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Flora and Fauna Assessment



**Lot 39 // DP 1215451 Major Roberts Ave, Tahmoor
Planning Proposal**

Prepared for: ABAX Contracting Pty Ltd

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Glossary and abbreviations

ABBR./TERM	DESCRIPTION
CEEC	Critically endangered ecological community
DA	Development application
ECA	Ecological Constraints Assessment
EP&A Act	NSW <i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
ha	hectares
mm/cm/m/km	millimetres/centimetres/metres/kilometres
masl	metres above sea level
TEC	Threatened ecological community, listed as vulnerable, endangered or critically endangered under either the BC and/or EPBC Acts
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
WM Act	Water Management Act 2012
WDGP	Wollondilly Development Control Plan 2011
WLEP	Wollondilly Local Environment Plan 2011
*	Denotes exotic species

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1 Introduction

1.1 Purpose of report and legislative context

This flora and fauna assessment has been undertaken for the West Tahmoor Minimum Lot Size Amendment 2 Planning Proposal (dated June 2017). The planning proposal proposes to make changes to zoning and minimum lot sizes to Lot 39 // DP 1215451 (hereafter, the 'study area').

This report addresses the legislative context provided in **Table 1.1**.

Table 1.1: Legislative framework addressed in this report.

INSTRUMENT	CONSIDERATIONS	CONTEXT
Commonwealth		
<i>Environment Protection and Biodiversity Conservation (EPBC) Act 1999</i>	Matters of National Environmental Significance	An action will require approval from the Minister if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance.
State (New South Wales)		
<i>Environmental Planning and Assessment (EP&A) Act 1979¹</i>	Section 5A	Assessment of the potential for an action or activity to have a significant effect on threatened species, populations or ecological communities, or their habitats.
<i>Biosecurity Act 2015</i>	Priority Weeds	Describes the state and regional priority for weeds in New South Wales
<i>Threatened Species Conservation Act (TSC Act) 1995¹</i>	Schedules 1, 1A, 2 and 3	Lists threatened species, populations, ecological communities and key threatening processes to be considered under Section 5A EP&A Act.
Local		
Wollondilly Local Environmental Plan (WLEP) 2011	Clause 7.2: Biodiversity Protection	The objective of this clause is to maintain terrestrial biodiversity by protecting native flora and fauna, protecting the ecological processes necessary for their continued existence, and encouraging the conservation and recovery of native flora and fauna and their habitats. It applies to "sensitive land" on the Natural Resources – Biodiversity Map.

¹ The TSC Act and sections of the EP&A Act were repealed and replaced by the NSW Biodiversity Conservation Act 2016 (BC Act) on 25th August 2017. However, the study area is located within an interim designated area, so the previous planning provisions remain in place (in accordance with the NSW Biodiversity Conservation (Savings and Transitional) Regulation 2017).

INSTRUMENT	CONSIDERATIONS	CONTEXT
Wollondilly Local Environmental Plan (WLEP) 2011	Clause 7.3: Water protection	The objective of this clause is to maintain the hydrological functions of riparian land, waterways and aquifers, including protecting water quality, natural water flows, the stability of the bed and banks of waterways and ground water systems. It applies to "sensitive land" on the Natural Resources – Water Map

1.2 Site description

1.2.1 Study area

Following the Threatened Species Test of Significance Guidelines (DECC 2007) the subject site is defined as the area 'directly affected by the proposal', and includes all vegetation proposed to be removed. The study area is defined as the subject site and all areas that are directly or indirectly affected by the proposal. For the purposes of this report, the study area includes the entirety of Lot 39 // DP 1215451, while the subject site includes the portions of the study area which are to be zoned R2 Low Density Residential (**Figure 1.1**).

The study area is located approximately one kilometre (km) to the west of the town centre of Tahmoor, and 5 kilometres (km) south-south-west of Picton, in the Wollondilly Shire Local Government Area (LGA).

The study area comprises approximately 2.5 ha and contains remnant forest along Myrtle Creek, scattered trees, exotic plantings, a water detention basin, a modified drainage line entering Myrtle Creek and cleared land. Intact Shale Sandstone Transition Forest (SSTF) remains on the banks of Myrtle Creek which forms the northern boundary of the site. Patches of disturbed SSTF are located in the cleared areas within the study area. The majority of the intact SSTF in the study area is proposed to be retained on land whose zoning is proposed to be changed to E2 Environmental Conservation.

To the north of the study area there is a thin strip of land along Myrtle Creek which is zoned RU4 Primary Production Small Lots. Immediately north of this narrow zoning is a wider corridor of intact vegetation which is zoned E2 Environmental Conservation. To the east of the study area there is a retirement village, including some remnant trees, and this area is zoned R2 Low Density Residential. The area south of the study area is also zoned R2 Low Density Residential and most of the land between the study area and south to Thirlmere Way has been developed. The land west of the study area is currently zoned RE1 Public Recreation, contains modified vegetation and is currently used as an equestrian facility.

1.2.2 Locality

Unless otherwise stated, the **locality** is described as the area within 5 km of the study area (**Figure 1.2**). The locality consists of predominantly cleared and/or disturbed lands, having historically been cleared for agriculture and grazing, along with residential development (the study area is situated on the western boundary of the residential area of Tahmoor township).

A large proportion of the locality has either been cleared (43 %), or where vegetated, it has been mapped in low condition (Tx) by NPWS (2002) (18%). The remaining vegetation, which has

been mapped in higher condition classes (A, B or C) by NPWS (2002) (39%), is found in either the conservation estate to the west (e.g. Thirlmere Lakes National Park) or in riparian corridors and gorges of the locality (Ecoplanning 2015).

A more recent map of remnant vegetation (Tozer et al 2010) is provided in **Figure 1.3**. This shows that the majority of the locality has been cleared and that the majority of the remnant vegetation occurs in the south and west of the locality.

1.3 Description of the proposal

The planning proposal proposes to make changes to the Wollondilly Local Environment Plan 2011 (WLEP 2011) to rezone approximately 0.76 hectares (ha) of residential land purposes to environmental conservation purposes and to reduce the minimum lot size of an additional 1.72 ha of land to allow for smaller lot subdivision.

The area proposed for rezoning from residential to environmental conservation purposes is located on the northern boundary of the site, adjacent to Myrtle Creek.

The area proposed for a reduction in the minimum lot size for subdivisions is located outside of the proposed environmental conservation zoning. It includes land in the southern portion of the study area (**Figure 1.5**). Nominated building envelopes and Asset Protection Zones (APZs) for the proposal are shown in **Figure 1.6**.



Figure 1.1: Study area.

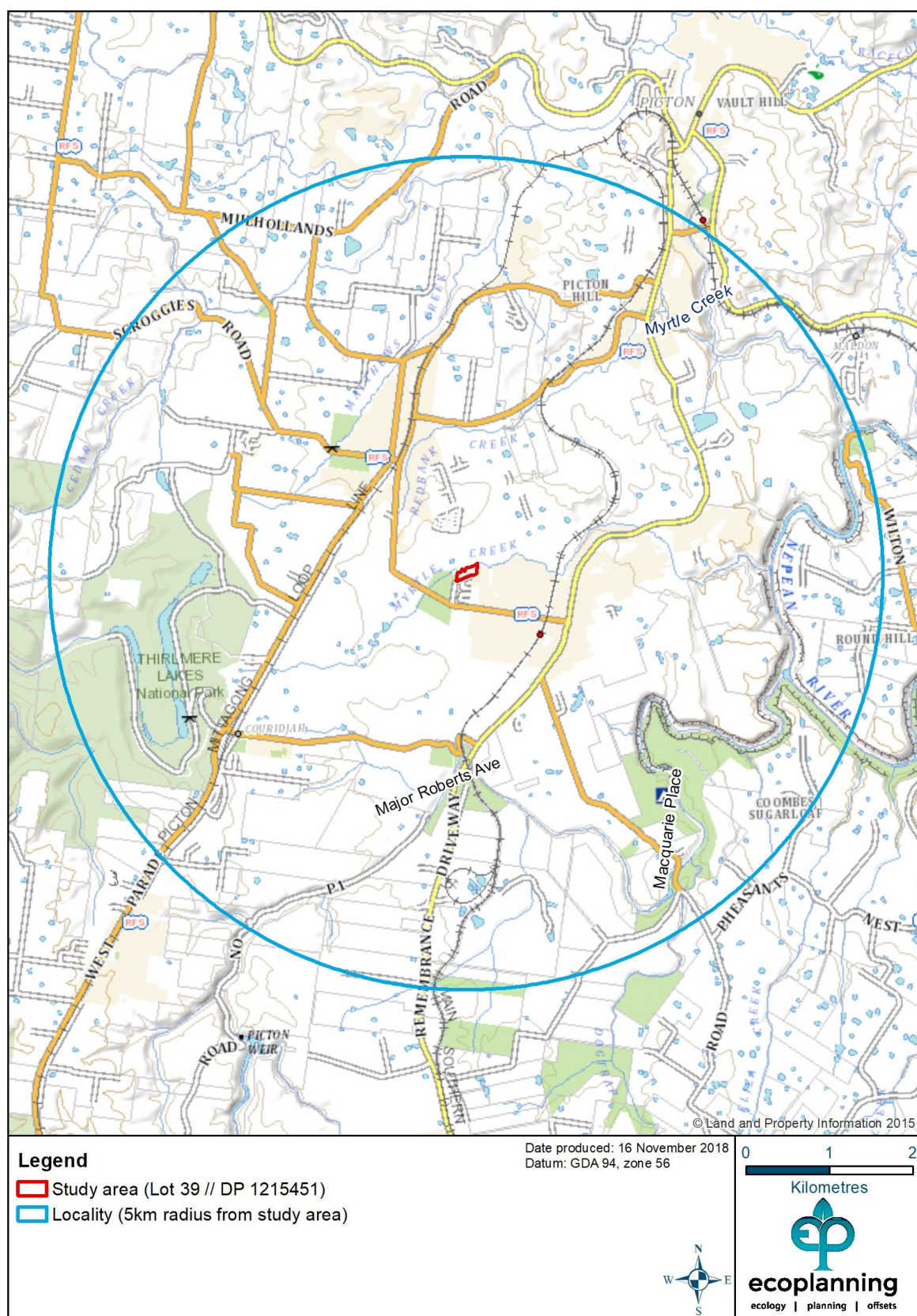


Figure 1.2: Locality.

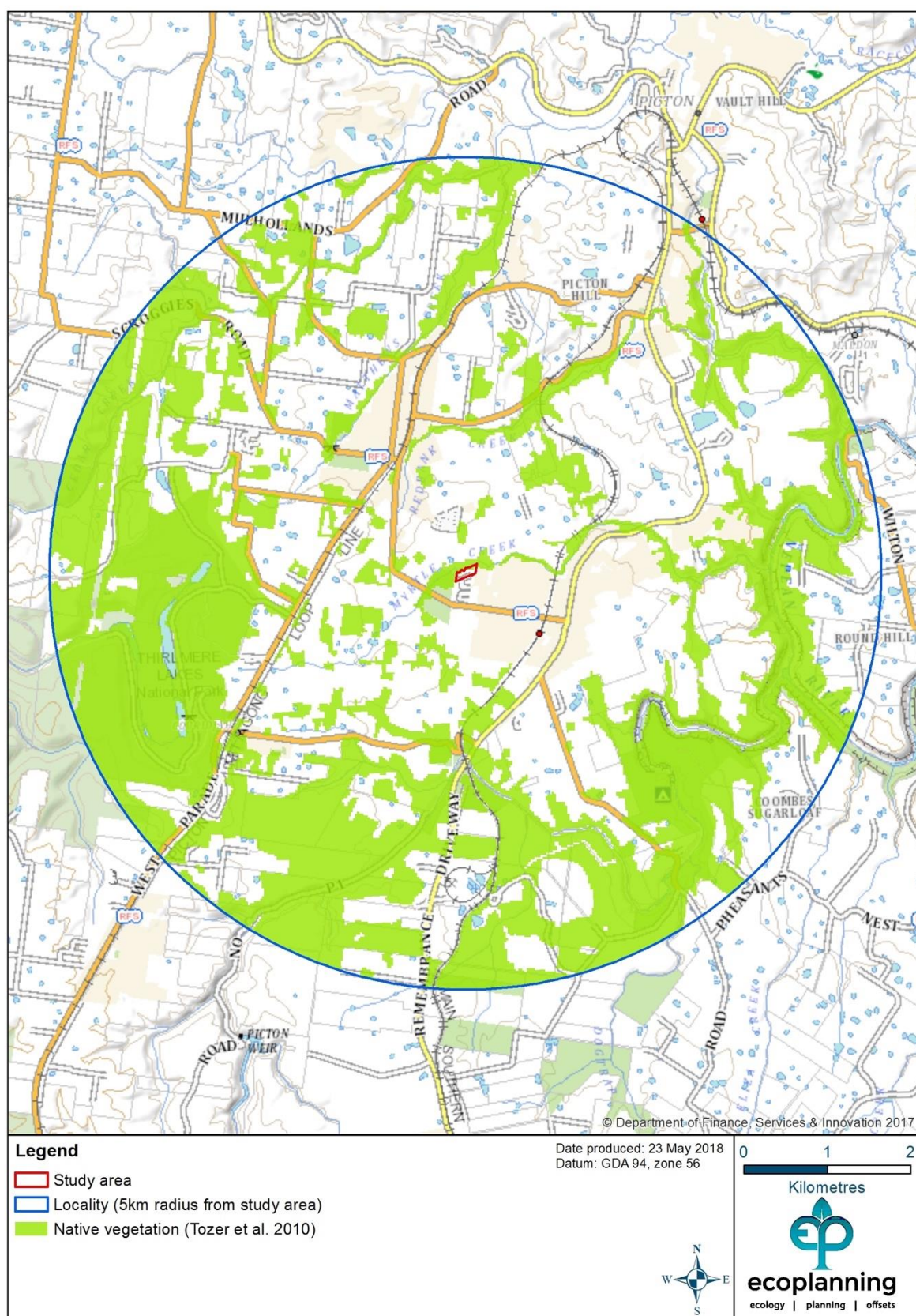


Figure 1.3: Native vegetation within 5 km of the subject site.

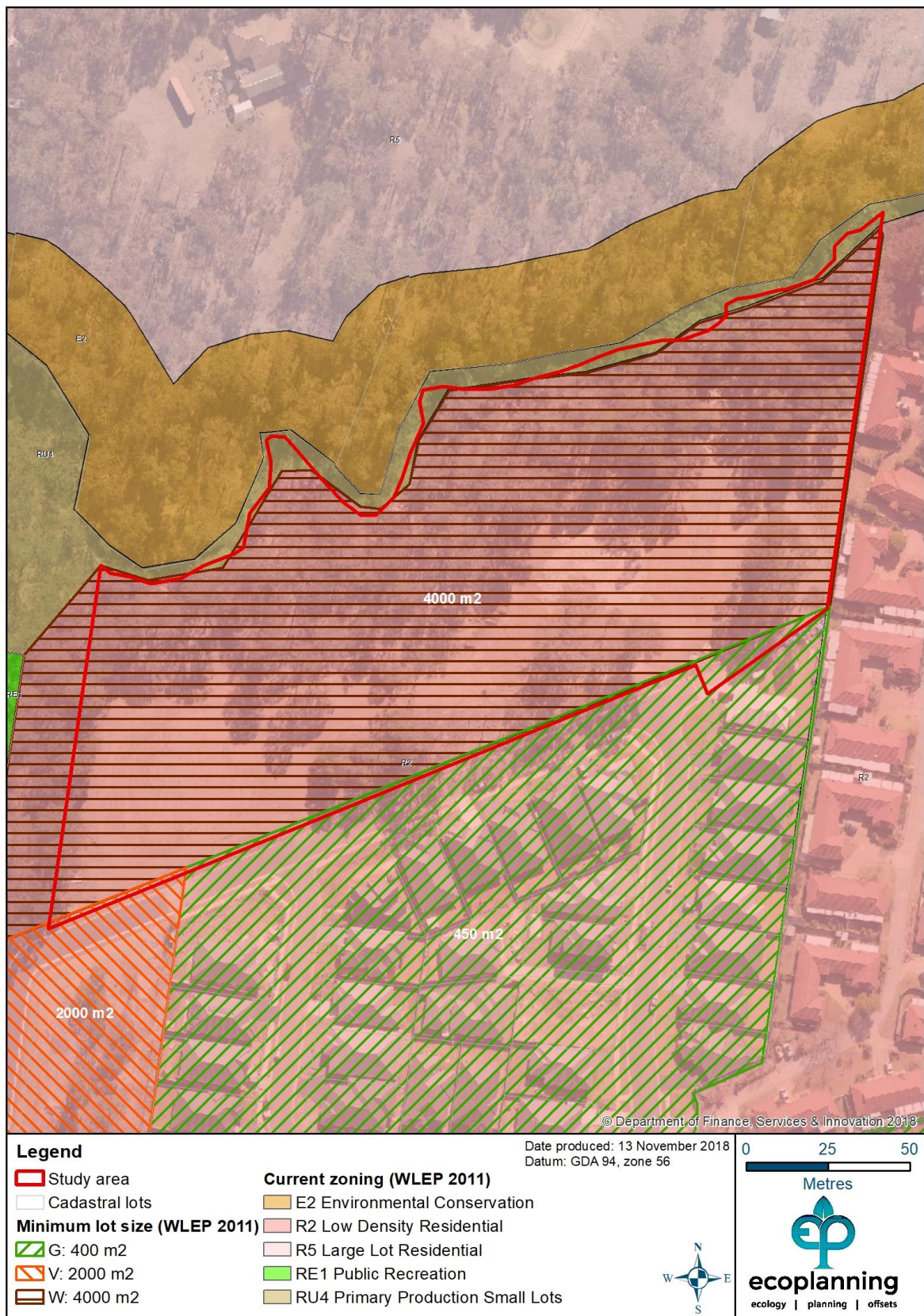


Figure 1.4: Current land zoning and minimum lot sizes.





Figure 1.6: Nominated building envelopes and asset protection zones

2 Methods

2.1 Literature and database review

A site-specific literature and database review was undertaken prior to the preparation of this report, which included the following sources:

- NSW Planning Viewer (NSW Dept. of Planning and Environment 2018)
- BioNet Atlas of NSW Wildlife (NSW Office of Environment and Heritage 2018a)
- Protected Matters Search Tool (Commonwealth Dept. of the Environment 2018)
- Native vegetation of the Cumberland Plain (NPWS 2002)
- Soil landscapes of the Wollongong-Port Hacking 1:100 000 map sheet (Hazelton and Tiller 1990)
- SIX Maps (LPI 2015)

Previous reports of relevance to the study are and surrounds that were reviewed included:

- Lots 58 & 60 // DP 21549, 35 & 45 Marion Street, Thirlmere - Proposed Vegetation Clearing – Flora and Fauna Assessment (Hayes 2005)
- Picton, Tahmoor, Thirlmere – New Urban Land – Local Environmental Study: Flora and Fauna Survey and Constraints Assessment (Biosis 2011)
- Flora and Fauna Survey and 7-part Test of Significance for Lots 1-4, DP 243776, Thirlmere Way, West Tahmoor, New South Wales (Hawkeswood 2013)
- Macquarie Place, West Tahmoor – Threatened Species Conservation Act advice and prelim Biocertification calculations (ELA 2014)
- Flora and Fauna Assessment - Part Lots 1-3 // DP 243776, Macquarie Place and Thirlmere Way, Tahmoor. Prepared for Precise Planning (Ecoplanning 2015a).
- Biodiversity Assessment Report – Macquarie Place, Tahmoor, NSW (v 1.2). Prepared for ABAX Contracting, c/o Precise Planning (Ecoplanning 2015b)
- Assessment of ecological impacts and avoidance, mitigation and offsetting measures for planning proposal at Thirlmere Way, West Tahmoor, Wollondilly LGA. Prepared for Precise Planning (Ecoplanning 2015c)
- Flora, Fauna and Riparian Assessment – Lot 6 // DP 793897, 20 Macquarie Place, Tahmoor. Prepared for Precise Planning (Ecoplanning 2015d)
- Flora and Fauna Assessment – Part Lot 2 // DP 243776, Macquarie Place and Thirlmere Way, Tahmoor. Prepared for ABAX Contracting (Ecoplanning 2015e).
- Response to Wollondilly Council – Report to Ordinary Meeting of Council 20 February 2017: Draft Planning Proposal – West Tahmoor Minimum Lot Size Amendment no. 2. Prepared for ABAX Contracting and Precise Planning (Ecoplanning 2018).

Threatened species, populations and migratory species recorded during the literature and database review were consolidated and their likelihood of occurrence was considered by:

- review of location and date of recent (<5 years) and historical (>5-20 years) records
- review of available habitat within the study and surrounding areas
- review of the scientific literature pertaining to each species and population
- applying expert knowledge of each species

The potential for each threatened species, population and/or migratory species to occur was then considered and the necessity for targeted field surveys was determined. Following field surveys and review of available habitat within the subject site and study area, the potential for species to utilise the site and be affected directly or indirectly by the proposed action were considered as either:

- “Recent record” = species has been recorded in the study area within the past 5 years
- “High” = species has previously been recorded in the study area (>5 years ago) or in close proximity (for mobile species), and/or habitat is present that is likely to be utilised by a local population
- “Moderate” = suitable habitat for a species is present onsite but no evidence of a species detected and relatively high number of recent records (5-20 years) in the locality or species is highly mobile
- “Low” = suitable habitat for a species is present onsite but limited or highly degraded, no evidence of a species detected and relatively low number of recent records in the locality
- “Not present” – suitable habitat for the species is not present onsite or adequate survey has determined species does not occur in the study area

2.2 Review of previous field surveys

Previous field surveys within and adjacent to the study area undertaken for previous reports are considered adequate to identify and understand the biodiversity values within the study area. In particular, Ecoplanning (2015a) have ground-truthed vegetation and flora and fauna habitat within the study area and the land between the study area and Thirlmere Way.

Previous surveys included traverses to record flora species and validate vegetation, plot-based surveys, habitat assessments, opportunistic fauna surveys, observations of signs of direct and indirect fauna occupancy. No targeted threatened flora surveys have been undertaken as no threatened flora species or populations were considered to have the potential to occur in the study area.

It is acknowledged that previous surveys have not provided a definitive list of the flora within the study area and that more species could be recorded during a longer survey over various seasons. Nevertheless, the techniques used in previous surveys are considered adequate to gather the data necessary to validate the vegetation communities and condition and detect any threatened flora with the potential to occur. Full fauna surveys following *Threatened Species Survey and Assessment Guidelines* (OEH 2013) were not undertaken because sufficient detail to determine the likelihood of occurrence of threatened and migratory species was achieved through habitat assessment. As such, further detailed fauna survey is not considered necessary.

3 Results

3.1 Topography, drainage, soils, biodiversity and water layers

The study area is approximately 280 masl, relatively flat and dropping away at the northern end of the study area towards Myrtle Creek. Myrtle Creek is a prescribed stream on the NSW Major River Database (OEH 2011) and the riparian zone along this creek is mapped on the state-wide topographic map (LPI 2015) and on the *Natural Resources – Water* map of the WLEP (Cl. 7.3) (**Figure 3.1**). Within the study area the width of the 'sensitive land' mapped on the riparian *Natural Resources – Water* map of the WLEP (Cl. 7.3) is 50 m from Myrtle Creek, although adjacent properties only include a 30 m buffer. In a meeting with Wollondilly Council on 1 November 2018, in principle support was given from Council for the proposed rezoning which would include rezoning of a 30 m wide corridor to E2 Environmental Conservation. The inclusion of a 30 m wide corridor, zoned E2 Environmental Conservation, as part of the proposal is consistent with the findings of a riparian corridor assessment undertaken by CT Environmental (2018). This study recommended that a 30 m vegetated riparian zone, measured from top of bank, is adequate to protect and maintain the geomorphic form and ecological function of Myrtle Creek and that the 30 m buffer would be consistent with the WLEP (2011) and WM Act.

There are no dams along the Myrtle Creek, but one detention basin has been constructed just south of land mapped as *Natural Resources - Water* (**Figure 3.1**). In the eastern part of the study area there is also a constructed drainage line that runs north into Myrtle Creek.

Regional scale mapping of soil landscape groups by Hazelton and Tille (1990) indicate that the soils of the study area are derived from the Lucas Heights (lh) residual landscape, which is recognised by “*interbedded shale, laminite and fine to medium-grained quartz sandstone*”. It occurs on gently undulating surfaces and ridges and is located stratigraphically between Ashfield Shale and Hawkesbury Sandstone.

Approximately 47 % (1.17 ha) of the study area and 25% of the subject site is mapped on the *Natural Resources – Biodiversity* map of the WLEP (Cl. 7.2) and this includes most of the SSTF (**Figure 3.1**).

3.2 Threatened species, populations and migratory species

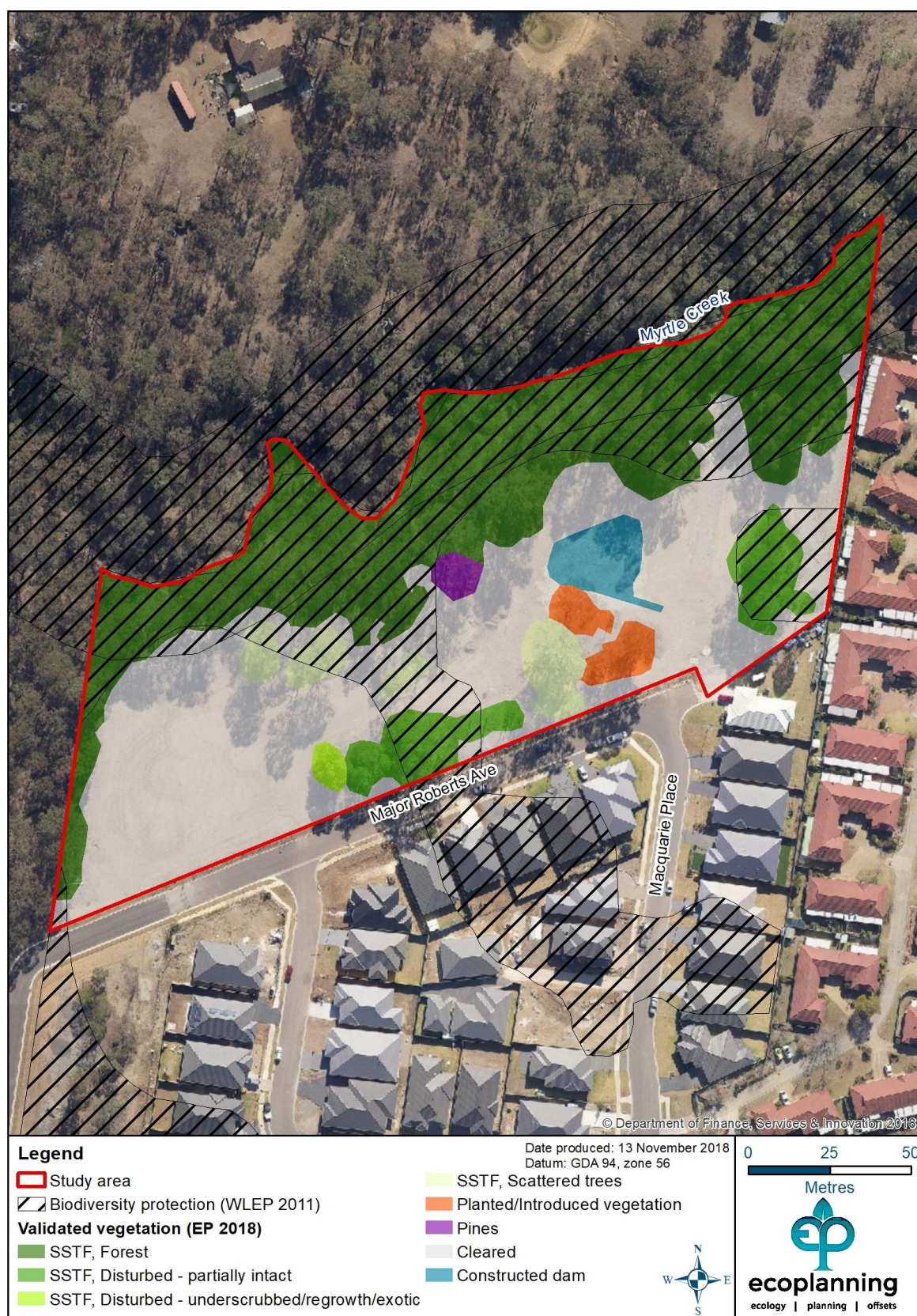
An updated search of relevant databases and literature identified fifteen threatened flora species, 27 threatened fauna species (including one amphibian, 14 birds, twelve mammals [five of which are microbats], and one gastropod), and one migratory bird that have been recorded within a 5 km radius of the study area (see **Figure 3.2**).

There is one record onsite of Black-chinned Honeyeater from the Atlas in 2010, which is likely to be the record in Biosis (2011). An additional threatened microbat (*Falsistrellus tasmaniensis*) was ‘possibly’ detected (i.e. results of analysis of microbat calls to identify the species was not definitive) by Hayes (2005) during Anabat surveys on the properties to the north-west on the

western side of Marion St, Thirlmere, although this record is not present in the Bionet Atlas of NSW Wildlife (OEH 2018).

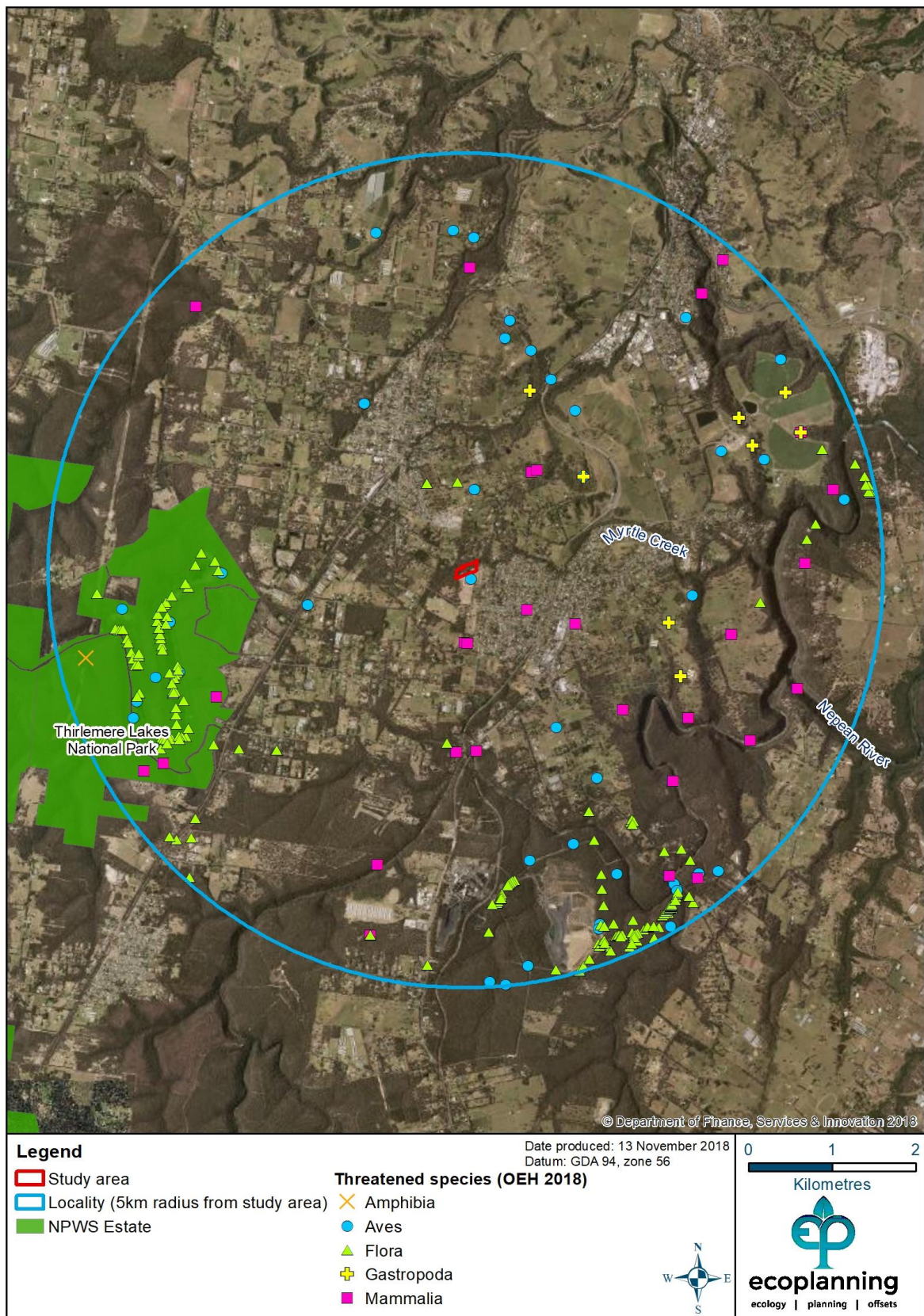
A likelihood of occurrence analysis has been undertaken, based on the review of previous reports and updated vegetation mapping for this report, which identified eight threatened species that have been 'recently recorded', or have 'high' or 'moderate' potential to use the study area (**Appendix A**). These include:

- Threatened microbats
 - *Miniopterus schreibersii oceanensis* (Eastern Bentwing Bat) (moderate)
 - *Mormopterus norfolkensis* (Eastern Freetail-bat) (moderate)
 - *Chalinolobus dwyeri* (Large-eared Pied Bat) (moderate)
 - *Myotis macropus* (Southern Myotis) (moderate)
 - *Scoteanax rueppellii* (Broad-nosed Bat) (moderate)
- Threatened birds
 - *Daphoenositta chrysoptera* (Varied Sittella) (moderate)
 - *Hieraaetus morphnoides* (Little Eagle) (moderate)
 - *Melithreptus gularis gularis* (Black-chinned Honeyeater – eastern sub-species) (recently recorded)



Note: validated vegetation layer was modified to accommodate recent clearing. Boundaries were drawn based on aerial from 8 February 2018.

Figure 3.1: Biodiversity of the study area.



Note: validated vegetation layer was modified to accommodate recent clearing. Boundaries were drawn based on aerial from 8 February 2018.

Figure 3.2: Threatened species records from Bionet in the locality (OEH 2018).

3.3 Vegetation communities and flora species

3.3.1 Shale Sandstone Transition Forest

Shale Sandstone Transition Forest (SSTF) is described by OEH (2014) as occupying the edges of the Cumberland Plain, where clay soils from the shale rock intergrade with earthy and sandy soils from sandstone, or where shale caps overlay sandstone. The boundaries are indistinct, and the species composition varies depending on the soil influences. The main tree species include *Eucalyptus tereticornis* (Forest Red Gum), *E. punctata* (Grey Gum), *E. globoidea* (White Stringybark), *E. eugenioides* (Thin-leaved Stringybark), *E. fibrosa* (Red Ironbark) and *E. crebra* (Narrow-leaved Ironbark). Areas of low sandstone influence (more clay-loam soil texture) have an understorey that is closer to Cumberland Plain Woodland. This community (SSTF) is listed as a Critically Endangered Ecological Community (CEEC) under the BC Act and the EPBC Act.

Based on the results of recent reports and fieldwork, and updated vegetation mapping based on recent aerial photos, the vegetation within the study area has been identified as SSTF in various condition states (**Figure 3.1**).

It is noted that *E. moluccana* (Grey Box) and *E. tereticornis* (Grey Gum) are common along Myrtle Creek (Ecoplanning 2015a) and that they have also been recorded in the study area. These species are more common elements of the Cumberland Plain Woodland vegetation community, which is associated with shale soils, although this community is not considered to be in the study area. Rather, the presence of these species is considered to be representative of the fact that the soils are transitioning from shale to sandstone, with a large number of Eucalypts present in the study area that are more representative of sandstone derived soils (e.g. *E. racemosa*; *C. gummifera*) and the transition zone between shale and sandstone (e.g. *E. punctata*; *E. globoidea*; *E. crebra*).

Most of the SSTF in the study area is located along Myrtle Creek and is in an intact condition (**Figure 3.3**). It is dominated by *E. tereticornis* and *Angophora floribunda* (Rough-barked Apple) along the creek and *E. moluccana* and *E. globoidea* in higher areas along the bank (Biosis 2011). Other canopy species occurring along Myrtle Creek include *E. crebra* (Narrow-leaved Ironbark) and *E. punctata* (Grey Gum) (Ecoplanning 2015a). This vegetation is in an intact condition and contains a mid-storey and ground layer dominated by native shrubs, grasses forbs and herbs (Ecoplanning 2015a).

In smaller disturbed patches of SSTF (**Figure 3.4**) there is a high prevalence of exotic species present including *Sida rhombifolia** (Paddy's Lucerne), *Bidens pilosa** (Cobblers Pegs), *Hypericum perforatum** (St Johns Wort) and *Verbena** spp. (Purpletop) (Ecoplanning 2015a). The groundcover retains a high proportion of exotic grass species including, *Axonopus fissifolius** (Narrow-leaved Carpet Grass), *Paspalum dilatatum** (Paspalum), *Pennisetum clandestinum** (Kikuyu), *Setaria parviflora** (Slender Pigeon Grass), *Dactylis glomerata** (Cocksfoot) and *Ehrharta erecta** (Panic veldt-grass). Common exotic herbs and forbs included, *Plantago lanceolata** (Lambs Tongue), *Hypochaeris radicata** (Catsear), and *Anagallis arvensis** (Scarlett Pimpernel).

The vegetation within the study area has been mapped in a number of condition states, as presented in **Figure 3.1** and described in **Table 3.1** which also contains the statistics related to

the amount of vegetation that would be conserved within the proposed E2 environmental zoning and the subject site (the remainder of the study area).

Table 3.1 Vegetation types found in the study area showing the condition and area.

Vegetation type	Vegetation zone (condition class)	Description	Proposed Zone E2 (ha)	Subject site (ha)	
				APZ	Development area
Shale Sandstone Transition Forest	Forest	Intact remnant vegetation, with native indigenous overstorey present typical of forest vegetation (i.e. 30-70 % projected foliage cover) (Specht et al 1974). Each vegetation stratum dominated by native species.	0.75	0.20	0.03
	Disturbed – partially intact	As for 'Forest' vegetation zone, but vegetation midstorey strata only partially intact, high proportion of native understorey.	0.00	0.00	0.14
	Disturbed – underscrubbed/ regrowth/ exotic	Native indigenous overstorey present with projected foliage cover typical of woodland vegetation (i.e. 10-30%) (Specht et al 1974), but native midstorey absent following management through slashing and/or grazing. Partial regeneration occurring in some areas and self-recruitment of exotic weed species.	0.00	0.00	0.01
	Scattered trees	As per 'Disturbed – underscrubbed', but with very sparse projected foliage cover (<5%). Understorey dominated by exotic vegetation (>50 %).	0.00	0.05	0.05
Total native vegetation			0.75	0.25	0.23
Other vegetation	Pines	Planted Radiata Pines	0.00	0.02	0.00
	Planted/Introduced	Ornamental and horticultural plantings of exotic and introduced non-indigenous Australian native plants.	0.00	0.00	0.05
Total vegetation			0.75	0.27	0.28

* Total area of vegetation subject to rounding errors

Condition thresholds under the EPBC Act

The *Conservation Advice (including listing advice) for Shale Sandstone Transition Forest of the Sydney Basin Bioregion* (TSSC 2014) provides condition thresholds for when a patch retains sufficient conservation value to be considered as a Matter of National Environmental Significance (MNES). This rationale is provided in **Table 3.2**.

Application of the rationale in TSSC (2014) would categorise all of the SSTF mapped as 'Forest' along Myrtle Creek as 'Category D: High condition class'. This is because it is a patch of >2 ha with perennial understorey vegetation is made up of >50 % native species (Ecoplanning 2015a) (**Figure 3.6**).

In addition, application of the rationale in TSSC (2014) would also categorise the smaller patches of SSTF adjacent to Myrtle Creek into the 'Category D: High condition class' as collectively they may be considered part of the larger patch along Myrtle Creek (they are within 100 m of the vegetation along Myrtle Creek).

Table 3.2: Condition categories, rationale and thresholds for Shale Sandstone Transition Forest

Category and Rationale	Thresholds		
A. Moderate condition class Represented by medium to large-size patch as part of a larger native vegetation remnant and/or with mature trees	Patch size >0.5ha And >30% of the perennial understorey vegetation cover is made up of native species. And		
	The patch is contiguous with a native vegetation remnant (any native vegetation where cover in each layer present is dominated by native species) >1ha in area.	Or	The patch has at least one tree with hollows or at least one large locally indigenous tree (>80cm dbh).
B. Moderate condition class Represented by medium to large size patch with high quality native understorey	Patch size >0.5ha And >50% of the perennial understorey vegetation cover is made up of native species.		
C. High condition class Represented by medium to large size patch with very high quality native understorey	Patch size >0.5ha And >70% of the perennial understorey vegetation cover is made up of native species.		
D. High condition class Represented by larger size patch with high quality native understorey	Patch size >2ha And >50% of the perennial understorey vegetation cover is made up of native species.		
<i>Perennial understorey vegetation cover</i> includes vascular plant species of both the ground layer and mid/shrub layer (where present) with a lifecycle of more than two growing seasons. Measurements of perennial understorey vegetation cover exclude annuals, cryptogams, leaf litter or exposed soil. <i>Contiguous</i> means the patch of the ecological community is continuous with, or in close proximity (within 100 m) to another area of vegetation that is dominated by native species in each vegetation layer present.			



Figure 3.3: Shale Sandstone Transition Forest, 'Forest' zone, along the riparian zone of Myrtle creek.



Figure 3.4: Shale Sandstone Transition Forest – disturbed – underscrubbed/regrowth/exotic, adjacent to Myrtle Creek.

3.3.2 Other vegetation

The remaining vegetation within the study area was classified as either 'Planted/introduced' (ornamental plantings) or 'Pines' (planted *Pinus* spp.*). The area of these vegetation types and the condition assigned to each of them is described in **Table 3.1** and shown in **Figure 3.5**.



Figure 3.5: Other vegetation – Pines, planted vegetation and exotic grassland.



Figure 3.6: Condition class of the vegetation within the study area and subject site under the EPBC Act.

3.3.3 Flora species

Ecoplanning (2015a) recorded a total of 180 flora species, including 67 exotic species, within the area between Myrtle Creek and Thirlmere Way. In the riparian area along Myrtle Creek (i.e. the intact SSTF), Ecoplanning (2015a) recorded a total of 102 species, including 38 exotic species. Of the exotic species, Ecoplanning (2015a) identified eight weeds listed under the NSW *Biosecurity Act 2015*, seven of which are recognised as Weeds of National Significance (**Table 3.3**). The most common weeds within the riparian area along Myrtle Creek include *Ligustrum lucidum** (Large-leaved Privet), *Ligustrum sinense** (Small-leaved Privet) and *Lantana camara** (Lantana).

No threatened flora species were recorded or expected to potentially occur in the study area (Ecoplanning 2015a).

Table 3.3: Priority weeds and Weeds of National Significance (WONS)

Common name	Scientific name	WoNS ¹	Duty under the Biosecurity Act 2015
Asparagus Fern	<i>Asparagus aethiopicus</i> *	Yes	Prohibition on dealing Must not be imported into the State or sold
Bridal Creeper	<i>Asparagus asparagoides</i> *	Yes	Prohibition on dealing Must not be imported into the State or sold (this requirement also applies to the Western Cape form of bridal creeper)
Fireweed	<i>Senecio madagascariensis</i> *	Yes	Prohibition on dealing Must not be imported into the State or sold
Prickly Pear	<i>Opuntia stricta</i> *	Yes	Prohibition on dealing Must not be imported into the State or sold
Blackberry	<i>Rubus fruticosus</i> species aggregate	Yes	Prohibition on dealing Must not be imported into the State or sold (All species in the <i>Rubus fruticosus</i> species aggregate have this requirement, except for the varieties Black Satin, Chehalem, Chester Thornless, Dirksen Thornless, Loch Ness, Murrindindi, Silvan, Smooth Stem, and Thornfree)
African Olive	<i>Olea europea</i> subsp. <i>cuspidata</i>	No	Regional Recommended Measure An exclusion zone is established for all lands in Blue Mountains City Council and Central Coast local government areas. The remainder of the region is classified as the core infestation area. Whole region: The plant or parts of the plant are not traded, carried, grown or released into the environment. Exclusion zone: The plant is eradicated from the land and the land kept free of the plant. Core infestation area: Land managers prevent spread from their land where feasible.
Lantana	<i>Lantana camara</i>	Yes	Prohibition on dealing Must not be imported into the State or sold

Common name	Scientific name	WoNS ¹	Duty under the Biosecurity Act 2015
African Boxthorn	<i>Lycium ferocissimum</i>	Yes	Prohibition on dealing Must not be imported into the State or sold

¹ <http://weeds.dpi.nsw.gov.au/WeedBiosecurities?Areald=140>

3.3.4 Fauna species

Fauna species recorded during previous surveys included three frogs, 40 bird species (including five exotic bird species), 10 mammals and two reptiles (Biosis 2011; Hawkeswood (2013); EcoPlanning (2015a).

To provide a broad overview of the fauna species that may occur in the study area the fauna lists from the above reports and from EcoPlanning (2015a) are provided in **Appendix B**. It should be noted that not all fauna listed would necessarily occur in the study area and in the riparian vegetation along Myrtle Creek.

Only one threatened species, the Black-chinned Honeyeater (eastern sub-species) (*Melithreptus gularis gularis*), has been recorded during previous surveys (Biosis 2011).

3.3.5 Fauna habitat

A range of fauna habitat features are present in the study area (EcoPlanning 2015a):

- Vegetated areas of tall open forest
- Hollow bearing and stag trees
- Fallen timber and hollow logs
- Constructed dam and water detention basin

Fauna habitat within the study area is concentrated in the intact SSTF along Myrtle Creek and includes potential foraging, roosting, breeding and nesting resources. The habitat features relevant to each fauna group are identified in **Table 3.4**. This includes potential habitat for the following threatened species (likelihood of occurrence is provided in brackets):

- Threatened microbats
 - *Miniopterus schreibersii oceanensis* (Eastern Bentwing Bat) (moderate)
 - *Mormopterus norfolkensis* (Eastern Freetail-bat) (moderate)
 - *Chalinolobus dwyeri* (Large-eared Pied Bat) (moderate)
 - *Myotis macropus* (Southern Myotis) (moderate)
 - *Scoteanax rueppellii* (Broad-nosed Bat) (moderate)
- Threatened birds
 - *Daphoenositta chrysoptera* (Varied Sittella) (moderate)
 - *Hieraaetus morphnoides* (Little Eagle) (moderate)
 - *Melithreptus gularis gularis* (Black-chinned Honeyeater – eastern sub-species) (moderate)

Records of these species are not common in the locality and they are predominantly located along riparian areas and gullies, or in the conservation estate to the west (Thirlmere Lakes National Park) (EcoPlanning 2015a). Only one threatened fauna species has been recorded in the study area by Biosis (2011), the Black-chinned Honeyeater – eastern subspecies. This species is known to occur in low numbers in the landscape and is not known to persist in

remnants of <200 ha (NSW SC 2011). This is the only record within 5 km of the study area in the past 20 years and given the highly cleared and lineal nature of the remnant vegetation in locality the study area is not considered to retain significant habitat for this species. This record is now 7 years old, and no further records in the locality have been entered into the Atlas since (OEH 2018).

Hollow bearing and stag trees do occur in the study area within the SSTF along Myrtle Creek, as such, they provide limited roosting habitat for threatened microbats. Given the low number of records and the large amount of semi-cleared rural land in the locality, the study area provides foraging habitat for microbats, but this amount of habitat is low compared to the foraging habitat within the locality. None of the hollow-bearing trees were present within the subject site and no hollow-bearing trees are proposed for removal.

Similarly, there is moderate potential for the Varied Sittella, Little Eagle and Square-tailed Kite to utilise the foraging and roosting habitat in the study area, but there are few records in the locality, with only four records of the Varied Sittella and only one record of the Little Eagle in the past 20 years (OEH 2018). Therefore, the vegetation and habitat in the study area is not likely to be significant for populations of these highly mobile species within the locality and more intact habitat is present in the nearby riparian areas, gullies and the conservation estate.

Table 3.4: Key fauna habitat features present within the study area

Habitat features	Fauna species
Vegetated areas of tall open forest	Diurnal and nocturnal birds, arboreal mammals and microchiropteran bats
Hollow bearing trees	Hollow dependant fauna, birds, amphibian, mammals and microbats
Stag tree	Birds (roosting) and microchiropteran bats (refuge)
Constructed dam and water detention basin	Amphibians; birds, microbats, reptiles and mammals
Fallen timber	Foraging and refuge for reptiles, gastropods and birds
Leaf litter	Foraging resources for reptiles, gastropods, birds and mammals

4 Impact assessment

This section outlines the anticipated direct and indirect impacts of the proposal on the ecological values of the study area. It is noted that the current proposal is only for rezoning and would not involve any direct impacts to ecology of the study area, however this report assesses likely impacts associated with proposed rezoning and subsequent development.

4.1 Direct Impacts

4.1.1 Vegetation clearing

The proposed E2 zoning will protect the majority (0.75 ha) of the high biodiversity values within the study area including most of the Shale Sandstone Transition Forest, which is a Threatened Ecological Community (TEC) listed under the BC Act and the EPBC Act.

The retention of the 2,000 square metre minimum lot size along the western boundary may help to retain the thin strip of SSTF along the western boundary, however for the purposes of this impact assessment it has been assumed that all vegetation outside the proposed E2 zone would be removed, with exception of those areas nominated for management as an APZ. Within areas nominated as an APZ, partial clearing of the canopy, shrub and understorey has been assumed.

As summarised in **Table 3.1**, the proposal would involve complete loss of 0.23 ha of native vegetation comprising SSTF, of which 0.20 ha is already in a disturbed condition. A further 0.25 ha of native vegetation comprising SSTF would be managed as an APZ with partial clearing of the canopy, shrub and understorey to occur. The SSTF to be impacted, within the proposed APZ and development areas includes land mapped as Natural Resources - Biodiversity (**Figure 3.1**).

4.1.2 Loss of fauna habitat

The proposal will remove a small amount of native vegetation representing of fauna habitat, including 0.23 ha. The fauna habitat to be impacted includes potential foraging, roosting and nesting habitat for threatened species. No hollow bearing trees were identified during field assessments and are proposed to be removed by the current proposal. Dumped rubbish was also identified during field assessments and will also be removed by the proposal.

As discussed in **section 3.3.5**, the fauna habitat which would be impacted included potential habitat for threatened bird and microbat species. However given the relatively few records of these species in the locality and the disturbed nature of the vegetation within the subject site which is located adjacent to existing residential development, the vegetation and habitat in the study area is not likely to be significant for populations of these highly mobile species within the locality. The overall impact to fauna habitat is considered relatively minor given the condition of the habitat which would be impacted and its location within an urban environment. Furthermore, only disturbance tolerant and highly mobile fauna species are considered likely to use the habitat within the subject site. Any fauna species capable of utilising the habitat within the study area would be highly mobile and would be capable of accessing vegetation of higher conservation significance which remains within the locality.

4.1.3 Habitat connectivity

The vegetation that runs along Myrtle Creek within the study area is part of an east-west corridor of remnant vegetation in an otherwise heavily fragmented landscape (**Figure 1.3**). However, it can be seen that this corridor is relatively narrow and is fragmented at its western end. As such it would be useful as a corridor for more mobile fauna species such as birds and bats.

The *Framework for the Spatial Prioritisation of Koala Conservation Actions in NSW* is a recent report prepared for OEH and the Saving Our Species Iconic Koala Project 2017-21 (Rennison and Fisher 2018). Accompanying data from the report is shown in **Figure 4.1**. This shows the vegetation to the west of the study area has been mapped with a low Habitat Functionality Class.

This means that there is low expectation that this land will be able to support koala populations into the future, given current assumptions of threatening processes (Rennison and Fisher 2018). Given the scale of the mapping, it is assumed that the study area would also be classified with a low Habitat Functionality Class.

4.2 Indirect impacts

It is difficult to quantify indirect impacts of the proposed development, but these may include impacts such as erosion and water quality impacts that may be associated with the construction phase of the project. These impacts can be managed through the development of a Construction Environmental Management Plan (CEMP). Given the disturbed nature of the study area, and the implementation of appropriate controls, these indirect impacts from the proposal are likely to be relatively minor.

4.3 Avoidance and mitigation

The proposed rezoning to E2 Environmental Conservation of a 30 m corridor along the northern boundary of the study area, and avoiding any indirect impacts within this area, has avoided impacts to the majority of the better-quality native vegetation within the study area. Further, retention of this area and management in accordance with a Vegetation Management Plan (VMP), will maintain the existing functionality of this vegetation as a habitat part of a habitat corridor which extends east and west along Myrtle Creek.

To avoid potential indirect offsite impacts during construction, an appropriate erosion and sedimentation control plan should be in place following best practice protocols such as that detailed in Landcom (2004). It is recommended that appropriate erosion and sedimentation control and the pre-clearance protocols are included in a site-specific Construction Environment Management Plan, prior to any construction works taking place.

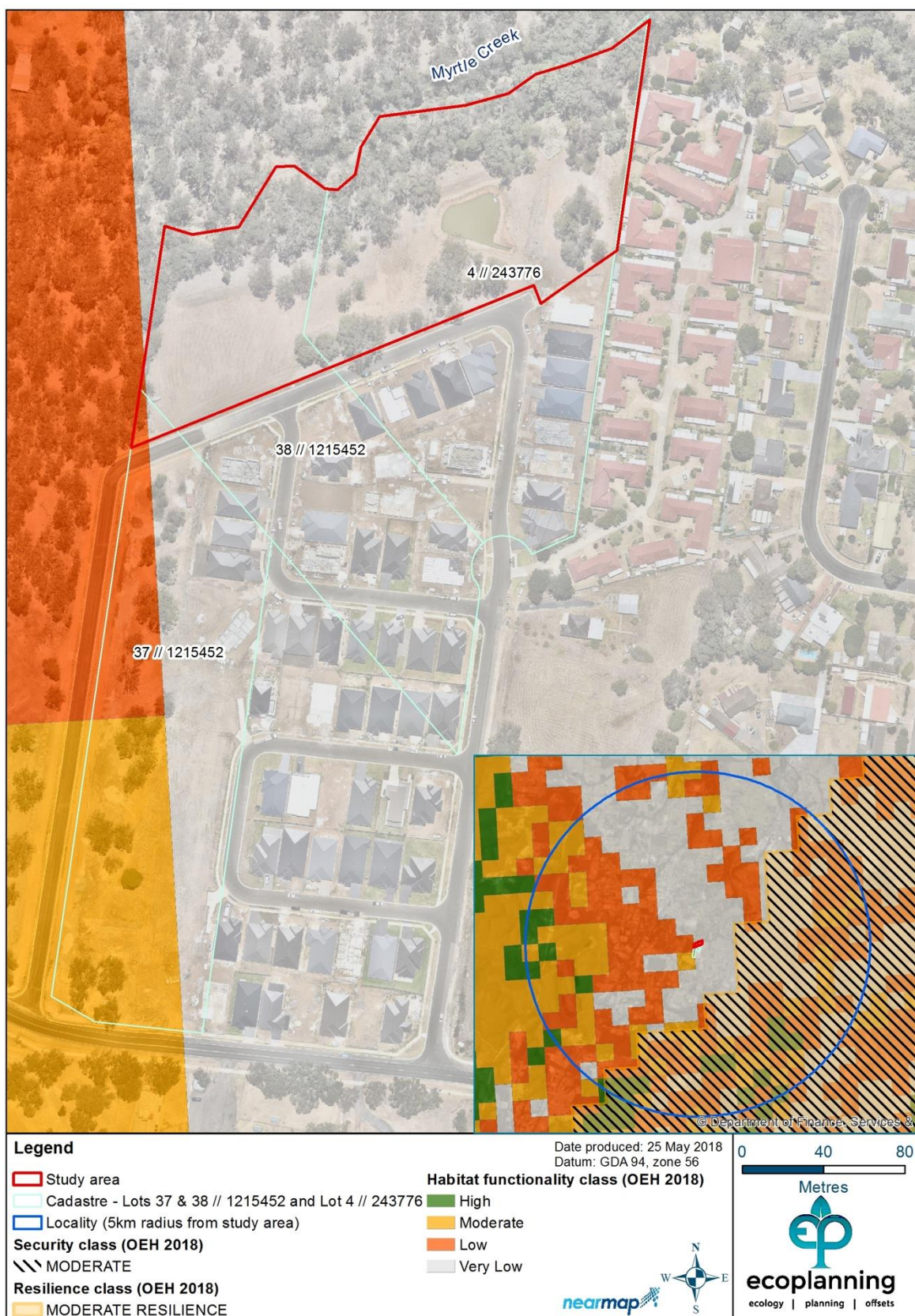


Figure 4.1: Koala security, resilience and habitat functionality.

4.4 Legislative context

4.4.1 Commonwealth considerations

One Matter of National Environmental Significance (MNES) has been identified within the study area, SSTF which is listed as Critically Endangered under the EPBC Act. As outlined within **section 3.3.1**, all of the SSTF within the study area meets the definition of this community including the condition thresholds as outlined within TSSC (2014).

Assessment of the proposed impacts to SSTF against the Significant Impact Guidelines (DotE 2012; **Appendix C**) concluded that the clearing of 0.23 ha, and partial clearing of 0.27 ha within proposed APZs, is unlikely to significantly impact the ecological community and a referral is not required.

4.4.2 State considerations

Impact assessment in accordance with Part 5A of the EP&A Act (i.e. the 'test of significance') and the associated guidelines (DECC 2009) have been undertaken for SSTF and the following threatened species identified as having potential to utilise the study area (**Appendix C**):

- Threatened microbat species
 - *Miniopterus schreibersii oceanensis* (Eastern Bentwing Bat) (moderate)
 - *Mormopterus norfolkensis* (Eastern Freetail-bat) (moderate)
 - *Chalinolobus dwyeri* (Large-eared Pied Bat) (moderate)
 - *Myotis macropus* (Southern Myotis) (moderate)
 - *Scoteanax rueppellii* (Broad-nosed Bat) (moderate)
- Threatened birds
 - *Daphoenositta chrysoptera* (Varied Sittella) (moderate)
 - *Hieraaetus morphnoides* (Little Eagle) (moderate)
 - *Melithreptus gularis gularis* (Black-chinned Honeyeater – eastern sub-species) (moderate)

These assessments found that subject to the avoidance and mitigation measures outlined in Section 4.3, the proposed development is unlikely significantly impact the SSTF ecological community or threatened species.

4.4.3 Local Considerations

The subject site includes land mapped in WLEP's 'Natural Resources – Biodiversity Map' and as such the consent authority must consider the matters listed under Clause 7.2 of the WLEP. Specific matters relevant to the study area include the need to consider impacts to:

- native ecological communities,
- the habitat of any threatened species, populations or ecological community,
- regionally significant species of fauna and flora or habitat,
- habitat elements providing connectivity.

Additionally, clause 7.2 (4) of the WLEP requires that proposed developments avoid or minimise or mitigate any adverse environmental impact.

As outlined within **section 4.1**, one native ecological community is present within the study area which also provides potential habitat to threatened bird and microbat species. Assessment of

potential impacts to the threatened entities concluded that they would not be impacted the proposed development. Additionally, the existing habitat corridor along Myrtle creek would be retained as part of the proposed development and its functionality as a habitat corridor as is unlikely to be reduced by the proposed development.

As outlined within **section 4.3** impacts to native vegetation have been avoided and minimised through the retention of vegetation within, and proposed rezoning to E2, of a 30 m wide corridor along Myrtle Creek. The proposed zoning will protect the majority of the high biodiversity values within the study area including most of the SSTF and will maintain the east-west connectivity along Myrtle Creek. Some residual impacts to land mapped on the *Natural Resources – Biodiversity* map of the WLEP (Cl. 7.2) would occur as part of the proposed development. These residual impacts have been mitigated through a Biodiversity Offset Strategy (BOS) included as **section 5** of this report.

5 Biodiversity Offset Strategy

This BOS has been developed to mitigate impacts to vegetation on land mapped on the *Natural Resources – Biodiversity* map of the WLEP (**Figure 3.1**). This BOS has been adapted from a BOS previously prepared for 20 Macquarie Place Tahmoor (Ecoplanning 2015b).

Impacts to the 0.48 ha vegetated component of the land identified by the 'Natural Resources – Biodiversity Map' on site were assessed using the BCAM (DECCW 2011). Vegetation condition was assessed using a BioMetric survey plot and transect established within 20 Macquarie Place Tahmoor (approximately 250 m from the current study area) which contained native vegetation within the area identified in the 'Natural Resources - Biodiversity Map'. The vegetation within the study area and within the vegetation surveyed at 20 Macquarie Place were considered broadly equivalent in terms of their condition. The vegetation within 20 Macquarie Place was mapped by Ecoplanning (2015) as Shale Sandstone Transition Forest (NPWS 2002). The vegetation zone (i.e. condition class) where the plot was positioned was mapped as 'Disturbed – underscrubbed/regrowth/exotic'.

The plot was surveyed by Gary Leonard (Senior Botanist) and Joel Honeysett (Ecologist) on 16 September 2015. Data were entered to the Biocertification Tool in order to determine the appropriate quantum of biodiversity credits required to offset the impacts to native vegetation within the area mapped under Cl. 7.2 of the WLEP.

It is noted that inconsistencies and inaccuracies in the BCAM calculator meant a small change to the approach to calculate credits was required. The vegetation type present on site (HN556 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin) was not available in the BCAM calculator due to a data error within the calculator related to the vegetation types within the Hawkesbury-Nepean Major Catchment (formerly the HN CMA). As a work around the equivalent vegetation type from the Sydney Metropolitan Major Catchment (formerly the Sydney Metro CMA) was used (ME021- Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin). Although within a different Major Catchment, the vegetation type is equivalent in every way to the Hawkesbury-Nepean Major Catchment type and will not have an impact on the credit calculations for the proposal.

5.1 Results

The BioMetric data recorded was entered into the BCAM calculator and a total site value score of 25.17/100 was recorded in the BCAM calculator. This places the vegetation into the 'low' condition category under the BCAM (DECCW 2011), as the site value is < 34/100. Additional landscape components were also entered into the BCAM calculator, and a landscape score of 10 recorded. The landscape score is comprised of a 'local biodiversity link' and the maximum adjacent remnant area of 501 ha.

The BCAM uses Plant Community Types (PCT) (OEH 2014) as the vegetation classification system for trading in ecosystem credits. The PCT equivalent to the vegetation type impacted at the site is 'Narrow leaved Ironbark Broad leaved Ironbark Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion'.

Assessment according to the BCAM results in a requirement of seven (7) credits for the impacts to 0.48 ha of vegetation within the area identified by the 'Natural Resources - Biodiversity Map'.

5.2 Credit profile

The BCAM uses Plant Community Types (PCT) (OEH 2014) as the vegetation classification system for trading in ecosystem credits. The PCT equivalent to the vegetation type impacted at the subject site is, 'Narrow leaved Ironbark Broad leaved Ironbark Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion'. The credit profile for credit trading options of this PCT is provided in **Table 5.1**. Credits can be sourced from a range of locations, specifically the surrounding Cumberland Plain within the Hawkesbury-Nepean or Sydney Metropolitan Major Catchment areas.

Table 5.1: Ecosystem credits and summary

Plant community type (impact)	Impact area assessed (ha)	Credits required	Plant community type (offset options)	IBRA sub-region
Narrow leaved Ironbark Broad leaved Ironbark Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (ME021)*	0.48	7	1. Narrow leaved Ironbark Broad leaved Ironbark Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (HN556); and/or 2. Narrow leaved Ironbark Broad leaved Ironbark Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (ME021)	'Cumberland – Hawkesbury Nepean' and any CMA subregion that adjoins the CMA subregion in which the development occurs
Total	0.48	7		

* ME021 used instead of HN556 due to an error in the BCAM calculator for the Hawkesbury-Nepean Major Catchment. The use of this equivalent vegetation type has no impact on the credit calculations

6 Conclusions

The proposal will directly impact on ~0.55 ha of vegetated land, of which ~0.48 ha consists of native vegetation (SSTF) with the remaining ~0.07 ha consisting of planted or non-native vegetation.

The SSTF vegetation community within the study area is a CEEC listed under the TSC Act and EPBC Act. Proposed impacts to SSTF were assessed in accordance with the Significant Impact Criteria (DoE 2013) and in accordance with s5A of the EP & A Act. These assessments determined that the planning proposal is not likely to have a significant effect on SSTF.

The SSTF vegetation community within the study area was identified as potential foraging habitat for several threatened bird and bats species. Proposed impacts to foraging habitat for threatened bird and bat species were assessed in accordance with the Significant Impact Criteria (DoE 2013), where relevant, and in accordance with s5A of the EP & A Act. These assessments determined that the planning proposal is not likely to have a significant effect on the threatened bird and bat species identified as potentially utilising the study area.

The subject site includes land mapped in WLEP's *'Natural Resources – Biodiversity Map'* and as such the consent authority must consider the matters listed under Clause 7.2 of the WLEP. In accordance with clause 7.2 (4) of the WLEP, the proposed works have avoided and minimised impacts to native vegetation through retention and rezoning to E2 Environmental Conservation a 30 m wide vegetated corridor along Myrtle Creek. Residual impacts, after attempts to avoid and minimise impacts, have been mitigated through a BOS. Specifically, 7 (seven) ecosystem credits corresponding to the native vegetation within the study area (Narrow leaved Ironbark Broad leaved Ironbark Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion [PCT 1395]) should be purchased and retired prior to impacting upon the SSTF within the study area.

References

Biosis (2011). Picton, Tahmoor, Thirlmere – New Urban Land – Local Environmental Study: Flora and Fauna Survey and Constraints Assessment. Prepared by Biosis Research for Cardno Forbes Rigby on behalf of Wollondilly Shire Council.

Commonwealth Dept. of the Environment (DoE) (2015). Protected Matters Search Tool. Accessed at: <http://www.environment.gov.au/epbc/protected-matters-search-tool>

CT Environmental (2018). *Investigation of suitable Vegetated Riparian Zone (VRZ) for #1234 West Tahmoor*. Letter to Lucas McKinnon dated 21 August 2018.

Department of Environment, Climate Change and Water (2011). Biodiversity Certification Assessment Methodology. Department of Environment, Climate Change and Water, Sydney.

Department of Environment and Conservation (2005). *Recovering Bushland on the Cumberland Plain: Best practice guidelines for the management and restoration of bushland*. Department of Environment and Conservation, Sydney.

Department of Environment and Climate Change (2007). *Threatened species assessment guidelines: The assessment of significance*. DECC, Sydney.

Ecoplanning (2015a). *Flora and Fauna Assessment - Part Lots 1-3 // DP 243776, Macquarie Place and Thirlmere Way, Tahmoor*. Prepared for Precise Planning.

Ecoplanning (2015b) Biodiversity Assessment Report – Macquarie Place, Tahmoor, NSW (v 1.2). Prepared for ABAX Contracting, c/o Precise Planning.

Ecoplanning (2015c). *Assessment of ecological impacts and avoidance, mitigation and offsetting measures for planning proposal at Thirlmere Way, West Tahmoor, Wollondilly LGA*. Prepared for Precise Planning.

Ecoplanning (2015d). *Flora, Fauna and Riparian Assessment – Lot 6 // DP 793897, 20 Macquarie Place, Tahmoor*. Prepared for Precise Planning.

Ecoplanning (2015e). *Flora and Fauna Assessment – Part Lot 2 // DP 243776, Macquarie Place and Thirlmere Way, Tahmoor*. Prepared for ABAX Contracting.

Ecoplanning (2018). *Response to Wollondilly Council – Report to Ordinary Meeting of Council 20 February 2017: Draft Planning Proposal – West Tahmoor Minimum Lot Size Amendment no. 2*. Prepared for ABAX Contracting and Precise Planning.

ELA (2014). Macquarie Place, West Tahmoor – *Threatened Species Conservation Act* advice and prelim Biocertification calculations. Letter advice prepared for Precise Planning by Eco Logical Australia, Sutherland.

Gibbons, P. and Lindenmayer, D. (2001). *Tree Hollows and Wildlife Conservation in Australia*. CSIRO Publishing, Collingwood, Vic.

Hawkeswood (2013). Flora and Fauna Survey and 7-part Test of Significance for Lots 1-4, DP 243776, Thirlmere Way, West Tahmoor, New South Wales. Prepared by T. J. Hawkeswood Scientific Consulting.

Hayes (2005). Lots 58 & 60 // DP 21549, 35 & 45 Marion Street, Thirlmere – Proposed Vegetation Clearing – Flora and Fauna Assessment. Prepare by Hayes Environmental.

Hazelton P.A. and Tille P.J. (1990). Soil Landscapes of the Wollongong-Port Hacking 1:100,000 Sheet map and report, Soil Conservation Service of NSW, Sydney.

NSW Dept. of Environment and Climate Change (DECC) (2007). Threatened species assessment guidelines: The assessment of significance Assessment of Significance Guidelines.

NSW Dept. of Planning and Environment (DPE) (2015). NSW Planning Viewer Beta. NSW Government. Accessed at: <https://maps.planningportal.nsw.gov.au/Terms>

NSW Land and Property Information (LPI) (2015). SIX Maps. Accessed at: <https://maps.six.nsw.gov.au/>

NSW National Parks and Wildlife Service (NPWS) (2002). Interpretation Guidelines for the Native Vegetation Maps of the Cumberland Plain, Western Sydney, Final Edition. NSW NPWS, Hurstville.

NSW Office of Environment and Heritage (OEH) (2011). Major Rivers Database: Prescribed New South Wales watercourses for determining riparian buffer strip widths. Accessed 22 February 2015, at: <http://www.environment.nsw.gov.au/vegetation/MajorRivers.htm>

NSW Office of Environment and Heritage (OEH) (2013). Threatened Species Survey and Assessment Guidelines. Accessed at: <http://www.environment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.htm>

NSW Office of Environment and Heritage (OEH) (2014). Shale Sandstone Transition Forest in the Sydney Basin Bioregion – profile. Accessed at: <http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10755>

NSW Office of Environment and Heritage (OEH) (2017) *Guidance to assist a decision-maker to determine a serious and irreversible impact*. NSW Government.

NSW Office of Environment and Heritage (OEH) (2018a). BioNet Atlas of NSW Wildlife. Accessed at: http://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx

NSW Office of Environment and Heritage (OEH) (2018). NSW threatened species Website BioNet Atlas of NSW Wildlife. Accessed at: <http://www.environment.nsw.gov.au/threatenedspecies/>

(Rennison and Fisher 2018). *Framework for the Spatial Prioritisation of Koala Conservation Actions in NSW* is a recent report prepared for OEH and the Saving Our Species Iconic Koala Project 2017-21.

Specht, R.L., Roe, E.M. and Boughton, V.H. (1974). Conservation of major plant communities in Australia and Papua New Guinea. *Australian Journal of Botany* 7, pp. 1–647.

Threatened Species Scientific Committee (TSSC) (2014). Approved Conservation Advice (including listing advice) for Shale Sandstone Transition Forest of the Sydney Basin Bioregion.

Appendix A: Species likelihood of occurrence

The potential for each threatened species, population and/or migratory species to occur was then considered and the necessity for targeted field surveys was determined. Following field surveys and review of available habitat within the subject site and study area, the potential for species to utilise the site and be affected directly or indirectly by the proposed action were considered as either:

- “Recent record” = species has been recorded in the study area within the past 5 years
- “High” = species has previously been recorded in the study area (>5 years ago) or in close proximity (for mobile species), and/or habitat is present that is likely to be utilised by a local population
- “Moderate” = suitable habitat for a species is present onsite but no evidence of a species detected and relatively high number of recent records (5-20 years) in the locality or species is highly mobile
- “Low” = suitable habitat for a species is present onsite but limited or highly degraded, no evidence of a species detected and relatively low number of recent records in the locality
- “Not present” – suitable habitat for the species is not present onsite or adequate survey has determined species does not occur in the study area

Unless otherwise referenced, information on habitat and ecology of species are taken from the Atlas of NSW Wildlife, NSW Threatened Species Website (OEH 2015), and/or determinations made by the NSW Scientific Committee or Commonwealth Threatened Species Scientific Committee for each relevant species.

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
KINGDOM: Plantae; CLASS: Magnoliopsida							
<i>Commersonia prostrata</i> (Dwarf Kerrawang)	BC Act: E EPBC Act: E	Occurs on the Southern Highlands and Southern Tablelands (one plant at Penrose State Forest, one plant at Tallong, a small population near the Corang and about 2000 plants at Rowes Lagoon), a larger population in the Thirlmere Lakes area (particularly among the dying reeds at the edge of the water), and on the North Coast (less than 100 plants at the Tomago sandbeds north of Newcastle). It is also found in Victoria.	Occurs on sandy, sometimes peaty soils in a wide variety of habitats: Snow Gum (<i>Eucalyptus pauciflora</i>) Woodland and Ephemeral Wetland floor at Rowes Lagoon; Blue leaved Stringybark (<i>E. agglomerata</i>) Open Forest at Tallong; and in Brittle Gum (<i>E. mannifera</i>) Low Open Woodland at Penrose; Scribbly Gum (<i>E. haemostoma</i>) Swamp Mahogany (<i>E. robusta</i>) Ecotonal Forest at Tomago.	71	2.9km (2011)	2011 (3.4km)	Not present
<i>Darwinia biflora</i>	BC Act: V EPBC Act: V	Recorded in Ku-ring-gai, Hornsby, Baulkham Hills and Ryde local government areas. The northern, southern, eastern and western limits of the range are at Maroota, North Ryde, Cowan and Kellyville, respectively.	Occurs on the edges of weathered shale-capped ridges, where they intergrade with Hawkesbury Sandstone.	1	1.1km (2015)	2015 (1.1km)	Not present

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
<i>Epacris purpurascens</i> var. <i>purpurascens</i>	BC Act: V	Recorded from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South.	Found in a range of habitat types, most of which have a strong shale soil influence. Lifespan is recorded to be 5-20 years, requiring 2-4 years before seed is produced in the wild. Killed by fire and re-establishes from soil-stored seed.	1	1.1km (2015)	2015 (1.1km)	Not present
<i>Eucalyptus camfieldii</i> (Camfield's Stringybark)	BC Act: V EPBC Act: V	Restricted distribution in a narrow band with the most northerly records in the Raymond Terrace area south to Waterfall. Localised and scattered distribution includes sites at Norah Head (Tuggerah Lakes), Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park.	Poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges. Occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas.	1	1.1km (2015)	1.1km (2015)	Not present
<i>Grevillea parviflora</i> subsp. <i>parviflora</i> (Small-flower Grevillea)	BC Act: V EPBC Act: V	Sporadically distributed throughout the Sydney Basin with sizeable populations around Picton, Appin and Bargo (and possibly further south to the Moss Vale area) and in the Hunter at in the Cessnock - Kurri Kurri area. Separate populations are also known from Putty to Wyong and Lake Macquarie on the Central Coast.	Found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests. Hunter occurrences are usually 30-70m ASL, while the southern Sydney occurrences are typically at 200-300m ASL. Often occurs in open, slightly disturbed sites such as along tracks. Flowering has been recorded between July to December as well as April-May.	25	1.1km (2015)	2016 (4.8km)	Not present

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
<i>Leucopogon exolasius</i> (Woronora Beard-Heath)	BC Act: V EPBC Act: V	Woronora Beard-heath is found along the upper Georges River area and in Heathcote National Park.	The plant occurs in woodland on sandstone. Flowering occurs in August and September.	2	1.1km (2015)	2015 (1.1km)	Not present
<i>Melaleuca deanei</i> (Deane's Melaleuca)	BC Act: V EPBC Act: V	Deane's Paperbark occurs in two distinct areas, in the Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas respectively. There are also more isolated occurrences at Springwood (in the Blue Mountains), Wollemi National Park, Yalwal (west of Nowra) and Central Coast (Hawkesbury River) areas.	The species occurs mostly in ridgetop woodland, with only 5% of sites in heath on sandstone. Flowers appear in summer, but seed production appears to be small and consequently the species exhibits a limited capacity to regenerate.	1	1.1km (2015)	2015 (1.1km)	Not present
<i>Persicaria elatior</i> (Tall Knotweed)	BC Act: V EPBC Act: V	Has been recorded in south-eastern NSW (Mt Dromedary), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW it is known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). The species also occurs in Queensland.	Normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	2	3.6km (2010)	2010 (3.6km)	Not present

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
<i>Persoonia bargoensis</i> (Bargo Geebung)	BC Act: E1 EPBC Act: V	Restricted to a small area south-west of Sydney on the western edge of the Woronora Plateau and the northern edge of the Southern Highlands. The historical limits are Picton and Douglas Park (northern), Yanderra (southern), Cataract River (eastern) and Thirlmere (western).	Occurs in woodland or dry sclerophyll forest on sandstone and on heavier, well drained, loamy, gravelly soils of the Wianamatta Shale and Hawkesbury Sandstone. It favours interface soil landscapes such as between the Blacktown Soil Landscape and the complex Mittagong Formation soils (Lucas Heights Soil Landscape) with the underlying sandstone (Hawkesbury Soil Landscape and Gynea Soil Landscape).	91	3.2km (2005)	2009 (3.7km)	Not present
<i>Persoonia glaucescens</i> (Mittagong Geebung)	BC Act: E EPBC Act: V	The historical distribution places the northern and eastern limit at Couridjah (Thirlmere Lakes), the southern limit at Fitzroy Falls and the western limit at High Range. However, recent surveys have indicated that the species no longer extends to Fitzroy Falls or Kangaloon and that the present southern limit is near Berrima. The northern limit appears to have contracted a few kilometres south to Buxton.	Grows in woodland to dry sclerophyll forest on clayey and gravelly laterite. The preferred topography is ridge-tops, plateaux and upper slopes. Within its habitat, it is generally rare and the populations are linear and fragmented. Under ideal circumstances, the species can be locally common, though such conditions are very rare. Plants are killed by fire and recruitment is solely from seed.	5	3.1km (2017)	2017 (3.1km)	Not present

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
<i>Persoonia hirsuta</i> (Hairy Geebung)	BC Act: E EPBC Act: E	<i>Persoonia hirsuta</i> has a scattered distribution around Sydney. The species is distributed from Singleton in the north, along the east coast to Bargo in the south and the Blue Mountains to the west. <i>Persoonia hirsuta</i> has a large area of occurrence, but occurs in small populations, increasing the species' fragmentation in the landscape.	The Hairy Geebung is found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. It is usually present as isolated individuals or very small populations. It is probably killed by fire (as other <i>Persoonia</i> species are) but will regenerate from seed.	5	1.1km (2015)	2017 (3.5km)	Not present
<i>Pimelea curviflora</i> var. <i>curviflora</i>	BC Act: V EPBC Act: V	Confined to the coastal area of the Sydney and Illawarra regions. Populations are known between northern Sydney and Maroota in the north-west. New population discovered at Croom Reserve near Albion Park in Shellharbour LGA in August 2011. Formerly recorded around the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly.	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Also recorded in Illawarra Lowland Grassy Woodland habitat at Albion Park on the Illawarra coastal plain.	1	1.1km (2015)	2015 (1.1km)	Low

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
<i>Pomaderris brunnea</i> (Brown Pomaderris)	BC Act: E EPBC Act: V	Brown Pomaderris is found in a very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It also occurs near Walcha on the New England tablelands and in far eastern Gippsland in Victoria.	Brown Pomaderris grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines. The species is expected to live for 10 - 20 years, while the minimum time to produce seed is estimated to be 4 - 6 years. The species has been found in association with <i>Eucalyptus amplifolia</i> , <i>Angophora floribunda</i> , <i>Acacia parramattensis</i> , <i>Bursaria spinosa</i> and <i>Kunzea ambigua</i> .	1	4.3km (2008)	2008 (4.3km)	Not present
<i>Syzygium paniculatum</i> (Magenta Lilly Pilly)	BC Act: E EPBC Act: 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 south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	1	1.1km (2016)	2016 (1.1km)	Not present

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
<i>Tetratheca glandulosa</i>	BC Act: V	Restricted to the following Local Government Areas: Baulkham Hills, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Pittwater, Ryde, Warringah, and Wyong. The eastern limit is at Ingleside (Pittwater LGA) and the western limit is at East Kurrajong (Wollemi NP). The current north-south range is approximately 65km.	Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone, with associated soil landscapes such as Lucas Heights, Gynea, Lambert and Faulconbridge. Soils are generally shallow, consisting of a yellow, clayey/sandy loam. Stony lateritic fragments are also common in the soil profile on many of the ridgetops.	1	1.1km (2015)	2015 (1.1km)	Low
KINGDOM: Animalia; CLASS: Amphibia							
<i>Pseudophryne australis</i> (Red-crowned Toadlet)	BC Act: V	Confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains.	Occurs in open forests, but most often on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. A localised species that appear to be largely restricted to the immediate vicinity of suitable breeding habitat and thus a relatively small localised disturbance may have a significant impact on a local population if it occurs on a favoured breeding or refuge site. Breeds all year round (Thumm and Mahoney 2002) within small ephemeral creeks characterised by a series of shallow pools that feed into larger semi-perennial streams (Thumm and Mahony 1997).	1	4.6km (2010)	2010 (4.6 km)	Not present
KINGDOM: Animalia; CLASS: Aves							

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
<i>Ardea ibis</i>	EPBC Act:	The Cattle Egret is widespread and common according to migration movements and breeding localities surveys. Two major distributions have been located; from north-east Western Australia to the Top End of the Northern Territory and around south-east Australia.	The Cattle Egret breeds in colonies, either mono-specific or with other Egrets/Herons. In Australia the principal breeding sites are the central east coast from about Newcastle to Bundaberg. It also breeds in major inland wetlands in north NSW (notably the Macquarie Marshes).	8	0.8km (2015)	2015 (0.8km)	Low
<i>Artamus cyanopterus cyanopterus</i> Dusky Woodswallow	BC Act: V	Dusky woodswallows are widespread in eastern, southern and south western Australia. The 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 inhabit 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.	8	0.9 km (2012)	2012 (0.9km)	Low

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
<i>Anthochaera phrygia</i> (Regent Honeyeater)	BC Act: E4A EPBC Act: E, M	Once recorded between Adelaide and the central coast of Queensland, its range has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands.	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Woodlands are often ones that support a significantly high abundance and species richness of bird species. These woodlands also have a significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.	3	4.7 km (1996)	1996 (4.7 km)	Not present

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
<i>Botaurus poiciloptilus</i> Australasian Bittern	BC Act: E EPBC Act: E	Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west.	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (<i>Typha</i> spp.) and spikerushes (<i>Eleocharis</i> spp.). Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. Feeding platforms may be constructed over deeper water from reeds trampled by the bird; platforms are often littered with prey remains. Breeding occurs in summer from October to January; nests are built in secluded places in densely-vegetated wetlands on a platform of reeds; there are usually six olive-brown eggs to a clutch.	1	4.2km (2014)	2014 (4.2km)	Not present
<i>Callocephalon fimbriatum</i> (Gang-gang Cockatoo)	BC Act: V	Distributed from southern Victoria through south- and central-eastern NSW. In NSW, the species is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. It occurs regularly in the ACT. It is rare at the extremities of its range, with isolated records known from as far north as Coffs Harbour and as far west as Mudgee.	Favouring old growth attributes for nesting and roosting, during summer, it is usually found in tall mountain forests and woodlands (Higgins 1999). In winter, it may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often in urban areas. May also occur in sub-alpine Snow Gum (<i>Eucalyptus pauciflora</i>) woodland and occasionally in temperate rainforests. Tree hollows are required for breeding (Gibbons and Lindenmayer 1997).	4	3.5km (2004)	2014 (3.6km)	Low

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
<i>Calyptorhynchus lathami</i> (Glossy Black-Cockatoo)	BC Act: V	Uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW.	Open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (<i>Allocasuarina littoralis</i>) and Forest Sheoak (<i>A. torulosa</i>) are important food sources. Hollows stumps or limbs, in either living or dead trees are required for breeding (Higgins 1999).	7	1.9km (2008)	2014 (2.7km)	Not present
<i>Climacteris picumnus victoriae</i> (Brown Treecreeper – eastern subspecies)	BC Act: V	Endemic to eastern Australia. The western boundary of the range of <i>Climacteris picumnus victoriae</i> runs approximately through Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell and along this line the subspecies intergrades with the arid zone subspecies of Brown Treecreeper, which then occupies the remaining parts of the state.	Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range. Mostly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species. Also found in mallee and River Red Gum (<i>Eucalyptus camaldulensis</i>) and forest bordering wetlands with an open understorey of acacias saltbush, lignum, cumbungi and grasses.	10	3.5km (2006)	2015 (4.5km)	Not present

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
<i>Daphoenositta chrysoptera</i> (Varied Sittella)	BC Act: V	Inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland (Higgins and Peter 2002). Builds nest in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	4	0.9km (2012)	2014 (2.9km)	Moderate
<i>Glossopsitta pusilla</i> (Little Lorikeet)	BC Act: V	Distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia.	Forages primarily in the canopy of open Eucalyptus forest and woodland. Riparian habitats are also favoured. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species.	1	4.1km (2010)	2010 (4.1km)	Low
<i>Hieraaetus morphnoides</i> (Little Eagle)	BC Act: V	Throughout Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. Occurs as a single population throughout NSW.	Mostly in lightly timbered open eucalypt forest, woodland or open woodland. Open areas are needed for hunting. Sheoak or <i>Acacia</i> woodlands and riparian woodlands of interior NSW are also used. Have also been recorded foraging in grasslands, crops, treeless dune fields, and recently logged areas. Nests in tall living trees within remnant patches (Marchant & Higgins 1993).	1	2.8km (2013)	2013 (2.8km)	Moderate

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
<i>Lophoictinia isura</i> (Square-tailed Kite)	BC Act: V	Along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems.	A variety of timbered habitats including dry woodlands and open forests. In NSW it is often associated with ridge and gully forests dominated by <i>Eucalyptus longifolia</i> , <i>Corymbia maculata</i> , <i>E. elata</i> , or <i>E. smithii</i> . Preference is for timbered watercourses. In arid regions, observations have been made in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. Breeding is from July to February, with nest sites generally located along or near watercourses (Marchant & Higgins 1993).	1	2.3km (2010)	2010 (2.3km)	Low

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
<i>Melithreptus gularis</i> (Black-chinned Honeyeater – eastern subspecies)	BC Act: V	Extends south from central Queensland, through NSW, Victoria into south eastern South Australia. In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond and Clarence River areas. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions, though it is very rare in the latter.	Frequents the upper strata of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (<i>Eucalyptus sideroxylon</i>), White Box (<i>E. albens</i>), Inland Grey Box (<i>E. microcarpa</i>), Yellow Box (<i>E. melliodora</i>), Blakely's Red Gum (<i>E. blakelyi</i>) and Forest Red Gum (<i>E. tereticornis</i>) (Higgins et al. 2001). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.	1	0.1km (2010)	2010 (0.1km)	Moderate

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
<i>Ninox strenua</i> (Powerful Owl)	BC Act: V	Endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria.	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Requiring large tracts of forest or woodland habitat, it can also occur in fragmented landscapes. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. By day, it roosts in dense vegetation comprising species such as <i>Syncarpia glomulifera</i> , <i>Allocasuarina littoralis</i> , <i>Acacia melanoxylon</i> , <i>Angophora floribunda</i> , <i>Exocarpos cupressiformis</i> and a number of eucalypt species. The species is linked to 50 vegetation classes. Tree hollows are particularly important for the Powerful Owl because a large proportion of the diet is made up of hollow-dependent arboreal marsupials (Gibbons and Lindenmayer 1997).	1	2.3km (2008)	2008 (2.3km)	Low
<i>Petroica boodang</i> (Scarlet Robin)	BC Act: V	South east Queensland to south east South Australia and also in Tasmania and south west Western Australia. In NSW, it occurs from the coast to the inland slopes.	Dry eucalypt forests and woodlands in both mature and regrowth vegetation. The understorey is usually open and grassy with few scattered shrubs. Some adults and young birds disperse to more open habitats after breeding. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Habitat usually contain abundant logs and fallen timber.	3	2.5km (2014)	2014 (2.5km)	Low

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
<i>Stagonopleura guttata</i> Diamond Firetail	BC Act: V	The Diamond Firetail is 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. Not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley.	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season). Usually encountered in flocks of between 5 to 40 birds, occasionally more.	2	4.5km (2006)	2006 (4.5km)	Low
KINGDOM: Animalia; CLASS: Gastropoda							
<i>Meridolum corneovirens</i> (Cumberland Plain Land Snail)	BC Act: E	Lives in small areas on the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains.	Probably restricted to Cumberland Plain, Castlereagh Woodlands and boundaries between River-flat Forest and Cumberland Plain Woodland. Normally found beneath logs, debris and amongst piles of leaf and bark particularly at the base of trees. May also use soil cracks for refuge.	8	1.8km (2009)	2016 (3.7km)	Not present
KINGDOM: Animalia; CLASS: Mammalia							

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
<i>Chalinolobus dwyeri</i> (Large-eared Pied Bat)	BC Act: V EPBC Act: V	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.	Mostly found in dry sclerophyll forests and woodlands, but also in rainforest fringes and subalpine woodlands (Churchill 2008; Hoyer and Schulz 2008). This species is linked to 58 vegetation classes. Roosts in caves, Fairy Martin nests and mines, and beneath rock overhangs. Most likely to hibernate during the cooler months (Churchill 2008). Only one maternity roost is known within a sandstone cave near Coonabarabran (Pennay 2008).	5	2.5km (2007)	2014 (3.9km)	Moderate
<i>Dasyurus maculatus</i> (Spotted-tailed Quoll)	BC Act: V EPBC Act: E	Along the east coast of Australia and the Great Dividing Range	Utilises a range of habitats including sclerophyll forests and woodlands, coastal heathlands and rainforests (Dickman and Read 1992). Occasional sightings made in open country, grazing lands, rocky outcrops and other treeless areas. The species is linked to 74 vegetation classes. Requirements include suitable den sites, including hollow logs, rock crevices and caves, an abundance of food and an area of intact vegetation in which to forage (Edgar and Belcher 1995).	2	0.8km (2006)	2006 (0.8km)	Not present

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
<i>Falsistrellus tasmaniensis</i> (Eastern False Pipistrelle)	BC Act: V	The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania.	Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy. Hibernates in winter. Females are pregnant in late spring to early summer.	1	Detected approx. 1km north by Hayes (2005)	Detected approx. 1km north by Hayes (2005)	Low
<i>Miniopterus australis</i> (Little Bentwing-bat)	BC Act: V	East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW.	Generally found in well-timbered moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. Roosting sites are often shared with the Common Bentwing-bat and, in winter, the two species may form mixed clusters.	1	0.8km (2013)	2014 (3.2km)	Low

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
<i>Miniopterus schreibersii oceanensis</i> (Eastern Bentwing-bat)	BC Act: V	Along the east and north-west coasts of Australia.	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. They occur in a broad range of habitats including rainforest, wet and dry sclerophyll forest, paperbark forest and open grasslands. The species is linked to 74 vegetation classes. Forages for flying insects above the tree canopy and along waterways (Churchill 2008; Hoyer and Hall 2008).	3	1.7km (2013)	2013 (1.7km)	Moderate
<i>Mormopterus norfolkensis</i> (Eastern Freetail-bat)	BC Act: V	The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW.	Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous.	2	3.2km (2014)	2014 (3.2km)	Moderate
<i>Myotis macropus</i> (Southern Myotis)	BC Act: V	The coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers.	Roosts in caves, mines or tunnels, under bridges, in buildings, tree hollows, and dense foliage. Colonies occur close to water bodies where they use their hind claws to catch aquatic insects and small fish (Richards et al. 2008).	4	3.2km (2014)	2014 (3.2km)	Moderate

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
<i>Petaurus australis</i> (Yellow-bellied Glider)	BC Act: V	The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria.	Occurs in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein.	2	0.8km (2015)	2015 (0.8km)	Low
<i>Petrogale penicillata</i> (Brush-tailed Rock-wallaby)	BC Act: E1 EPBC Act: V	Occurs along the Great Dividing Range south to the Shoalhaven. Also in the Warrumbungles and Mt Kaputar.	Habitats vary from rainforest to open woodland. Habitat preferences include presence of numerous ledges, caves and crevices, particularly where these have a northerly aspect (Eldridge and Close 1995).	1	4.5km (2006)	2006 (4.5km)	Not present
<i>Phascolarctos cinereus</i> (Koala)	BC Act: V EPBC Act: V	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. Also known from a few locations on the Southern Tablelands and Southern Sydney.	While diet is almost exclusively eucalypt foliage, their preferences vary regionally (Martin et al. 2008). Primary feed trees include <i>Eucalyptus robusta</i> , <i>E. tereticornis</i> , <i>E. punctata</i> , <i>E. haemastoma</i> and <i>E. signata</i> (DoP 1995). Where habitat quality is high, home ranges are around 1-2 ha and can overlap. In semi-arid country they are usually discrete with ranges around 100 ha (Martin et al. 2008). The species is linked to 60 vegetation classes.	8	1.4km (2017)	2017 (1.4km)	Not present

Scientific Name (Common Name)	Legal Status	Distribution	Habitat and Ecology	Number of records	Closest proximity and date	Most recent and proximity	Likelihood of occurrence
<i>Pteropus poliocephalus</i> (Grey-headed Flying Fox)	BC Act: V EPBC Act: V	Grey-headed Flying-foxes are generally found 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. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young.	1	4.6km (2017)	2017 (4.6km)	Low
<i>Scoteanax rueppellii</i> (Greater Broad-nosed Bat)	BC Act: V	Mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however does not occur at altitudes above 500 m.	Uses 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. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects. Usually roosting in tree hollows, it has also been found in buildings.	2	1.7km (Bionet 2013); Recorded approx. 1km north by Hayes (2005)	Bionet 2013 (1.7km); recorded approx. 1km north by Hayes (2005)	Moderate

Appendix B: Flora and fauna species lists

Flora

Family	Genus	Species	Common name	Native/ Exotic	Type	Riparian area
Acanthaceae	<i>Brunoniella</i>	<i>australis</i>	Blue Trumpet	native	Herb	o
Acanthaceae	<i>Pseuderanthemum</i>	<i>variabile</i>		native	Herb	u
Adiantaceae	<i>Adiantum</i>	<i>aethiopicum</i>	Common Maidenhair	native	Fern	o
Amaranthaceae	<i>Alternanthera</i>	<i>denticulata</i>	Lesser Joyweed	native	Herb	u
Apiaceae	<i>Centella</i>	<i>asiatica</i>	Indian Pennywort	native	Herb	u
Apocynaceae	<i>Araujia</i>	<i>sericifera</i>	Moth Vine	exotic	Vine	u
Asparagaceae	<i>Asparagus</i>	<i>aethiopicus</i>	Asparagus Fern	exotic	Herb	u
Asparagaceae	<i>Asparagus</i>	<i>asparagoides</i>	Bridal Creeper	exotic	Herb	u
Asteraceae	<i>Ageratina</i>	<i>adenophora</i>	Crofton Weed	exotic	Herb	u
Asteraceae	<i>Bidens</i>	<i>pilosa</i>	Cobbler's Pegs	exotic	Shrub	o
Asteraceae	<i>Cirsium</i>	<i>vulgare</i>	Thistle	exotic	Herb	u
Asteraceae	<i>Conyza</i>	sp.	Fleabane	exotic	Herb	u
Asteraceae	<i>Hypochaeris</i>	<i>radicata</i>	Catsear ???	exotic	Herb	u
Asteraceae	<i>Ozothamnus</i>	<i>diosmifolius</i>	White Dogwood	native	Shrub	u
Asteraceae	<i>Senecio</i>	<i>madagascariensis</i>	Fireweed	exotic	Herb	u
Asteraceae	<i>Taraxicum</i>	<i>officinale</i>	Dandelion	exotic	Herb	u
Caprifoliaceae	<i>Lonicera</i>	<i>japonica</i>	Japanese Honeysuckle	exotic	Vine	u
Caryophyllaceae	<i>Cerastium</i>	<i>glomeratum</i>	Mouse-ear Chickweed	exotic	Herb	u
Caryophyllaceae	<i>Stellaria</i>	<i>media</i>	Common Chickweed	exotic	Herb	u

Family	Genus	Species	Common name	Native/ Exotic	Type	Riparian area
Chenopodiaceae	<i>Einadia</i>	<i>hastata</i>	Berry Saltbush	native	Herb	o
Clusiaceae	<i>Hypericum</i>	<i>gramineum</i>	Small St. Johns Wort	native	Herb	u
Clusiaceae	<i>Hypericum</i>	<i>perforatum</i>	St. Johns Wort	exotic	Herb	u
Commelinaceae	<i>Commelina</i>	<i>cyanea</i>	Native Wandering Jew	native	Herb	o
Convolvulaceae	<i>Dichondra</i>	<i>repens</i>	Kidney Weed	native	Herb	o
Cyperaceae	<i>Carex</i>	<i>appressa</i>		native	Sedge	u
Cyperaceae	<i>Carex</i>	<i>inversa</i>		native	Sedge	o
Cyperaceae	<i>Cyperus</i>	<i>gracilis</i>	Slender Flat-sedge	native	Sedge	u
Cyperaceae	<i>Cyperus</i>	<i>eragrostis</i>	Umbrella Sedge	exotic	Sedge	u
Cyperaceae	<i>Gahnia</i>	<i>sieberiana</i>	Sword Sedge	native	Sedge	u
Cyperaceae	<i>Lepidosperma</i>	<i>laterale</i>		native	Sedge	u
Erticaceae	<i>Lissanthe</i>	<i>strigosa</i> subsp. <i>strigosa</i>		native	Shrub	u
Fabaceae - Faboideae	<i>Desmodium</i>	<i>varians</i>	Slender Tick-trefoil	native	Herb	u
Fabaceae - Faboideae	<i>Glycine</i>	<i>clandestina</i>	Glycine	native	Vine	o
Fabaceae - Faboideae	<i>Glycine</i>	<i>tabacina</i>	Glycine	native	Vine	u
Fabaceae - Mimosoideae	<i>Acacia</i>	<i>binervata</i>	Two-veined Hickory	native	Shrub	u
Fabaceae - Mimosoideae	<i>Acacia</i>	<i>decurrens</i>	Black Wattle	native	Shrub	o
Fabaceae - Mimosoideae	<i>Acacia</i>	<i>floribunda</i>		native	Shrub	o
Fabaceae - Mimosoideae	<i>Acacia</i>	<i>implexa</i>	Hickory	native	Shrub	o
Gentianaceae	<i>Centaurium</i>	<i>tenuiflorum</i>		exotic	Herb	u
Geraniaceae	<i>Geranium</i>	<i>solanderi</i> subsp. <i>solanderi</i>	Native Geranium	native	Herb	u
Juncaceae	<i>Juncus</i>	<i>usitatus</i>		native	rush	u
Lamiaceae	<i>Clerodendrum</i>	<i>tomentosum</i>	Hairy Clerodenrum	native	Shrub	u

Family	Genus	Species	Common name	Native/ Exotic	Type	Riparian area
Lamiaceae	<i>Mentha</i>	sp.		native	herb	u
Lobeliaceae	<i>Pratia</i>	<i>purpurascens</i>		native	Herb	o
Lomandraceae	<i>Lomandra</i>	<i>filiformis</i> subsp. <i>filiformis</i>	Wattle Mat-rush	native	Sedge	u
Lomandraceae	<i>Lomandra</i>	<i>longifolia</i>		native	Sedge	u
Luzuriagaceae	<i>Eustrephus</i>	<i>latifolius</i>	Wombat Berry	native	Shrub	u
Malvaceae	<i>Modiola</i>	<i>caroliniana</i>	Red-flowered Mallow	exotic	Herb	u
Malvaceae	<i>Sida</i>	<i>rhombofolia</i>	Paddy's Lucerne	exotic	Shrub	o
Myrsinaceae	<i>Anagallis</i>	<i>arvensis</i>	Scarlet Pimpernel	exotic	Herb	u
Myrtaceae	<i>Angophora</i>	<i>floribunda</i>	Rough-barked Apple	native	Tree	o
Myrtaceae	<i>Corymbia</i>	<i>citriodora</i>	Lemon-scented Gum	native	Tree	u
Myrtaceae	<i>Eucalyptus</i>	<i>punctata</i>	Grey Gum	native	Tree	o
Myrtaceae	<i>Eucalyptus</i>	<i>crebra</i>	Narrow-leaved Ironbark	native	Tree	o
Myrtaceae	<i>Eucalyptus</i>	<i>moluccana</i>	Grey Box	native	Tree	c
Myrtaceae	<i>Eucalyptus</i>	<i>tereticornis</i>	Forest Red Gum	native	Tree	c
Myrtaceae	<i>Kunzea</i>	<i>ambigua</i>	Tick Bush	native	Shrub	o
Myrtaceae	<i>Melaleuca</i>	<i>styphelioides</i>		native	Tree	o
Nephrolepidaceae	<i>Nephrolepis</i>	<i>cordifolia</i>	Fishbone Fern	native	Fern	u
Oleaceae	<i>Ligustrum</i>	<i>lucidum</i>	Large-leaved Privet	exotic	Shrub	o
Oleaceae	<i>Ligustrum</i>	<i>sinense</i>	Small Leaved Privet	exotic	Shrub	o
Oleaceae	<i>Olea</i>	<i>europaea</i> subsp. <i>cuspidata</i>	African Olive	exotic	Shrub	o
Oxalidaceae	<i>Oxalis</i>	<i>perennans</i>		native	Herb	u
Phormiaceae	<i>Stypandra</i>	<i>glauca</i>		native	Shrub	u
Pittosporaceae	<i>Bursaria</i>	<i>spinosa</i> subsp. <i>spinosa</i>	Boxthorn	native	Shrub	o

Family	Genus	Species	Common name	Native/ Exotic	Type	Riparian area
Pittosporaceae	<i>Pittosporum</i>	<i>undulatum</i>		native	Shrub	o
Plantaginaceae	<i>Plantago</i>	<i>lanceolata</i>	Lamb's Tongue	exotic	Herb	u
Plantaginaceae	<i>Plantago</i>	sp.		native	Herb	u
Poaceae	<i>Anisopogon</i>	<i>avenaceus</i>	Oat Speargrass	native	Grass	u
Poaceae	<i>Aristida</i>	<i>vagans</i>	Threeawn Speargrass	native	Grass	u
Poaceae	<i>Axonopus</i>	<i>fissifolius</i>	Narrow-leafed Carpet Grass	exotic	Grass	o
Poaceae	<i>Bromus</i>	<i>catharticus</i>	Rescue Grass	exotic	Grass	u
Poaceae	<i>Cynodon</i>	<i>dactylon</i>	Couch	native	Grass	o
Poaceae	<i>Echinopogon</i>	<i>caespitosus</i> subsp. <i>caespitosus</i>	Bushy Hedgehog Grass	native	grass	u
Poaceae	<i>Ehrharta</i>	<i>erecta</i>	Panic Veldtgrass	exotic	Grass	o
Poaceae	<i>Entolasia</i>	<i>stricta</i>		native	Herb	u
Poaceae	<i>Eragrostis</i>	<i>leptostachya</i>	Paddock Lovegrass	native	Grass	u
Poaceae	<i>Imperata</i>	<i>cylindrica</i> var. <i>major</i>	Blady Grass	native	Grass	o
Poaceae	<i>Microlaena</i>	<i>stipoides</i>	Weeping Grass	native	Grass	c
Poaceae	<i>Oplismenus</i>	<i>aemulus</i>	Basket Grass	native	Grass	o
Poaceae	<i>Paspalum</i>	<i>dilatatum</i>	Paspalum	exotic	Grass	o
Poaceae	<i>Pennisetum</i>	<i>clandestinum</i>	Kikuyu	exotic	Grass	u
Poaceae	<i>Rytidosperma</i>	sp.	Wallaby Grass	native	Grass	u
Poaceae	<i>Setaria</i>	<i>parviflora</i>	Slender Pigeon Grass	exotic	Grass	o
Poaceae	<i>Sporobolus</i>	<i>elongatus</i>	Slender Rat's Tail Grass	native	Grass	u
Poaceae	<i>Themeda</i>	<i>australis</i>	Kangaroo Grass	native	Grass	u
Pteridaceae	<i>Cheilanthes</i>	<i>sieberi</i>	Rock Fern	native	Fern	u
Pteridaceae	<i>Pteridium</i>	<i>esculentum</i>	Bracken Fern	native	Fern	o

Family	Genus	Species	Common name	Native/ Exotic	Type	Riparian area
Raunclaceae	<i>Clematis</i>	<i>aristata</i>	Old Man's Beard	native	Vine	u
Rosaceae	<i>Rubus</i>	<i>fruticosus</i>	Blackberry	exotic	Shrub	u
Scrophulariaceae	<i>Veronica</i>	<i>plebeia</i>	Trailing Speedwell	native	Herb	u
Solanaceae	<i>Lycium</i>	<i>ferocissimum</i>	African Boxthorn	exotic	Shrub	u
Solanaceae	<i>Solanum</i>	<i>nigrum</i>	Blackberry Nightshade	exotic	Shrub	u
Solanaceae	<i>Solanum</i>	<i>linnaeanum</i>	Apple of Sodom	exotic	Shrub	u
Solanaceae	<i>Solanum</i>	<i>prinophyllum</i>	Forest Nightshade	native	Herb	u
Solanaceae	<i>Solanum</i>	<i>pseudocapsicum</i>		exotic	Herb	u
Ulmaceae	<i>Trema</i>	<i>tomentosa</i> var. <i>viridis</i>		native	Shrub	o
Urticaceae	<i>Urtica</i>	<i>dioica</i>	Stinging Nettle	exotic	Herb	u
Verbenaceae	<i>Lantana</i>	<i>camara</i>	Lantana	exotic	Shrub	u
Verbenaceae	<i>Verbena</i>	<i>bonariensis</i>	Purpletop	exotic	Herb	o
Verbenaceae	<i>Verbena</i>	<i>rigida</i>		exotic	Herb	o
Violaceae	<i>Viola</i>	<i>betonicifolia</i>	Arrowhead Violet	native	Herb	u

c = common; o = occasional; u = uncommon; p = present. Flora list adapted from Ecoplanning (2015a)

Fauna

Class	Family	Genus	Species	Common name	Native/ Exotic	Ecoplanning (2015)	Hawkeswood (2013)	Biosis (2011)
Amphibia	Hylidae	<i>Litoria</i>	<i>dentata</i>	Bleating Tree Frog	Native			W
Amphibia	Myobatrachidae	<i>Crinia</i>	<i>signifera</i>	Common Eastern Froglet	Native		x	W
Amphibia	Myobatrachidae	<i>Limnodynastes</i>	<i>peronii</i>	Striped March Frog	Native		x	W
Aves	Anatidae	<i>Anas</i>	<i>castanea</i>	Chestnut Teal	Native			O
Aves	Anatidae	<i>Chenonetta</i>	<i>jubata</i>	Australian Wood Duck	Native	O	x	O
Aves	Ardeidae	<i>Ardea</i>	<i>pacifica</i>	White-necked Heron	Native	O		
Aves	Artamidae	<i>Cracticus</i>	<i>tibicen</i>	Australian Magpie	Native	W	x	O
Aves	Artamidae	<i>Cracticus</i>	<i>torquatus</i>	Grey Butcherbird	Native	W		OW
Aves	Artamidae	<i>Strepera</i>	<i>graculina</i>	Pied Currawong	Native	W		W
Aves	Cacatuidae	<i>Cacatua</i>	<i>galerita</i>	Sulphur-crested Cockatoo	Native	OW		OW
Aves	Cacatuidae	<i>Cacatua</i>	<i>sanguinea</i>	Little Corella	Native		x	OW
Aves	Cacatuidae	<i>Cacatua</i>	<i>tenuirostris</i>	Long-billed Corella	Native			O
Aves	Cacatuidae	<i>Eolophus</i>	<i>roseicapilla</i>	Galah	Native			O
Aves	Campephagidae	<i>Coracina</i>	<i>novaehollandiae</i>	Black-faced Cuckoo-shrike	Native			OW
Aves	Columbidae	<i>Ocyphaps</i>	<i>lophotes</i>	Crested Pigeon	Exotic		x	
Aves	Columbidae	<i>Phaps</i>	<i>chalconotus</i>	Forest Bronzewing Pigeon	Native		x	
Aves	Columbidae	<i>Streptopelia</i>	<i>chinensis</i>	Spotted Turtle Dove	Exotic			O
Aves	Estrildidae	<i>Neochmia</i>	<i>temporalis</i>	Red-browed Finch	Native			OW
Aves	Halcyonidae	<i>Dacelo</i>	<i>novaeguineae</i>	Laughing Kookaburra	Native			W
Aves	Hirundinidae	<i>Hirundo</i>	<i>neoxena</i>	Welcome Swallow	Native	O		OW
Aves	Maluridae	<i>Malurus</i>	<i>cyaneus</i>	Superb Fairywren	Native	W		O
Aves	Meliphagidae	<i>Anthochaera</i>	<i>carunculata</i>	Red Wattlebird	Native			OW
Aves	Meliphagidae	<i>Anthochaera</i>	<i>chrysoptera</i>	Little Wattlebird	Native			W

Class	Family	Genus	Species	Common name	Native/ Exotic	Ecoplanning (2015)	Hawkeswood (2013)	Biosis (2011)
Aves	Meliphagidae	<i>Lichenostomus</i>	<i>chrysops</i>	Yellow-faced Honeyeater	Native			W
Aves	Meliphagidae	<i>Lichenostomus</i>	<i>leucotis</i>	White-eared Honeyeater	Native			W
Aves	Meliphagidae	<i>Manorina</i>	<i>melanocephala</i>	Noisy Miner	Native	OW	x	
Aves	Meliphagidae	<i>Melithreptus</i>	<i>gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	Native			W
Aves	Meliphagidae	<i>Philemon</i>	<i>corniculatus</i>	Noisy Friarbird	Native			W
Aves	Monarchidae	<i>Grallina</i>	<i>cyanoleuca</i>	Magpie-lark	Native	OW		OW
Aves	Oriolidae	<i>Oriolus</i>	<i>sagittatus</i>	Olive-backed Oriole	Native	W		
Aves	Pardalotidae	<i>Pardalotus</i>	<i>punctatus</i>	Spotted Pardalote	Native			W
Aves	Passeridae	<i>Passer</i>	<i>domesticus</i>	House Sparrow	Exotic			OW
Aves	Phasianidae	<i>Gallus</i>	<i>gallus</i>	Chicken	Exotic		x	
Aves	Psittaculidae	<i>Alisterus</i>	<i>scapularis</i>	Australian King Parrot	Native			OW
Aves	Psittaculidae	<i>Platycercus</i>	<i>elegans</i>	Crimson Rosella	Native		x	O
Aves	Psittaculidae	<i>Platycercus</i>	<i>eximius</i>	Eastern Rosella	Native	OW	x	
Aves	Psittaculidae	<i>Psephotus</i>	<i>haematonotus</i>	Red-rumped Parrot	Native			O
Aves	Psittaculidae	<i>Trichoglossus</i>	<i>haematodus</i>	Rainbow Lorikeet	Native			W
Aves	Ptilonorhynchidae	<i>Ptilonorhynchus</i>	<i>violaceus</i>	Satin Bowerbird	Native		x	I
Aves	Rhipiduridae	<i>Rhipidura</i>	<i>leucophrys</i>	Willie Wagtail	Native			OW
Aves	Sturnidae	<i>Acridotheres</i>	<i>tristis</i>	Common Myna	Exotic	O	x	
Aves	Sturnidae	<i>Sturnus</i>	<i>vulgaris</i>	Common Starling	Exotic			O
Aves	Turdidae	<i>Turdus</i>	<i>merula</i>	Common Blackbird	Exotic	OW		
Mammalia	Bovidae	<i>Ovis</i>	<i>aries</i>	Sheep	Exotic	OW	x	
Mammalia	Canidae	<i>Canis</i>	<i>familiaris</i>	Domestic Dog	Exotic	O	x	
Mammalia	Canidae	<i>Vulpes</i>	<i>vulpes</i>	European Red Fox	Exotic		x	P

Class	Family	Genus	Species	Common name	Native/ Exotic	Ecoplanning (2015)	Hawkeswood (2013)	Biosis (2011)
Mammalia	Equidae	<i>Equus</i>	<i>ferus</i> subsp. <i>caballus</i>	Horse	Exotic	O	x	
Mammalia	Felidae	<i>Felis</i>	<i>catus</i>	Domestic Cat	Exotic		x	
Mammalia	Leporidae	<i>Oryctolagus</i>	<i>cuniculus</i>	European Rabbit	Exotic		x	
Mammalia	Macropodidae	<i>Macropus</i>	<i>giganteus</i>	Eastern Grey Kangaroo	Native			P
Mammalia	Macropodidae	<i>Wallabia</i>	<i>bicolor</i>	Swamp Wallaby	Native			P
Mammalia	Petauridae	<i>Petaurus</i>	<i>breviceps</i>	Sugar Glider	Native	F/TK (chew marks)		
Mammalia	Phalangeridae	<i>Trichosurus</i>	<i>vulpecula</i>	Brush-tailed Possum	Native	F/TK	x	
Reptilia	Scincidae	<i>Lampropholis</i>	<i>delicata</i>	Delicate Skink	Native		x	
Reptilia	Scincidae	<i>Lampropholis</i>	<i>platurus</i>	Grass Skink	Native			K
Standard Atlas reporting codes: B = burrow; E = nest/roost; F = scratching; K = dead; P = Scat; TK = on trunk.								

Appendix C: Significant Impact Assessments

Commonwealth listings under the EPBC Act

Shale Sandstone Transition Forest of the Sydney Basin Bioregion – critically endangered ecological community

In accordance with the Matters of National Environmental Significance – Significant Impact Guidelines 1.1 (DotE 2013), an action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- *reduce the extent of an ecological community*

There is currently 1.23 ha of vegetation within the study area which is consistent with SSTF as listed under the EPBC Act. The local occurrence of Shale Sandstone Transition Forest CEEC is considered for a 5 km radius around the study area, as there is a relatively contiguous canopy of this vegetation type or other native vegetation types through riparian corridors and ridgetops, allowing for the exchange of genetic material. Within this area, NPWS (2002) have mapped approximately 4464 ha of native vegetation, with approximately 1092 ha of this mapped as Shale Sandstone Transition Forest (NPWS 2002). NPWS (2002) uses the condition codes A, B and C to delineate vegetation of higher conservation quality (i.e. more intact canopy) within its mapping, and Tx for more degraded areas such urban/rural areas with <10% project foliage cover.

If the higher condition ABC class vegetation is used as a surrogate for the condition thresholds outlined by TSSC (2014), approximately 465 ha of Shale Sandstone Transition Forest CEEC of EPBC condition is mapped within 5 km. The proposal will require the clearing of 0.23 ha with a further 0.25 ha to be managed as an APZ, which would equate to a reduction in extent of 0.1 %.

- *fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines*

The vegetation clearing will result in a small increase in the fragmentation of vegetation within the study area. However, the existing connectivity of vegetation within the study area and areas to the east and west along Myrtle Creek would be maintained through the rezoning of a 30 m wide corridor as E2 Environmental Conservation.

- *adversely affect habitat critical to the survival of an ecological community*

The extent of vegetation clearance is not considered to be critical to the survival of the ecological community.

- *modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns*

There will be no modification to the water, nutrients or soil to the extent that the ecological communities survival outside of the subject site would be threatened. As the proposal will

result in the complete removal of the ecological community from 0.23 ha and management of a further 0.25 ha as an APZ, the modification to abiotic factors at the subject from the proposal will not impact on the survival or persistence of this ecological community.

- *cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting*

The proposal will result in the complete removal of the ecological community from 0.23 ha and management of a further 0.25 ha as an APZ. Given the highly modified and disturbed nature of this ecological community onsite, it is deemed unlikely that its removal will significantly change the species composition of the ecological community within the study area as a whole.

- *cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:*
 - assisting invasive species, that are harmful to the listed ecological community, to become established, or
 - causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community

The proposal will result in the complete removal of 0.23 ha of the ecological community, with a further 0.25 ha to be managed as an APZ. As this vegetation only makes up a small proportion (0.1%) of the local occurrence of this ecological community, its removal will not cause a substantial reduction in its quality or integrity. Additionally, retain vegetation with the proposed E2 zoning would be managed in accordance with a VMP which would aim to improve the quality and integrity of this vegetation.

- *interfere with the recovery of an ecological community.*

The proposal will not interfere with the recovery of the ecological community, as it is a relatively small area of modified and previously disturbed vegetation.

In conclusion, the proposal does not represent an action that has a real chance or possibility to have a significant impact on this critically endangered ecological community.

Large-eared Pied Bat (*Chalinolobus dwyeri*)

In accordance with the Matters of National Environmental Significance – Significant Impact Guidelines 1.1 (DotE 2013), an action is likely to have a significant impact on vulnerable species if there is a real chance or possibility that it will:

- *lead to a long-term decrease in the size of an important population of a species*

An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

Given the very small area of degraded foraging habitat within the study area, and the absence of any breeding habitat, it is unlikely that any individuals of this species are dependent upon this habitat. Furthermore, any individuals utilising this habitat would not be located near the limit of the range of this species and would not form an important population.

The proposed works are unlikely to lead to a long-term decrease in the size of an important population of this species.

- *reduce the area of occupancy of an important population*

The study area and subject site are unlikely to impact an important population of the species.

- *fragment an existing important population into two or more populations*

Given the highly mobile nature of this species, the proposed clearing of 0.23 ha of foraging habitat with a further 0.25 ha to be managed as an APZ, would not fragment any populations of this species.

- *adversely affect habitat critical to the survival of a species*

The study area and subject site do not contain any breeding habitat for this species and only contain potential foraging habitat for this species. The habitat is not critical to the survival of the species.

- *disrupt the breeding cycle of an important population*

The proposed works would not impact any breeding habitat for this species.

- *modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The proposed works would impact upon approximately 0.48 ha of foraging habitat in total (including 0.23 ha of clearing and management of 0.25 ha as an APZ). This is unlikely to cause the species to decline.

- *result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The proposed works are unlikely to introduce invasive species that are harmful to the Large-eared Pied Bat, into the study area.

- *introduce disease that may cause the species to decline, or*

The proposed works are unlikely to introduce disease that may cause the species to decline.

- *interfere substantially with the recovery of the species.*

The proposed impacts to 0.48 ha of degraded foraging habitat is unlikely to cause the species to decline.

In conclusion, the proposal does not represent an action that has a real chance or possibility to have a significant impact on this vulnerable species.

State listings under the TSC Act

For the purposes of s5A of EP&A Act and, in particular, in the administration of sections 78A, 79B, 79C, 111 and 112, the following factors and any assessment guidelines must be taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats. The below s5A assessments have been prepared in accordance with the appropriate guidelines (DECC 2007).

Shale Sandstone Transition Forest of the Sydney Basin (SSTF) – Critically Endangered Ecological Community

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

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,

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 local occurrence of an ecological community is defined by DECC (2007) as that which: *occurs within the study area... including any adjacent areas of the ecological community that forms part of a larger contiguous area of that ecological community and the movement of individuals and exchange of genetic material across the boundary of the study area can be clearly demonstrated.*

For the purposes of this report, the local occurrence is considered for a 5 km radius around the study area (though it may extend further than this), as there is a relatively contiguous canopy of Shale Sandstone Transition Forest or other similar native vegetation types (e.g. Shale Plains Woodland), along riparian corridors and ridgetops, allowing for the exchange of genetic material.

The proposed clearing will result in the removal of 0.23 ha of this ecological community, with a further 0.25 ha to be managed as an APZ. Vegetation within the subject site which would be impacted is predominately in a disturbed condition including areas under-scrubbed or consisting of scattered trees.

This vegetation represents approximately 0.04 % of the local occurrence of all Shale Sandstone Transition Forest CEEC (i.e. all condition states), which is approximately 1,092 ha. If considering only areas mapped in moderate to good condition by NPWS (2002) (i.e. A, B or C condition class) then the impact translates to 0.1 % of the local occurrence mapped.

The proposal will not adversely impact on the local occurrence nor substantially modify the composition of this ecological community to an extent that it will be placed at risk of extinction.

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,

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 proposed works will result in the clearing of 0.23 ha of SSTF with a further 0.25 ha to managed as an APZ. Combined, this area of 0.48 ha represents approximately 0.1 % of the local occurrence in moderate-good condition (A, B, C condition).

The proposed works will result in a small increase in fragmentation of a somewhat already fragmented patch of vegetation. However, the connectivity to the east and west along Myrtle Creek would not be impacted. Further, the management of the proposed E2 zoning in accordance with a VMP would aim to improve the quality and integrity of vegetation within this corridor.

Due to the small extent of clearing, the already degraded nature of the vegetation, the importance of the habitat that is proposed to be cleared is low and is unlikely to impact upon the long term survival of this ecological community.

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

There is no critical habitat listed under the TSC Act for Shale Sandstone Transition Forest.

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

The Cumberland Plain Recovery Plan (DECCW 2011) is a multi-entity recovery plan that has been prepared for 20 threatened species, populations and ecological communities that reside there.

The recovery plan has the following objectives:

1. To build a protected area network, comprising public and private lands, focused on the priority conservation lands
2. To deliver best practice management for threatened biodiversity across the Cumberland Plain, with a specific focus on the priority conservation lands and public lands where the primary management objectives are compatible with biodiversity conservation

3. To develop an understanding and enhanced awareness in the community of the Cumberland Plain's threatened biodiversity, the best practice standards for its management, and the recovery program
4. To increase knowledge of the threats to the survival of the Cumberland Plain's threatened biodiversity, and thereby improve capacity to manage these in a strategic and effective manner.

The proposal is not inconsistent with these objectives.

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

There is one key threatening process of relevance to this proposal, 'clearing of native vegetation'. The proposed action will result in the removal of 0.23 ha of SSTF in a highly modified and state and management of a further 0.25 h.

Conclusion of s5A assessment of significance for Shale/Sandstone Transitional Forest

The proposed development will not have a significant effect upon Shale Sandstone Transition Forest, due to:

- the small amount of vegetation clearing proposed.
- the currently highly modified and degraded condition of the extant vegetation at the subject site.
- the proposal not further fragmenting or isolating this ecological community.
- the proposal not being inconsistent with the objectives of the Cumberland Plain Recovery Plan.

Black-chinned Honeyeater – eastern subspecies (Melithreptus gularis gularis)

The Black-chinned Honeyeater eastern subspecies extends south from central Queensland, through NSW, Victoria into south eastern South Australia, though it is very rare in the last state. In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond and Clarence River areas. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions, though it is very rare in the latter.

Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis*). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.

Feeding territories are large making the species locally nomadic. Recent studies have found that the Black-chinned Honeyeater tends to occur in the largest woodland patches in the landscape as birds forage over large home ranges of at least 5 hectares. The species does not persist in remnants less 200 ha (NSW SC 2001).

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

This species was not recorded within the study area during the field survey but is known from the locality, with one recent record from Myrtle Creek (2010, see OEH 2015 and Biosis 2011). It is uncertain whether a viable local population of the species utilises resources of the subject site, but it has not been recorded within 5 km of the study area in the past 20 years and is not considered likely to utilise remnants <200 ha (NSW SC 2001). The small amount of vegetation present onsite would not provide sufficient habitat that a viable local population would be reliant on the resources available. The proposal will not affect the life cycle of this species such that a viable local population is likely to be placed 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

The vegetation at the subject site constitutes a degraded edge of a larger patch (>5 ha), which persists along Myrtle Creek and to the west. The proposal will result in a very small increase in fragmentation around the edges of a patch of woodland but will not fragment or isolate the corridor of vegetation extending along Myrtle Creek.

The importance of the habitat is not considered to be significant to long-term survival of the species given that the species has only been recorded nearby once in the past 20 years.

e. Whether the action proposed is likely to have an adverse effect on critical habitat.

Critical habitat cannot be declared under the TSC Act for vulnerable species.

f. Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A recovery plan has not been prepared and there are no threatened abatement plans of relevance to the Black-chinned Honeyeater.

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.

There is one key threatening processes of relevance to this proposal, 'clearing of native vegetation'. The proposed action will result in the removal of 0.23 ha of SSTF in a highly modified and degraded state and the management of 0.25 ha of SSTF as an APZ.

Conclusion of s5A assessment of significance for Black-chinned Honeyeater

The proposed development will not have a significant effect upon the Black-chinned Honeyeater, due to:

- only a small amount of the vegetation onsite being potential habitat
- the currently highly modified and degraded condition of the extant vegetation at the subject site,
- the low likelihood of a local population being reliant on this small degraded patch of vegetation, given relatively low numbers of records in the past 20 years
- the proposal not further fragmenting or isolating habitat for this mobile species.

Little Eagle – (Hieraaetus morphnoides)

The species is distributed widely around Australia, with the exception of Tasmania and some drier areas of WA, SA and NT. It occupies many habitats including open forest, woodland and scrub communities, as well as open agricultural land (Simpson & Day 2004). Little Eagles are known to nest in canopy trees during spring and early summer, in open woodland or riparian zones, where open areas are available to forage for birds, reptiles and mammals.

The Little Eagle was not recorded during the surveys and only two records are known from the locality, although the most recent record is within 1.5 km of the subject site. There is potential for the species to occur on the site, the species would likely use the subject site as foraging habitat, rather than roosting or breeding habitat.

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

Impacts likely to have an adverse effect on the life cycle of the Little Eagle would include widespread loss of breeding or foraging habitat. Given the amount of foraging habitat available in the local area, the removal 0.23 ha of degraded habitat and management of a further 0.25 ha as an APZ is unlikely to place a viable local population of this species 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 remove 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 native vegetation mapped at the subject site may be used as a foraging resource for this species. The 0.48 ha of native vegetation at the subject site constitutes a degraded edge of a larger patch (>5 ha), which persists along the riparian corridor to the north and to patches to the northwest. The proposal will not result in the fragmentation or isolation of other areas of habitat as the vegetation at the subject site is located at the margin of a larger patch and would not impact the vegetated corridor along Myrtle Creek.

Due to the low number of records in the locality and the high mobility of this species the proposal will not fragment habitat for this species and the subject site is not considered to provide important habitat for this species.

e. Whether the action proposed is likely to have an adverse effect on critical habitat.

No critical habitat has been declared by the Director-General of the NPWS for the Little Eagle.

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 plan has been developed for the Little Eagle.

g. 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.

One key threatening process is relevant to this proposal with respect to the Little Eagle, 'clearing of native vegetation'.

Conclusions of s5A assessment of significance for Little Eagle

The proposal is unlikely to constitute a significant impact on Little Eagle given that:

- the proposed works would constitute a minor disturbance given the amount of foraging habitat within the locality
- similar suitable foraging habitat is present within the locality
- the proposal would not isolate or fragment any currently connecting areas of habitat in terms of use by this highly mobile species.

On the basis of the above considerations, it is unlikely that the proposal will constitute a significant impact on the Little Eagle.

Varied Sittella (Daphoenositta chrysoptera) (moderate)

Varied Sittella is a sedentary bird that inhabits most of the Australian mainland, except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. Inhabiting eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland, it feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. The Varied Sittella's population size in NSW is uncertain but is believed to have undergone a moderate reduction over the past several decades. Its generation length is estimated to be five years.

Threats to this species include:

- The sedentary nature of the Varied Sittella makes cleared land a potential barrier to movement
- The dominance of Noisy Miners in woodland patches, and
- Habitat degradation through small-scale clearing for fence lines and road verges, rural tree decline, loss of paddock trees and connectivity, 'tidying up' on farms, and firewood collection.

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

This species was not recorded within the study area during the field survey but is known from the locality. It is uncertain whether a viable local population of the species utilises resources of the subject site, but the small amount of vegetation present onsite would not provide sufficient habitat that a viable local population would be reliant on the resources available. The proposal will not affect the life of this species such that a viable local population is likely to be placed 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

The vegetation at the subject site constitutes a degraded edge of a larger patch (>5 ha), which persists along Myrtle Creek and to the west. The proposal will result in the fragmentation of a very small area on the margin of this corridor but would not impact the functionality of the corridor along Myrtle Creek with respect to this species.

The importance of the habitat is not considered to be significant to long-term survival of the species given that the species has only been recorded nearby once in the past 20 years, with the majority of records in the locality found in the Thirlmere Lakes National Park

e. Whether the action proposed is likely to have an adverse effect on critical habitat.

Critical habitat cannot be declared under the TSC Act for vulnerable species.

f. Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A recovery plan has not been prepared and there are no threatened abatement plans of relevance to the Varied Sittella.

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.

There is one key threatening processes of relevance to this proposal, 'clearing of native vegetation'. The proposed action will result in the removal of a small area (0.23 ha) of SSTF with a further 0.25 ha to be managed as an APZ.

Conclusion of s5A assessment of significance for Varied Sittella

The proposed development will not have a significant effect upon Varied Sittella, due to:

- the small amount of vegetation clearing proposed,
- the currently highly modified and degraded condition of the extant vegetation at the subject site,
- the low likelihood of a local population being reliant on this small degraded patch of vegetation, given relatively low numbers of records in the past 20 years
- the proposal not further isolating habitat for this species.

Microchiropteran bats (Eastern Bentwing Bat, Eastern Freetail-bat, Large-eared Pied Bat, Southern Myotis and Broad-nosed Bat)

Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) occupies a range of forested environments (including wet and dry sclerophyll forests), along the coastal portion of eastern Australia, and through the Northern Territory and Kimberley area (subject to subdivision of this species). This species forages from just above the tree canopy, to many times the canopy height in forested areas, and will utilise open areas where it is known to forage at lower levels. Moths appear to be the main dietary component. This highly mobile species is capable of large regional movements in relation to seasonal differences in reproductive behaviour and winter hibernation. Though individuals often use numerous roosts (including, mines, culverts,

stormwater channels, buildings, and occasionally tree-hollows), it congregates in large numbers at a small number of nursery caves to breed and hibernate (Churchill 2008).

Eastern Freetail-bat (*Mormopterus norfolkensis*) is listed as a vulnerable species under Schedule 2 of the TSC Act. It is found along the east coast from south Queensland to southern NSW. The species occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. East-coast Freetail-bat roost mainly in tree hollows, usually in hollow spouts of large mature trees but will also roost under exfoliating bark or in man-made structures (Churchill 2008). The species is solitary and probably insectivorous. Threats to the species include the loss of hollow-bearing trees, loss of foraging habitat and the application of pesticides in or adjacent to foraging areas.

The Large-eared Pied Bat (*Chalinolobus dwyeri*) is listed as vulnerable under Schedule 2 of the TSC Act. The species occupies a range of forested environments from dry sclerophyll forests and woodlands to rainforest and wet sclerophyll forest (Churchill 1998). It mainly occurs in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. This species roosts communally during the day near the entrances of caves, crevices in cliffs, mines, tunnels, culverts, and the disused bottle-shaped mud nest of the Fairy Martin (*Hirundo ariel*). They forage predominantly below the canopy level and also low along creekbeds (Hoye & Dwyer 1995). Little is known about the preferred prey of this species, but they are insectivorous (Hoye & Dwyer 1995). It is uncertain whether mating occurs during early winter or in spring, but females have been recorded raising young in maternity roosts from November through to January, utilising roof domes in sandstone caves. They remain loyal to the same cave over many years and are likely to hibernate through the coolest months.

The Southern Myotis (*Myotis macropus*) is listed as vulnerable under Schedule 2 of the TSC Act. This species is considered to be widespread throughout the coastal regions of eastern and northern Australia, ranging from the Kimberley in Western Australia to Victoria and South Australia (Churchill 1998). It is relatively common in tropical areas but uncommon further south (NPWS 1994), and rare in Victoria (Menkhorst & Lumsden 1995). Whilst regarded as having a primarily coastal distribution (rarely found more than 100km inland), it does occur further inland along major rivers (Churchill 1998). This species has been recorded in mangroves, paperbark swamps and in a range of forest and woodland habitats (Churchill 1998). Southern Myotis are cave dwellers but are also known to roost in tree hollows, under bridges, in clumps of vegetation, buildings, mine tunnels and stormwater drains (Menkhorst & Knight 2001; Churchill 1998). Roosts are usually in groups of 10-15, in close proximity to water over which the bats forage. The large feet and hind claws are used to rake the water surface for insects and small fish, and are known to forage in small groups of three or four (Churchill 1998). This species is also capable of foraging aerially (Menkhorst & Knight 2001).

The Greater Broad-nosed Bat (*Scoteanax rueppellii*) occurs along the east-coast of Australia inhabiting moist gullies and river systems from the Atherton Tableland in QLD to southern NSW. The distributional stronghold of the Greater Broad-nosed Bat is regarded as the north-east of NSW (H. Parnaby, in NPWS 1994) particularly in the gullies and river systems draining the Great Dividing Range (Hoye & Richards 1995). It is listed as vulnerable under Schedule 2 of the NSW Threatened Species Conservation Act 1995. The Greater Broad-nosed Bat is found in a variety of habitats from dry woodland to tall, wet forests and does not occur at altitudes above 500m (Hoye & Richards 1995), except in the very north of its range where it has been recorded at 780m (Churchill 1998). This species roosts in tree-hollows, tree

branches and in the roofs of old buildings. Its flight pattern is suited to open eucalypt woodlands and forests particularly because it has limited manoeuvrability and is a noticeably slow flier. It feeds on slow flying prey (such as large moths) but will also feed on ground beetles that are 'hawked' within 20m of the ground along rows of trees which line creeks and small rivers and the edges of patches of woodland in otherwise cleared paddocks (Churchill 1998). The Greater Broad-nosed Bat is also known to eat other small bats, including the threatened Little Bent-wing Bat (*Miniopterus australis*), especially when captured together in harp traps or mist nets.

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

Impacts likely to have an impact of threatened bat species would be impacts to breeding habitat (hollow-bearing trees, caves, crevices, dwelling) or loss of large areas of foraging habitat. The proposed works would only impact a very small area of potential foraging habitat (0.23 ha of SSTF to be cleared with a further 0.25 ha managed as an APZ) and would not impact any hollow-bearing trees or other potential roosting or breeding habitat.

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

The proposed work would result in clearing 0.23 ha of potential habitat with a further 0.25 ha to be managed as an APZ. The vegetation at the subject site constitutes a degraded edge of a larger patch (>5 ha), which persists along Myrtle Creek and to the west. The proposal will result in the fragmentation of a very small area on the margin of this corridor but would not impact the functionality of the corridor along Myrtle Creek with respect to these species.

The importance of the habitat is not considered to be significant to long-term survival of the species given it is a very small area of degraded foraging habitat which does not support any roosting habitat for microbat species.

e. Whether the action proposed is likely to have an adverse effect on critical habitat.

No critical habitat has been declared for these microbat species.

f. Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A national recovery plan has been prepared for the Large-eared Pied Bat. The proposed works are not inconsistent with the objectives of this 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.

There is one key threatening processes of relevance to this proposal, 'clearing of native vegetation'. The proposed action will result in the removal of a small area (0.23 ha) of SSTF with a further 0.25 ha to be managed as an APZ.

Conclusion of s5A assessment of significance for microbat species

The proposed development will not have a significant effect upon Varied Sittella, due to:

- the small amount of vegetation clearing proposed,
- the currently highly modified and degraded condition of the extant vegetation at the subject site,
- the proposal not further isolating habitat for this species.