



Ravensfield Downs Development

Species Impact Statement

Prepared for
Ravensfield Downs Pty Ltd

February 2019



DOCUMENT TRACKING

Item	Detail
Project Name	Farley Seniors Living and Manufactured Home Estate – Species Impact Statement
Project Number	18NEWECO-11281
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Status	DRAFT
Version Number	1
Last saved on	19 February 2019
Cover photos	Clockwise from top left: <i>Litoria peronii</i> ; <i>Diuris punctata</i> var <i>punctata</i> ; <i>Hardenbergia violacea</i> ; Lower Hunter Spotted Gum Ironbark forest on the subject site.

This report should be cited as ‘Eco Logical Australia January 2019. *Ravensfield Downs Development - Species Impact Statement*. Prepared for Ravensfield Downs Pty Ltd.’

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Template 29/9/2015

Contents

Definitions	ix
Certification.....	xii
Executive summary.....	xiii
1 Introduction.....	16
1.1 Purpose of this report	16
1.2 Form of the Species Impact Statement	16
1.2.1 Matters which have been limited or modified	16
1.2.2 Matters to be addressed.....	16
1.3 Project background.....	16
2 Contextual Information	20
2.1 Strategic planning context	20
2.2 Description of the proposal.....	21
2.2.1 Lot and deposit plan numbers	21
2.2.2 Associated facilities such as roads and other amenities	21
2.2.3 Asset Protection Zones (APZs)	23
2.2.4 Access and egress routes	23
2.2.5 Changes in surface water flows.....	26
2.2.6 Impacts of noise disturbance and pollution	26
2.2.7 Increase in people and road traffic	26
2.3 Definition of the SIS study area	26
2.4 Description of the SIS study area.....	28
2.4.1 Plant Community Types	28
2.5 Previous land uses and events	30
2.6 Fire history	30
2.7 Local planning provisions	30
2.8 Land tenure.....	30
2.9 Regional Conservation Plan	30
3 Initial assessment.....	33
3.1 Identifying subject species.....	33
3.1.1 Assessment of available information	33
3.1.2 Previous studies	33
3.1.3 Initial assessment of subject species	34
4 Survey methods.....	39

4.1	Rationale.....	39
4.2	Vegetation surveys	39
4.2.1	Full floristic surveys	39
4.2.2	Identification of Plant Community Types (PCTs).....	42
4.3	Targeted threatened flora surveys.....	42
4.4	Fauna habitat assessment	43
4.4.1	Hollow-bearing tree assessment	43
4.4.2	Koala habitat assessment	44
4.5	Fauna surveys	44
4.5.1	Amphibian surveys	44
4.5.2	Diurnal bird surveys	45
4.5.3	Nocturnal bird surveys.....	47
4.5.4	Arboreal mammal surveys.....	47
4.5.5	Terrestrial mammal surveys	48
4.5.6	Microchiropteran bat surveys	50
4.5.7	Megachiropteran bat surveys	51
4.6	Summary of survey effort	51
4.7	Weather conditions during surveys	55
4.8	Experience and qualifications.....	55
5	Results.....	57
5.1	Vegetation surveys	57
5.2	Habitat assessment	61
5.3	Targeted threatened flora surveys.....	64
5.4	Targeted fauna surveys.....	65
5.4.1	Amphibian surveys	65
5.4.2	Diurnal bird surveys.....	66
5.4.3	Nocturnal bird surveys.....	66
5.4.4	Arboreal and terrestrial surveys.....	67
5.4.5	Microchiropteran bat surveys	68
5.5	Identification of affected species	68
5.6	Subject species not identified as affected species within this SIS	70
6	Assessment of likely impacts on threatened species and populations	71
6.1	Assessment of likely affected species.....	71
6.2	Definitions used within the assessment of likely impacts	71
6.3	<i>Lathamus discolor</i> (Swift Parrot)	71
6.3.1	Conservation status.....	71
6.3.2	Local and regional abundance	72
6.3.3	Assessment of habitat	73

6.4	<i>Pomatostomus temporalis temporalis</i> (Grey-crowned Babbler).....	76
6.4.1	Conservation status.....	76
6.4.2	Local and regional abundance	77
6.4.3	Assessment of habitat	79
6.5	Microchiropteran bat species.....	81
6.5.1	Conservation status.....	81
6.5.2	Local and regional abundance	88
6.5.3	Assessment of habitat	88
7	Assessment of likely impacts on C/EECs.....	91
7.1.1	Assessment of ecological communities likely to be affected.....	91
7.1.2	Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion.....	91
7.1.3	Conservation status.....	91
7.1.4	Significance within a local and regional context	93
7.1.5	Discussion of corridor values.....	93
7.1.6	Assessment of habitat	93
8	Ameliorative measures	95
8.1	Description of feasible alternatives.....	95
8.1.1	Developing the site	95
8.1.2	Appropriate development	95
8.2	Measures to avoid	96
8.3	Ameliorative measures	96
9	Compensatory strategies	98
9.1	Proposed measures to offset residual impacts	98
9.2	Measurement of the adequacy of offsets	102
9.3	Operation of the BBCC for the subject site (impact)	102
9.3.1	Landscape features	102
9.3.2	Native vegetation	103
9.3.3	Threatened Species	103
9.3.4	Plot and transect data.....	103
9.4	Consistency of the offset against the NSW Offsets Policy.....	104
10	Conclusion	107
	References	109
	Appendix A Chief Executives Requirements for a Species Impact Statement.....	111
	Appendix B Likelihood of Occurrence Assessment	112
	Appendix C Flora survey data.....	130

Appendix D Fauna survey data..... 134

Appendix E Fauna species list..... 137

Appendix F Bat call analysis..... 139

Appendix G BioBanking Credit Calculator Full Report 140

Appendix H Assessments of Significance 141

List of figures

Figure 1 Concept plan 18

Figure 2 Site map 19

Figure 3 Hunter Regional Plan 2036 Growth Areas22

Figure 4 Regional context24

Figure 5 Location map.....25

Figure 6 Drainage.....27

Figure 7 Plant Community Types29

Figure 8. Zoning in the study area31

Figure 9 Regional Conservation Assessment32

Figure 10 Threatened flora recorded in the locality (OEH, 2018)37

Figure 11 Threatened fauna recorded in the locality (OEH, 2018)38

Figure 12 Flora survey effort41

Figure 13 Fauna survey locations46

Figure 14 Weather conditions during the surveys.....55

Figure 15 Threatened Ecological Communities60

Figure 16 Fauna habitats63

Figure 17 Threatened species recorded within the study area69

Figure 18 Swift Parrot regional occurrence.....74

Figure 19 Swift Parrot habitat.....75

Figure 20 Grey-crowned Babbler (eastern subspecies) regional occurrence.....78

Figure 21 Grey-crowned Babbler (eastern subspecies) local occurrence and habitat occurrence	80
Figure 22 Eastern Freetail-bat regional occurrence.....	85
Figure 23 Little Bentwing-bat regional occurrence.....	86
Figure 24 Greater Broad-nosed Bat regional occurrence	87
Figure 25 Microchiropteran bat habitat within the study area	90
Figure 26 Regional occurrence of Spotted Gum Ironbark Forest EEC	92
Figure 27 Plant community types at the BA329 biobank site.....	100
Figure 28 Plant community types at the BA330 biobank site.....	101

List of tables

Table 1. PCTs in the study area.....	28
Table 2. Survey effort for flora subject species	42
Table 3. Survey effort	52
Table 4: Survey and planning team.....	56
Table 5. PCT 1590 Spotted Gum – Broad Leaved Mahogany – Red Ironbark shrubby open forest	58
Table 6. Exotic grassland	59
Table 7: Fauna habitat values within the study area.....	61
Table 8: Habitat requirements for affected microchiropteran bats	81
Table 9: Regional representation of affected microchiropteran bats within conservation reserves.....	83
Table 10: Local and regional abundance of affected microchiropteran bats	88
Table 11 BioBanking Credit requirement	99
Table 12: Landscape feature assessment within the BBCC for the subject site (impact)	102
Table 13: Native vegetation assessment within the BBCC for the subject site (impact)	103
Table 14: Threatened species assessment within the BBCC for the subject site (impact).....	103
Table 15 Plot and transect data	103
Table 16. Likelihood of occurrence of threatened flora species and populations	112
Table 17. Likelihood of occurrence of threatened fauna species and populations	116
Table 18. Likelihood of occurrence of threatened communities.....	128

Table 19. Flora survey data.....	130
Table 20. Fauna survey data.....	134
Table 21 Fauna species detected	137

Abbreviations

Abbreviation	Description
APZ	Asset Protection Zone
BBAM	BioBanking Assessment Methodology
BBCC	BioBanking Credit Calculator
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
BMP	Biodiversity Management Plan
CE	Chief Executive
CER	Chief Executives Requirements
DA	Development Application
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DECCW	Department of Environment, Climate Change and Water
DoEE	Department of the Environment and Energy
DP&E	NSW Department of Planning and Environment
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
EOO	Extent of Occurrence
Elton	Elton Consulting Pty Ltd
EP&A Act	NSW <i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
FFA	Flora and Fauna Assessment
BMP	Biodiversity Management Plan
HBT	Hollow-bearing Tree
KTP	Key Threatening Process
LEP	Local Environmental Plan
LGA	Local Government Area

Abbreviation	Description
MCC	Maitland City Council
MNES	Matters of National Environmental Significance
NSW	New South Wales
NPW Act	NSW <i>National Parks and Wildlife Act 1974</i>
OEH	NSW Office of Environment and Heritage
OMP	Offset Management Plan
PCT	Plant Community Type
PVMP	Property Vegetation Plan
SEE	Statement of Environmental Effects
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
TEC	Threatened Ecological Community
TSC Act	NSW <i>Threatened Species Conservation Act 1995</i>
VMP	Vegetation Management Plan

Definitions

Term	Description
Abundance	Means a quantification of the population of the species or community
Activity	Has the same meaning as in the EP&A Act
Affected species	Means subject species likely to be affected by the proposal
Composition	Means both the plant and animal species present, and the physical structure of the ecological community
Conservation status	Is regarded as the degree of representation of a species or community in formal conservation reserves
DA number	Number means Development Application number
Development	Has the same meaning as in the EP&A Act
Direct impacts	Are those that directly affect the habitat and individuals. They include, but are not limited to, death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat.
Chief Executive	Means the Chief Executive of the Office of Environment and Heritage
DP	Means deposited plan which is the plan number given to a subdivision that is registered by the Land Property Information

Term	Description
Extent	Is the physical area and/or the compositional components of the habitat removed and the degree to which each is affected
Habitat	The area occupied, or periodically or occasionally occupied, by any threatened species, population or ecological community and includes all the different aspects (both biotic and abiotic) used by species during the different stages of their life cycles.
Importance	Relates to the stages of the species' life cycles and how reproductive success may be affected.
Indirect impacts	Occur when project-related activities affect species, populations or ecological communities in a manner other than direct loss.
LGA	Means Local Government Area.
Life cycle	The series of stages of reproduction, growth, development, ageing and death of an organism.
Local occurrence	The ecological community or threatened species that occur within the study area. This may include adjacent areas if the study area forms part of a larger contiguous area of that ecological community or threatened species habitat, and the movement of individuals and exchange of genetic material across the boundary of the study area can be clearly demonstrated.
Local population	The population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area.
Local population of a threatened plant species	Comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area.
Local population of a resident fauna species	Comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.
Local population of migratory or nomadic fauna species	Comprises those individuals that are likely to occur in the study area from time to time.
Locality	Means the area within a five (5) kilometre radius of the study area.
Region	Has the same meaning as that contained in the TSC Act
Risk of extinction	The likelihood that the local population will become extinct either in the short-term or in the long-term as a result of direct or indirect impacts on the viability of that population
Significant species	Means species not listed in the TSC Act but considered to be of regional or local significance
Study area	Is the subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly
Subject site	Means the area which is proposed for development/activity

Term	Description
Subject species	Means those threatened and significant species, populations and ecological communities which are known or considered likely to occur in the study area
Threatening process	Has the same meaning as that contained in the TSC Act; the definition is not limited to key threatening processes
Viable	The capacity to successfully complete each stage of the life cycle under normal conditions

Certification

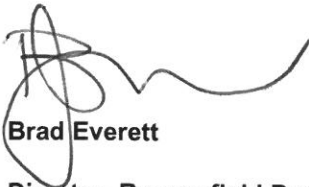
This Species Impact Statement (SIS) has been prepared by Eco Logical Australia Pty Ltd (ELA) in accordance with the requirements of Sections 109 and 110 of the *Threatened Species Conservation Act 1995* (TSC Act) and with regard to the requirements issued on behalf of the Chief Executive (CE) of the then Office of Environment and Heritage (OEH) dated 18 October 2018 (**Appendix A**).

The SIS was prepared by principally by Alex Pursche of ELA, on behalf of the applicant, Ravensfield Downs Pty Ltd. The applicant has read and understands the implications of the recommendations made in the statement and accept that the recommendations may be placed as conditions of consent or concurrence for the proposal.



Dr Alexander Pursche, Senior Ecologist, Eco Logical Australia Pty Ltd

"I Brad Everett (Director) on behalf of Ravensfield Downs Pty Ltd, being the applicant for the proposed development of Lot 100 and Lot 101 DP1230313, Farley in Maitland LGA, have read and understood this species impact statement. I understand the implications of the recommendations made in the statement and accept that they may be placed as conditions of consent or concurrence for the proposal."



Brad Everett

Director, Ravensfield Downs Pty Ltd

Executive summary

This Species Impact Statement (SIS) has been prepared by Eco Logical Australia Pty Ltd (ELA) on behalf of Ravensfield Downs Pty Ltd for the development of a manufactured home estate for seniors at Farley, in the Maitland Local Government Area (LGA). The subject site is identified within the Hunter Regional Plan 2036 as being within the Hunter Growth Area and is directly adjoining the developing Farley Urban Release Area. This SIS aims to identify potential impacts to threatened species and provide appropriate avoidance, amelioration and mitigation measures for any adverse impacts on the threatened species resulting from the proposal.

This SIS has been prepared in accordance with the requirements of Division 2 of the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Chief Executives Requirements (CERs) issued for this proposal.

The subject species, those species, populations or communities that are known or considered likely to occur in the study area for this SIS, have been determined with reference to the CERs, information held within databases of threatened species records, and targeted surveys within the subject site, study area and locality by ELA and others between 2011 and 2018. The databases searched included:

- NSW Wildlife Atlas.
- Commonwealth Protected Matters database.
- Database of threatened species incorporated in the NSW Biobanking Credit Calculator.

In accordance with Section 110(2) (b) of the TSC Act, the subject species in the study area are likely to be affected by the proposal were determined. In general, those subject species which were not recorded within the study area despite targeted survey, and which are not species that are difficult to detect, or which would use the site infrequently, were considered unlikely to be affected by the proposal and were not the subject of further assessment. The following subject species were subjected to further assessment as affected species in accordance with Section 110(2) (c-f) of the TSC Act on the basis that they were considered likely to be affected by the proposal:

- *Lathamus discolor* (Swift Parrot)
- *Pomatostomus temporalis temporalis* (Grey-crowned Babbler) (eastern subspecies)
- *Miniopterus australis* (Little Bentwing-bat)
- *Micronomus norfolkensis* (syn. *Mormopterus norfolkensis*) (Eastern Freetail-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)
- Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion (LHSGIF)

Further assessment in accordance with Section 110(2) (c-f) of the TSC Act and the CERs included an assessment of the local and regional abundance for each of these species and community; an assessment of habitat within the region including specific habitat features, habitat utilisation, and the conservation status of the species; and finally, an assessment of the likely effect of the proposal at the local and regional scale. Consideration of these factors for each of the affected species was used to guide a revised assessment of the significance of impacts in accordance with the former section 5A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), known as the ‘Seven-part test’, to inform the consent authority whether the development application (DA) be approved.

The assessments of significance conducted for species and communities likely and known to be affected by the proposal considered direct impacts, including removal of approximately 26.4 ha of vegetation. They also considered potential indirect impacts including changes in the hydrological regime resulting

from altered surface flows, and greater susceptibility to weeds, pests, competition, disease, predation, insect attack and other disturbances associated with edge effects and human access.

Detailed assessment for *Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin* concluded the proposal will remove approximately 26.4 ha of this Endangered Ecological Community (EEC) within study area. This impact was considered to be significant due to the loss of habitat for the EEC, as well as a local reduction in the extent of the EEC. However, this will be offset by retiring appropriate credits utilising the BioBanking Assessment Methodology (BBAM).

Detailed assessments for microchiropteran bats including Little Bentwing-bat, Eastern Freetail-bat, and Greater Broad-nosed Bat identified that the study area contained suitable foraging and potential roosting habitat for these species. However, foraging and roosting habitat was widely spread in the locality, which is easily accessible by these highly mobile species. The removal of foraging and roosting habitat within the subject site would not constitute a significant impact upon these species, as 1.16 ha of habitat would be retained within the study area and habitat for these species will be offset by retiring ecosystem credits utilising the BBAM.

Detailed assessment for the Swift Parrot, identified potential foraging habitat for this species. Habitat that would be lost due to the development of the subject site was not considered to be critical to the viability of the local population of this species; as there is extensive suitable foraging habitat for the Swift Parrot present elsewhere in the locality.

Special consideration was given to the assessment for Grey-crowned Babbler. The assessment identified that the study area contained breeding and non-breeding habitat for this species. It was concluded that the removal of approximately 26.4 ha of forest habitat would constitute a significant impact if the development was approved without any proposal to ameliorate or compensate for the impacts. The proposal will reduce the connectivity of habitat within the study area, but this will be ameliorated by the retention of 1.16 ha of breeding habitat and compensated by retiring of ecosystem credits utilising the BBAM.

The proponent has provided an offset package to offset the impacts of the proposal on threatened species and ecological communities. To offset the loss of 26.4 ha of habitat for threatened species and communities appropriate ecosystem credits will be retired utilising the BBAM. The offset package will include the retiring of existing biobanking credits currently owned by the proponent, as well as supplementing this through either creating additional biobanking credits, purchasing existing credits from another owner, or conversion into credits under the *Biodiversity Conservation Act 2016* and retiring of the offset obligation in accordance with the Biodiversity Offset Scheme.

The suitability of this offset was evaluated using the BioBanking Credit Calculator (BBCC). For ecosystem credit species (Swift Parrot, Grey-crowned Babbler, Little Bentwing-bat, Eastern Freetail-bat, Greater Broad-nosed Bat) threatened species habitat, the suitability of offset vegetation was derived from the list of predicted species within each vegetation zone from the BBCC. For EECs, credit calculations were undertaken using ecosystem credits to determine the adequacy of the offsets proposed. Based on the output of the BBCC, all species and EECs will be adequately compensated for. No impacted species are identified as species credits under the BioBanking Assessment Methodology (BBAM; OEH, 2014). Based on the likely impact of the proposal, the proponent is required to retire 1,357 ecosystem credits from the PCT HU804 (or an equivalent credit in accordance with the BBAM). This is equivalent to approximately 147 ha of land that will be protected in perpetuity under a BioBanking Agreement, which is equivalent to a 5.6:1 ratio (offset:impact).

The offset, as calculated using the BBCC and secured by retiring of biodiversity credits, is considered to adequately compensate for the impacts of the proposal, and therefore a significant impact on any endangered ecological communities or any threatened species is not likely to occur as a result of the development of the subject site.

1 Introduction

Eco Logical Australia Pty Ltd (ELA) was contracted by Ravensfield Downs Pty Ltd to draft a Species Impact Statement (SIS) to support the development application (DA) of the proposed construction of Seniors Living Development and Manufactured Home Estate at Farley, NSW. This SIS has been drafted in accordance with the Chief Executives Requirements' (CERs) for a SIS, issued by the NSW Office of Environment and Heritage (OEH) on 18 October 2018 (**Appendix A**).

1.1 Purpose of this report

The purpose of this SIS is to:

- allow the applicant or proponent to identify threatened species issues and provide appropriate amelioration for adverse impacts resulting from the proposal
- assist consent and determining authorities in the assessment of a development application under Part 4 of the EP&A Act
- assist the Chief Executive of OEH in deciding whether or not concurrence should be granted for the purposes of Parts 4 of the EP&A Act.

1.2 Form of the Species Impact Statement

In accordance with Section 109 (1 & 2) of the TSC Act:

- a SIS must be in writing
- a SIS must be signed by the principal author of the statement and if the SIS is prepared for the purposes of the EP&A Act, the applicant for the development consent or the proponent of the activity proposed to be carried out (as the case requires).

1.2.1 Matters which have been limited or modified

The following matters identified within Section 110 of the TSC Act have been identified within the CERs to be only addressed where relevant:

- all reference to threat abatement plans
- all reference to critical habitat. At the time of printing (of the CERs) the areas of declared critical habitat are not relevant to this proposal.

Any recovery plans, key threatening processes (KTPs) or critical habitat may be listed between the submission of this SIS and the granting of consent.

1.2.2 Matters to be addressed

The SIS must meet all matters specified in Section 109 and 110 of the TSC Act with the exclusion of those matters listed above. The requirements outlined in Section 109 and 110 of the TSC Act were replicated within the CERs, along with specific requirements relevant to the proposal. The CERs also identify that previous surveys and assessments that are relevant to the locality may be used to assist in addressing these requirements.

1.3 Project background

The proposal comprises a Seniors Living and Manufactured Home Estate within the township of Farley in New South Wales. An indicative layout plan for the development is shown in **Figure 1**. This will include

construction of 295 dwellings for seniors living and manufactured homes and associated infrastructure such as roads, electricity, and sewerage and stormwater basins. The proposal has been designed to minimise environmental, social, and economic impacts and includes protection of waterways and offsets. The extent of development is simplified and shown in Figure 2.

The proposal is located in Lot 100 and lot 101 of DP1230313 within the Maitland City Local Government Area (LGA) which is an 'interim designated area' under the Biodiversity Conservation (Savings and Transitional) Amendment Regulation 2018. Accordingly, development applications are assessed under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in accordance with the repealed NSW *Threatened Species Conservation Act 1995* (TSC Act) until 24 November 2018. Therefore, this SIS has been prepared in accordance with Section 111 of the repealed TSC Act.

Development site

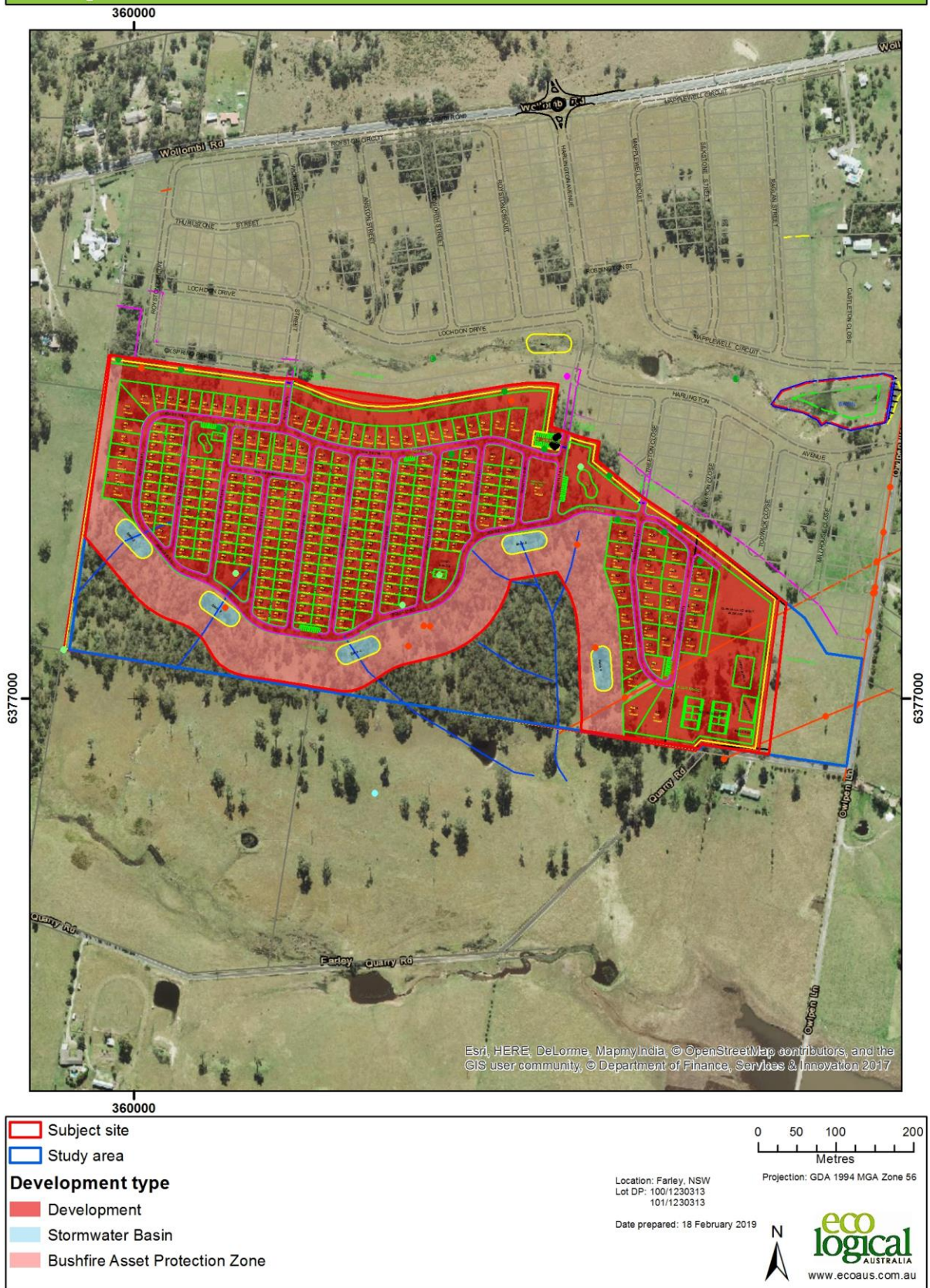


Figure 1 Concept plan

Site map

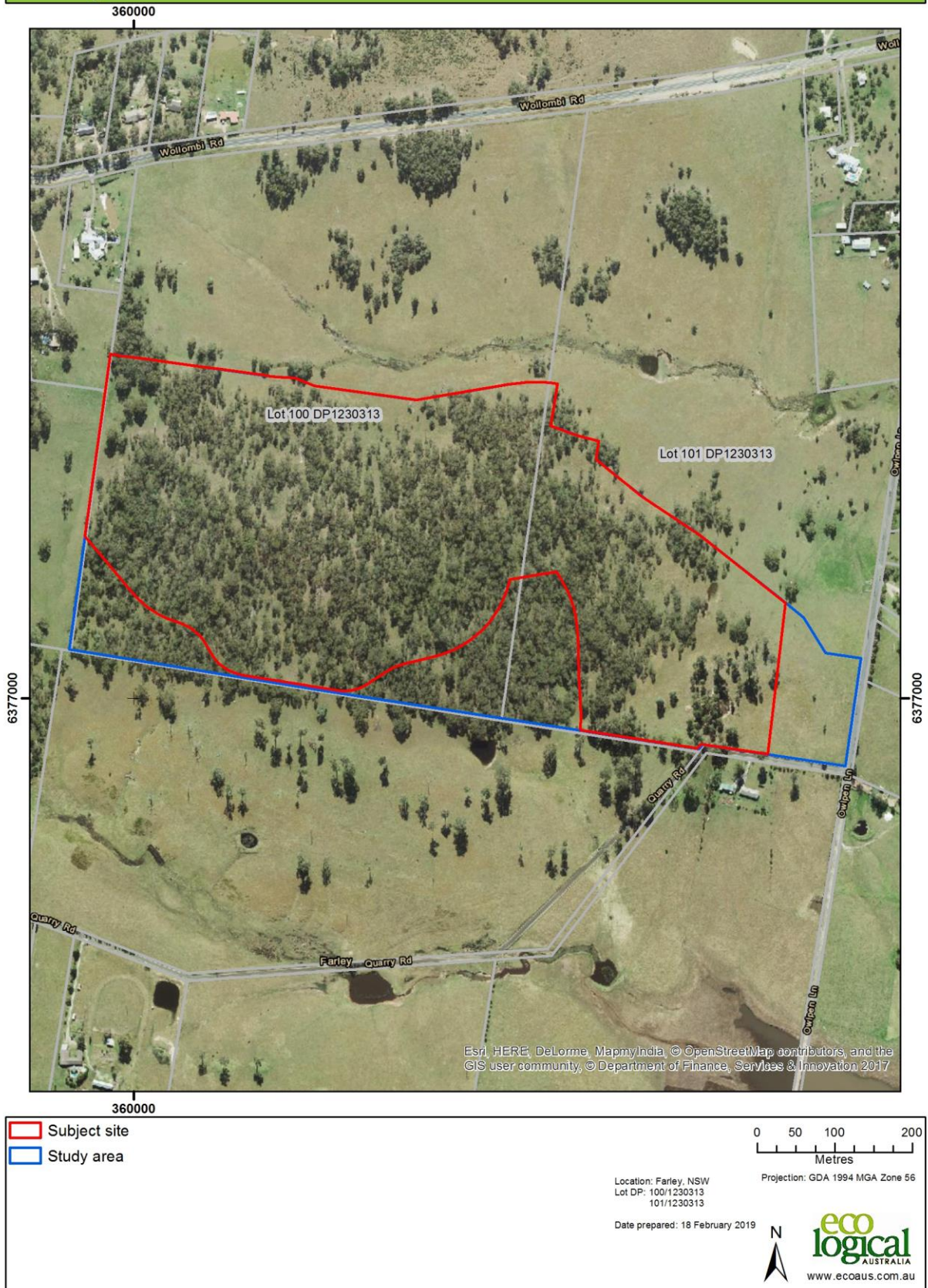


Figure 2 Site map

2 Contextual Information

The proposed development is located within the Maitland Local Government Area (LGA) as shown on Figure 4. The subject site is located within a mosaic of cleared landscapes between the city of Maitland and the Wentworth Swamps.

2.1 Strategic planning context

The proposal is consistent with the directions of the Hunter Regional Plan 2036. Part of the land is already identified as category 1 in the MCC Maitland Urban Settlement Strategy (MUSS) (Figure 3), with the remaining land being identified as a Preliminary Investigation Area (PIA). In addition, the site forms part of a single land holding that has an approved residential subdivision of 360 lots currently under construction within the Farley URA.

The Hunter Regional Plan 2036 has been developed to guide State Authorities and local Council's in preparing strategies which guide land use planning and infrastructure funding decisions. A 20 year blueprint for the Hunter's future.

The Hunter Regional Plan 2036 estimates that population in the Hunter will grow to 862,250 people by 2036, with 25% expected to be aged 65 years or over. The Maitland LGA is recognised as a high growth area, with Maitland's population expected to rise from 78,000 in 2016 to 104,850 in 2036. The Hunter Regional Plan also forecasts that the number of dwellings in the Maitland LGA will rise by 12,550 homes with an increase from 31,650 in 2016, to 44,200 by 2036.

The Greater Newcastle Metropolitan Plan also recognises that a significant proportion of Greater Newcastle's greenfield development will continue to occur in Maitland, focused on the two priority housing release areas of Thornton–Lochinvar and Maitland–Kurri Kurri. Farley is strategically located in the centre of these growth corridors.

Farley is identified as a residential growth area in close proximity to the identified Strategic Centres of Rutherford and Central Maitland and the existing Maitland Hospital Precinct. The subject land directly adjoins the current Farley URA and is identified within a targeted future growth area in the Hunter Regional Plan.

The Farley locality, including the subject site, is identified as a future growth area in the Hunter Regional Plan 2036. The site is located within 2.5km of Rutherford Shopping Centre, 5 km to the Regional Central Maitland Business District and 3 km to the existing Maitland hospital and other specialist medical services. It is also located within 5-10km of the strategic centres of Green Hills and East Maitland and 8 km from direct access to the Hunter Expressway.

In a local context, Maitland LGA has maintained a medium to high level of growth over the past 10 years of between 2.2% - 2.5% pa. The population of Farley/Rutherford itself has grown 15% over the past 5 years.

The subject land is located within a rapidly developing locality directly adjoining the Farley Urban Release Area, and in close proximity to the regional road network. The character of the area is changing as development progresses from directly north and east of the site. Construction has commenced on the development of a 350 residential lot subdivision on part of the site. A new intersection and roadworks have been constructed to provide direct access to Wollombi Road. The part of the site the subject of this SIS will utilise these critical important infrastructure elements. The locality will continue to evolve as

Maitland continues to grow and transition in line with the vision of the Hunter Regional Plan. In addition more than \$5 million dollars has been expended on lead in water and sewer infrastructure which has been funded under the Hunter Water Funding for Growth Policy.

The Hunter Regional Plan also recognises the need to provide housing diversity to reflect the changes in the population. Currently 14.3% of the population of Maitland are identified as 'seniors' aged 65 or over. In Rutherford/Farley 97.7% of the population in 2017 were living in separate single dwelling houses, slightly higher than the City of Maitland with 91.5% (ABS 2017). Across the City only 7.3% of the population were living in medium density housing, and less than 0.1% were living in high density housing.

The development the subject of this SIS is a Manufactured Home Estate which is targeted at people over 50 years of age. The Maitland Social Plan and the Maitland City Council Cultural Plan 2016 – 2019 both recognise the need to plan for the older age groups within the City. The opportunities however for seniors living housing or retirement living are limited across the City. The location of seniors living housing on the edge of residential development provides an opportunity for affordable and attractive retirement living in close proximity to urban services.

Seniors living development is captured under Council's Citywide S94 Plan to make contributions towards the provision of any additional services and facilities generated by the development. It is an important addition to the housing diversity for not only the western catchment of Maitland, but as importantly to the growth of the City.

2.2 Description of the proposal

2.2.1 Lot and deposit plan numbers

The proposal occurs within the southern parts of the following lots (Figure 2):

- Lot 100 in DP 1230313
- Lot 101 in DP 1230313

The site is located in the Newcastle Coastal Ramp landscape in the Hunter IBRA Subregion (Figure 5).

It involves the construction of a and manufactured seniors living estate and includes:

- construction of a total of 295 lots for seniors living and/or manufactured homes
- associated site works and landscaping including bulk earthworks

2.2.2 Associated facilities such as roads and other amenities

The proposal also includes work for associated facilities such as:

- roads
- services including electricity and sewerage
- Asset Protection Zones
- Stormwater basins as required

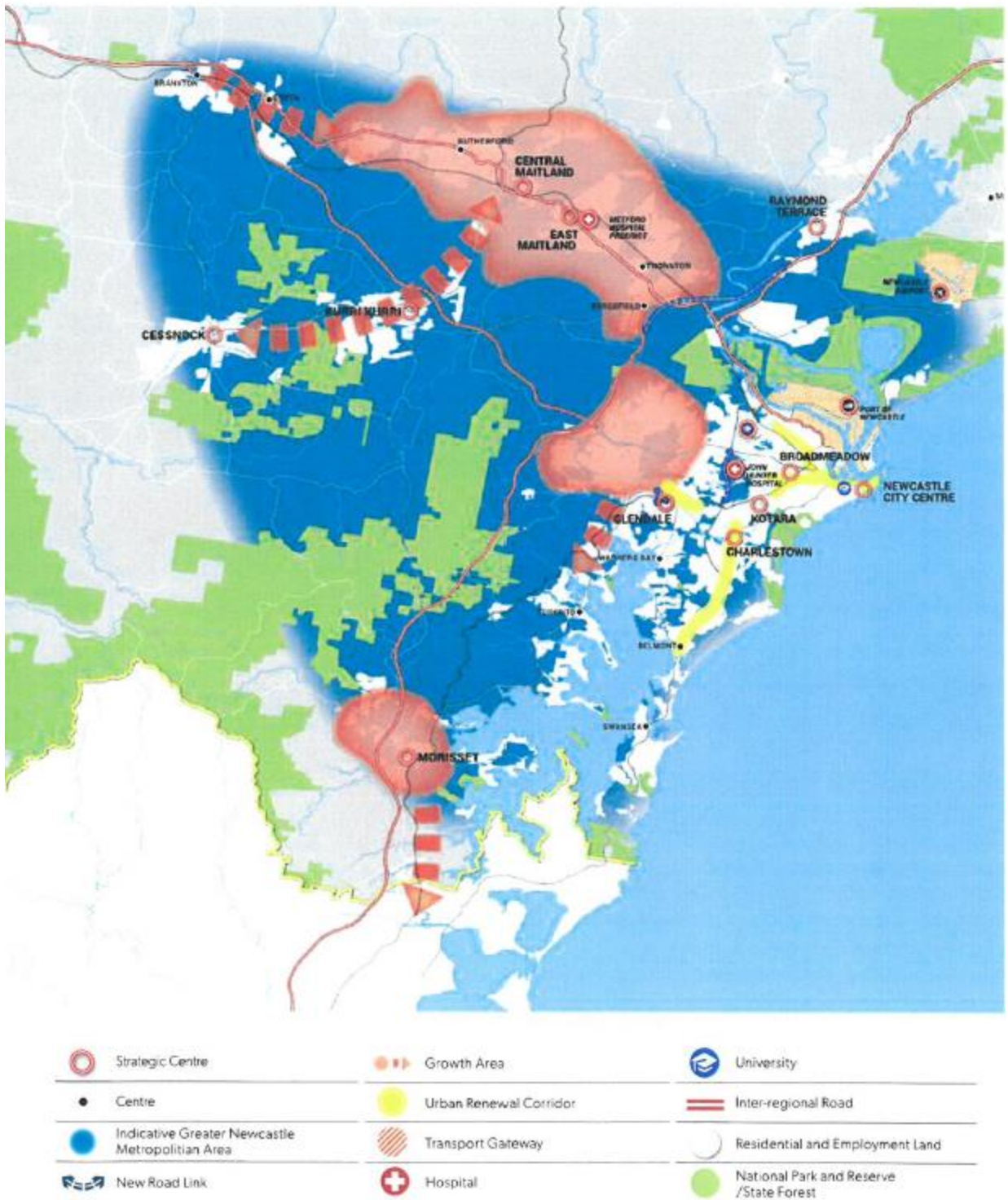


Figure 3 Hunter Regional Plan 2036 Growth Areas

2.2.3 Asset Protection Zones (APZs)

The Bushfire Prone Land Map (Maitland LEP, 2011) shows that the study area is predominately located within Vegetation Category 1 and also includes land identified as Vegetation Buffer. This map also shows Vegetation buffers located predominantly on the northern and eastern parts of the subject site. Vegetation within the study area is classified as either cleared land or forest for bushfire hazard assessment purposes.

An Asset Protection Zone (APZ) is required as a defensible space around buildings within the proposed development that is adjacent to the future bushfire hazard. An (APZ) has been incorporated into the building footprint (subject site), through strategic use of roads and landscaped areas, which complies with Planning for Bushfire Protection (NSW Rural Fire Service, 2006) (**Figure 1**).

2.2.4 Access and egress routes

The proposal will have access and egress routes to the north and east as shown in **Figure 1**.

Access and egress for the seniors living estate will be via four roads that exit the subject site to the north. The eastern road also forms the southern boundary of the Seniors Living Estate and connects to the other three roads.

For further information on access and egress please refer to the Development Application.

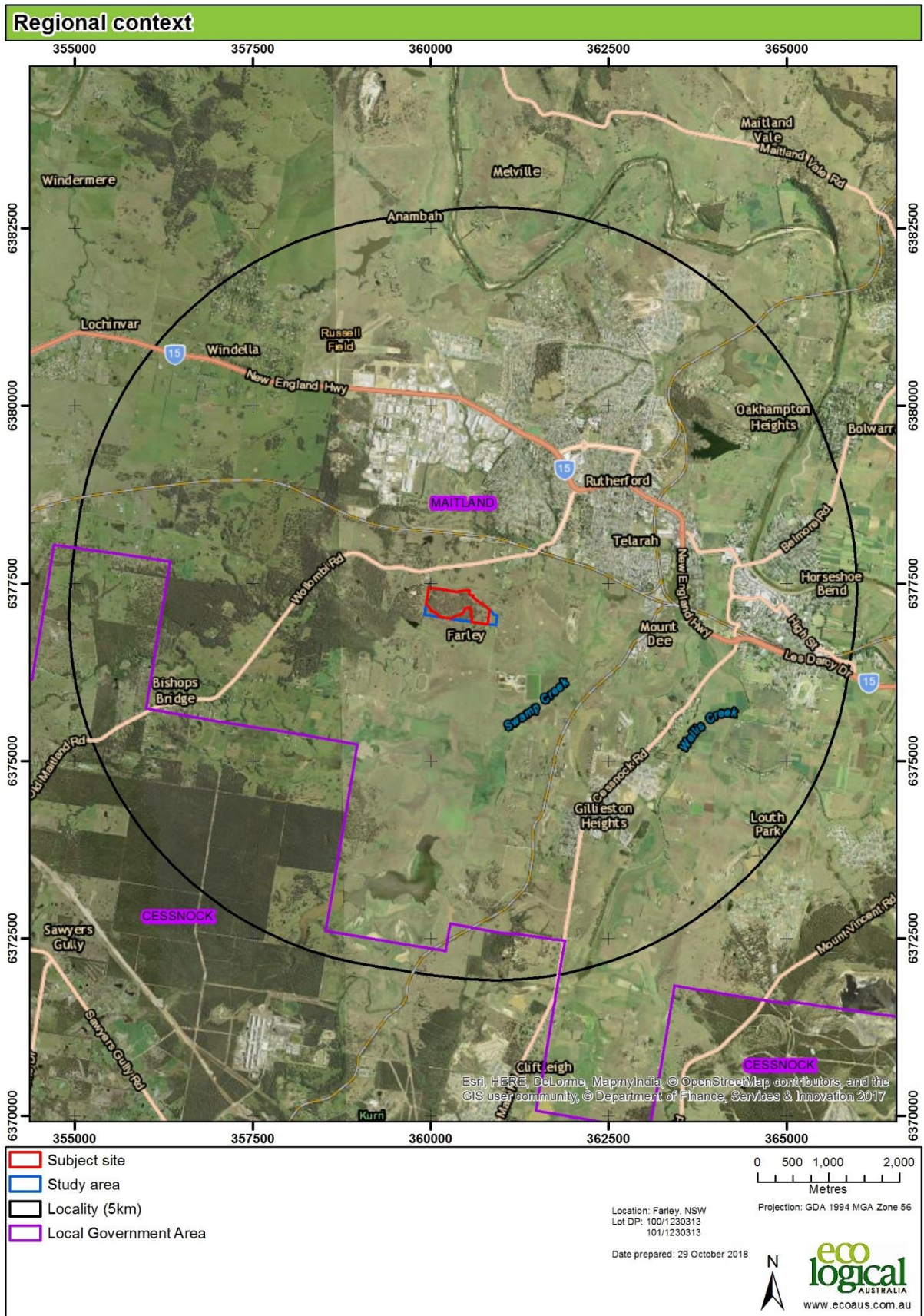
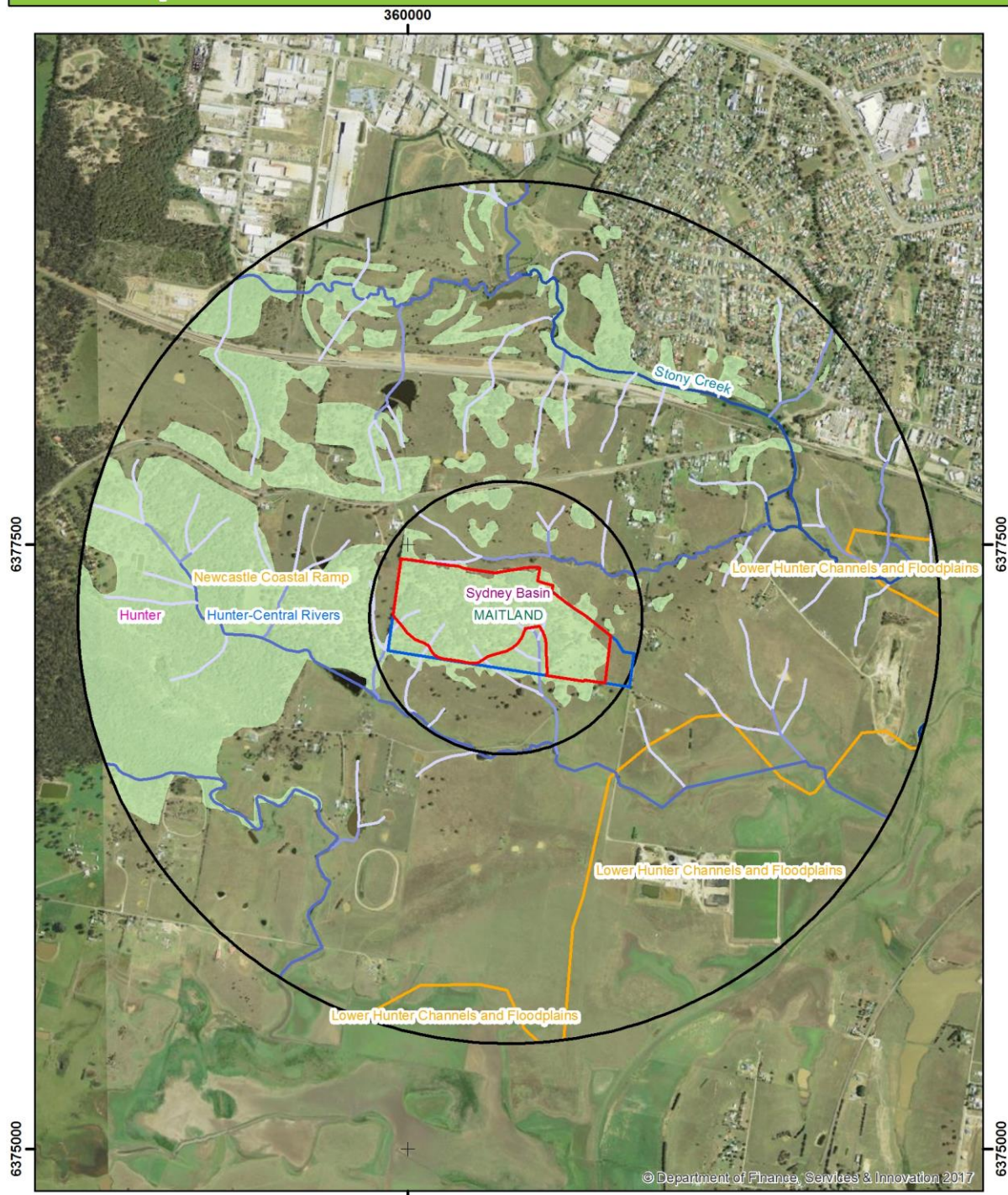


Figure 4 Regional context

Location map



<ul style="list-style-type: none"> Subject site Study area Inner assessment circle (100 ha) Outer assessment circle (1000 ha) Local Government Area Major Catchment Area 	<ul style="list-style-type: none"> IBRA Subregion IBRA Region Mitchell landscapes Native vegetation 	<p>Drainage (strahler order)</p> <p>Strahler</p> <ul style="list-style-type: none"> 1 2 3 4 6 	<p>0 125 250 500 Metres</p> <p>Projection: GDA 1994 MGA Zone 56</p> <p>Location: Farley, NSW Lot DP: 100/1230313 101/1230313</p> <p>Date prepared: 18 February 2019</p> <p style="text-align: right;"> eco logical AUSTRALIA www.ecoaus.com.au </p>
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Figure 5 Location map

2.2.5 Changes in surface water flows

The subject site is located on a low relief, east-west orientated hill. The northern part of the subject site slopes gently downslope to the north and the southern part of the subject site has slightly steeper slopes to the south. There are several unnamed first order streams which occur within the study area (Figure 6)

Over most of the north-facing slope, surface water flows overland and northward through forest and cleared land into Stony Creek, which is part of the approved residential development at Wollombi Road, directly north of and adjacent to the study area. In the north-western corner of the subject site, surface water first flows into a small first order watercourse before entering Stony Creek, which is part of the approved residential development at Wollombi Road, directly north of the study area. Over the south-facing slopes, surface water flows overland southward and westward through forest and cleared land into five first order watercourses which are located outside of the subject site. These watercourses are ephemeral and do not support aquatic vegetation. In addition, overland flows in the west of the study area enter a small dam located in the south-east of the study area and contains aquatic vegetation.

The proposed development will change the surface from a forest and grassland state to an urban state. The development will include permeable surfaces such as lawns and landscaping as well as impermeable surfaces including roads, paths, houses and driveways. Surface flows will be redirected into stormwater drains and sedimentation ponds before discharging into the current watercourses.

2.2.6 Impacts of noise disturbance and pollution

Vehicles currently travelling along Wollombi Road and Owlpen Lane generate noise that indirectly impacts the study area. As a result of urban development noise levels within the study area are expected to increase during the daytime and evenings. The current development under construction immediately to the north of the study area is likely to increase noise disturbance and pollution to be equivalent with that which is likely from the proposed development within this SIS.

2.2.7 Increase in people and road traffic

The site is currently unoccupied and is not subject to people and road traffic. The proposed development will include an increase in the numbers of people and the amount of road traffic within the study area. No specific traffic study has been conducted.

2.3 Definition of the SIS study area

The study area includes the development site boundary (subject site) and additional areas in which indirect impacts occur, including the vegetation to be retained within Lots 100 and 101 in DP 1230313.

The subject site is the area is proposed for the development/activity, including all ancillary works such as roads and services. The subject site includes the following areas:

- the development footprint required for 295 manufactured home lots and seniors living lots
- roads and associated services such as electricity and sewage
- all drainage works including stormwater detention basins
- APZs around the southern part of the development

Potential indirect impacts of the proposed development include:

- Habitat fragmentation and altered hydrology
- Increase in light and noise pollution
- Increase in dust (during construction)
- Changes to the fire regime

Drainage

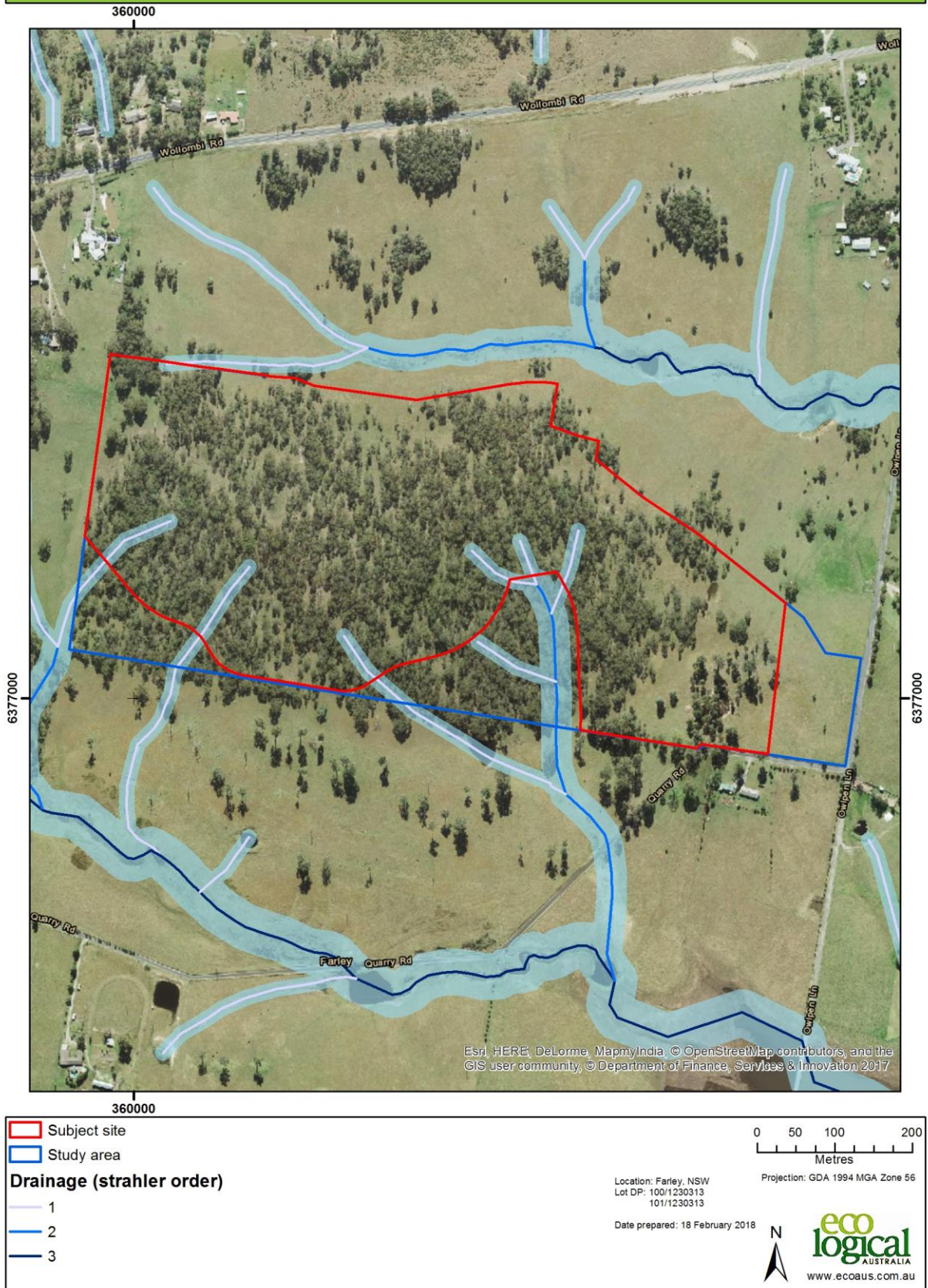


Figure 6 Drainage

2.4 Description of the SIS study area

2.4.1 Plant Community Types

Vegetation communities within the northern part of the study area have been previously mapped by RPS (2011) as part of the flora and fauna assessment of the Farley Investigation Area. This vegetation mapping, along with native vegetation community mapping undertaken across the Lower Hunter and Central Coast Regions (House, 2003) and in the locality, were reviewed to inform the identification of Plant Community Types (PCTs) within the study area.

The existing vegetation mapping within the study area was verified by ELA using recent high resolution aerial photos. The classification of the vegetation communities was based on traverses on foot and vegetation quadrats, and the PCT type was assigned based on general location, vegetation structure and dominant species.

One PCT; *Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest* (PCT 1590), was mapped within the study area in this SIS (Figure 7). This PCT is the Endangered Ecological Community (EEC) *Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion* (LHSGIF), which is listed under the TSC Act. Cleared areas within the study area have been mapped as Exotic Grassland. The areas of the PCTs, EECs and Exotic Grassland within the study area are provided in **Table 1**.

Table 1. PCTs in the study area

PCT name	EEC Name	TSC Act	EPBC Act	Area (ha)
1590 Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest	Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion	EEC	Not listed	31.27
Exotic Grassland	N/A	Not listed	Not listed	2.82
Total				34.09

Plant community types

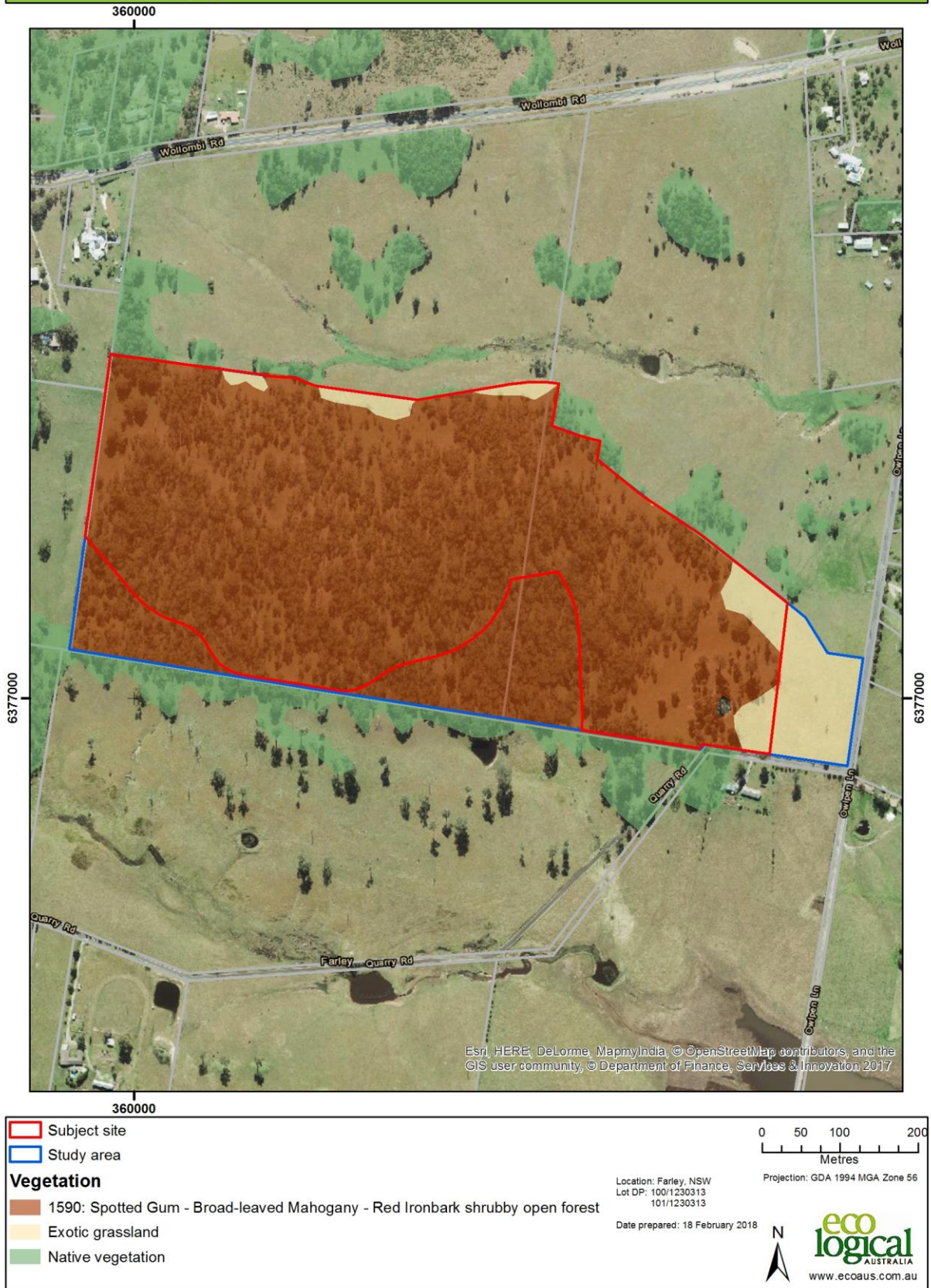


Figure 7 Plant Community Types

2.5 Previous land uses and events

Review of aerial imagery from between 2004 and 2018 with Google Earth indicates a history of disturbance and regrowth of the understorey over 14 years. However, the extent of forest and grassland appears to have remained unchanged.

The 2004 aerial photo only includes part of lot 100 and shows a sparse to dense shrubby layer. In 2006, it is evident that the shrubby layer in the entire study area has either been cleared or grazed. The low cover of shrubs is also apparent in the 2007 aerial. By 2010 it appears that shrubs have regrown to some extent in most of the forested areas and the 2012 aerials also show a cover of shrubs. However, in 2013 it appears that the shrubs have been cleared or grazed again. Based on the photos between 2014 and 2018 it appears that the shrub cover has regrown and remained relatively untouched since 2013.

2.6 Fire history

Fire history of the study area is currently unknown. There was limited evidence of fire within the study area.

2.7 Local planning provisions

The study area is zoned under the Maitland LEP (2011) and includes the following zoning types as shown in **Figure 8**:

- RU2 – Rural Landscape

The objectives of RU2 – Rural Landscape zoning are to:

- encourage sustainable primary industry production by maintaining and enhancing the natural resource base
- maintain the rural landscape character of the land
- to provide for a range of non-agricultural uses where infrastructure is adequate to support the uses and conflict between land uses is minimised

The minimum lots size within the study area is 40 ha. The study area is located directly south of the Farley Urban Release Area.

2.8 Land tenure

The study area includes portions of Lot 100 DP1230313 and Lot 101 DP1230313, both of which are owned by Ravensfield Downs Pty Ltd.

There were no restrictions to access to land within the study area. No changes to land tenure are planned as part of this proposal.

2.9 Regional Conservation Plan

The subject site includes land identified in the Regional Conservation Assessment, Lower Hunter and Central Coast Region (Morison and House, 2004), including regionally and state significant conservation areas as shown on Figure 9.

Land Zoning - Maitland LEP 2011

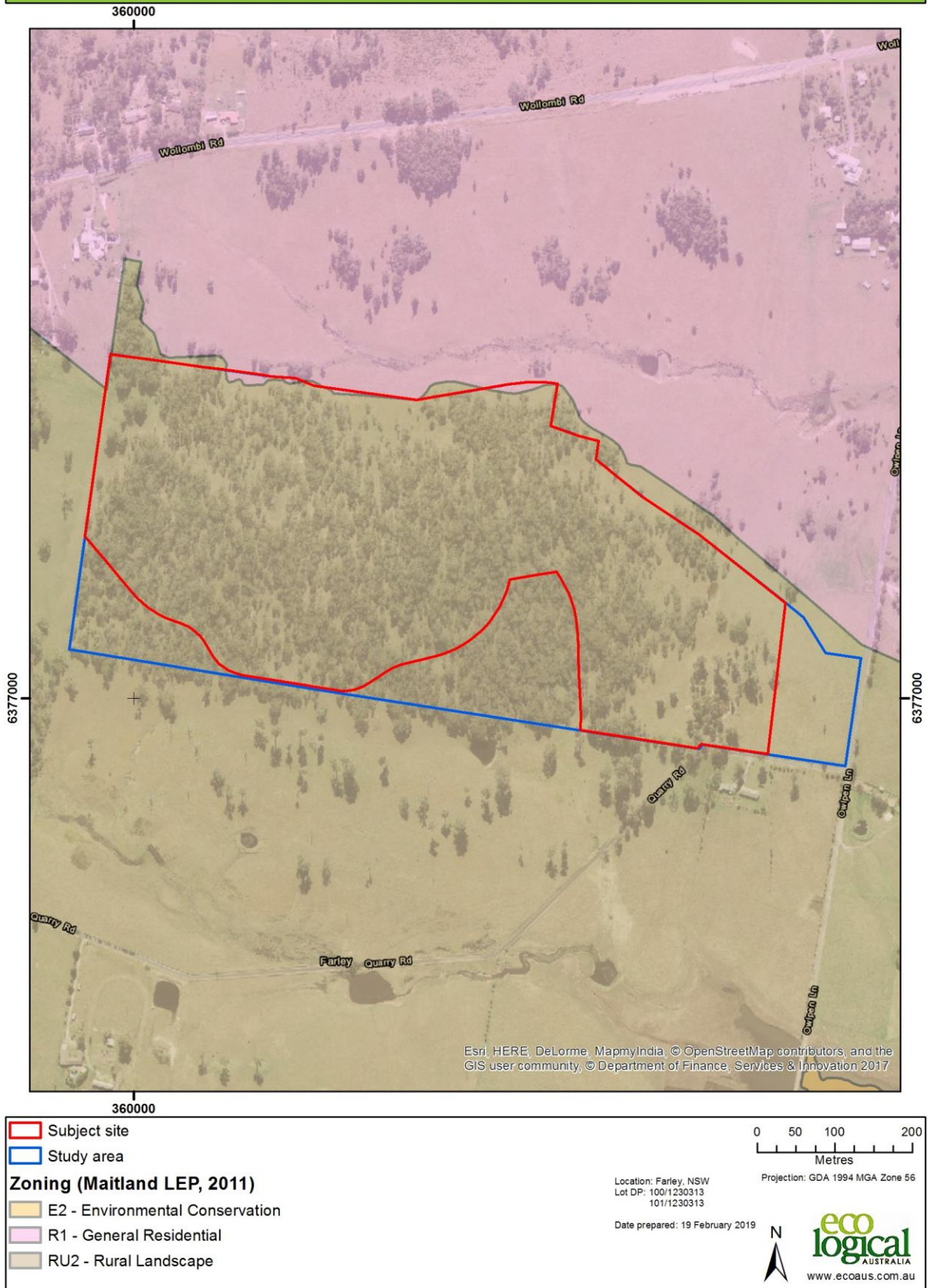
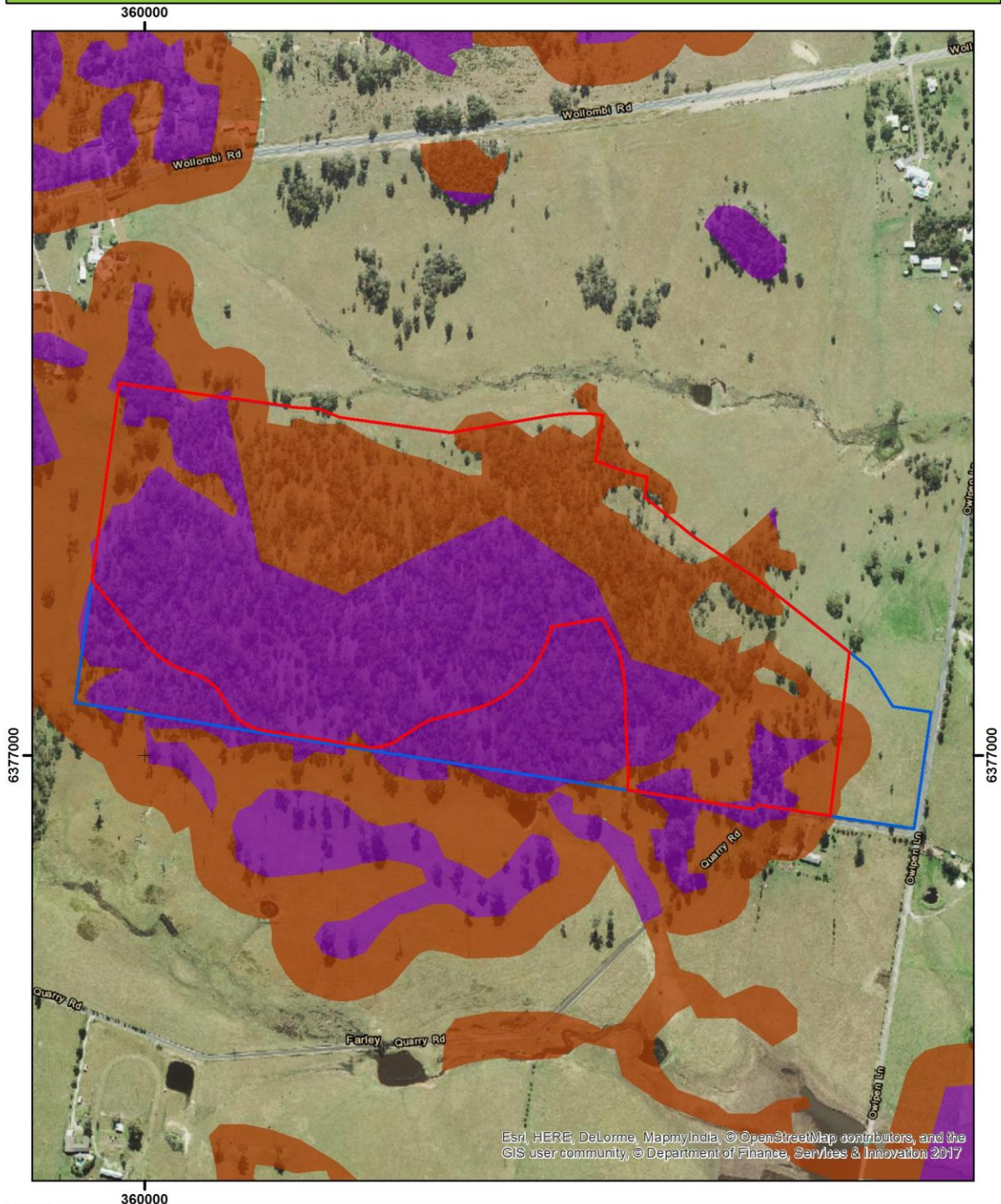


Figure 8. Zoning in the study area

Lower Hunter Regionally Significant Biodiversity Conservation Areas




<ul style="list-style-type: none"> Subject site Study area 	
<p>Lower Hunter Regional Conservation Plan</p>	
<ul style="list-style-type: none"> Local Regional State 	<p>Location: Farley, NSW Lot DP: 100/1230313 101/1230313</p> <p>Projection: GDA 1994 MGA Zone 56</p> <p>Date prepared: 19 February 2019</p> <div style="text-align: right;">  <p>eco logical AUSTRALIA www.ecoaus.com.au</p> </div>

Figure 9 Regional Conservation Assessment

3 Initial assessment

3.1 Identifying subject species

As noted above, 'subject species' means those threatened and significant species, populations and ecological communities which are known or considered likely to occur in the study area.

3.1.1 Assessment of available information

The identification of subject species was undertaken with consideration to the habitat types present within the study area, recent and historical records of threatened species or populations in the locality and the known distribution of threatened species.

The following databases were reviewed for recent (less than 10 years) and historic records and predictions of species, populations and communities when identifying the list of subject species:

- NSW BioNet (OEH's Atlas of NSW Wildlife), (www.bionet.nsw.gov.au), (OEH, 2018)
- BioBanking Credit Calculator (BBCC), (www.environment.nsw.gov.au/biobanking/calculator.htm), (OEH, 2018)
- Atlas of Living Australia, (www.ala.org.au), (ALA, 2018)
- Australian Museum, (<http://ozcam.org.au>), (AM, 2018)
- Birdlife Australia (<http://birdsaustralia.ala.org.au/BDRS/home.htm>), (BA, 2018)
- Royal Botanic Gardens, (<http://plantnet.rbgsyd.nsw.gov.au>), (RBG, 2018)
- EPBC Act Protected Matters Search Tool, (www.environment.gov.au/epbc/protected-matters-search-tool), (DoEE, 2018)
- Eremaea Birdlines, (www.eremaea.com), (EB, 2018)

In addition, the CERs provided a list of species, populations and communities that have either been recorded in the locality (5 km radius), are within the species known geographic limits or their broad habitat preference may be within the study area.

3.1.2 Previous studies

A number of studies and surveys have been undertaken in association with previous proposals for development of areas adjacent to the study area. This SIS considers the findings of previous studies, and where appropriate utilises existing data to comply with the CERs.

These studies and surveys have involved various survey methodologies and summaries of these in relation to methodologies and threatened species recorded are outlined below:

Flora and Fauna Assessment, Farley Investigation Area, NSW (RPS, 2011)

This report covered 173 hectares, including the northern edge of the study area, the land between the study area and Wollombi Road and land to the north of Wollombi Road.

Methods included trapping, spotlighting, habitat assessments, and targeted searches for threatened flora and fauna species, which were undertaken from 23 to 27 November 2009 and from 13 to 14 September 2010. The following species, populations or communities were recorded within or near the study area and were considered potential to occur on the study area:

- Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion
- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*)
- Eastern Freetail-bat *Micronomus norfolkensis* (syn. *Mormopterus norfolkensis*)

- Eastern Bentwing-bat (*Miniopterus schreibersii*)
- Little Bentwing-bat (*Miniopterus australis*)
- Eastern Cave Bat (*Vespadelus troughtoni*)

Assessments of significance (7-part tests) for Stages 1-4 Residential Subdivision at Wollombi Road, Farley (Firebird ecoSultants Pty Ltd, 2015)

This report assessed potential impacts to the then Lot 1 DP 456832 and Lot 17 DP 2881 Wollombi Road, Farley. This area is now located in Lots 100 and 101 DP 1230313 and includes a small portion of the north of the study area.

This report included additional surveys on 25 and 29 June 2015 to confirm vegetation, threatened species and habitat values. No additional threatened species, populations or communities were recorded.

3.1.3 Initial assessment of subject species

Subject species are those species, populations and communities that are known or considered likely to occur within the study area. *Affected species* are a subset of subject species that are considered to be likely to be affected by the proposed development.

Some subject species are not considered to be affected species. For example, a species may have initially been considered likely to occur within the study area based on database records, desktop mapping of habitat and knowledge of species habitat requirements, but after collection of more detailed information about the actual habitat in the study area through the field survey, as well as the results of targeted surveys, that species may be considered to not occur within the study area, because the habitat type was not appropriate or because that species was not recorded after adequate surveys had been completed.

Alternatively, the study area may only provide relatively minimal resources for highly mobile species that may occur in the study area from time to time. Such a species is not considered to be an affected species if the habitat within the study area does not consist of important breeding, movement or foraging habitat.

The identification of subject and affected species within this SIS followed a four-stage approach as described below.

Stage 1 Desktop assessment

A desktop assessment was undertaken to identify a list of species, populations and communities that have been recorded or that have been predicted within the locality, based on a review of databases, vegetation and habitat mapping and previous reports in and around the study area.

All the species, populations and communities from the desktop assessment were combined to produce a list of threatened species, populations and communities previously recorded or predicted in the locality. This resulted in a list of 22 flora species, and 66 fauna species and 8 communities listed under the TSC and EPBC Acts, which is provided in the likelihood table in **Appendix B**.

Stage 2 Assessment of likelihood of occurrence

A likelihood of occurrence assessment for all species, populations and communities that have been recorded or predicted within a 5 km radius of the study area was undertaken to identify a list of species that had potential to occur or that were likely to occur within the study area. The location of threatened flora and fauna records in the locality is shown on Figure 10 and Figure 11 respectively.

In order to produce a list of subject species (either known to occur or likely to occur in the study area) the results of the desktop analysis the results of the desktop assessment were analysed with consideration of the following factors:

- The type of vegetation communities present in the study area
- The habitat types and features within the study area
- The presence, quantity, quality and degree of fragmentation or likely habitat for individual threatened species
- The known distributions and geographic limits of species, populations and communities
- The known and predicted use of habitat for all potential species

Based on the assessment shown in **Appendix B**, the following species, populations and communities are considered to be subject species (i.e. known or considered likely to occur in the study area based on the desktop assessment):

Flora

- *Callistemon linearifolius* (Netted Bottle Brush)
- *Cynanchum elegans* (White-flowered Wax Plant)
- *Diuris pedunculata* (Small Snake Orchid)
- *Eucalyptus glaucina* (Slaty Red Gum)
- *Maunderia triglochinoidea* (Small Water-ribbons)
- *Persoonia pauciflora* (North Rothbury Persoonia)
- *Pterostylis chaetophora* (A Greenhood Orchid)

Amphibians

- *Litoria aurea* (Green and Golden Bell Frog)

Birds

- *Anthochaera phrygia* (Regent Honeyeater)
- *Artamus cyanopterus cyanopterus* (Dusky Woodswallow)
- *Callocephalon fimbriatum* (Gang-gang Cockatoo)
- *Chthonicola sagittata* (Speckled Warbler)
- *Climacteris picumnus* subsp. *victoriae* (Brown Treecreeper)
- *Daphoenositta chrysoptera* (Varied Sittella)
- *Glossopsitta pusilla* (Little Lorikeet)
- *Hieraaetus morphnoides* (Little Eagle)
- *Lathamus discolor* (Swift Parrot)
- *Lophoictinia isura* (Square-tailed Kite)
- *Melanodryas cucullata cucullata* (Hooded Robin) (south-eastern form)
- *Melithreptus gularis gularis* (Black-chinned Honeyeater) (eastern subspecies)
- *Ninox connivens* (Barking Owl)
- *Ninox strenua* (Powerful Owl)
- *Petroica boodang* (Scarlet Robin)
- *Petroica phoenicea* (Flame Robin)
- *Pomatostomus temporalis temporalis* (Grey-crowned Babbler) (eastern subspecies)
- *Tyto novaehollandiae* (Masked Owl)

Mammals

- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Dasyurus maculatus* (Spotted-tailed Quoll)
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)

- *Miniopterus australis* (Little Bentwing-bat)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat)
- *Micronomus norfolkensis* (syn. *Mormopterus norfolkensis*)
- *Myotis macropus* (Large-footed Myotis)
- *Nyctophilus corbeni* (Corben's Long-eared Bat)
- *Petaurus norfolcensis* (Squirrel Glider)
- *Phascogale tapoatafa* (Brush-tailed Phascogale)
- *Phascolarctos cinereus* (Koala)
- *Pteropus poliocephalus* (Grey-headed Flying-fox)
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)
- *Vespadelus troungtoni* (Eastern Cave Bat)

Populations

Cymbidium canaliculatum population in the Hunter Catchment

Communities

- Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin bioregions
- Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion

Stage 3 Targeted surveys for subject species

At stage 3 of the assessment of subject species, a field survey strategy was drafted for subject species. Surveys included collection of vegetation data and information about habitats within the study area and responded to the survey requirements of the CERs.

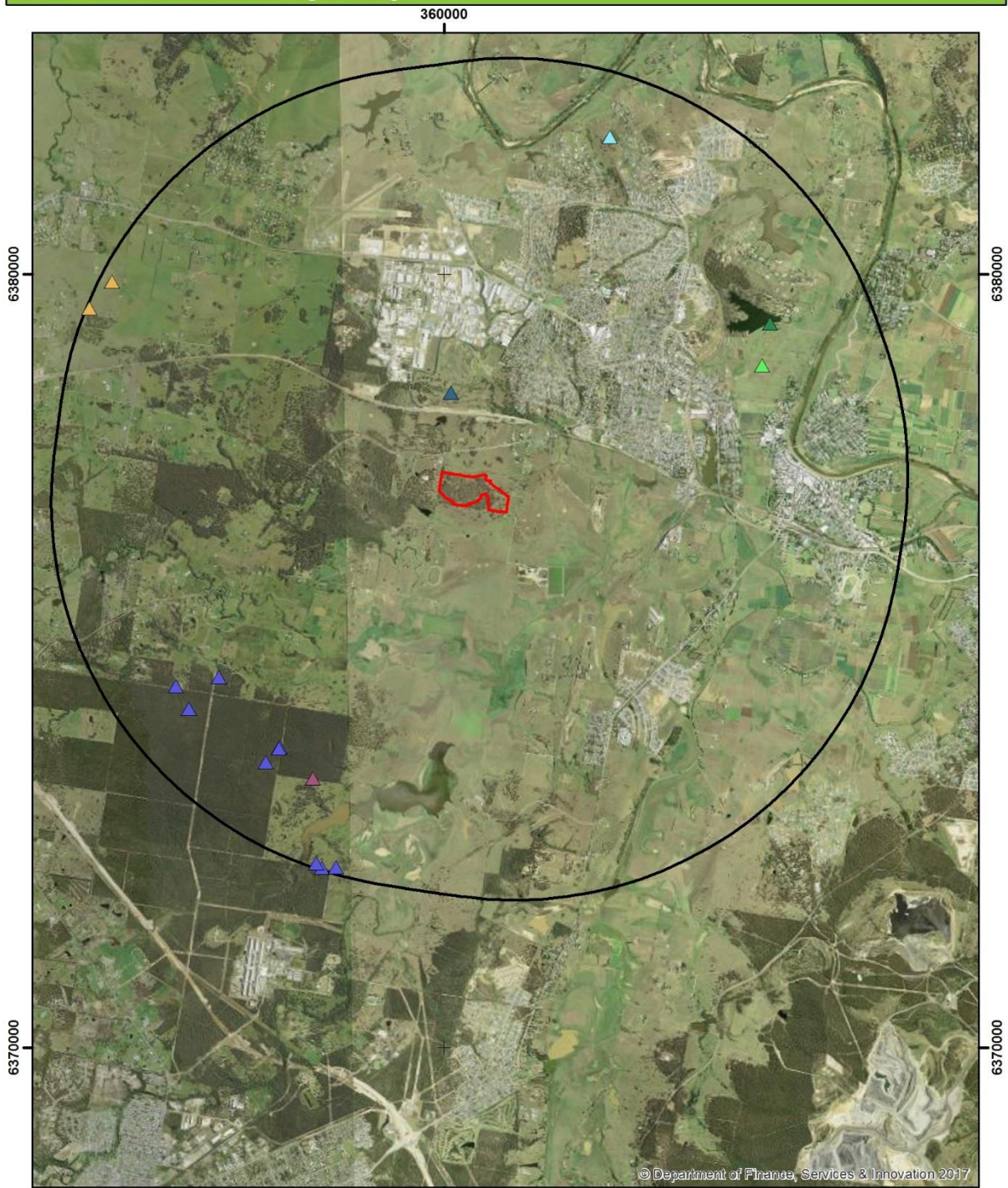
Targeted surveys for threatened flora and fauna species were undertaken at a level at which it was reasonably expected that the species would be detected and at the correct time of year to maximise the likelihood of detection, using the correct survey technique as described within the relevant guideline.

Stage 4 Identification of affected species

Following results of the targeted surveys a list of affected species was identified (**Appendix B**). Species, populations or communities that are known to occupy the study area and that would be directly impacted by the proposed development have been classified as affected species. Species, populations and communities that occupy the study area but that will not be directly impacted by the proposal are not considered to be affected species. **Section 4** provides the methodology for the surveys within the study area designed to determine the presence of subject species within the study area.

Section 5 provides the results of surveys and subsequently identifies the affected species.

Threatened flora records (BioNet)



Subject site	<i>Eucalyptus camaldulensis</i>	 Kilometers Projection: GDA 1994 MGA Zone 56
Locality (5km buffer)	<i>Eucalyptus glaucina</i>	
Threatened flora records (BioNet)		
<i>Callistemon linearifolius</i>	<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	Location: Farley, NSW Lot DP: 100/1230313 101/1230313 Date prepared: 29 October 2018
<i>Cymbidium canaliculatum</i>	<i>Rutidosia heterogama</i>	
	<i>Syzygium paniculatum</i>	

Figure 10 Threatened flora recorded in the locality (OEH, 2018)

Threatened fauna records (BioNet)

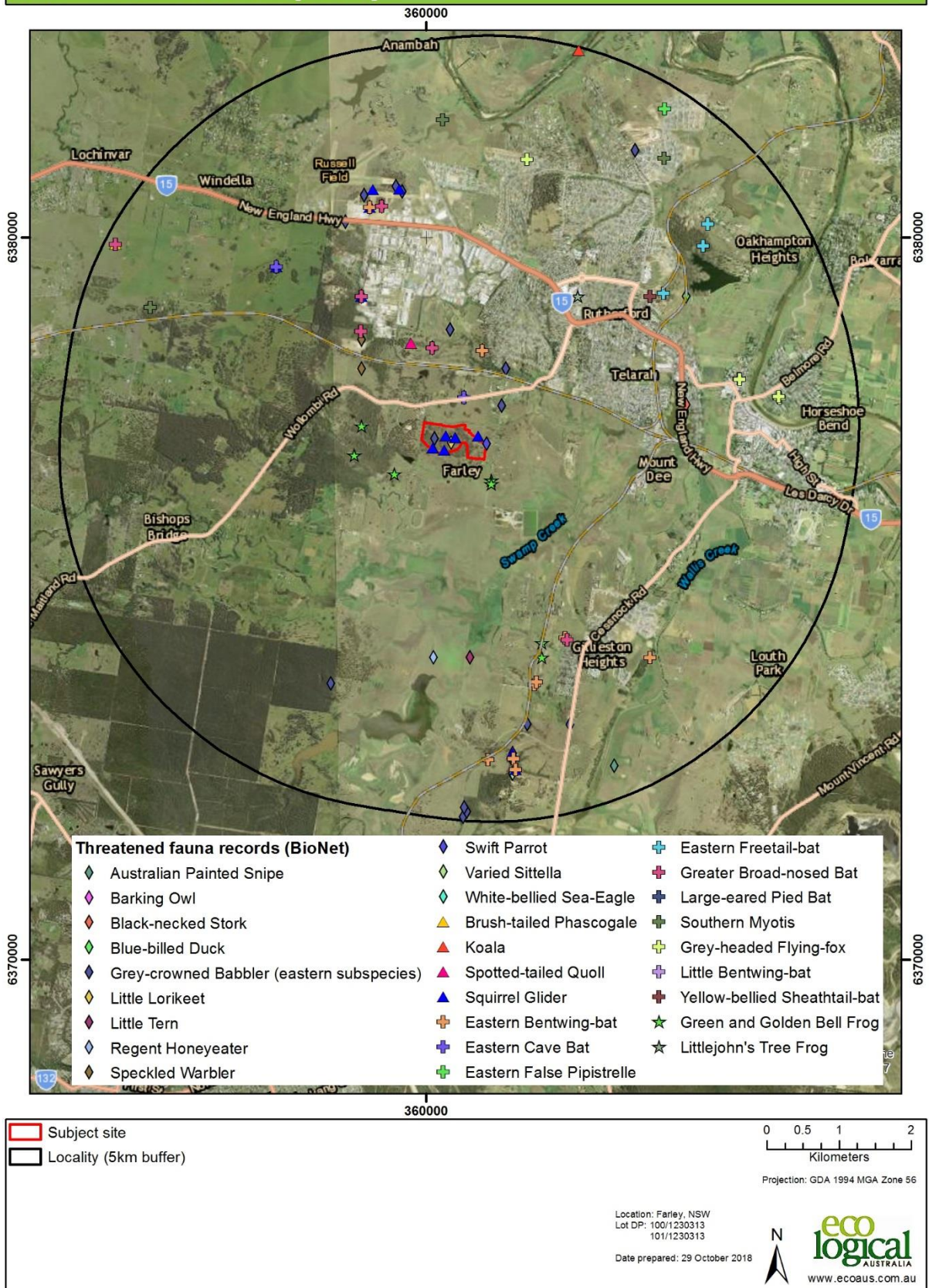


Figure 11 Threatened fauna recorded in the locality (OEH, 2018)

4 Survey methods

4.1 Rationale

Section 4.1 of the CERs require a flora and fauna survey to be undertaken, including targeted surveys for all subject species identified in **Section 3**. The purpose of the surveys is to characterise the biodiversity in the study area and detect any subject species, populations or communities.

Survey procedures and assessments of results have been undertaken according to the following guidelines:

- DEC, 2004. *Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft)*, New South Wales Department of Environment and Conservation, Hurstville, NSW.
- DECC, 2009. *Threatened species survey and assessment guidelines: field survey methods for fauna. Amphibians*. Department of Environment and Climate Change, Hurstville, NSW.
- NSW Office of Environment and Heritage (OEH) 2016. *NSW Guide to Surveying Threatened Plants*. Office of Environment and Heritage, Hurstville, NSW.
- Department of the Environment and Climate Change (DECC) 2007. *Threatened Species Assessment Guidelines. The Assessment of Significance*. Department of Environment and Climate Change, Sydney.

Based on the preliminary list of subject species identified in **Section 3.1.3** of this SIS, the following surveys were undertaken for the relevant subject species:

- vegetation surveys to determine vegetation communities
- targeted flora surveys during the correct flowering period
- diurnal bird surveys
- nocturnal bird surveys
- amphibian and reptile surveys
- microchiropteran bat surveys
- arboreal mammal surveys

4.2 Vegetation surveys

Full floristic surveys were undertaken in accordance with DEC (2004) and with the CERs. This included stratification of the site and sampling using the floristic quadrat/transect consistent with both the BioBanking Assessment Methodology (BBAM) (OEH 2014) and DEC (2004).

4.2.1 Full floristic surveys

Transect surveys were undertaken by ELA to collect data suitable for inclusion within the BioBanking Credit Calculator (BBCC). Five plot and transects were surveyed within the subject site on the 27 September 2018.

Within each plot and transect survey, the following information was collected:

- Within a 20 m x 20 m quadrat:
 - The number, cover, and abundance of native species present
- Along a 50 m transect every 5 m:
 - Native over-storey cover (%)

- Native mid-storey cover (%)
 - Exotic over-storey cover (%) and
 - Exotic mid-storey cover (%)
- Along a 50 m transect every 1 m:
 - Native ground cover (grasses)
 - Native ground cover (shrubs)
 - Native ground cover (other) and
 - Exotic ground cover.
- Within a 50 m x 20 m quadrat:
 - Number of trees with hollows and
 - Total length of fallen logs > 10 cm width (m);
- Within whole vegetation zone:
 - All canopy species and
 - Proportion of regenerating canopy species.

A map showing the locations of the plots is provided in **Figure 12** and floristic data is provided in **Appendix C**.

Flora survey effort

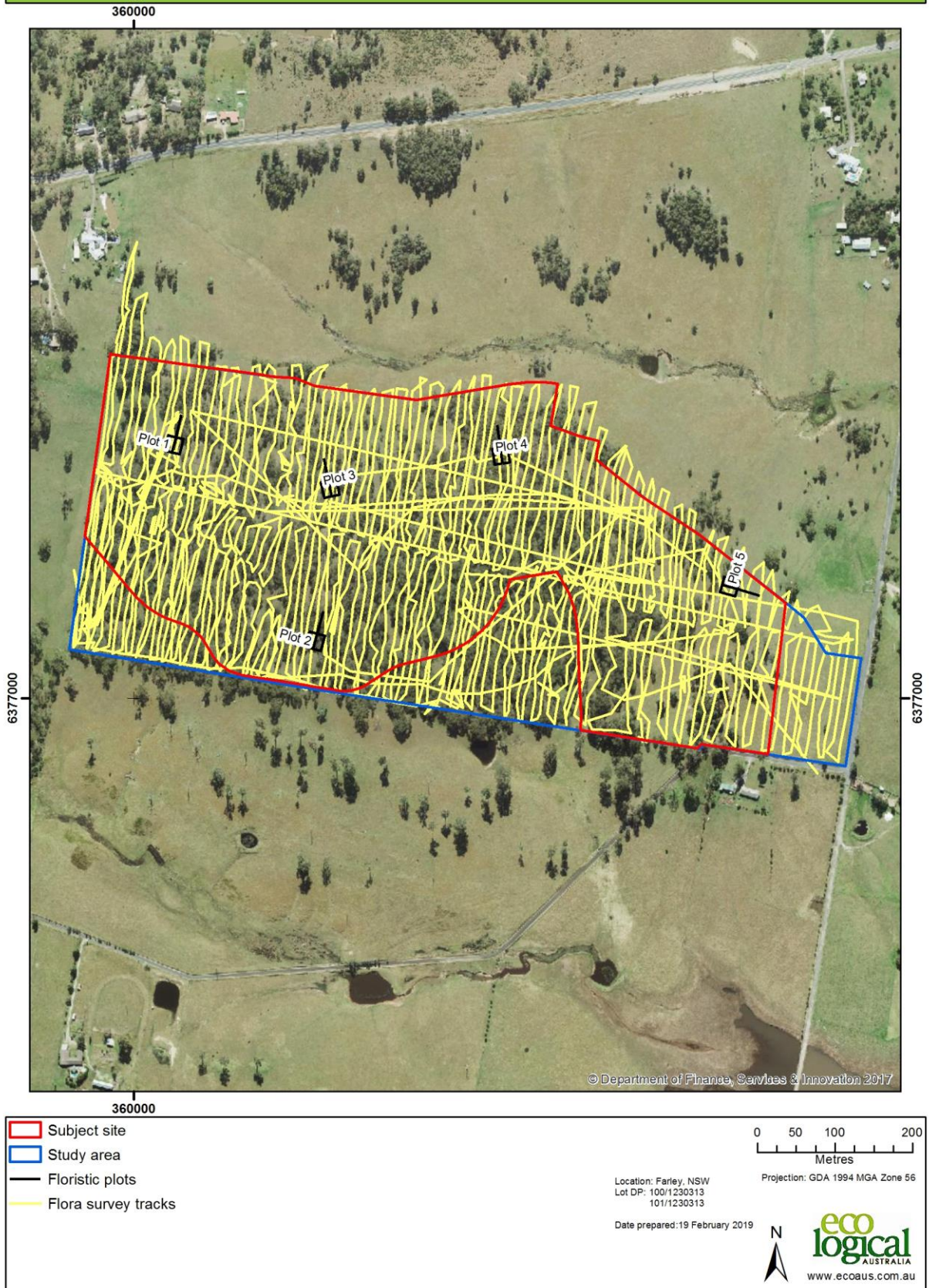


Figure 12 Flora survey effort

4.2.2 Identification of Plant Community Types (PCTs)

Identification of PCTs was determined by incorporating field data with available databases and mapping and by incorporating the following hierarchy of factors:

- occurrence of the PCT within the Hunter IBRA subregion
- vegetation formation
- landscape position
- dominant species

The above data was compared against the PCT descriptions within the VIS Classification 2.1 database. PCTs were selected based on a 'best fit' approach, with consideration given to the past disturbances within the study area.

4.3 Targeted threatened flora surveys

Targeted surveys for flora subject species identified in **Section 3.1.3** were undertaken via a combination of transect as well as floristic plot analysis and in accordance with OEH (2016). This included a systematic approach that maximises the likelihood of detecting threatened plant species, including a consideration of seasonal and temporal constraints.

Belt transects were undertaken over 4 days within the study area (34.09 ha) by ELA ecologist Will Introna. Transects spaced approximately 10 m apart were walked and tracks recorded using Collector for ArcGIS. Subject species that were targeted, the flowering/fruitletting periods, survey dates and confirmation with guidelines are provided **Table 2**. A map showing the transects is provided in **Figure 12**.

Table 2. Survey effort for flora subject species

Species name	Flowering/fruitletting periods	Parallel transect dates	Conforms to OEH (2016)
<i>Callistemon linearifolius</i> (Netted Bottle Brush)	Flowers September to March Fruit matures November to January	23 October 2018 24 October 2018 25 October 2018 6 November 2018	Yes
<i>Cynanchum elegans</i> (White-flowered Wax Plant)	Any time of the year (NPWS 2002)	23 October 2018 24 October 2018 25 October 2018 6 November 2018	Yes
<i>Diuris pedunculata</i> (Small Snake Orchid)	Flowers August to December (Bishop 2000)	23 October 2018 24 October 2018 25 October 2018 6 November 2018	Yes
<i>Eucalyptus glaucina</i> (Slaty Red Gum)	Flowers September to November (Brooker and Kleinig 1999)	23 October 2018 24 October 2018 25 October 2018 6 November 2018	Yes

Species name	Flowering/fruitletting periods	Parallel transect dates	Conforms to OEH (2016)
<i>Maundia triglochiioides</i>	Flowers November to January (Benson and McDougall 2002)	25 October 2018 6 November 2018	Yes
<i>Persoonia pauciflora</i> (North Rothbury Persoonia)	Flowers from January to May Flowers not necessary for identification (OEH 2012)	23 October 2018 24 October 2018 25 October 2018 6 November 2018	Yes
<i>Pterostylis chaetophora</i> (A Greenhood Orchid)	Flowers from September to November (Bishop 2000)	23 October 2018 24 October 2018 25 October 2018 6 November 2018	Yes

The species in **Table 2** were also searched for during plot surveys on 27 September 2018.

4.4 Fauna habitat assessment

A general fauna habitat assessment was undertaken in the subject site. This included searching for and recording the following features with a GPS if they were present:

- hollow-bearing tree (HBT)
- bush rock / rocky outcrops
- watercourses
- wetland areas
- standing / flowing water
- permanent soaks and seepages
- leaf litter
- flowering tree species
- winter flowering eucalypts
- *Allocasuarina* species
- flowering shrubs
- natural burrows
- logs
- nests and roosts
- den trees
- latrine or den sites
- distinctive scats
- bat subterranean roosts including caves, culverts, tunnels etc.

The study area was also mapped according to broad habitat types including dry sclerophyll forest, cleared/disturbed land, watercourses and dams.

4.4.1 Hollow-bearing tree assessment

A hollow-bearing tree (HBT) assessment was undertaken within the subject site on 27 September, 22 October, and 23 October 2018. Searches were conducted throughout the subject site on foot and HBTs and stags were mapped with a GPS. The species of tree and size and number of hollows was recorded.

Observation of fauna use was also recorded and included searches for scratches on the trunk of trees and evidence of nesting material, signs of chewing, rubbing, scratching or droppings on hollow entrances, presence of fauna inside hollows and fauna entering or exiting hollows.

4.4.2 Koala habitat assessment

The study area was assessed for activity by Koalas using the following methods:

- A search of the BioNet Atlas of NSW Wildlife (OEH, 2018) was undertaken to identify records of Koalas in the area.
- The site was surveyed on foot with any species of Koala food trees being inspected for signs of Koala usage. Trees were inspected and identified for presence of Koalas, scratch and claw marks on the trunk and scats around the base of each tree. The proportion of any trees showing signs of Koala use was calculated for the whole of the site. The location and density of droppings were documented if found.
- Koalas were targeted during spotlight surveys.
- Identification and assessment of tree density for species listed as Koala food trees under the *State Environmental Planning Policy No. 44 - Koala Habitat Protection* was undertaken.

4.5 Fauna surveys

Fauna surveys were conducted in October and November 2018 and complied with DEC (2004) and DECC (2009) or with species-specific guidelines where they were available.

As only one vegetation type occurred within the study area which was relatively uniform in terms of fauna habitat, it was not stratified further. Fauna surveys included the following:

- amphibian surveys including diurnal and nocturnal frog and tadpole searches and call playback
- reptile diurnal and nocturnal spotlighting searches
- diurnal bird surveys
- nocturnal bird call playback and spotlighting searches and daytime roost searches
- arboreal mammals Elliot trapping, spotlighting, call playback, remote cameras and searching for scats and signs
- mammal diurnal and nocturnal spotlighting searches
- mammal trapping using small and medium size Elliot traps on the ground and arboreal mounted, as well as cage traps
- ultrasonic bat call recording and harp traps
- opportunistic observation.

Generally, fauna surveys at night consisted of a point survey for forest owls (call playback) as well as a one hour meander across the entire site searching trees for arboreal mammals, and waterways for amphibian species (as shown in Figure 13).

Each survey technique is described below.

4.5.1 Amphibian surveys

Amphibian surveys targeted *Litoria aurea* (Green and Golden Bell Frog) and were undertaken according to DECC (2009). The potential habitat that was surveyed included a small farm dam approximately 5 x 2 m in the south east of the subject site. It is noted that this dam is the only habitat island for the species within the study area, and it is significantly spatially separated from other areas of habitat for the species.

Surveys included diurnal and nocturnal searches and call surveys, including static or point call surveys and call playback.

Nocturnal searches for adult frogs involved walking around the potential habitat (farm dam), actively looking for exposed or active frogs and eyeshine. The entire perimeter of the dam was surveyed. All aspects of the dam were searched, including under logs and rocks, in shrubs and trees, under bark and in litter or emergent vegetation.

Static or point call survey involved listening to and recording calls at the farm dam and was conducted during the nocturnal searches.

Surveys were undertaken on three separate days/evenings on 10 - 12 December 2018. This was considered a time of year suitable for survey as males call between September and January and surveys were undertaken during a build-up of rainfall events.

The location of amphibian surveys is provided in **Figure 13**.

4.5.2 Diurnal bird surveys

Diurnal bird surveys were undertaken within the study area on 27 September, then 22 to 25 October 2018. Surveys consisted of early morning 20-minute walking censuses across the vegetated areas of the subject site during which all species of bird observed or heard calling were recorded (DEC 2004). Seven (7) census areas within the study area were surveyed and their locations are provided in **Figure 13**. The number of sites and effort is summarised in Table 3.

A particular focus was given by to determining the presence of the following subject species within the study area:

- *Anthochaera phrygia* (Regent Honeyeater)
- *Artamus cyanopterus cyanopterus* (Dusky Woodswallow)
- *Callocephalon fimbriatum* (Gang-gang Cockatoo)
- *Chthonicola sagittata* (Speckled Warbler)
- *Climacteris picumnus* subsp. *victoriae* (Brown Treecreeper)
- *Daphoenositta chrysoptera* (Varied Sittella)
- *Glossopsitta pusilla* (Little Lorikeet)
- *Hieraaetus morphnoides* (Little Eagle)
- *Lathamus discolor* (Swift Parrot)
- *Lophoictinia isura* (Square-tailed Kite)
- *Melanodryas cucullata cucullata* (Hooded Robin) (south-eastern form)
- *Melithreptus gularis gularis* (Black-chinned Honeyeater) (eastern subspecies)
- *Petroica boodang* (Scarlet Robin)
- *Petroica phoenicea* (Flame Robin)
- *Pomatostomus temporalis temporalis* (Grey-crowned Babbler) (eastern subspecies)

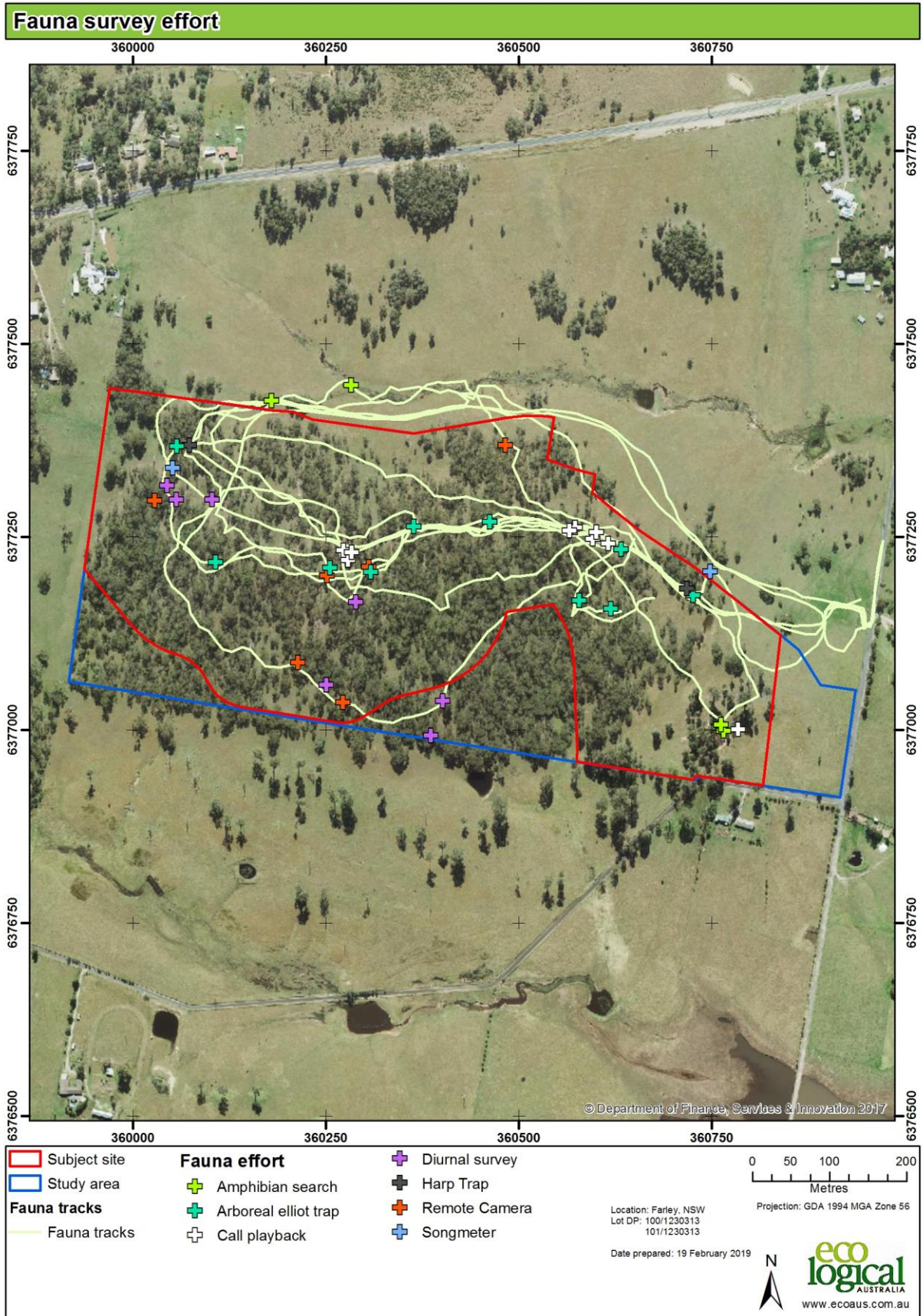


Figure 13 Fauna survey locations

4.5.3 Nocturnal bird surveys

Call playback was undertaken within the study area on eight separate occasions on 22 & 23 October, 26, 27, & 29 November, and 10 – 12 December for the following subject species:

- *Ninox connivens* (Barking Owl)
- *Ninox strenua* (Powerful Owl)
- *Tyto novaehollandiae* (Masked Owl)

A single call playback location was used, near the centre of the subject site, as the entire study area was contained within an 800 m radius of the call playback site (DEC, 2004). Call playback consisted of a listening period of 10 minutes following by searching for 10 minutes. Calls of target species were then played intermittently for 5 minutes following a 10-minute listening period (DEC, 2004).

In addition, searches of habitat for pellets, roosting nocturnal owls and likely hollows was undertaken during one day on 27 September by walking through potential habitat.

The location of searches and call playback sites is shown on Figure 13 and survey effort is summarised in Table 3.

4.5.4 Arboreal mammal surveys

Surveys were undertaken within the study area in September and October for the following arboreal mammal subject species:

- *Petaurus norfolcensis* (Squirrel Glider)
- *Phascogale tapoatafa* (Brush-tailed Phascogale)

Techniques used included (DEC, 2004):

- Arboreal trapping using B-size Elliot traps on brackets
- Spotlighting on foot
- Call playback
- Remote cameras
- Searches for scats and signs

Six remote cameras aimed at baits of rolled oats, peanut butter and honey mounted in trees and on the ground were used from 27 September to 22 October.

Arboreal trapping involved installation of ten B-size Elliot traps mounted approximately 6 m high on wooden brackets on large trees over four nights. Traps were baited with a mixture of rolled oats, peanut butter and honey and honey water was sprayed on the trees. Traps were checked each morning within one hour of sunrise. Spotlighting by foot was undertaken on the 22 & 23 October, 26, 27, & 29 November, and 10 – 12 December by two ecologists for one hour through the subject site.

Call playback for the Squirrel Glider was undertaken on 22 & 23 October, 26, 27, & 29 November, and 10 – 12 December.

One day of searches for scats and signs was undertaken on 27 September.

The location of all traps, cameras and call playback sites is shown in **Figure 13**. The survey effort is summarised in **Table 3**.



Photograph 1 Arboreal Elliot trap in Spotted Gum Forest

4.5.5 Terrestrial mammal surveys

Remote camera surveys were undertaken for the following subject species:

- *Dasyurus maculatus* (Spotted-tailed Quoll)

Six remote cameras aimed at baits of rolled oats, peanut butter and honey mounted on the ground were used from 27 September to 22 October.



Photograph 2 Ground baited remote camera



Photograph 3 Arboreal baited remote camera

4.5.6 Microchiropteran bat surveys

Surveys were undertaken for the following microchiropteran bat subject species:

- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Miniopterus australis* (Little Bentwing-bat)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat)
- *Micronomus norfolkensis* (Eastern Freetail-bat)
- *Myotis macropus* (Large-footed Myotis)
- *Nictophylus corbeni* (Corben's Long-eared Bat)
- *Saccolaimus flaviventris* (Yellow-bellied Sheath-tail-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)
- *Vespadelus troughtoni* (Eastern Cave Bat)

Surveys included ultrasonic echolocation detection with Song Meters and harp trapping (DEC, 2004). Two Song Meters were installed from the 5 to 7 November 2018 and operated from dusk until dawn. Units were programmed to operate from 1800 to 0600, recording continuously from 1800 till 0000, then every half hour from 0000 till 0600. Songmeter data was analysed by Greg Ford from Balance! Environmental Pty Ltd.

Two harp traps were installed for four consecutive nights from 22 to 26 October within flyways in forested areas.

The location of all Song Meters and harp traps is shown in **Figure 13**. The survey effort is summarised in **Table 3**.



Photograph 4 Harp trap in flyway Spotted Gum Forest

4.5.7 Megachiropteran bat surveys

Surveys were undertaken for:

- *Pteropus poliocephalus* (Grey-headed Flying-fox)

Surveys included spotlighting and listening for the audible calls and movement in trees. Spotlighting transects are shown in **Figure 13** and survey effort is summarised in **Figure 12**.

4.6 Summary of survey effort

Surveys were designed to be compliant with guidelines. A summary of all fauna survey effort is shown in **Table 3**. Surveys were compared to the appropriate recommended surveys effort for that survey technique included DEC (2004) and OEH (2016) for vegetation and habitat description and targeted flora searches, DECC (2009) for amphibian searches and OEH (2014) for the BBAM methodology.

Table 3. Survey effort

Subject species	Survey technique	Locations and times	Dates	Effort	Recommended effort	Compliance
Vegetation	Full floristic surveys	Four plot/transects according to the BBAM.	27 and 28 September 2018	5 transect/plots in one vegetation zone	4 transect/plots or 3 transect/plots if vegetation is in low condition in a vegetation zone of 20 – 50 ha in area (OEH, 2014)	Yes
Flora species	Parallel transects	Transects spaced approximately 10 m apart covering the entire study area over four days.	23, 24 and 25 October and 6 November 2018	10 metre parallel field traverses 30-person hours for 39.04 ha	Maximum distance between parallel field traverses when searching for orchids in open vegetation is 10 m (OEH, 2016). Estimated time for 50 ha is 33.33 hours	Yes
Amphibians	Nocturnal searches	One dam for one hour.	10 - 12 December 2018	Two ecologists for one hour per night for four nights	Minimum of one hour on three separate occasions during the species activity period (OEH, 2009)	Yes
	Static or point call surveys	One dam during nocturnal surveys.		Two ecologists for one hour per night for four nights	Can be conducted during nocturnal searches (OEH, 2009)	Yes
	Call playback	One dam during nocturnal surveys		Two ecologists for 15 minutes per night for three nights	No minimum guideline	Yes
Diurnal birds	Walking transect	Through the centre of the subject site in the early morning.	22, 23, 24 and 25 October 2018	Two ecologists for 20 minutes in the early morning over four days	No minimum guideline	Yes

Subject species	Survey technique	Locations and times	Dates	Effort	Recommended effort	Compliance
Nocturnal birds	Call playback	One site near the centre of the subject site over 2 nights in October and 6 nights in November 2018. Call playback consisted of 10 min listening, 10 min searching, 5 min call playback of each target species and 10 min listening.	22 & 23 October, 26, 27, & 29 November, and 10 – 12 December	A total of 8 visits per site.	At least 5 visits per site for the Powerful Owl and Barking Owl (DECC, 2004). At least 8 visits per site for the Masked Owl (DECC, 2004).	Yes
Arboreal mammals	Arboreal trapping with B-size Elliot traps	Ten B-size Elliot traps over four nights in one stratification unit.	22 - 26 October 2018	10 traps over 4 consecutive nights = 40 trap nights per stratification unit.	24 trap nights over 3-4 consecutive nights per stratification unit (DECC, 2004)..	Yes
	Spotlighting on foot	One transect on foot for a least one kilometre by two ecologists at 1 km per hour over two nights.	22 & 23 October, 26, 27, & 29 November, and 10 – 12 December	2 x 1 hour and 1 km walking at approximately 1 km per hour on 2 separate nights	2 x 1 hour and 1 km walking at approximately 1 km per hour on 2 separate nights (DECC, 2004).	Yes
	Call playback	Two call playback locations in the subject site over two nights.	22 & 23 October, 26, 27, & 29 November, and 10 – 12 December	2 sites with call playback undertaken over two nights	2 sites per stratification unit up to 200 hectares. Each playback site must have the session conducted twice, on separate nights (DECC, 2004).	Yes
	Remote cameras	Six sites over 25 nights.	From 27 September to 22 October 2018	Six sites x 25 nights = 150 trap nights	No minimum guideline	Yes

Subject species	Survey technique	Locations and times	Dates	Effort	Recommended effort	Compliance
	Searches for scats and signs	Searches of potential habitat within the study area over one day.	27 October 2018	1 person day of searching in appropriate habitat	No minimum guideline	Yes
Terrestrial mammals	Remote cameras	Six sites over 25 nights.	From 27 September to 22 October 2018	Six sites x 25 nights = 150 trap nights	No minimum guideline	Yes
Microchiropteran bats	Ultrasonic echolocation detection	Two sites over two nights.	From 5 to 7 November 2018	Two sites over 2 nights, starting from dusk and recording until dawn	Two sound activated recording devices utilised for the entire night (a minimum of four hours), starting at dusk for two nights (DECC, 2004).	Yes
	Harp trapping	Two sites over four nights.	From 22 to 26 October	Two sites over four consecutive nights = 8 trap nights	Two trap nights over two consecutive nights (with one trap placed outside the flyways for one night) (DECC, 2004).	Yes
Megachiropteran bats	Spotlighting on foot	One transect on foot for a least one kilometre by two ecologists at 1 km per hour over two nights.	22 & 23 October, 26, 27, & 29 November, and 10 – 12 December	2 x 1 hour and 1 km walking at approximately 1 km per hour on 2 separate nights	For targeted survey near likely food resources: 2 x 1 hour spotlighting on two separate nights (DECC, 2004).	Yes

4.7 Weather conditions during surveys

Weather conditions during surveys were considered appropriate to detect subject species. Specific weather conditions for amphibians have been described within the methods above. Survey timing was designed to coincide with suitable weather conditions to maximise detection of species.

Weather during the survey period was typical of the region. No abnormal weather events (such as heat waves) that may preclude detectability of species was experienced.

Survey timing and weather conditions are shown below in Figure 14.

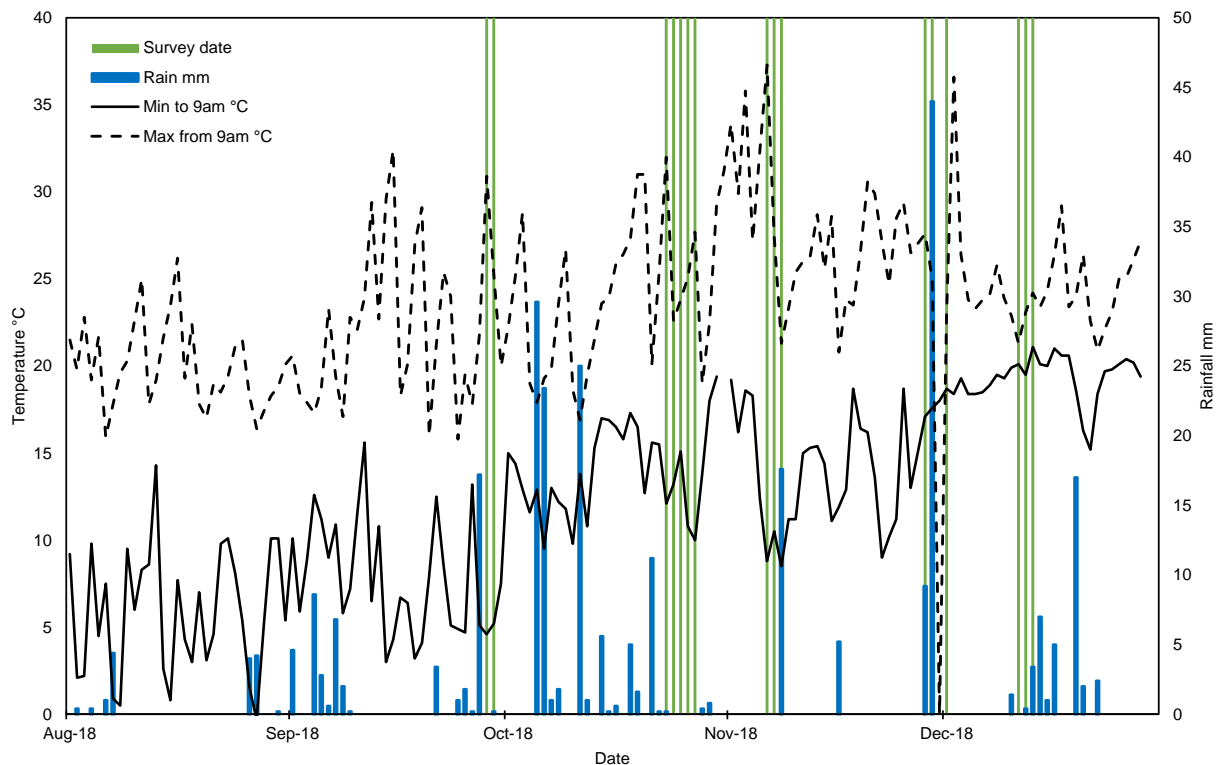


Figure 14 Weather conditions during the surveys

4.8 Experience and qualifications

The field survey was undertaken by trained ELA ecologists as described in **Table 4**. Data analysis of SongMeter data was undertaken by Greg Ford of Balance! Environmental.

Table 4: Survey and planning team

Name	Responsibility	Qualifications	Experience
Martin Sullivan	Project director, report review	Bachelor of Science (Biodiversity and Conservation) BAM Accredited Assessor	15 years' experience
Alex Pursche	Fauna survey team leader - planning and surveys, reporting	Bachelor of Science (Hons) PhD BAM Accredited Assessor	9 years' experience
Lily Gorrell	Floristic quadrat surveys, reporting	Bachelor of Natural Resource Management (Hons) BAM Accredited Assessor	9 years' experience
Tom Schmidt	Fauna surveys, reporting	Bachelor of Environmental Science (Hons)	6 years' experience
Will Introna	Targeted threatened flora surveys, reporting	Bachelor of Science (Environmental Biology) Master of Science	15 years' experience

5 Results

5.1 Vegetation surveys

Vegetation surveys were consistent with BBAM and included collection of full floristic quadrat data, as well as plot and transect data as identified in Chapter 4 of this SIS.

Vegetation surveys identified one PCT in two broad condition states within the study area, namely PCT 1590: Spotted Gum – Broad Leaved Mahogany – Red Ironbark shrubby open forest, and one area of exotic grassland. Details of these two vegetation communities, and their defining features are detailed in Table 5 and Table 6. Plant Community Type mapping within the study area is shown on Figure 7.

PCT 1590 complies with the final determination for Spotted Gum – Ironbark Forest of the Sydney Basin Bioregion, which is listed as an Endangered Ecological Community (EEC) under the TSC Act. The location of EEC within the study area is shown on Figure 15. No TEC's under the EPBC Act were identified within the study area.

Table 5. PCT 1590 Spotted Gum – Broad Leaved Mahogany – Red Ironbark shrubby open forest

1590 – Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest	
Vegetation formation:	Dry Sclerophyll Forests (Shrub/grass sub-formation)
Vegetation class:	Hunter-Macleay Dry Sclerophyll Forests
Vegetation structure	Open forest
Conservation status:	Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion (BC Act)
	
	<p>This community occurs throughout the study area in a mosaic of conditions, with some small patches underscrubbed, and other areas with a more or less density of trees and shrubs. This community was characterised by canopy of <i>Corymbia maculata</i> (Spotted Gum) and <i>Eucalyptus fibrosa</i> (Red Ironbark), an understorey of <i>Daviesia ulicifolia</i> (Gorse Bitter Pea), <i>Pultenaea spinosa</i> (Spiny Bush-pea) and <i>Bursaria spinosa</i> Blackthorn and a ground layer of <i>Themeda triandra</i> (Kangaroo Grass).</p>
Landscape position	Low ranges of the lower Hunter Valley and Central Coast at lower elevations.
Characteristic trees	<i>Corymbia maculata</i> , <i>Eucalyptus fibrosa</i>
Characteristic midstorey	<i>Pultenaea spinosa</i> , <i>Daviesia ulicifolia</i> , <i>Bursaria spinosa</i>
Characteristic groundcovers	<i>Aristida vagans</i> , <i>Themeda triandra</i> , <i>Cheilanthes sieberi</i> , <i>Cynodon dactylon</i> , <i>Lomandra multiflora</i> , <i>Entolasia stricta</i> , <i>Goodenia rotundifolia</i>
Mean native richness	27
Weediness (all species)	1 %
Exotic species	<i>Ehrharta erecta</i> , <i>Lantana camara</i> , <i>Anagallis arvensis</i>
Condition	Moderate-Good condition, with historical under-scrubbing.
Variation and disturbance	Ground cover varies with disturbance regime.
Soil type	Sandy clay loam with ironstone nodules
% remaining in NSW	42 %
Threats	Weed invasion, grazing, under-scrubbing
No. sites sampled	Plot 1 – Plot 4
Threatened flora species	None

Table 6. Exotic grassland

Exotic grassland	
Vegetation formation:	No applicable vegetation formation
Vegetation class:	No applicable vegetation class
Vegetation structure	Grassland/Cleared land
Conservation status:	Not listed
	
	<p>This community occurs in the east of the study area in a single condition state as a cleared paddock with naturalised and exotic pasture grasses. This community was characterised by an absence of canopy and shrub species, and includes a ground layer dominated by <i>Cynodon dactylon</i> (Couch), <i>Petrorhagia dubia</i>, <i>Senecio madagascariensis</i> (Fireweed), and <i>Gamochaeta purpurea</i> (Purple Cudweed).</p>
Landscape position	Flats and low hills in the east of the study area.
Characteristic trees	<i>Absent</i>
Characteristic midstorey	<i>Absent</i>
Characteristic groundcovers	<i>Cynodon dactylon</i> (Couch), <i>Petrorhagia dubia</i> , <i>Senecio madagascariensis</i> (Fireweed), and <i>Gamochaeta purpurea</i> (Purple Cudweed)
Mean native richness	9
Weediness (all species)	90.6 %
Exotic species	<i>Petrorhagia dubia</i> , <i>Senecio madagascariensis</i> , <i>Conyza bonariensis</i> , <i>Gamochaeta purpurea</i>
Condition	Poor
Variation and disturbance	Homogenous exotic pasture – previously cleared for agriculture
Soil type	Sandy clay loam with ironstone nodules
% remaining in NSW	n/a
Threats	n/a
No. sites sampled	Plot 5
Threatened flora species	None

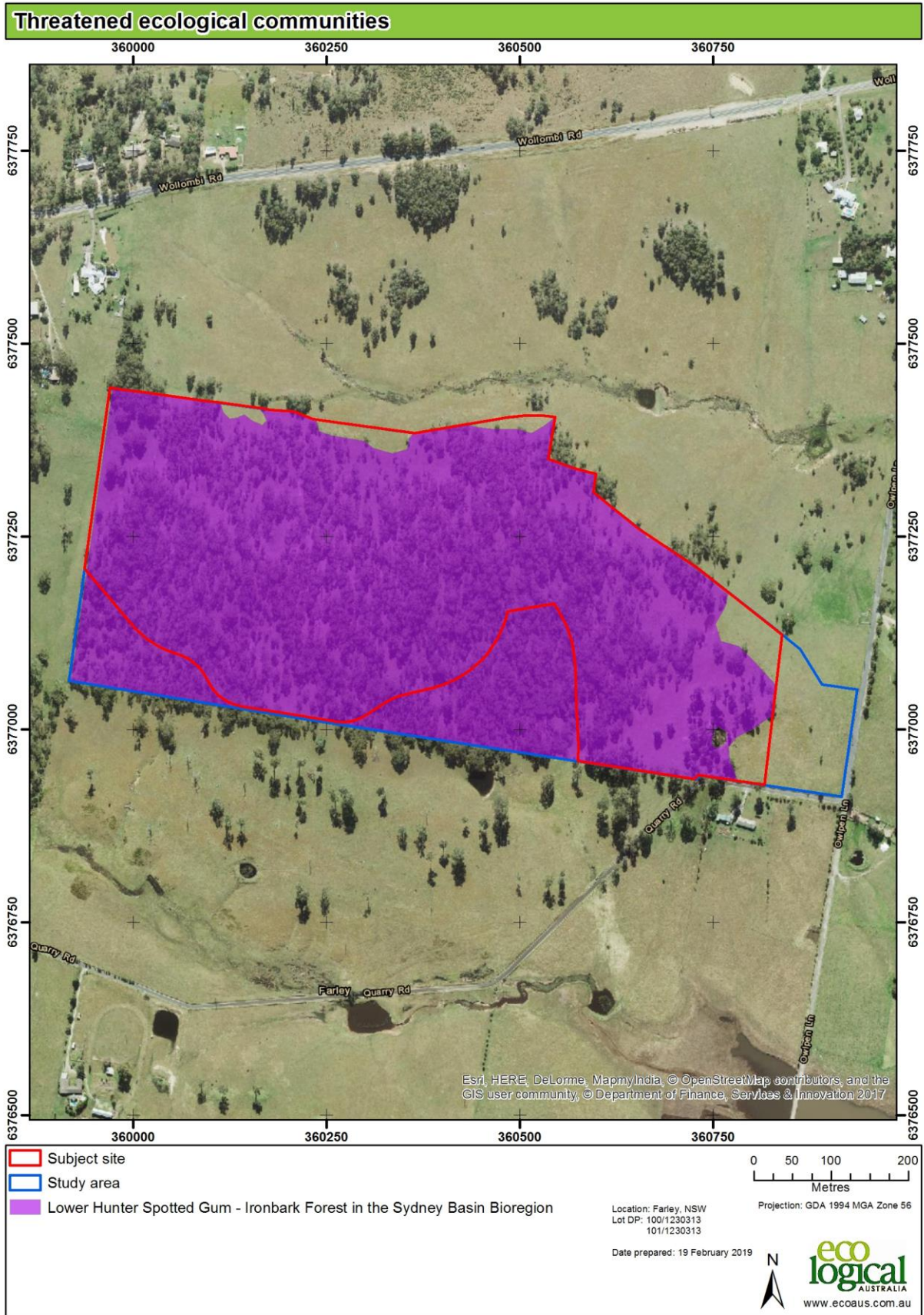


Figure 15 Threatened Ecological Communities

5.2 Habitat assessment

Fauna habitat within the study area consists primarily of potential breeding and foraging habitat for a range of fauna. There are 49 hollow-bearing trees (HBTs) which are either alive or are stags, within the subject site and 3 HBTs outside of the subject site (two live trees and one stag), which will be retained. The subject site also includes a small farm dam.

The forested vegetation includes a mix of older and younger trees, an open to dense shrubby layer and an open to dense ground layer dominated by grasses and herbs.

Fauna habitats are primarily suited to arboreal mammals and woodland birds. There are no banksias or flowering mid-storey species present. Watercourse habitats are ephemeral. The only permanent water source onsite during the surveys was a small dam in the east of the study area.

Table 7: Fauna habitat values within the study area

Fauna habitat type	Site characteristics
Site topography	A central east west ridge with gentle slopes to the north and steeper slopes to the south, with first order watercourses
Soil landscapes	Bolwarra Heights over the entire study area.
Habitat types	Dry Sclerophyll Forest
Hollow-bearing trees	52
Number of large hollows (> 30 cm)	1
Number of medium hollows (20 – 30 cm)	2
Number of small hollows (10 – 20 cm)	20
Number of small hollows (5 – 10 cm)	83
Number of small hollows (< 5 cm)	19
Rocky outcrops	None observed. Some surface rocks in steeper areas around first order watercourses
Watercourses	Five first order watercourses outside and south of the subject site.
Wetland areas	A small depression with intermittent water and rushes and a small farm dam occur within the subject site.
Leaf litter	An average of 40% litter cover in a 1 x 1 m area
Flowering tree species	<i>Corymbia maculata</i> , <i>Eucalyptus fibrosa</i> , <i>Eucalyptus punctata</i> ,
Flowering shrubs	<i>Acacia ulicifolia</i> , <i>Bursaria spinose</i> , <i>Ozothamnus diosmifolius</i> , <i>Daviesia ulicifolia</i> , <i>Lissanthe strigosa</i> , <i>Epacris sp.</i>
Bush rock and rocky outcrops	Some exposed sandstone on steeper slopes
Natural burrows	None observed
Logs	Average of 2.75 m of fallen logs in a 0.1 ha

Fauna habitat type	Site characteristics
Standing or flowing water	No flowing water. One small farm dam
Nests and roosts	Grey-crowned Babbler nest, Noisy Miner nests
Den trees	None
Distinctive scats	None
Latrine or den sites	None
Allocasuarina sp.	None
Bat tree roosts	None
Bat subterranean roosts	None
Winter flowering eucalypts	<i>Corymbia maculata</i>
Permanent soaks and seepages	None
Disturbance history	Previous under-scrubbing, grazing and historical thinning
Koala habitat	None present



Figure 16 Fauna habitats

5.3 Targeted threatened flora surveys

Surveys were conducted at the correct time of year for each species to determine the presence of each species occurrence within the study area. No threatened flora were identified in the subject site during surveys. Several *Diuris* species such as *D. punctata* var *punctata* (as confirmed by yellow on the central callus ridges of the labellum) and *D. maculata* were observed within the forested areas of the site, as well as along fringes of vegetation along the east of the site.

No other species of interest were recorded within the study area.



Photograph 5 *Diuris punctata* var *punctata* within the study area



Photograph 6 *Diuris maculata* within the study area

5.4 Targeted fauna surveys

5.4.1 Amphibian surveys

Amphibian species recorded within the study area are common in the region. Amphibian habitat within the study area is confined to a single, small dam in the east of the study area. This dam is manmade and provides an isolated habitat for amphibians.

Weather during amphibian surveys ranged from dry evenings to rainfall events. Rain in December was highly suitable for detection of amphibians, with evening temperatures above 22C.

A total of ten species of amphibian were recorded within the study area. Common species encountered included *Litoria peronii* and *Litoria caerulea*, which are forest species that less reliant on ephemeral or permanent water sources.

No threatened amphibian species were recorded within the study area. A complete list of species recorded is shown in Table 21.



Photograph 7 *Litoria dentata* observed on sedge in dry dam

5.4.2 Diurnal bird surveys

Diurnal birds observed or heard within the study area are common for the region. The dominant bird heard and observed was *Manorina melanocephala* (Noisy Miner), of which a significant population occupy the study area. Surveys were conducted in Spring (late October) which is ideal conditions for detecting the majority of diurnal birds.

A total of 25 woodland birds were observed or heard within the study area.

One species listed as Vulnerable under the TSC Act was observed within the study area, namely *Pomatostomus temporalis temporalis* (Grey-crowned Babbler (eastern subspecies)). This species was observed on several occasions, as well as breeding sites identified in the southern portion of the study area. There is a resident group of approximately 8 individuals within the study area.

Previous records indicated Little Lorikeet (OEH, 2007) and Swift Parrot (OEH, 2015) have been observed within the study area. Neither of these species were observed during surveys.

No species listed under the EPBC Act were observed.

5.4.3 Nocturnal bird surveys

Nocturnal bird surveys were conducted across eight evenings, primarily targeting forest owls. Only three species of nocturnal bird *Aegotheles cristatus* (Australian Owlet-nightjar), *Ninox boobook* (Southern Boobook) and *Podargus strigoides* (Tawny Frogmouth) were observed or heard within the study area.

No forest owls, being foraging roosting or breeding, were observed within the study area.

5.4.4 Arboreal and terrestrial surveys

Terrestrial and arboreal mammals surveys detected four species of mammals within the study area. These were *Canis lupus familiaris* (Dog), *Macropus giganteus* (Eastern Grey Kangaroo), *Trichosurus vulpecula* (Common Brushtail Possum), and *Vulpes vulpes* (Red Fox).

One threatened species *Pteropus poliocephalus* (Grey-headed Flying-fox), which is listed as Vulnerable under the TSC Act and Vulnerable under the EPBC Act, was heard adjacent to the study area on one occasion. This species may utilise the study area on occasion for feeding on *Corymbia maculata* (during flowering times), but does not use the site for roosting or breeding.

Despite the numerous records of Squirrel Glider within the study area from 2007, this species was not encountered during either the eight nights of spotlighting, a week of arboreal Elliot trapping, and a month of baited arboreal remote camera trapping. This result was initially surprising given the suitability of habitat within the study area. The absence of this species from the volume of surveys indicates that the species is unlikely to remain within the study area. This may be due to the increased urban development pressure adjacent to the study area, population dynamics, or the abundance of resident Common Brushtail Possums within the study area (of which nearly 15 were observed on each survey evening).

The dominant mammal species observed during surveys was the Eastern Grey Kangaroo, of which there is a resident population of approximately 70 animals. These were observed on every occasion during surveys. Perimeter fencing around the study area does not prevent this species from moving between properties, however there is a distinct preference for the study area within this species home range.



Photograph 8 Eastern Grey Kangaroos within grassy areas (north of the study area)

5.4.5 Microchiropteran bat surveys

Microchiropteran bat surveys were conducted using a variety of methods during October and November 2018 during suitable weather. Surveys identified that there are 12 species of microchiropteran bat that utilise the study area. Of these species, they are predominately woodland species that are common to the region. One species, *Miniopterus orianae* (Northern Bentwing-bat) was detected on both Songmeters. This result is of interest as it represents a significant range extension. The species is not listed under the TSC Act or EPBC Act.

Harp trapping only detected one species, *Vespadelus vulturinus* (Little Forest Bat).

Three microchiropteran bat species were recorded within the study area, all of which are listed as Vulnerable under the TSC Act:

- *Micronomus norfolkensis* (syn. *Mormopterus norfolkensis*)
- *Miniopterus australis*
- *Scoteanax rueppellii*

These species are locally common. The fauna habitats present, as well as the limited number of detections does not indicate that there is a breeding colony for any of these species within the study area.

A complete analysis of all ultrasonic bat data is provided within **Appendix F**.

5.5 Identification of affected species

Section 5 of the CERs requires the SIS to refine the list of subject species, given the outcome of current and previous surveys, to identify which subject species (species, populations or communities) may be directly or indirectly affected (including cumulatively) by the proposal, in accordance with Section 110(2) (b) of the TSC Act.

A total of 35 threatened fauna species, 7 threatened flora species, one flora population and two EECs, were considered as subject species for this SIS (Section 3.1.3 and **Appendix B**). From this extensive list the following species and communities were identified as affected species. As discussed above, given the absence of recent records of the species, Squirrel Glider has not been identified to be using the study area. Given the absence of detections in the past 12 years, combined with numerous ecological studies of the study area (by RPS, Firebird, and ELA) this species has not been included within the affected species. Similarly, there was no recent recorded activity of Little Lorikeet within the study area.

Based on the assessment of likelihood of occurrence and considering the results of extensive field surveys, the following species are likely to be known to occur within the study area and will be directly affected by the proposal:

- *Lathamus discolor* (Swift Parrot) – likely to use site on occasion
- *Pomatostomus temporalis temporalis* (Grey-crowned Babbler) (eastern subspecies)
- *Miniopterus australis* (Little Bentwing-bat)
- *Micronomus norfolkensis* (syn. *Mormopterus norfolkensis*) (Eastern Freetail-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)
- Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion

The location of all threatened species identified within the study area and their habitat is shown on Figure 17.

The potential impact of the proposal on these affected species is addressed in **Section 6**.

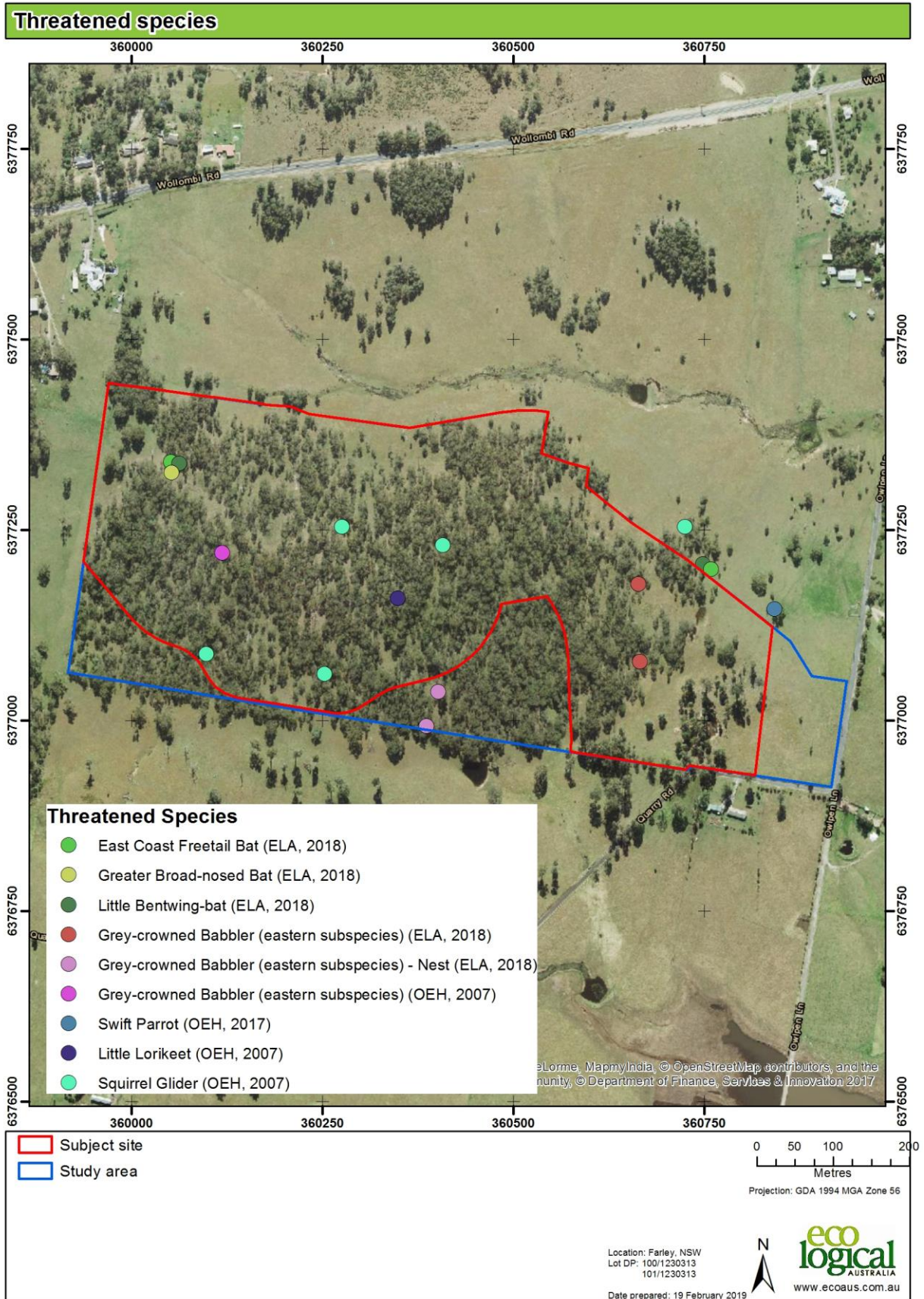


Figure 17 Threatened species recorded within the study area

5.6 Subject species not identified as affected species within this SIS

If adequate surveys/studies have been undertaken to demonstrate that a subject species does not occur in the study area, or if not resident, will not utilise habitats on site on occasion, or if off-site, be influenced by off-site impacts of the activity, the species does not have to be considered further.

Two subject species were not considered to be affected species because of one or more of following reasons (**Appendix B**):

- They have not been detected within the study area despite extensive survey within the study area and review of records and known habitat in the study area and locality, or
- Are not species that are difficult to detect, or where suitable habitat is limited, or
- They would only use the study area infrequently and the study area does not provide important breeding or foraging habitat.

As discussed above, given the absence of recent records of the species, Squirrel Glider has not been identified to be using the study area. Given the absence of detections in the past 12 years, combined with numerous ecological studies of the study area (by RPS, Firebird, and ELA) this species has not been included within the affected species. Similarly, there was no recent recorded activity of Little Lorikeet within the study area.

6 Assessment of likely impacts on threatened species and populations

6.1 Assessment of likely affected species

The following assessment of likely impacts on threatened species follows the CERs for the SIS which outline that an assessment of impacts must consider the nature, extent and timing of the proposal and all associated actions, including construction, provision and ongoing maintenance of all structures, utilities and landscaping. The assessment of impacts includes assessment of direct and indirect impacts within the study area and includes the consideration of impacts associated with the establishment of any proposed APZs.

6.2 Definitions used within the assessment of likely impacts

For the purposes of this SIS, the region (or bioregion) of interest is the Sydney Basin Bioregion. This Bioregion occurs within NSW and encompasses Sydney, Wollongong, Nowra, Newcastle, Cessnock, Muswellbrook and some towns in the Blue Mountains area.

A local occurrence is defined as the ecological community or threatened species that occur within the study area. This may include adjacent areas if the study area forms part of a larger contiguous area of that ecological community or threatened species habitat, and the movement of individuals and exchange of genetic material across the boundary of the study area can be clearly demonstrated.

Discussions of distribution and conservation status are based on Bionet records obtained for this SIS.

6.3 *Lathamus discolor* (Swift Parrot)

6.3.1 Conservation status

Local, regional and state conservation status

The Swift Parrot is listed as Endangered under the TSC Act and Critically Endangered under the EPBC Act.

Key threatening processes

Major threats to the Swift Parrot include the loss and alteration of foraging and nesting habitat through forestry activities, including firewood harvesting, and residential, industrial and agricultural development. Other identified threats include climate change impacts, competition for foraging and nesting resources, mortality from collisions with human-made objects, Psittacine beak and feather disease, and illegal bird capture and trade, high fire frequency impacting on food resources and predation by cats (Birds Australia 2011; OEH, 2018).

Habitat requirements

This species breeds in Tasmania and occurs in south-east mainland Australia between March and October, where they forage on abundantly flowering eucalypts or lerp infestations. Among the favoured trees are *Corymbia maculata* (Spotted Gum), which is a dominant tree in the study area. They have been found to preferentially forage in large mature trees that provide more reliable foraging resources than younger trees (Birds Australia, 2011).

LHSGIF is known to be a threatened ecological community that contains suitable habitat for this species (Birds Australia 2011).

The species has been identified within BioNet (OEH, 2018) as being known to be associated with PCT 1590, which occurs within the study area. The Swift Parrot species was recorded in the subject site in May 2017 as identified on BioNet (although no further information about this record is available.) Given the species is known to feed on *C. maculata* the study area is considered to be foraging habitat for this species.

Recovery plans or threat abatement plans

There is a national recovery plan for the Swift Parrot (Birds Australia, 2011).

Assessment of representation within conservation reserves in the region

The species is represented within many conservation reserves within the region. Nearby to the study area, there are records of these species from Werakata SCA and Werakata NP.

Within the region, this species has been recorded mostly along the coast and in the Hunter Valley. Within the Sydney Basin Bioregion, the species is represented within the following 20 conservation reserves as shown on Figure 18.

- Barren Grounds Nature Reserve
- Botany Bay National Park
- Brisbane Water National Park
- Castlereagh Nature Reserve
- Colongra Swamp Nature Reserve
- Dharawal National Park
- Goulburn River National Park
- Heathcote National Park
- Ku-ring-gai Chase National Park
- Lake Macquarie State Conservation Area
- Mulgoa Nature Reserve
- Nattai National Park
- Royal National Park
- Scheyville National Park
- Sydney Harbour National Park
- Upper Nepean State Conservation Area
- Werakata National Park
- Werakata State Conservation Area
- Wollemi National Park
- Wyrabalong National Park

This species is not at the limit of its known distribution in the study area.

6.3.2 Local and regional abundance

The Swift Parrot is likely to forage within the study area from time to time. Therefore, any Swift Parrots within the study area would be part of a larger population that forages on mainland Australia.

Discussion of other known local populations

This is a highly mobile species. However, there are no other records within the locality. Any other individuals in the locality would be part of the same population which could occur in the study area.

The locality is not likely to be regionally significant for the Swift Parrot, as larger and more intact areas of known habitat occur elsewhere in the region. The closest areas of foraging habitat with numerous records

is in Werakata National Park, which is just south west of the locality and contains more extensive and intact habitat.

6.3.3 Assessment of habitat

Description of habitat values

The LHSGIF in the study area provides foraging habitat for the Swift Parrot. It is dominated by *Corymbia maculata* (Spotted Gum) which is a nectar resource tree species for this species (Birds Australia, 2011).

Discussion of habitat utilisation

The Swift Parrot is likely to forage in the study area from time to time. However, the degree of site fidelity, if any, is unknown. The condition of the vegetation and habitat within the study area is considered to be of lower quality than the other more intact areas within the locality. This because of expected competition from aggressive birds such as the Noisy Miner and Rainbow Lorikeet would make foraging in the study area more energetically expensive for the Swift Parrot, which is less likely to occur in such habitats (Birds Australia, 2011).

Extent of habitat removal

The proposal will require the removal of approximately 26.4 ha of foraging habitat.

Consideration of corridors

The proposal is located at the eastern end of fragmented woodland of varying sizes in the west and south of the locality. Although there will be clearing of vegetation in order to develop the subject site, there will be retention of vegetation within the study area which will maintain the link with existing vegetation to the west in the locality.

Within a regional context, the development of the subject site will not affect fauna corridors suitable for this highly mobile species. Extensive vegetation exists to the south and west, including conservation reserves such as Werakata National Park, which is also known habitat for this species.

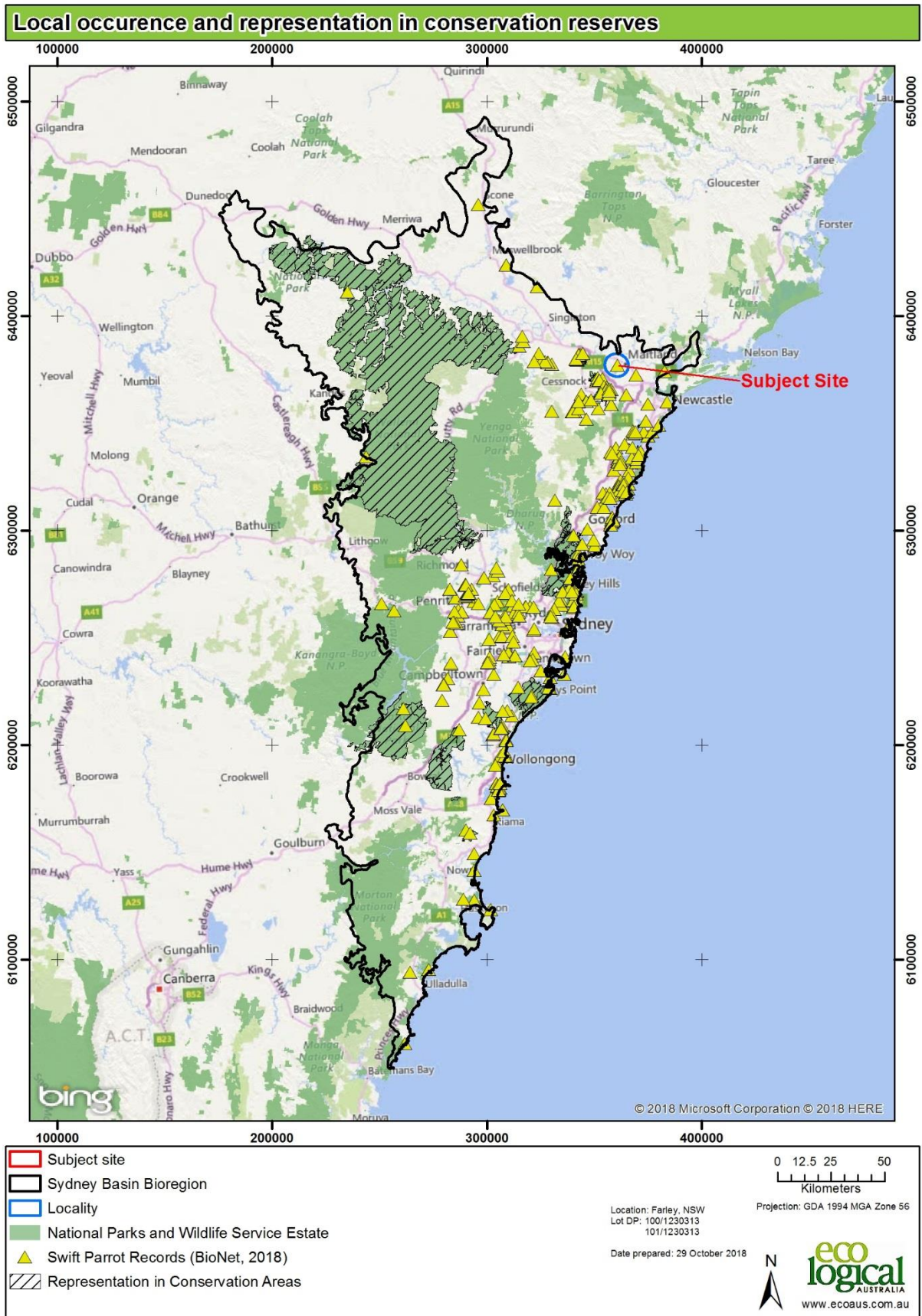


Figure 18 Swift Parrot regional occurrence

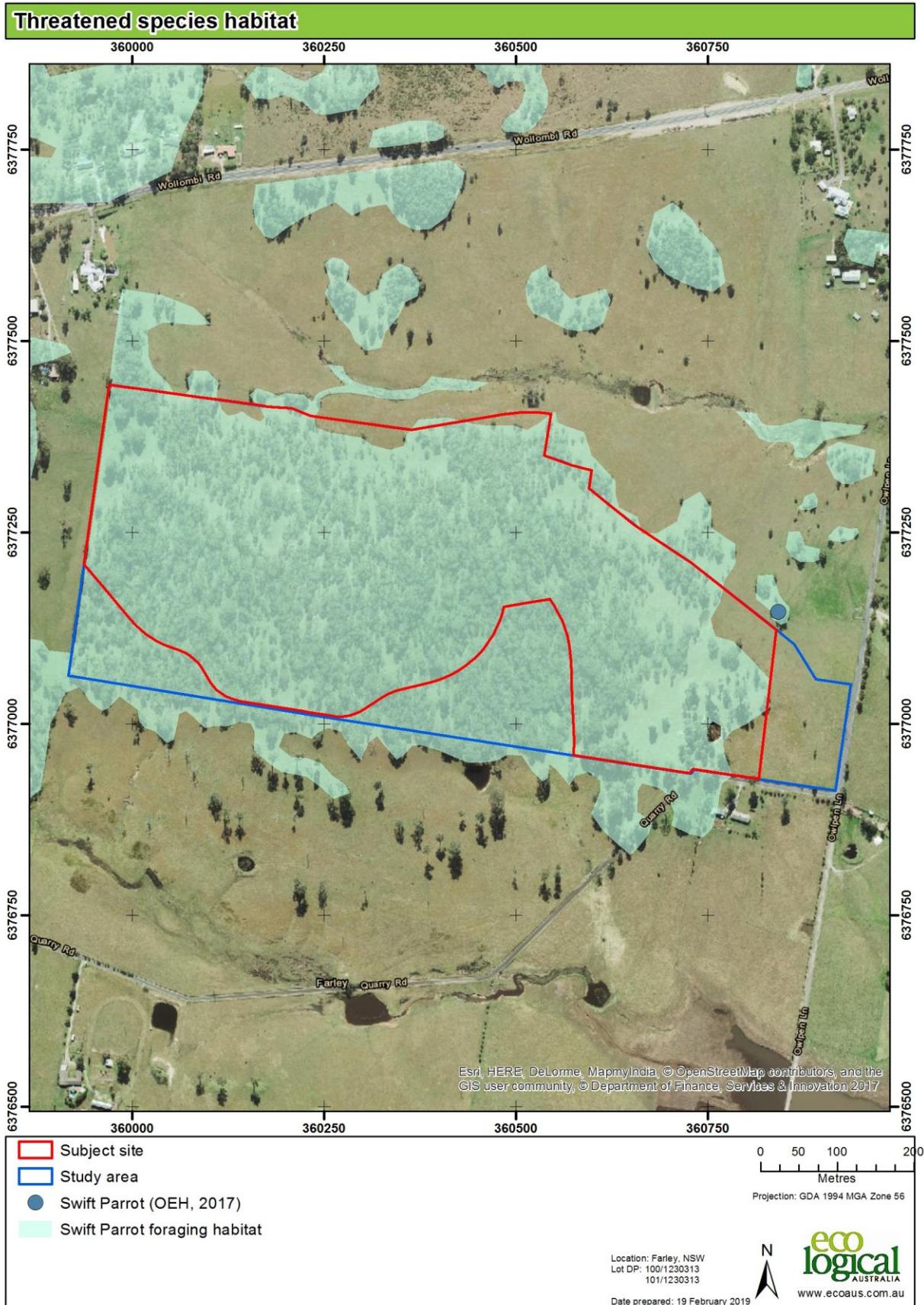


Figure 19 Swift Parrot habitat

6.4 *Pomatostomus temporalis temporalis* (Grey-crowned Babbler)

6.4.1 Conservation status

Local, regional and state conservation status

The Grey-crowned Babbler is listed as Vulnerable under the TSC Act. This species is not listed under the EPBC Act.

Key threatening processes

The main threats to the Grey-crowned Babbler are attributed to loss, degradation and fragmentation of woodland habitat on high fertility soils, excessive grazing, loss of coarse woody debris, invasive weeds including exotic perennial grasses, inappropriate fire regimes, aggressive exclusion from forest and woodland habitat by over abundant Noisy Miners, climate change impacts including reduction in resources due to drought and nest predation by species such as ravens and butcherbirds may be an issue in some regions where populations are small and fragmented (OEH 2018).

'Clearing of native vegetation', 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition' and 'Aggressive exclusion of birds by noisy miners (*M. melanocephala*)' are listed as KTPs in NSW under the TSC Act, which apply to the proposal.

Habitat requirements

This species requires woodland and they are generally unable to cross large open areas. They live in family groups and feed on invertebrates, either by foraging on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses.

They build and maintain several conspicuous, dome-shaped stick nests about the size of a football usually located in shrubs or sapling eucalypts, although they may be built in the outermost leaves of low branches of large eucalypts. A nest is used as a dormitory for roosting each night. This species breeds between July and February and territories range from one to fifty hectares (usually around ten hectares) and are defended all year (OEH 2018).

This species has been identified within BioNet (OEH, 2018) as being known to be associated with HU804 in the locality.

This species was recorded in the study area site during surveys for this SIS and nest were also recorded both within and outside of the subject site. The edges of the open forest vegetation within the study area was identified as habitat for this species.

Recovery plans or threat abatement plans

There is no Recovery Plan or Threat Abatement Plan available for this species.

Assessment of representation within conservation reserves in the region

This species is represented within many conservation reserves within the region. Nearby to the study area, there are records of these species from Sugarloaf SCA, Werakata SCA and Werakata NP.

Within the region, this species is widespread. Within the Sydney Basin Bioregion this species is represented within the following 7 conservation reserves as shown on **Figure 20**.

- Belford National Park
- Goulburn River National Park
- Towarri National Park

- Werakata National Park
- Werakata State Conservation Area
- Wollemi National Park
- Yengo National Park

This species is not at the limit of its known distribution in the study area.

6.4.2 Local and regional abundance

This species has been recorded in the north, west and south of the locality on the edges of what is now large patches of intact woodland or in scattered woodland areas. Within the region, this species is more abundant within the woodland areas on the southern edge of the Hunter Valley and the edges of Goulburn River National Park. There are also records from Yengo National Park and the Gosford area, though it is likely to be less abundant in those areas as open woodland habitat is less common.

Discussion of other known local populations

This species has been observed moving into and outside of the study area from adjacent habitats to the south and south east. It is likely that the family groups that occur in the study area interact with and breed with other family groups centred in habitat outside of the study area to the west. While there are records of this species to the north of the study area, this species is unlikely to occur in a local population given it breeds in Tasmania and only migrates to the mainland for foraging over winter.

There are also likely to be other populations made up of family groups within the south west of the locality on the edges of areas of large intact woodland.

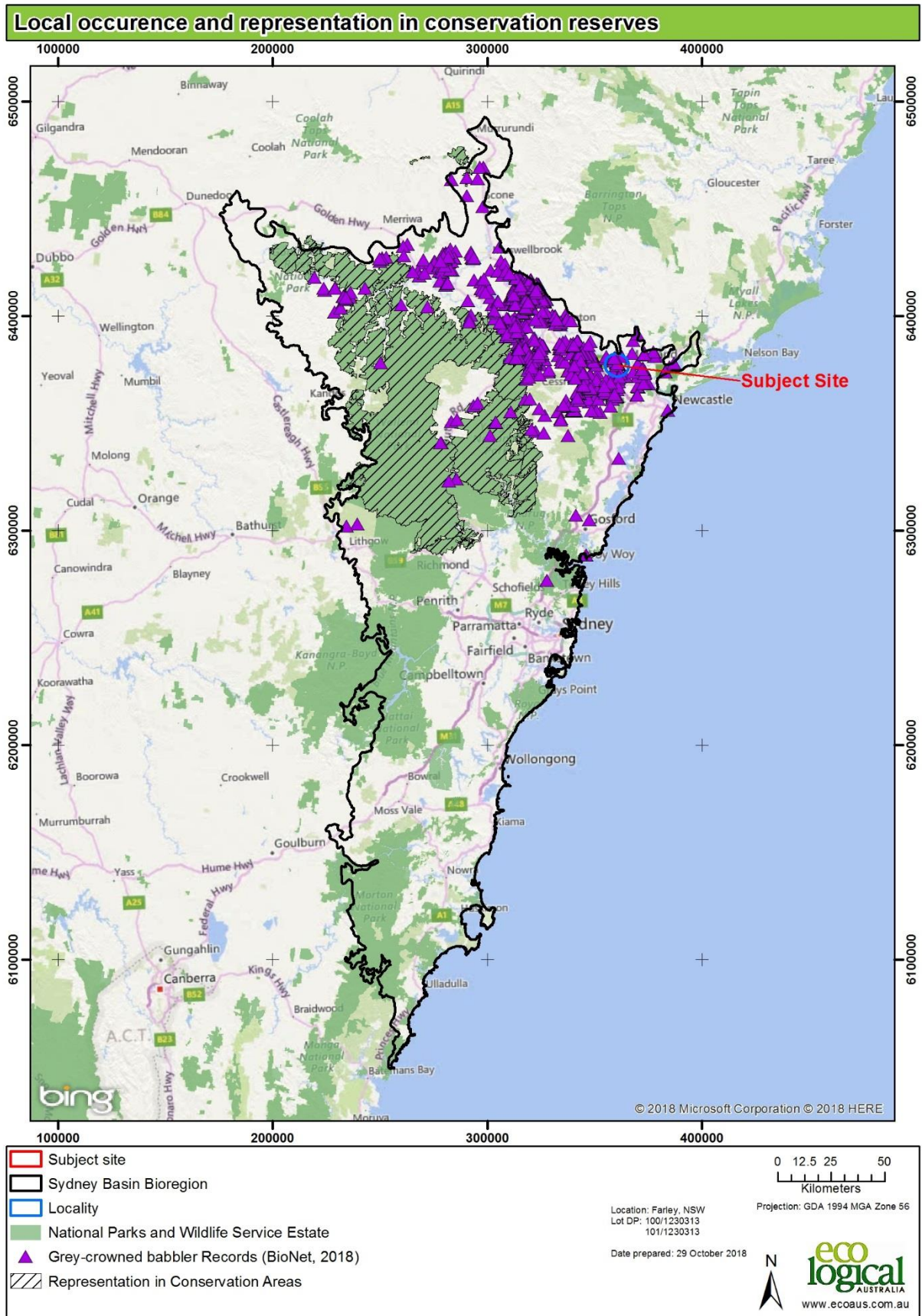


Figure 20 Grey-crowned Babbler (eastern subspecies) regional occurrence

6.4.3 Assessment of habitat

Description of habitat values

Habitat values within the study area include the edges of the open forest, scattered trees, grassed areas and fallen timber. This species also uses a number of trees in the study area for nests.

Discussion of habitat utilisation

This species was observed using the study area for foraging. Six nests were recorded outside of the subject site in woodland that would be retained and so it is likely that it also uses the study area for breeding. Foraging and breeding habitat utilised within the study area included more open grassy areas on the edges of the woodland patch where trees were less dense around the borders of the study area. Nests and general foraging habitat have been mapped in **Figure 21**.

Extent of habitat removal

The proposal will require the removal of approximately 27.5 ha of foraging and breeding habitat within the study area including approximately six (6) nests. This is likely to remove habitat for one or two family groups.

There are larger, more extensive areas of open forest and woodland within the locality to the west of the subject site. It is expected that these areas would also contain breeding and foraging habitat for this species.

While some breeding habitat will remain and adjacent to the study area, the removal of breeding and foraging habitat from the subject site will reduce the viability of the population that currently occurs in the study area.

Consideration of corridors

The proposal is located at the eastern end of a series of larger fragmented patches of woodland to the west. Although there will be clearing of vegetation in order to develop the subject site, there will be retention of vegetation within the study area which will maintain the link with existing vegetation to the west in the locality.

Within a regional context, the development of the subject site will not affect fauna corridors suitable for this species. Extensive vegetation exists to the south and west, including conservation reserves such as Werakata National Park, which is also known habitat for this species.

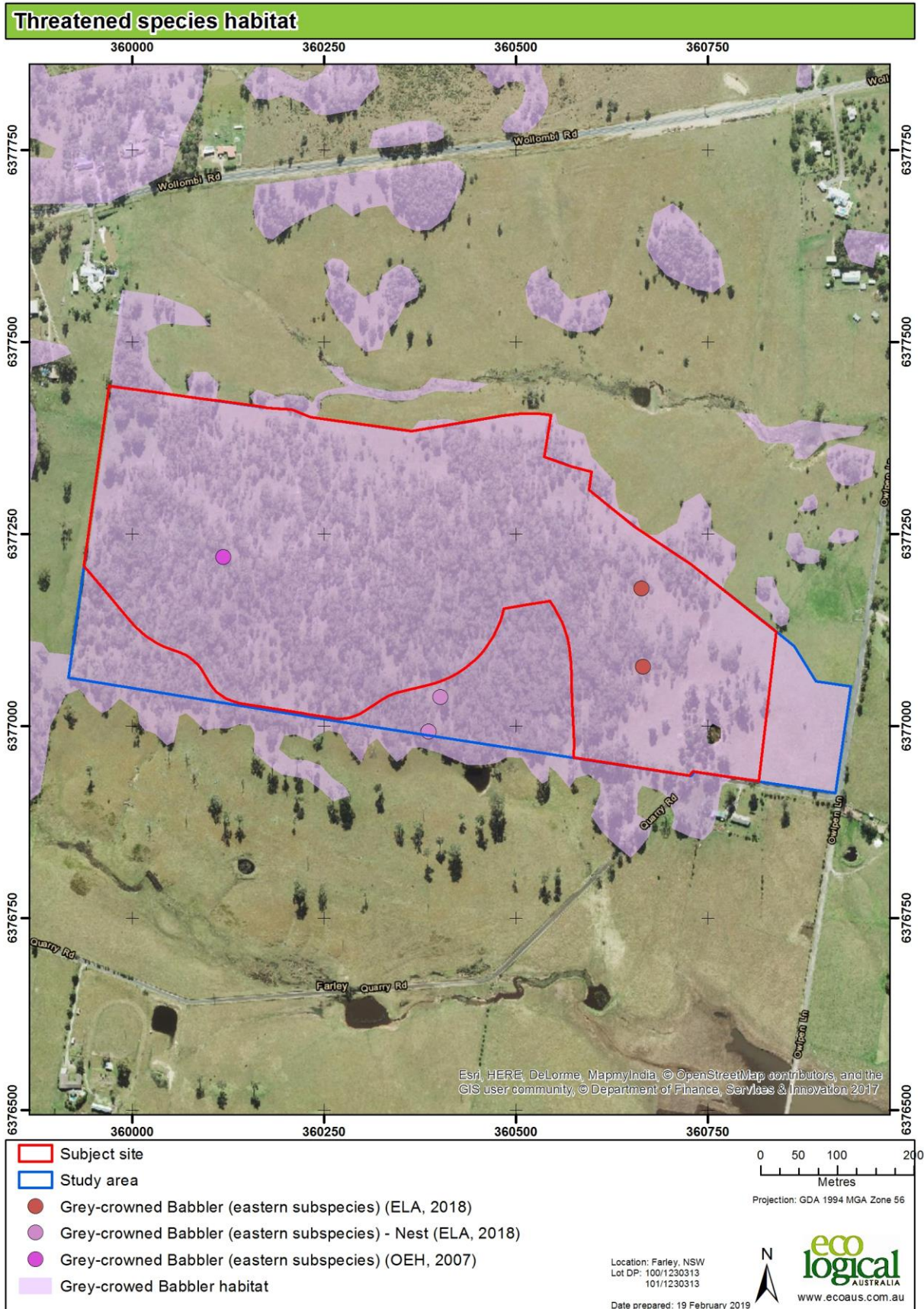


Figure 21 Grey-crowned Babbler (eastern subspecies) local occurrence and habitat occurrence

6.5 Microchiropteran bat species

The assessment of the following microchiropteran bats have been combined for the purposes of this assessment as they share similar habitat attributes and where dissimilarities occur between the species this has been detailed:

- *Miniopterus australis* (Little Bentwing-bat)
- *Micronomus norfolkensis* (syn. *Mormopterus norfolkensis*) Eastern Freetail-bat
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)

6.5.1 Conservation status

Local, regional and state conservation status

Little Bentwing-bat, Eastern Freetail-bat, and Greater Broad-nosed Bat are listed as Vulnerable under the TSC Act. None of the affected microchiropteran bat species are listed under the EPBC Act.

Key threatening processes

Clearing of native vegetation, predation by the *Felis catus* (feral cat), predation by the *Vulpes vulpes* (European red fox), and loss of hollow-bearing trees are listed as KTPs in NSW under the TSC Act, which apply to the proposal. The following KTPs that are listed for these species under the TSC Act will not result from the proposed development:

- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands
- High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition

Habitat requirements

Habitat requirements are similar for all affected microchiropteran bat species. Habitat for these species within the study area consists predominately of foraging habitat. However, there are numerous hollow-bearing trees within the study area which provide potential roosting habitat for these bats. There are no caves, culverts or man-made structures within the study area suitable for breeding habitat for any of these species.

The specific requirements for each species are shown in **Table 8** below.

Table 8: Habitat requirements for affected microchiropteran bats

Species Name	Common Name	Habitat requirements
<i>Miniopterus australis</i>	Little Bentwing-bat	Utilises moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, <i>Melaleuca</i> swamps, dense coastal forests and <i>Banksia</i> scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage in densely vegetated habitats. Breeds in caves, often limestone. Predicted to occur within the LHSGIF in the study area.

Species Name	Common Name	Habitat requirements
Micronomus norfolkensis (syn. Mormopterus norfolkensis)	Eastern Freetail-bat	Occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. This species mainly roosts in tree hollows but will also roost under bark or in man-made structures. Breeds in hollows in dead or alive trees Predicted to occur within the LHSGIF in the study area.
Scoteanax rueppellii	Greater Broad-nosed Bat	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Breeds in live or dead hollow-bearing trees, under exfoliating bark, or buildings Predicted to occur within the LHSGIF in the study area.

Recovery plans or threat abatement plans

There are no Recovery Plans or Threat Abatement Plans for these species.

Assessment of representation within conservation reserves in the region

All species are well represented within conservation reserves within the region. Nearby to the study area, there are records of these species from:

- Werakata National Park
- Werakata State Conservation Area
- Beford National Park
- Hunter Wetlands National Park
- Medowie State Conservation Area
- Sugarloaf State Conservation Area

Within the region, these species are widespread. A summary of the representation of microchiropteran bats within conservation reserves including NPs, SCAs, Regional Parks (RPs) and Nature Reserves (NRs) is shown below in **Table 9**, and Figure 22 to Figure 24.

Table 9: Regional representation of affected microchiropteran bats within conservation reserves

Conservation Reserve Name	Common Name		
	Little Bentwing-bat	Eastern Freetail-bat	Greater Broad-nosed Bat
Agnes Banks NR		X	X
Belford NP		X	
Bents Basin SCA		X	
Berowra Valley NP	X	X	
Blue Gum Hills RP	X		
Blue Mountains NP		X	X
Bouddi NP	X	X	X
Brisbane Water NP		X	X
Bugong NP		X	X
Burratorang SCA			X
Castlereagh NR		X	X
Cattai NP		X	X
Cockle Bay NR	X		X
Conjola NP		X	
Dharawal NP	X	X	X
Dharug NP		X	X
Garigal NP	X		
Gulguer NR		X	
Heathcote NP	X		X
Hunter Wetlands NP	X	X	
Jervis Bay NP			X
Jilliby SCA	X	X	X
Kemps Creek NR			X
Ku-ring-gai Chase NP	X		
Lake Macquarie SCA	X		X
Leacock RP		X	X
Manobalai NR		X	
Maroota Ridge SCA	X		X
Medowie SCA	X		
Meroo NP			X

Conservation Reserve Name	Common Name		
	Little Bentwing-bat	Eastern Freetail-bat	Greater Broad-nosed Bat
Morton NP		X	X
Mulgoa NR			X
Munmorah SCA	X		
Nattai NP			X
Pambalong NR	X	X	X
Parr SCA	X	X	
Pitt Town NR		X	
Popran NP		X	X
Prospect NR		X	X
Royal NP			X
Scheyville NP		X	X
Seven Mile Beach NP			X
Sugarloaf SCA	X	X	X
Sydney Harbour NP		X	
Towra Point NR	X		X
Tuggerah NR			X
Upper Nepean SCA		X	X
Walarah NP	X		
Wambina NR			X
Werakata NP	X	X	X
Werakata SCA	X		
Wianamatta NR		X	X
Wianamatta RP		X	X
William Howe RP		X	
Windsor Downs NR		X	X
Wollemi NP	X	X	X
Wyrabalong NP	X		X
Yengo NP		X	X
Total representation within conservation reserves	23	35	40

X denotes representation within the conservation reserve as indicated by Bionet Atlas records

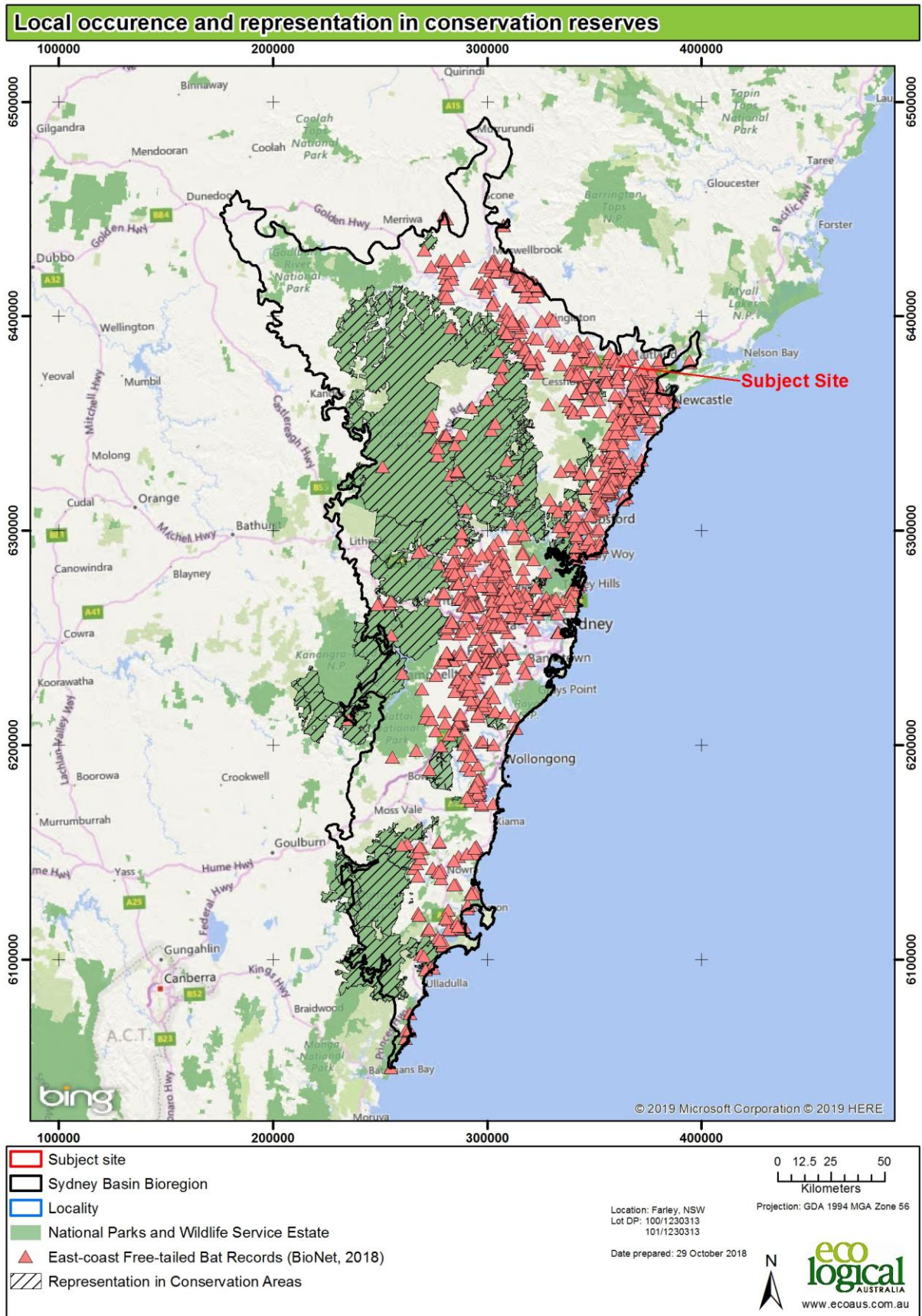


Figure 22 Eastern Freetail-bat regional occurrence

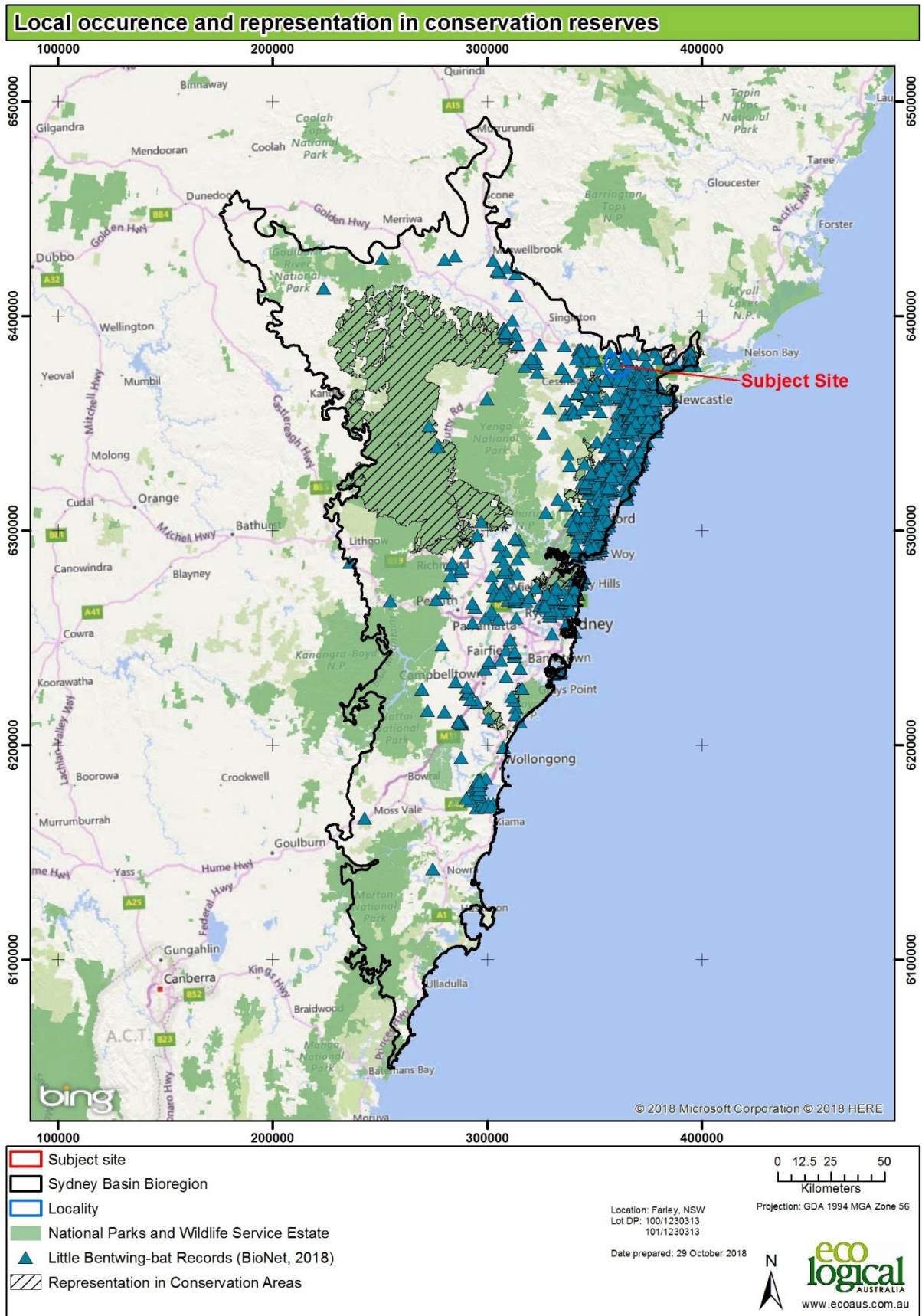


Figure 23 Little Bentwing-bat regional occurrence

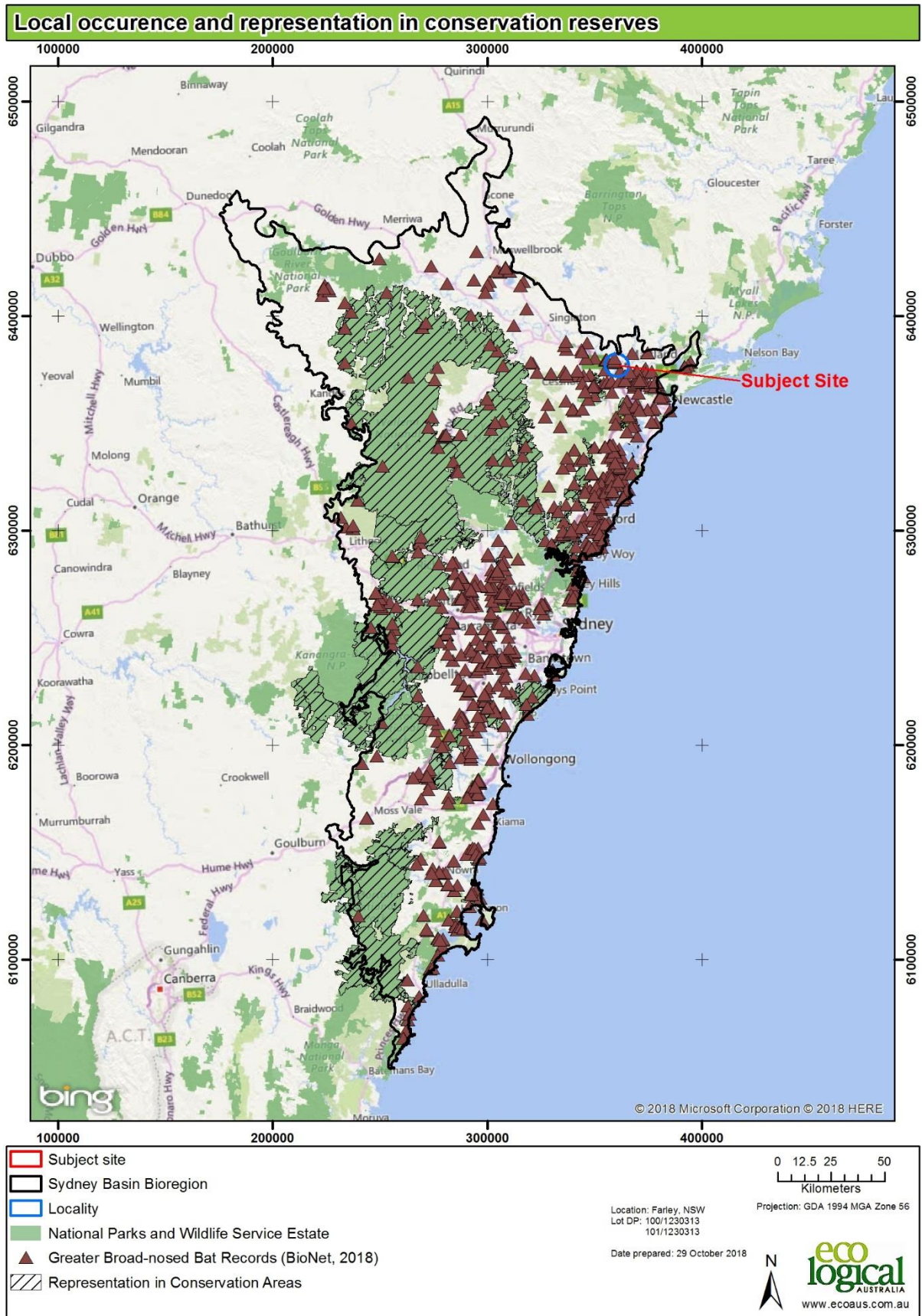


Figure 24 Greater Broad-nosed Bat regional occurrence

6.5.2 Local and regional abundance

Little Bentwing-bats are found on the east coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Eastern Freetail-bats are found along the east coast from south Queensland to southern NSW. Greater Broad-nosed Bats are found mainly in the gullies and river systems that drain from the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland in Queensland. It extends to the coast over much of its range (OEH 2018).

The abundance of affected threatened microchiropteran bats within the locality and region is difficult to estimate as there is little available public data to inform population sizes. As a proxy for population abundance, detection rates across the locality and region are relatively abundant. The populations within the study area, if present, would likely be very low and confined to a foraging aggregation only, given the limited number of calls recorded.

Table 10: Local and regional abundance of affected microchiropteran bats

Species Name	Common Name	Abundance within the study area	Abundance within the locality	Abundance within the region
<i>Miniopterus australis</i>	Little Bentwing-bat	Recorded at two locations within the study area	Recorded at six locations within the locality	Identified at 983 locations within the region. No data available on regional abundance.
<i>Micronomus norfolkensis</i> (syn. <i>Mormopterus norfolkensis</i>)	Eastern Freetail-bat	Recorded at two locations within the study area	Recorded at 13 locations within the locality	Identified at 1174 locations within the region. No data available on regional abundance.
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	Recorded at one location within the study area	Recorded at 6 locations within the locality	Identified at 782 locations within the region. No data available on regional abundance

Discussion of other known local populations

Other local populations of these species exist throughout the region. All of the species recorded are relatively abundant across the Hunter Valley and given the large tranches of vegetation within the locality and region there is likely to be other substantial populations present.

6.5.3 Assessment of habitat

Description of habitat values

Both foraging and roosting habitat values for microchiropteran bat species are present within the study area. Habitat present that would be suitable for insectivorous bats includes open forest, hollow-bearing trees and a dam. Hollow-bearing trees may provide breeding habitat for tree-dwelling bats, however this was not observed within the study area.

Discussion of habitat utilisation

All threatened microchiropteran bats would be utilising the study area primarily as foraging and roosting habitat (Figure 25). Suitable habitat for each species also occurs outside the subject site. Given the highly mobile nature of these species it is likely that they would also use habitat outside of the study area.

Extent of habitat removal

The proposal will require the removal / modification of approximately 26.4 ha of LHSGIF within the study area including the removal of hollow-bearing trees.

Consideration of corridors

The study area is located at the eastern end of east-west corridor of fragmented woodland within the locality. The proposal is not likely to disrupt and movement corridors in for these highly mobile bats and would not separate any areas of breeding and foraging habitat.

In a regional context, the study area is located north of the proposed Biodiversity Corridor the Watagan to Stockton Link (PE, 2016) and would not affect this planned biodiversity corridor. The site is part of a biodiversity corridor identified by House (2003) which sought to prioritise areas of land within the lower hunter and central coast.

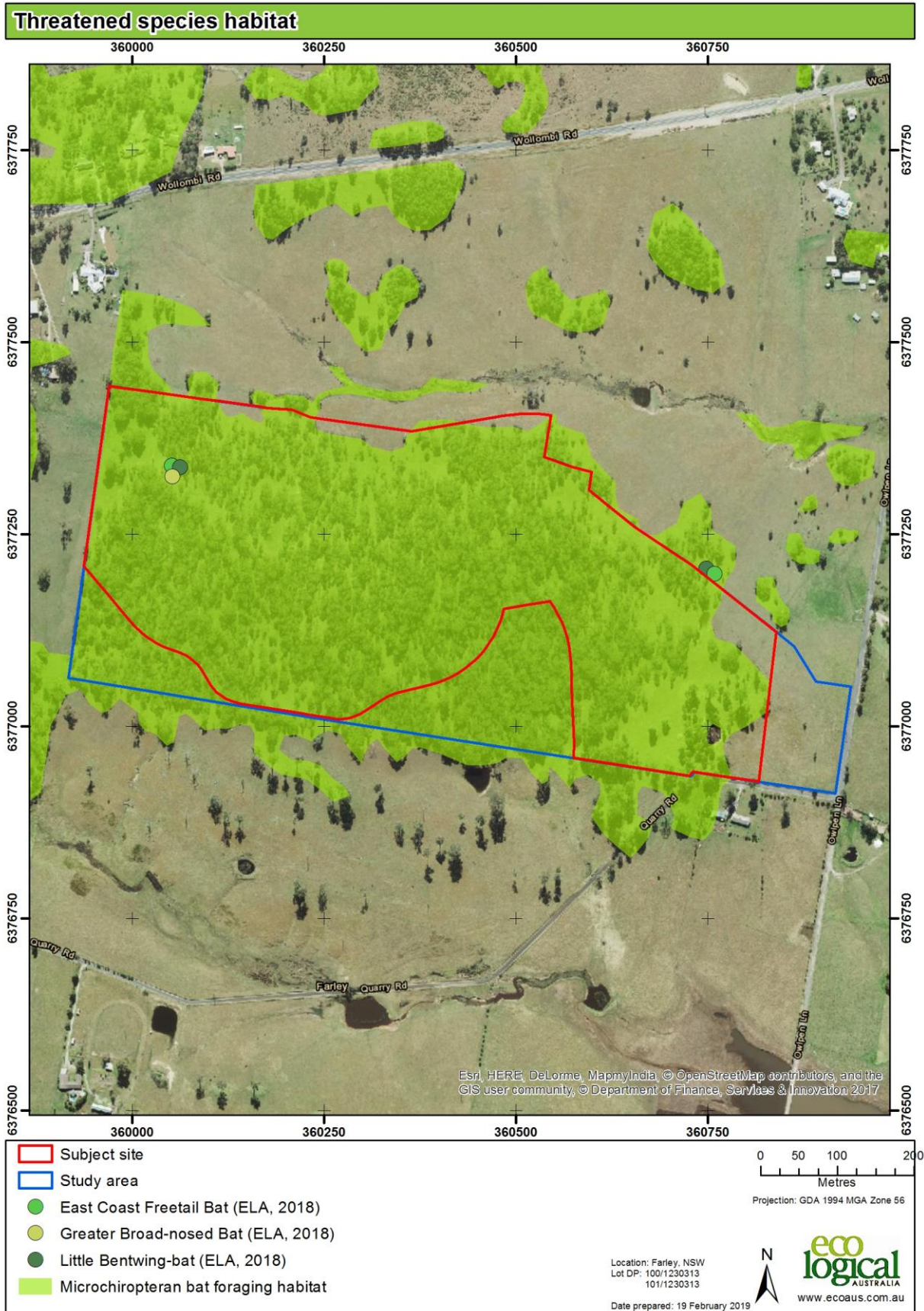


Figure 25 Microchiropteran bat habitat within the study area

7 Assessment of likely impacts on C/EECs

7.1.1 Assessment of ecological communities likely to be affected

One EEC listed as Endangered under the TSC Act has been identified within the study area and is considered within this SIS. This EEC will be directly impacted by the proposed development of the subject site.

7.1.2 Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion

7.1.3 Conservation status

Local, regional and state conservation status

Lower Hunter Spotted Gum- Ironbark Forest in the Sydney Basin Bioregion is listed as an endangered ecological community under the TSC Act. It is not listed under the federal EPBC Act.

Key threatening processes

Key threats to this community include inappropriate fires regime, dumping of rubbish, plants, and cars weed invasion, deliberately lit fires, disturbance by recreational users, fragmentation, lack of protection, change in land use, Noisy Miners, deer, firewood collection, lack of management, climate change, vehicle access, pollution of creek lines from mining (OEH 2018).

The following KTPs that are listed for this community under the TSC Act are unlikely to result from the proposed development:

- High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition
- Aggressive exclusion of birds by noisy miners (*M. melanocephala*)
- Invasion of native plant communities by African Olive *Olea europaea* subsp. *cuspidata*
- Invasion of native plant communities by exotic perennial grasses
- Invasion, establishment and spread of Lantana (*Lantana camara*)

Habitat requirements

This community occurs principally on Permian geology in the central to lower Hunter Valley. The Permian substrates most commonly supporting the community belong to the Dalwood Group, the Maitland Group and the Greta and Tomago Coal Measures, although smaller areas of the community may also occur on the Permian Singleton and Newcastle Coal Measures and the Triassic Narrabeen Group. The community is strongly associated with, though not restricted to, the yellow podsolic and solodic soils of the Lower Hunter soil landscapes of Aberdare, Branxton and Neath. These substrates are said to produce 'moderately fertile' soils (OEH 2018).

Recovery plans or threat abatement plans

There are no recovery plans or threat abatement plans that apply to this community.

Assessment of representation within conservation reserves in the region

This community is well represented in conservation reserves in the Sydney basin Bioregion and is only represented in the following 3 conservation reserves:

- Sugarloaf State Conservation Area
- Werakata National Park
- Werakata State Conservation Area

Lower Hunter Spotted Gum - Ironbark Forest

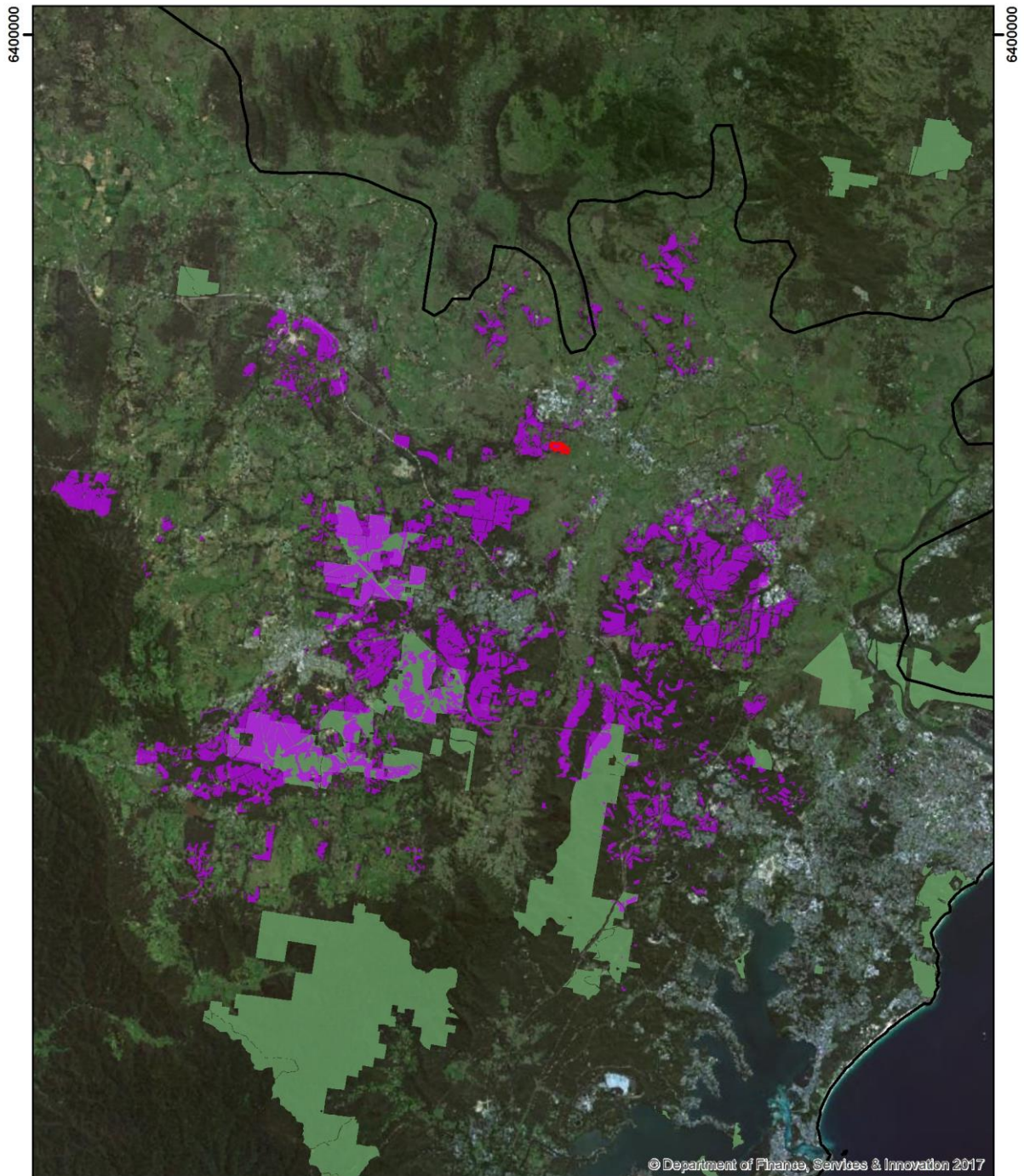


Figure 26 Regional occurrence of Spotted Gum Ironbark Forest EEC

7.1.4 Significance within a local and regional context

Within the study area, approximately 26.4 ha would be removed or modified. The area to be retained contains drainage lines and these areas have been deliberately avoided as they pose an unnecessary environmental impact to locate the development within these areas. The LHSGIF in the study area is in relatively good condition with limited areas of soil disturbance, erosion or weeds, despite being disturbed in the past and surrounding by agricultural land uses.

Within the local context the study area is located on the edge of a local occurrence of 360 ha of this community, which is situated just west of the city of Maitland. The subject site is 26.4 ha, which is approximately 7% of the local occurrence.

Within the regional context, the subject site is approximately 0.1 % of the remaining LHSGIF within the Sydney Basin Bioregion. The tenure of The LHSGIF within the region is predominately within private ownership, with large land holdings of the EEC also in National Parks.

This community is fragmented (over 4,800 fragments) of which most are less than 10 ha in area. The four largest patches are approximately 7,000 ha, which is less than one-quarter of the current distribution, and which is approximately 10% of the estimated pre-European distribution. Approximately 1,600 hectares of this community exists in Werakata National Park (OEH 2018).

7.1.5 Discussion of corridor values

The LHSGIF forest within the subject site occurs on the eastern edge of a larger local occurrence. The proposal will increase edge effects for this community. There are no corridors that link areas of this community within the subject site.

The subject site is located on the eastern end of the local occurrence and does not form part of a corridor for this community in the local context. However, it may form part of a stepping stone corridor for highly mobile fauna species and plant propagules in the wider locality and regional context.

7.1.6 Assessment of habitat

Description of habitat values

The condition of the LHSGIF habitat in the study area is relatively good. There are few weeds or areas of soil disturbance. The vegetation contains native species in all its structural layers.

It provides potential habitat for a number of threatened fauna including Swift Parrot and a wide range of non-threatened flora and fauna.

Disturbance history

As discussed in Section 2.4, the study area appears to have undergone disturbance from under-scrubbing over the past 14 years. Since 2013 it appears that the shrub and ground layer have remained undisturbed. Most of the trees in the study area have been cleared or logged in the past as evidenced by the fact that the majority of trees are of a younger age class than the less common larger trees, which mostly have hollows.

Extent of habitat removal

The proposal will remove 26.4 ha of LHSGIF from the study area. This would have indirect impacts associated with edge effects and fragmentation on the LHSGIF that would remain in the study area.

There are no other development applications within the study area that would contribute to cumulative impacts on LHSGIF. However, the areas to be retained within the study area are sites used for offset

other development located between the study area and Wollombi Road. Management of these offset site will ensure that this community is maintained and managed within the study area.

The estimated amount of the total extent of LHSGIF, based on GIS analysis (OEH, 2010) is 17,500 ha. The quality of all the patches of this community is unknown and there are no quantitative estimates of the area of this community that retains a substantially unmodified understorey (TSSC 2011). The proposal would remove 26.4 ha which is 0.1 % of the estimated total extent of this community.

The estimated amount of LHSGIF in the locality is 360 ha. The proposal is unlikely to cause the local occurrence of LHSGIF to be put at risk of extinction as it involves the removal of only 7 % of the local occurrence.

While the proposal would remove a source of propagules from the local occurrence, habitat and fauna resources would still remain in other patches that form part of the local occurrence. Therefore, while the proposal will remove 7 % of the LHSGIF in the locality, the largest patch (local occurrence) of LHSGIF in the locality is expected to remain viable.

8 Ameliorative measures

Where there is likely to be a significant impact on a threatened species, endangered population or endangered ecological community, the first objective is to avoid the impact. Where avoidance is not possible or feasible, impacts must be mitigated. Those significant impacts that cannot be mitigated can be offset.

8.1 Description of feasible alternatives

The CERs have identified a requirement for a description of any feasible alternatives to the action that are likely to be of lesser effect and the reasons justifying the carrying out of the action in the manner proposed having regard to the biophysical, economic and social considerations and the principles of ecologically sustainable development.

The alternatives for development at the site include:

- Not developing the site at all.
- Proposing a development that responds to the biodiversity values of the study area, its constraints and is of an appropriate scale and nature.

8.1.1 Developing the site

The proposed development is a permissible development and the development application submitted is consistent with the additional permitted uses within the Maitland LEP (MLEP, 2011).

The subject site is zone RU2 – Rural Landscape and minimum lots sizes which can provide for a range of non-agricultural uses where infrastructure is adequate to support the uses and conflict between land uses is minimised.

8.1.2 Appropriate development

The development of the subject site is considered by the applicant to be a balanced approach between conservation and development with an appropriate response with regards to scale, character, and the constraints of the site and locality.

The current proposal is considered the most feasible approach to development at the site given considerations around engineering feasibility and the viability of the development, as well as with due regard to physical and environmental constraints.

The proposed development has been designed to respond to the following:

- The environmental characteristics of the site and locality including topography, drainage, substrate and landform, through:
 - Siting of the development in the flatter areas of the study area and protecting first order streams by Incorporating stormwater management techniques to:
 - Control stormwater quality, adopting stormwater treatment measures to remove pollutants, including sediments, from urban runoff, to closely mimic pre-construction water quality (to levels acceptable to the NSW Office of Water) to minimise impacts on downstream receiving waters;
 - Control stormwater quantity, adopting measures to control runoff and minimise slope gradient and flow distance within disturbed areas, to mimic pre-

construction water quantity to minimise impacts on downstream receiving waters;

- Using designs that are consistent with the existing visual landscape.
- The ecological characteristics of the site including high value features. The design aims to:
 - Minimise impacts to threatened fauna habitat values, in particular to nests of the Grey-crowned Babbler by the configuration of the development, location of roads and Asset Protection Zones
 - Incorporation of all APZs within the development footprint through strategic placement of parking areas and landscaping to avoid additional impacts to biodiversity.

Each of the biodiversity constraints that are relevant to the site has been assessed in accordance with requirements of the EP&A Act and impacts have been avoided and/or minimised wherever possible by modifications to the design of both the northbound and southbound sites.

8.2 Measures to avoid

The following measures to avoid impacts have been or will be incorporated into the proposal:

- The footprint of the proposed development has been sited appropriately to avoid and minimise impacts to threatened species and their habitats, particularly occurrence of Grey-crowned Babbler nests
- A conservation sensitive approach for the creation and management of the APZ will be developed to avoid and minimise impacts to threatened species and their habitats. Details include incorporating all APZ requirements within the development footprint to limit any additional clearing of vegetation outside the immediate footprint of the project.

8.3 Ameliorative measures

The following ameliorative measures will be incorporated into the proposal:

- The non-developed portions of the study will be managed post-development through a Vegetation management Plan (VMP) that aims to ensure that the ecological values of these areas are maintained. The VMP will prohibit the collection of fire wood, bush rock removal, rubbish dumping, vehicular access other than fire fighting vehicles, and restrictions on pets in the conservation area.
- A Biodiversity Management Plan (BMP) will be developed, endorsed, and enacted for the study area which will include:
 - Provisions for compliance with statutory requirements applicable to flora, fauna and fish management within relevant legislative Acts.
 - Flora and fauna management strategies for pre-construction, construction, and post-construction activities including environmental control measures for pre-clearing processes.
 - A fauna rescue and release procedure.
 - A procedure for controlling and introduction and spreading of weeds and pathogens.
 - Strategies for re-use of coarse woody debris and bush rock.
 - Procedures for dealing with unexpected threatened species records.
 - Details of exclusion zones to be established and maintained during construction.
 - Weed management procedures.
 - Pre-clearance procedures.

- Protocols for clearing vegetation and bushrock.
 - Pathogen management controls.
 - Additional management strategies as required, in accordance with the provisions of development consent issued by MCC, and conditions of concurrence by OEH, if they are issued.
- Replacement of tree hollows removed during construction with similar sized nest boxes at a removal: replacement ratio greater than 1:1. Prior to the commencement of construction, 50% of required nest boxes will be installed throughout lands retained. All tree limbs with hollows removed will be relocated into retained areas to improve fauna habitat.

9 Compensatory strategies

The CERs for the proposed development require the proponent to avoid, minimise and ameliorate the impacts of the proposal to the maximum extent possible. Compensatory measures should be considered for any significant impacts that cannot be avoided or mitigated. These offsetting measures should be developed in accordance with the “Principles for the use of Biodiversity Offsets in NSW” and that in particular, the BioBanking Assessment methodology (BBAM) can be used to develop proposed offsetting measures.

Despite the measures taken to avoid and minimise impacts outlined above, the proposal will result in the following impacts:

- Loss of six Grey-crowned Babbler nests
- Loss of 27.5 ha of habitat for threatened fauna species known within the study area
- Loss of 49 hollow-bearing trees.
- Loss of 26.4 ha of the LHSGIF EEC

9.1 Proposed measures to offset residual impacts

The proponent has made a commitment to preserve all retained vegetation and cleared areas for the purpose of improving biodiversity within the study area (the VMP area). This includes all vegetation not directly impacted by the current proposal. The VMP proposal does not include vegetation currently subjected to maintenance for existing powerline easements.

In addition to managing residual land within the study area, and in accordance with Section 7.2.1 of the CERs, the proponent commits to providing offsets for the residual direct impacts of the proposal in accordance with the BBAM (OEH, 2014). The residual impacts for the project have been calculated using the BioBanking Credit Calculator v4.0 (BBCC) using plot and transect data collected as part of the field studies for this SIS.

In addition to those commitments to protect biodiversity in retained areas onsite, and in accordance with the BBCC, the following offsets as described in **Table 11** will be required for the project. This will fully compensate for the 26.4 ha of impact to native vegetation and threatened species habitat.

The required offset will be achieved by retiring all credits as calculated by the BBCC. The credits may be sourced by either:

- Establishing a stewardship site on land owned by the proponent; or
- Purchasing credits from the market
- Converting credit requirements into BAM credits and retiring in accordance with the Biodiversity Offsets Scheme under the BC Act

In accordance with the CERs, the proponent also reserves the right to submit a request for a reasonable equivalence notice to the NSW OEH, for either a portion or all of the credits required by this project, to be converted into suitable credits under the BC Act. Whilst this is not the intent of the offset strategy, the proponent wishes to retain this flexibility given the current Legislative framework overlap in NSW.

ELA notes that the proponent may stage the impacts of the proposal, and as such the offset requirement may be staged commensurate to the level of impact within each stage.

Table 11 BioBanking Credit requirement

Impacted entity	Impact area	Credit type	BioBanking credits required
<i>Lathamus discolor</i> (Swift Parrot)	26.4 ha	Ecosystem	No credits required – associated with vegetation
<i>Pomatostomus temporalis temporalis</i> (Grey-crowned Babbler) (eastern subspecies)		Ecosystem	No credits required – associated with vegetation
<i>Miniopterus australis</i> (Little Bentwing-bat)		Ecosystem	No credits required – associated with vegetation
<i>Mormopterus norfolkensis</i> (Eastern Freetail-bat)		Ecosystem	No credits required – associated with vegetation
<i>Scoteanax rueppellii</i> (Greater Broad-nosed Bat)		Ecosystem	No credits required – associated with vegetation
Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion		Ecosystem	1,357 HU804 credits

The proposed offset will be managed for the purposes of improving biodiversity in perpetuity and will include the following management actions:

- Weed management (both control and suppression) and monitoring
- Management of retained native vegetation and habitat
- Feral animal control
- Fire management (including APZs)
- Public access (including restriction of increased traffic and associated increased refuse and pests)
- Minimisation of edge effects and fragmentation
- Stormwater control and changes to hydrology
- Management of specific habitat enhancement measures
- Fauna displacement and if appropriate translocation
- Proposed surveys, such as baseline, pre-clearance and rehabilitation surveys
- Details of long-term monitoring
- Details of rehabilitation programs including timing, rehabilitation measures, and monitoring
- Measures to ensure conservation in perpetuity

The proponent has already established two biodiversity offsets under BioBanking Agreements under the TSC Act, which generate suitable credits to offset the impacts of the proposed development in this SIS. The proponent currently has the option to buy 552 HU804 credits and 93 HU803 credits; which can be retired to offset the impacts of this development. Maps of the biobank sites containing these credits including the suitable PCTs are shown in Figure 27 and Figure 28. The residual 742 credits will be resolved through appropriate mechanisms (either establishment of a stewardship site, purchase from the market, or convert to BAM credits and retire under the BOS) prior to commencement of construction.

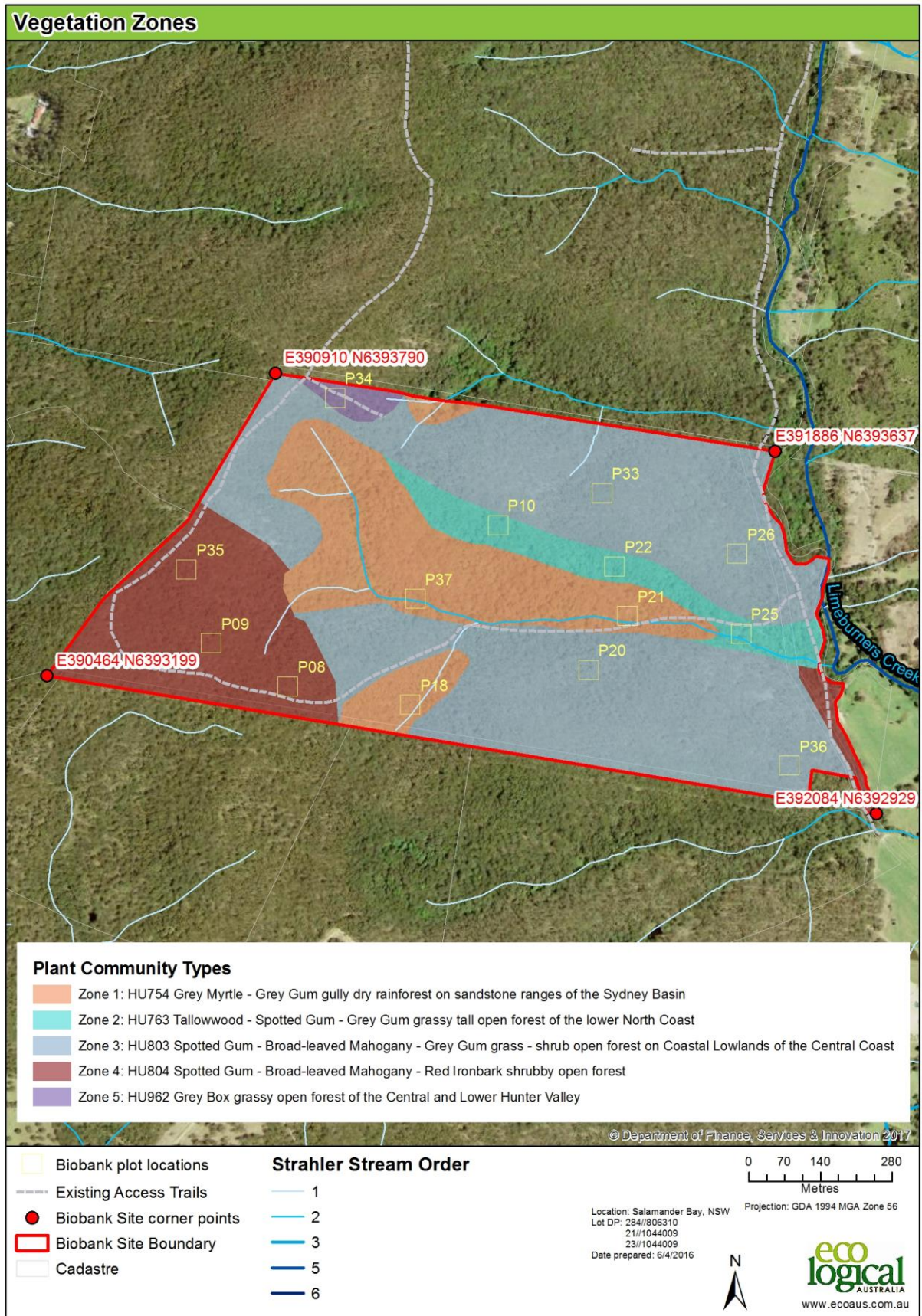


Figure 27 Plant community types at the BA329 biobank site

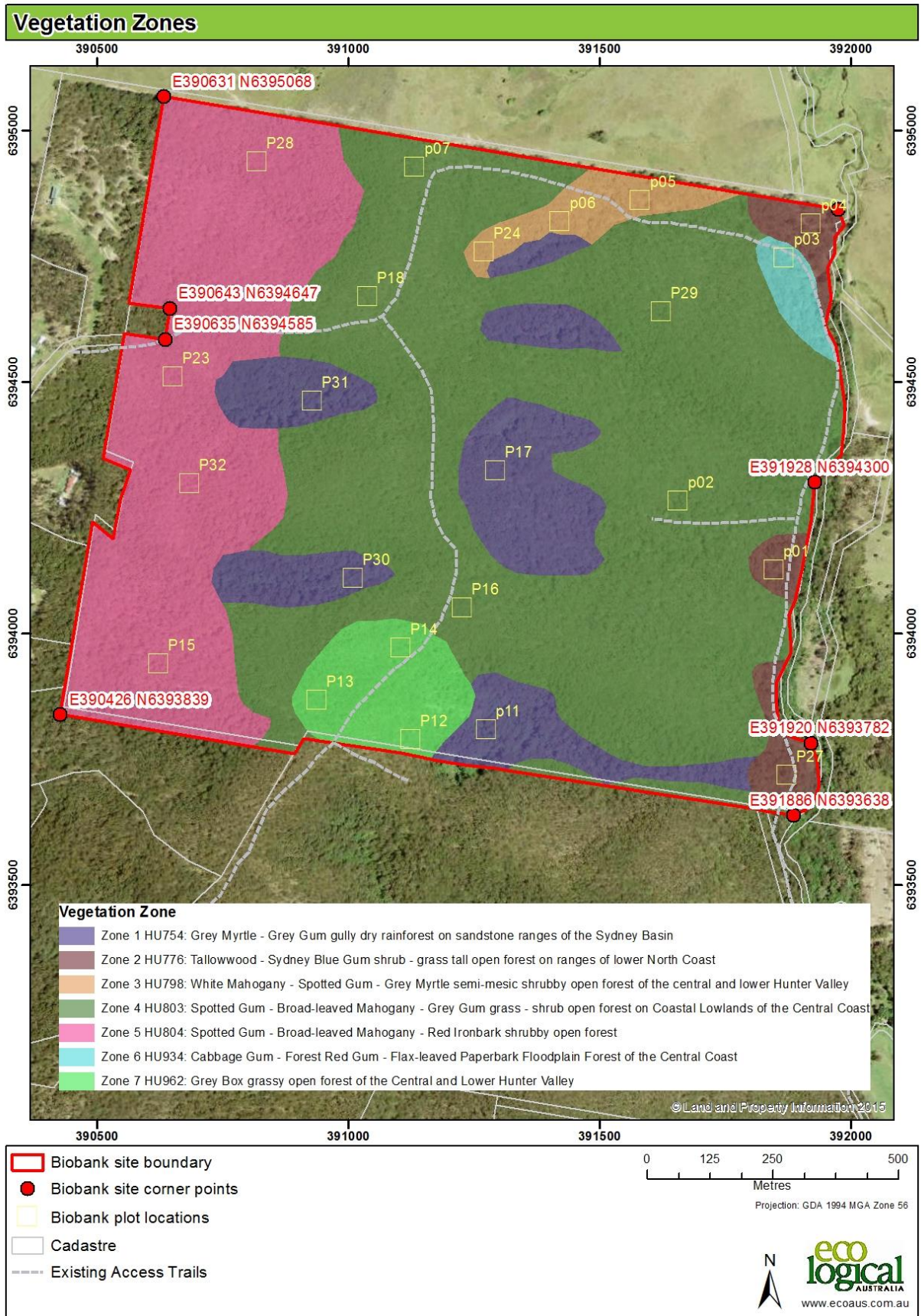


Figure 28 Plant community types at the BA330 biobank site

9.2 Measurement of the adequacy of offsets

Operation of the BBCC was undertaken in accordance with the BioBanking Assessment Methodology (BBAM; OEH 2014). The BBAM was applied to the site in respect to calculation of the number of ecosystem and species credits required for the development, as well as the number of ecosystem credits generated at the proposed offset.

Details of the inputs into the BBCC for the subject site are provided below.

9.3 Operation of the BBCC for the subject site (impact)

9.3.1 Landscape features

Table 12: Landscape feature assessment within the BBCC for the subject site (impact)

Landscape Feature	Data input into BBCC						
IBRA bioregions and subregions	Sydney Basin Bioregion, Hunter IBRA subregion, Hunter – Central Rivers Major Catchment Area						
Mitchell Landscape	Newcastle Coastal Ramp						
Assessment circle size	Outer 1000 ha, inner 100 ha						
Native vegetation extent within outer assessment circle		Before			After		
		ha	%	Cat	ha	%	Cat
	Outer	235	23.5	21 - 25	209	20.9	21-25
	Inner	42.0	42.0	41 - 45	15.6	15.6	16 - 20
Rivers and streams present	2 nd order stream present						
Wetlands within, adjacent, or downstream of the site	None present						
Landscape score components:							
Method applied	Site based assessment						
Percent native vegetation cover within the landscape	21 - 25						
Connectivity value	Connectivity >5 – 30m PFC at BM PFC Mid-storey >50% BM						
Patch size	201 ha						
Strategic location	No						
Landscape value score	12						

9.3.2 Native vegetation

Table 13: Native vegetation assessment within the BBCC for the subject site (impact)

Native Vegetation Feature	Data input into BBCC
Description of PCTs including vegetation class, vegetation type, area (ha) of each vegetation type, species relied upon for identification of vegetation type and relative abundance, justification of evidence used to identify a PCT, EEC status, and estimate percent cleared value of PCT	Data relating to selection of PCTs is contained within Table 5 of this SIS
Vegetation zones within the development site including condition class and subcategory, area, and survey effort	All vegetation zones are as shown in this SIS. Survey effort for each vegetation zone is summarised in Appendix C

9.3.3 Threatened Species

Table 14: Threatened species assessment within the BBCC for the subject site (impact)

Threatened species criteria	Data input into BBCC
Identify ecosystem credit species associated with PCTs	No input required
Species credit assessment	As described in Section 3.1 of this SIS
List of candidate species	As described in Section 3.1 of this SIS
Justification for inclusions and exclusions based on habitat features	As described in Section 3.1 of this SIS
Details of targeted survey technique, effort, timing, and weather	As described in Chapter 4 of this SIS
Species polygons	None required

9.3.4 Plot and transect data

Table 15 Plot and transect data

PlotName	Native species	Native Over storey	Native mid-storey	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant growth	Number of trees with hollows	Over-storey regeneration	Fallen logs
1	20	26	0	50	6	2	0	0	1	0
2	34	13	8	80	44	14	0	1	1	3
3	25	18.5	0	84	10	14	0	0	1	8
4	23	31	1	78	18	12	0	0	1	0

9.4 Consistency of the offset against the NSW Offsets Policy

The NSW offsets policy identifies that the suitability of offsets are guided by thirteen principles. Details of how this BOS complies with the six principles of the NSW offsets policy are provided below.

1. Impacts must be avoided first by using prevention and mitigation measures.

Offsets are then used to address the remaining impacts. This may include modifying the proposal to avoid an area of biodiversity value or putting in place measures to prevent offsite impacts.

This development retains areas around natural drainage lines

2. All regulatory requirements must be met.

Offsets cannot be used to satisfy approvals or assessments under other legislation, such as assessment requirements for Aboriginal heritage sites and for pollution or other environmental impacts (unless specifically provided for by legislation or additional approvals).

The offsets proposed are in addition to the requirements of the development.

3. Offsets must never reward ongoing poor performance.

Offset schemes should not encourage landholders to deliberately degrade or mismanage offset areas in order to increase the value from the offset.

The offset will be managed under an approved management plan and will be audited by the NSW Government.

4. Offsets will complement other government programs.

A range of tools is required to achieve the NSW Government's conservation objectives, including the establishment and management of new national parks, nature reserves, state conservation areas and regional parks, and incentives for private landholders.

The offset will be in addition to any other government conservation objectives.

5. Offsets must be underpinned by sound ecological principles.

Biodiversity management actions, such as enhancement of existing habitat and securing and managing land of conservation value for biodiversity, can be suitable offsets. Reconstruction of ecological communities involves high risks and uncertainties for biodiversity outcomes and is generally less preferable than other management strategies, such as enhancing existing habitat. They must:

- include the conservation of structure, function and compositional elements of biodiversity, including threatened species*
- enhance biodiversity at a range of scales*
- consider the conservation status of ecological communities*
- ensure the long-term viability and functionality of biodiversity.*

Biodiversity management actions at the biobank sites are structured under the BBAM which are designed to improve biodiversity on the offset site. This includes standard management actions, as well as additional management actions for threatened species.

6. Offsets should aim to result in a net improvement in biodiversity over time.

Enhancement of biodiversity in offset areas should be equal to or greater than the loss in biodiversity from the impact site. Setting aside areas for biodiversity conservation without additional management or increased security is generally not sufficient to offset the loss of biodiversity. Factors to consider include protection of existing biodiversity (removal of threats), time-lag effects, and the uncertainties and risks associated with actions such as revegetation. Offsets may include:

- *enhancing habitat and reconstructing habitat in strategic areas to link areas of conservation value*
- *increasing buffer zones around areas of conservation value and removing threats by conservation agreements or reservation.*

Offsets established under the BBAM are designed to achieve a net improvement in biodiversity, through prescribed management actions to reduce degradation of vegetation (weed management, fencing etc) as well as providing a covenant on the land to prevent any further development within the biobank site.

7. Offsets must be enduring – they must offset the impact of the development for the period that the impact occurs.

As impacts on biodiversity are likely to be permanent, the offset should also be permanent and secured by a conservation agreement or reservation and management for biodiversity. Where land is donated to a public authority or private conservation organisation and managed as a biodiversity offset, it should be accompanied by resources for its management. Offsetting should only proceed if an appropriate legal mechanism or instrument is used to secure the required actions.

BioBanking Agreements established under the TSC Act are in perpetuity and run with the land. All BioBanking Agreements are supplemented by a management plan and a costed fund sheet which funds all prescribed management activities.

8. Offsets should be agreed prior to the impact occurring.

Offsets should minimise ecological risks from time-lags. The feasibility and in-principle agreements to the necessary offset actions should be demonstrated prior to the approval of the impact. Legal commitments to the offset actions should be entered into prior to the commencement of works under approval.

The proponent has already established two biobank sites under the TSC Act. The residual offset requirement will be resolved in full prior to commencement of construction.

9. Offsets must be quantifiable – the impacts and benefits must be reliably estimated.

Offsets should be based on quantitative assessment of the loss in biodiversity from the clearing or other development and the gain in biodiversity from the offset. The methodology must be based on the best available science, be reliable and used for calculating both the loss from the development and the gain from the offset. The methodology should include:

- *the area of impact*
- *the types of ecological communities and habitat or species affected*
- *connectivity with other areas of habitat or corridors*
- *the condition of habitat*
- *the conservation status and/or scarcity or rarity of ecological communities*
- *management actions and the level of security afforded to the offset site.*

The best available information or data should be used when assessing impacts of biodiversity loss and gains from offsets. Offsets will be of greater value where:

- *they protect land with high conservation significance*
- *management actions have greater benefits for biodiversity*
- *the offset areas are not isolated or fragmented*
- *the management for biodiversity is in perpetuity, such as secured through a conservation agreement.*

Management actions must be deliverable and enforceable.

The quantity of required offset has been measured using the BBAM, which is the preferred methodology as described by the CERs.

10. Offsets must be targeted.

They must offset impacts on the basis of like-for-like or better conservation outcomes. Offsets should be targeted according to biodiversity priorities in the area, based on the conservation status of the ecological community, the presence of threatened species or their habitat, connectivity and the potential to enhance condition by management actions and the removal of threats. Only ecological communities that are equal or greater in conservation status to the type of ecological community lost can be used for offsets. One type of environmental benefit cannot be traded for another: for example, biodiversity offsets may also result in improvements in water quality or salinity but these benefits do not reduce the biodiversity offset requirements.

The offsets provided are predominately the same credit type as specified by the BBAM, being HU804. Remaining HU803 credits under the proponents control can also be used to offset the impacts as described in the 'like for like' credit list in the BBCC full report (**Appendix G**).

11. Offsets must be located appropriately.

Wherever possible, offsets should be located in areas that have the same or similar ecological characteristics as the area affected by the development.

The offsets proposed are located approximately 35km from the development site, and have the same ecological characteristics, being the same vegetation community.

12. Offsets must be supplementary.

They must be beyond existing requirements and not already funded under another scheme. Areas that have received incentive funds cannot be used for offsets. Existing protected areas on private land cannot be used for offsets unless additional security or management actions are implemented. Areas already managed by the government, such as national parks, flora reserves and public open space, cannot be used as offsets.

The offsets proposed within this SIS are additional to any statutory requirements for local development under Part 4 of the EP&A Act.

13. Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or contracts.

Offsets must be audited to ensure that the actions have been carried out, and monitored to determine that the actions are leading to positive biodiversity outcomes.

All biobank sites are auditable and enforceable.

10 Conclusion

The proposed development includes construction of a seniors living and manufactured home estate within the study area at Farley, NSW. Ecological investigations were conducted as part of a rezoning application to the north of the study area, as well as updated investigations to support the DA for the development of the subject site. It was determined that a significant impact to threatened species would be likely as a result of the removal of threatened ecological community habitat. As such the CERs were requested from OEH, which have guided this SIS.

A desktop assessment was undertaken to determine all threatened species likely to occur within the study area. Based on the PCTs and habitat types available, the list of species was reduced to include only those species likely to occur within the study area. Targeted surveys were undertaken for these species to reduce the list of likely species to those known from the study area. Based on the outcomes of targeted surveys, the following threatened species and threatened ecological communities were identified as known from the study area, and considered affected species the subject of this SIS:

- *Lathamus discolor* (Swift Parrot)
- *Pomatostomus temporalis temporalis* (Grey-crowned Babbler) (eastern subspecies)
- *Miniopterus australis* (Little Bentwing-bat)
- *Mormopterus norfolkensis* (Eastern Freetail-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)
- Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion

Further assessment in accordance with the CERs included an assessment of the local and regional abundance for each of these species and EECs; an assessment of habitat within the region including specific habitat features, habitat utilisation, and the conservation status of the species; and finally an assessment of the likely effect of the proposal at the local and regional scale. Consideration of these factors for each of the affected species was used to guide a revised assessment of the significance of impacts in accordance with section 5A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), known as the ‘Seven-part test’, to inform the consent authority whether the development application (DA) be approved.

To reduce the impacts of the proposal, ameliorative measures were proposed including re-designing the development to avoid and minimise impacts to threatened species and EECs. The proposed development has been designed to respond to the ecological characteristics of the site including high value features. The design does this through:

- incorporation of all APZs within the development footprint through strategic placement of parking areas and landscaping to avoid additional impacts to biodiversity
- The non-developed portions of the study will be managed post-development through a VMP that aims to ensure that the ecological values of these areas are maintained.
- A BMP will be developed, endorsed, and enacted for the study area which will include management strategies for pre-construction, construction, and post-construction activities including environmental control measures for pre-clearing processes.
- Replacement of all tree hollows removed during construction with similar sized nest boxes at a removal: replacement ratio greater than 1:1. Prior to the commencement of construction, 50% of required nest boxes will be installed. All tree limbs with hollows removed will be relocated into retained areas to improve fauna habitat.

Each of the biodiversity constraints that are relevant to the site has been assessed in accordance with requirements of the EP&A Act and impacts have been avoided and/or minimised wherever possible. Despite the measures taken to avoid and minimise impacts, the proposal will result in the following impacts:

- Loss of threatened species habitat
- Loss of 26.4 ha of a threatened ecological community

An offset package has been proposed to compensate for the residual impacts of the project after all ameliorative and avoidance measures have been applied. The proposed offset will provide for security and management, in perpetuity for an area of land within a biobank site. The proponent has already established two biobank sites which will provide for 45% of the offset requirement of the proposed development. The residual offset requirement will be resolved through appropriate mechanisms, prior to commencement of construction, through either (or a combination thereof):

- Purchase and retire of BBAM credits from the market
- Conversion of offset liability into BAM credits and then offsetting in accordance with the BOS under the BC Act

The BBCC has been used to confirm the adequacy of this offset which provides for sufficient habitat to compensate for impacts to threatened species and ecological communities. The offset will be secured in perpetuity by a BioBanking Agreement under the TSC Act.

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Appendix A Chief Executives Requirements for a Species Impact Statement



DOC18/643706-6

Mr Alex Pursche
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Dear Mr. Pursche

Chief Executive's Requirements for a Species Impact Statement for a Proposed Seniors Living Development and Manufactured Home Estate at Farley, in the Maitland City LGA

I refer to your email dated 16 October 2018 to the Chief Executive of the Office of Environment and Heritage (OEH) seeking Chief Executive's Requirements (CERs) for a Species Impact Statement (SIS) for a proposed seniors living development and a manufactured home estate.

OEH previously provided CERs for this matter on 15 October 2018, but they only related to the proposed seniors living development. Your recent email indicates that the proposal also includes the proposed construction of a manufactured home estate. In this instance, given changes to the actual development, OEH has decided to re-issue the CERs. Furthermore, this allows OEH to clarify its position on the 'Transitional and Savings arrangements' under the Biodiversity Conservation (Savings and Transitional) Amendment Regulation 2018. As such these CERs replace those issued on 15 October 2018.

OEH notes that the proposal is located within the Maitland City local government area, which is an 'interim designated area' under the Biodiversity Conservation (Savings and Transitional) Amendment Regulation 2018. As such this means that Part 4 matters (development application) under the *Environmental Planning and Assessment Act 1979* (EP&A Act) are assessed in accordance with the repealed *Threatened Species Conservation Act 1995* (TSC Act) until 24 November 2018.

The SIS is to be prepared in accordance with Section 111 of the repealed TSC Act. OEH understands the proposal is for a seniors living development and a manufactured home estate (by Ravensfield Downs Pty. Ltd. – the applicant) under the Part 4 provisions of the EP&A Act which is located within Lot 100 and Lot 101 in DP1230313, located at Farley, within the Maitland City local government area (LGA).

In response to your request, please find attached CERs for a SIS (**Attachment A**) to address all known and potential threatened species, populations and ecological communities (including their habitat). The SIS must address all likely species, populations, ecological communities and their habitats that may be directly or indirectly impacted by the proposal. A list of potential species, populations and ecological communities has been provided in **Attachment A**. Survey and assessment work already completed can contribute to the SIS so long as it meets OEH survey requirements (including referenced guidelines

and currency [i.e. 5 years or less]) and that the CERs are met by the total survey effort. The proponent will need to ensure that all surveys (both flora and fauna, and targeted surveys) are current (i.e. not greater than five years old), including any BioBanking plots undertaken to inform offsetting strategies, and they are undertaken in accordance with current OEH guidelines or currently accepted methodologies. OEH acknowledges that there is no requirement to officially use Biobanking, but it is useful in quantifying the amount of offsetting required. Similarly, OEH is not obliged to accept the outcomes of a Biobanking assessment as the SIS process is a negotiated outcome. Any BioBanking assessments will need to use the 2014 methodology and all appropriate calculator files must be submitted via the OEH portal. If biodiversity credits are used as part of the offsetting process and concurrence is given, they will be converted over to the appropriate credit equivalents under the *Biodiversity Conservation Act 2016*. Credit variations permitted under the Framework for Biodiversity for Major Projects or the Biodiversity Assessment Methodology (BAM 2017) for State Significant Developments (SSD) / State Significant Infrastructure (SSI) projects do not apply to Part 4 matters.

Following completion of the SIS, it is to be submitted to the Maitland City Council as the consent authority. If the consent authority determines that the proposal is likely to have a significant effect on threatened species, populations or ecological communities (including their habitat), then the concurrence of the Chief Executive of OEH is required before consent may be granted. A concurrence application is not required should Council decide to reject the application or if Council determines that the proposal is unlikely to have a significant effect on threatened species, populations or ecological communities. The consent authority must ensure that the SIS is compliant with the CERs.

Under the Biodiversity Conservation (Savings and Transitional) Amendment Regulation 2018 (Clause 7 (1)f), the development application must be submitted to Maitland City Council (the consent authority) before 24 November 2018. If not, then the proposal may be subject to the *Biodiversity Conservation Act 2016* and would likely trigger the application of the Biodiversity Offset Scheme and the application of the Biodiversity Assessment Method. **The SIS must be submitted to Maitland City Council before the 24 February 2018.** If not, the proposal will need to be assessed under *Biodiversity Conservation Act 2016*.

Please note that the issuing of CERs is a statutory requirement for OEH and should not be considered as support or endorsement of the proposed development.

If seeking concurrence, OEH requests that Council or the proponent provide: one (1) printed copy and a searchable electronic copy (i.e. *.pdf format) of the SIS (including copies of survey data sheets and GIS mapping files), the original development application, any social and economic appraisal of the development and any supporting or background reports (including previous surveys). Any BioBanking calculations undertaken for offsetting purposes must include the submission of the credit calculator files and associated field data sheets and GIS mapping files. A checklist for determining if the SIS has met the requirements of the Minister administering the TSC Act is provided in **Attachment B**.

If you require any further information regarding this matter please contact Steve Lewer, Regional Biodiversity Conservation Officer, on 4927 3158.

Yours sincerely



NICOLE DAVIS
ACTING SENIOR TEAM LEADER - PLANNING
 HUNTER CENTRAL COAST BRANCH
 CONSERVATION AND REGIONAL DELIVERY DIVISION

18 October 2018

Enclosures: Attachments A & B

Cc. Brad Everett
Director – Ravensfield Downs Pty. Ltd.
C/- P.O. Box 3042, Thornton, NSW 2322

ATTACHMENT A:

CHIEF EXECUTIVE'S REQUIREMENTS FOR A SPECIES IMPACT STATEMENT FOR A PROPOSED SENIORS LIVING DEVELOPMENT AND MANUFACTURED HOME ESTATE AT FARLEY, NSW

The purpose of a Species Impact Statement (SIS) is to:

- allow the applicant or proponent to identify threatened species issues and provide appropriate amelioration for adverse impacts resulting from the proposal
- assist consent and determining authorities in the assessment of a development application under Part 4 or request for Part 5 approval under the EP&A Act
- assist the Chief Executive of OEH in deciding whether or not concurrence should be granted for the purposes of Parts 4 or 5 of the EP&A Act
- assist the Chief Executive of OEH or the Minister for the Environment when consulted for the purposes of Parts 4 or 5 of the EP&A Act
- assist the Chief Executive of OEH in the assessment of Section 91 License applications lodged under the TSC Act.

DEFINITIONS

The definitions given below are relevant to these requirements:

- **abundance** means a quantification of the population of the species or community
- **activity** has the same meaning as in the EP&A Act
- **affected species** means subject species likely to be affected by the proposal
- **conservation status** is regarded as the degree of representation of a species or community in formal conservation reserves
- **DA** number means Development Application number
- **development** has the same meaning as in the EP&A Act
- **Chief Executive** means the Chief Executive of the Office of Environment and Heritage
- **DP** means *Deposited Plan* which is the **plan** number given to a subdivision that is registered by the Land Property Information
- **LGA** means local government area
- **locality** means the area within a five (5) kilometre radius of the study area.
- **region** has the same meaning as that contained in the TSC Act
- **significant species** means species not listed in the TSC Act but considered to be of regional or local significance
- **study area** is the subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly.
- **subject site** means the area which is proposed for development/activity
- **subject species** means those threatened and significant species, populations and ecological communities which are known or considered likely to occur in the study area
- **threatening process** has the same meaning as that contained in the TSC Act; the definition is not limited to key threatening processes.

All other definitions are the same as those contained in the TSC Act.

MATTERS WHICH HAVE BEEN LIMITED OR MODIFIED

The following Section 110 matters in the TSC Act need only be addressed where relevant:

- all reference to threat abatement plans; and
- all reference to critical habitat. At the time of printing, the areas of declared critical habitat are not relevant to this proposal.

The proponent should be aware that recovery plans may be approved, critical habitat may be declared and key threatening processes may be listed between the issue of these requirements and the granting of consent. If this occurs, these additional matters will need to be addressed in the SIS and considered by the consent, determining or concurrence authority.

MATTERS TO BE ADDRESSED

The TSC Act provides that the SIS must meet all the matters specified in Sections 109 and 110 of the TSC Act with the exception of those matters limited above. The requirements outlined in Sections 109 and 110 (excluding the matters limited above) have been repeated below (*italics*) along with the specific CERs for your proposal. Previous surveys and assessments that are relevant to the locality may be used to assist in addressing these requirements.

Section 111 (1) of the TSC Act states that an applicant must comply with the CERs concerning the form and content of the SIS. Failure to fully comply with the CERs is therefore a potential breach of the legislation, and may result in OEHL being unable to grant concurrence to a request by the consent authority to carry out the activity. Accordingly, the SIS must be formatted to follow the sections and subsections provided in the CERs.

1 FORM OF THE SPECIES IMPACT STATEMENT

- 1.1 *A species impact statement must be in writing (Section 109 (1));*
- 1.2 *A species impact statement must be signed by the principal author of the statement and by:*
 - (a) *the applicant for the licence, or*
 - (b) *if the species impact statement is prepared for the purposes of the Environmental Planning and Assessment Act 1979, the applicant for development consent or the proponent of the activity proposed to be carried out (as the case requires) Section 109(2)).*

The applicant or proponent must sign the following declaration:

"I... [insert name], of ...[address], being the applicant for the development consent...[insert DA number, Lot & DP numbers, street, suburb and LGA names] have read and understood this species impact statement. I understand the implications of the recommendations made in the statement and accept that they may be placed as conditions of consent or concurrence for the proposal".

2. CONTEXTUAL INFORMATION

2.1 Description of proposal, subject site and study area

A species impact statement must include a full description of the action proposed, including its nature, extent, location, timing and layout (Section 110 (1))

2.1.1 Description of the proposal

A full description of the action includes a description of all associated actions, including, but not restricted to: - location of all lots / building envelopes, installation and maintenance of any proposed buildings / dwellings and associated structures, the proposed number and size of such lots, buildings / dwellings and associated structures, location of any associated facilities (including roads, amenities and other services), fire protection zones, access and egress routes, changes in surface water flows, impacts of noise disturbance and pollution, and any increases in people and road traffic. Actions that occur both on and off the subject land as a result of the proposal must be assessed; including actions conducted during any construction phase and any proposed action post-construction (e.g. proposed actions within a management plan).

2.1.2 Definition of SIS study area

The SIS study area must be defined. The study area will generally be larger than the development site as it includes any adjacent areas that will be directly or indirectly affected by the proposal. In defining the study area consideration shall be given to possible indirect effects of the proposed action on the area surrounding the subject site, for example habitat fragmentation, vegetation corridors, altered hydrology regimes, soil erosion, pollution, and increased human presence or associated impacts. These may include adjacent parcels of land containing suitable habitat for threatened species. It is therefore important to recognise that these parcels may need to be investigated along with the development site. The location, size and dimensions of the study area shall be provided. In describing the study area, the SIS must consider cumulative impacts, such as additional known or proposed development adjacent to the works subject to this proposal.

The study area should be established before the list of likely impacted threatened species, populations, ecological communities (including their habitat) is determined so species etc. that are less obviously affected are also included. The study area must be clearly defined, marked on a geo-referenced map / aerial photograph (or equivalent), clearly showing the development site boundary and any additional areas facing indirect impact, and included in the final report.

Direct impacts are those that directly affect individuals or their habitat. Examples of direct impacts include:

- poisoning or removal of the organism itself
- removal of habitat
- clearing of native vegetation / habitat

If the proposal involves the clearing of vegetation and removal / damage to habitat the environmental assessment must clearly articulate the size of this impact, and where applicable delineate this based on vegetation / habitat type.

Indirect impacts occur when project-related activities affect species, populations or ecological communities in a manner other than direct loss. Examples of indirect impacts include (but not limited to):

- sediment, pollutant or nutrient runoff into adjacent vegetation
- habitat fragmentation or isolation
- implementation of asset protection zones (*though these may also represent direct impact)
- loss of genetic diversity of threatened species, populations or communities
- altered pollination syndromes that may adversely affect seed set
- soil erosion
- altered hydrology regimes (including downstream impacts)
- changes to the saline / freshwater balance in marine environments
- exposure to heat or predators, or loss of shade
- inhibition of nitrogen fixation
- weed invasion and feral animal incursion
- introduction and spread of pathogens, such as Dieback fungus (*Phytophthora*) and Myrtle Rust (*Uredo rangellii*)
- noise
- dust
- light pollution (i.e. increasing skyglow from uncontrolled urban uplight)
- fire (such as changes to intensity and frequency)
- fertilizer drift
- increased human activity (including litter) within or directly adjacent to sensitive habitat areas.

Indirect impacts should not be just limited to the terrestrial habitats. In stances where a development site adjoins marine, estuarine and riparian / riverine environs / habitat, impacts on these must be considered.

A map of the locality, showing any locally significant areas for threatened species such as parks and reserves, and areas of high human activity such as townships, regional centres and major roads will also be provided. The location, size and dimensions of study area shall be provided.

Where any biodiversity offsets are proposed, the proponent must provide OEH with a proper survey plan, prepared by a registered surveyor that clearly shows the location and boundaries of any offset land. A printed copy of each survey plan must be provided to OEH at A1 or A0 scale. The survey plan must be of a form that is acceptable to OEH. Electronic copies should also be provided.

2.3 Land tenure information

Information about the land tenure across the study area. Any limitations to sampling across the study area (e.g. denied access to private land) shall be noted.

3 INITIAL ASSESSMENT

A general description of the threatened species or populations known or likely to be present in the area that is the subject of the action and in any area, that is likely to be affected by the action (Section 110 (2)(a)).

3.1 Identifying subject species

3.1.1 Assessment of available information

In determining these species ('the subject species'), consideration shall be given to the habitat types present within the study area, recent and historic records of threatened species or populations in the locality and the known distribution of threatened species.

Databases such as OEH's *Atlas of NSW Wildlife* (www.bionet.nsw.gov.au), *BioBanking Credit Calculator* (www.environment.nsw.gov.au/biobanking/calculator.htm), *Atlas of Living Australia* (www.ala.org.au), *Australian Museum* (<http://ozcam.org.au>), *Birdlife Australia* (<http://birdsaustralia.ala.org.au/BDRS/home.htm>), and the *Royal Botanic Gardens* (<http://plantnet.rbgsyd.nsw.gov.au>) should be consulted to assist in compiling the list. It should be noted that if the OEH Wildlife Atlas is the only database that is referred to, due to data exchange agreements, the data provided by OEH will only include that for which OEH is a custodian. In many cases, this may only be a small subset of the data available. Other databases must also be consulted to create a comprehensive list of subject species.

The following species shall be considered for inclusion in the list of subject species, as they have either been recorded in the general area (approx. 10km radius), are within the species' known geographic limits or their broad habitat preferences may be present on site:

Threatened Species

(* indicates species that are listed on the *Environment Protection and Biodiversity Conservation Act 1999*).

Flora (14 taxa):

For targeted surveys please note the following known flowering / fruiting times for each species to time surveys appropriately. Surveying at these times is required for species that are not readily detectable (or are cryptic), where flowers or fruits are necessary for their positive identification. If targeted flora surveys for these species are conducted outside a species known phenology then justification must be provided as to why; if this is not provided or considered inappropriate, then all such species will be considered to be present on all available habitat and in viable numbers, and as such will require suitable biodiversity offsets or their habitat avoided. For species which do not require flowers / fruits for positive identification (e.g. large trees / shrubs), then survey as appropriate (though appropriate justification on methods used is still required). It is recommended to utilise known reference sites to help delineate flowering patterns and sampling timeframes. OEH can provide advice on this for some species.

Note: Indirect impacts may lead to direct loss, and as such must be adequately quantified and assessed. Both impacts within the proposed development footprint and on adjacent / surrounding lands must be considered, and where appropriate adequately considered and addressed.

2.1.3 Description of SIS study area

The description of the study area must include (but not limited to):

- The vegetation communities (Plant Community Types [PCTs], including derived types and derived native grasslands – OEHL notes that attached correspondence to the SIS request contained a map that showed both wooded and likely derived grassland communities) and habitat types, including identification of the classification system used in the SIS. Details of the methodology adopted to delineate vegetation communities on site (e.g. random stratified sampling). Full floristic description of all vegetation communities present (including disturbed and undisturbed). A listing of the amount (in hectares) of each vegetation community in the study area. A geo-referenced map / aerial photograph (or equivalent) showing the location of the vegetation communities. A full floristic list in tabular format of all taxa (both native and exotic) recorded on the subject site, indicating which communities they occur in, their cover / abundance and frequency, conservation (including taxa of conservation significance) and comparisons to previous vegetation studies / mapping (if applicable);
- An examination of previous land uses and events, and the effect of these land uses and events on the study area. Examples of such land uses and events are clearing, timber felling, draining, recreational use and agricultural activities (including grazing);
- An examination of the fire history, or at least the time since the last fire, for the subject site is to be provided. Ideally, information on the frequency, season and intensity of fire events on the subject site will be provided. To adequately address this requirement, it may be necessary to consider fire events in the surrounding landscape;
- The local government land zoning and any proposed rezoning, and an examination of the degree of protection that current zoning and any proposed rezoning provides or will provide to native vegetation and threatened species, populations and ecological communities on the subject site and in the study area and the locality;
- The land tenure and any proposed changes (e.g. acquisition by OEHL as a nature reserve, national park, regional park etc.), and an examination of the degree of protection that current land tenures and any proposed land tenures provides or will provide to native vegetation and threatened species in the study area;
- Cumulative impacts of surrounding development, both known and proposed.
- State Environmental Planning Policies (e.g. SEPP (Coastal Management) 2018 [formerly SEPP 14 Coastal Wetlands, SEPP 71 Coastal Protection etc.], SEPP 44 Koala Habitat Protection) and an examination of the degree of protection these policies provide to native vegetation and threatened species on the subject site and in the study area; and
- Relevant Local Government planning instruments, including Local Environmental Plans and Development Control Plans.

2.2 Provision of relevant plans and maps

A plan of the subject area, including the scale of the plan should be provided. An aerial photograph (preferably colour) of the locality (or reproduction of such a photograph) shall be provided, if possible. This aerial photograph should clearly show the subject site and the scale of the photograph. It should be geo-referenced and show the date of the photograph.

A geo-referenced topographic map or equivalent of the subject site and immediate surrounds at an appropriate scale should be provided. This map should detail the location of the proposal and location of works on site (including areas of indirect impact). Additionally, to provide an overview of the natural landscape in the general locality, the map should show or be overlain with details of vegetated (i.e. woody [e.g. forests, woodland, shrubland and heath] and non-woody native vegetation [e.g. grassland, sedgeland and saltmarsh]) vs. cleared areas, as well as indicating the current activities/usage of this land, such as rural, agricultural, industrial and residential. OEHL expects a separate map will be provided to indicate what specific vegetation communities are on subject site (as detailed above in Section 2.1.3).

Targeted flora surveys must also adequately sample / cover all suitable habitat on the study area, and utilise suitable detection techniques (as per OEH 2016) such as belt transects (at appropriate widths to spot cryptic species) or random meanders (that sufficiently cover all known / potential habitat areas [i.e. not just the tracks or readily accessible areas]). If targeted flora surveys are poorly conducted or surveyed out of season (incl. > 5 year currency) then appropriate justification must be provided as to why; if this is not provided or considered inappropriate, then all such affected species will be considered to be present on all available habitat and in viable numbers, and as such will require suitable biodiversity offsets or their habitat avoided.
Subject threatened flora to be considered:

- **Bynoe's Wattle (*Acacia bynoeana*)*** - flowering mainly in the summer (Harden 2002) from September until March and the fruit matures November to January with the peak fruit maturation occurring in November (Driscoll 2006).
- **Netted Bottle Brush (*Callistemon linearifolius*)** – flowers spring to summer (Harden 2002), with Benson & McDougall (1998) specifically noting October to November in the Greater Sydney Region.
- **Small Snake Orchid (*Diuris pedunculata*)*** - flowers August to September (Bishop 2000); historically recorded from the Lower Hunter (e.g. Maitland), appears now confined to north east NSW on the New England Tablelands, around Armidale, Uralla, Guyra and Ebor; typically grows on grassy slopes or flats (OEH – Threatened species profile database, accessed December 2014).
- **Slaty Red Gum (*Eucalyptus glaucina*)** – flowers from September to November (Brooke & Kleinig 1999); locally frequent, though restricted to Casino, Taree to Broke, and west of Maitland areas; known to hybridise with the closely allied red gum – *Eucalyptus tereticornis* (e.g. Taree area). It can be distinguished by its angled (quadrangular) younger branchlets which have persistent angle striations on older growth (K. Hill [RBG] correspondence sent to DECC).
- **Parramatta Red Gum (*Eucalyptus parramattensis* subsp. *decadens*)*** – flowering typically occurs between November to January (Bell 2006).
- **Tangled Bedstraw (*Galium australe*)** – poorly recorded in NSW; following a taxonomic revision, many recent records in NSW have been re-determined as other species, as such Tangled Bedstraw has been recorded historically in the Nowra (Colymea) and Narooma areas and is extant in Nadgee Nature Reserve, south of Eden, though its actual NSW distribution is still unclear, records in the Sydney area are yet to be confirmed; most flowering collections have been made in late spring to early autumn, potentially overlooked due to its small size and cryptic nature, fruits required to separate genera *Asperula* and *Galium* (Harden 1992); flowers spring – summer (Thompson 2009).
- **Small-flower Grevillea (*Grevillea parviflora* subsp. *parviflora*)*** – flowers from July to December (Benson & McDougall 2000, Makinson 2000, Harden 2002, Fairley 2004); in the Lower Hunter, Lake Macquarie / Newcastle area flowering normally occurs annually between late September and early December (Falding 2013).
- **Small Water-ribbons (*Maundia triglochoides*)** – flowers November to January, in the warmer months (Harden 1993, Benson & McDougall 2002); without flowering material it may be confused with the more common genus *Triglochin* (i.e. 'individual fruit dehiscent but carpels remaining fused along their central axis for most of their length, ovule pendulous, attached at the apex of ovary in *Maundia*' cf. 'individual fruit separating into carpels, ovule erect, attached at the base of the ovary in *Triglochin*' [Aston 1971, Harden 1993]), though *Maundia* tends to have spongy inflated leaves compared to linear, flattened or terete and strap-like in *Triglochin* (Aston 1971, Harden 1993).
- **North Rothbury Persoonia (*Persoonia pauciflora*)*** - extremely restricted distribution; all but one of the plants which make up the only known population occur within a 2.5 km radius of the original specimen at North Rothbury in the Cessnock local government area, within this range, there are three main sub-populations which comprise approximately 90% of the total population, the other 10% of the population occurs as scattered individuals in what is a relatively disturbed landscape; flowers from January through to May (OEH threatened species profile – 2018).
- **A Greenhood Orchid (*Pterostylis chaetophora*)** – flowers from September to November (Bishop 2000); currently known to occur between Kurri Kurri and Taree, including from the Grahamstown Dam catchment area, Seaham-Clarence Town district, Pokolbin / Central Hunter area and Columbey National Park (Bell 2009) which are near the subject site. The Grahamstown Dam population is just north-east (<5km) from the proposal, and as such OEH would recommend using this location as a reference site with respect to flowering and informing appropriate sampling time.

The Grahamstown Dam site, along with the Seaham populations have both been recorded in the depauperate *Melaleuca* understory of Ironbark-Spotted Gum communities; to which OEH notes that this habitat is likely present on the proposal and needs to be adequately sampled (i.e. in accordance with OEH 2016).

- **Illawarra Greenhood (*Pterostylis gibbosa*)*** - all known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage; flowers in spring, notably August to November (Bishop 2000), though in the Hunter, Burton (2015) notes September to November.
- **Heath Wrinklewort (*Rutidosia heterogama*)*** - Harden (1993) notes that it flowers chiefly in autumn, though Bell & Driscoll (2004) note flowering can occur earlier from November to December (in the Lower Hunter and Central Coast); while DECC (2009b) recorded it flowering in late march on coastal headlands in the Newcastle area.
- **Magenta Lilly Pilly (*Syzygium paniculatum*)*** - flowers December to January / March (Harden 2002, Benson & McDougall 1998), though mature fruits are required to positively identify this species, which mature in May (Payne 1997).
- **Black-eyed Susan (*Tetradlea juncea*)*** – flowers predominantly November to February, though known to flower early from June onwards (Harden 1992, Driscoll 2003); noted infrequently all year under suitable conditions, recorded in late autumn to winter in some sub-coastal populations (e.g. Awabakal NR – S. Lewer pers. comm. 2013).

Fauna (62 species):

For Fauna species please be aware of: (i) habitat preferences and known distribution for each of the species as an indication as to whether they may occur in the study area, and (ii) the best times of year these species may be detected if subject to surveys. If animals are captured with an uncertain taxonomy, species should be forwarded to the Australian Museum by a suitably qualified scientific licence holder.

Subject threatened fauna to be considered:

Amphibians (2 species):

Green and Golden Bell Frog (*Litoria aurea*)*

Littlejohn's Tree Frog (*Litoria littlejohni*)*

Reptiles (1 species):

Pale-headed Snake (*Hoplocephalus bitorquatus*)

Birds (41 species):

Magpie Goose (*Anseranas semipalmata*)

Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)

Australasian Bittern (*Botaurus poiciloptilus*)

Bush Stone-curlew (*Burhinus grallarius*)

Curlew Sandpiper (*Calidris ferruginea*)

Gang-gang Cockatoo (*Callocephalon fimbriatum*)

Glossy Black Cockatoo (*Calyptorhynchus lathamii*)

Spotted Harrier (*Circus assimilis*)

Brown Treecreeper (*Climacteris picumnus* subsp. *victoriae*)

Varied Sittella (*Daphoenositta chrysoptera*)

White-fronted Chat (*Epthianura albifrons*)

Black-necked Stork (*Ephipporhynchus asiaticus*)

Black Falcon (*Falco subniger*)

Little Lorikeet (*Glossopsitta pusilla*)

Painted Honeyeater (*Grantiella picta*)

White-bellied Sea-eagle (*Haliaeetus leucogaster*)*

Little Eagle (*Hieraaetus morphnoides*)

Comb-crested Jacana (*Irediparra gallinacea*)

Black Bittern (*Ixobrychus flavicollis*)

Swift Parrot (*Lathamus discolor*)*

Black-tailed Godwit (*Limosa limosa*)
 Square-tailed Kite (*Lophoictinia isura*)
 Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis* subsp. *gularis*)
 Hooded Robin (south-eastern form) (*Melanodryas cucullata* subsp. *cucullata*)
 Turquoise Parrot (*Neophema pulchella*)
 Barking Owl (*Ninox connivens*)
 Powerful Owl (*Ninox strenua*)
 Blue-billed Duck (*Oxyura australis*)
 Osprey (previously *Pandion haliaetus* now *Pandion cristatus*)
 Scarlet Robin (*Petroica boodang*)
 Flame Robin (*Petroica phoenicea*)
 Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis* subsp. *temporalis*)
 Rose-crowned Fruit-dove (*Ptilinopus regina*)
 Speckled Warbler (*Pyrrholaemus sagittatus*)
 Australian Painted Snipe (*Rostratula australis*)*
 Diamond Firetail (*Stagonopleura guttata*)
 Freckled Duck (*Stictonetta naevosa*)
 Grass Owl (*Tyto capensis*)
 Masked Owl (*Tyto novaehollandiae*)
 Sooty Owl (*Tyto tenebricosa*)
 Regent Honeyeater (*Xanthomyza phrygia*)*

Mammals (18 species):

Eastern Pygmy-possum (*Cercartetus nanus*)
 Large-eared Pied Bat (*Chalinolobus dwyeri*)
 Spotted-tailed Quoll (*Dasyurus maculatus*) *
 Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
 Little Bent-wing Bat (*Miniopterus australis*)
 Eastern Bent-wing Bat (*Miniopterus schreibersii* subsp. *oceanensis*)
 Eastern Freetail bat (*Mormopterus norfolkensis*)
 Large-footed Myotis (*Myotis adversus*)
 Corben's Long-eared Bat (*Nyctophilus corbeni*)
 Yellow-bellied Glider (*Petaurus australis*)
 Squirrel Glider (*Petaurus norfolkensis*)
 Brush-tailed Phascogale (*Phascogale tapoatafa*)
 Koala (*Phascolarctos cinereus*)* only combined populations of Qld, NSW and the ACT are listed on EPBC Act.
 Common Planigale (*Planigale maculata*)
 Grey-headed Flying-fox (*Pteropus poliocephalus*)*
 Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*)
 Greater Broad-nosed Bat (*Scoteanax rueppellii*)
 Eastern Cave Bat (*Vespadelus troughtoni*)

Endangered Populations

- *Cymbidium canaliculatum* population in the Hunter Catchment (*Note: *Cymbidium canaliculatum* flowers from September to October (Bishop 2000), typically it is most commonly found in *Eucalyptus albens* (White Box) dominated woodlands (including those dominated by the intergrade *E. albens-moluccana*) of the Upper Hunter, though it has been found, less commonly, to grow on *E. dawsonii* (Slaty Box), *E. crebra* (Narrow-leaved Ironbark), *E. moluccana* (Grey Box), *Angophora floribunda* (Rough-barked Apple), *Acacia salicina* (Cooba) and on some other species; also in dead stags).
- *Eucalyptus camaldulensis* (a tree) in the Hunter catchment.
- *Leionema lamprophyllum* subsp. *obovatum* population in the Hunter Catchment.

Endangered ecological communities

- Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions.
- Central Hunter Ironbark Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions.
- Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions.
- Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions.
- Lower Hunter Spotted Gum—Ironbark Forest in the Sydney Basin Bioregion.
- River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.
- Swamp Oak Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.

The above lists are not necessarily exhaustive. The applicant must carry out their own process of determining the subject species. This process should incorporate consideration of:

- the vegetation communities present within the study area
- the presence, quantity, quality and degree of fragmentation of likely habitat for individual threatened species
- recent (within the last ten years) records of threatened species, populations and ecological communities in the locality
- the known distribution of threatened species, populations and ecological communities
- the known and predicted use of habitat for all potential species.

OEH's *Atlas of NSW Wildlife*, *Australian Museum* and *Royal Botanic Gardens* databases, the *Birds Australia* and *NSW Bird Atlas* databases (for birds) and other relevant databases should be used to assist in compiling or assessing the list. The Data Licensing Officer at OEH's Head Office should be contacted on 9585 6684 to obtain information on the Atlas database.

Threatened species, populations and ecological communities on the above list may be excluded from further consideration as subject species only if a fully documented justification, robust to external examination, is provided. This documentation must address, as a minimum, the criteria for determining subject species that are listed above. In particular, threatened species that are cryptic, mobile or little surveyed (or possess combinations of these parameters (e.g. bats)), and for which the study area provides suitable habitat and falls within the species' range, must not be excluded solely on the basis of a lack of records in the locality. Furthermore, threatened species that occur in a range of habitats must not be excluded on the basis that their core habitat is not present in the study area or locality.

The proponent should be aware that additional species, populations, and ecological communities could be added to the schedules of the TSC Act between the issue of these requirements and the granting of consent. If this occurs, these additional matters will need to be addressed in the SIS and considered by the consent, determining, or concurrence authority.

Preliminary Listed Species

OEH draws your attention to species that may have preliminary listing under the TSC Act. They may be found on the website of the NSW Scientific Committee at www.environment.nsw.gov.au/committee/ListOfScientificCommitteeDeterminations.htm. Any preliminary-listed may receive final determination under the Act during your SIS process and hence you would need to consider them.

Any 'final determination' to list a species, population or ecological community as 'critically endangered' or 'endangered' made after lodgement of a development application or activity proposal needs to be included in the consideration of impacts and the application of the assessment of significance.

Vulnerable species listed after lodgement are not subject to impact assessment as long as the application is determined within 12 months of lodgement.

4 SURVEY

4.1 Requirement to survey

A fauna and flora survey must be conducted in the study area. Targeted surveys should be conducted for all subject species determined in accordance with Section 3.1. Recent (less than 5 years old) surveys and assessments may be used to assist in addressing this requirement. However, previous surveys (5 years or less) will not be considered to have addressed this requirement if they have:

- been undertaken in seasons, weather conditions or following extensive disturbance events when the target subject species are unlikely to be detected or present (e.g. outside known flowering / fruiting periods, adverse drought conditions, flooding, bushfire [though some species are 'fire obligates' requiring fire to germinate], slashing and overgrazing etc.); or
- utilised methodologies, survey sampling intensities, timeframes or baits that are not the most appropriate ones for detecting the target subject species unless these differences can be clearly demonstrated to be likely to have had an insignificant impact upon the outcomes of the surveys.

Surveys must be undertaken by appropriately experienced and qualified persons (including appropriately accredited people under 142B(1)(c) of the *Threatened Species Conservation Act 1995* with respect to the use of the BioBanking Assessment Methodology). A recognised expert, from institutions such as the Australian Museum (Sydney), the National Herbarium of NSW at the Royal Botanic Gardens (Sydney) or the Queensland Herbarium (Brisbane), or who is otherwise considered acceptable by OEH, must be used to determine or confirm the identification of species that are unknown or which have been only provisionally identified.

Survey methods adopted must be those considered by experienced wildlife surveyors to be those most likely to detect the targeted subject species (more than one survey method must be utilized for those subject species for which complementary methods have the potential to result in a significant increase in detection). Survey effort (including intensity, repetition and coverage) must be at a level that can be reasonably expected to detect the subject species if present in the study area. Surveys must be undertaken at the time of year when the subject species are most likely to be detected (e.g. targeted threatened flora should be carried out when a species is flowering or fruiting, as these features are typically required to positively identify species) and, where possible, in appropriate weather conditions. OEH expects the weather conditions (e.g. minimum ambient air temperature, maximum ambient air temperature, amount of precipitation that occurs each 24 hour period, details about wind speed and direction and the amount of cloud cover) and the phase of the moon to be recorded for each day of survey (including dates) to be documented and included in the report.

Survey procedures and assessment of results should be consistent with those procedures and assessment approaches contained within the following OEH publications:

- '*Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities*' (DEC – November 2004). (*Note: Section 6.1 Assessment of Significance has been amended by DECC 2007b)
- '*Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians*' (DECC – April 2009a)
- '*Threatened Species Assessment Guidelines: The Assessment of Significance*' (DECC – August 2007b).
- 'NSW Guide to Surveying Threatened Plants'. (OEH, 2016)

*Note that OEH has produced separate survey guidelines to cover Amphibians (frogs) and plants, which replace those sections in the DEC (2004) guidelines. However, the survey requirements for all other species of fauna are still found in the DEC (2004) guidelines.

The above documents can be located on OEH's website under the 'Threatened species survey and assessment guidelines' at:

- <http://www.environment.nsw.gov.au/surveys/GuidelinesForCarryingOutASurvey.htm>

If a proposed survey methodology is likely to vary significantly from widely accepted methods, the proponent should discuss the proposed methodology with OEH prior to undertaking the SIS, to determine whether OEH considers that it is appropriate.

In addition to the above guidelines, OEH has recently posted new information on OEH website to ensure appropriate surveys are completed, with particular reference to fauna surveying.

False absences and imperfect detection

While the presence of a target species can often be confirmed at a site relatively easily, it is generally impossible to confirm a species is absent. Unless a species has a 100% chance of being detected on a single visit (i.e. it has a probability detection of 1) non-detection does not necessarily mean the species is absent (MacKenzie *et al.* 2002). Very few species are so conspicuous that they are always detected in each survey (MacKenzie *et al.* 2002).

A species' detectability is influenced by several factors (Tyre *et al.* 2003). Such factors include:

- the species in question – fauna species with large home ranges are especially likely to go undetected in an area, as at any given time they may be in another part of their range
- climatic conditions (e.g. temperature, rainfall)
- experience of the surveyor/s
- the survey methodology used.

An observed absence may be due to an observer failing to detect a species that is actually resident at the site, for example, a bird that was elsewhere in its home range at the time of the survey or failed to call during a point count (MacKenzie 2005). False absences have serious consequences for habitat modelling and monitoring studies as well as impact assessments. When fauna surveys are conducted for the purpose of impact assessment, false absences may result in inadequate conservation measures and an increased risk of local extinction (Wintle *et al.* 2005).

Hence, the SIS should be conservative when determining whether a species, population or community (including their habitat) are potentially present (i.e. precautionary approach).

Stratifying the site

When designing a field survey, firstly stratify the study area (i.e. divide the area into relatively homogenous units – often referred to as 'environmental sampling units' or 'stratification units'). Stratified sampling provides a logical, objective and efficient method of undertaking surveys and ensures that the full range of potential habitats and vegetation types will be systematically sampled and mapped. For the mapping of vegetation and delineation of habitat types, the study area / subject site should be initially stratified on biophysical attributes (e.g. landform, geology, elevation, slope, soil type, aspect, climate, rainfall etc.) that best delineate likely vegetation changes across the landscape. Vegetation structure or type (as per the OEH Plant Community Type or other acknowledged vegetation mapping / classification), condition and disturbance history may be used to better define the boundaries of stratification units.

Once the stratification units have been identified, they should be recorded on a survey map. Remote sensing such as aerial or satellite photograph interpretation coupled with ground truthing will help better refine and determine the spatial vegetation patterns and habitat types across a study area.

For further information on stratification and the use of Biometric tool (BioBanking Credit Calculator) in this process (particularly for fauna) refer to the new information posted on OEH website, as detailed above.

Visiting the site

Conduct a preliminary site visit to refine the initial stratification units, determine the broad vegetation types (e.g. if using OEH BioNet Vegetation Classification database to determine Plant Community Types [PCTs]) present at the site, assess the vegetation condition and conduct a broad habitat assessment to help delineate specific features suitable for sampling.

Taking a copy of OEH's BioNet Vegetation Classification database (for PCTs) (<http://www.environment.nsw.gov.au/research/Visclassification.htm>) for the relevant former Catchment Management Authority (CMA), local government areas or equivalent (e.g. existing vegetation mapping) into the field during the preliminary site visit, may be useful in determining the likely vegetation types present. However, for some CMAs this should only be used as a guide as some vegetation types / communities have not been captured or delineated in the database.

Survey Design

Once the site has been stratified, an adequate survey design (e.g. stratified random sampling for vegetation / flora) should be developed which adequately samples all stratification units and habitat types. Vegetation survey sites should be selected randomly and be based on the variation inherent in the stratification, while fauna sites are likely to be selected on the basis of vegetation change and specific habitat types present (e.g. hollow bearing trees, feed trees, rock outcrop, presence of water etc.). Additional targeted surveying will be required for threatened species that are dependent on specific vegetation types or habitats or require specific sampling because of seasonality (e.g. flowering season for some plants, warmer months for fauna etc.).

To sample vegetation, for example, a standard plot should be adopted to ensure the structural and floristic character of all vegetation types on site is adequately captured (e.g. 0.04 ha [20m × 20m] quadrat).

Targeted Surveys - Flora

For targeted flora surveys please note the known flowering / fruiting times for each species to time surveys appropriately (as listed above for potential 'subject species'). Surveying at known flowering times is required for all potential species that are not readily detectable (or are cryptic), where flowers or fruits are necessary for their positive identification. If targeted flora surveys for potential species are conducted outside a species known phenology then justification must be provided as to why; if this is not provided or considered inappropriate, then all such species will be considered to be present on all available habitat and in viable numbers, and as such will require suitable biodiversity offsets or their habitat avoided. For species which do not require flowers / fruits for positive identification (e.g. large trees / shrubs), then survey as appropriate (though appropriate justification on methods used is still required). It is recommended to utilise known reference sites to help delineate flowering patterns and sampling timeframes. OEH can provide advice on this for some species.

Targeted flora surveys must also adequately sample / cover all suitable habitat on the study area, and utilise suitable detection techniques such as belt transects (at appropriate widths to spot cryptic species) or random meanders (that sufficiently cover all known / potential habitat areas [i.e. not just the tracks or readily accessible areas]). OEH has produced a new survey guideline which outlines preferred survey methodologies and techniques - 'NSW Guide to Surveying Threatened Plants'. (OEH, 2016). If targeted flora surveys are poorly conducted or surveyed then appropriate justification must be provided as to why; if this is not provided or considered inappropriate, then all such affected species will be considered to be present on all available habitat and in viable numbers, and as such will require suitable biodiversity offsets or their habitat avoided.

Targeted Surveys – Fauna

When undertaking targeted fauna surveys, you must be aware of: (i) habitat preferences and known distribution for each of the species as an indication as to whether they may occur in the study area, (ii) the best times of year these species may be detected if subject to surveys, and (iii) suitable survey techniques to adequately detect a potential species. If targeted fauna surveys are poorly conducted, inappropriately surveyed or undertaken outside known detection periods, then appropriate justification must be provided as to why; if this is not provided or considered inappropriate, then all such affected species will be considered to be present on all available habitat and in viable numbers, and as such will require suitable biodiversity offsets or their habitat avoided.

If animals are captured with an uncertain taxonomy, species should be forwarded to the Australian Museum by a suitably qualified scientific licence holder.

Habitat assessment

Habitat assessment is recommended for all sites and should be used to supplement surveying and survey design. In instances where intensive or species-specific surveys have not been carried out due to either timing or seasonality constraints, habitat assessment may be used as a surrogate for intensive surveys. However, in this instance threatened species should be assumed present if their habitat requirements are met. Ensure all impact assessments include a thorough habitat assessment.

Undertaking a habitat assessment of the study area will assist with predicting the occurrence of threatened species in the study area and will guide the location of targeted surveys. A comprehensive habitat assessment should be conducted across the whole site, identifying key habitat features for both flora and fauna.

You should be familiar with the habitat requirements of each threatened species identified as possibly occurring in the study area. This information can be obtained from OEHS recovery plans website (<http://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/programs-legislation-and-framework/recovery-plans>), threatened species profiles and scientific literature. Threatened species profiles are available on OEHS website:

- www.environment.nsw.gov.au/threatenedspecies/

The habitat assessment should include information on:

- landscape features in the study area (e.g. river banks, rocky outcrops, dry slopes, wetlands, undulating terrain)
- any other features that could provide habitat such as hollow-bearing trees or culverts
- the vegetation types present (such as OEHS's BioNet Vegetation Classification database (for PCTs - <http://www.environment.nsw.gov.au/research/Visclassification.htm>) or appropriate vegetation mapping).

It is important to record all areas of native and introduced vegetation, as even weeds can potentially provide habitat for threatened fauna. As part of the habitat assessment, you should look for:

- hollow-bearing trees, including dead stags;
- bush rock and rocky outcrops;
- natural burrows, such as those of the Hastings River Mouse;
- large trees with basal cavities;
- logs;
- wetlands, streams, rivers, dams and other water bodies;
- nests and roosts;
- wombat burrows;
- dens used by yellow-bellied gliders, squirrel gliders and brush-tailed phascogales;
- yellow-bellied glider and squirrel glider sap feed trees;
- distinctive scats (e.g. those of the spotted-tailed quoll or koala);
- latrine and den sites of the spotted-tailed quoll;

- *Allocasuarina* spp.;
- flying-fox camps;
- Microchiropteran bat tree roosts;
- Microchiropteran bat subterranean roosts (caves, culverts, tunnels and disused mineshafts);
- swift parrot and regent honeyeater feed or nest trees;
- winter-flowering eucalypts;
- mistletoes;
- permanent soaks and seepages; and
- areas that can act as corridors for plant or animal species.

Another important factor to consider is the connectivity value of the site. If the proposal site forms an important corridor in the area, the development is likely to have an effect on threatened species in the region.

A geo-referenced map / aerial photograph (or equivalent), of the study area detailing key habitat features, including the vegetation types, must be included in the report.

Flora / Vegetation Survey and Mapping

Typically, a floristic quadrat / transect will be used for vegetation based surveying. This should record the vegetation structure and cover of all structural layers, all species present, including their cover and abundance, and general location (e.g. Global Positioning System (GPS) co-ordinates etc.) and physiographic details (e.g. condition, position in landscape, soils etc.). These techniques are described in the OEH guidelines and are generally the accepted national (NVIS – National Vegetation Inventory System) standard (www.environment.gov.au/topics/science-and-research/databases-and-maps/national-vegetation-information-system). Each stratification unit must be adequately sampled, this includes woody vegetation types, derived vegetation types, and non-woody communities (including derived native grasslands).

All quadrats / transects should be adequately assessed to determine a suitable vegetation classification which accurately reflects the site. This may be done manually, or through the aid of appropriate statistical software / numerical analysis, such as cluster analysis and ordination analysis computer packages (e.g. PATN (Belbin 1989)). The latter will be dependent on how detailed the survey was, the size of the area sampled, the inherent diversity / complexity of vegetation on site and the amount of plot data collected. Details of the classification and how it was determined must be supplied in the report.

To complement and better refine the vegetation classification, ground truthing and aerial photograph or satellite imagery interpretation should be used. This will be used to generate the vegetation map and enable greater definition / delineation of vegetation communities present, and ensure a more accurate map. Ground-truthing and Aerial Photograph Interpretation (API) should be conducted at a level which captures all the obvious vegetation changes / communities on the subject site (particularly those that are noticeable at the ground-level) and ensure that all vegetation communities are adequately delineated on a geo-referenced map (the 'vegetation map'). Floristic quadrats / transects and any associated analysis will help define and describe the communities shown on the vegetation map. Recognition and delineation of native vegetation patterns on aerial photography may be based on combinations of:

- texture (crown size and shape)
- vegetation height and density
- vegetation and background tone and colour
- landuse pattern (non-woody areas).

Determining Biometric vegetation types / Plant Community Types

The classification of native vegetation in NSW follows the system described by Dr David Keith in '*Ocean Shores to Desert Dunes: The Native Vegetation of New South Wales and the ACT*' (Keith 2004). This

classification scheme divides native vegetation into 17 broad vegetation formations. Each formation consists of a number of vegetation classes. There are 99 vegetation classes.

OEH has developed a 'NSW Vegetation Types Database' for use with the BioMetric tool, which is designed to assist in assessing biodiversity values when preparing property vegetation plans under the *Native Vegetation Act 2003* and BioBanking agreements under the TSC Act. This database (known as VIS) provides detailed information on the Plant Community Types (PCT) of NSW, such structure, floristics, key characteristics species, distribution and conservation value (but not limited to this). Access to the information on PCTs and the VIS database is located at:

- www.environment.nsw.gov.au/biobanking/tools.htm

If you are proposing to conduct a biodiversity assessment using BioBanking Assessment Methodology under Biodiversity Banking and Offsets Scheme, as outlined in the 'BioBanking Assessment Methodology 2014' (OEH 2014b), to determine the offset requirements of the proposal, then it is advisable and advantageous that during the survey component of the SIS that you collect the relevant data in the appropriate format for the Biometric tool (i.e. BioBanking Credit Calculator) (*Note: this may reduce duplication or further surveying at a later date). This process can provide details of the required ecosystem and species (threatened) credits that need to be retired to offset the impacts of the development. Under this scenario all vegetation types in the study area should be identified and matched to an OEH BioMetric vegetation type.

For details on the use of Biometric, the 'BioBanking Assessment Methodology 2014' (OEH 2014b) and BioBanking in general refer to the following OEH website (Note: - the new information posted on the OEH website, as detailed above, includes details on site selection, survey intensity and methodology, and vegetation condition measurements):

- www.environment.nsw.gov.au/biobanking/

If a BioBanking assessment is conducted using the Credit Calculator then OEH requests that the proponent provide an explanation of how the local vegetation communities were assigned to Biometric vegetation types, copies of BioBanking Credit Reports, copies of all field data sheets, an explanation of the underlying assumptions used at every step of the BioBanking Credit Calculator (see Section 4.5 below), and the submission of the credit calculator files via the OEH portal (as described in **Appendix 2**).

4.2 Documentation of survey effort and technique

4.2.1 Description of survey techniques and survey sites

Survey technique(s) must be described and a reference given, where available, outlining the survey technique employed. Specific subject species targeted by each survey technique should be listed.

Survey site(s) and stratification units must be identified on a geo-referenced map / aerial photograph (or equivalent), with a clear legend, at the same scale as previous maps where possible. The size, orientation and dimensions of a quadrat or a length of transect should be clearly noted for each type of survey technique undertaken. Full Australian Map Grid (AMG) grid (Geocentric Datum of Australia (GDA) compliant) references for the survey site(s) should be noted.

4.2.2 Documenting survey effort

The time invested in each survey technique applied must be summarised (preferably in tabular format) in the SIS (e.g. - number of person hours per transect / quadrat, duration of call playback, number of nights traps set etc.). It is not sufficient to aggregate all time spent on all survey techniques. Effort must be expressed for each separate survey technique and each separate vegetation community. Survey, quadrat and transect sites must be schematically shown on a geo-referenced map or photograph. Targeted surveys also need to specify method adopted (e.g. belt transects, random meander [Cropper 1993]), habitats searched (e.g. type / features), duration, effort, prevailing weather conditions and

location. Environmental conditions during the survey should be noted at the commencement of each survey technique.

Personnel details including name of all surveyor(s) and contact phone number should be provided. The person who identified records (e.g. Anabat, hair tubes, motion-sensor camera, and scat analysis) should also be identified.

4.3 Survey results

4.3.1 Subject species survey results

The report should provide a full list of all flora and fauna recorded in the study area / subject site.

Subject species recorded in the study area shall be identified, and the vegetation community in which they were recorded noted. Information concerning all records of threatened species made during the survey is to be provided in an appendix to the SIS. This information is to be in a form consistent with *Atlas of NSW Wildlife* data recording cards and include information for all fields listed on these cards.

The limitations of survey techniques employed (including survey intensity, detectability of species, seasonality, weather conditions and adverse disturbance conditions) must be considered and discussed with respect to the results of the survey, and additional subject species considered to potentially occur in the study area identified. This assessment must be robust to external evaluation.

4.3.2 General species survey results

The SIS must provide details of all the vegetation communities (including disturbed and undisturbed / modified), habitat types, and all fauna and flora recorded on the subject site and study area in general.

A full list of the protected fauna and native plant species (as defined by the *National Parks and Wildlife Act 1974*) found during the course of surveys must be included. Such information is indicative of the habitat quality of the site. This list must indicate the significance of each species, whether the species is introduced, and the habitat in which each species was recorded.

4.4 Subject species habitat mapping

Areas identified as known or potential habitat in the study area are to be mapped on a geo-referenced map / aerial photograph (or equivalent) separately for each of the subject species. These maps should be at the same scale as previous maps where feasible, and are to include any point locality records of the relevant subject species recorded from the SIS survey in the study area. **Note:** Records obtained from the 'Atlas of NSW Wildlife' database can be used in determining likely habitat, but they are not to be schematically mapped in the SIS, as this is considered a breach of licence conditions for such records.

While in some circumstances the task of identifying potential habitat can be problematic, the SIS should provide the best expert estimate of the habitat of each threatened species, populations and ecological communities known or considered likely to occur in the study area. This is necessary in order to clearly support conclusions concerning the quantitative significance of habitat loss associated with the proposal. Information which can be used in preparing these maps includes records of threatened species in the local area, maps of vegetation communities and broad habitat types in the study area, information on the habitat requirements of threatened species and site-specific knowledge gained through field survey and inspection during preparation of the SIS.

4.5 General report structure

In summary, the report must include details on the following (but not be limited to):

- a description of the subject site, study area and its regional context; including a geo-referenced map / aerial photograph (or equivalent) indicating their location;
- details of the survey methodology and design adopted, including:

- the number and location of traps (e.g. cage, Elliott, hair sampling tubes etc.), call playback sites, diurnal searches, random meanders, quadrats and transects,
- the number of repetitions (Note: – you will need to provide a justification if this differs from the recommendations in these guidelines),
- details of all floristic plots and transects,
- details of the stratification,
- identification of the classification system used (e.g. Specht *et. al.* (1974), Walker & Hopkins (1998) [Note: the classification must have regard to both structural and floristic composition elements]),
- timing of surveying, climatic (weather) conditions and phases of the moon during survey,
- details of how the vegetation classification for the site was developed, including details and associated products (e.g. dendrograms / two-way tables) of any analyses used, if applicable,
- copies of any analyses used (e.g. PATN or other statistical files) and all field data sheets, and
- geo-referenced maps / aerial photographs (or equivalent) showing the location of all survey points, quadrats and transects, and stratification units.
- detailed description of all vegetation communities / types (both undisturbed and disturbed AND woody and non-woody (including derived native grasslands)) on the site and study area (it is preferable to link them to, OEH's Plant Community Types / Biometric vegetation types – in which case a step by step summary of how the site vegetation was matched with available Biometric vegetation types should also be included), including a geo-referenced map / aerial photograph (or equivalent) showing their location. The descriptions should include: - a general description, characteristic features (e.g. lacks a mid-storey, restricted to a particular geomorphic / edaphic feature etc.), their distribution and size (e.g. hectares), their vegetation structure (including cover), their condition, key diagnostic species, relationship to other communities, species richness and any significant species present (e.g. threatened species, Rare or Threatened Australian Plants (ROTAP: Briggs & Leigh 1996), regionally significant taxa);
- details of all habitat features / types should be included and mapped (where appropriate), such as frequency and location of stags, hollow bearing trees (including size), mature / old growth trees, culverts, rock shelters, rock outcrops, presence of feed tree / shrub / groundcover species (e.g. winter-flowering eucalypts, *Acacia* and *Banksia* trees, *Casuarina* / *Allocasuarina* and areas of native grasses], crevices, caves, drainage lines, soaks etc.;
- if a BioBanking assessment is conducted for the development site and any offset sites then the proponent must provide:
 - copies of any BioBanking Credit Reports and BioBanking Agreement Credit Reports generated,
 - copies of all field data sheets,
 - copies of a checklist that includes the data and underlying assumptions used at every step of the BioBanking Credit Calculator, and
 - submission of the credit calculator files via the OEH portal (as outlined in **Appendix 2**).
- a list of all flora and fauna detected on the study area / subject site during the surveys, including threatened species. All threatened species, populations and ecological communities must be clearly marked on geo-referenced map / aerial photograph (or equivalent);
- details of how the proposal will impact (both direct and indirect) and affect known and potential threatened species, populations and ecological communities (including their habitat). This is likely to include a revised 5A assessment of significance;
- details of the habitat assessment;
- detail the cumulative impacts of this proposal and any other developments within the locality that impact on threatened species, populations, ecological communities and their habitats; including an appraisal of how any adverse impacts will be avoided, mitigated against or offset;
- details of how the proposal may impact on corridors, connective links and fragmentation;
- details of how the proposal will impact (both directly and indirectly) on adjacent or nearby OEH conservation estate or if applicable, other internationally / nationally important areas, (e.g. Ramsar wetlands, wetlands listed in the Directory of Important Wetlands, SEPP (Coastal Management) 2018 (formerly SEPP14) mapped wetlands and Forestry flora reserves);
- details of any impacts on or relevance of other environmental policies or guidelines (as outlined in Section 2.1.3);

- details of mitigation and offset / compensatory habitat measures;
- details of any other approvals required under any other State or Federal legislation;
- names, qualifications and experience of all personnel involved in the field surveys, analysis of results and report writing;
- paper copies of any maps of proposed biodiversity offset areas at A0 or A1 scale that clearly show the location and boundaries of any proposed offset area. These maps must be prepared by a registered surveyor and be proper survey plans that are acceptable to local Councils;
- an assessment of how the project meets the principles of Ecologically Sustainable Development, as defined in section 6(2) of the *Protection of the Environment Administration Act 1991*;
- a discussion of the likely social and economic consequences of granting or of not granting concurrence; and
- any other information outlined elsewhere in these guidelines, such as background and comparisons to previous studies (e.g. vegetation mapping reports), mitigation and offset measures etc. that should be included in the report.

5 ASSESSMENT OF LIKELY IMPACTS ON THREATENED SPECIES AND POPULATIONS

Section 5 need only be addressed if threatened species or endangered populations are likely to be affected.

Assessment of impacts must include the assessment of indirect impacts and those of associated activities, including, but not restricted to: installation and maintenance of utilities, access and egress routes; and changes in surface water flows. These actions or impacts may occur on or off the subject land.

Assessment of impacts must also include an assessment of impacts from the provision of fire protection zones. If, as part of the development, there will be a requirement to provide fuel free or fuel reduced zones in retained bushland, the impacts of this on any threatened species or populations must be addressed as part of the impacts of the overall proposal. Proponents should also consider recommendations in '*Planning for Bushfire Protection*' (NSW Rural Fire Service 2006) and consider the use of perimeter roads as an option in providing fuel free zones and reducing impacts on retained bushland.

5.1 Assessment of species likely to be affected

An assessment of which threatened species or populations known or likely to be present in the area are likely to be affected by the action (Section 110(2)(b)).

This requirement is asking you to refine your list of subject species and populations (given the outcome of survey and analysis of likely impacts) in order to identify which threatened species or endangered populations may be affected and the nature of the impact.

The remaining requirements in this section need only be addressed for those species that are likely to be affected by the proposal.

5.2 Discussion of conservation status

For each species or population likely to be affected, details of its local, regional and State-wide conservation status, the key threatening processes generally affecting it, its habitat requirements and any recovery plan or threat abatement plan applying to it (Section 110 (2)(c)).

An assessment of whether those species or populations are adequately represented in conservation reserves (or other similar protected areas) in the region (Section 110 (2)(e)).

An assessment of whether any of those species or populations is at the limit of its known distribution (Section 110 (2)(e1)).

Assessment should include reference to the threatening processes that are generally accepted by the scientific community as affecting the species or population and are likely to be caused or exacerbated by the proposal. Assessment should also include reference to any approved or draft recovery plans which may be relevant to the proposal; including those prepared by other state Governments of the Commonwealth Government.

5.3 Discussion of local and regional abundance

An estimate of the local and regional abundance of those species or populations (Section 110 (2)(d)).

5.3.1 Discussion of other known local populations

A discussion of other known populations in the locality shall be provided, along with an assessment of their regional significance. The long-term security of other habitats shall be examined as part of this discussion. The relative significance of the subject site for threatened species or endangered population in the locality shall be discussed.

5.3.2 Discussion of habitat utilisation

An estimate of the numbers of individuals utilising the area and how these individuals use the area (e.g. residents, transients, adults, juveniles, nesting, foraging). This should include discussion of the significance of these individuals to the viability of the threatened species or endangered population in the locality.

5.3.3 Description of vegetation

The vegetation present within the study area and the area covered by each vegetation community should be mapped and described, as previously stated in Section 4.3.2.

5.4 Assessment of habitat

A full description of the type, location, size and condition of the habitat (including critical habitat) of those species and populations and details of the distribution and condition of similar habitats in the region (Section 110 (2)(f)).

5.4.1 Description of habitat values

Specific habitat features shall be described, such as frequency and location of stags, hollow bearing trees (including size), mature / old growth trees, culverts, rock shelters, rock outcrops, presence of feed tree / shrub / groundcover species (e.g. winter-flowering eucalypts, Acacia and Banksia trees, *Casuarina* / *Allocasuarina*, Mistletoes and areas of native grasses), crevices, caves, drainage lines, soaks etc.), and density of understorey vegetation / groundcover.

The condition of the habitat within the study area shall be discussed, including the prevalence of introduced species, species of weeds present and an estimate of the total weed cover as a percentage of each vegetation community, whether trampling or grazing is apparent, effects of erosion, prevalence of rubbish dumping, history of resource extraction or logging and proximity to roads, and assessment of the potential for native seed bank resilience in disturbed areas.

Details of the fire history of the subject site (e.g. frequency, time since last fire, intensity) and the source of fire history (e.g. observation, local records) shall be provided.

5.4.2 Extent of habitat removal

The location, nature and extent of habitat removal or modification (e.g. including impacts of Asset Protection Zones (APZs)) which may result from the proposed action including the cumulative loss and fragmentation (isolation) of habitat from the study area (including all Development Applications and those areas in the subject area already with development consent or identified for development) and the impacts of this on the viability of the threatened species or endangered population in the locality.

This shall include an assessment of the proportion of the habitat of the affected species to be affected by the proposal, in relation to the total extent of the habitat in the study area and subject site, and the impact of this on the viability of the affected species in the locality.

5.4.3 Consideration of corridors

Areas within the subject site which may act as local or regional corridors (or part thereof) for affected species must be identified and described. A geo-referenced map showing identified corridors must be provided, and the impact of the proposal on these areas shall be discussed. If relevant, this section should include consideration of 'Key Habitats and Corridors for Forest Fauna' (NPWS Occasional Paper 32: Scotts 2003) and regional linkages, as identified within 'Regional Conservation Assessment, Lower Hunter and Central Coast Region' (Morison & House 2004), or other appropriate studies (e.g. Council specific LES, LEP documents and structure plans).

5.4.4 Impacts on Threatened Species and Populations in OEH Estate

This section only needs to be addressed when threatened species and populations in OEH estate (e.g. National Parks, Nature Reserves) are likely to be either directly or indirectly impacted upon.

The SIS must assess the potential impacts on any threatened species and populations which may likely be directly or indirectly impacted upon that reside with OEH estate, including but not limited to fragmentation or loss of connective linkages, edge effects (e.g. increased boundary to area ratio), increased predation potential, weed invasion, loss or impacts on pollination vectors, changes to hydrology, nutrient increases, pollution, anthropogenic impacts (e.g. increased visitation, refuse) etc.

5.5 Description of feasible alternatives

A description of any feasible alternatives to the action that are likely to be of lesser effect and the reasons justifying the carrying out of the action in the manner proposed, having regard to the biophysical, economic and social considerations and the principles of ecologically sustainable development (Section 110(2)(h)).

Where a Statement of Environmental Effects (SEE), Environmental Impact Statement (EIS) or Review of Environmental Factors (REF) deals with these matters, the SIS may refer to the relevant section of the SEE, EIS or REF.

This section must include details of the condition and use of other parts of the subject area and why these can or cannot be considered as feasible alternatives.

6 ASSESSMENT OF LIKELY IMPACTS ON ECOLOGICAL COMMUNITIES (ENDANGERED AND CRITICALLY ENDANGERED)

Section 6 need only be addressed when ecological communities are likely to be affected.

Assessment of impacts must include the assessment of indirect impacts and those of associated activities, including, but not restricted to: installation and maintenance of utilities, access and egress routes; and changes in surface water flows. These actions or impacts may occur on or off the subject land.

Assessment of impacts must also include an assessment of impacts from the provision of fire protection zones. If, as part of the development, there will be a requirement to provide fuel free or fuel reduced zones in retained bushland, the impacts of this on any endangered and critically endangered ecological communities must be addressed as part of the impacts of the overall proposal. Proponents should also consider recommendations in 'Planning for Bushfire Protection' (NSW Rural Fire Service 2006) and consider the use of perimeter roads as an option in providing fuel free zones and reducing impacts on retained bushland.

6.1 Assessment of ecological communities (both endangered and critically endangered) likely to be affected

A general description of the ecological community present in the area that is the subject of the action and in any area that is likely to be affected by the action (Section 110(3)(a)).

This must include reference to the ecological community as described by the NSW Scientific Committee, including maps of the extent and condition of the community with particular reference to those parts of the community that may only be represented by soil stored seed with no above ground components of the community present.

6.2 Discussion of conservation status

For each ecological community present, details of its local, regional and State-wide conservation status, the key threatening processes generally affecting it, its habitat requirements and any recovery plan or any threat abatement plan applying to it (Section 110(3)(b)).

An assessment of whether those ecological communities are adequately represented in conservation reserves (or other similarly protected areas) in the region (Section 110(3)(b1)).

An assessment of whether any of those ecological communities is at the limits of its known distribution (Section 110(3)(b2)).

Assessment should include reference to the threatening processes that are generally accepted by the scientific community as affecting the endangered and critically endangered ecological community and are likely to be caused or exacerbated by the proposal. The assessment should also include reference to any approved or draft recovery plans which may be relevant to the proposal.

6.2.1 Significance within a local context

An assessment of the community on the subject site in relation to other sites in the study area and in the locality. The tenure and long term security of other localities shall be examined as part of this discussion.

The relative significance of the subject site for the endangered and critically endangered ecological community shall be discussed. The assessment of the community should be considered in terms of the following features including, the size of the remnant, the quality of the habitat and the level of disturbance on this site in comparison to other sites in the locality.

6.2.2 Discussion of corridor values

The potential of the proposal to increase fragmentation of the community and increase edge effects.

If corridors that allow connectivity between localities of endangered and critically endangered ecological communities are present within the subject site, the impact of the proposal on these areas shall also be discussed.

6.2.3 Discussion of regional significance

The significance of the locality for the community from a regional perspective shall be noted and discussed.

6.2.4 Impacts on Ecological Communities in OEH Estate

This section only needs to be addressed when endangered and critically endangered ecological communities in OEH estate are likely to be either directly or indirectly impacted upon.

The SIS must assess the potential impacts on any endangered and critically endangered ecological communities which may likely be directly or indirectly impacted upon that reside with OEH estate.

OEH notes a number of conservation estates which may contain ecological communities in the vicinity (5 km radius) as outlined in Section 5.4.4.

6.3 Assessment of habitat

A full description of the type, location, size and condition of the habitat of the ecological community and details of the distribution and condition of similar habitats in the region (Section 110 (3)(c)).

6.3.1 Description of disturbance history

If the site shows signs of disturbance, details should be provided of the site's disturbance history and an assessment should be made of the ability of the ecological community to recover to a pre-disturbance condition.

6.3.2 Extent of habitat removal

The location, nature and extent of habitat removal or modification which may result from the proposed action including the cumulative loss of habitat from the study area (including all proposed DAs and those areas in the subject area already with development consent or identified for development) and the impacts of this on the viability of the endangered and critically endangered ecological community in the locality.

This shall include an assessment of the proportion of the ecological community to be affected by the proposal, in relation to the total extent of the ecological community, and the impact of this on the viability of the ecological community in the locality.

6.4 Description of feasible alternatives

A description of any feasible alternatives to the action that are likely to be of lesser effect and the reasons justifying the carrying out of the action in the manner proposed having regard to the biophysical, economic and social considerations and the principles of ecologically sustainable development (Section 110(3)(e)).

Where a Statement of Environmental Effects (SEE), Environmental Impact Statement (EIS) or Review of Environmental Factors (REF) deals with these matters, the SIS may refer to the relevant section of the SEE, EIS or REF.

In the discussion of feasible alternatives to the proposed development with regards to biophysical, economic and social considerations, and the principles of ecologically sustainable development, the SIS must also include details on the condition and use of other parts of the subject area and why these can or cannot be considered as feasible alternatives.

7 AMELIORATIVE MEASURES

7.1 Description of ameliorative measures

A full description and justification of the measures proposed to avoid or mitigate any adverse effect of the action on the species and populations and ecological community including a compilation (in a single section of the statement) of those measures (Section 110 (2)(i) and Section 110 (3)(f)).

7.1.1 Long-term management strategies

Consideration shall be given to developing long-term management strategies to protect areas within the study area which are of particular importance for the threatened species, endangered populations or endangered / critically endangered ecological communities likely to be affected. This may include proposals to restore, improve or provide long term protection for habitat on site where possible. Any such proposal is to be accompanied by a plan of management identifying the specific areas to be restored, improved or protected, the threatened species / ecological community values of those areas, and detailing the management actions to be implemented to maintain and protect those values, including corrective actions to be taken in the event that monitoring indicates that management does not achieve specified objectives.

7.1.2 Compensatory strategies

OEH notes that its 'offset provision' principles (**Appendix 1**) state that impacts must be avoided first by using prevention and mitigation measures (DECC 2007a). Where significant modification of the proposal to minimise impacts on threatened species, populations or endangered / critically endangered ecological communities is not possible then compensatory strategies should be considered. These should include offsite or local area proposals that contribute to long term conservation of affected threatened species, population or ecological communities. If on or off-site compensatory habitat is not considered appropriate, justification must be provided. OEH is of the opinion that where a proposal which involves the clearing of threatened species habitat (i.e. native vegetation) that cannot be avoided or mitigated against, and then appropriate offsets which compensate for the clearing of the habitat must be provided. The proponent must provide proper survey plans of any biodiversity offsets with the SIS, as described in sections 2.2 and 4.5 above.

Compensatory benefits likely to result from such measures proposed for alternative sites are to be discussed and evaluated along with a discussion of mechanisms of how they might best occur.

The tenure of lands, land use and the future use of lands proposed to support compensatory habitat must be considered.

Justification for any area(s) proposed as compensatory habitat / offsets is to include an assessment of the threatened species / biodiversity values impacted on by the proposed works (i.e. those of the

subject site) and a comparison of whether the proposed offset area(s) provides equivalent or greater values – ‘improve or maintain important biodiversity values’.

To determine the adequate biodiversity offset required to compensate the loss of threatened species, populations, ecological communities and their habitat (e.g. vegetation communities) either one of the following methodologies are to be used:

- OEH's 'offsetting principles' (OEH 2014a), as outlined on OEH's website: *Principles for the use of biodiversity offsets in NSW* (OEH's website - www.environment.nsw.gov.au/biodivoffsets/index.htm) can be used as general guide for offsetting and compensatory habitat requirements
- a biodiversity assessment using BioBanking Assessment Methodology under Biodiversity Banking and Offsets Scheme, as outlined in the *BioBanking Assessment Methodology 2014* (OEH 2014b). This would provide details of the required ecosystem and species (threatened) credits that need to be retired to offset the impacts of the development.

Although the *BioBanking Assessment Methodology (BBAM) 2014* (OEH 2014b) under the Biodiversity Banking and Offsets Scheme previously represented an alternative pathway (i.e. BioBanking Statement) to that of the SIS for Part 4 matter, OEH is of the opinion that a biodiversity assessment using this process provides a transparent framework and a quantitative alternative to the principles-based approach (i.e. 'offset provision' principles as outlined in the biodiversity accreditation guideline - OEH 2014a – Appendix 1). Although this option is no longer formally available, the BBAM calculator is still operational and can be accessed during the Saving and Transitional arrangements associated with the 'interim designated areas'.

OEH acknowledges that in this instance BBAM is a voluntary process and not a requirement under the SIS CERs, but believes it provides a valuable insight and quantitative appraisal into what would be an acceptable offset package to compensate the likely impacts of the development. OEH notes that under the *Principles for the use of biodiversity offsets in NSW* – Principle 9 states that *'offsets must be quantifiable – the impacts and benefits must be reliably estimated'*, in that offsets should be based on quantitative assessment of the loss in biodiversity from the clearing or other development and the gain in biodiversity from the offset. OEH is of the opinion that the BBAM represents the only currently recognised quantitative methodology that ensures offsets are quantifiable. Please note, if BioBanking is not used then OEH would expect an alternative quantitative methodology is adopted that clearly indicates that the biodiversity values of an offset site is commensurate with those found at the impact site, whether it be with respect to size and scale, or as a measure of biodiversity credits (as per BioBanking). Under this scenario, it is likely OEH would undertake a desk-top (as a minimum) BioBanking assessment to assess the veracity of any alternative methods used. Please note - If BioBanking is used then all appropriate files must be sent via OEH's portal, credit reports, biometric assessment reports, figures (e.g. GIS) and data sheets need to be provided with the SIS when it is lodged.

OEH acknowledges that there is no requirement to officially use BioBanking, but it is useful in quantifying the amount of offsetting required. Similarly, OEH is not obliged to accept the outcomes of a BioBanking assessment as the SIS process is a negotiated outcome. If biodiversity credits are used as part of the offsetting process and concurrence is given, they will be converted over to the appropriate credit equivalents under the *Biodiversity Conservation Act 2016*. Credit variations permitted under the Framework for Biodiversity for Major Projects or the Biodiversity Assessment Methodology (BAM 2017) for State Significant Developments (SSD) / State Significant Infrastructure (SSI) projects do not apply to Part 4 matters.

Note: On 1 October 2014, the BioBanking Credit Calculator (BioBanking Assessment Methodology 2014 [OEH 2014b]) has become the compulsory version of the tool to use for BioBanking assessments (see www.environment.nsw.gov.au/biobanking/calculator.htm for more details). The credit calculator is now web-based and no longer produces 'xml' files. Instead a copy of the assessment can be sent electronically to OEH by following the steps outlined in **Appendix 2**. The requirement of submitting background files for OEH to use in checking the BioBanking assessment still stands and is also explained in **Appendix 2**.

The following principles are relevant to areas without an existing biodiversity offsets program. Offsets will require the proponent to consider adequate conservation in perpetuity, appropriate management regimes (including other habitat enhancement or mitigation measures) and financial security with respect to ongoing management. OEH would typically consider suitable measures to ensure conservation in perpetuity, such as:

- the establishment of BioBanking sites with BioBanking agreements under the TSC Act
- the retirement of BioBanking credits (where appropriate credits are available)
- the dedication of land as a public reserve under the NPW Act
- a Conservation Agreement in-perpetuity registered on title under s69A-KA of the NPW Act
- a Trust Agreement in-perpetuity registered on title under the Nature Conservation Trust Act 2001
- a Planning Agreement under s 93F (soon to be s116T) of the EP&A Act.

Note:

- OEH preferred method of securing an offset is under the BioBanking provisions of the *Threatened Species Conservation Act 1995* (i.e. a registered BioBanking Agreement site).
- OEH no longer supports public positive covenant under s88E of the *Conveyancing Act 1919* as an appropriate conservation mechanism to secure and manage biodiversity offsets.
- Although OEH supports the use of conservation agreements under the NPW Act as one of the acceptable offsetting mechanisms, we are reviewing this approach and it is advisable that if you are considering this mechanism you contact OEH's Conservation Partners Program (ph: 9995 6761) about its applicability.

OEH notes that its preference for compensatory measures is physical land offsets of a 'like-for-like' nature.

To appropriately manage any proposed compensatory offsets, any retained habitat enhancement features within the development footprint and impact mitigation measures (including proposed rehabilitation and monitoring programs), OEH would require that an appropriate Management Plan (such as vegetation or habitat) be developed as a key amelioration measure. OEH acknowledges that where a proponent chooses a BioBanking Agreement, Conservation Agreement or similar that a Management Plan will be specifically developed as part of their establishment process.

Management plans should be prepared prior to any potential approval of the development. Management Plans should clearly document how any retained vegetated areas or habitat features will be managed with respect to long-term conservation and viability, including clear details on how they will be funded. They should cover (where applicable), but not be limited to, the following issues:

- weed management (both control and suppression) and monitoring
- management of retained native vegetation and habitat (including buffer zones)
- feral animal control
- fire management (including asset protection zones [APZs])
- public access (including restriction of, increased traffic, and associated impacts, such as increased refuse and pets)
- size and management of buffer zones
- minimisation of edge effects and fragmentation
- stormwater control and changes to hydrology (including stormwater / runoff control and sediment / erosion control measures)
- management of specific habitat enhancement measures (e.g. hollow / habitat trees, animal fencing to facilitate movement, artificial hollows and nest boxes etc.)
- fauna displacement and if appropriate translocation (including any licence requirements)
- proposed surveys, such as pre-extraction baseline, pre-clearance and rehabilitation surveys
- details of long-term monitoring (including proposed timing)
- details of any rehabilitation program, including details of timing (including proposed staging details), rehabilitation measures (including details of proposed revegetation and species mix), and post-rehabilitation monitoring

- measures to ensure conservation in perpetuity (e.g. transfer to OEH [NPWS] estate, conservation agreements or covenants)
- funding details of long-term financial commitment to any proposed conservation measures, including any mechanisms to be implemented to achieve this.

7.1.3 Ongoing monitoring

Any proposed pre-construction flora, fauna or vegetation monitoring plans or on-going monitoring of the effectiveness of the mitigation measures shall be outlined in detail, including the objectives of the monitoring program, method of monitoring, reporting framework, duration and frequency. Generally, ameliorative strategies which have not previously been proved effective should be undertaken under experimental design conditions, appropriately monitored and appropriately analyzed. Data analysis could include an 'Analysis of similarities' (ANOSIM) assessment of changes in foliage cover of plant species recorded in fixed quadrats or transects between sampling periods (Clarke 1993). Objectives of any monitoring plans are to include identifying any modifications needed to improve the effectiveness of ameliorative measures. These aspects should also be covered in any relevant management plans. Additionally a review of management plans should be undertaken at regular intervals (e.g. 5 years) to ensure adaptive management, where required, is undertaken.

8 ASSESSMENT OF SIGNIFICANCE OF LIKELY EFFECT OF PROPOSED ACTION

An 'Assessment of Significance' (s. 5A EP&A Act) is to be provided for each of the affected species (threatened species, populations or ecological communities) identified in the SIS, incorporating relevant information from sections 5.1 to 7 of the SIS. On the basis of these assessments a conclusion is to be provided concerning whether, based on more detailed assessment through the SIS process and consideration of alternatives and ameliorative measures proposed in the SIS, the proposal is still considered likely to have a significant effect on threatened species, populations or ecological communities or their habitats.

The threatened species 'Assessment of significance' should be consistent with those procedures and assessment approaches contained within OEH publication:

- '*Threatened Species Assessment Guidelines: The Assessment of Significance*' (DECC – August 2007b). This document is available from OEH's website: <http://www.environment.nsw.gov.au/surveys/GuidelinesForCarryingOutASurvey.htm>

9 ADDITIONAL INFORMATION

9.1 Qualifications and experience

A species impact statement must include details of the qualifications and experience in threatened species conservation of the person preparing the statement and of any other person who has conducted research or investigations relied on in preparing the statement (Section 110(4)).

You should have extensive experience in conducting field surveys and should be able to identify threatened species and their habitats relevant to the study area, as well as any similar species that may be confused with them. You should familiarise yourself with herbarium or museum specimens of any threatened species you are not already familiar with, before you conduct field surveys.

9.2 Other approvals required for the development or activity

A list of any approvals that must be obtained under any other Act or law before the action may be lawfully carried out, including details of the conditions of any existing approvals that are relevant to the species or population or ecological community (Sections 110(2)(f) and 110(3)(g)).

In providing a list of other approvals the following shall be included:

- Where a consent is required under Part 4 of the *Environmental Planning and Assessment Act 1979*, the name of the consent authority and the timing of the development application should be included; or
- Where an approval(s) is required under Part 5 of the *Environmental Planning and Assessment Act 1979*, the name of the determining authority or authorities, the basis for the approval and when these approvals are proposed to be obtained should be included; or
- Where an approval(s) is required under *Native Vegetation Act 2003*, the name of the determining authority or authorities, the basis for the approval and when these approvals are proposed to be obtained should be included.

Environment Protection and Biodiversity Conservation Act 1999

An action will require the approval of the Federal Minister for the Environment (in addition to any State or Local Government approval or determination) if that action will have, or is likely to have, a significant impact on a matter of national environmental significance. Threatened species and communities listed in the Australian Government *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are considered to be a matter of national environmental significance.

Many of the species and ecological communities listed in the TSC Act are also listed in the EPBC Act. Further information regarding the operation of the EPBC Act, including listed threatened species and communities, may be obtained by contacting the Australian Government Department of the Environment and Energy on 1800 803 772 or at the Department's website www.environment.gov.au/biodiversity/threatened/index.html.

9.3 Licensing matters relating to the survey

Persons conducting flora and fauna surveys must have appropriate licences or approvals under relevant legislation. The relevant legislation and associated licences and approvals that may be required are listed below:

National Parks and Wildlife Act 1974:

- General Licence (Section 120) to harm or obtain protected fauna (this may include threatened fauna).
- Licence to pick protected native plants (Section 131).
- Scientific Licence (Section 132C) to authorise the carrying out of actions for scientific, educational or conservation purposes.

Threatened Species Conservation Act 1995:

- Licence to harm threatened animal species, or pick threatened plants or damage the habitat of a threatened species (Section 91).

Animal Research Act 1985:

- Animal Research Authority to undertake fauna surveys.

Typically, you will require a licence under section 132C of the NPW Act to undertake an activity (e.g. survey) for scientific, educational or conservation purposes that is likely to result in one or more of the following:

- harm to any protected fauna, or to an animal that is a threatened species or is part of an endangered population or an endangered ecological community
- harm to any protected native plant, or any plant that is a threatened species or is part of an endangered population or an endangered ecological community. You will need a licence if you plan to collect voucher specimens for identification purposes, pick cuttings or whole plants, or collect seed
- damage to critical habitat

- damage to a habitat of a threatened species, an endangered population or an endangered ecological community.

Information pertaining to section 132C licences can be obtained from the following website:

- <http://www.environment.nsw.gov.au/licences-and-permits>

Section 132C licences came into effect in January 2003 and replaced the previous need for separate licences under other provisions of the NPW Act and the TSC Act.

It is a condition of all licences that you submit a report of the work carried out under the licence, including any results and specific details / locations of all flora and fauna, to OEH within two months of the expiry of the licence.

Also, be aware of the requirements relating to animal care and ethics when conducting wildlife surveys. The handling and capture of animals is regulated by the *Animal Research Act 1985* and the *Animal Research Regulation 1995*, which are administered by Department of Trade and Investment, Regional Infrastructure and Services. The Act requires that every person undertaking animal research must hold an Animal Research Authority. Under the Act, animal research includes the 'use' (e.g. handling, trapping etc.) of animals in field surveys. Details on animal ethics can be obtained from the following website:

- www.animaethics.org.au/home

All surveys must be carried out in accordance with the NSW Department of Trade and Investment, Regional Infrastructure and Service's Guidelines for wildlife surveys located at:

- www.animaethics.org.au/policies-and-guidelines/wildlife-research/wildlife-surveys

9.4 Section 110 (5) reports

Section 110(5) of the TSC Act has the effect of requiring OEH to provide that information regarding the State-wide conservation status of the subject species that it has available, in order to satisfy ss.110(2)&(3) of the Act. These documents are available on the internet at:

- <http://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species>

This website provides basic profiles for the majority of species listed as threatened, as well as links to the Scientific Committee determinations, more detailed profiles, environmental impact assessment guidelines and recovery plans, where these documents are available. OEH is unable to provide any further information for section 110(5) reports.

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APPENDIX 1:

Principles for the use of biodiversity offsets in NSW (OEH 2014)

Located at: www.environment.nsw.gov.au/biodivoffsets/oehoffsetprincip.htm

These principles have been developed by the Office of Environment and Heritage (OEH) to provide a useful framework when considering biodiversity impacts and appropriate offset requirements.

They are intended to be used for proposals other than those for state significant development (SSD) or state significant infrastructure (SSI). A Biodiversity Offsets Policy for Major Projects has been developed to deal with proposals for SSD and SSI.

1. Impacts must be avoided first by using prevention and mitigation measures.

Offsets are then used to address the remaining impacts. This may include modifying the proposal to avoid an area of biodiversity value or putting in place measures to prevent offsite impacts.

2. All regulatory requirements must be met.

Offsets cannot be used to satisfy approvals or assessments under other legislation, such as assessment requirements for Aboriginal heritage sites and for pollution or other environmental impacts (unless specifically provided for by legislation or additional approvals).

3. Offsets must never reward ongoing poor performance.

Offset schemes should not encourage landholders to deliberately degrade or mismanage offset areas in order to increase the value from the offset.

4. Offsets will complement other government programs.

A range of tools is required to achieve the NSW Government's conservation objectives, including the establishment and management of new national parks, nature reserves, state conservation areas and regional parks, and incentives for private landholders.

5. Offsets must be underpinned by sound ecological principles.

They must:

- include the conservation of structure, function and compositional elements of biodiversity, including threatened species
- enhance biodiversity at a range of scales
- consider the conservation status of ecological communities
- ensure the long-term viability and functionality of biodiversity.

Biodiversity management actions, such as enhancement of existing habitat and securing and managing land of conservation value for biodiversity, can be suitable offsets. Reconstruction of ecological communities involves high risks and uncertainties for biodiversity outcomes and is generally less preferable than other management strategies, such as enhancing existing habitat.

6. Offsets should aim to result in a net improvement in biodiversity over time.

Enhancement of biodiversity in offset areas should be equal to or greater than the loss in biodiversity from the impact site.

Setting aside areas for biodiversity conservation without additional management or increased security is generally not sufficient to offset the loss of biodiversity. Factors to consider include protection of existing biodiversity (removal of threats), time-lag effects, and the uncertainties and risks associated with actions such as revegetation.

Offsets may include:

- enhancing habitat
- reconstructing habitat in strategic areas to link areas of conservation value
- increasing buffer zones around areas of conservation value

- removing threats by conservation agreements or reservation.

7. Offsets must be enduring – they must offset the impact of the development for the period that the impact occurs.

As impacts on biodiversity are likely to be permanent, the offset should also be permanent and secured by a conservation agreement or reservation and management for biodiversity. Where land is donated to a public authority or private conservation organisation and managed as a biodiversity offset, it should be accompanied by resources for its management. Offsetting should only proceed if an appropriate legal mechanism or instrument is used to secure the required actions.

8. Offsets should be agreed prior to the impact occurring.

Offsets should minimise ecological risks from time-lags. The feasibility and in-principle agreements to the necessary offset actions should be demonstrated prior to the approval of the impact. Legal commitments to the offset actions should be entered into prior to the commencement of works under approval.

9. Offsets must be quantifiable – the impacts and benefits must be reliably estimated.

Offsets should be based on quantitative assessment of the loss in biodiversity from the clearing or other development and the gain in biodiversity from the offset. The methodology must be based on the best available science, be reliable and used for calculating both the loss from the development and the gain from the offset. The methodology should include:

- the area of impact
- the types of ecological communities and habitat or species affected
- connectivity with other areas of habitat or corridors
- the condition of habitat
- the conservation status and/or scarcity or rarity of ecological communities
- management actions
- level of security afforded to the offset site.

The best available information or data should be used when assessing impacts of biodiversity loss and gains from offsets. Offsets will be of greater value where:

- they protect land with high conservation significance
- management actions have greater benefits for biodiversity
- the offset areas are not isolated or fragmented
- the management for biodiversity is in perpetuity, such as secured through a conservation agreement.

Management actions must be deliverable and enforceable.

10. Offsets must be targeted.

They must offset impacts on the basis of like-for-like or better conservation outcomes. Offsets should be targeted according to biodiversity priorities in the area, based on the conservation status of the ecological community, the presence of threatened species or their habitat, connectivity and the potential to enhance condition by management actions and the removal of threats.

Only ecological communities that are equal or greater in conservation status to the type of ecological community lost can be used for offsets. One type of environmental benefit cannot be traded for another: for example, biodiversity offsets may also result in improvements in water quality or salinity but these benefits do not reduce the biodiversity offset requirements.

11. Offsets must be located appropriately.

Wherever possible, offsets should be located in areas that have the same or similar ecological characteristics as the area affected by the development.

12. Offsets must be supplementary.

They must be beyond existing requirements and not already funded under another scheme. Areas that have received incentive funds cannot be used for offsets. Existing protected areas on private land cannot be used for offsets unless additional security or management actions are implemented. Areas already managed by the government, such as national parks, flora reserves and public open space, cannot be used as offsets.

13. Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or contracts.

Offsets must be audited to ensure that the actions have been carried out, and monitored to determine that the actions are leading to positive biodiversity outcomes.

Page last updated: 8 September 2014

APPENDIX 2

Checklist of information required when utilising the Biobanking Assessment Methodology and Submitting BioBanking assessments to OEH using the BioBanking Credit Calculator v.4.0

An Assessors' Guide / Manual to Using the BioBanking Credit Calculator is available for download from the Office of Environment and Heritage (OEH) website <http://www.environment.nsw.gov.au/biobanking/calculator.htm>. The guide provides information on the operation and use of the web-based BioBanking Credit Calculator version.4.0.

To submit your assessment to OEH, open your assessment in *Edit* mode. Navigate to the *Assessment details* page and select the *Submit* button in the top right hand corner. A *Submit the assessment for approval* box will appear (Figure 1), where you can confirm submission (*OK* button) or cancel submission (*Cancel* button). Once a case has been submitted to OEH, the status of the case will change in your *My work* tab from *Work in progress (WIP)* to *submitted*. Please note that you cannot make any edits to an assessment that has been submitted, although you will be able to view the assessment.

Submit the assessment for approval

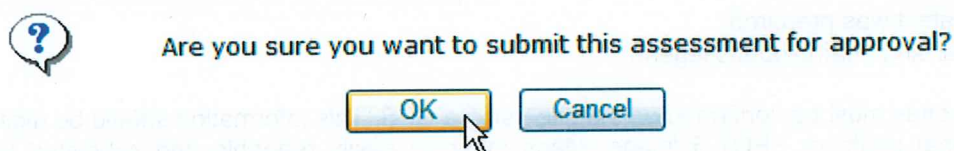


Figure 1: Submitting an assessment

The following documentation must be submitted with your Environmental Impact Statement or Species Impact Statement report (in hard copy and soft copy):

- BioBanking Assessment Report including a list of dominant indigenous species for overstorey, mid-storey and ground cover for each vegetation type and, where required:
 - local benchmark data,
 - request for increase in gain of site value,
 - a description of the proposed development,
 - measures to avoid and mitigate the impacts of development,
 - an assessment of indirect impacts,
 - a statement of onsite measures,
 - a description of the application of the BioBanking Assessment Methodology, including details of and assumptions made in utilising the methodology, such as (but not limited to) placement of assessment circles, remnant value, connectivity and reasoning behind selection of vegetation types in the Biometric Vegetation Type database,
 - plot and transect values including a list of the indigenous plant species identified in each of the plots,
 - a description of targeted threatened flora and fauna surveys, and any general baseline surveys (incl. vegetation specific surveys). These should be also be provided schematically, and

Where required, the BioBanking Assessment Report should also include:

- expert reports,
 - an application for a determination on red flag areas,
 - more appropriate use of local data for vegetation types, benchmarks or threatened species,
 - environmental contributions accompanied by a BioBanking Agreement Credit Report (if applicable), and
 - application for deferred retirement arrangements (if applicable).
- Copies of completed field data sheets, and updated with correct plant taxonomy in instances where field names have been used.

Maps (soft copy as A4 jpgs) of:

- offset site / BioBanking Agreement boundary or development footprint
- vegetation zones
- management zones
- and where required:
 - existing waste
 - existing erosion
 - existing structures (in waterways)

- Separate shape files should be supplied for all the maps mentioned above plus:
 - plots and transects
 - assessment circles
 - species polygons
 - polygons for adjacent remnant area
 - the location or habitat area of sensitive species, and the management area related to that sensitive species (as this information cannot be displayed publicly).

All maps must include:

- a title (as per the names above)
- the site's name, location and lot/DP numbers
- the scale
- the date it was prepared
- a clear and unambiguous legend.

Boundaries and zones must be confirmed on the site using a GPS. This information should be digitised onto an ortho-rectified aerial photo or SPOT-5 image. Maps must be easily readable and submitted to OEH as a Geographic Information System (GIS) file that is ESRI compatible. Shape files must use GDA94 datum. Name each shape file as: 'biobank site name_descriptor'. For example, 'Hill Farm_photo points' or 'Hill Farm_management zones'.

Photo points should be named A, B, C, D, E, F, G, etc. Photo points should be located in areas where change is expected (i.e. where replanting, natural regeneration, intensive weeding or other active management actions are to be carried out). As a rough guide, include at least one photo point in each management zone where active management actions will be undertaken. Boundaries and zones must be confirmed on the site using a GPS. This information should be digitised onto an ortho-rectified aerial photo or SPOT-5 image. Maps must be easily readable and submitted to OEH as a Geographic Information System (GIS) file that is ESRI compatible.

Shape files must use GDA94 datum. Name each shape file as: 'biobank/development site name_descriptor'. For example, 'Hill Farm_photo points' or 'Hill Farm_management zones'.

Additional requirements for offset sites that may be required (based on liaison with OEH):

- completed biobanking agreement management action template (provided in MS-Word format), and
- Biodiversity Credits Pricing Spreadsheet

Once the case has been received OEH will review the data entered, and any supporting documentation. For State Significant Development (SSD), State Significant Infrastructure and residual Part 3A (under the *Environmental Planning and Assessment Act 1979*) this review will take place during the assessment of the Environmental Impact Statement or Environmental Assessment report (for Part 3A matters).

ATTACHMENT B:

Checklist for determining if an SIS has met the requirements of the Chief Executive of the Office of Environment and Heritage

Under the *Environmental Planning and Assessment Act 1979*, where a significant effect on threatened species, populations or ecological communities is likely, a development application must be accompanied by concurrence from the Office of Environment and Heritage (OEH). A species impact statement prepared in accordance with Division 2 of Part 6 of the *Threatened Species Conservation Act 1995* (TSC Act) must accompany the application.

The development is taken not to significantly affect threatened species, populations or ecological communities, or their habitats if:

- a) the development is to be carried out on biodiversity certified land (within the meaning of Part 7AA of the TSC Act, or
- b) a BioBanking statement has been issued in respect of the development under Part 7A of the TSC Act.

Before deciding to issue consent or approval and consequently requesting the concurrence of the Chief Executive of OEH, it is required of the consent or determining authority to determine whether the SIS meets the Chief Executive's requirements (CERs).

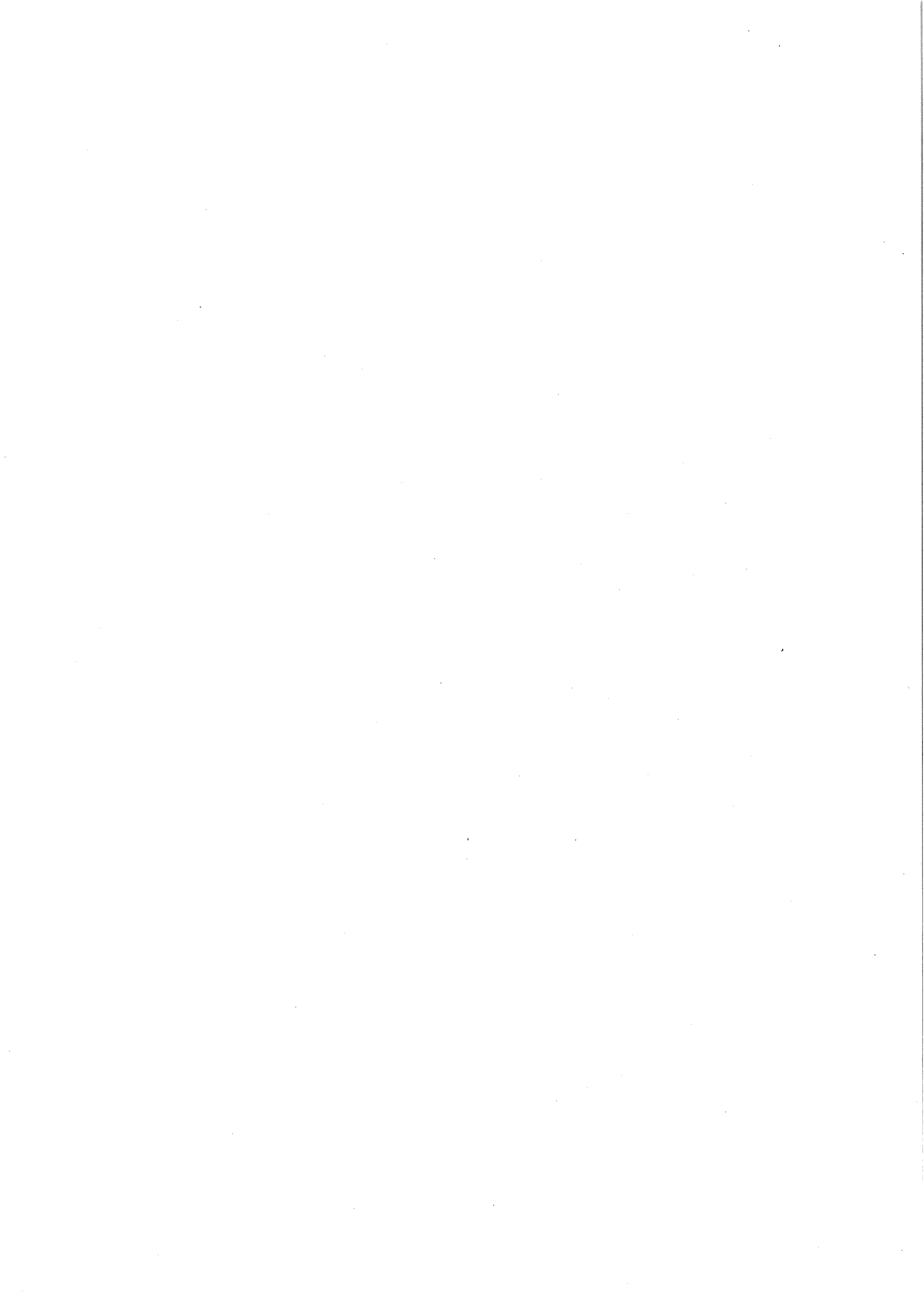
This checklist has been drawn up to assist consent and determining authorities in this matter. A comments column has been included to allow authorities to provide, among other things, reasons for their decisions or comments on whether an omission is significant.

Note that this is a generic checklist and some items may not be relevant to the application being reviewed or the CERs issued. If the requirements do not specify one of the matters below, then it is recommended that this be noted in the comments column. Consultants preparing an SIS may also use this checklist as a brief guide to preparing the SIS.

Matter	Yes/No	Comments
Has the SIS been signed by both its author and the applicant for consent/approval?		
Has the description of the proposal included all associated activities and works, such as hazard reduction zones, access roads and road upgrades, utilities, etc?		
Have all requested plans, maps and aerial photographs been provided? This includes any A1 or A0 sized proper survey plans prepared by a registered surveyor that clearly show the location and boundaries of any proposed offsets.		
Has the SIS determined the subject species by reviewing the suggested list in the CERs, other available information and survey results and assessing which species, populations and ecological communities are to be impacted by the development?		
Has the survey undertaken provided sufficient information to determine the likely impacts of the proposal on threatened species, populations and ecological communities?		

Matter	Yes/No	Comments
Have surveys been undertaken during the appropriate season(s) for the detection of the species that may possibly occur on site?		
Have surveys been undertaken during appropriate weather conditions?		
Have climatic conditions preceding the surveys (e.g. drought c.f. wet) affected the possibility of subject species being detected?		
Have all specific survey methods, techniques and intensities requested in the CERs been followed completely?		
Has the documentation of survey effort, locations and techniques provided sufficient information to determine the above?		
Has the assessment of impacts included the impacts of ALL activities associated with the development, including fire hazard reduction requirements, access road upgrades, downstream and downslope impacts, detention basins, severing of fauna movement corridors, etc.		
Has the SIS discussed the extent, conservation significance and security of other occurrences of the subject species' in the locality (locality is defined in the CERs)?		
Has the SIS discussed the significance of the population/remnant to be affected, relative to others within the locality?		
Has the SIS discussed the extent, conservation significance and security of other occurrences of the subject species in the region (region is defined in the TSC Act).		
Has the SIS discussed the significance of the population/remnant to be affected, relative to others within the region?		
Have alternatives to the proposal been discussed? Alternatives may include relocation of infrastructure or, for example, reducing minimum lot size so that a similar number of lots may be realised whilst retaining a larger conservation lot within a subdivision, or changing mining techniques.		
Has the discussion of alternatives included assessment of the social and economic (not merely financial) aspects of these alternatives (particularly, of not proceeding)?		
Has the discussion included an assessment of how the project meets the principles of Ecologically Sustainable Development, as defined in section 6(2) of the <i>Protection of the Environment Administration Act 1991</i> ?		
Have all proposals for compensatory actions (e.g. purchase of similar vegetation / habitat or revegetation of habitat, where appropriate) been discussed with the relevant landowners/manager?		

Matter	Yes/No	Comments
Is there documented agreement for sale or revegetation activities?		
Is there agreement to change zoning or enter into a covenant on title in order to secure the conservation of the properties being purchased or revegetated?		
If translocation is proposed, has the impact of the translocation on the recipient site(s) been assessed?		
Is there a 'Plan of Management' or similar titled document?		
Has the SIS utilised relevant information from published draft and final recovery plans? If no plan has been published, but it is known that one is being prepared, has the SIS utilised advice from the NPWS as to the likely contents of that recovery plan (liaison to obtain this advice may have been specified in the CERs)? For example, would the proposal result in the loss of a local population or remnant that a recovery plan describes as being of particular importance to the conservation of the species, population or ecological community?		
If a BioBanking assessment has been done for the proposal have the following been provided: copies of BioBanking Credit reports, copies of field datasheets, and copies of a checklist that includes all data used in the credit calculator and the underlying assumptions, such as how local vegetation communities were assigned to BioMetric vegetation types?		
Has the SIS discussed the relationship of the proposal to any listed Key Threatening Processes (e.g. does the proposal result in the need for High Frequency Fire as a fire hazard reduction measure, or does it result in the Clearing of Native Vegetation)?		
Has the SIS discussed the relationship of the proposal to any published Threat Abatement Plan (e.g. does the proposal result in an increased threat in a manner that is specifically at odds with a published plan)?		
Has a revised Part 5A assessment of significance been included?		
Has the 'Additional Information' specified in section 9 of the CERs been provided?		
Have the qualifications and experience of those involved in the surveys been included?		
Have other approvals which are required for the development or activity been documented?		
Any licensing requirements (e.g. s.91 under TSC Act).		



Appendix B Likelihood of Occurrence Assessment

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

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

The likelihood of occurrence was determined prior to field survey. If a flora species was not identified following targeted survey, then it is not considered to occur within the study area and is not considered as an affected species for this SIS.

Table 16. Likelihood of occurrence of threatened flora species and populations

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Distribution	Habitat	Likelihood of occurrence	Will habitat be impacted?	Affected species
Fabaceae	<i>Acacia bynoeana</i>	Bynoe's Wattle	E	V	Bynoe's wattle is found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains. It has recently been found in the Colymea and Parma Creek areas west of Nowra.	Dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple. Flowers September to March.	Unlikely. Soil mapping indicates suggests the presence of clay soils.	No. No suitable habitat in the study area as it requires sandy soils, which are not present in the study area. Not recorded after adequate surveys.	No
Myrtaceae	<i>Callistemon linearifolius</i>	Netted Bottle Brush	V		Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Recorded in 2000 at Coalcliff in the northern Illawarra. This species has also been recorded from Yengo National Park.	Grows in dry sclerophyll forest on the coast and adjacent ranges. Flowers spring to summer.	Potential. Dry sclerophyll forest mapped on the site.	No. This species was not recorded in the study area after adequate surveys.	No
Orchidaceae	<i>Cymbidium canaliculatum</i>	<i>Cymbidium canaliculatum</i> population in the Hunter Catchment	E2		The Hunter population occurs as far south as Weston and Pokolbin in the Lower Hunter, but is centred in the Upper Hunter, predominantly north of Singleton. Isolated occurrences are also known from the Merriwa plateau, Bylong valley and the Gungal area near Goulburn River.	Grows on trees in sclerophyll forest or woodland, where its host trees typically occur on Permian Sediments of the Hunter Valley floor. Within the Hunter Catchment, most commonly found in <i>Eucalyptus albens</i> (White Box) dominated woodlands.	Potential.	No. This species was not recorded in the study area after adequate surveys.	No.

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Distribution	Habitat	Likelihood of occurrence	Will habitat be impacted?	Affected species
Apocynaceae	<i>Cynanchum elegans</i>	White-flowered Wax Plant	E1	E	Restricted to eastern NSW, from Brunswick Heads on the north coast to Gerroa in the Illawarra region, and as far west as Merriwa in the upper Hunter River valley.	Dry rainforest; littoral rainforest; <i>Leptospermum laevigatum</i> - <i>Banksia integrifolia</i> subsp. <i>integrifolia</i> (Coastal Tea-tree – Coastal Banksia) coastal scrub; <i>Eucalyptus tereticornis</i> (Forest Red Gum) or <i>Corymbia maculata</i> (Spotted Gum) open forest and woodland; and <i>Melaleuca armillaris</i> (Bracelet Honey Myrtle) scrub. Flowers between August and May.	Potential. <i>Corymbia maculata</i> (Spotted Gum) is a dominant tree within the study area.	No. This species was not recorded in the study area after adequate surveys.	No.
Poaceae	<i>Dichanthium setosum</i>	Bluegrass	V	V	In NSW, found on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes.	Cleared woodland, grassy roadside remnants and highly disturbed pasture, on heavy basaltic black soils and red-brown loams with clay subsoil.	Unlikely. Suitable habitat and soils are not present within the study area.	Unlikely. No suitable habitat is present within the study area.	No
Orchidaceae	<i>Diuris pedunculata</i>	Small Snake Orchid	E1	E	Confined to north east NSW, now mainly found on the New England Tablelands, around Armidale, Uralla, Guyra and Ebor. Recorded historically near Maitland.	Grassy slopes or flats, on peaty soils in moist areas, on shale and trap soils, on fine granite, and among boulders. Flowers from August to September.	Potential Shale soils have been mapped in the study area	Unlikely. Not recorded within the subject site after adequate surveys. Low potential to occur in the study area outside of the subject site, which had that same habitat, but was surveyed in November, just outside the flowering period.	No.
Myrtaceae	<i>Eucalyptus camaldulensis</i>	Eucalyptus camaldulensis population in the Hunter catchment	E2		Disjunct population occurring from Bylong, south of Merriwa, to the east at Hinton, on the bank of the Hunter River.	Riparian and floodplain woodland, often with <i>Eucalyptus tereticornis</i> , <i>E. melliodora</i> , <i>Casuarina cunninghamiana</i> subsp. <i>cunninghamiana</i> and <i>Angophora floribunda</i> .	No. The subject site is not on the Hunter River.	No. This population was not recorded on the subject site.	No
Myrtaceae	<i>Eucalyptus glaucina</i>	Slaty Red Gum	V	V	Found only on the north coast of NSW and in separate districts: near Casino where it can be locally common, and farther south, from Taree to Broke, west of Maitland.	Grows in grassy woodland and dry eucalypt forest. Grows on deep, moderately fertile and well-watered soils.	Potential. Dry eucalypt forest mapped in the study area.	Potential. This species was not recorded in the study area after adequate surveys.	No
Myrtaceae	<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	Parramatta Red Gum	V	V	There are two separate meta-populations of <i>E. parramattensis</i> subsp. <i>decadens</i> . The Kurri Kurri meta-population is bordered by Cessnock—Kurri Kurri in the north and Mulbring—Abedare in the south. Large aggregations of the subspecies are located in the Tomalpin area. The Tomago Sandbeds meta-population is bounded by Salt Ash and Tanilba Bay in the north and Williamtown and Tomago in the south.	This species generally occurs on deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high.	Unlikely. Clay soils have been mapped in the study area.	No. Clay soils area present in the study area and this species was not detected after adequate surveys.	No.

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Distribution	Habitat	Likelihood of occurrence	Will habitat be impacted?	Affected species
Scrophulariaceae	<i>Euphrasia arguta</i>		E4A	CE	In NSW, recently recorded only from Nundle area of the north western slopes and tablelands, from near the Hastings River and from the Barrington Tops.	Eucalypt forest with a mixed grass and shrub understorey, disturbed areas, along roadsides, in meadows near rivers.	Unlikely. Mostly recorded from the north western slopes.	Unlikely. Only one type of known habitat, eucalypt forest with a grass and shrub understorey, occurs in the study area, and the study area is outside of the known distribution	No
Rubiaceae	<i>Galium australe</i>	Tangled Bedstraw	E1		Recorded historically in the Nowra (Colymea) and Narooma areas; extant in Nadgee Nature Reserve, south of Eden. Unconfirmed records from the Sydney region.	Turpentine forest and coastal <i>Acacia</i> shrubland in NSW. Elsewhere sand dunes, sand spits, shrubland and woodland. Flowers spring-summer.	No. The study area is outside of the known or predicted distribution of this species.	No. Suitable habitat not present within the study area.	No
Proteaceae	<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flowered Grevillea	V	V	Sporadic locations in the Sydney Basin with sizeable populations around Picton, Appin and Bargo and in the Cessnock – Kurri Kurri area.	From heath to shrubby woodland to open forest. Sandy or light clay soils usually over thin shales, often with lateritic ironstone gravels and nodules. Usually on tertiary sands and alluvium and soils derived from the Mittagong Formation.	Unlikely. The study area is outside of its known distribution.	No. Soils in the study area are not sandy or light clay nor are they located on tertiary alluvium. Not recorded within the study area after adequate surveys.	No
Rutaceae	<i>Leionema lamprophyllum</i> subsp. <i>obovatum</i> population in the Hunter Catchment		CE		The Hunter Catchment population of <i>Leionema lamprophyllum</i> subsp. <i>obovatum</i> occurs west of Maitland near Pokolbin in the Hunter Valley.	Occurs in dry eucalypt forest on exposed rocky terrain.	Unlikely. The study area is unlikely to have exposed rocky areas.	No. No suitable habitat in the study area and this species was not recorded during adequate surveys.	No
Juncaginaceae	<i>Maundia triglochinooides</i>		V		Coastal NSW north from Wyong and extending into southern Qld.	Swamps, lagoons, dams, channels, creeks or shallow freshwater 30 - 60 cm deep on heavy clay.	Potential. A farm dam is mapped in the study area.	No. Not recorded after suitable surveys	No.
Proteaceae	<i>Persoonia pauciflora</i>	North Rothbury Persoonia	E4A	CE	Restricted to a 2.5 km radius of the original specimen at North Rothbury in the Cessnock local government area.	Open forest or woodland dominated by <i>Corymbia maculata</i> (Spotted Gum), <i>Eucalyptus fibrosa</i> (Broad-leaved Ironbark) and/or <i>E. crebra</i> (Narrow-leaved Ironbark), mainly on silty sandstone soils.	Potential. Open forest dominated by <i>Corymbia maculata</i> (Spotted Gum) and <i>Eucalyptus fibrosa</i> (Broad-leaved Ironbark) occur in the study area.	No. This species was not recorded on the site after adequate surveys.	No
Orchidaceae	<i>Prasophyllum petilum</i>	Tarengo Leek Orchid	E1	E	Four sites in NSW: at Boorowa, Captains Flat, Ilford and Delegate. Also experimentally introduced at Bowning Cemetery NSW.	Natural Temperate Grassland, grassy woodland, and Box-Gum woodland.	Unlikely. Suitable habitat not mapped in the study area.	No. No suitable habitat within the study area.	No

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Distribution	Habitat	Likelihood of occurrence	Will habitat be impacted?	Affected species
Orchidaceae	<i>Pterostylis chaetophora</i>		V		In NSW, currently known from 18 scattered locations between Taree and Kurri Kurri, extending to the south-east towards Tea Gardens and west into the Upper Hunter, with additional records near Denman and Wingen. There are also a few records from the Sydney region. Known from Grahamstown Dam 5km north east of the site (Bell, 2009).	Seasonally moist, dry sclerophyll forest. Flowers from September to November.	Potential. Dry sclerophyll forest occurs within the study area.	No. This species was not recorded after adequate surveys.	No.
Orchidaceae	<i>Pterostylis gibbosa</i>	Illawarra Greenhood	E	E	Known from a small number of populations in the Hunter region (Mibrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra).	Hunter region habitat includes open forest of <i>Eucalyptus crebra</i> (Narrow-leaved Ironbark), <i>Eucalyptus tereticornis</i> (Forest Red Gum) and <i>Callitris endlicheri</i> (Black Cypress Pine).	Unlikely. Forest mapped in the study area is dominated by <i>Corymbia maculata</i> (Spotted Gum)	No. No suitable habitat occurs in the study area. This species was not recorded after surveys.	No.
Asteraceae	<i>Rutidosia heterogama</i>	Heath Wrinklewort	V	V	Recorded from near Cessnock to Kurri Kurri with an outlying occurrence at Howes Valley. On the Central Coast it is located north from Wyong to Newcastle. There are north coast populations between Woolli and Evans Head in Yuraygir and Bundjalung National Parks. It also occurs on the New England Tablelands from Torrington and Ashford south to Wandsworth south-west of Glen Innes.	Grows in heath on sandy soils and moist areas in open forest and has been recorded along disturbed roadsides.	No. No suitable habitat (sandy soils) occurs in the study area, which has clay soils.	No. No suitable habitat within the study area.	No
Myrtaceae	<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E	V	The Magenta Lilly Pilly is found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest.	On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	No. No suitable habitat in the study area.	No. No suitable habitat in the study area.	No
Elaeocarpaceae	<i>Tetradlea juncea</i>	Black-eyed Susan	V	V	Confined to the northern Sydney Basin bioregion and the southern North Coast bioregion in the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock.	Low open forest/woodland, heathland and moist forest, mainly on low nutrient soils associated with the Awaba Soil Landscape.	Unlikely. Habitat in the study area is dry sclerophyll forest on clay soils.	No. Unsuitable habitat in the study area. Not recorded after adequate targeted surveys in the study area.	No
Santalaceae	<i>Thesium australe</i>	Austral Toadflax	V	V	In eastern NSW it is found in very small populations scattered along the coast, and from the Northern to Southern Tablelands.	Grassland on coastal headlands or grassland and grassy woodland away from the coast. Flowers spring-summer.	Unlikely. Suitable habitat not present in the study area.	No. Not recorded in the study area during adequate surveys.	No

Table 17. Likelihood of occurrence of threatened fauna species and populations

Scientific Name	Common Name	TSC Act	EPBC Act	Distribution	Habitat	Likelihood of occurrence	Will habitat be impacted?	Affected Species
Aves								
<i>Anseranas semipalmata</i>	Magpie Goose	V		In NSW, found in central and northern parts of the state, with vagrants as far as south-eastern NSW.	Shallow wetlands, floodplains, grasslands, pastures, dams and crops.	No. No suitable habitat present.	No. Suitable habitat not present in the study area.	No
<i>Anthochaera phrygia</i>	Regent Honeyeater	E4A	CE	Inland slopes of south-east Australia, and less frequently in coastal areas. In NSW, most records are from the North-West Plains, North-West and South-West Slopes, Northern Tablelands, Central Tablelands and Southern Tablelands regions; also recorded in the Central Coast and Hunter Valley regions.	Eucalypt woodland and open forest, wooded farmland and urban areas with mature eucalypts, and riparian forests of <i>Casuarina cunninghamiana</i> (River Oak).	Potential. This species may pass through the study area or feed on <i>Corymbia maculata</i> (Spotted Gums) or <i>Eucalyptus fibrosa</i> (Broad-leaved Ironbark) during winter.	No. While removal of <i>C. maculata</i> and <i>E. fibrosa</i> would result in a reduction in potential foraging habitat for this highly mobile species, the site is not likely to consist of breeding habitat and therefore it would not be affected.	No
<i>Apus pacificus</i>	Fork-tailed Swift		M	Recorded in all regions of NSW but does not breed in Australia.	Riparian woodland, swamps, low scrub, heathland, saltmarsh, grassland, <i>Spinifex</i> sandplains, open farmland and inland and coastal sand-dunes.	Unlikely. This species is mostly aerial and is unlikely to land in the study area due to unsuitable habitat.	No. No suitable habitat would be affected.	No
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	V		Dusky woodswallows are widespread in eastern, southern and south western Australia. This species occurs throughout most of New South Wales, but is sparsely scattered in, or largely absent from, much of the upper western region. Most breeding activity occurs on the western slopes of the Great Dividing Range.	Primarily inhabits dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland.	Potential. Suitable habitat (eucalypt forest and woodland) is present within the study area.	No. Not recorded during adequate surveys.	No
<i>Botaurus poiciloptilus</i>	Australasian Bittern	E1	E	Found over most of NSW except for the far north-west.	Permanent freshwater wetlands with tall, dense vegetation, particularly <i>Typha</i> spp. (bullrushes) and <i>Eleocharis</i> spp. (spikerushes).	No. Suitable habitat not present in the study area.	No. No habitat would be affected.	No
<i>Burhinus grallarius</i>	Bush Stone-curlew	E		The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range.	Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch.	Unlikely. Habitat within the study area is mostly dense and shrubby.	No. No suitable habitat within the study area.	No.

Scientific Name	Common Name	TSC Act	EPBC Act	Distribution	Habitat	Likelihood of occurrence	Will habitat be impacted?	Affected Species
<i>Calidris ferruginea</i>	Curlew Sandpiper	E1	CE, M	Occurs along the entire coast of NSW, and sometimes in freshwater wetlands in the Murray-Darling Basin.	Littoral and estuarine habitats, including intertidal mudflats, non-tidal swamps, lakes and lagoons on the coast and sometimes inland.	No. Suitable habitat not present within the study area.	No. No habitat would be affected.	No
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V		In NSW, distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. Isolated records known from as far north as Coffs Harbour and as far west as Mudgee.	Tall mountain forests and woodlands in summer; in winter, may occur at lower altitudes in open eucalypt forests and woodlands, and urban areas.	Potential. Potential winter habitat in the form of eucalypt forests and woodlands is present in the study area.	No. The few records within the locality are from 2005 and 9 km from the study area to the south east near Werakata National Park. Not recorded during surveys. Habitat in the study area is unlikely to be suitable.	No.
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	V		In NSW, widespread along coast and inland to the southern tablelands and central western plains, with a small population in the Riverina.	Open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur.	Potential. Open forest occurs within the study area.	No. No records within the locality. Potential foraging habitat (<i>Allocasuarina</i> spp.) trees are very sparse within the study area. While some hollow-bearing trees occur in the study area which could provide potential breeding habitat, this species was not recorded during adequate surveys and is therefore considered unlikely to be breeding or foraging in the study area.	No.
<i>Chthonicola sagittata</i>	Speckled Warbler	V		From south-eastern Qld, the eastern half of NSW and into Victoria, as far west as the Grampians, mostly on hills and tablelands of the Great Dividing Range and rarely on coast.	Eucalyptus-dominated communities with a grassy understorey and sparse shrub layer, often on rocky ridges or in gullies.	Potential. Open forest present in the study area, however, it is dominated by <i>Corymbia maculata</i> (Spotted Gum).	No. Not recorded during adequate surveys for this species. The study area contains of woodland with a grassy understorey and sparse shrub layer around the perimeter of the subject site. However, the majority of the study area is unsuitable as it contains a dense shrub layer. This species was not recorded during diurnal bird censuses and is considered unlikely to occur in the study area.	No

Scientific Name	Common Name	TSC Act	EPBC Act	Distribution	Habitat	Likelihood of occurrence	Will habitat be impacted?	Affected Species
<i>Circus assimilis</i>	Spotted Harrier	V		Found throughout the Australian mainland, except in densely forested or wooded habitats, and rarely in Tasmania.	Grassy open woodland, inland riparian woodland, grassland, shrub steppe, agricultural land and edges of inland wetlands. Sedentary bird, builds a stick nest and young remain in nest for several months (spring/summer)	Unlikely. Most of the study area is not suitable habitat as it is densely wooded.	Unlikely. Only two records in the locality (1983 and 2014), both more than 5 km from the study area. This species was not recorded during adequate surveys and is therefore considered unlikely to be breeding or foraging in the study area.	No.
<i>Climacteris picumnis</i> subsp. <i>victoriae</i>	Brown Treecreeper	V		Endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges. The eastern subspecies lives in eastern NSW in eucalypt woodlands through central NSW and in coastal areas with drier open woodlands such as the Snowy River Valley, Cumberland Plains, Hunter Valley and parts of the Richmond and Clarence Valleys.	Sedentary. Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains.	Potential. While there are no records of this species in the locality it has been recorded more intact vegetation around Kurri Kurri (ALA, 2018).	No. The study area contains of woodland with a grassy understorey and sparse shrub layer around the perimeter of the subject site. However, the majority of the study area is unsuitable as it contains a dense shrub layer. This species was not recorded during diurnal bird censuses and is considered unlikely to occur in the study area.	No
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V		Distribution in NSW is nearly continuous from the coast to the far west.	Inhabits eucalypt forests and woodlands, mallee and Acacia woodland. This species is sedentary.	Potential. Eucalypt forest occurs in the study area.	No. While this species contains suitable habitat (eucalypt forest) it was not recorded during adequate surveys and is therefore considered unlikely to be breeding or foraging in the study area.	No.
<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E1	E	There are three main populations: Northern - southern Qld/northern NSW, Central - Barren Ground NR, Budderoo NR, Woronora Plateau, Jervis Bay NP, Booderee NP and Beecroft Peninsula and Southern - Nadgee NR and Croajingalong NP in the vicinity of the NSW/Victorian border.	Central and southern populations inhabit heath and open woodland with a heathy understorey. In northern NSW, habitat comprises open forest with dense tussocky grass understorey.	No. Suitable habitat not present.	No. No suitable habitat within the study area.	No
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E1		Coastal and subcoastal northern and eastern Australia, south to central-eastern NSW and with vagrants recorded further south and inland.	In NSW, floodplain wetlands of the major coastal rivers are key habitat. Also minor floodplains, coastal sandplain wetlands and estuaries.	No. Suitable habitat not present in the study area.	No. No suitable habitat within the study area.	No

Scientific Name	Common Name	TSC Act	EPBC Act	Distribution	Habitat	Likelihood of occurrence	Will habitat be impacted?	Affected Species
<i>Epthianura albifrons</i>	White-fronted Chat	V		Occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state.	Saltmarsh vegetation, open grasslands and sometimes low shrubs bordering wetland areas.	No. Suitable habitat not present in the study area.	No. No suitable habitat within the study area.	No
<i>Erythroriorchis radiatus</i>	Red Goshawk	E4A	V	In NSW, extends to ~30°S. Recent records confined to the Northern Rivers region north of the Clarence River.	Open woodland and forest, often along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, <i>Melaleuca</i> swamp forest and coastal riparian <i>Eucalyptus</i> forest.	No. Suitable habitat not present.	No. No records in the locality and no suitable habitat present in the study area.	No
<i>Falco subniger</i>	Black Falcon	V		The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be referable to the Brown Falcon. In New South Wales there is assumed to be a single population that is continuous with a broader continental population, given that falcons are highly mobile, commonly travelling hundreds of kilometres (Marchant & Higgins 1993). The Black Falcon occurs as solitary individuals, in pairs, or in family groups of parents and offspring.	The Black Falcon inhabits woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees. The Black Falcon is usually associated with streams or wetlands, visiting them in search of prey and often using standing dead trees as lookout posts.	Unlikely. Suitable habitat not present in the study area.	No. No suitable habitat present and records of Black Falcons on the coast and around the study area are likely to be Brown Falcons.	No
<i>Glossopsitta pusilla</i>	Little Lorikeet	V		In NSW, found from the coast westward as far as Dubbo and Albury.	Dry, open eucalypt forests and woodlands, including remnant woodland patches and roadside vegetation.	Likely. Previously recorded in the study area in 2007. Potential foraging and roosting habitat available. Likely to utilise the study area from time to time.	No. The study area contains of woodland with a grassy understorey. This species was not recorded during diurnal bird censuses and is considered unlikely to occur in the study area.	No
<i>Grantiella picta</i>	Painted Honeyeater	V	V	Widely distributed in NSW, predominantly on the inland side of the Great Dividing Range but avoiding arid areas.	Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests.	Unlikely. Suitable habitat not present in the study area and no records within the locality.	No. While mistletoe is present within the study area, the known forest types do not occur within the study area. Not recorded during adequate surveys.	No.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V		Distributed along the coastline of mainland Australia and Tasmania, extending inland along some of the larger waterways, especially in eastern Australia.	Freshwater swamps, rivers, lakes, reservoirs, billabongs, saltmarsh and sewage ponds and coastal waters. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest and urban areas.	Unlikely. Preferred habitat not present in the study area.	No. The habitat within the study area is not preferred habitat for this species. Not recorded during adequate surveys.	No

Scientific Name	Common Name	TSC Act	EPBC Act	Distribution	Habitat	Likelihood of occurrence	Will habitat be impacted?	Affected Species
<i>Hieraaetus morphnoides</i>	Little Eagle	V		Throughout the Australian mainland, with the exception of the most densely-forested parts of the Dividing Range escarpment.	Open eucalypt forest, woodland or open woodland, including sheoak or <i>Acacia</i> woodlands and riparian woodlands of interior NSW.	Potential. Although there are no records in the locality, potential foraging habitat occurs within open and grassy woodland areas of the study area.	No. This species was not detected during adequate surveys and no nests of this species was recorded.	No
<i>Irediparra gallinacean</i>	Comb-crested Jacana	V		The Comb-crested Jacana occurs in northern and eastern Australia, mainly in coastal and subcoastal regions, from the north-eastern Kimberley Division of Western Australia to Cape York Peninsula then south along the east coast to the Hunter region of NSW, with stragglers recorded in south-eastern NSW (possibly in response to unfavourable conditions further north).	This species inhabits permanent freshwater wetlands, either still or slow-flowing, with a good surface cover of floating vegetation, especially water-lilies, or fringing and aquatic vegetation	No. No suitable habitat occurs on the site. The farm dam is small and has a low cover of floating vegetation.	No	No.
<i>Ixobrychus flavicollis</i>	Black Bittern	V		In NSW, records are scattered along the east coast, with individuals rarely being recorded south of Sydney or inland.	Terrestrial and estuarine wetlands. Also flooded grassland, forest, woodland, rainforest and mangroves where permanent water is present.	No. Suitable habitat not present in the study area.	No. No suitable habitat occurs in the study area.	No
<i>Lathamus discolor</i>	Swift Parrot	E	CE	Breeds in Tasmania and migrates to south-eastern Australia as far up as south-east Queensland. Mostly occurs on the coast and south west slopes in NSW.	In areas where eucalypts flower profusely, including <i>Corymbia maculata</i> (Spotted Gum).	Yes. A species record is located within the study area. <i>Corymbia maculata</i> (Spotted Gum) is a dominant canopy species within the study area.	Yes. This species has been previously recorded in the study area. Foraging habitat would be removed by the proposal.	Yes
<i>Limosa limosa</i>	Black-tailed Godwit	V		A migratory bird that occurs in Australia between August and March. In NSW, it is most frequently recorded at Kooragang Island (Hunter River estuary), with occasional records elsewhere along the coast, and inland.	Primarily a coast pieces found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. Inland it can be found in mudflats and shallow water (less than 10 cm deep).	No. No suitable habitat in the study area.	No. No habitat would be affected.	No.
<i>Lophoictinia isura</i>	Square-tailed Kite	V		In NSW, it is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast.	Timbered habitats including dry woodlands and open forests, particularly timbered watercourses.	Potential. While it prefers timbered watercourses it could prey on passerines and insects in the study area.	Unlikely. Only one record in the locality, approximately 6 km from the study area. No timbered watercourses present and not recorded during surveys.	No.

Scientific Name	Common Name	TSC Act	EPBC Act	Distribution	Habitat	Likelihood of occurrence	Will habitat be impacted?	Affected Species
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	V		Found throughout much of inland NSW, with the exception of the extreme north-west, where it is replaced by subspecies <i>picata</i> .	Open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Territories range from 10 to 30 ha.	Potential. It has potential occur on the fringes of the study area where the country is more lightly wooded.	No. Closest records at 10 km away to the south west in Werakata National Park. This species was not recorded during surveys and is unlikely to occur within the study area.	No.
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V		Widespread in NSW from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. Also Richmond and Clarence River areas and a few scattered sites in the Hunter, Central Coast and Illawarra regions.	Open forests or woodlands dominated by box and ironbark eucalypts, or by smooth-barked gums, stringybarks, river sheoaks and tea-trees.	Potential. Open forest dominated by smooth-barked gums (<i>Corymbia maculata</i>) have been mapped in the study area.	No. Nesting habitat (river sheoaks) not present. This species tends to occur in the largest patches of woodland in the landscape and has been recorded in larger woodlands south west of the study area around Kurri Kurri, 10 km away.	No
<i>Neophema pulchella</i>	Turquoise Parrot	V		Occurs along the length of NSW from the coastal plains to the western slopes of the Great Dividing Range.	Eucalypt and cypress pine open forests and woodlands, ecotones between woodland and grassland, or coastal forest and heath.	Unlikely. Mainly occurs on the western side of the tablelands and inland slopes. Only one record 7 km south of the study area.	No. Unlikely to occur in the study area. Surveys were undertaken in breeding period (August to December) and it was not detected.	No.
<i>Ninox connivens</i>	Barking Owl	V		Wide but sparse distribution in NSW, avoiding the most central arid regions. Core populations exist on the western slopes and plains and in some northeast coastal and escarpment forests.	Woodland and open forest, including fragmented remnants and partly cleared farmland, wetland and riverine forest. Sometimes timbered watercourses in cleared landscaped. Breeds in hollows of large old trees.	Potential. One record in the locality 4 km south of the study area in 2013. Potential foraging habitat within the study area.	No Large hollows are present in the study area. Potential to be breeding and has potential to forage within the study area. Not recorded in the study area during surveys.	No
<i>Ninox strenua</i>	Powerful Owl	V		In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains.	Woodland, open sclerophyll forest, tall open wet forest and rainforest.	Potential. One record in the locality 7 km south of the study area in 2000 Potential foraging habitat within the study area.	No Large hollows are present in the study area. Potential to be breeding and has potential to forage within the study area. Not recorded in the study area during surveys.	No

Scientific Name	Common Name	TSC Act	EPBC Act	Distribution	Habitat	Likelihood of occurrence	Will habitat be impacted?	Affected Species
<i>Oxyura australis</i>	Blue-billed Duck	V		Widespread in NSW but is most concentrated in the southern Murray-Darling Basin area.	Coastal and inland wetlands and swamps.	No. Suitable habitat not present within the study area.	No. No habitat present within the study area.	No
<i>Pandion cristatus</i>	Eastern Osprey	V		Common around the northern NSW coast, and uncommon to rare from coast further south. Some records from inland areas.	Rocky shorelines, islands, reefs, mouths of large rivers, lagoons and lakes.	Unlikely. Suitable habitat not present within the study area.	No. No suitable habitat is present in the study area.	No
<i>Petroica boodang</i>	Scarlet Robin	V		In NSW, it occurs from the coast to the inland slopes.	Dry eucalypt forests and woodlands, and occasionally in mallee, wet forest, wetlands and tea-tree swamps.	Potential. The most recent records are in 2004 7 km to the south and 9 km to the south west of the study area.	No. Not recorded during adequate surveys.	No
<i>Petroica phoenicea</i>	Flame Robin	V		In NSW, breeds in upland areas, and in winter many birds move to the inland slopes and plains, or occasionally to coastal areas. Likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands.	Breeds in upland tall moist eucalypt forests and woodlands. In winter uses dry forests, open woodlands, heathlands, pastures and native grasslands. Occasionally occurs in temperate rainforest, herbfields, heathlands, shrublands and sedgeland at high altitudes.	Potential. Winter habitat (woodland and open areas) present within the study area. One record 8 km south west of the study area in 2007.	Yes. While potential wintering habitat occurs in the study area, the study area is unlikely to be significant for this wide-ranging species.	No
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V		In NSW, occurs on the western slopes of the Great Dividing Range, and as far as Louth and Balranald on the western plains. Also occurs in woodlands in the Hunter Valley and in some locations on the north coast	Open woodland habitats; favours Box-gum woodlands on the slopes and Box-cypress and open Box woodlands on alluvial plains.	Yes. Recorded within the study area.	Yes Breeding and foraging habitat will be affected by the proposal.	Yes
<i>Ptilinopus regina</i>	Rose-crowned Fruit-dove	V		Coast and ranges of eastern NSW and Queensland, from Newcastle to Cape York. Vagrants are occasionally found further south to Victoria.	Rose-crowned Fruit-doves occur mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful.	Unlikely Habitat in the study area has been mapped as dry sclerophyll forest.	No. No suitable habitat occurs in the study area.	No.
<i>Rostratula australis</i>	Australian Painted Snipe	E	E	In NSW many records are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Other important locations with recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys.	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds.	Unlikely. No swamps or large dams are mapped in the study area.	No. No suitable habitat available in the study area.	No

Scientific Name	Common Name	TSC Act	EPBC Act	Distribution	Habitat	Likelihood of occurrence	Will habitat be impacted?	Affected Species
<i>Stagonopleura guttata</i>	Diamond Firetail	V		Endemic to south-eastern Australia, extending from central Queensland to the Eyre Peninsula in South Australia. It is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina.	Grassy woodlands, Box-Gum woodlands, Snow Gum woodlands, open forest, mallee, natural temperate grasslands, secondary grasslands and derived communities.	Potential. Open forest and open areas have been mapped in the study area.	No. While potential habitat occurs on the site, this species was not recorded during adequate surveys.	No
<i>Sternula albifrons</i>	Little Tern	E1	M	In NSW, it arrives from September to November, occurring mainly north of Sydney, with smaller numbers found south to Victoria.	Sheltered coastal environments, harbours, inlets and rivers.	No. No suitable habitat within the study area.	No.	No
<i>Stictonetta naevosa</i>	Freckled Duck	V		Inland river systems, occurring as far as coastal NSW in times of drought.	Freshwater swamps and creeks, lakes, reservoirs, farm dams and sewage ponds.	No. No suitable habitat within the study area.	No. No habitat occurs in the study area.	No
<i>Tyto novaehollandiae</i>	Masked Owl	V		Recorded over approximately 90% of NSW, excluding the most arid north-western corner. Most abundant on the coast but extends to the western plains.	Dry eucalypt forests and woodlands from sea level to 1100 m.	Potential. Potential foraging habitat within the study area.	No Large hollows are present in the study area. Potential to be breeding and has potential to forage within the study area. Not recorded in the study area during surveys.	No
<i>Tyto tenebricosa</i>	Sooty Owl	V		Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands.	Dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests.	No. No suitable habitat mapped within the study area.	No. No suitable habitat present within the study area.	No
Mammalia								
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V		Found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extends from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes.	A broad range of habitats from rainforest through sclerophyll forests and heaths. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes. Also eats insects and flowers. Tree hollows favoured for nests and shelters in hollows, stumps, holes and abandoned nests, dreys or thickets of vegetation.	Potential. Dry sclerophyll forest has been mapped in the study area.	No. No records within the locality and very low abundance of banksia and bottlebrushes.	No

Scientific Name	Common Name	TSC Act	EPBC Act	Distribution	Habitat	Likelihood of occurrence	Will habitat be impacted?	Affected Species
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes.	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (<i>Petrochelidon ariel</i>), frequenting low to mid-elevation dry open forest and woodland close to these features. Well-timbered areas containing gullies.	Potential. No suitable breeding habitat on or likely to be near the study area. More likely to breed or forage in the south east of the locality where it has been previously recorded.	No. No suitable habitat present.	No
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	Eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania.	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den sites include hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites.	Potential. The study area is within the range of this species and includes habitat features such as hollows and open forest.	Unlikely. This species was not recorded during adequate surveys.	No
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V		South-east coast and ranges of Australia, from southern Qld to Victoria and Tasmania. In NSW, records extend to the western slopes of the Great Dividing Range.	Trees taller than 20 m. Prefers moist habitats.	Likely. Suitable foraging and roosting habitat present in the study area.	Unlikely. This species was not recorded during adequate surveys.	No
<i>Miniopterus australis</i>	Little Bentwing-bat	V		East coast and ranges south to Wollongong in NSW.	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, <i>Melaleuca</i> swamps, dense coastal forests and banksia scrub. Roosts in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings.	Likely. Recorded to the north of the study area (RPS, 2011).	Yes. May forage or roost in tree hollows in the study area.	Yes.
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V		In NSW it occurs on both sides of the Great Dividing Range, from the coast inland to Moree, Dubbo and Wagga Wagga.	Rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland.	Likely. Recorded to the north of the study area (RPS, 2011).	Unlikely. This species was not recorded during adequate surveys.	No
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V		Found along the east coast from south Qld to southern NSW.	Dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roosts mainly in tree hollows.	Likely. Recorded to the north of the study area (RPS, 2011).	Yes. Potential foraging and roosting habitat occurs within the study area.	Yes.

Scientific Name	Common Name	TSC Act	EPBC Act	Distribution	Habitat	Likelihood of occurrence	Will habitat be impacted?	Affected Species
<i>Myotis adversus</i> (syn. <i>Myotis macropus</i>)	Large-footed Myotis	V		In NSW, found in the coastal band. It is rarely found more than 100 km inland, except along major rivers.	Foraging habitat is waterbodies (including streams, or lakes or reservoirs) and fringing areas of vegetation up to 20 m.	Potential. Potential foraging habitat (vegetation and a dam) occurs in the south east corner of the study area.	Unlikely. This species was not recorded during adequate surveys.	No
<i>Nyctophilus corbeni</i>	Corben's Long-eared Bat	V	V	Overall, the distribution of the south eastern form coincides approximately with the Murray Darling Basin, with the Pilliga Scrub region being the distinct stronghold for this species.	Inhabits a variety of vegetation types, including mallee, bullocke <i>Allocasuarina leuhmanni</i> and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark.	Potential. Potential foraging and roosting habitat occurs in the study area.	No. Although potential foraging habitat occurs within the study area, this species was not recorded during surveys.	No
<i>Petaurus norfolcensis</i>	Squirrel Glider	V		Widely though sparsely distributed on both sides of the Great Dividing Range in eastern Australia, from northern Qld to western Victoria.	Mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas.	Likely. This species has been recorded in the study in 2007	No. Although potential foraging habitat occurs within the study area, this species was not recorded during surveys.	No
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	E1	V	In NSW they occur from the Qld border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit.	Rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges.	No. Suitable habitat not present within the study area.	No. No suitable habitat within the study area.	No
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V		In NSW it is mainly found east of the Great Dividing Range although there are occasional records west of the divide.	Dry sclerophyll open forest, heath, swamps, rainforest and wet sclerophyll forest.	Potential. The study area contains some open woodland areas with sparse shrubs which is potential habitat.	No. This species was not recorded during adequate surveys.	No.
<i>Phascolarctos cinereus</i>	Koala	V	V	The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range.	Eucalypt forests and woodlands. Feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	Potential. Eucalypt forests have been mapped in the study area.	No. While some secondary feed trees have been recorded in the study area, the Koala was not recorded.	No

Scientific Name	Common Name	TSC Act	EPBC Act	Distribution	Habitat	Likelihood of occurrence	Will habitat be impacted?	Affected Species
<i>Planigale maculata</i>	Common Planigale	V		Coastal north-eastern NSW, coastal east Queensland and Arnhem Land. This species reaches its confirmed southern distribution limit on the NSW lower north coast however there are reports of its occurrence as far south as the central NSW coast west of Sydney.	Rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water. They are active at night and during the day shelter in saucer-shaped nests built in crevices, hollow logs, beneath bark or under rocks.	Potential. Eucalypt forest has been mapped in the study area, the type of forest habitat is not suitable for this species.	No. Suitable habitat does not occur within the study area.	No
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	Within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations.	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	Potential. Eucalypt forest has been mapped in the study area.	No. No camps in the study area and not detected during spotlighting.	No
<i>Potorous tridactylus</i>	Long-nosed Potoroo	V	V	In NSW it is generally restricted to coastal heaths and forests east of the Great Dividing Range, with an annual rainfall exceeding 760 mm.	Coastal heaths and dry and wet sclerophyll forests.	Unlikely. No suitable habitat within the study area.	No. No suitable habitat within the study area	No
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V		There are scattered records of this species across the New England Tablelands and North West Slopes. Rare visitor in late summer and autumn to south-western NSW.	Almost all habitats, including wet and dry sclerophyll forest, open woodland, open country, mallee, rainforests, heathland and waterbodies.	Likely. Suitable foraging and breeding habitat within the study area.	Unlikely. This species was not recorded during adequate surveys.	No
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V		Both sides of the great divide, from the Atherton Tableland in Qld to north-eastern Victoria, mainly along river systems and gullies. In NSW it is widespread on the New England Tablelands.	Woodland, moist and dry eucalypt forest and rainforest.	Likely. Suitable foraging and breeding habitat within the study area.	Yes. Potential foraging habitat occurs in the study area.	Yes
<i>Vespadelus troughtoni</i>	Eastern Cave Bat	V		Found in a broad band on both sides of the Great Dividing Range south to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT.	Dry open forest and woodland, near cliffs or rocky overhangs, cliff-lines in wet eucalypt forest and rainforest.	Potential. Potential habitat mapped in the study area.	Unlikely. This species was not recorded during adequate surveys.	No

Amphibia

Scientific Name	Common Name	TSC Act	EPBC Act	Distribution	Habitat	Likelihood of occurrence	Will habitat be impacted?	Affected Species
<i>Litoria aurea</i>	Green and Golden Bell Frog	E	V	Formerly distributed from the NSW north coast near Brunswick Heads, southwards along the NSW coast to Victoria where it extends into east Gippsland. Records from west to Bathurst, Tumut and the ACT region. Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations. These locations occur over the species' former range; however, they are widely separated and isolated.	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (<i>Typha</i> spp.) or spikerushes (<i>Eleocharis</i> spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (<i>Gambusia holbrooki</i>), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas.	Potential. Suitable habitat (one dam) mapped in the study area.	No. Not detected during adequate surveys for this species.	No
<i>Litoria littlejohni</i>	Littlejohn's Tree Frog	V	V	Plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest south to Buchan in Victoria. This species has not been recorded in southern NSW within the last decade.	Breeding habitat is the upper reaches of permanent streams and perched swamps. Non-breeding habitat is heath-based forests and woodlands	No. Suitable habitat not present in the study area.	No	No
Reptilia								
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	V		A patchy distribution from north-east Queensland to the north-eastern quarter of NSW. In NSW it has historically been recorded from as far west as Mungindi and Quambone on the Darling Riverine Plains, across the north west slopes, and from the north coast from Queensland to Sydney.	Found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest. In drier environments, it appears to favour habitats close to riparian areas. It shelters during the day between loose bark and tree-trunks, or in hollow trunks and limbs of dead trees.	Unlikely. While the study area is within the range of the species and open forest has been mapped in the study area, there are no records in the locality and habitat preferences	No. Unlikely to occur within the study area.	No

Table 18. Likelihood of occurrence of threatened communities

Community Name	TSC Act	EPBC Act	Description	Distribution	Habitat	Likelihood of occurrence	Will habitat be impacted?	Affected Community
Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions	E	CE	Central Hunter Grey Box–Ironbark Woodland typically forms a woodland dominated by Narrow-leaved Ironbark (<i>Eucalyptus crebra</i>), Kurrajong (<i>Brachychiton populneus</i> subsp. <i>populneus</i>) and Grey Box (<i>Eucalyptus moluccana</i>). A shrub layer is often present and common shrub species include Velvet Mock Olive (<i>Notelaea microcarpa</i> var. <i>microcarpa</i>), Coffee Bush (<i>Breynia oblongifolia</i>), Blackthorn (<i>Bursaria spinosa</i> subsp. <i>spinosa</i>), <i>Cassinia quinquefaria</i> and Sticky Hop-bush (<i>Dodonaea viscosa</i>). Ground cover can be moderately dense to dense and consist of numerous forbs and grass species as well as a small number of ferns, sedges and twiners.	Central Hunter Valley between about Singleton and Muswellbrook. It is known to occur in the Cessnock, Singleton and Muswellbrook LGAs but may occur elsewhere within the Sydney Basin Bioregion.	Areas of relatively low rainfall and high temperatures. It is associated mostly with Permian lithology, and is situated on gently undulating hills, slopes and valleys, or occasionally on rocky knolls.	Potential. This community has not been mapped in the study area.	No. No <i>E. moluccana</i> (Grey Box) is present. The canopy is dominated by <i>Corymbia maculata</i> (Spotted Gum). This community does not occur within the study area.	No
Central Hunter Ironbark Spotted Gum – Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions	E	CE	Typically forms an open forest or woodland dominated by Narrow-leaved Ironbark (<i>Eucalyptus crebra</i>), Spotted Gum (<i>Corymbia maculata</i>) and Grey Box (<i>Eucalyptus moluccana</i>). The shrub layer varies from sparse to moderately dense. Common shrub species include Gorse Bitter Pea (<i>Daviesia ulicifolia</i> subsp. <i>ulicifolia</i>), Grey Bush-pea (<i>Pultenaea spinosa</i>), Coffee Bush (<i>Breynia oblongifolia</i>), Needlebush (<i>Hakea sericea</i>) and Blackthorn (<i>Bursaria spinosa</i> subsp. <i>spinosa</i>). Ground cover can be sparse to moderately dense and consists of numerous forbs, a few grass species and occasional ferns and sedges.	Central Hunter Valley mainly between Maitland and Muswellbrook. It has been recorded from Singleton, Cessnock and Muswellbrook LGAs but may occur elsewhere within the North Coast and Sydney Basin Bioregions. It has been mapped as being recorded in Bellfield National Park and in the Singleton Military Area	Occupies undulating country including low rises and slopes, occurring on all aspects. It may also occur on alluvial and colluvial soils in valleys. It mostly occurs on clayey soils found on Permian sediments.	Unlikely. This community has not been mapped in the study area.	No. No <i>E. moluccana</i> (Grey Box) is present. This community does not occur in the study area.	No
Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions	E		A tall to very tall (18-35 m) woodland on floodplains and associated rises along the Hunter River and tributaries. Generally dominated by <i>Eucalyptus camaldulensis</i> (River Red Gum) in combinations with <i>Eucalyptus tereticornis</i> (Forest Red Gum), <i>Eucalyptus melliodora</i> (Yellow Box) and <i>Angophora floribunda</i> (Rough-barked Apple). Within the community stands of <i>Casuarina cunninghamiana</i> subsp. <i>cunninghamiana</i> (River Oak) and <i>Casuarina glauca</i> (Swamp Oak) can form a part of this community. The groundcover is diverse.	Recorded from the local government areas of Maitland, Mid-Western, Muswellbrook, Singleton, and Upper Hunter but may occur elsewhere within the NSW North Coast and Sydney Basin Bioregions.	It generally occurs on floodplains and floodplain rises. Known to contain the endangered River Red Gum population in the Hunter Catchment	Unlikely The study area does not occur on floodplain or floodplain rises.	No. The study area does not occur on floodplains and it is not dominated by characteristic trees of this community.	No
Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions.	E		An open forest where the most common canopy tree species are <i>Eucalyptus tereticornis</i> (Forest Red Gum) and <i>E. punctata</i> (Grey Gum). The shrub layer is open and the ground cover comprises grasses and herbs.	Between Muswellbrook, Beresfield, Mulbring and Cessnock in the Lower Hunter It has been recorded from the Maitland, Cessnock, Port Stephens, Muswellbrook and Singleton LGAs, but may occur elsewhere in these bioregions.	Occurs on the Permian sediments of the Hunter Valley floor. Occurs on gentle slopes of depressions and drainage flats on the Hunter Valley floor.	Unlikely. The study area does not occur on gentle slopes of depressions and drainage flats.	No. The study area occurs on low hills and is dominated by <i>Corymbia maculata</i> (Spotted Gum).	No

Community Name	TSC Act	EPBC Act	Description	Distribution	Habitat	Likelihood of occurrence	Will habitat be impacted?	Affected Community
Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion	E	E	This community is dominated by <i>Corymbia maculata</i> (Spotted Gum) and <i>Eucalyptus fibrosa</i> Broad-leaved Ironbark, while <i>E. punctata</i> (Grey Gum) and <i>E. crebra</i> (Grey Ironbark) occur occasionally. The understorey is marked by the tall shrub, <i>Acacia parvipinnula</i> , and by the prickly shrubs, <i>Daviesia ulicifolia</i> , <i>Bursaria spinosa</i> , <i>Melaleuca nodosa</i> and <i>Lissanthe strigosa</i> . Other shrubs include <i>Persoonia linearis</i> , <i>Maytenus silvestris</i> and <i>Breynia oblongifolia</i> . The ground layer is diverse; frequent species include <i>Cheilanthes sieberi</i> , <i>Cymbopogon refractus</i> , <i>Dianella revoluta</i> , <i>Entolasia stricta</i> , <i>Glycine clandestina</i> , <i>Lepidosperma laterale</i> , <i>Lomandra multiflora</i> , <i>Microlaena stipoides</i> , <i>Pomax umbellata</i> , <i>Pratia purpurascens</i> , <i>Themeda australis</i> and <i>Phyllanthus hirtellus</i>	Restricted to a range of approximately 65 km by 35 km centred on the Cessnock - Beresfield area in the Central and Lower Hunter Valley.	Permian geology in the central to lower Hunter Valley, including the Dalwood Group, the Maitland Group and the Greta and Tomago Coal Measures. Smaller areas of the community may also occur on the Permian Singleton and Newcastle Coal Measures and the Triassic Narrabeen Group.	Yes. This community has been mapped RPS (2011) in the north of the study area and is likely to occur in the remainder of the study area.	Yes. This community is present and will be affected by the proposal.	Yes
River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions	E		A forest on river-flats where the most widespread and abundant dominant trees include <i>Eucalyptus tereticornis</i> (forest red gum), <i>E. amplifolia</i> (cabbage gum), <i>Angophora floribunda</i> (rough-barked apple) and <i>A. subvelutina</i> (broad-leaved apple). <i>Eucalyptus baueriana</i> (blue box), <i>E. botryoides</i> (bangalay) and <i>E. elata</i> (river peppermint) may be common south from Sydney, <i>E. ovata</i> (swamp gum) occurs on the far south coast, <i>E. saligna</i> (Sydney blue gum) and <i>E. grandis</i> (flooded gum) may occur north of Sydney, while <i>E. benthamii</i> is restricted to the Hawkesbury floodplain.	The floodplains of the Hunter, Hawkesbury, Moruya, Bega and Towamba Rivers, although many smaller floodplains and river flats also contain examples of the community.	Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains.	Unlikely. The study area is not mapped on river-flats, drainage lines and river terraces associated with coastal floodplains.	No. The dominant trees are not characteristic trees. The study area does not occur on river-flats or associated drainage lines.	No.
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E		An open to dense tree layer of eucalypts and paperbarks. Some remnants now only have scattered trees as a result of partial clearing. The most widespread and abundant dominant trees include <i>Eucalyptus robusta</i> (swamp mahogany), <i>Melaleuca quinquenervia</i> (paperbark) and, south from Sydney, <i>Eucalyptus botryoides</i> (bangalay) and <i>Eucalyptus longifolia</i> (woollybutt). Other trees may be scattered throughout at low abundance or may be locally common at few sites, including <i>Callistemon salignus</i> (sweet willow bottlebrush), <i>Casuarina glauca</i> (swamp oak) and <i>Eucalyptus resinifera</i> subsp. <i>hemilampra</i> (red mahogany), <i>Livistona australis</i> (cabbage palm) and <i>Lophostemon suaveolens</i> (swamp turpentine).	Major examples once occurred on the floodplains of the Tweed, Richmond, Clarence, Macleay, Hastings and Manning Rivers, although smaller floodplains would have also supported considerable areas of this community.	Associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Generally occurs below 20 m (though sometimes up to 50 m) elevation.	Unlikely. The study area is not mapped as being below 20 masl.	No. Neither characteristic soils or tree species are present.	No
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E	E	It has a dense to sparse tree layer in which <i>Casuarina glauca</i> (swamp oak) is the dominant species northwards from Bermagui. Other trees including <i>Acmena smithii</i> (lilly pilly), <i>Glochidion</i> spp. (cheese trees) and <i>Melaleuca</i> spp. (paperbarks) may be present as subordinate species and are found most frequently in stands of the community northwards from Gosford. Tree diversity decreases with latitude, and is the only abundant tree in this community south of Bermagui.	On the coastal floodplains of NSW.	Associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Generally occurs below 20 m (rarely above 10 m) elevation.	Unlikely. The study area has not been mapped as occurring on coastal floodplains.	No. The study area occurs on small hills. The dominant tree species in the study area are not characteristic of this community.	No

Appendix C Flora survey data

Table 19. Flora survey data

Species	*	Form	HTW	Plot 1			Plot 2			Plot 3			Plot 4			Plot 5		
				S	C	A	S	C	A	S	C	A	S	C	A	S	C	A
<i>Corymbia maculata</i>		Tree (TG)	0	U	20	7	U	10	4	U	20	6	U	15	12			
<i>Acacia ulicifolia</i>		Shrub (SG)	0				M	3	50									
<i>Bursaria spinosa</i>		Shrub (SG)	0				M	2	50				M	1	10			
<i>Daviesia ulicifolia</i>		Shrub (SG)	0	M	60	100				M	2	20	M	3	50			
<i>Epacris spp.</i>		Shrub (SG)	0				G	1	50	G	0.1	1						
<i>Eremophila debilis</i>		Shrub (SG)	0				G	0.1	2	G	2	50	G	1	20			
<i>Hibbertia spp. 1</i>		Shrub (SG)	0	G	0.1	2												
<i>Hibbertia spp. 2</i>		Shrub (SG)	0	G	0.1	5												
<i>Hibbertia spp. 3</i>		Shrub (SG)	0	G	0.1	1												
<i>Lissanthe strigosa</i>		Shrub (SG)	0				G	0.1	20									
<i>Ozothamnus diosmifolius</i>		Shrub (SG)	0	G	0.1	2	M	2	50	G	0.5	20	M	0.1	5			
<i>Pultenaea villosa</i>		Shrub (SG)	0										M	0.1	2			
<i>Glycine clandestina</i>		Other (OG)	0	G	0.1	5	G	0.1	50				G	0.1	2			
<i>Glycine spp.</i>		Other (OG)	0				G	0.1	20	G	0.1	20						

Species	*	Form	HTW	Plot 1			Plot 2			Plot 3			Plot 4			Plot 5		
				S	C	A	S	C	A	S	C	A	S	C	A	S	C	A
<i>Hardenbergia violacea</i>		Other (OG)	0				G	0.1	5				G	0.1	2			
<i>Aristida vagans</i>		Grass & grasslike (GG)	0	G	10	500	G	8	1000	G	10	1000	G	5	500	G	0.1	1
<i>Cynodon dactylon</i>		Grass & grasslike (GG)	0				G	5	500	G	2	50				G	70	2000
<i>Echinopogon spp.</i>		Grass & grasslike (GG)	0				G	0.1	20									
<i>Entolasia stricta</i>		Grass & grasslike (GG)	0	G	0.1	10	G	1	50	G	2	100	G	5	100			
<i>Lomandra glauca</i>		Grass & grasslike (GG)	0	G	5	100	G	2	100	G	1	100	G	2	500			
<i>Lomandra longifolia</i>		Grass & grasslike (GG)	0				G	2	50	G	0.5	10	G	1	50			
<i>Lomandra multiflora</i>		Grass & grasslike (GG)	0	0	G	1	50	G	1	50	G	1	50	G	1			
<i>Paspalidium distans</i>		Grass & grasslike (GG)	0	G	1	50	G	5	500	G	1	50						
<i>Themeda triandra</i>		Grass & grasslike (GG)	0				G	0.2	20	G	2	50	G	1	50			
<i>Juncus subsecundus</i>		Grass & grasslike (GG)	0													G	1	200

Species	*	Form	HTW	Plot 1			Plot 2			Plot 3			Plot 4			Plot 5		
				S	C	A	S	C	A	S	C	A	S	C	A	S	C	A
<i>Dichelachne micrantha</i>		Grass & grasslike (GG)	0													G	0.5	50
<i>Themeda triandra</i>		Grass & grasslike (GG)	0													G	0.2	20
<i>Aristida ramosa</i>		Grass & grasslike (GG)	0													G	2	200
<i>Unidentified grass</i>		Grass & grasslike (GG)	0													G	0.1	20
<i>Brunoniella australis</i>		Forb (FG)	0	G	0.5	20	G	0.2	50	G	0.1	20	G	0.2	20			
<i>Commelina cyanea</i>		Forb (FG)	0	G	0.1	1												
<i>Dianella revoluta</i>		Forb (FG)	0				G	1	50	G	0.1	5	G	0.1	5			
<i>Dichondra repens</i>		Forb (FG)	0				G	0.1	50									
<i>Goodenia rotundifolia</i>		Forb (FG)	0	G	2	50	G	2	500	G	2	100	G	2	100			
<i>Laxmannia gracilis</i>		Forb (FG)	0	G	2	100	G	0.2	20	G	0.1	10	G	0.1	5			
<i>Murdannia graminea</i>		Forb (FG)	0	G	0.1	20												
<i>Oxalis spp.</i>		Forb (FG)	0				G	0.1	20									
<i>Pomax umbellata</i>		Forb (FG)	0	G	1	50	G	0.2	100	G	0.2	50	G	0.1	20			
<i>Pratia purpurascens</i>		Forb (FG)	0				G	2	500				G	0.1	5			

Species	*	Form	HTW	Plot 1			Plot 2			Plot 3			Plot 4			Plot 5		
				S	C	A	S	C	A	S	C	A	S	C	A	S	C	A
<i>Solanum prinophyllum</i>		Forb (FG)	0				G	0.1	20	G	0.1	5						
<i>Vernonia cinerea</i>		Forb (FG)	0				G	0.1	20									
<i>Vittadinia spp.</i>		Forb (FG)	0							G	0.1	5						
<i>Wahlenbergia spp.</i>		Forb (FG)	0													G	8	2000
<i>Phyllanthus virgatus</i>		Forb (FG)	0													G	0.1	50
<i>Cheilanthes sieberi</i>		Fern (EG)	0	G	1	100	G	5	1000	G	0.1	5	G	0.2	50	G	0.5	100
<i>Paspalum dilatatum</i> *			0	1	G	0.1	10											
<i>Pultenaea cunninghamii</i>			0	0			M	3	50	M	3	50	M	2	20			
<i>Thelymitra ixioides</i>			0	0			G	0.1	50	G	0.1	5						
<i>Petrorhagia dubia</i> *			0	0												G	5	500
<i>Senecio madagascariensis</i> *			0	1												G	10	1000
<i>Conyza bonariensis</i> *			0	0												G	0.5	50
<i>Gamochaeta purpurea</i> *			0	0												G	5	500
<i>Briza minor</i> *			0	0												G	0.1	50

Appendix D Fauna survey data

Table 20. Fauna survey data

Survey Method	Date	Site	Easting	Northing	Observers	Survey Start	Survey Stop
Active search	22-10-18	AS1	360180	6377426	Alex Pursche	9:03 PM	9:17 PM
Active search	29-11-18	AS2	360283	6377446	Alex Pursche, Tom Schmidt	8:12 PM	9:13 PM
Arboreal Elliot Trap	22-10-18	ARB 01	360726	6377175	Alex Pursche	n/a	n/a
Arboreal Elliot Trap	22-10-18	ARB 02	360620	6377157	Alex Pursche	n/a	n/a
Arboreal Elliot Trap	22-10-18	ARB 03	360579	6377168	Alex Pursche	n/a	n/a
Arboreal Elliot Trap	22-10-18	ARB 04	360633	6377234	Alex Pursche	n/a	n/a
Arboreal Elliot Trap	22-10-18	ARB 05	360463	6377270	Alex Pursche	n/a	n/a
Arboreal Elliot Trap	22-10-18	ARB 06	360364	6377264	Alex Pursche	n/a	n/a
Arboreal Elliot Trap	22-10-18	ARB 07	360309	6377204	Alex Pursche	n/a	n/a
Arboreal Elliot Trap	22-10-18	ARB 08	360256	6377210	Alex Pursche	n/a	n/a
Arboreal Elliot Trap	22-10-18	ARB 09	360108	6377217	Alex Pursche	n/a	n/a
Arboreal Elliot Trap	25-10-18	ARB 10	360057	6377367	Alex Pursche	n/a	n/a
Call Playback	22-10-18	CP1	360596	6377247	Alex Pursche, Tom Schmidt	9:14 PM	9:49 PM
Call Playback	23-10-18	CP2	360616	6377241	Alex Pursche, Tom Schmidt	8:16 PM	9:44 PM
Call Playback	26-11-18	CP3	360573	6377262	Alex Pursche, Tom Schmidt	8:15 PM	9:00 PM
Call Playback	27-11-18	CP4	360566	6377258	Alex Pursche, Tom Schmidt	8:39 PM	10:00 PM

Survey Method	Date	Site	Easting	Northing	Observers	Survey Start	Survey Stop
Call Playback	29-11-18	CP5	360601	6377256	Alex Pursche, Tom Schmidt	8:12 PM	9:13 PM
Diurnal survey	27-09-18	DS1	360044	6377317	Alex Pursche	10:46 AM	11:43 AM
Diurnal survey	27-09-18	DS2	360251	6377059	Alex Pursche	12:14 PM	12:56 PM
Diurnal survey	23-10-18	DS3	360103	6377298	Alex Pursche	6:07 AM	6:46 AM
Diurnal survey	24-10-18	DS4	360289	6377166	Alex Pursche	7:00 AM	8:03 AM
Diurnal survey	25-10-18	DS5	360056	6377298	Alex Pursche	6:20 AM	6:40 AM
Diurnal survey	25-10-18	DS6	360386	6376993	Alex Pursche	2:42 PM	2:42 PM
Diurnal survey	25-10-18	DS7	360402	6377038	Alex Pursche	2:47 PM	2:47 PM
Harp Trap	22-10-18	Harp1	360718	6377183	Alex Pursche	n/a	n/a
Harp Trap	22-10-18	Harp2	360073	6377369	Alex Pursche	n/a	n/a
IR Camera	27-09-18	HUNT 10	360029	6377297	Alex Pursche	n/a	n/a
IR Camera	27-09-18	HUNT 39	360273	6377036	Alex Pursche	n/a	n/a
IR Camera	27-09-18	HUNT 29	360214	6377087	Alex Pursche	n/a	n/a
IR Camera	27-09-18	HUNT 28	360306	6377211	Alex Pursche	n/a	n/a
IR Camera	27-09-18	HUNT 34	360252	6377200	Alex Pursche	n/a	n/a
IR Camera	27-09-18	HUNT 23	360483	6377369	Alex Pursche	n/a	n/a
Ultrasonic detector	26-11-18	SM2-8	360748	6377205	Alex Pursche	n/a	n/a
Ultrasonic detector	26-11-18	SM2-5	360052	6377339	Alex Pursche	n/a	n/a

Survey Method	Date	Site	Easting	Northing	Observers	Survey Start	Survey Stop
Active search	10-12-18	AS3	360784	6377000	Alex Pursche	8:03 PM	8:35 PM
Call Playback	10-12-18	CP6	360278	6377219	Alex Pursche	8:40 PM	9:10 PM
Call Playback	11-12-18	CP7	360272	6377232	Alex Pursche	8:49 PM	9:20 PM
Call Playback	12-12-18	CP8	360284	6377006	Alex Pursche	8:41 PM	9:31 PM
Active search	11-12-18	AS4	360765	6376998	Alex Pursche	8:11 PM	8:41 PM
Active search	12-12-18	AS5	360762	6377006	Alex Pursche	7:55 PM	8:27 PM

Appendix E Fauna species list

Table 21 Fauna species detected

Class	Species	Common	BC Act	EPBC Act
Amphibia	<i>Crinia signifera</i>	Common Eastern Froglet	Not listed	Not listed
	<i>Limnodynastes peronii</i>	Brown-striped Frog	Not listed	Not listed
	<i>Limnodynastes tasmaniensis</i>	Spotted Grass Frog	Not listed	Not listed
	<i>Litoria caerulea</i>	Green tree Frog	Not listed	Not listed
	<i>Litoria dentata</i>	Bleating Tree Frog	Not listed	Not listed
	<i>Litoria fallax</i>	Eastern Dwarf Tree Frog	Not listed	Not listed
	<i>Litoria latopalmata</i>	Broad-palmed Frog	Not listed	Not listed
	<i>Litoria peronii</i>	Peron's Tree Frog	Not listed	Not listed
	<i>Litoria tyleri</i>	Tyler's Tree Frog	Not listed	Not listed
	<i>Uperoleia laevigata</i>	Smooth Toadlet	Not listed	Not listed
Aves	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	Not listed	Not listed
	<i>Ardea pacifica</i>	white-necked heron	Not listed	Not listed
	<i>Caligavis chrysops</i>	Yellow-faced Honeyeater	Not listed	Not listed
	<i>Chenonetta jubata</i>	Australian Wood Duck	Not listed	Not listed
	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	Not listed	Not listed
	<i>Corcorax melanorhamphos</i>	White-winged Chough	Not listed	Not listed
	<i>Corvus coronoides</i>	Australian Raven	Not listed	Not listed
	<i>Cracticus tibicen</i>	Australian Magpie	Not listed	Not listed
	<i>Cracticus torquatus</i>	Grey Butcherbird	Not listed	Not listed
	<i>Dacelo novaeguineae</i>	Laughing Kookaburra	Not listed	Not listed
	<i>Eudynamys orientalis</i>	Common Koel	Not listed	Not listed
	<i>Eurystomus orientalis</i>	Dollarbird	Not listed	Not listed
	<i>Gerygone olivacea</i>	White-throated Gerygone	Not listed	Not listed
	<i>Glossopsitta concinna</i>	musk lorikeet	Not listed	Not listed
	<i>Grallina cyanoleuca</i>	Magpie-lark	Not listed	Not listed
	<i>Manorina melanocephala</i>	Noisy Miner	Not listed	Not listed
	<i>Nesoptilotis leucotis</i>	White-eared Honeyeater	Not listed	Not listed
	<i>Ninox boobook</i>	Southern Boobook	Not listed	Not listed

Class	Species	Common	BC Act	EPBC Act
Aves	<i>Pardalotus striatus</i>	Striated Pardalote	Not listed	Not listed
	<i>Platycercus elegans</i>	Crimson Rosella	Not listed	Not listed
	<i>Platycercus eximius</i>	Eastern Rosella	Not listed	Not listed
	<i>Podargus strigoides</i>	Tawny Frogmouth	Not listed	Not listed
	<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	Vulnerable	Not listed
	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Vulnerable	Vulnerable
	<i>Rhipidura leucophrys</i>	Willie Wagtail	Not listed	Not listed
	<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo	Not listed	Not listed
	<i>Sturnus tristis</i>	Common Myna	Not listed	Not listed
	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	Not listed	Not listed
Mammalia	<i>Austronomus australis</i>	White-striped Freetail-bat	Not listed	Not listed
	<i>Canis lupus familiaris</i>	Dog	Not listed	Not listed
	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	Not listed	Not listed
	<i>Chalinolobus morio</i>	Chocolate Wattled Bat	Not listed	Not listed
	<i>Macropus giganteus</i>	Eastern Grey Kangaroo	Not listed	Not listed
	<i>Micronomus norfolkensis syn Mormopterus norfolkensis</i>	Eastern Freetail-bat	Vulnerable	Not listed
	<i>Miniopterus australis</i>	Little Bentwing-bat	Vulnerable	Not listed
	<i>Miniopterus orianae</i>	Northern Bentwing-bat	Not listed	Not listed
	<i>Nyctophilus sp.</i>	long-eared bat	Not listed	Not listed
	<i>Ozimops planiceps syn. Mormopterus planiceps</i>	Little Mastiff-bat	Not listed	Not listed
	<i>Ozimops ridei syn. Mormopterus ridei</i>	Eastern Freetailed-bat	Not listed	Not listed
	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	Vulnerable	Not listed
	<i>Scotorepens orion</i>	Eastern Broad-nosed Bat	Not listed	Not listed
	<i>Trichosurus vulpecula</i>	Common Brushtail Possum	Not listed	Not listed
	<i>Vespadelus vulturnus</i>	Little Forest bat	Not listed	Not listed

Appendix F Bat call analysis



Microbat Call Identification Report

Prepared for (“Client”):	Eco Logical Australia (Newcastle)
Survey location/project name:	Farley, Maitland area
Survey dates:	26 November – 4 December 2018
Client project reference:	11281
Job no.:	ELA-1902
Report date:	9 January 2019

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Methods

Survey summary / data received

Metadata provided with the dataset indicated the survey was undertaken using two Song Meter detectors (“SM5” & “SM8”) deployed at separate sites in the study area for eight consecutive nights (26th November – 3rd December 2018). Data were downloaded from the detectors and converted to zero-crossing analysis format bat-call sequence files (ZC files) by the client. Balance! Environmental received 3963 ZC files for analysis.

Call identification

All ZC files were analysed in *AnalookW* (Corben 2018), with species identification achieved manually by comparing the call spectrograms and derived metrics with those of reference calls and published call descriptions for New South Wales (Pennay *et al.* 2004). Calls with fewer than three clearly-defined, non-fragmented pulses were excluded from the analysis.

Species' identification was also guided by considering probability of occurrence based on general distribution information (Churchill 2008; van Dyck *et al.* 2013) and/or *Atlas of Living Australia* on-line database records (<http://www.ala.org.au>).

Reporting standard

The format and content of this report follows Australasian Bat Society standards for the interpretation and reporting of bat call data (Reardon 2003), available on-line at <http://www.ausbats.org.au>.

Species nomenclature follows Jackson & Groves (2015), which elevates the sub-genus names proposed by Reardon *et al.* (2014) for the small free-tailed bats formerly included in the genus *Mormopterus*. New names used in this report and their synonyms include:

- *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat), formerly *Mormopterus norfolkensis* (Eastern Free-tailed Bat);
- *Ozimops planiceps* (Southern Free-tailed Bat), formerly *Mormopterus planiceps* and *M.* ‘species 4’; and
- *O. ridei* (Ride’s Free-tailed Bat), formerly *Mormopterus ridei* and *M.* ‘species 2’ (Eastern Free-tailed Bat).

Jackson & Groves (2015) also lists the Common/Eastern Bent-winged Bat (*Miniopterus schreibersii oceanensis*) under the new name of *M. oriana* (Large Bent-winged Bat). It is understood the eastern form of the species still falls within the distinct sub-species *M. o. oceanensis*.

Results & Discussion

Data quantity/quality

Sixty percent of the ZC files contained useable call data (see **Table 1**), but 1591 ZC files contained only background noise (e.g. from wind, insects, etc.) or very brief, fragmented calls (i.e. <3 pulses) that were of no use for species identification. Of the 2389 potentially-identifiable bat calls recognised in the dataset, 69% were reliably identified, with the remainder (“unresolved calls”) potentially representing multiple species that share similar call characteristics.

Table 1 Data output summary for the Farley survey, 26 November – 3 December 2018.

Detector:	SM5	SM8	Total
Number of ZC files submitted	2130	1833	3963
Number of files with no useable data (% total files)	807 (38%)	784 (43%)	1591 (40%)
Number of files with potentially-identifiable calls (% total files)	1323 (62%)	1049 (57%)	2372 (60%)
Number of calls recognised	1333	1056	2389
Number of calls positively identified (% total calls)	927 (70%)	730 (69%)	1657 (69%)
Number of unresolved calls (% total calls)	406 (30%)	326 (31%)	732 (31%)

Species recorded

Eleven call types were positively identified to one of ten unique species or the *Nyctophilus* genus (refer top portion of **Table 2**). Two *Nyctophilus* species probably occur in the study area: Lesser Long-eared Bat *N. geoffroyi*; and Gould’s Long-eared Bat *N. gouldi*.

Nine “unresolved” call types were recognised (see lower portion of **Table 2**), representing at least three and up to seven additional species. These are discussed further below.

The Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) contributed 38% of the positively-identified calls (upper portion of **Table 2**). Four other species - Gould’s Wattled Bat (*Chalinolobus gouldii*), Chocolate Wattled Bat (*C. morio*), Ride’s free-tailed Bat (*Ozimops ridei*) and Large Bent-winged Bat (*Miniopterus orianae*) - were responsible for another 55% of the reliably identified calls. Collectively, these five species contributed 65% of the overall call tally.

Half of the “unresolved” calls (see lower portion of **Table 2**) were attributed to two species groups: *Vespadelus* spp./*C. morio* (125 calls); and *C. gouldii*/*Ozimops* spp. (241 calls). The *Vespadelus* spp. group includes Eastern Forest Bat (*Vespadelus pumilus*), Eastern Cave Bat (*V. troughtoni*) and Little Forest Bat (*V. vulturinus*), all of which probably occur in the study area but are difficult to differentiate on call features. Another 24% of the “unresolved” calls were attributable to two groups comprising three species: Eastern Falsistrelle (*Falsistrellus tasmaniensis*); Greater Broad-nosed Bat (*Scoteanax rueppellii*); and Eastern Broad-nosed Bat (*Scotorepens orion*). The latter two species were also positively-identified.

Example call spectrograms for each species and unresolved group are presented in **Appendix 1**. Technical terms used in the following call descriptions are explained in the **Glossary**.

Table 2 Bat species recorded during the Farley survey, 26 November – 3 December 2018. Number of calls allocated to each species or unresolved species group.

Detector:	SM5	SM8	Species Total
Positively identified calls			
<i>Chalinolobus gouldii</i>	102	161	263
<i>Chalinolobus morio</i>	19	323	342
<i>Nyctophilus sp.</i>	50	3	53
<i>Scotorepens orion</i>	19	1	20
<i>Scoteanax rueppellii</i>	2		2
<i>Miniopterus australis</i>	13	8	21
<i>Miniopterus orianae</i>	54	58	112
<i>Austronomus australis</i>		3	3
<i>Micronomus norfolkensis</i>	498	139	637
<i>Ozimops planiceps</i>		6	6
<i>Ozimops ridei</i>	170	28	198
Unresolved calls			
<i>C. gouldii</i> or <i>Ozimops spp.</i>	150	91	241
<i>M. orianae</i> or <i>Vespadelus regulus</i>	7	13	20
<i>Nyctophilus sp.</i> or <i>Myotis macropus</i>	3	54	57
<i>S. orion</i> or <i>Falsistrellus tasmaniensis</i>	40	47	87
<i>S. orion</i> or <i>S. rueppellii</i>	66	19	85
<i>V. pumilus</i> or <i>V. vulturinus</i> or <i>V. troughtoni</i>	31	18	49
<i>Vespadelus spp.</i> or <i>C. morio</i>	56	69	125
<i>M. norfolkensis</i> or <i>O. ridei</i>	53	14	67
<i>Saccolaimus flaviventris</i>		1	1
Site Total	1333	1056	2389

Unresolved species groups

The “unresolved” call groups were based on the following characteristics:

- *C. gouldii* or *Ozimops spp.*
 - Flattish to steep curvilinear pulses with characteristic frequency (Fc) around 28-32 kHz
 - *C. gouldii* positively identified where pulses were mostly steep and had clear frequency alternation
 - *O. planiceps* positively identified where pulses were mostly flat and Fc<28 kHz
 - *O. ridei* positively identified where pulses were flattish or steeper curvilinear, without clear alternation and with Fc>30 kHz and time-between-pulses >200 ms
 - A few calls with mixed pulse shapes and no clear alternation in the 28-32 kHz band could have been from any of *C. gouldii*, *O. planiceps* or *O. ridei*

- *M. orianae* or *V. regulus*
 - Curvilinear pulses with no hook and tail either absent or slightly down-swept
 - Fc~44-46 kHz
 - Calls allocated positively to *M. orianae* had uniformly long-duration pulses with characteristic flattish body and sharp change of slope from initial sweep to body
 - Calls allocated to group had variable pulse shapes and shorter duration, with some pulses tending toward hooked shapes, suggesting possibly *V. regulus*
- *Nyctophilus* sp. or *Myotis macropus*
 - Steep, almost-linear pulses with broad frequency sweep terminating around 35-45 kHz
 - calls with uniform pulse shape and time-between-pulses were allocated to *Nyctophilus* spp.
 - Calls with irregular pulse-shape and spacing were allocated to the group
 - *M. macropus* considered low likelihood of occurrence at recording sites
- *S. orion* or *Falsistrellus tasmaniensis*
 - Steep curvilinear pulses at Fc~37-40 kHz, mostly with with down-swept tails
 - Calls without down-swept tails were allocated to *S. orion*
 - Atlas of Living australia shows both species recorded in the local area, but most records appear to be ultrasonic recordings, so their veracity is questionable given the similarities in these species' calls with those of the *S. rueppellii* (see below)
- *S. orion* or *Scoteanax rueppellii*
 - Steep, curvilinear pulses with no tail or down-swept tail and Fc=34-36 kHz
 - Frequency change between Fk and Fc was 3 ± 0.3 kHz and considered insufficient evidence to differentiate between these species – Pennay *et al.* (2004) suggest a 3kHz change is the threshold for differentiation, whereby $F_k - F_c > 3\text{kHz}$ represents *S. rueppellii*
 - Calls in this Fc range with $F_k - F_c$ value of < 2.5 kHz were allocated to *S. orion*
- *V. pumilus* or *V. troughtoni* or *V. vulturinus*
 - Steep, curvilinear pulses with mostly hooked bodies and Fc~49-53 kHz
 - All three species have been recorded in the local area and variability in observed calls suggest at least *V. pumilus* and *V. vulturinus* were recorded during the Farley survey
- *Vespadelus* spp. or *C. morio*
 - Steep, curvilinear pulses with variable pulse shape and tail configuration and Fc~48-53 kHz
 - Calls attributed to *C. morio* had consistent pulse shapes with clear down-swept tails, while those allocated to the *Vespadelus* species pair had consistently-hooked pulse shapes
 - Calls allocated to this group had mixed pulse shapes and were mostly short duration sequences (< 10 pulses)
- *M. norfolkensis* or *O. ridei*
 - Flattish pulses with Fc~31-35 kHz
 - Calls with predominantly very flat pulses and clear frequency alternation were allocated reliably to *M. norfolkensis*
 - *O. ridei* identified where pulses were more slanted and had no evidence of Fc alternation
 - Group calls were short-duration sequences with limited evidence of alternation and/or mixed pulse shapes
- *Saccolaimus flaviventris*
 - One only brief call with three weak pulses of a shape and frequency consistent with *S. flaviventris* (Fc~21 kHz)

References

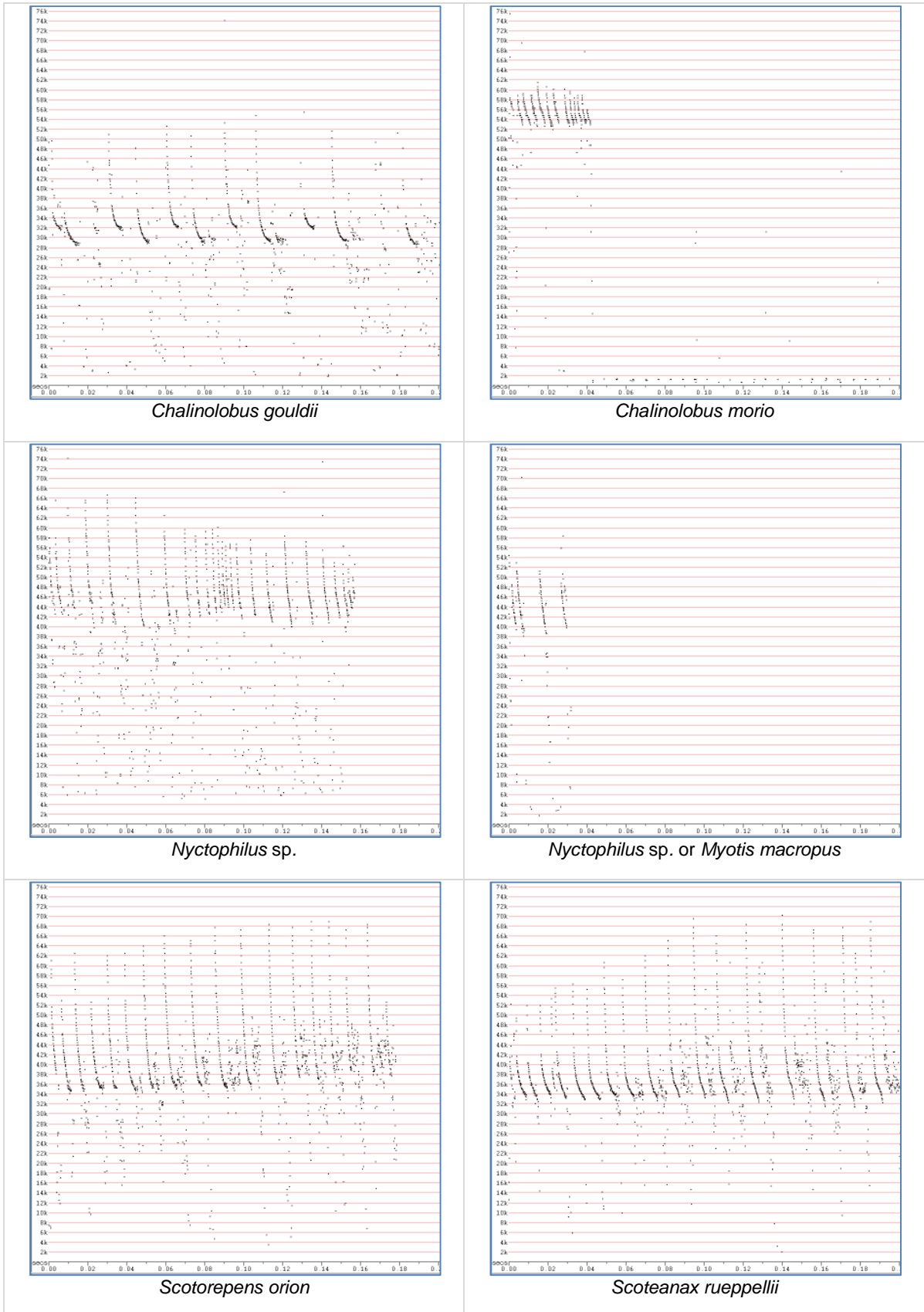
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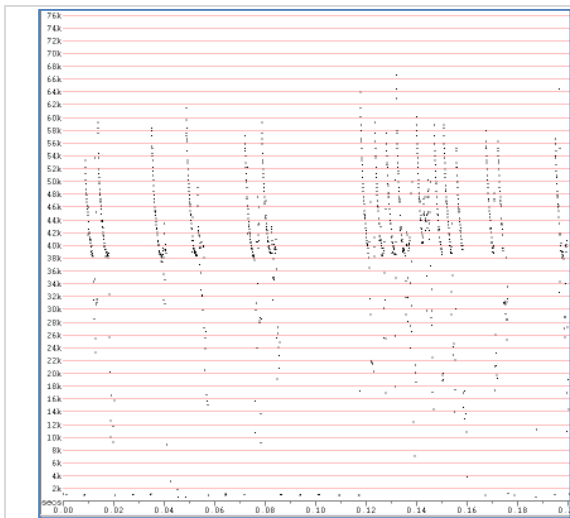
Glossary

Technical terms used in this report are described in the following table.

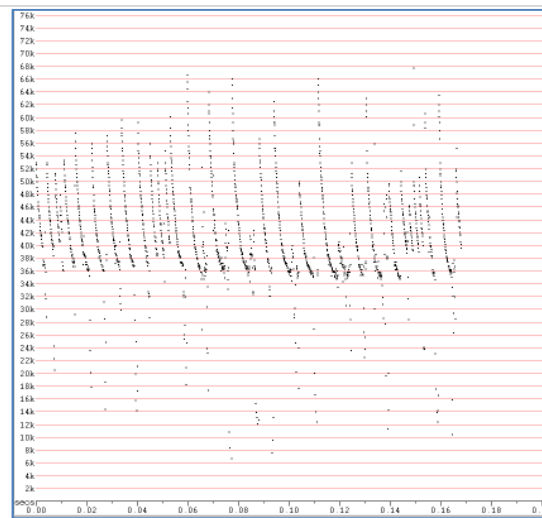
Approach phase	The part of a bat <i>call</i> emitted as the bat starts to home in on a detected prey item; a transitional series of <i>pulses</i> between the <i>search phase</i> and <i>feeding buzz</i> , that become progressively steeper and shorter in duration.
Call	Refers to a single bat call, made up of a series of individual sound <i>pulses</i> in one or more <i>phases</i> (<i>search, approach, feeding buzz</i>).
CF (=Constant Frequency)	A type of <i>pulse</i> in which the dominant component consists of a more-or-less 'pure tone' of sound at a Constant Frequency; with <i>shape</i> appearing flat on the sonogram. Often also contains a brief <i>FM</i> component at the beginning and/or end of the CF component (<i>viz.</i> FM-CF-FM).
Characteristic frequency (Fc)	The frequency of the flattest part of a <i>pulse</i> ; usually the lowest frequency reached in the <i>qCF</i> component of a pulse. This is often the primary diagnostic feature for species identification.
Duration	The time period from the beginning of a <i>pulse</i> to the end of the pulse.
Feeding buzz	The terminal part of a <i>call</i> , following the <i>approach phase</i> , emitted as the bat catches a prey item; a distinctive, rapid series of very steep, very short-duration pulses.
FM (=Frequency Modulated)	A type of <i>pulse</i> in which there is substantial change in frequency from beginning to end; <i>shape</i> ranges from almost vertical and linear through varying degrees of curvature.
FC range	Refers to the range of frequencies occupied by the <i>characteristic frequency</i> section of <i>pulses</i> within a call or set of calls.
Frequency sweep or "band-width"	The range of frequencies through which a <i>pulse</i> sweeps from beginning to end; Maximum frequency (Fmax) – minimum frequency (Fmin).
Knee	The transitional part of a <i>pulse</i> between the initial (usually steeper) frequency sweep and the <i>characteristic frequency</i> section (usually flatter); time to knee (Tk) and frequency of knee (Fk) can be diagnostic for some species.
Pulse	An individual pulse of sound within a bat <i>call</i> ; the <i>shape, duration</i> and <i>characteristic frequency</i> of a pulse are the key diagnostic features used to differentiate species.
Pulse body	The part of the <i>pulse</i> between the <i>knee</i> and <i>tail</i> and containing the <i>characteristic frequency</i> section.
Pulse shape	The general appearance of a <i>pulse</i> on the sonogram, described using relative terms related to features such as slope and degree of curvature. See also <i>CF, qCF</i> and <i>FM</i> .
qCF (=quasi Constant Frequency)	A type of <i>pulse</i> in which there is very little change in frequency from beginning to end; <i>shape</i> appears to be almost flat. Some pulses also contain an <i>FM</i> component at the beginning and/or end of the qCF component (<i>viz.</i> FM-qCF).
Search phase	The part of a bat <i>call</i> generally required for reliable species diagnosis. A consistent series of <i>pulses</i> emitted by a bat that is searching for prey or and/or navigating through its habitat. Search phase pulses generally have longer duration, flatter slope and more consistent shape than <i>approach phase</i> and <i>feeding buzz</i> pulses.
Sequence	Literally, a sequence of <i>pulses</i> that may be from one or more bats; but generally refers to a <i>call</i> or part (e.g. <i>phase</i>) of a call.
Tail	The final component of a <i>pulse</i> , following the <i>characteristic frequency</i> section; may consist of a short or long sweep of frequencies either upward or downward from the Fc; or may be absent.

Appendix 1 Representative call sequences from the Farley survey, 26/11/2018 – 3/12/2018.
 (AnalogW 'F7 compressed' display: x=time(s); y=frequency(kHz); time between pulses removed)

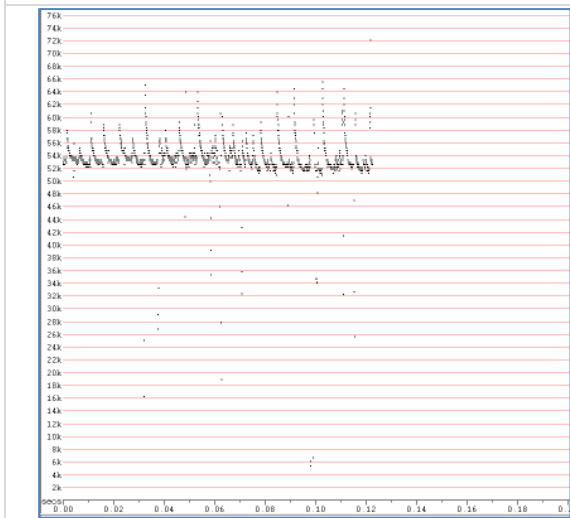




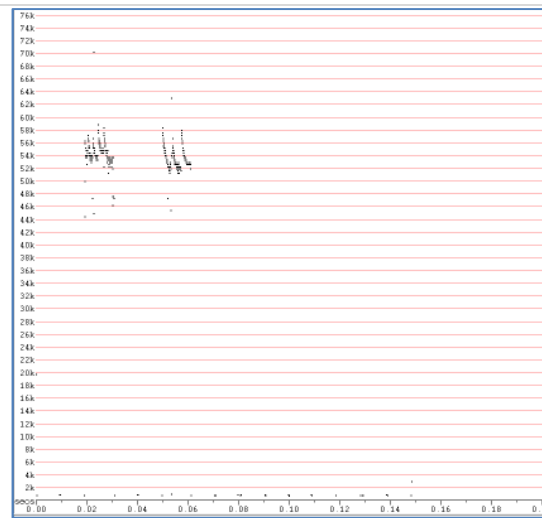
S. orion or *Falsistrellus tasmaniensis*



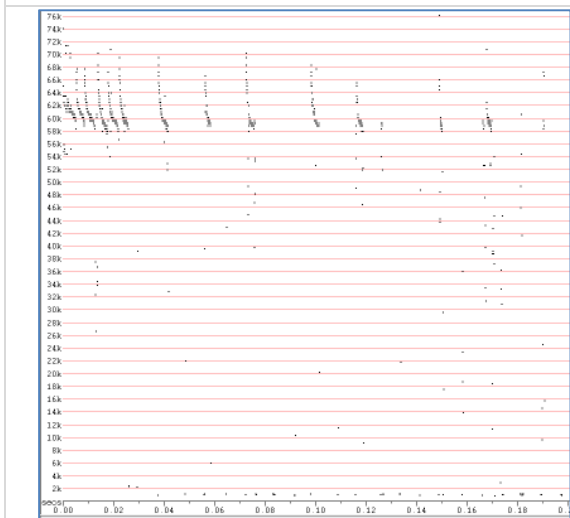
S. orion or *Scoteanax rueppellii*



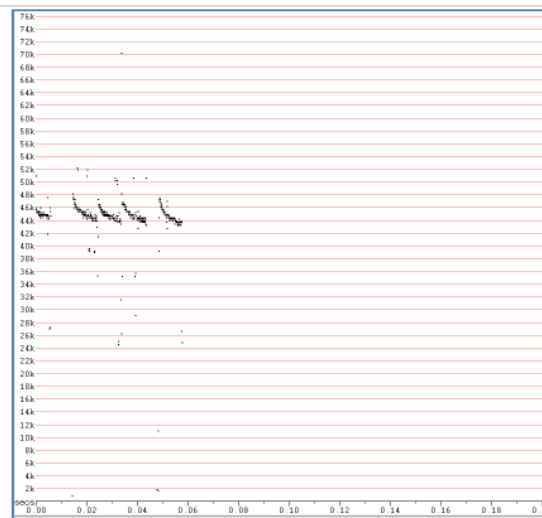
V. pumilus or *V. vulturinus* or *V. trougtoni*



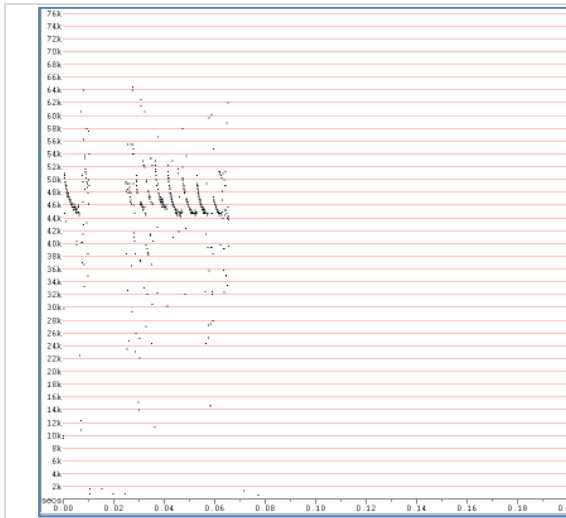
Vespadelus spp. or *C. morio*



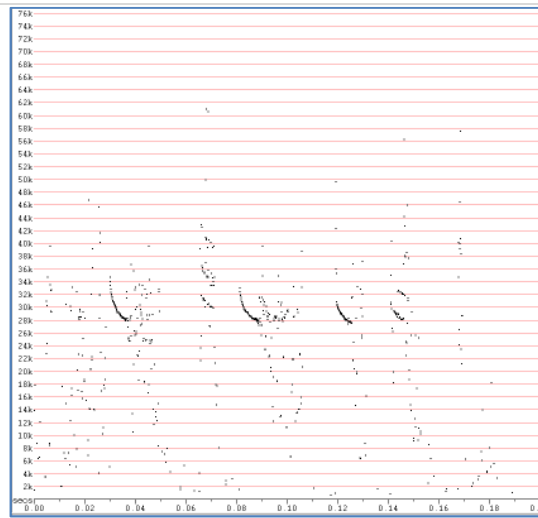
Miniopterus australis



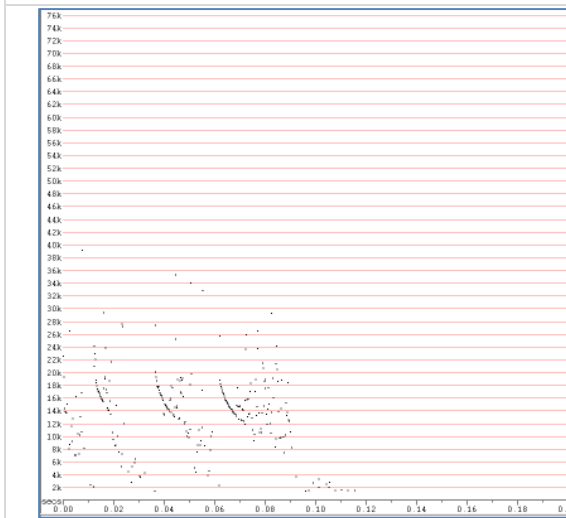
Miniopterus orianae



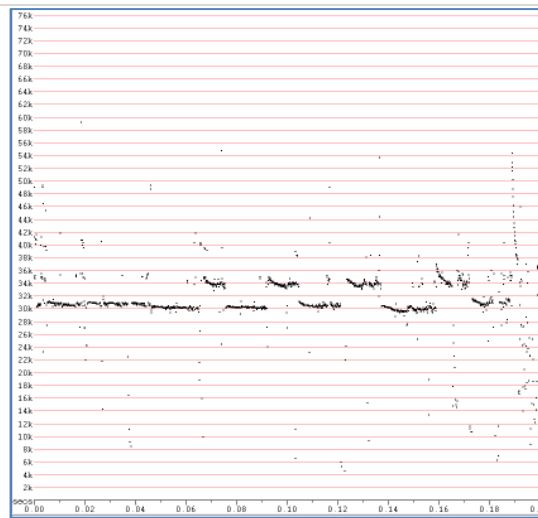
M. oriana or *Vespadelus regulus*



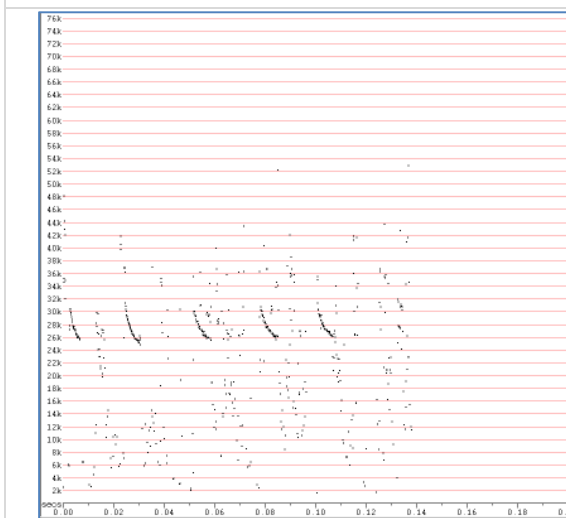
C. gouldii or *Ozimops* spp.



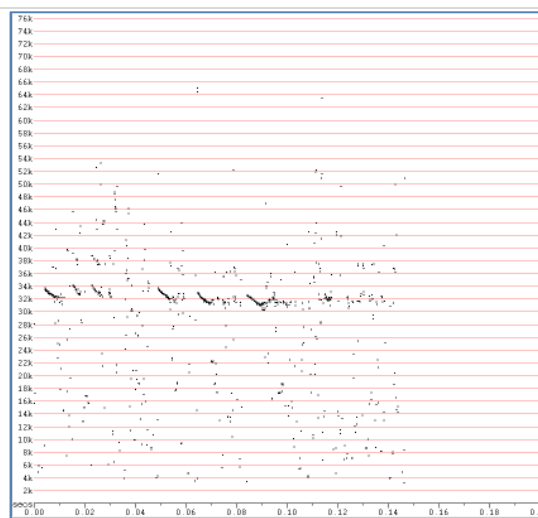
Austronomus australis



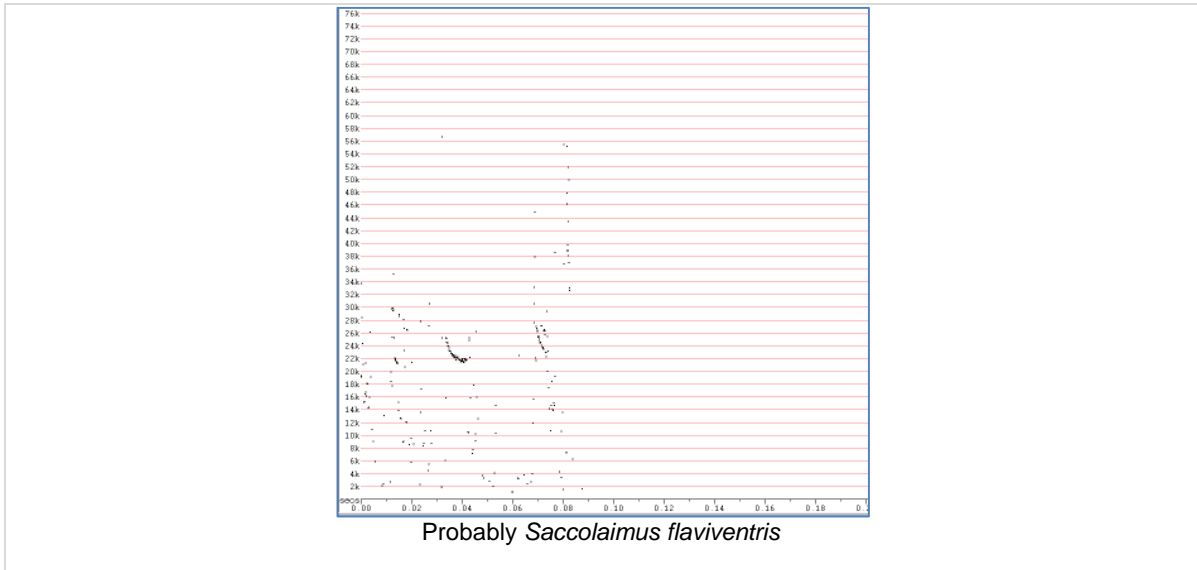
Micronomus norfolkensis



Ozimops planiceps



Ozimops ridei



Appendix G BioBanking Credit Calculator Full Report

This report identifies the number and type of credits required at a DEVELOPMENT SITE.

Date of report: 29/11/2018

Time: 2:11:16PM

Calculator version: v4.0

Development details

Proposal ID: 227/2018/4938D
Proposal name: Farley SIS
Proposal address: 207 Wollombi Road Farley NSW 2320

Proponent name: Ravensfield Downs
Proponent address: tba NSW 2000
Proponent phone: 99999999

Assessor name: Alex Pursche
Assessor address: Suite 28 & 29, Level 7 19 Bolton Street Newcastle NSW 2300
Assessor phone: +61 2 4910 3406
Assessor accreditation: 227

Improving or maintaining biodiversity

An application for a red flag determination is required for the following red flag areas

Red flag	Reason
Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	Vegetation type being > 70% cleared; or it contains an endangered ecological community;

The application for a red flag determination should address the criteria set out in the BioBanking Assessment Methodology. Please note that a biobanking statement cannot be issued unless the determination is approved.

Additional information required for approval:

- Change to percent cleared for a vegetation type/s
- Use of local benchmark
- Change negligible loss
- Expert report...
- Request for additional gain in site value
- Predicted threatened species not on site
- Change threatened species response to gain (Tg value)

Ecosystem credits summary

Plant Community type	Area (ha)	Credits required	Red flag
Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	26.50	1,357.26	Yes
Total	26.50	1,357	

Credit profiles

1. Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest, (HU804)

Number of ecosystem credits created	1,357
IBRA sub-region	Hunter

Offset options - vegetation types	Offset options - CMA sub-regions
<p>Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest, (HU804)</p> <p>Melaleuca decora low forest of the central Hunter Valley, Sydney Basin Bioregion, (HU564)</p> <p>Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast, (HU619)</p> <p>Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast, (HU802)</p> <p>Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on Coastal Lowlands of the Central Coast, (HU803)</p> <p>Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter, (HU806)</p> <p>Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter, (HU807)</p> <p>Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter, (HU814)</p> <p>Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815)</p> <p>Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter, (HU816)</p> <p>Grey Box - Grey Gum - Rough-barked Apple - Blakely's Red Gum grassy open forest of the central Hunter, (HU822)</p>	<p>Hunter</p> <p>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs</p>

Species credits summary

Appendix H Assessments of Significance

The NSW Assessment of Significance (Seven-part Test) is a statutory mechanism under Section 5A of the Environmental Planning and Assessment Act 1979 (EP&A Act) for assessing whether a proposed development activity may have a significant impact on threatened species, populations or ecological communities or their habitats as listed under the TSC Act. The results of this test are used to determine if a Species Impact Statement (SIS) is required for each species potentially occurring within the subject site. In the case of this SIS, the Seven-part test has been applied in light of consideration of the offsetting proposal presented in Chapter 9.

Assessments of significance have been undertaken for the following community and species (affected species):

EECs

- Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion (LHSGIF)

Woodland Birds

- *Lathamus discolor* (Swift Parrot)
- *Pomatostomus temporalis temporalis* (Grey-crowned Babbler) (eastern subspecies)

Microchiropteran Bats

- *Miniopterus australis* (Little Bentwing-bat)
- *Micronomus norfolkensis* syn. *Mormopterus norfolkensis* (Eastern Freetail-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)

Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion

This community is dominated by *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark), while *E. punctata* (Grey Gum) and *E. crebra* (Grey Ironbark) occur occasionally. The understorey is marked by the tall shrub, *Acacia parvipinnula*, and by the prickly shrubs, *Daviesia ulicifolia*, *Bursaria spinosa*, *Melaleuca nodosa* and *Lissanthe strigosa*. Other shrubs include *Persoonia linearis*, *Maytenus silvestris* and *Breynia oblongifolia*. The ground layer is diverse; frequent species include *Cheilanthes sieberi*, *Cymbopogon refractus*, *Dianella revoluta*, *Entolasia stricta*, *Glycine clandestina*, *Lepidosperma laterale*, *Lomandra multiflora*, *Microlaena stipoides*, *Pomax umbellata*, *Pratia purpurascens*, *Themeda australis* and *Phyllanthus hirtellus*. It occurs on permian geology in the central to lower Hunter Valley, including the Dalwood Group, the Maitland Group and the Greta and Tomago Coal Measures. Smaller areas of the community may also occur on the Permian Singleton and Newcastle Coal Measures and the Triassic Narrabeen Group. Restricted to a range of approximately 65 km by 35 km centred on the Cessnock - Beresfield area in the Central and Lower Hunter Valley.

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

Not applicable

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

Not applicable

- (c) *in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
- i. *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
 - ii. *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

The proposal will have an adverse effect on the extent of the LHSGIF as it involves the removal of 26.4 ha of this community. The local occurrence of this community includes the LHSGIF within the study area and the vegetation mapped as Lower Hunter Spotted Gum – Ironbark Forest by Hill (2003) to the west and north of the study area, the total area of which is approximately 350 ha. However, since 2003, some of this local occurrence has been cleared and so this would be a slight overestimation.

Nonetheless, the proposal will involve the removal of approximately 7 % of the local occurrence. On its own, this is unlikely to place the local occurrence at risk of extinction. However, it could contribute to the cumulative impact to the local occurrence as the tenure of the remainder of the local occurrence is unknown and therefore could be subject to clearance in the future.

The local occurrence is already fragmented and the patches directly west of the study area has been underscrubbed and grazed. The removal of LHSGIF from the study area would remove a source of flora propagules, fauna and habitat resources that would otherwise be available for the adjacent patches. However, based on the aerial photography, other patches of LHSGIF in the local occurrence are likely to be in relatively good condition (trees and understorey present) and also act a source of propagules. Therefore, the proposal in unlikely to substantially and adversely modify the composition of LHSGIF such

that its local occurrence is likely to be placed at risk of extinction, as other patches in the local occurrence will act as a source of propagules for the local occurrence.

- (d) *in relation to the habitat of a threatened species, population or ecological community:*
- i. *the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
 - ii. *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
 - iii. *the importance of the habitat to be removed, modified, fragmented or isolated to the long term survival of the species, population or ecological community in the locality,*

The proposal will remove approximately 26.4 ha of LHSGIF. The LHSGIF that is retained within the study area may be modified by weed invasion and edge effects. While no areas of habitat of LHSGIF in the study area will become isolated, the local occurrence will be further fragmented by the proposal.

The habitat of LHSGIF to be removed is important for the local occurrence as it provides a source of propagules and allows the components of the community to continue to undertake life cycle processes.

In summary, the removal, modification and fragmentation of LHSGIF in the study area is unlikely to place the local occurrence at risk of extinction as it is located on the edge of the local occurrence and similar flora and fauna resources will remain within the local occurrence to enable life cycle processes to continue.

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

No critical habitat of this community has been identified by OEH on the Register of Critical Habitat.

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

No Recovery Plan or Threat Abatement Plans are relevant to this community.

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

The proposal constitutes the following key threatening process:

- Clearing of native vegetation
- Loss of hollow-bearing trees

The proposal may result in the increase the following key threatening processes:

- Aggressive exclusion of birds from woodland and forest habitats by abundance Noisy Miner (*Manorina melanocephala*)
- Anthropogenic climate change (through land use changes)
- High fire frequency resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition
- Removal of dead wood and trees

Conclusion

The proposal will result in a direct impact on LHSGIF, which involves the removal of 26.4 of this community, which is 7 % of the local occurrence. The proposal may also have indirect impacts on the remainder of the local occurrence such as weed invasion, inappropriate fire regimes and an increase in aggressive birds. However, the remainder of the local occurrence is unlikely to be placed at risk of extinction.

The impact from the proposal will be offset by the purchase of credits under the BioBanking scheme. Therefore, the proposal is not likely to have a significant impact on LHSGIF.

***Pomatostomus temporalis temporalis* (Grey-crowned Babbler) (eastern subspecies)**

This species requires woodland as they are generally unable to cross large open areas. They live in family groups and feed on invertebrates, either by foraging on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses. They build and maintain several conspicuous, dome-shaped stick nests about the size of a football usually located in shrubs or sapling eucalypts, although they may be built in the outermost leaves of low branches of large eucalypts. A nest is used as a dormitory for roosting each night. This species breeds between July and February and territories range from one to fifty hectares (usually around ten hectares) and are defended all year (OEH 2018).

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

The Grey-crowned Babbler and its nests were recorded within the study area during surveys for this SIS. Six nests were recorded within the study area, south of the subject site in an area that would be retained. Foraging habitat within the study area includes more open woodland areas and extends outside of the study area. A family group has a territory of between 1 and fifty hectares (OEH, 2018). Given that six nests were recorded at the same location in the study area, it is likely that the study area is utilised by at least one family group.

A viable local population of the Grey-crowned Babbler would include the family group that utilises the edges of the study area as well as any other family groups with which it can interbreed. Such family groups are likely to be located in open woodland areas to the east, south and west of the study area. Therefore, the habitat for the viable local population includes other adjoining woodland areas in the locality.

The proposal would remove approximately 26.4 ha of foraging habitat for the Grey-crowned Babbler. However, since the nesting habitat would be retained and since territories range widely in size, it is likely that the family group would continue to breed in the study area. However, a reduced area of foraging habitat may reduce the size of the family group, which may reduce their breeding success (Brown et al. 1983). Nonetheless, given that a family group is likely to persist within the study area and continue to interbreed with other family groups in the viable local population, the proposal is not likely to place a viable local population of the Grey-crowned Babbler at risk of extinction.

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

Not applicable

- (c) *in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
- i. *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
 - ii. *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

Not applicable

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

- i. *the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
- ii. *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- iii. *the importance of the habitat to be removed, modified, fragmented or isolated to the long term survival of the species, population or ecological community in the locality,*

Approximately 26.4 ha of foraging habitat for the Grey-crowned Babbler would be removed as part of the proposal. Most of the potential indirect impacts to habitat that would remain within the study area are likely to be minimal as they would be managed. However, increased competition from the aggressive Noisy Miner is likely to increase. In addition, residential development could result in an increase in cats within the study area which would be likely to have an adverse effect on the Grey-crowned Babbler (DSE, 2003).

Potential habitat for the Grey-crowned Babbler to the east of the study area is likely to be isolated from habitat within the study area.

Similar habitat will be retained in the study area and the locality and this is expected to support the long-term survival of these species in the locality.

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

No critical habitat of this species has been identified by OEH on the Register of Critical Habitat.

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

No Recovery Plan or Threat Abatement Plans are relevant to this species.

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

The proposal constitutes the following key threatening process:

- Clearing of native vegetation
- Loss of hollow-bearing trees

The proposal may result in the increase the following key threatening processes:

- Anthropogenic climate change (through land use changes)
- High fire frequency resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition
- Removal of dead wood and trees
- Predation by the Feral Cat (*Felis catus*)

Conclusion

The proposal will remove foraging and breeding habitat for Grey-crowned Babbler. However, this species will be able to continue to use the habitats that remain in the study area and viable local populations are likely to be able to persist within the locality.

In addition, direct and indirect impacts would be offset by the purchase of suitable credits determined from the BioBanking Credit Calculator.

Therefore, the proposal is not likely to have a significant impact on this woodland bird species.

***Lathamus discolor* (Swift Parrot)**

This species breeds in Tasmania and occurs in south-east mainland Australia between March and October, where they forage on abundantly flowering eucalypts or lerp infestations. Among the favoured trees are *Corymbia maculata* (Spotted Gum). They have been found to preferentially forage in large mature trees that provide more reliable foraging resources than younger trees (Birds Australia, 2011). LHSGIF is known to be a threatened ecological community that contains suitable habitat for this species (Birds Australia, 2011).

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

This species breeds in Tasmania. A viable local population of this species would include all individuals that migrate to mainland Australia. There is potential for this species to forage within the *Corymbia maculata* (Spotted Gum) within the study area when it is flowering. Based on the extent of the local occurrence of LHSGIF in the locality, extensive foraging habitat is also present outside of the study area. Removal of 26.4 ha of foraging habitat from the study area is unlikely to have an adverse effect on the life cycle of the Swift Parrot such that a viable local population of this species would be placed at risk of extinction as extensive foraging habitat would remain within the locality.

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

Not applicable

- (c) *in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
- i. *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
 - ii. *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

Not applicable

- (d) *in relation to the habitat of a threatened species, population or ecological community:*
- i. *the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
 - ii. *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
 - iii. *the importance of the habitat to be removed, modified, fragmented or isolated to the long term survival of the species, population or ecological community in the locality,*

Approximately 26.4 ha of potential foraging habitat for the Swift Parrot would be removed as part of the proposal. Most of the potential indirect impacts to the foraging habitat that would remain within the study area are likely to be minimal as those indirect impacts would be managed. However, increased competition from the aggressive Noisy Miner and Rainbow Lorikeet is likely to increase.

Nonetheless, the habitat to be removed or modified is unlikely to be important to the long-term survival of the Swift Parrot in the locality, as more extensive and better-quality habitat would remain in the locality.

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

No critical habitat of this species has been identified by OEH on the Register of Critical Habitat.

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

There is a national Swift Parrot Recovery Plan (Birds Australia, 2011). The proposed action is not consistent with this recovery plan.

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

The proposal constitutes the following key threatening process:

- Clearing of native vegetation

The proposal may result in the increase the following key threatening processes:

- Anthropogenic climate change (through land use changes)
- High fire frequency resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition
- Removal of dead wood and trees
- Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miner (*Manorina melanocephala*).

Conclusion

The proposal will remove foraging habitat for the Swift Parrot. However, this species will be able to continue to use the habitats that remain, and viable local populations are likely to be able to persist within the locality.

In addition, direct and indirect impacts would be offset by the purchase of suitable credits determined from the BioBanking Credit Calculator.

Therefore, the proposal is not likely to have a significant impact on this migratory bird species.

Microchiropteran Bats

- *Miniopterus australis* (Little Bentwing-bat)
- *Micronomus norfolkensis* syn. *Mormopterus norfolkensis* (Eastern Freetail-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)

The Little Bentwing-bat, Eastern Freetail-bat, and Greater Broad-nosed Bat are all listed as Vulnerable species under the TSC Act and have all been recorded within the study area.

These species are highly mobile and require home ranges / territories or seasonably variable ranges during foraging that far exceed the amount of foraging habitat within the study area. In addition, not all of the potential breeding or roosting habitats are available in the study area. Therefore, while individuals of these species may use the study area for foraging from time to time, any viable local population of these species would extend well beyond the study area and the study area alone is unlikely to be sufficient to meet their full lifecycle requirements.

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

Factors likely to have an adverse effect on the life cycle of these species would include a substantial loss of known breeding habitats such as tree hollows, caves, tunnels, abandoned mines, stormwater drains, culverts and/or bridges, loss and/or fragmentation of foraging habitat around these roosting sites, pesticide usage and inappropriate fire regimes.

The Little Bentwing-bat, Eastern Freetail-bat, and Greater Broad-nosed Bat are highly mobile and have large home ranges. These species are known to occur in the study area. Based on the results of the microbat surveys, it is not possible to confirm that these species do not use at least some of the hollow-bearing trees in the study area.

Indirect impacts upon these species from the proposed development such as noise and light will be reduced by installing sound and light barriers around the development. Impacts on the potential breeding habitats of these species will also be reduced by avoiding clearing of vegetation during the breeding season for these species.

It is unlikely that the loss of known foraging and potential breeding habitat will significantly disrupt the life cycle of these species such that viable local populations of these species would be placed at risk of extinction as similar habitat will be retained within the study area and extensive habitat with similar values will remain within the locality.

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

Not applicable

- (c) *in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
- i. *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
 - ii. *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

Not applicable

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

- i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
- ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long term survival of the species, population or ecological community in the locality,*

Approximately 26.4 ha of vegetation which is suitable foraging and roosting habitat for these species will be removed. Habitat which represents potential foraging and roosting habitat for these bat species will be retained within the study area. Hollow bearing trees that occur in the subject site will be removed. The habitat that remains within the study area will be modified by edge effects, but these indirect impacts will be managed to minimise their effect.

The study area will be fragmented by the proposal, but habitat is not likely to become isolated for these highly mobile species.

The habitat that will be removed, fragmented and modified is not likely to be important for the long-term survival of these widely distributed and wide-ranging microbat species. This is because the amount to be affected is small in comparison to the known and potential foraging and breeding habitat for these species will be retained within the study area and the locality.

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

No critical habitat of this species has been identified by OEH on the Register of Critical Habitat.

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

There is no adopted or made Recovery Plan for these species and no Threat Abatement Plan has been identified as being relevant for these species.

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

The proposal constitutes the following key threatening process:

- Clearing of native vegetation

The proposal may result in the increase the following key threatening processes:

- Anthropogenic climate change (through land use changes)
- High fire frequency resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition
- Removal of dead wood and trees

Conclusion

The proposal will remove known foraging habitat for the Little Bentwing-bat, Eastern Freetail-bat, and Greater Broad-nosed Bat. However, these species will be able to continue to use the habitats that remain

within the study area and the locality and viable local populations are likely to be able to persist within the locality.

In addition, direct and indirect impacts would be offset by the purchase of suitable credits determined from the BioBanking Credit Calculator.

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