figure 4. The track from Lemontree Drive passing through remnant vegetation. Stylo is one of the commonest weeds along the edges of the track.



Figure 5. Clearing at the end of the track. The tall invasive Rhodes Grass (*Chloris gayana*) has established here, and the clearing also harbours several other weeds in rocky soil.

3.3 Distribution and Characteristics of Weed Species

Stylo (*Stylosanthes scabra*) is the commonest weed along the edges of the track from Lemontree Drive. Along some sections of the track, dense stands have established on disturbed rocky soil, but the species becomes less common in neighbouring woodlands. It is found at the property entrance and almost continuously along the track and into the clearing at the end of the track.

The herbaceous to semi-woody Praxelis (*Praxelis clematidea*) is scattered throughout the offset site. It is more common on disturbed rocky soils. It can be locally problematic if allowed to regenerate without intervention.

Red Natal Grass (*Melinis repens*) and the related Molasses Grass (*M. minutiflora*) have similar weed characteristics to Praxelis, and can form dense stands on disturbed sites becoming problematic if not controlled. Red Natal Grass is found along the road verge of Lemontree Drive, and as small populations and isolated incidences near the track. The species is often found as individual plants in remnant woodland. Molasses Grass is uncommon in the offset site and is found as isolated patches in more sheltered woodlands on slopes; a small patch near a creek crossing along the track; and in the circular clearing at the end of the track.

Rhodes Grass (*Chloris gayana*) is restricted to near the entrance into the property, along Lemontree Drive, and at the circular clearing at the end of the track, where it forms a dense stand. This tall grass can be very problematic when established in large areas.

Wynn Cassia (*Chamaecrista rotundifolia*), although appearing to be an inconspicuous ground creeper, is difficult to eradicate once established. The weed sets large quantities of seed with a hard coating, which remain viable in the soil seed bank for many years. Successive germination of the species retards native species succession and displaces important native grasses. Wynn Cassia is found at the property entrance and at the circular clearing at the end of the track.

Signal Grass (*Urochloa decumbens*) is a weedy grass that will establish in dense swards under woodland cover, particularly marginally wetter woodlands and zones where water runoff increases longer-term soil-moisture availability. The grass effectively displaces native species and carries a hot fire, which can have serious impacts. Signal Grass is found along the verges of Lemontree Drive and at the offset site property entrance. An established stand of Signal Grass is also found at the circular clearing at the end the track leading to the tributary of Oaky Creek. Another interesting location of this grass is at the vehicle track end which provides access to the walking track to the Mt Emerald summit. Although this vehicle track section is not on the offset site, the walking track heads into the offset site, and therefore, there is potential for Signal Grass to be carried into the high elevation aspects of the property, where it would be very difficult to control.

Hyptis (*Hyptis suaveolens*) is found as a few plants near the gate on the property boundary at Lemontree Drive, and at the circular clearing at the end of the track. This is serious shrubby weed, which can significantly alter natural fire ecology. It is highly invasive if not controlled early. The seeds will adhere to clothing, the fur of animals, and on vehicles and machinery.

Beggar's Tick's (*Bidens bipinnata*) occurs in disturbed rocky soil at the clearing at the end of the track. It is a semi-herbaceous daisy which will germinate in large numbers. The species could be locally problematic and should be controlled early before it becomes an issue.

Less conspicuous weeds are found at the property entrance, and include Flannel Weed (*Sida cordifolia*) and Common Sida (*S. rhombifolia*). These weeds are scattered and do not form dense infestations.

4.0 WEED IDENTIFICATION GUIDE

Unless stated, the weeds shown here were recorded from the Mt Emerald Wind Farm offset site (Lot 22 on SP210202) at the gate entrance on Lemontree Drive or along and at the end of the track leading to the tributary of Oaky Creek.

Although not found on the offset site, Grader Grass, Light Blue Snakeweed, Rubber Vine, Stinking Passion Flower and Thatch Grass are included as these species occur along the primary access roads leading to the property and are known to be deleterious to natural processes.



Beggar's Ticks
(*Bidens bipinnata*)



Common Sida - juvenile
(*Sida rhombifolia*)



Flannel Weed
(*Sida cordifolia*)



Grader Grass - **NOT ON SITE**
(*Themeda quadrivalvis*)



Hyptis
(*Hyptis suaveolens*)



Light Blue Snakeweed - **NOT ON SITE**
(*Stachytarpheta jamaicensis*)



Molasses Grass
(*Melinis minutiflora*)



Praxelis
(*Praxelis clematidea*)



Red Natal Grass
(*Melinis repens*)



Rhodes Grass
(*Chloris gayana*)



Rubber Vine - **NOT ON SITE**
(*Cryptostegia grandiflora*)



Signal Grass
(*Urochloa decumbens*)



Stinking Passion Flower – **NOT ON SITE**
(*Passiflora foetida*)



Stylo
(*Stylosanthes scabra*)



Thatch Grass - **NOT ON SITE**
(*Hyparrhenia rufa*)



Wynn Cassia
(*Chamaecrista rotundifolia*)

5.0 RECOMMENDATIONS

The following recommendations are intended as a guide, as this document is not a weed management plan. The principles and methods of weed control should be relevant to the weed species, the population size and be in accordance with the label instructions of the registered chemical herbicide (if used). Records of weed sightings, new species, control measures and outbreaks should be maintained at all times.

5.1 Dedicated Weed Management and Control

The offset site is in near-pristine natural condition and weeds have the potential to detract from these values. A commitment should be made to continuous weed detection, management and control in order to preserve the long-term integrity and condition of the site.

5.2 Weed Surveillance and Vigilance

The early detection and ability to prioritise weed control is critical for effective weed management. Invasive grasses and shrubs should be detected and controlled as a priority. Follow-up control must be applied until weed populations are either eradicated or adequately controlled.

Field surveys and monitoring for weeds should be undertaken every month during the wet season when conditions and weed growth are likely to be optimal. One survey during the driest period of the year is also recommended. Specific timing of the weed surveillance surveys will be dictated by the prevailing weather conditions and patterns.

5.3 Priority Weed Species

Surveillance for weeds and timely control should target the most invasive and potentially harmful species. Priority weeds include, but are not limited to the species outlined in **Table 2**.

Table 2. Priority weeds.

Weed	Location	Comment
Rhodes Grass (<i>Chloris gayana</i>)	Gate and cleared area at end of track.	PRIORITY. Grub out plants at gate. Control with herbicide at clearing. Surveillance and control of future outbreaks.
Hyptis (<i>Hyptis suaveolens</i>)	Gate and cleared area at end of track.	PRIORITY. Grub out plants and spot spray seedlings with herbicide. Surveillance and control of future outbreaks.
Signal Grass (<i>Urochloa decumbens</i>)	Cleared area at end of track.	PRIORITY. Control with herbicide at clearing. Surveillance and control of future outbreaks.
Stylo (<i>Stylosanthes scabra</i>)	At gate, along and at end of track. Isolated occurrences elsewhere.	Herbicide control along track, particularly dense patches. Herbicide control at clearing.
Molasses Grass (<i>Melinis minutiflora</i>)	On watercourse crossing and at end of track. Isolated occurrences elsewhere.	Spot control with herbicide patches near vehicle access. Hand remove smaller plants in isolated sections of site if possible.
Red Natal Grass (<i>Melinis repens</i>)	At gate, along and at end of track. Isolated occurrences elsewhere.	Spot control with herbicide larger patches. Hand remove isolated specimens detected in new areas.
Grader Grass (<i>Themeda quadrivalvis</i>)	NOT ON OFFSET SITE	PRIORITY for continued surveillance and early detection. If detected control immediately.
Thatch Grass (<i>Hyparrhenia rufa</i>)	NOT ON OFFSET SITE	PRIORITY for continued surveillance and early detection. If detected control immediately.
Stinking Passion Flower (<i>Passiflora foetida</i>)	NOT ON OFFSET SITE	PRIORITY for continued surveillance and early detection. If detected control immediately.
Rat's Tail Grasses (<i>Sporobolus</i> spp.)	NOT ON OFFSET SITE	PRIORITY for continued surveillance and early detection. If detected control immediately.
Other weeds*	Lantana, Gambia Pea, Senna spp., Snakeweeds, Fountain Grasses, <i>Chloris</i> spp., <i>Pennisetum</i> spp., <i>Cenchrus</i> spp., Mother-of-Millions, etc.	PRIORITY for continued surveillance, early detection and control of any new weed species which become problematic. Any existing weeds which are currently relatively benign but may become problematic should be controlled.

* This list is not inclusive and surveillance and early detection should treat all introduced species as potentially harmful, and therefore should be controlled immediately upon detection.

Appendix B Bat Fauna MEWF Offsets Site Report

Bat Call Analysis Report

Mt Emerald Wind Farm

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I.0 Introduction

I.1 Background

An assessment on the likelihood of the presence of microbat species using four echolocation detectors (Songmeters SM2BAT) was conducted during an ecological survey at Mt Emerald Wind Farm. The site is located in Mutchilba, Mareeba Shire in Queensland.

I.2 Scope of Works

The specific scope of works for this report includes the following:

- Outline the methodology used to survey microbat species within the subject site;
- Analyse and provide an assessment of the likelihood of occurrence of threatened microbat species listed under State and Commonwealth legislation; and,
- Identify of local statutory considerations relevant to ecological aspects (relevant to bats) of the site.

2.0 Methodology

2.1 Capture

Data was collected over seven nights from 24 October 2017 using Songmeters SM2BAT. The original call files display Australian Eastern Standard Time. The majority of calls were considered to be of medium to good quality calls.

Data was received via an electronic transfer (Dropbox) on the 23rd November 2017 and was analysed using Kaleidoscope Pro. In total, 1,424 call sequence files were marked as containing recognisable bat calls.

2.2 Call Identification

Call identification for this dataset was based on call keys and descriptions published for Queensland (Reinhold, 2001) and Northern Territory (PWCNT, 2002) with reference to descriptions for New South Wales (Pennay et al., 2004).

Species' identification was further refined using the probability of occurrence of each species based on their geographic distribution (Churchill, 2008, Van Dyck and Strahan, 2008). Species nomenclature used in this report follows Churchill (2008).

The reliability of identification is as follows:

- **Definite** - one or more calls where there is no doubt about the identification of the species;
- **Probable** - most likely to be the species named, low probability of confusion with species that use similar calls; and,
- **Possible** - call is comparable with the named species, with a moderate to high probability of confusion with species of similar calls.

2.3 Survey Limitations

The ability to detect call and accurately identify them to species level can vary greatly with the surrounding environment and the location of the echolocation device. The survey undertaken as part of this assessment only represents a 'snapshot' in time and therefore, may not provide a true indication of species presence at the site. Hence, this survey should not be regarded as conclusive evidence that certain protected microbats species do not occur at the site.

2.4 National Standard

The format and content of this report complies with the nationally accepted standards for the interpretation and reporting of Anabats and Songmeters data (Reardon, 2003), which is currently available from the Australasian Bat Society at www.ausbats.org.au.

3.0 Results

3.1 Total of Species Recorded

A total of 1,424 sequence files were marked as recognised bat calls.

A total of 10 microbat species were definitely identified being present on site and an additional seven (7) species were potentially recorded on site.

One threatened species, *Saccolaimus saccolaimus*, listed under the *Nature Conservation Act 1992* as Endangered and under the *Environmental Protection and Biodiversity Act 1999* as Vulnerable was highly likely recorded on site. This species cannot be definitely confirmed due the similarity in call with sympatric species and overlap in their distribution. This species also presents a number of call variation, even on reference calls, which makes it difficult to confirm its presence using only echolocation techniques. Only direct capture of this species is likely to definitely confirm the presence of this species on site.

However, we note that the full spectrum of number of recorded calls were clustered closely with those of *S. saccolaimus* and harmonics would likely be attributed to *S. saccolaimus*. As this species was also recorded 500m away from the site, it is considered highly likely that the calls can be attributed to this species. A detailed assessment of the call recorded is provided in **Section 3.2**.

A summary of the species present on site is provided in **Table 1**.

Table 1: Summary of bat calls

Species	NC Act	EPBC Act	Site 12						Site 19			
			24/10	25/10	26/10	27/10	28/10	29/10	25/10	26/10	27/10	
<i>Austronomus australis</i>	LC	NOC	Definite	Definite	Definite	Definite	Definite			Definite	Definite	Definite
<i>Chaerephon jobensis</i>	LC	NOC		Definite		Possible	Possible			Definite		
<i>Chalinolobus picatus</i>	LC	NOC				Definite	Definite					
<i>Chalinolobus nigrogriseus</i>	LC	NOC	Definite	Definite	Definite						Definite	Definite
<i>Miniopterus australis</i>	LC	NOC	Possible		Definite	Definite	Definite	Definite		Possible		Definite
<i>Miniopterus orianaae oceanensis</i>	LC	NOC	Definite	Definite	Definite	Definite				Definite	Definite	Definite
<i>Mormopterus lumsdenae</i>	LC	NOC		Definite	Definite	Definite		Definite	Definite			Definite
<i>Mormopterus ridei</i>	LC	NOC	Definite	Definite				Definite	Definite		Definite	Definite
<i>Nyctophilus geoffroyi</i>	LC	NOC	Possible		Possible	Possible				Possible	Possible	
<i>Nyctophilus gouldi</i>	LC	NOC	Possible		Possible	Possible				Possible	Possible	
<i>Nyctophilus bifax</i>	LC	NOC	Possible		Possible	Possible				Possible	Possible	
<i>Rhinolophus megaphyllus</i>	LC	NOC		Definite	Definite					Definite		Definite
<i>Saccolaimus flaviventris</i>	LC	NOC	Possible	Possible					Possible	Possible		Possible
<i>Saccolaimus saccolaimus</i>	Endangered	Vulnerable	Probable	Probable		Probable	Probable	Probable	Possible	Possible		Possible
<i>Scotorepens orion</i>	LC	NOC		Probable	Probable	Probable					Probable	
<i>Taphozous troughtoni</i>	LC	NOC	Possible	Possible		Possible	Possible	Possible	Possible	Possible		Possible
<i>Vespadelus pumilus</i>	LC	NOC	Possible	Definite	Definite					Possible	Possible	

LC: Least Concern /NOC: Not Of Concern / NR: Not Recorded

3.2 Analysis of the presence of *Saccolaimus saccolaimus*

The purpose of the bat survey was to identify the presence of *S. saccolaimus* on site. Characteristic call attributes of *S. saccolaimus* (PWCNT, 2002) include:

- A dominant harmonic with characteristic frequency around 22-25 kHz;
- At least 3 and up to five distinct harmonics at approximately 13 kHz intervals (1 below and up to 3 above the dominant harmonic); and
- Call pulses sometimes in “triplet” sets with pulse intervals of approximately 10-20ms between first and second pulses and 20-40ms between second and third pulses and an inter-triplet interval of about 80-100ms.

A number of sequence files were recorded that may be representative of *S. saccolaimus* and this call show all the harmonic characteristics. While it is not possible to reliably separate this species from several sympatric species with similar call attributes (i.e. *T. troughtoni*), *S. saccolaimus* was previously recorded within the site and it is considered that *S. saccolaimus* is highly likely to occur on site.

3.3 Samples of Calls / Sequences Files

Samples of call extracted from the dataset for each species identified is provided in the following figures.

Figure 1: Probable *Austronomus australis*

This species is one of the few bat species with calls audible to human ears. This species exhibits a characteristic frequency ranging from 10.5 to 15 kHz (Pennay *et al*, 2004).

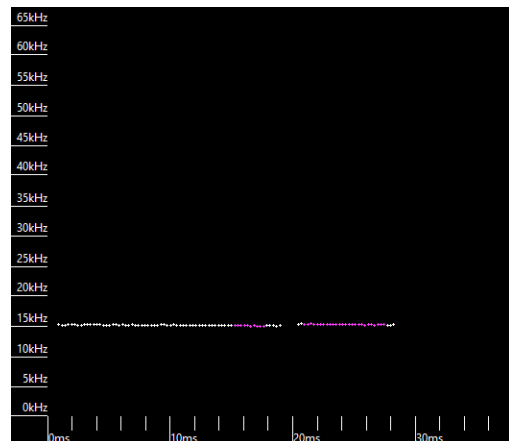


Figure 2: : Definite *Chaerephon jobensis*

Their characteristic frequency average 19.8 kHz (range 16.12-23.6kHz). *C. jobensis* often flies in pairs and therefore produce paired call pulses at alternating frequencies with intermittent, “excited”, linear pulses. This pattern is probably the result of bats interacting with each other. The calls of an individual *C. jobensis* are therefore likely to be difficult to identify from *S. flaviventris* or *M. lumsdenae*.

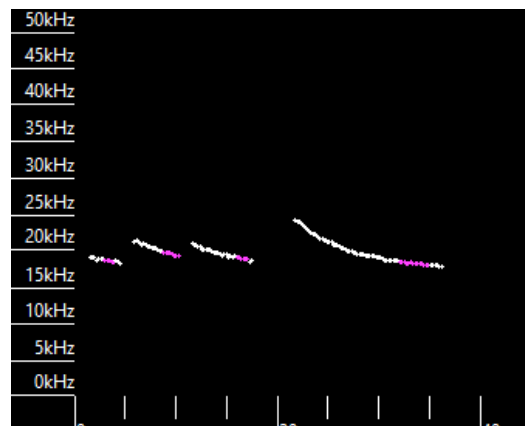


Figure 3: Definite *Chalinolobus nigrogriseus*

Curved shape with characteristic frequency 37 to 40kHz (Reinhold *et al*, 2001). Usually has no tail. Characteristic section and tail takes up at least 2/3 if the time of the pulse when in search phase.

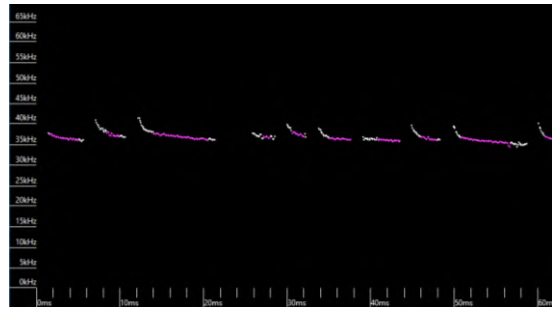


Figure 4: Definitely *Chalinolobus picatus*

Usually no tail with a characteristic frequency 38 to 42kHz with distinctive pulses alternate in frequency every second pulse is stepped-up by about 2kHz. Cannot be confused with any other species. While this species is rare in the location of the survey, it has been recorded around Cairns.

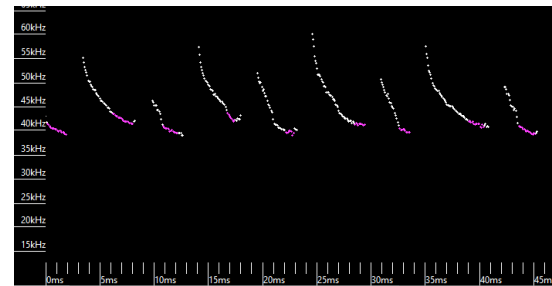


Figure 5: Definitely *Miniopterus australis*

This species displays a characteristic frequency between 54.5 – 64.5 kHz with a curved, usually down-sweeping tail (Pennay *et al* 2004). It overlaps in frequency with *Vespadelus pumilus* between 57 – 58 kHz but the latter exhibits curved up-sweeping tail.

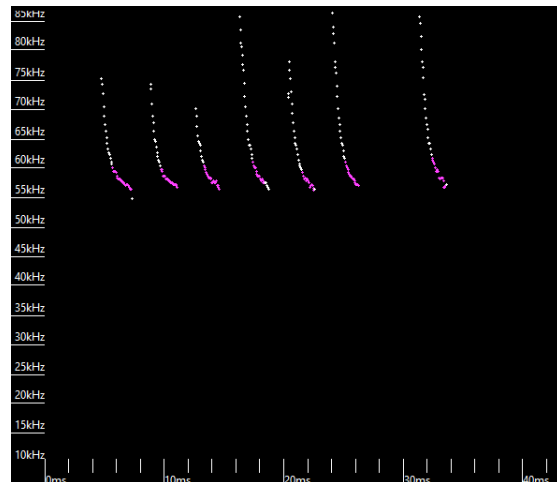


Figure 6: Definite *Miniopterus orianae oceanensis*

The species call is characterised by its relatively long curved pulse with a small down-sweeping tail and its frequency 43-47kHz (Reinhold, 2001).

Pulse shape and time between calls usually variable within a sequence.

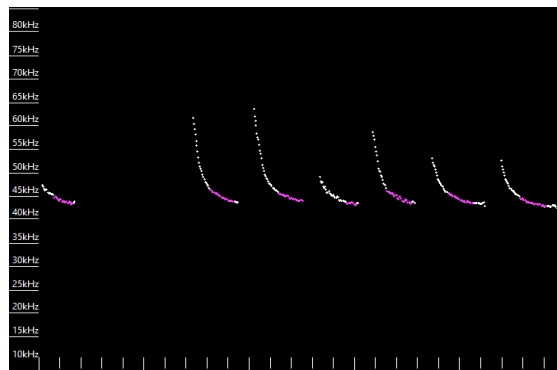


Figure 7: : Definite *Mormopterus lumsdenae*

Characteristic frequency higher than 22 and lower than 24kHz. *Mormopterus lumsdenae* pulse can be confused with *S. flaviventris* However, the latest rarely have calls above 22kHz. *M. lumsdenae* reference calls have pulse rising in frequency and can get up to 27kHz as shown here. *S. flaviventris* change more rapidly from search phase to buzz phase which is distinctive.

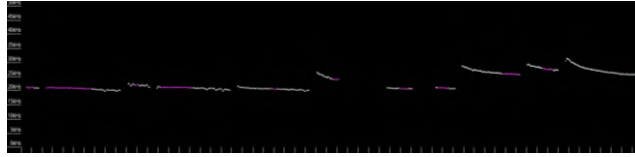


Figure 8: Definite *Mormopterus ridei*

Characteristic frequency 30 to 36 kHz. May be flat but sometime with short initial and down-sweeping tail (Reinhold *et al*, 2001).

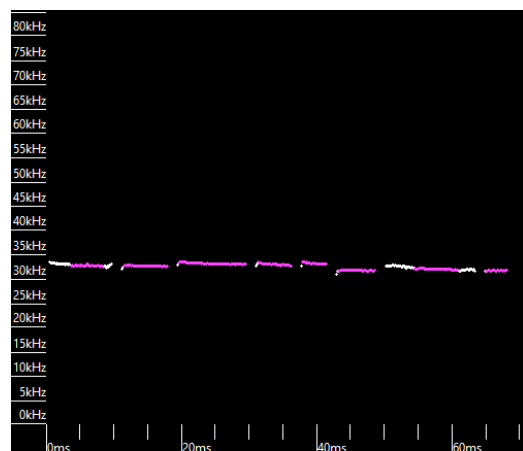


Figure 9: Possible *Nyctophilus sp.*

This species displays a near-vertical pulse, characteristic frequency between 80 and 35kHz (Pennay *et al*, 2004). The call of these species cannot be distinguished from each other.

There are three species of *Nyctophilus spp* occurring within the site area. *N. geoffroyi*, *N. gouldi* and *N. bifax*.

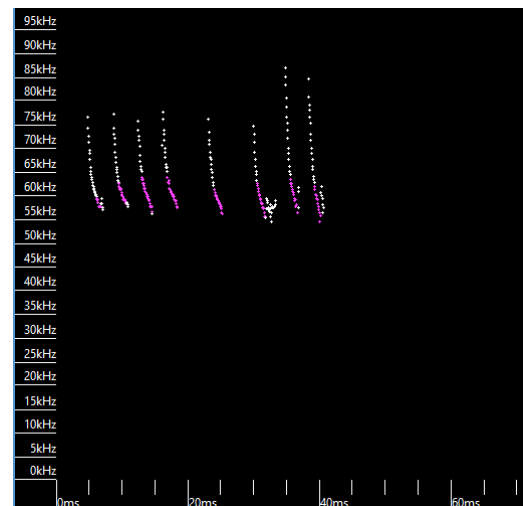


Figure 10: Definite *Rhinolophus megaphyllus*

The species call cannot be misidentified with any other species. Pulses have an up-sweeping initial section a perfectly flat, relatively long characteristic section and a down sweeping tail (Reinhold, 2001). Characteristic frequency ranges from 66 to 72 kHz.

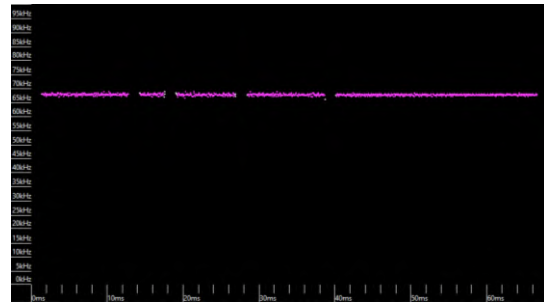
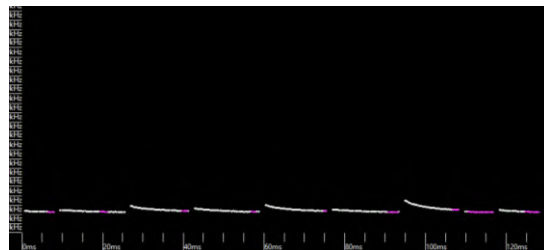


Figure 11: Probable *Saccolaimus saccolaimus*

Few sequence files were recorded on site that may be representative of *Saccolaimus saccolaimus*. Distinguishing this species acoustically is not straightforward, despite some recent literature and conference presentations that have pointed to subtle but diagnostically useful characters and sequence patterns.

Echolocation calls for *S. saccolaimus* have peak energy in the range 23-25kHz, similar to the frequency band of other large sheath-tail bats in Australia. *S. flaviventris* pulses rarely go above 22kHz and have one harmonic at about 30kHz which we cannot see here.

T. troughtoni also produces a flat type call pulse at the same frequency as *S. saccolaimus*. It is typically long and straight or slightly curved and almost horizontal, similar to *S. saccolaimus*.



Harmonics

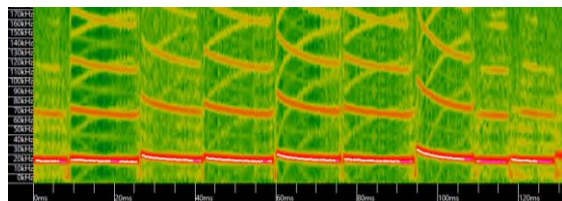


Figure 12: Probable *Scotorepens orion*

Characteristic frequency between 34.5 and 37.5 kHz with curved, absent tail sometime down-sweeping tail (Reinhold et al, 2001). Knee of the pulse is usually lower than 38 kHz.

Can be confused with *Scoteanax rueppelli* but has a longer pre-characteristic section (can be up to 70kHz) which differentiate it from other species.

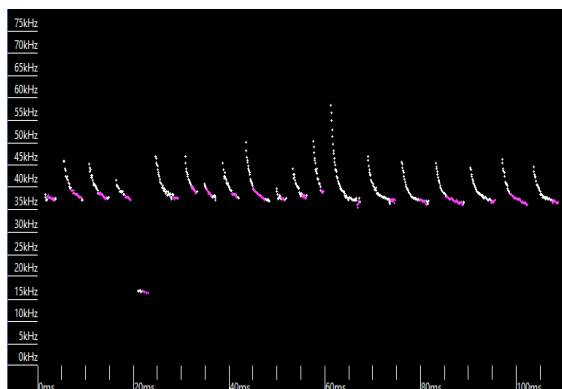
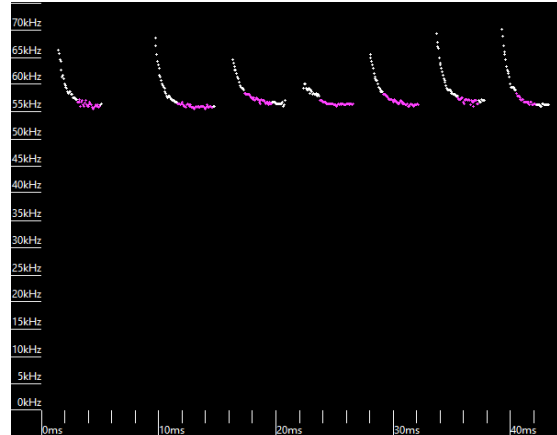


Figure 13: Definite *Vespadelus pumilus*

This species displays a characteristic frequency between 50 – 58 kHz and has a prominent up-sweeping tail (Pennay *et al*, 2004).

Calls of this species may be easily confused with *V. troughtoni*, unless the end frequency is higher than 54 kHz, which is representative of *V. pumilus*, as illustrated in the **Figure 4**.



4.0 Conclusion

A total of 10 microbat species were detected occurring within the site. A total of seven (7) microbat species were potentially/probably recorded on site.

The presence of *S. saccolaimus*, listed as Endangered under NC Act, and listed as Vulnerable under EPBC Act, was analysed. This species could not be definitely confirmed due the similarity in call with sympatric species and overlap in their distribution. This species also presents a number of call variation which makes it difficult to confirm its presence using only echolocation techniques. However, a number of call presented harmonics that could highly likely be attributed to *S. Saccolaimus* and therefore, we would consider that *S. saccolaimus* is highly likely to occur within the surveyed area.

All bats identified on the site were expected to be present within the region. Bat activity levels at the site are considered to be similar compared to other surveys within similar areas in the surrounding region.

5.0 References

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Appendix C Fauna List

A summary of species identified during survey on the MEWF Offset Site.

Species	Common Name
Bird	
<i>Centropus phasianinus</i>	Pheasant Coucal
<i>Strepera graculina</i>	Pied Currawong
<i>Turnix maculosus</i>	Red-backed Buttonquail
<i>Alectura lathami</i>	Australian Brush-turkey
<i>Podargus strigoides</i>	Tawny frogmouth
<i>Ninox boobook</i>	Boobook Owl
<i>Coracina tenuirostris</i>	Common cicadabird
<i>Lichmera indistincta</i>	Brown honeyeater
<i>Todiramphus macleayii</i>	Forest kingfisher
<i>Pachycephala pectoralis</i>	Australian golden whistler
<i>Colluricincla harmonica</i>	Grey shrikethrush
<i>Dacelo novaeguineae</i>	Laughing kookaburra
<i>Meliphaga lewinii</i>	Lewin's honeyeater
<i>Myiagra rubecula</i>	Leaden flycatcher
<i>Hieraaetus morphnoide</i>	Little eagle
<i>Philemon corniculatus</i>	Noisy friarbird
<i>Manorina melanocephala</i>	Noisy miner
<i>Platycercus adscitus</i>	Pale-headed rosella
<i>Merops ornatus</i>	Rainbow Bee-eater
<i>Malurus melanocephalus</i>	Red-backed fairywren
<i>Neochmia temporalis</i>	Red-browed finch
<i>Rhipidura rufifrons</i>	Rufous fantail
<i>Dicrurus bracteatus</i>	Spangled drongo
<i>Ninox boobook</i>	Southern boobook
<i>Lalage leucomela</i>	Varied triller
<i>Aquila audax</i>	Wedge-tailed eagle
<i>Haliastur sphenurus</i>	Whistling kite
<i>Melithreptus albogulari</i>	White-throated honeyeater
Mammal	
<i>Dasyurus hallucatus</i>	Northern Quoll
<i>Felis catus</i>	Cat
<i>Isodon macrourus</i>	Northern brown bandicoot
<i>Canis Lupus</i>	Dog

Species	Common Name
<i>Melomys burtoni</i>	Melomys
<i>Petrogale mareeba</i>	Mareeba Rock Wallaby
<i>Rattus fuscipes</i>	Bush rat
<i>Sus scrofa</i>	Pig
<i>Tachyglossus aculeatus</i>	Short-beaked echidna
<i>Trichosurus vulpecula</i>	Brush Tailed Possum
<i>Uromys caudimaculatus</i>	Giant white-tailed rat
<i>Wallabia bicolor</i>	Agile Wallaby
<i>Pteropus conspicillatus</i>	Spectacled Flying fox
<i>Pteropus alecto</i>	Black Flying Fox
<i>Pteropus scapulatus</i>	Little Red Flying Fox
<i>Austronomus australis</i>	White-striped free-tailed bat
<i>Chaerophon jobensis</i>	Northern freetail bat
<i>Chalinobus picatus</i>	Little Pied Bat
<i>Chalinobus nigrogiseus</i>	Hoary Wattled Bat
<i>Miniopterus australis</i>	Little bent-wing bat
<i>Miniopterus orianae oceanensis</i>	Eastern Bent-wing Bat
<i>Mormopterus lumsdenae</i>	Northern Free-tailed Bat
<i>Mormopterus ridei</i>	Ride's Free-tailed Bat
<i>Nyctophilus geoffroyi</i>	Lesser long-eared bat
<i>Nyctophilus gouldi</i>	Gould's long-eared bat
<i>Nyctophilus bifax</i>	Eastern long-eared bat
<i>Rhinolophus megaphyllus</i>	Smaller horseshoe bat
<i>Saccolaimus flaviventris</i>	Yellow-bellied sheath-tailed bat
<i>Saccolaimus saccolaimus</i>	Bare-rumped Sheath-tail Bat
<i>Scotorepens orion</i>	Eastern broad-nosed bat
<i>Taphozous troughtoni</i>	Troughton's sheath-tailed bat
<i>Vespadelus pumilus</i>	Taphozous troughtoni
Reptile	
<i>Diporiphora bilineata</i>	Two Lined Dragon
<i>Pseudonaja textilis</i>	Eastern brown snake
<i>Varanus tristis</i>	Black-headed monitor
<i>Varanus varius</i>	Lace monitor
<i>Liburnascincus mundivensis</i>	Outcrop Rainbow-skink
<i>Gehyra dubia</i>	Gecko

Species	Common Name
Amphibian	
<i>Rhinella marina</i>	Cane Toad
<i>Litoria rubella</i>	Desert tree frog
<i>Litoria inermis</i>	Bumpy rocket frog
<i>Litoria latopalmata</i>	Broad-palmed Frog
<i>Litoria wilcoxii</i>	Eastern stony creek frog
