



Offset Monitoring Program – Mount Emerald Wind Farm

RATCH Australia Corporation Limited

4 Elements Consulting (Qld) 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 (DEE), 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 Science.

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; and
- ▶ Targeted weed surveys.

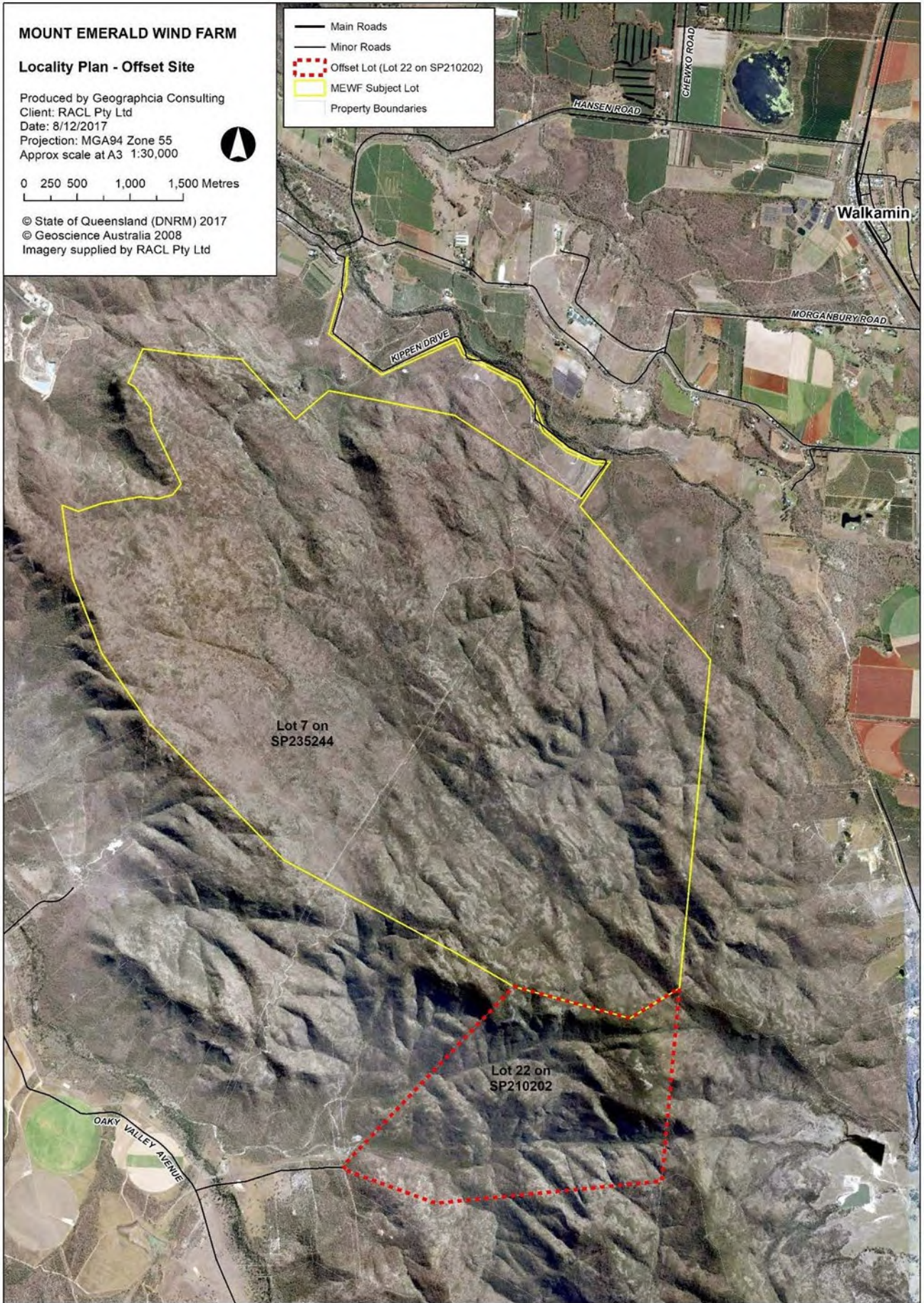


Figure 1 Project Location

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 is 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 2018 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).	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. pachycalyx</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. ² Biodiversity management status: E - Endangered; OC - Of Concern, NCP - No Concern at Present. 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>				

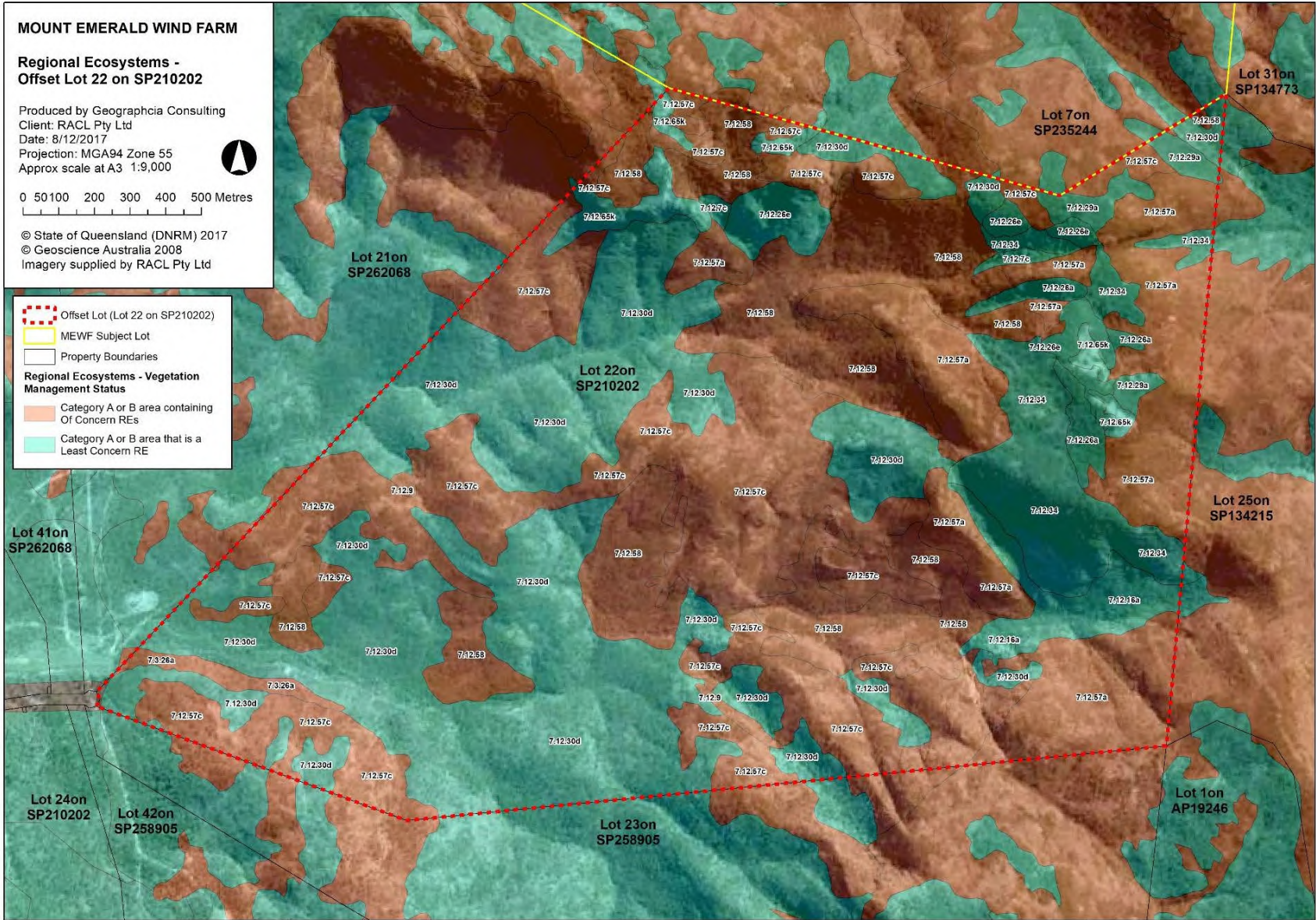


Figure 2 MEWF Regional Ecosystems on Offset Lot

2.0 Methods

The following sections detail the methods employed for the 2018 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 over four days between 3 July - 18 July 2018.

Total rainfall across the Mount Emerald range was recorded as 21 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 25°C. Winds were calm, with a mix of overcast and sunny days throughout the 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 4 Elements Consulting (2017) shown in **Figure 3**.

A total of 19 camera traps (Scout Guard Boly 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 and a single hand rolled ball of general fauna bait (oats, honey and peanut butter) 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 minimum 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 DEE (2014b) were unachievable (i.e. 5 hours per 50 ha/night = a total of 365 hrs of spotlighting).

Previously survey efforts RPS (2016) and 4 Elements Consulting (2017) have focused on foraging of Spectacled Flying-fox in suitable forage trees located during diurnal site traverse for nocturnal spotlighting efforts. This year the survey effort relied solely on recording availability of forage trees as an indicator of habitat suitability for the Spectacled Flying Fox and nocturnal spotlighting was not conducted.

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

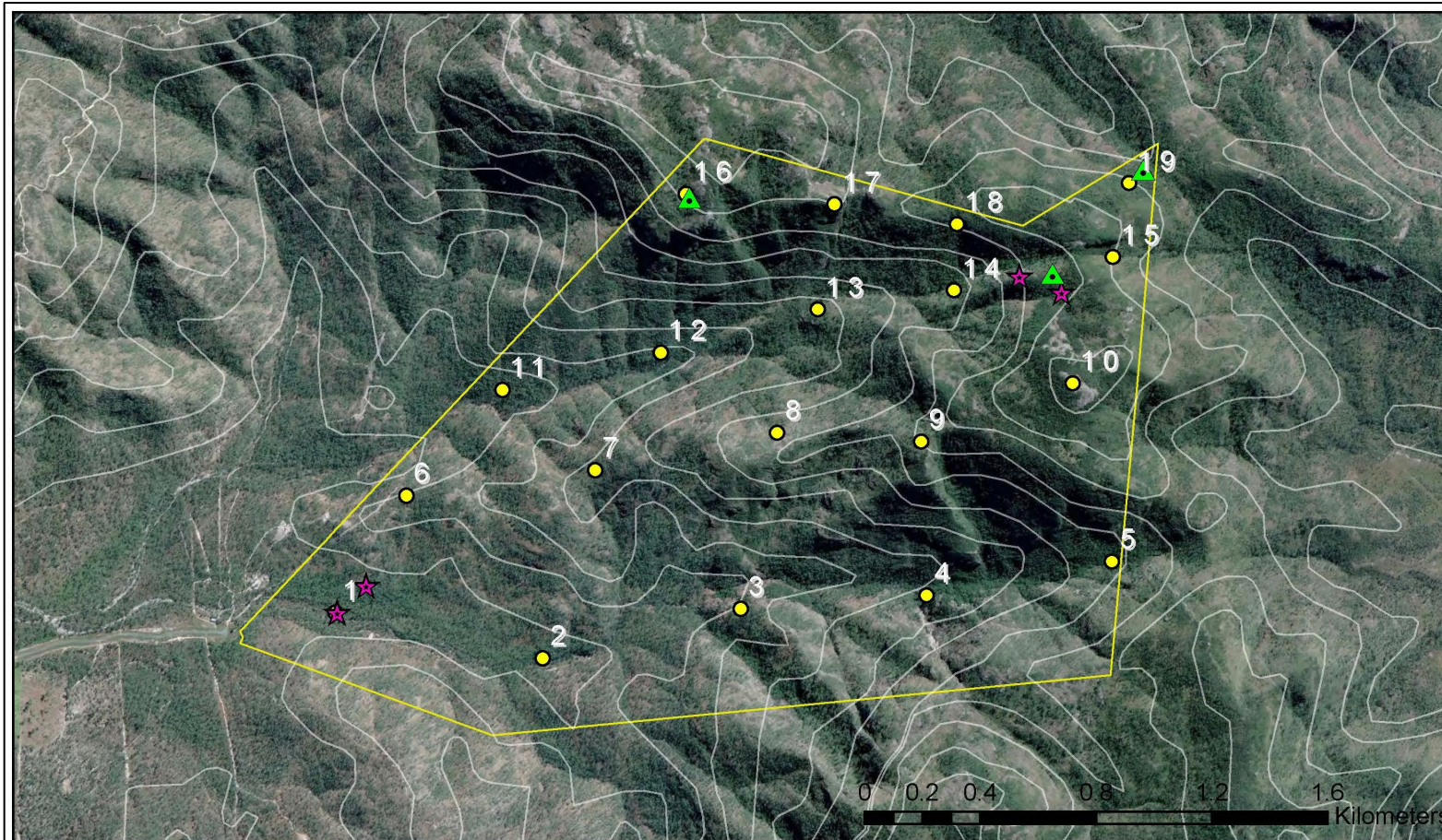
2.1.3.1 Methods

Three ultrasonic bat call detectors (Anabat Swifts) 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 Oaky Creek. The entire length of the track was traversed on foot. Additional spot observations of weed presence in remnant, undisturbed vegetation were undertaken previously in 2016, 2017 and during the current survey effort.



Legend



-  Anabat
-  Photo_points
-  Camera_Traps_OFFSET
-  Lot Boundary



Figure 3 Monitoring Points on Offset Lot

2.3 Opportunistic Assessment

Fauna were monitored at 19 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 19 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; and
- ▶ Sex of feral pigs.

2.6 Results and Discussion

2.6.1 Northern Quoll

A total of 266 camera trap nights were conducted on the offsets site and all units captured images. A total of 16 Northern Quolls were recorded during the camera trapping survey and many of the quolls revisited the same site on multiple nights. All individuals showed evidence of good condition. This total is an increase from 10 individuals in the previous year 4 Elements Consulting (2017) and from 2016 baseline surveys of 13 individuals RPS (2016). From experience at the MEWF site this result is most likely due to the time of year at which the survey was conducted. A higher number is expected to be recorded earlier in the breeding season (July 2018) as opposed to later in the season (September 2018) with males rapidly dying off after completion of their breeding season (Burnett *et al*, 2013). Three animals were located at multiple monitoring locations, identified from the unique spot marking on their backs.

Site 2 recorded the highest number (4) Northern Quolls of the sites surveyed with Site 11 and Site 13 recording (4) individuals. These sites were all within the more productive lower elevation creek lines lower with a large number of hollows and available habitat. The distribution of the population across the offset site is similar to 2016 and 2017, with the majority of monitoring sites recording Northern Quoll activity in both sampling years regardless of vegetation composition and elevation.



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 early dry season with abundant fish and insect fauna being recorded.

2.6.2 Spectacled Flying-fox

Targeted diurnal search for the SFF habitat concentrated in areas where vegetation was either in fruit or flower. As with the previous year the lower creek lines were considered important as they contained fruiting Burdekin Plum (*Pleigynium timorense*). A single individual SFF was found flying low overhead near to Fauna Site 2 in the lower creek line at midday on the first day of the field survey (3 July 2018).

Flowering Eucalypt trees were also recorded during other survey work. A high proportion of species were recorded throughout the site with *Corymbia abergiana* and *Corymbia leichardtii* flowering in high numbers along the higher ridgelines across site. Lower more fertile areas also had high proportions of *Eucalyptus crebra* and *Corymbia citriodora* in flower.

Approximately 20-25% 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) and 4 Elements (2017) 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.

Based on SFF being recorded foraging across site in low numbers last year 4 Elements Consulting (2017) and the single overhead record this year, with high quality foraging habitat availability the offset site continues to provide refuge for the SFF.



Figure 4 Potential Spectacled Flying Fox Habitat on Offset Lot

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

A total of 39 detector nights of microchiropteran bat call surveys were conducted within the project site between 4 and 17 July.

A total of seven (7) microbat species were detected as a definite occurrence within the site. A total of two (2) microbat species were identified as probable records 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 were a probable match for BRSB. Based on previous confirmed records of this species within the locality in recent years, we would consider BRSB is highly likely to occur within the surveyed area (**Appendix A**).

Characteristic call attributes of BRSB include:

- ▶ A dominant harmonic with characteristic frequency around 22-25 kHz;
- ▶ At least three 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 80100 ms (**Appendix A**).

In both 2016 and 2017, probable calls were recorded at Site 19 which is the high altitude *Corymbia citriodora* (lemonscented gum) +/- *Eucalyptus portuensis* (white mahogany) woodland to open forest aspect of the site. Again, in this round of survey the Bat was a probable detection in the same location.

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. A total of nine (9) species being recorded this year is four (4) fewer species than were identified during the previous year’s effort. Baselines surveys in 2016, recorded the lowest number with seven (7) species being recorded therefore no trend can be concluded other than general microchiropteran bat diversity is relatively consistent on site. Weather conditions were with low wind, good insect availability due to relatively recent rain were good for collecting bat call data 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 nigrogiseus</i>	Least Concern	NOC	Definite
<i>Miniopterus australis</i>	Least Concern	NOC	Definite
<i>Miniopterus orianae oceanensis</i>	Least Concern	NOC	Definite
<i>Mormopterus ridei</i>	Least Concern	NOC	Definite
<i>Nyctophilus sp</i>	Least Concern	NOC	Probable
<i>Rhinolophus megaphyllus</i>	Least Concern	NOC	Definite
<i>Saccolaimus saccolaimus</i>	Vulnerable	Endangered	Probable

2.7 General Fauna

From a combination of camera trap and opportunistic sightings during site traverses a total of 44 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 22 birds 19 mammals, 3 reptiles (**Appendix C**).

The birds included species such as the Pheasant Coucal (*Centropus phasianinus*) and Noisy Friarbird (*Philemon corniculatus*) Little Eagle (*Hieraaetus morphnoides*) Golden Whistler (*Pachycephala pectoralis*).

The cryptic Mareeba Rock-wallaby (*Petrogale mareeba*) was identified on the mid mountain slopes at site 14. The Echidna *Tachyglossus aculeatus* and Melomys (*Melomys burtoni*) were distributed in multiple locations across the site.

A total of three reptile species were identified in diurnal site traverse:

- ▶ 1 Rainbow Skink (*Carlia munda*) and
- ▶ 2 Lined Dragon (*Diporiphora bilineata*)
- ▶ 1 Green Tree Snake (*Dendrelaphis punctulatus*)

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

2.8 Baseline BioCondition Surveys

The first round of BioCondition monitoring was undertaken in May 2018. Eight sites representing a variety of regional ecosystems representative of both the MEWF Offset Site and MEWF were assessed using the BioCondition methodology (Eyre *et al* and Nelder *et al* 2017). The exception to this being the vine forest communities RE 7.3.26a and RE 7.12.9 only being found on the MEWF Offset site. All sites assessed were considered to be of a high integrity with only minimal weed incursion being recorded at some sites. These results will be used as a baseline to monitor for any changes in these communities across site in future annual monitoring. Full report is attached in **Appendix B**.

2.9 Weed Control

Since the initial weed survey conducted in January 2018 a population of Grader Grass (*Themeda triandra*) had established along the main access track from Lemon Tree Drive. This species is readily detectable and had not previously been recorded on site including earlier during the January 2018 weed survey. The Grader Grass population extended along the access track entry gate along the entire length of the track to the vehicle turnaround at the end. The Grader Grass population concentrated at the vehicle turn around with individual plants being recorded directly adjacent to the track cutting.

This infestation was removed (15 May, 2018) by hand pulling all plants by carefully removing roots, leaf and seed material. This was then placed into large 80 L garbage bags and disposed off site. A total of five (5) 80 L garbage were filled with material during this process.

Subsequent visits to the access track and site traverses have not recorded any other visible populations of Grader Grass. As the population was setting mature seed at the time of removal and given the fast rate of establishment of this species, it is recommended that a further survey be undertaken prior to the wet season and a further, more critical survey be conducted mid-wet season. It is expected that this population will return once wet conditions persist later in the year.

Grader Grass is considered a priority weed species to be managed for the MEWF Offset Site. It is a prolific species and is quick to establish. It initially colonises disturbed areas such as vegetation clearing and track formation. This species once established has the potential to penetrate areas of undisturbed open woodland where it can outcompete native flora species and alter recruitment of native vegetation.

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 2018 monitoring season. Evidence of pig (*Sus scrofa*) activity was found close to Site 9, Site 16 and Site 18. This included a recently constructed grass nest and some extensive foraging.

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

Table 3 Evidence of Feral Pigs on Offset Site

Survey	Location	Species	Number
Rooting	Site 9, 16, 18	Pig	3
Nesting	Site 18	Pig	1



Plate 2 Evidence of pig rooting 13 July, 2018 near to Fauna site 18







Plate 3 Fresh pig nest recorded 13 July, 2018 near to Fauna Site 18





No evidence of feral cats or feral dogs were recorded during this year's field survey.

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 4** 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 4 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>			North	South
				East	West

Site ID	Description	Photograph from North, South, East, West	
<p>Photo Point 2 Location: 0328099, 8096579</p>	<p>Mapped 7.12.30d 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 data-bbox="1003 751 1084 778">North</p>	 <p data-bbox="1727 751 1807 778">South</p>
		 <p data-bbox="1003 1323 1084 1350">East</p>	 <p data-bbox="1727 1323 1807 1350">West</p>

Site ID	Description	Photograph from North, South, East, West	
<p>Photo Point 3 Location 0330501, 8097591</p>	<p>Site conforms to RE 7.12.57a 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 data-bbox="1003 751 1077 778">North</p>	 <p data-bbox="1727 751 1800 778">South</p>
		 <p data-bbox="1003 1326 1077 1353">East</p>	 <p data-bbox="1727 1326 1800 1353">West</p>

Site ID	Description	Photograph from North, South, East, West	
<p>Photo Point 4 Location: 0330355, 8097647</p>	<p>Mapped as RE 7.12.16a</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 data-bbox="1003 751 1075 778">North</p>	 <p data-bbox="1727 751 1798 778">South</p>
		 <p data-bbox="1003 1323 1075 1350">East</p>	 <p data-bbox="1727 1323 1798 1350">West</p>

4.0 Management Actions

4.1 Comparison to Previous Monitoring

Since the baseline monitoring collection in 2016 and previous years field investigations the conditions of the site have changed very little. The absence of fire improving 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 pigs 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 have been improved through the securing of perimeter fencing. The tracks were showing signs of rill erosion, as well as disturbance by unauthorised vehicular access (primarily motorbikes). Unauthorised access by vehicles has not stopped with fencing however as the main entrance gate to the site remains unlocked. Further weed incursion has been recorded on this track with a new population of Grader Grass (*Themeda quadrivalvis*) and Hyptis (*Hyptis suaveolens*) recorded and subsequently hand removed during late January 2018. This main track will require further ongoing weed monitoring prior to the wet season and again during the wet season to prevent the reestablishment of further populations at the same location or spreading to other locations on site.

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, nests and rooting's sightings across the site. Considerable damage to mid-slope vegetation resulting in Aerial shooting 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 – July 2019, close to 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

The ecological surveys undertaken in the MEWF offset site during 2018 provide the second round of annual monitoring data that can be directly compared with the baseline and first year of data collected in 2016 and 2017. 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 DEE and DES. 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 Sheath-tail 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 baseline surveys due to increased rainfall and rehabilitation since a fire event therefore small reptiles and amphibians have increasingly utilised a wider distribution of the offset site.

Feral pigs are evident on the site and are at a stage that management actions require appropriate measures.

Weed surveys indicated there are currently no priority listed weed species on site, however vigilance will be required along the access track and road entry to ensure there are no access points for these threats. Continued 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 baseline surveys were conducted in 2016.

6.0 References

- Burnett, S., Shimizu, Y. and Middleton, J. (2013). Distribution and abundance of the northern quoll (*Dasyurus hallucatus*) in far north Queensland. Unpublished report to Ratch Australia.
- Eyre TJ, Ferguson DJ, Hourigan CL, Smith GC, Mathieson MT, Kelly, AL, Venz MF, Hogan, LD & Rowland, J. (2014). Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland. Department of Science, Information Technology, Innovation and the Arts, Queensland Government, Brisbane.
- Eldridge, M. D. B., Johnson, P. M., Hensler, P., Holden, J., and Close, R. K. (2008). The distribution of three parapatric, cryptic species of rock-wallaby (*Petrogale*) in north-east Queensland: *P. assimilis*, *P. mareeba* and *P. sharmani*. *Australian Mammalogy*, 30(1), 37-42.
- Department of Environment and Energy (2017)
http://www.environment.gov.au/cgibin/sprat/public/publicspecies.pl?taxon_id=185
- Eyre, T., Ferguson, DJ, Hourigan, CL, Smith, GC, Mathieson, MT, Kelly, AL, Venz, MF, Hogan, LD A Rowland, J. 2014. Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland. Department of Science, Information Technology, Innovation and the Arts, Queensland Government, Brisbane.
- Gleed, Simon (2016) Mt Emerald Threatened Species Management Plan. Prepared for RATCH Australia Corporation, Brisbane.
- Nelder, V.J., Wilson, B.A., Thompson, E.J. and Dillewaard, H.A. (2012). Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland. Version 3.2. Updated August 2012. Queensland Herbarium, Queensland Department of Science, Information Technology, Innovation and the Arts, Brisbane. 124 pp.
- RPS Australia East (2016) Offset Area Management Plan. Unpublished Report prepared for RATCH Australia Corporation Limited, Brisbane.
- State of Queensland (2016). *Regional Ecosystem Details for 3.5.2*. Url:
<https://environment.ehp.qld.gov.au/regional-ecosystems/details/?re=3.5.2>. (Accessed 6/9/2017).

Appendix A Bat Call Analysis Report
Greentape Solutions – 29/08/2018

Bat Call Analysis Report

Mt Emerald Wind Farm

Prepared for Four Elements Consulting Pty Ltd

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I.0 Introduction

I.1 Background

An assessment on the likelihood of the presence of microbat species using three echolocation detectors (Anabat Swift) was conducted during an ecological survey (two weeks) at Mt Emerald Wind Farm. The site is located in Mareeba Shire, 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 thirteen nights from 4 July 2018 using three Anabat Swifts. 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 on the 3rd August 2018 and was analysed using Kaleidoscope Pro. In total, 10,424 call sequence files were recorded but only 1,212 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 1,212 call sequence files were marked as recognised bat calls.

A total of seven microbat species were definitely identified being present on site and an additional two (2) 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 likely recorded on site. This species cannot be definitely confirmed due the similarity in call with sympatric species and overlap in their distribution. The full spectrum of three recorded calls were clustered closely with those of *S. saccolaimus* and harmonics would probably be attributed to *S. saccolaimus*.

A summary of the species present on site is provided in **Table 1**. The microbats species calls are separated by devices. The devices remained at the same location for the period of the survey. It is noted that three devices were deployed but one failed to record any bats.

Table 1: Summary of bat calls

Species	NC Act	EPBC Act	Anabat 4	Anabat 5	Anabat 7
<i>Austronomus australis</i>	LC	NOC	Definite	Definite	
<i>Chaerephon jobensis</i>	LC	NOC		Definite	Definite
<i>Chalinolobus nigrogriseus</i>	LC	NOC	Definite		Definite
<i>Miniopterus australis</i>	LC	NOC	Definite	Definite	Definite
<i>Miniopterus orianae oceanensis</i>	LC	NOC	Definite	Definite	Definite
<i>Mormopterus ridei</i>	LC	NOC			Definite
<i>Nyctophilus sp</i>	LC	NOC	Probable		Probable
<i>Rhinolophus megaphyllus</i>	LC	NOC	Definite	Definite	Definite
<i>Saccolaimus saccolaimus</i>	Endangered	Vulnerable			Probable

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 total of three 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* would still probably 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: Definite *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).

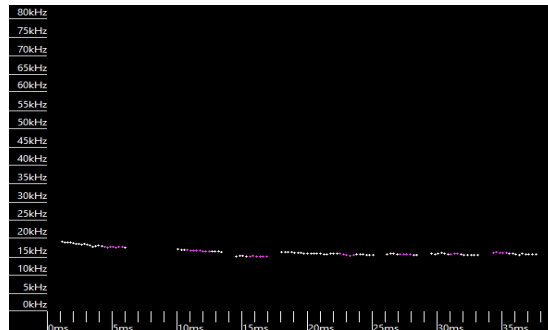


Figure 2: Definite *Chaerephon jobensis*

Their characteristic frequency average 19.8 kHz (range 16.12-23.6kHz). *C. jobensis* produce paired call pulses at alternating frequencies with intermittent, “excited”, linear pulses. This pattern is probably the result of bats interacting with each other.

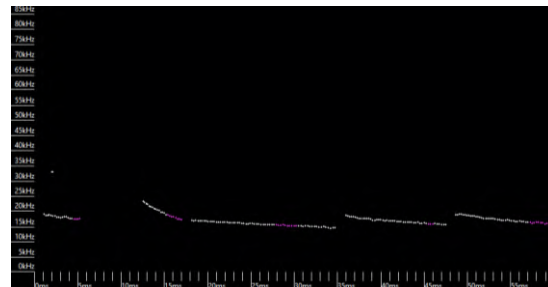


Figure 3: Definite *Chalinolobus nigrogriseus*

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.

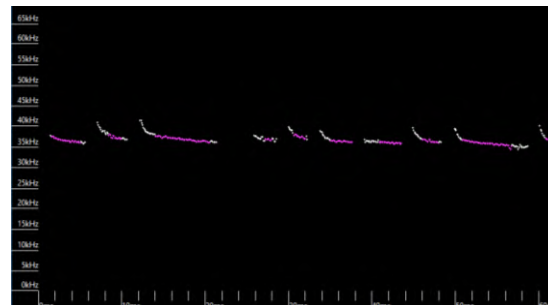


Figure 4: Definite *Miniopterus australis*

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.

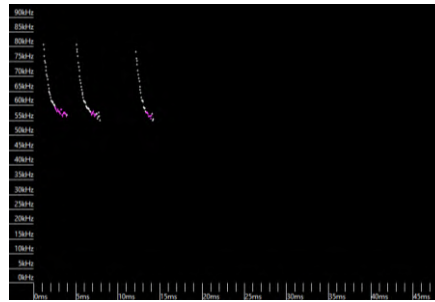


Figure 5: Definite *Miniopterus orianae oceanensis*

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.

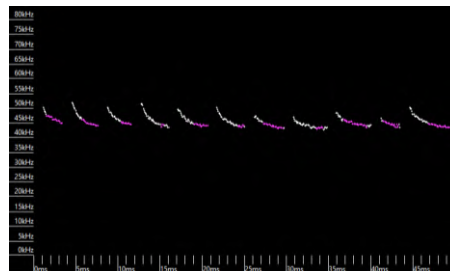


Figure 6: Definite *Mormopterus ridei*

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

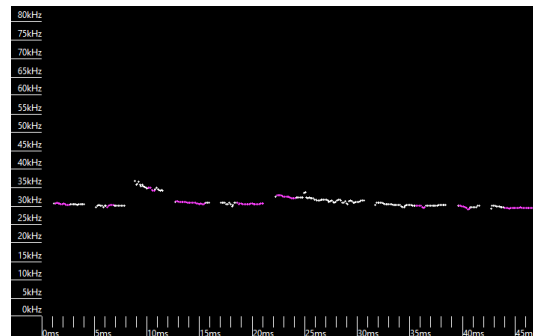


Figure 7: Probable *Nyctophilus* sp.

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*.

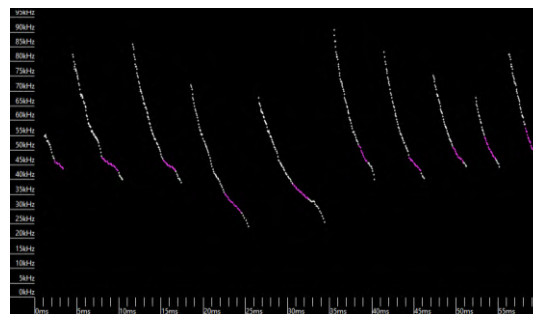


Figure 8: Definite *Rhinolophus megaphyllus*

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.

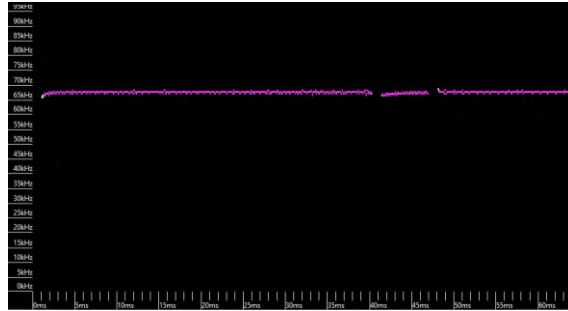
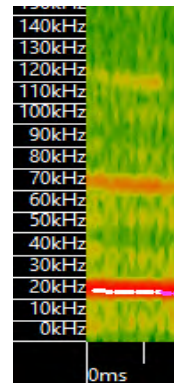


Figure 9: Probable *Saccolaimus saccolaimus*

Three sequence files were recorded on site that may be representative of *Saccolaimus saccolaimus*.

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 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

4.0 Conclusion

A total of seven microbat species were detected as definitely occurring within the site. Two other microbat species were 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 also presents a number of call variation which makes it difficult to confirm its presence using only echolocation techniques. However, a total of three calls presented harmonics that could probably be attributed to *S. Saccolaimus* and therefore, we would consider that *S. saccolaimus* probably occurs 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

CHURCHILL, S. 2008. *Australian Bats*, Sydney, Allen and Unwin.

PENNAY, M., LAW, B. A. & REINHOLD, L. 2004. Bat calls of New South Wales: Region based guide to the echolocation calls of microchiropteran bats. *In: NSW DEPARTMENT OF ENVIRONMENT AND CONSERVATION* (ed.). Hurstville.

PWCNT 2002. Key to the Bat Calls of the Top End of the Northern Territory. *In: PARKS AND WILDLIFE COMMISSION OF THE NORTHERN TERRITORY* (ed.). Damian J. Milne.

REARDON, T. 2003. Standards in bat detector based surveys. *Australasian Bat Society Newsletter* 20.

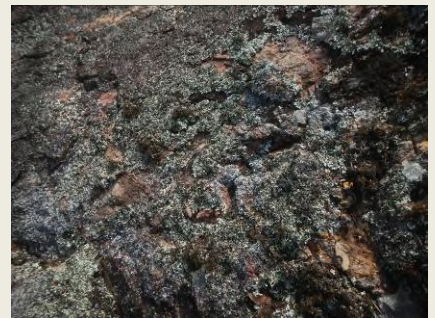
REINHOLD, L. 2001. *Key to the Bat Calls of South-east Queensland and North-east New South Wales*, Queensland Department of Natural Resources and Mines.

VAN DYCK, S. & STRAHAN, R. 2008. *The Mammals of Australia (Third Edition)*; , Sydney, New Holland.

Appendix B BioCondition Surveys 2018
S Glead – June 2018



Mt Emerald Wind Farm Offset Site BioCondition Surveys 2018



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

S. Gleed, June 2018
Reference: SG1804



Mt Emerald Wind Farm Offset Site BioCondition Surveys 2018

Mt Emerald Wind Farm

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

by

Simon Gleed

ATRATA

22nd June 2018

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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.

A series of BioCondition assessments were undertaken in the offset site during May 2018.

Climatic conditions were deemed suitable to accurately identify plants to species rank, with the exception of some obscure grasses carrying insufficient fertile material to make an accurate identification. These were typically identified to the rank of genus.

1.1 Limitations

We were unable to gain access to the north-east section of the offset site due to its remote location and the demise of the vehicle track because of the previous wet season. Consequently, the following regional ecosystems (REs) were not surveyed in this area: 7.12.29a, 7.12.57a and 7.12.34.

Also, surveying RE 7.12.26e was considered to pose an unacceptable safety risk due to the precipitous terrain over which the community occurs.

Given the remoteness of remnant areas in the offset site, a modified level of assessment was undertaken because of time constraints (i.e. most sites required long walks to gain access). Four days were allocated to field surveys.

Benchmarks were not set for remnant communities in the offset site because the limited time available for fieldwork precluded completing the minimum three surveys per regional ecosystem as recommended by Eyre *et al.* (2017). Undertaking this level of survey would require a minimum of two week's fieldwork. Based on comparative observations and numerous spot surveys across the offset site and the Mt Emerald Wind Farm site over the previous three to ten years, the information collected is nevertheless representative and typical of the communities on both sites.

1.2 Definitions

The following definitions are used in this document.

Attribute	Description
Recruitment of dominant canopy species	Proportion of the dominant canopy (ecologically dominant layer) species with evidence of recruitment.
Native plant species richness	The number of species expected in four life form groups, i.e. tree, shrub, grass, forbs and other species.
Tree strata: <ul style="list-style-type: none"> • Canopy • Sub-canopy • Large trees 	<p>A tree is defined as a woody plant, single stemmed >2 m tall.</p> <ul style="list-style-type: none"> • Height – median height in metres. • Cover - percentage cover (assessed as opaque crowns). • DBH (Diameter at Breast Height) – For large trees only; dbh threshold (cm). • Typical tree species.
Shrub strata: <ul style="list-style-type: none"> • Native shrub cover 	A shrub is defined as a woody plant, multi-stemmed from base or single stemmed and <2 m tall.

Attribute	Description
	<ul style="list-style-type: none"> • Cover - percentage cover (assessed as opaque crowns). • Typical shrub species
Ground cover: <ul style="list-style-type: none"> • Native perennial grass cover • Litter cover 	<ul style="list-style-type: none"> • Cover – percentage cover (assessed as projected foliage cover). • Typical ground cover species.
Coarse woody debris	<ul style="list-style-type: none"> • Total length in metres of woody debris > 10 cm diameter and > 0.5 m per hectare.
Non-native plant cover	<ul style="list-style-type: none"> • Cover – The percentage cover of non-native plants. • Typical non-native species listed with common names and declared pest status if applicable.

2.0 METHODOLOGY

The methods used for the BioCondition assessments followed those described by Eyre *et al.* (2017) and Neldner *et al.* (2017).

The method works on a series of plots and transects nested within survey area of 10,000 m² (1 ha).

2.1 Modification of Assessment Methodology

The following modifications were made to the survey methodology in order to complete the work within the allocated timeframe:

- Tree and shrub cover was estimated. This was necessary because of the uneven ground and high risk of trips and falls over steep terrain.
- An improved, less subjective method of recording ground cover attributes was adopted and based on advice from the Queensland Herbarium. The method used a tape measure intersect instead of visual estimates of cover within 1 x 1 m quadrats.
- For some REs (e.g. 7.12.65k) a 100 m transect within the plot was not possible due to the area representation and configuration of the community. A 50 m transect was used instead in these situations and data extrapolated to the 1 ha survey area.
- Tree basal area was not recorded.

3.0 RESULTS

Eight sites were assessed using the BioCondition methodology. With the exception of the vine forest communities, the balance of the sites are representative of the same types of vegetation found on the Mt Emerald Wind Farm. The locations of the surveys within the offset site are shown in **Figure 1** and the corresponding Regional Ecosystems (REs) in **Figure 2**. Results of these assessments are given in the following sections.

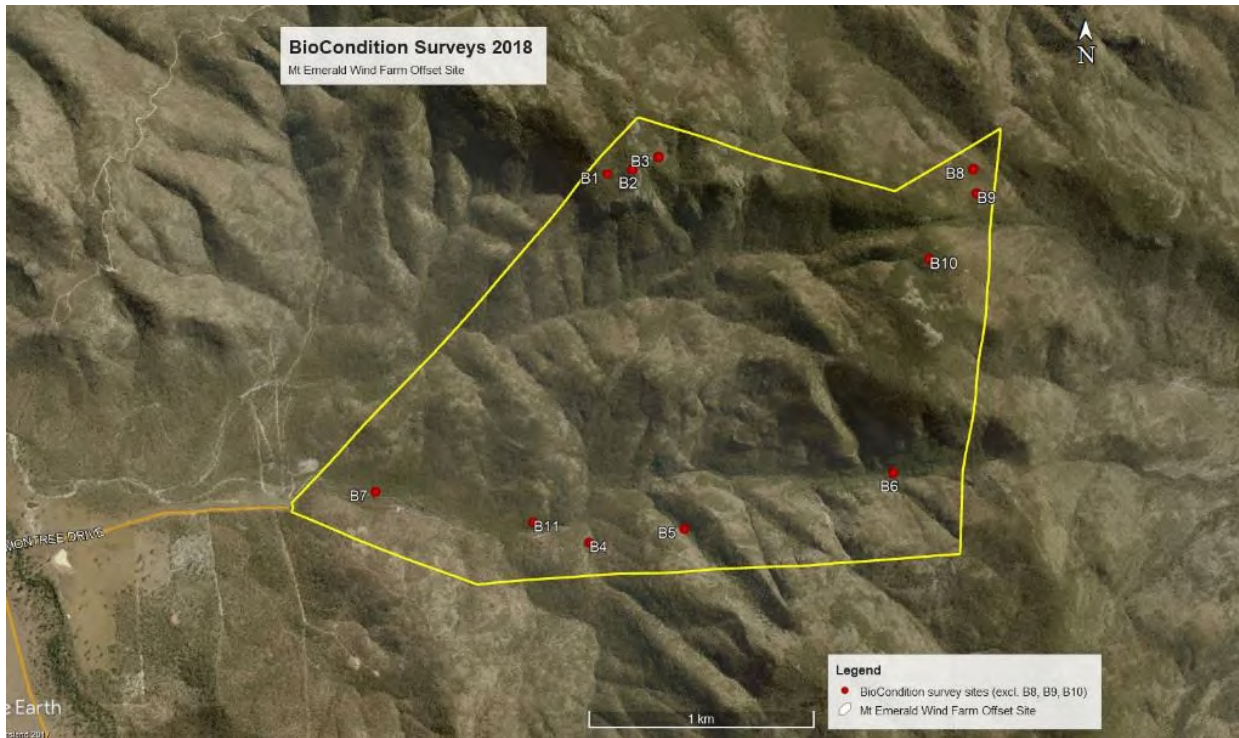


Figure 1. Location of 2018 BioCondition surveys in the Mt Emerald Wind Farm offset site.

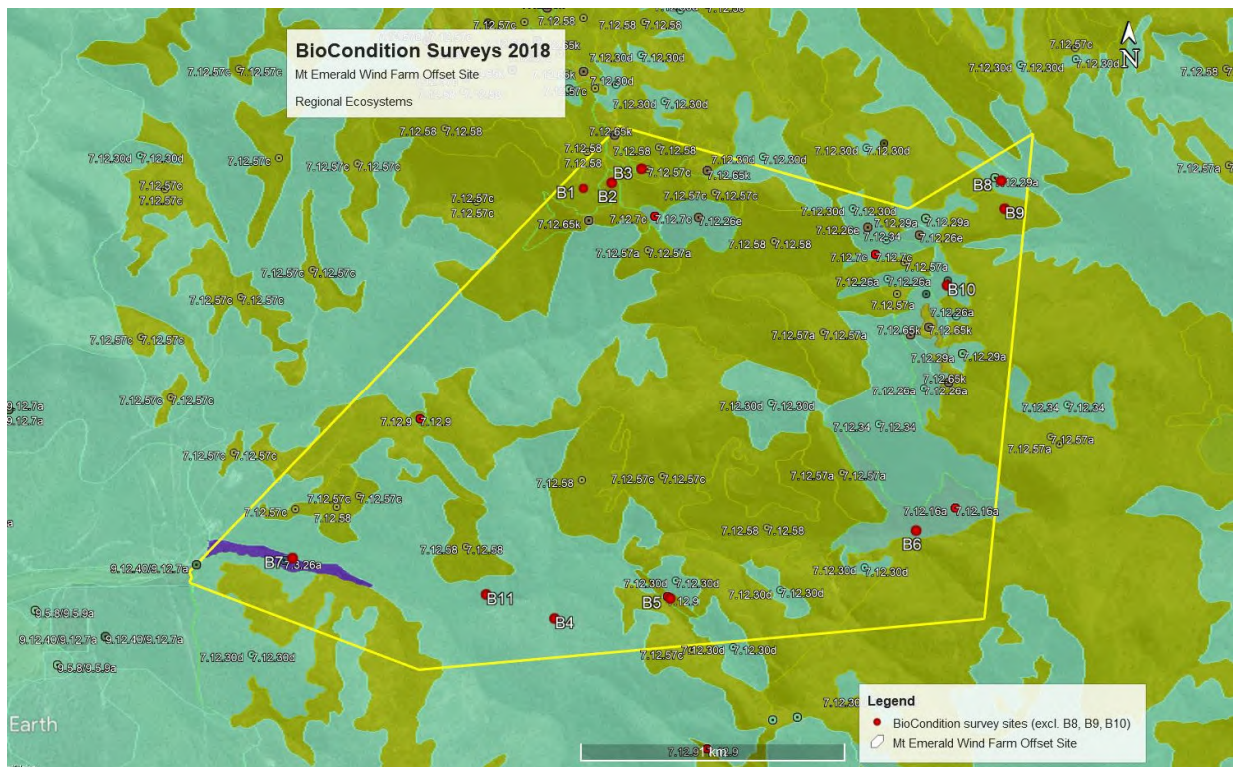


Figure 2. Regional ecosystems corresponding with the location of 2018 BioCondition surveys.

3.1 BioCondition Site: B1

Date of Survey: 25 May 2018

Plot origin: Zone: 55 K easting: 329103 northing: 8097846 Elev. 1039 m

Plot centre: Zone: 55 K easting: 329142 northing: 8097874 Elev. 1034 m

Plot bearing: NE **Plot alignment:** Parallel with contour of hill.



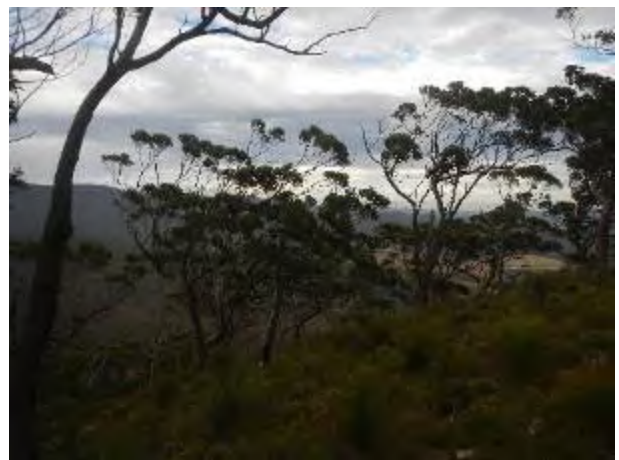
North



South



East



West

Habitat description: Woodland of *Eucalyptus reducta* on 40 degree south-facing rocky slope. Low heathy shrub layer of *Acacia calyculata*, *Monotoca scoparia* and *Leptospermum amboinense*.

Regional ecosystem (mapped): 7.12.58: *Eucalyptus reducta* +/- *E. granitica* +/- *Corymbia dimorpha* +/- *C. citriodora* woodland to open forest on granite and rhyolite.

Attributes

Recruitment of dominant canopy species (%): 100

Native plant species richness:

Trees:	3
Shrubs:	12
Grasses:	3
Forbs and other:	4

Trees:	Tree canopy	Tree canopy median height (m):	9
		Tree canopy cover (%):	19
	Tree sub-canopy	Tree sub-canopy median height (m):	0
		Tree sub-canopy cover (%):	0
	Large trees	Large eucalypt tree dbh threshold (cm):	35
		Number of large eucalypt trees per hectare:	14
		Large non-eucalypt tree dbh threshold (cm):	0
		Number of large non-eucalypt trees per hectare:	0

Typical tree species: *Corymbia intermedia*, *Eucalyptus reducta*, *Syncarpia glomulifera*.

Shrubs: Native shrub cover (%): 42

Ground cover (%):

Native perennial grass cover (%):	15
Forbs and non-grass (%):	1
Shrubs (%)	42
Organic litter cover (%):	11
Rock (%):	21
Bare ground (%):	10
Cryptograms (%)	0

Coarse woody debris: Total length (m) of debris ≥ 10 cm diameter and ≥ 0.5 m in length per hectare: 221

Non-native plant cover (%): 0

Typical non-native species: None

Native species richness:

Trees: *Corymbia intermedia*, *Eucalyptus reducta*, *Syncarpia glomulifera*.

Shrubs: *Leptospermum amboinense*, *Pultenaea millarii*, *Pseudanthus ligulatus*, *Exocarpos cupressiformis*, *Acacia calyculata*, *Monotoca scoparia*, *Comesperma anemosmaragdinum*, *Xanthorrhoea johnsonii*, *Platysace valida*, *Persoonia falcata*, *Acacia falciformis*, *Melichrus urceolatus*.

Grasses: *Aristida* sp., *Cleistochloa subjuncea*, *Eriachne mucronata*, *E. pallescens*.

Forbs and other species: *Pimelea linifolia*, *Lepidosperma laterale*, *Hovea nana*, *Usnea baileyi*.

Non-native species: None.

3.2 BioCondition Site: B2

Date of Survey: 24 May 2018

Plot origin: Zone: 55 K easting: 329249 northing: 8097871 Elev. 1019 m

Plot centre: Zone: 55 K easting: 329250 northing: 8097921 Elev. 1034 m

Plot bearing: North **Plot alignment:** Upslope across rock pavement.



North



South



East



West

Habitat description: Rhyolite rock pavement sloping to south. Surrounding/adjacent woodland of *Eucalyptus reducta* over *Acacia falciformis* and *Monotoca scoparia*.

Regional ecosystem (mapped): 7.12.65k: Granite and rhyolite rock outcrop, of dry western areas, associated with shrublands to closed forests of *Acacia* spp. and/or *Lophostemon* spp. and/or *Allocasuarina* spp. In the Mount Emerald area, shrubs may include *Acacia umbellata*, *Melaleuca borealis*, *Homoranthus porteri*, *Leptospermum neglectum*, *Melaleuca recurva*, *Melaleuca uxorum*, *Grevillea glossadenia*, *Corymbia abergiana*, *Eucalyptus lockyeri*, *Sannantha angusta*, *Pseudanthus ligulatus* subsp. *ligulatus*, *Acacia aulacocarpa*, *Leptospermum amboinense*, *Xanthorrhoea johnsonii* and *Jacksonia thesioides*. Ground-cover species may include *Borya septentrionalis*, *Lepidosperma laterale*, *Eriachne* spp., *Cleistochloa subjuncea*, *Boronia occidentalis*, *Cheilanthes* spp., *Coronidium newcastlianum*, *Schizachyrium* spp., *Tripogon loliiformis*, *Gonocarpus acanthocarpus* and *Eragrostis* spp. Dry western areas. Granite and rhyolite. (BVG1M: 29b)

Attributes

Recruitment of dominant canopy species (%):			25
Native plant species richness:		Trees:	4
		Shrubs:	21
		Grasses:	8
		Forbs and other:	10
Trees:	Tree canopy	Tree canopy median height (m):	NA
		Tree canopy cover (%):	NA
	Tree sub-canopy	Tree sub-canopy median height (m):	NA
		Tree sub-canopy cover (%):	NA
	Large trees	Large eucalypt tree dbh threshold (cm):	NA
		Number of large eucalypt trees per hectare:	NA
		Large non-eucalypt tree dbh threshold (cm):	0
		Number of large non-eucalypt trees per hectare:	0
Typical tree species:		In adjacent RE: <i>Corymbia abergiana</i> , <i>Eucalyptus atrata</i> , <i>E. lockyeri</i> , <i>E. reducta</i> .	
Shrubs:		Native shrub cover (%):	4
Ground cover (%):		Native perennial grass cover (%):	6
		Forbs and non-grass (%):	0
		Shrubs (%)	7
		Organic litter cover (%):	0
		Rock (%):	80
		Bare ground (%):	3
		Cryptograms (%)	4
Coarse woody debris:	Total length (m) of debris ≥ 10 cm diameter and ≥ 0.5 m in length per hectare:		0
Non-native plant cover (%):			<1
Typical non-native species:	<i>Praxelis clematidea</i> .		

Native species richness:

Trees: *Corymbia abergiana*, *Eucalyptus atrata*, *E. lockyeri*, *E. reducta*.

Shrubs: *Acacia aulacocarpa*, *A. calyculata*, *A. falciformis*, *Acrothamnus spathaceus*, *Astroloma* sp. (Baal Gammon B.P.Hyland 10341), *Astrotricha pterocarpa*, *Commersonia dasyphylla*, *Eucalyptus lockyeri*, *Hibbertia concinnum*, *Homoranthus porteri*, *Jacksonia thesioides*, *Keraudrenia lanceolata*, *Leucopogon* sp. (Border Island), *Leptospermum amboinense*, *Monotoca scoparia*, *Notelaea punctata*, *Platysace valida*, *Pseudanthus ligulatus*, *Sannantha angusta*, *Xanthorrhoea johnsonii*, *Zieria cytisoides*.

Grasses: *Aristida* sp., *Arundinella setosa*, *Cleistochloa subjuncea*, *Eragrostis schultzei*, *Eriachne mucronata*, *Schizachyrium pachyarthron*, *Themeda triandra*, *Tripogon loliiformis*.

Forbs/other: *Boronia occidentalis*, *Cladia muelleri*, *C. retipora*, *Drynaria rigidula*, *Gonocarpus acanthocarpus*, *Lepidosperma laterale*, *Plectranthus amoenus*, *P. parviflorus*, *Praxelis clematidea**, *Usnea baileyi*.

Non-native species: *Praxelis clematidea**.

3.3 BioCondition Site: B3

Date of Survey: 25 May 2018

Plot origin: Zone: 55 K easting: 329366 northing: 8097925 Elev. 1033 m

Plot centre: Zone: 55 K easting: 329361 northing: 8097949 Elev. 1020 m

Plot bearing: NNW **Plot alignment:** Upslope across centre of vegetation type.



North



South



East



West

Habitat description: Heathland to shrubland over patches of rock pavement.

Regional ecosystem (mapped): 7.12.57c: Shrubland/low woodland (1.5-9 m tall) mosaic with variable dominance, often including *Eucalyptus cloeziana*, *Corymbia abergiana*, *E. portuensis*, *E. reducta*, *E. lockyeri*, *C. leichhardtii*, *Callitris intratropica*, *E. atrata*, *E. pachycalyx*, *E. shirleyi*, *E. drepanophylla* and *Homoranthus porteri*, on rhyolite and granite. There is occasionally a very sparse to sparse secondary tree layer of *C. abergiana* and/or *C. stockeri*. A very sparse to sparse tall shrub layer may be present and can include *Persoonia falcata*, *Exocarpos cupressiformis* and *Melaleuca viridiflora* var. *viridiflora*. A sparse to dense lower shrub layer may include *Jacksonia thesioides*, *Acacia calyculata*, *Coelospermum reticulatum*, *Xanthorrhoea johnsonii*, *Acacia humifusa*, *Dodonaea lanceolata* var. *subsessilifolia*, *Grevillea dryandri* subsp. *dryandri*, *Grevillea glossadenia*, *Acacia umbellata* and Ericaceae spp.

The ground layer may be dominated by species such as *Themeda triandra*, *Xanthorrhoea johnsonii*, *Eriachne pallescens* var. *pallescens*, *Cleistochloa subjuncea*, *Borya septentrionalis*, and *Eriachne* 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)

Attributes

Recruitment of dominant canopy species (%):		100	
Native plant species richness:	Trees:	3	
	Shrubs:	18	
	Grasses:	6	
	Forbs and other:	9	
Trees:	Tree canopy	Tree canopy median height (m):	0
		Tree canopy cover (%):	0
	Tree sub-canopy	Tree sub-canopy median height (m):	0
		Tree sub-canopy cover (%):	0
	Large trees	Large eucalypt tree dbh threshold (cm):	42
		Number of large eucalypt trees per hectare:	4
		Large non-eucalypt tree dbh threshold (cm):	0
		Number of large non-eucalypt trees per hectare:	0
Typical tree species:	In adjacent RE: <i>Eucalyptus lockyeri</i> , <i>E. reducta</i> . <i>Allocasuarina inophloia</i>		
Shrubs:	Native shrub cover (%):	57	
Ground cover (%):	Native perennial grass cover (%):	31	
	Forbs and non-grass (%):	2	
	Shrubs (%)	57	
	Organic litter cover (%):	1	
	Rock (%):	9	
	Bare ground (%):	0	
	Cryptograms (%)	0	
Coarse woody debris:	Total length (m) of debris ≥ 10 cm diameter and ≥ 0.5 m in length per hectare:	0	
Non-native plant cover (%):		0	

Typical non-native species: None.

Native species richness:

Trees: *Allocasuarina inophloia*, *Eucalyptus lockyeri*, *E. reducta*.

Shrubs: *Acacia aulacocarpa*, *A. calyculata*, *Astrotricha pterocarpa*, *Hakea benthamii*, *Hibbertia bicarpellata*, *H. concinnum*, *Keraudrenia lanceolata*, *Leucopogon* sp. (Border Island), *Leptospermum amboinense*, *Melichrus urceolatus*, *Monotoca scoparia*, *Notelaea punctata*, *Platysace valida*, *Persoonia falcata*, *Pseudanthus ligulatus*, *Pultenaea millarii*, *Sannantha angusta*, *Xanthorrhoea johnsonii*.

Grasses: *Cleistochloa subjuncea*, *Eragrostis schultzei*, *Eriachne ciliata*, *E. mucronata*, *Panicum simile*, *Themeda triandra*.

Forbs and other species: *Cheilanthes nudiuscula*, *Cladia retipora*, *Coronidium newcastleanum*, *Cyperus pulchellus*, *Dendrobium speciosum*, *Gonocarpus acanthocarpus*, *Hibbertia longifolia*, *Lepidosperma laterale*, *Tricoryne anceps*.

Non-native species: None

3.4 BioCondition Site: B4

Date of Survey: 4 May 2018

Plot origin: Zone: 55 K easting: 329045 northing: 8096211 Elev. 666 m

Plot centre: Zone: 55 K easting: 329047 northing: 8096257 Elev. 655 m

Plot bearing: NW Plot alignment: Parallel with hill contour.



North



South



East



West

Habitat description: Steep rocky rhyolite slope with *Eucalyptus pachycalyx*, *Callitris intratropica* and *Corymbia leichhardtii*.

Regional ecosystem (mapped): 7.12.30d: Open woodland to open forest (10-20m tall) mosaic with variable dominance, often including *Eucalyptus cloeziana*, *C. citriodora*, *E. portuensis*, *E. lockyeri*, *C. leichhardtii*, *E. atrata*, *E. pachycalyx*, *E. reducta*, *C. intermedia* and *E. shirleyi*. There is often a very sparse to mid-dense secondary tree layer of *C. abergiana* and/or *C. stockeri*. A very sparse to sparse tall shrub layer may be present and can include *Acacia flavescens*, *Persoonia falcata*, *Bursaria spinosa* subsp. *spinosa*, *Allocasuarina inophloia*, *Petalostigma pubescens* and *Grevillea glauca*. A sparse to dense lower shrub layer may include *Jacksonia thesioides*, *Acacia calyculata*, *Xanthorrhoea johnsonii* and *Grevillea glossadenia*.

The ground layer may be dominated by species such as *Themeda triandra*, *Heteropogon triticeus*, *Mnesithea rottboellioides*, *Arundinella setosa*, *Cleistochloa subjuncea*, *Eriachne pallescens* var. *pallescens*, *Lepidosperma laterale* and *Xanthorrhoea johnsonii*. Rocky slopes on granite and rhyolite. (BVG1M: 9d).

Attributes

Recruitment of dominant canopy species (%):			5
Native plant species richness:		Trees:	5
		Shrubs:	21
		Grasses:	11
		Forbs and other:	10
Trees:	Tree canopy	Tree canopy median height (m):	12
		Tree canopy cover (%):	23
	Tree sub-canopy	Tree sub-canopy median height (m):	7
		Tree sub-canopy cover (%):	4
	Large trees	Large eucalypt tree dbh threshold (cm):	35
		Number of large eucalypt trees per hectare:	6
		Large non-eucalypt tree dbh threshold (cm):	25
		Number of large non-eucalypt trees per hectare:	4
Typical tree species:	<i>Eucalyptus cloeziana</i> , <i>E. pachycalyx</i> , <i>Corymbia leichhardtii</i> , <i>Callitris intratropica</i> , <i>Allocasuarina inophloia</i> .		
Shrubs:		Native shrub cover (%):	22
Ground cover (%):		Native perennial grass cover (%):	11
		Forbs and non-grass (%):	0
		Shrubs (%)	22
		Organic litter cover (%):	24
		Rock (%):	26
		Bare ground (%):	13
		Cryptograms (%)	4
Coarse woody debris:	Total length (m) of debris ≥ 10 cm diameter and ≥ 0.5 m in length per hectare:		15
Non-native plant cover (%):			0
Typical non-native species:	None		

Native species richness:

Trees: *Eucalyptus cloeziana*, *E. pachycalyx*, *Corymbia leichhardtii*, *Callitris intratropica*, *Allocasuarina inophloia*.

Shrubs: *Acacia calyculata*, *A. purpureopetala*, *A. whitei*, *Hibbertia stirlingii*, *Jacksonia thesioides*, *Grevillea glossadenia*, *Psydrax saligna*, *Denhamia cunninghamii*, *Acacia nesophila*, *Dodonaea dododecandra*, *Alyxia spicata*, *Xanthorrhoea johnsonii*, *Acacia umbellata*, *Acacia humifusa*, *Grevillea dryandri*, *Larsenaikia ochreatea*, *Bursaria incana*, *Breynia oblongifolia*, *Dodonaea lanceolata*, *Gompholobium nitidum*, *Acacia galioides*.

Grasses: *Cleistochloa subjuncea*, *Eriachne ciliata*, *Cymbopogon bombycinus*, *Schizachyrium fragile*, *Panicum simile*, *Triodia microstachya*, *Themeda triandra*, *Eriachne mucronata*, *Arundinella setosa*, *Heteropogon contortus*, *Aristida benthamii*.

Forbs and other species: *Gonocarpus acanthocarpus*, *Hibbertia longifolia*, *Tricoryne anceps*, *Phyllanthus virgatus*, *Cheilanthes nitida*, *Sedopsis* sp. (Bulimba Station), *Fimbristylis dichotoma*, *Wahlenbergia queenslandica*, *Cyanthillium cinereum*, *Pterocaulon redolens*.

Non-native species: None

3.5 BioCondition Site: B5

Date of Survey: 10 May 2018

Plot origin: Zone: 55 K easting: 329465 northing: 8096347 Elev. 725 m

Plot centre: Zone: 55 K easting: 3294483 northing: 8096336 Elev. 726 m

Plot bearing: SE **Plot alignment:** Upslope through wide, boulder-strewn gully.



North



South



East



West

Habitat description: Vine forest along rocky stream terrace.

Regional ecosystem (mapped): 7.12.9: *Acacia celsa* (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)

Attributes

Recruitment of dominant canopy species (%):			65
Native plant species richness:		Trees:	21
		Shrubs:	8
		Grasses:	2
		Forbs and other:	20
Trees:	Tree canopy	Tree canopy median height (m):	16
		Tree canopy cover (%):	80
	Tree sub-canopy	Tree sub-canopy median height (m):	8
		Tree sub-canopy cover (%):	54
	Large trees	Large eucalypt tree dbh threshold (cm):	0
		Number of large eucalypt trees per hectare:	0
		Large non-eucalypt tree dbh threshold (cm):	25
		Number of large non-eucalypt trees per hectare:	33
Typical tree species:	<i>Olea paniculata, Pleiogynium timorense, Gossia bidwillii, Chionanthus ramiflorus.</i>		
Shrubs:		Native shrub cover (%):	4
Ground cover (%):		Native perennial grass cover (%):	2
		Forbs and non-grass (%):	6
		Shrubs (%)	4
		Organic litter cover (%):	32
		Rock (%):	48
		Bare ground (%):	6
		Cryptograms (%)	2
Coarse woody debris:	Total length (m) of debris ≥ 10 cm diameter and ≥ 0.5 m in length per hectare:		57
Non-native plant cover (%):			3
Typical non-native species:	<i>Lantana camara*, Solanum seaforthianum*, Emilia sonchifolia*, Praxelis clematidea*, Ageratum conyzoides*.</i>		

Native species richness:

Trees: *Wilkiea pubescens*, *Olea paniculata*, *Gossia bidwillii*, *Pleiogynium timorense*, *Chionanthus ramiflorus*, *Alectryon tomentosus*, *Euroschinus falcata*, *Drypetes deplanchei*, *Psydrax dallachiana*, *Ficus rubiginosa*, *Ficus virens*, *Pittosporum venulosum*, *Lophostemon grandiflorus*, *Acronychia laevis*, *Larsenaikia ochreatea*, *Acacia celsa*, *Sersalisia sericea*, *Callitris intratropica*, *Atractocarpus fitzalanii*, *Bursaria tenuifolia*, *Elaeodendron melanocarpum*.

Shrubs: *Alyxia ruscifolia*, *Dendrocnide moroides*, *Alyxia spicata*, *Ozothamnus cassinioides*, *Wikstroemia indica*, *Myrsine variabilis*, *Flueggea virosa*, *Turraea pubescens*.

Grasses: *Oplismenus compositus*, *Arundinella setosa*.

Forbs and other species: *Parsonsia straminea*, *Tetrastigma nitens*, *Adiantum atroviride*, *Neoachmandra cunninghamii*, *Cyanthillium cinereum*, *Cissus oblonga*, *Smilax calophylla*, *Tectaria confluens*, *Adiantum hispidulum*, *Plectranthus amoenus*, *P. mirus*, *Asystasia* sp., *Proiphys amboinensis*, *Scleria mackaviensis*, *Dioscorea transversa*, *Drynaria rigidula*, *Abrus precatorius*, *Ventilago ecorollata*, *Dockrillia teretifolium*, *Paraceterach muelleri*.

Non-native species: *Lantana camara**, *Solanum seafortianum**, *Emilia sonchifolia**, *Praxelis clematidea**, *Ageratum conyzoides**.

3.6 BioCondition Site: B6

Date of Survey: 9 May 2018

Plot origin: Zone: 55 K easting: 330389 northing: 8096572 Elev. 793 m

Plot centre: Zone: 55 K easting: 330409 northing: 8096598 Elev. 792 m

Plot bearing: E **Plot alignment:** Crosses braided watercourse channel.



North



South



East



West

Habitat description: Vine forest across rocky stream and terrace.

Regional ecosystem (mapped): 7.12.16a: Simple notophyll vine forest on wet and moist uplands, granite and rhyolite. Uplands of the cloudy wet to moist rainfall zones. Granite and rhyolite. (BVG1M: 6b)

Attributes

Recruitment of dominant canopy species (%):			70
Native plant species richness:		Trees:	22
		Shrubs:	6
		Grasses:	2
		Forbs and other:	17
Trees:	Tree canopy	Tree canopy median height (m):	17
		Tree canopy cover (%):	75
	Tree sub-canopy	Tree sub-canopy median height (m):	10
		Tree sub-canopy cover (%):	55
	Large trees	Large eucalypt tree dbh threshold (cm):	0
		Number of large eucalypt trees per hectare:	0
		Large non-eucalypt tree dbh threshold (cm):	28
		Number of large non-eucalypt trees per hectare:	23
Typical tree species:	<i>Olea paniculata, Agathis robusta, Pleiogynium timorense.</i>		
Shrubs:		Native shrub cover (%):	4
Ground cover (%):		Native perennial grass cover (%):	2
		Forbs and non-grass (%):	10
		Shrubs (%)	4
		Organic litter cover (%):	16
		Rock (%):	40
		Bare ground (%):	4
		Cryptograms (%)	24
Coarse woody debris:	Total length (m) of debris ≥ 10 cm diameter and ≥ 0.5 m in length per hectare:		18.7
Non-native plant cover (%):			<1
Typical non-native species:	<i>Praxelis clematidea*</i>		

Native species richness:

Trees: *Olea paniculata*, *Agathis robusta*, *Pleiogynium timorense*, *Pittosporum venulosum*, *Euroschinus falcata*, *Guioa acutifolia*, *Harpullia pendula*, *Cupaniopsis anacardioides*, *Psydrax lamprophyllum*, *Psychotria dallachiana*, *Gossia bidwillii*, *Elaeodendron melanocarpum*, *Chionanthus ramiflorus*, *Ligustrum australianum*, *Polyalthia nitidissima*, *Drypetes deplanchei*, *Sersalisia sericea*, *Acronychia laevis*, *Atractocarpus fitzalanii*, *Bursaria tenuifolia*, *Ganophyllum falcatum*, *Polyscias elegans*.

Shrubs: *Myrsine porosa*, *Alyxia ruscifolia*, *Wikstroemia indica*, *Dendrocnide moroides*, *Ficus opposita*, *Myrsine porosa*.

Grasses: *Oplismenus compositus*, *Entolasia stricta*.

Forbs and other species: *Parsonsia rotata*, *Myrsine porosa*, *Melodinus australis*, *Adiantum atroviride*, *Hippocratea barbata*, *Smilax calophylla*, *Dioscorea transversa*, *Adiantum hispidulum*, *Proiphys amboinense*, *Ventilago ecorollata*, *Melodinus australis*, *Tectaria confluens*, *Cissus oblonga*, *Trophis scandens*, *Plectranthus mirus*, *Microsorium punctatum*, *Colysis sayeri*.

Non-native species: *Praxelis clematidea**

3.7 BioCondition Site: B7

Date of Survey: 11 May 2018

Plot origin: Zone: 55 K easting: 328005 northing: 8096481 Elev. 596 m

Plot centre: Zone: 55 K easting: 328056 northing: 8096475 Elev. 596 m

Plot bearing: SE **Plot alignment:** Follows flow path of braided watercourse across sand and rock bars.



North



South



East



West

Habitat description: Braided seasonal watercourse with sandy and rocky bars.

Regional ecosystem (mapped): 7.3.26a: *Casuarina cunninghamiana*, *Eucalyptus tereticornis*, *Lophostemon suaveolens*, *Melaleuca leucadendra*, *M. fluviatilis*, *Buckinghamia celsissima*, *Mallotus philippensis* woodland and forest with an understorey of *Melaleuca viminalis* and *Bursaria tenuifolia*. Fringing forests of larger streams. Riverine wetland or fringing riverine wetland. (BVG1M: 16a).

NB. This RE is mapped incorrectly; nevertheless, the type does occur further downstream on Oakey Creek in a similar landscape setting.

Attributes

Recruitment of dominant canopy species (%):			25
Native plant species richness:		Trees:	19
		Shrubs:	12
		Grasses:	11
		Forbs and other:	19
Trees:	Tree canopy	Tree canopy median height (m):	14
		Tree canopy cover (%):	18
	Tree sub-canopy	Tree sub-canopy median height (m):	7
		Tree sub-canopy cover (%):	5
	Large trees	Large eucalypt tree dbh threshold (cm):	45
		Number of large eucalypt trees per hectare:	3
		Large non-eucalypt tree dbh threshold (cm):	24
		Number of large non-eucalypt trees per hectare:	2
Typical tree species:	<i>Eucalyptus crebra</i> , <i>E. tereticornis</i> , <i>Corymbia clarksoniana</i> , <i>C. dallachiana</i> , <i>C. leichhardtii</i> , <i>Lophostemon grandiflorus</i> .		
Shrubs:		Native shrub cover (%):	7
Ground cover (%):		Native perennial grass cover (%):	29
		Forbs and non-grass (%):	3
		Shrubs (%)	7
		Organic litter cover (%):	10
		Rock (%):	49
		Bare ground (%):	2
		Cryptograms (%)	0
Coarse woody debris:	Total length (m) of debris ≥ 10 cm diameter and ≥ 0.5 m in length per hectare:		60
Non-native plant cover (%):			2
Typical non-native species:			6

Native species richness:

Trees: *Eucalyptus crebra*, *E. tereticornis*, *Corymbia clarksoniana*, *C. dallachiana*, *C. leichhardtii*, *Lophostemon grandiflorus*, *Bursaria tenuifolia*, *Planchonia careya*, *Canarium australianum*, *Santalum lanceolatum*, *Callitris intratropica*, *Alphitonia excelsa*, *Drypetes deplanchei*, *Petalostigma banksii*, *Larsenaikia ochreatea*, *Petalostigma pubescens*, *Grevillea parallela*, *Sersalisia sericea*, *Acacia flavescens*.

Shrubs: *Acacia multisiliqua*, *Dodonaea lanceolata*, *Exocarpos latifolia*, *Acacia disparrima*, *Ficus opposita*, *Trema aspera*, *Acacia nesophila*, *Grevillea glossadenia*, *Acacia humifusa*, *Clerodendrum floribundum*, *Wikstroemia indica*, *Flueggea virosa*.

Grasses: *Arundinella setosa*, *Themeda triandra*, *Cleistochloa subjuncea*, *Heteropogon contortus*, *Melinis repens**, *Heteropogon triticeus*, *Eriachne pallescens*, *Eragrostis schultzei*, *Chrysopogon fallax*, *Aristida queenslandica*, *Mnesithea rottboellioides*.

Forbs and other species: *Proiphys amboinense*, *Dianella nervosa*, *Heliotropium tabuliplagae*, *Jacksonia thesioides*, *Cajanus acutifolius*, *Pterocaulon redolens*, *Stylosanthes scabra**, *Praxelis clematidea**, *Breynia oblongifolia*, *Phyllanthus fuernrohrii*, *Dodonaea dododecandra*, *Tricoryne anceps*, *Hibiscus meraukensis*, *Crotalaria goreensis**, *Senna aciphylla*, *Cassytha filiformis*, *Grewia retusifolia*, *Chamaecrista rotundifolia**, *Scleria mackaviensis*.

Non-native species: *Lantana camara**, *Melinis repens**, *Stylosanthes scabra**, *Praxelis clematidea**, *Crotalaria goreensis**, *Chamaecrista rotundifolia**.

3.8 BioCondition Site: B8 (not surveyed)

Regional ecosystem (mapped): 7.12.29a: *Corymbia intermedia*, *Eucalyptus tereticornis*, *E. drepanophylla* open forest to low open forest and woodland with *Allocasuarina torulosa*, *A. littoralis*, *Lophostemon suaveolens*, *Acacia cincinnata*, *A. flavescens*, *Banksia aquilonia* and *Xanthorrhoea johnsonii*. Uplands, on granite and rhyolite. (BVG1M: 9c).

3.9 BioCondition Site: B9 (not surveyed)

Regional ecosystem (mapped): 7.12.57a: Shrubland and low woodland mosaic with *Syncarpia glomulifera*, *Corymbia abergiana*, *Eucalyptus portuensis*, *Allocasuarina littoralis* and *Xanthorrhoea johnsonii*. Uplands and highlands on granite and rhyolite, of the moist and dry rainfall zones. (BVG1M: 9d).

3.10 BioCondition Site: B10 (not surveyed)

Regional ecosystem (mapped): 7.12.34: *Eucalyptus portuensis* (white mahogany) and/or *E. drepanophylla* (ironbark), +/- *C. intermedia* (pink bloodwood) +/- *C. citriodora* (lemon-scented gum), +/- *E. granitica* (granite ironbark) open woodland to open forest. Uplands on granite, of the dry rainfall zone. (BVG1M: 9d)

3.11 BioCondition Site: B11

Date of Survey: 11 May 2018

Plot origin: Zone: 55 K easting: 328826 northing: 8096354 Elev. 630 m

Plot centre: Zone: 55 K easting: 328788 northing: 8096345 Elev. 624 m

Plot bearing: SW **Plot alignment:** Parallel with contour of rounded hill.



North



South



East



West

Habitat description: Grassy woodland on rocky hill.

Regional ecosystem (mapped): 7.12.30d: Open woodland to open forest (10-20m tall) mosaic with variable dominance, often including *Eucalyptus cloeziana*, *C. citriodora*, *E. portuensis*, *E. lockyeri*, *C. leichhardtii*, *E. atrata*, *E. pachycalyx*, *E. reducta*, *C. intermedia* and *E. shirleyi*. There is often a very sparse to mid-dense secondary tree layer of *C. abergiana* and/or *C. stockeri*. A very sparse to sparse tall shrub layer may be present and can include *Acacia flavescens*, *Persoonia falcata*, *Bursaria spinosa* subsp. *spinosa*, *Allocasuarina inophloia*, *Petalostigma pubescens* and *Grevillea glauca*. A sparse to dense lower shrub layer may include *Jacksonia thesioides*, *Acacia calyculata*, *Xanthorrhoea johnsonii* and *Grevillea glossadenia*. The ground layer may be dominated by species such as *Themeda triandra*, *Heteropogon triticeus*, *Mnesithea rottboellioides*, *Arundinella setosa*, *Cleistochloa subjuncea*, *Eriachne pallescens* var. *pallescens*, *Lepidosperma laterale* and *Xanthorrhoea johnsonii*. Rocky slopes on granite and rhyolite. (BVG1M: 9d).

Attributes

Recruitment of dominant canopy species (%):			40
Native plant species richness:		Trees:	9
		Shrubs:	23
		Grasses:	12
		Forbs and other:	24
Trees:	Tree canopy	Tree canopy median height (m):	10
		Tree canopy cover (%):	19
	Tree sub-canopy	Tree sub-canopy median height (m):	8
		Tree sub-canopy cover (%):	10
	Large trees	Large eucalypt tree dbh threshold (cm):	35
		Number of large eucalypt trees per hectare:	27
		Large non-eucalypt tree dbh threshold (cm):	23
		Number of large non-eucalypt trees per hectare:	11
Typical tree species:	<i>Callitris intratropica, Eucalyptus shirleyi, E. granitica, E. cloeziana, Corymbia leichhardtii.</i>		
Shrubs:		Native shrub cover (%):	16
Ground cover (%):		Native perennial grass cover (%):	50
		Forbs and non-grass (%):	0
		Shrubs (%)	16
		Organic litter cover (%):	24
		Rock (%):	8
		Bare ground (%):	2
		Cryptograms (%)	0
Coarse woody debris:	Total length (m) of debris ≥ 10 cm diameter and ≥ 0.5 m in length per hectare:		46
Non-native plant cover (%):			<1
Typical non-native species:	<i>Praxelis clematidea*, Stylosanthes scabra*.</i>		

Native species richness:

Trees: *Callitris intratropica*, *Eucalyptus shirleyi*, *E. granitica*, *E. atrata*, *E. cloeziana*, *Corymbia leichhardtii*, *Planchonia careya*, *Grevillea glauca*, *Corymbia erythrophloia*.

Shrubs: *Psydrax saligna*, *Jacksonia thesioides*, *Acacia calyculata*, *A. flavescens*, *Dodonaea lanceolata*, *Wikstroemia indica*, *Breynia oblongifolia*, *Acacia multisiliqua*, *Xanthorrhoea johnsonii*, *Hibbertia stirlingii*, *Denhamia cunninghamii*, *Persoonia falcata*, *Acacia humifusa*, *Antidesma parviflorum*, *Acacia disparrima*, *Acacia nesophila*, *Exocarpos cupressiformis*, *Bursaria incana*, *Pogonolobus reticulatus*, *Capparis canescens*, *Gastrolobium grandiflorum*, *Stylosanthes scabra**, *Grevillea glossadenia*.

Grasses: *Themeda triandra*, *Arundinella setosa*, *Panicum simile*, *Cymbopogon bombycinus*, *Heteropogon contortus*, *H. triticeus*, *Cleistochloa subjuncea*, *Digitaria* sp., *Mnesithea rottboellioides*, *Aristida* sp., *Triodia microstachya*, *Schizachyrium fragile*.

Forbs and other species: *Phyllanthus virgatus*, *P. fuernrohrii*, *Hibbertia longifolia*, *Cajanus marmoratus*, *Crotalaria montana*, *Commelina diffusa*, *Gompholobium nitidum*, *Crotalaria medicaginea*, *Phyllanthus collinus*, *Tephrosia filipes*, *Galactia tenuifolia*, *Tacca leontopetaloides*, *Wedelia spilanthoides*, *Pterocaulon redolens*, *Tricoryne anceps*, *Wahlenbergia queenslandica*, *Dianella nervosa*, *Cheilanthes nitida*, *Tephrosia juncea*, *Praxelis clematidea**, *Scleria brownii*, *Cyanthillium cinereum*, *Coronidium newcastleanum*, *Pimelea confertifolia*.

Non-native species: *Praxelis clematidea**, *Stylosanthes scabra**.

4.0 REFERENCES

- Eyre TJ, Kelly AL and Neldner VJ (2017). *Method for the Establishment and Survey of Reference Sites for BioCondition*. Version 3. Queensland Herbarium, Department of Science, Information Technology and Innovation, Brisbane.
- Neldner, V.J., Wilson, B.A., Dillewaard H.A. and Butler, D. W. (2017) *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland*. Version 4.0. Queensland Herbarium, Queensland Department of Science, Information Technology and Innovation, Brisbane.
- Queensland Herbarium (2018). *Regional Ecosystem Description Database (REDD)*. Version 10.1 (March 2018). DSITI, Brisbane.

Appendix C Fauna List

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

Species	Common Name
Bird	
<i>Alectura lathami</i>	Australian Brush-turkey
<i>Pachycephala pectoralis</i>	Australian golden whistler
<i>Milvus migrans</i>	Black Kite
<i>Lichmera indistincta</i>	Brown honeyeater
<i>Coracina tenuirostris</i>	Common cicadabird
<i>Colluricincla harmonica</i>	Grey shrikethrush
<i>Dacelo novaeguineae</i>	Laughing kookaburra
<i>Myiagra rubecula</i>	Leaden flycatcher
<i>Meliphaga lewinii</i>	Lewin's honeyeater
<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>Centropus phasianinus</i>	Pheasant Coucal
<i>Strepera graculina</i>	Pied Currawong
<i>Merops ornatus</i>	Rainbow Bee-eater
<i>Malurus melanocephalus</i>	Red-backed fairywren
<i>Nechmia temporalis</i>	Red-browed finch
<i>Dicrurus bracteatus</i>	Spangled drongo
<i>Haliastur sphenurus</i>	Whistling kite
<i>Melithreptus lunatus</i>	White-naped Honeyeater
<i>Melithreptus albogulari</i>	White-throated honeyeater
Mammal	
<i>Dasyurus hallucatus</i>	Northern Quoll
<i>Isodon macrourus</i>	Northern brown bandicoot
<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>Uromys caudimaculatus</i>	Giant white-tailed rat

Species	Common Name
<i>Wallabia bicolor</i>	Agile Wallaby
<i>Pteropus conspicillatus</i>	Spectacled Flying fox
<i>Austronomus australis</i>	White-striped free-tailed bat
<i>Chaerophon jobensis</i>	Northern freetail bat
<i>Chalinobus nigrogiseus</i>	Hoary Wattled Bat
<i>Miniopterus australis</i>	Little bent-wing bat
<i>Miniopterus oriana oceanensis</i>	Eastern Bent-wing Bat
<i>Mormopterus ridei</i>	Ride's Free-tailed Bat
<i>Nyctophilus sp.</i>	-
<i>Rhinolophus megaphyllus</i>	Smaller horseshoe bat
<i>Saccolaimus saccolaimus</i>	Bare-rumped Sheathtail Bat
Reptile	
<i>Diporiphora bilineata</i>	Two Lined Dragon
<i>Carlia munda</i>	Rainbow-skink
<i>Dendrelaphis punctulatus</i>	Green Tree Snake