

20 September 2019

Ethos Urban  
c/o CBRE Project Management  
Lvl 21, 363 George Street  
Sydney NSW 2000  
Attention: Hamish Rolls, Project Manager, CBRE ([Hamish.Rolls@cbre.com.au](mailto:Hamish.Rolls@cbre.com.au))

**Re: BDAR for NMH Stage 2 SSI Application 9775 (Revised) – FINAL**

Dear Hamish

## Background

Health Infrastructure (HI) have received Stage 1 concept approval under the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the New Maitland Hospital (NMH) State Significant Infrastructure (SSI) application. HI have subsequently received the SEARs for the NMH Stage 2 works (detailed design, construction and operation) from the NSW Department of Planning and Environment (DPE). The Stage 2 SEARs notes that biodiversity impacts related to the proposed development are to be assessed in accordance with the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR).

HI have subsequently commissioned Sclerophyll Flora Surveys and Research Pty Ltd (Sclerophyll) to prepare a BDAR to support the Stage 2 SSI application. This letter report thus serves as the Stage 2 NMH BDAR.

## Environmental Setting

The Stage 2 NMH development site boundary comprises Lot 7314 and Part Lot 401 DP 755237 contained within a portion of the former PGH/CSR brickworks site known as the Metford Triangle. The development site is 19.73 hectares in area and consists of a construction site with extensive earthworks associated with the Stage 1 NMH early works, a narrow strip of roadside open forest along Metford Road (south of the main hospital entrance) and adjoining open forest along the site's south-western and southern boundaries.

The development site is situated within the North Coast botanical subdivision (Anderson 1961), the Sydney Basin Bioregion (Thackway and Cresswell 1995), Newcastle Coastal Ramp Mitchell Landscape and Maitland City Council LGA.

The study area is mapped as being underlain with the Beresfield soil landscape group, comprising Permian-aged siltstone, mudstone and sandstone-derived silts, clays and sands. This regional mapping is generally consistent with site observations of clay topsoils and siltstone-mudstone rock outcropping.

The western portion of the development site drains to the west to Two-Mile Creek whilst the central and eastern portion drains to the east to an unnamed tributary of Three Mile Gully, which, in turn, all flow

northward to the Morpeth and Tenambit wetlands on the northern side of the main northern railway line, ultimately discharging into the Hunter River.

Land use surrounding the study area comprises the remaining portion of the former quarry and brickworks site (Metford Triangle) to the east and immediate north; transmission line easement and Metford residential suburb to the south; Metford light industrial area and Fieldsend Oval to the west; main northern railway line and Tenambit and Morpeth wetlands to the distant north.

Site context and development site plans are shown as Figures 1 and 2, respectively of **Attachment A**.

## Description of the Proposal

A summary description of the Stage 2 NMH SSI proposal is provided below:

- Construction and operation of a new 7 storey Acute Services Building, including;
  - Emergency services;
  - Medical, surgical, paediatric and maternity services;
  - Critical care services for adults and babies, including a special care nursery;
  - Operating theatres, delivery suites and assessment rooms;
  - Palliative care and rehabilitation services;
  - Mental health services;
  - Satellite renal dialysis;
  - A new chemotherapy service;
  - Oral health service;
  - A range of ambulatory care and outpatient clinics.
- Internal roadways and car parking for staff, patients and visitors;
- Signage;
- Site landscaping and open space improvements;
- Tree removal; and
- Utility and services connection and amplifications works.

## Streamlined Assessment Module (Small area development)

Appendix 2 of the BAM allows proposals to use the 'streamlined assessment module-small area development' if it meets the following 2 criteria:

- The development site is not mapped on the State-wide biodiversity values map (BV map); and

- Native vegetation clearing associated with the proposal falls below the maximum clearing thresholds prescribed for minimum lot sizes as listed in Table 13 Appendix 2 of the BAM.

Results from a desktop review revealed that the proposed Stage 2 clearing extent (0.76 ha) falls well below the maximum clearing threshold of 5 ha for the 40ha minimum lot size mapped for the 2 development site lots, as ascertained from Maitland Council LEP 2011 lot size maps. The vegetation proposed for removal as part of the Stage 2 SSI is shown as Figure 3 of **Attachment A**.

The Biodiversity Values Map and Threshold Tool (BMAT)

(<https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap>) was also reviewed to confirm that the development site is not mapped on the biodiversity values map.

Based on the results of the desktop review outlined above, the streamlined assessment module-small area development would apply to the Stage 2 NMH proposal.

## BAM Field Survey Methods

Two BAM field plots (0.1 ha in area) were undertaken within the stands of native vegetation remaining in the Stage 2 development site by Sclerophyll botanist Isaac Mamott on the 6th and 14 June 2019 in fine conditions. Plot data recorded during the field survey comprised species composition, foliage cover values as well as structural/functional attributes such as tree stem size classes, litter cover, hollows, length of fallen logs and tree regeneration. Survey effort was in accordance with the minimum plot requirements listed in Table 4 of the BAM.

Sclerophyll has relied on previous ecological investigations undertaken across the development site (and greater Metford triangle site) by General Flora and Fauna in the spring and summer of 2014 (General Flora and Fauna 2014) to satisfy the BAM Threatened species survey requirements for the Stage 2 NMH proposal. The BAM allows the use of previous investigations for current assessments as long as the previous studies were undertaken within 5 years from the current proposal. It is considered that the General Flora and Fauna 2014 investigations fall within the 5 year prescribed timeframe for the current Stage 2 proposal.

The suite of baseline and targeted terrestrial flora and fauna surveys undertaken by General Flora and Fauna (2014) on the Metford triangle site comprised:

- 9 full floristic botanical plots;
- 8 straight line botanical transects;
- Small mammal trapping (4 trap lines with each trap line comprising Elliott A/Bs, cage traps and hair tubes);
- Anabat microbat detection;
- Spotlighting;
- Diurnal bird surveys;
- Call playbacks; and
- Active searching for reptiles.

A number of fauna survey sites employed by General Flora and Fauna (2014) were situated within the Stage 2 development site and project influence area. The reader is referred to this report for a complete description of targeted Threatened survey methodologies employed (a full reproduction of the General Flora and Fauna 2014 report is provided as **Attachment B**).

## BAM Field Survey Results

One (1) Plant Community Type (PCT) was recorded in the development site, this being PCT ID 1592 Lower Hunter Spotted Gum-Red Ironbark-Grey Gum grass/shrub open forest of the lower Hunter. PCT 1592 is considered to be analogous to the Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions EEC, listed under Schedule 2 of the *Biodiversity Conservation Act* 2016 (BC Act). The PCT recorded within the development site generally comprised relatively young regrowth cohorts and was subject to high to very high levels of weed cover likely due to edge effects typically associated with an urban remnant. A PCT map is provided as Figure 3 of **Attachment A**.

It is noted that a narrow ephemeral drainage line was recorded bisecting a small patch of PCT 1592 on Lot 401 within the Stage 2 development site. Portions of the drainage line held standing water and supported a dense narrow band of native aquatic emergents, *Phragmites australis* and *Typha orientalis*. This assemblage of native aquatics along the drainage line would typically be mapped as PCT 1071 Coastal freshwater wetlands. However, the section of drainage line within the Stage 2 project influence area was considered too small an area to be mapped at the scale employed for the BDAR (3 metres wide x 15 metres in length) and was thus incorporated into PCT 1592 with which it adjoins.

No Threatened flora species were recorded on the development site by General Flora and Fauna (2014) nor by Sclerophyll during both the conduct of BBAM/FBA plots associated with the Stage 1 BAR and Stage 2 BAM plots.

A total of 7 Threatened fauna species listed under the BC Act were recorded by General Flora and Fauna (2014) on the greater Metford triangle site, these being:

- Little Lorikeet;
- Squirrel Glider;
- Little Bentwing Bat;
- Large Bentwing Bat;
- Greater Broad Nosed Bat;
- Large footed Myotis (also known as Southern Myotis); and
- Grey headed Flying Fox.

A total of 2 of these 7 species (Little Lorikeet, Squirrel Glider) were recorded by General Flora and Fauna (2014) within Spotted Gum - Ironbark Forest habitat on Lot 7314 within the Stage 2 NMH development site. General Flora and Fauna (2014) noted that the habitats recorded on the greater Metford triangle site may provide potential foraging and denning habitat for the species. A map showing the locations of the Threatened species recorded by General Flora and Fauna (2014) on the development site is provided as Figure 4 of **Attachment A**.



## Data Entered Into the BAM-C

The following data was entered into the BAM Calculator (BAM-C) for the Stage 2 NMH proposal:

- Assessment Type – Part 5 (small area development);
- IBRA Region – Sydney Basin;
- IBRA Sub-Region – Hunter;
- % Native Vegetation within 1500m buffer – 23 (refer Figure 5 of **Attachment A**);
- Vegetation zone 1 – PCT 1592 Medium (full clearing of 0.43 ha);
- Vegetation zone 2 – PCT 1592 Poor (Management Zone 1 partial clearing of 0.21 ha to reflect proposed underscrubbing and canopy retention; Management Zone 2 full clearing of 0.12 ha). Future vegetation integrity scores for Management Zone 1 were manually increased from ‘0’ to match the current vegetation integrity score values for tree composition and structure in order to reflect canopy retention proposed for MZ 1. Plot data for the 2 vegetation zones was entered into the BAM-C and is shown on the completed field data sheets provided as **Attachment C**;
- Confirmed Predicted Threatened Species (Ecosystem credit species) – 26 Threatened fauna species were confirmed in the BAM-C as predicted ecosystem credit species based on the presence of suitable site habitats (dry sclerophyll open forest). Only 1 of the 27 predicted ecosystem credit species was discounted and not confirmed in the BAM-C for the Stage 2 NMH proposal, this being the Koala, as there are no known Koala populations in the lower Hunter in the vicinity of the proposed development site;
- Confirmed Candidate Threatened Species (Species credit species) – A total of 2 Threatened flora species were confirmed in the BAM-C as candidate Threatened flora species credit species for the proposal, these being *Callistemon linearifolius* and *Grevillea parviflora* subsp. *parviflora*. These 2 species are most closely associated with Lower Hunter Spotted Gum Ironbark Forest (LHSGIF) habitats. A total of 5 Threatened fauna species credit species were confirmed as candidate species credit species in the BAM-C based on the presence of dry sclerophyll open forest habitats present on the Stage 2 development site, these being the Bush Stone Curlew, Green and Golden Bell Frog, Squirrel Glider, Common Planigale and Brush tailed Phascogale. A Candidate Threatened Species (Species credits) table has been prepared listing all initial and unfiltered species credit species generated by the BAM-C in the ‘Habitat Suitability’ tab along with species habitat information and justification for their inclusion or exclusion as a ‘Confirmed’ Candidate Threatened species (species credits) for the Stage 2 NMH proposal (refer Table 1, Pg. 6 to 11).
- Habitat Survey – Based on the results of General Flora and Fauna (2014), none of the confirmed candidate Threatened flora species was entered into the BAM-C as being present on the development site as ascertained from targeted surveys. Based on the results of General Flora and Fauna (2014), only 1 of the 5 confirmed candidate Threatened fauna species was entered into the BAM-C as being present on the Stage 2 development site as ascertained from targeted surveys, this being the Squirrel Glider. A species polygon habitat map was prepared for the Squirrel Glider (refer Figure 6 of **Attachment A**), denoting vegetation zones 1 and 2 as suitable habitat for the species within the Stage 2 development site. An area of species impact totalling 0.76 ha was entered into the BAM-C for the Squirrel Glider, reflecting the proposed removal of vegetation zones 1 and 2. A Candidate Threatened Species (Species credits) table has been prepared listing all 7 Threatened species (species credits) that were confirmed as having suitable habitat in the Stage 2 proposal area (ie. generated in the BAM-C ‘Habitat Survey’ tab) along with relevant

survey method and results data drawn from General Flora and Fauna (2014) as well as an assessment of compliance with current survey guidelines (refer Table 2, Pg 11-13).

## BAM-C Candidate Threatened Species tables

**Table 1 Candidate Threatened Species (species credits) Unfiltered list generated in 'Habitat Suitability' tab**

Candidate Species	Habitat Requirement	Habitat Present on Stage 2 NMH Proposal Site	Confirmed as a Candidate species for NMH Stage 2
<i>Grevillea parviflora</i> subsp <i>parviflora</i>	Central Coast/Hunter populations of this species are strongly associated with Coastal Plains Smooth barked Apple Woodland and various Spotted Gum-Ironbark Forest variants.	Yes	Yes
<i>Callistemon linearifolius</i>	Central Coast/Hunter populations of this species are strongly associated with various Spotted Gum-Ironbark Forest variants and Swamp Woodland communities.	Yes	Yes
<i>Rutidosis heterogama</i>	Heathlands on sand in the Cessnock-Kurri Kurri localities, typically on roadsides.	No	No
<i>Persoonia pauciflora</i>	Strongly associated with Spotted Gum-Ironbark Forest on sandstone (Farley Formation) at North Rothbury. Known only from North Rothbury.	Correct vegetation type but wrong soil formation	No
<i>Cryptostylis hunteriana</i>	Port Stephens populations of the species are strongly associated with sandstone, conglomerate and nerong volcanic substrates. None of the Port Stephens populations of this species recorded by the author have been associated with Lower Hunter Spotted Gum-Ironbark habitats.	No	No

Candidate Species	Habitat Requirement	Habitat Present on Stage 2 NMH Proposal Site	Confirmed as a Candidate species for NMH Stage 2
<i>Cynanchum elegans</i>	Dry and Littoral Rainforests	No	No
<i>Prostanthera cineolifera</i>	Woodlands on exposed sandstone ridges on skeletal soils.	No	No
<i>Pomaderris queenslandica</i>	Subtropical Coastal Floodplain Forest, often along major creeklines	No	No
<i>Eucalyptus glaucina</i>	Swamp Woodlands on floodplains	No	No
<i>Eucalyptus parramattensis</i> subsp <i>parramattensis</i>	Swamp Woodlands on floodplains, often on sandy alluviums	No	No
<i>Diuris praecox</i>	Hunter populations of the species are strongly associated with slashed coastal dune forest communities on aeolian sands, often in powerline easements.	No	No
<i>Acacia bynoeana</i>	Prefers heath or dry sclerophyll forest on sands, often in open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple. The author has recorded this species along transmission line easements and tracks/roadsides, rarely in intact interior forested habitats.	No	No
<i>Tetratheca juncea</i>	Central coast populations of the species are strongly associated with sandstones or clays (conglomerates) of the Awaba Soil Landscape unit, typically in Coastal Plain Smooth	No	No

Candidate Species	Habitat Requirement	Habitat Present on Stage 2 NMH Proposal Site	Confirmed as a Candidate species for NMH Stage 2
	barked Apple Woodland on ridges and upper slopes with southerly aspects.		
<b>Regent Honeyeater (Breeding)</b>	In NSW the species is confined to 2 known breeding areas, these being the Capertee Valley and Bundarra-Barraba region. Non breeding flocks occasionally seen in coastal areas foraging in flowering Spotted Gum and Swamp Mahogany Forests. Breeds in Box-Ironbark Woodland and riparian She-Oak forests.	No	No
<b>Bush Stone-curlew</b>	Fallen/standing dead timber including logs	Yes	Yes
<b>Gang-gang Cockatoo (Breeding)</b>	Timbered watercourses is preferred breeding habitat.	No	No
<b>Glossy Black Cockatoo (Breeding)</b>	Nests in trees with very large hollows in eucalypt forest close to forests with abundance of feed trees ( <i>Allocasuarina spp.</i> ).	No	No
<b>Eastern Pygmy-possum</b>	Woodlands and heathlands rich in nectarivorous plants (especially Banksias) for feeding and tree hollows for nesting	No	No
<b>Large-eared Pied Bat</b>	Cliffs and habitat within 2 km of rocky areas containing caves, overhangs and escarpments.	No	No
<b>White-bellied Sea-Eagle (Breeding)</b>	Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts. Foraging habitat comprises large areas of open water including	No	No



Candidate Species	Habitat Requirement	Habitat Present on Stage 2 NMH Proposal Site	Confirmed as a Candidate species for NMH Stage 2
	larger rivers, swamps, lakes, and the sea.		
<b>Little Eagle (Breeding)</b>	Little Eagles nest in mature living trees in open woodland or tree-lined watercourses.	No	No
<b>Pale-headed Snake</b>	Found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest. In NSW the species is now restricted to the far north-east NSW (northern rivers) although historically did extend south to Sydney.	Correct habitat but study area is outside the specie's present known distribution.	No
<b>Swift Parrot (Breeding)</b>	Breeds in Tasmania from September to January.	No	No
<b>Green and Golden Bell Frog</b>	Semi permanent or ephemeral wet areas	Yes, a small ephemeral drainage line was recorded in far north-western corner of study area	Yes
<b>Green thighed Frog</b>	Rainforests and wet sclerophyll forest which pool after rain	No	No
<b>Square-tailed Kite (Breeding)</b>	Square-tailed Kites nest on horizontal branches in mature living trees, especially eucalypts, often near water, and they need extensive areas of forest or woodland surrounding or nearby	No	No
<b>Little Bentwing-bat (Breeding)</b>	Little Bentwing-bats roost in caves, tunnels, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day.	No	No

Candidate Species	Habitat Requirement	Habitat Present on Stage 2 NMH Proposal Site	Confirmed as a Candidate species for NMH Stage 2
	Only five nursery sites /maternity colonies are known in Australia.		
<b>Eastern Bentwing-bat (Breeding)</b>	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	No	No
<b>Southern Myotis</b>	Hollow bearing trees within 200m of major riparian zone; bridges and caves within 200m of riparian zone	No	No
<b>Eastern Cave Bat</b>	Caves or within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops or crevices.	No	No
<b>Barking Owl (Breeding)</b>	Nests in hollows of large old Eucalypts typically River Red Gum, White Box, Red Box.	No	No
<b>Powerful Owl (Breeding)</b>	Nests in large tree hollows in very large eucalypts (dbh 80-240cm) that are at least 150 years old.	No	No
<b>Masked Owl (Breeding)</b>	Masked Owls breed when conditions are favourable and food items are plentiful. The nest is a bare chamber located deep in a tree hollow, which is lined with soil, sand or soft wood mulch.	No	No
<b>Squirrel Glider</b>	Woodland and open forest with reliable winter and early spring flowering Eucalypts.	Yes	Yes
<b>Brush tailed Rock wallaby</b>	Land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or clifflines	No	No

Candidate Species	Habitat Requirement	Habitat Present on Stage 2 NMH Proposal Site	Confirmed as a Candidate species for NMH Stage 2
<b>Brush tailed Phascogale</b>	Hollow bearing trees in open forest and woodland, often with sparse understorey.	Yes	Yes
<b>Common Planigale</b>	Common Planigales inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water.	Yes	Yes
<b>Grey headed Flying Fox (Breeding)</b>	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.	No	No
<b>Koala (Breeding)</b>	Open forest and woodland with high Koala activity typically associated with dominance of preferred feed trees such as Forest Red Gum and Swamp Mahogany	No	No

**Table 2 Candidate Threatened Species (Species credits) – Filtered list of 7 ‘Confirmed’ Candidate Species**

Candidate Species	Survey Method	Compliance with Relevant Guidelines
<i>Grevillea parviflora</i> <b>subsp. <i>parviflora</i></b>	Parallel line transects and random meander transects were undertaken by General (2014) in October, November and December 2014 over 3 days targeting this species (refer December 2014 Addendum letter prepared by General Flora and Fauna in Attachment B for detailed	Substantially consistent with NSW Guide to Surveying Threatened Plants (OEH 2016). No transect locations, widths between parallel line transects nor transect lengths were provided by General (2014). Although only substantially consistent with the survey guidelines, Sclerophyll has had the advantage of completing 10 BBAM plots as part of NMH Stage 1 (winter

Candidate Species	Survey Method	Compliance with Relevant Guidelines
	Threatened flora survey methods).	2017) and an additional 2 BBAM plots for NMH Stage 2 (winter 2019). Sclerophyll did not record any Threatened flora species as part of its surveys for Stages 1 and 2 and thus our results are consistent with those of General (2014).
<i>Callistemon linearifolius</i>	As above.	As above.
<b>Squirrel Glider</b>	Small mammal trapping survey undertaken by General (2014) in September 2014 with one trap line placed partly within the Stage 2 NMH study area (refer Appendix I, Figure 4 and Section 3.7 of Attachment B for detailed fauna trapping methods, results and locations of trap line). Species was recorded in one of the arboreal traps near the Stage 2 NMH study area.	Compliant with Draft DEC 2004 for stratification units up to 50 ha in area (refer Table 5.8 in Section 3.7 of Attachment B)
<b>Brush tailed Phascogale</b>	As above	As above
<b>Common Planigale</b>	As above	As above
<b>Green and Golden Bell Frog</b>	Targeted survey for the GGBF was undertaken by General (2014) in October, November and December 2014 (3 days/nights) targeting man made ponds and drainage lines within the greater Metford triangle site, employing nocturnal call playbacks and spotlighting as well as diurnal habitat searches (refer December 2014 Addendum letter prepared by General Flora and Fauna in Attachment	Compliant with DECC (2009) Amphibian Survey Guidelines

Candidate Species	Survey Method	Compliance with Relevant Guidelines
	B for detailed GGBF survey methods).	
<b>Bush Stone-curlew</b>	Spotlighting, call playbacks and diurnal habitat searches undertaken by General (2014) in September 2014 within and near the Stage 2 NMH study area (refer Appendix J, Figure 4 and Section 3.7 of Attachment B for detailed bird sample plot methods, results and locations of bird survey plot sites).	As per mammals above

## BAM-C Credit Results

A series of biodiversity credit and credit payment reports was generated by the BAM-C for the Stage 2 NMH proposal. A summary of the key report results is provided below:

- Ecosystem Credit requirement – 23 credits = \$68,900.44 payment into the BCF; and
- Species Credit requirement (Squirrel Glider) – 23 credits = \$13,695.41 payment into the BCF.

The total offset payment into the BCF for both Ecosystem and Species Credit requirements for the Stage 2 NMH proposal amounts to **\$82,595.85**.

The biodiversity credit reports generated by the BAM-C for the Stage 2 proposal are provided as **Attachment E**.

A Biodiversity Offset Strategy (BOS) for the Stage 2 NMH proposal would be prepared following project approval to identify the preferred mechanism by which HI will meet its offset obligations.

## Impact Assessment

The Stage 2 NMH proposal will result in the removal of 0.76 hectares of PCT 1592 (LHSGIF) situated within the Stage 2 Project Influence Area. Approximately half of this areal extent of LHSGIF habitat along Metford Road is considered to be highly degraded with a high exotic plant cover recorded.

The Stage 2 project influence area has been minimised to include only those areas required to undertake the development works including the location of road batters and services reticulation. The Stage 2 proposal footprint redesign (relative to the Stage 1 approved concept design) has enabled the retention of 1.9 ha of LHSGIF (PCT 1592) habitat on Lot 7314 that was approved for removal in Stage 1. Hence, the Stage 2 proposal has met the BAM principle of ‘avoid and minimise’ in relation to biodiversity impacts.



The LHSGIF EEC proposed for Stage 2 removal forms part of and is contiguous (albeit tenuously) with a larger LHSGIF remnant that extends to the east following the Ausgrid transmission line easement until its intersection with the main northern railway line (commonly referred to as the 'Metford triangle remnant'). The Metford triangle LHSGIF remnant has an areal extent of approximately 13 hectares and would be subject to further minor fragmentation impacts as a result of Stage 2 clearing proposed, although such negligible clearing would not be expected to significantly impact the wider remnant's overall integrity and viability to the point where it would be at risk of localised extinction.

Given the extent of available forested habitat in the wider locality for the more mobile subject species that have relatively large foraging ranges (eg. bats, woodland birds), the direct loss of 0.76 ha of disturbed LHSGIF dry sclerophyll forest habitat is not expected to result in significant fauna impact. These highly mobile subject species would not be expected to be exclusively reliant on site habitats for their life cycle requirements and would be expected to utilise extensive forested tracts south of the site at Four Mile Creek (south-west of the New England Highway) as well as additional extensive tracts of bushland further south to Mt Sugarloaf Reserve and Awaba State Forest and west to Kurri Kurri. It is thought that the New England Highway and main northern railway line form a local movement barrier for the Squirrel Glider in the immediate locality of the development site and that the species population is isolated both from smaller woodland stands surrounding the Tenambit and Morpeth wetlands to the north and from the larger tracts of forested lands to the south of the New England Highway. The Squirrel Glider was recorded in LHSGIF habitat on Lot 7314 (within the Stage 2 Project Influence Area) and as such is likely reliant on habitats within the greater Metford triangle for its life cycle requirements (i.e. foraging, denning, movement) given the likely isolation of its meta-population in the lower Hunter valley. The relatively minor vegetation clearing works proposed for Stage 2 NMH (along the far western boundary of the Metford triangle remnant) would not be expected to contribute to further habitat isolation nor movement barrier impacts for less mobile subject species such as the Squirrel Glider.

Potential indirect impacts on retained fauna (dry sclerophyll) habitats on Lot 7314 during construction activity include daytime noise and vibration and night time light spill. Noise, vibration and light spill can have an impact on a suite of protected and Threatened fauna such as roosting microbats, owls and denning arboreals such as the Squirrel Glider (recorded on Lot 7314). The subject site lies within an urban area of the lower Hunter valley and it is considered that the assemblage of resident and transient fauna utilising site habitats would be habituated to typical urban daytime ambient noise and vibration levels from Metford Road, the industrial area on the western side of Metford Rd (south of fieldsend oval) and the long-term mining activity and more recent remediation activity that has been undertaken on part of the Stage 2 development site.

The Stage 2 NMH proposal will not impact upon any habitats supporting karst, cliffs or other significant geological features nor would it impact upon habitats containing significant rock outcropping or man-made artificial Threatened fauna habitats. Hence, there are no 'prescribed' impacts expected as a result of the Stage 2 NMH proposal.

An assessment under SEPP 44 - Koala Habitat Protection and Draft SEPP (Environment) is provided as **Attachment F**. The SEPP 44 assessment concluded that the Stage 2 development site is not considered core Koala habitat and that the preparation of a site specific Koala Management Plan is not required.

## Mitigation Measures

The following measures will be utilised to reduce the potential impacts of the proposal on biodiversity through minimising the extent of clearing, maintaining key habitat and also reducing the potential injury to fauna during and after the clearing works. The BMP will also include a map showing specific areas where particular measures are to be implemented.

The following protocol would be undertaken as part of the clearing activities:

1. Clearing boundaries shall be pegged out by a registered surveyor and suitably demarcated (eg metal stake and high vis plastic mesh fencing) prior to vegetation clearing activity.
2. All contractors conducting clearing, earth works or construction activities within Lot 7314 must be informed of the ecological value of the retained forested remnants and particularly the restrictions to the clearing of vegetation outside the 'exclusion fencing'. No storage of materials, vehicle parking or other disturbance would be undertaken outside the exclusion fencing into retained bushland habitats.
3. A site induction must be undertaken so as to clearly inform personnel undertaking clearing operations the relevance of any marked items (e.g. hollow bearing trees requiring ecological supervision, clearing boundaries) and identify their responsibilities. A site induction will need to be signed by all relevant personnel involved with the clearing operations, noting they have understood ecological conduct requirements.
4. Trees would be felled away from the retained forested remnants back into the proposed development footprint.

The removal of any tagged and mapped hollow bearing trees (HBTs) must be undertaken with the presence of a suitably qualified and experienced fauna ecologist and the cavities of any hollow bearing trees will need to be checked for inhabiting fauna upon felling. Any injured fauna should be captured where possible and taken to the local wildlife carer. Once rehabilitation has been achieved (if possible), the individual should be released into retained habitats adjoining the capture site, and if required, into shelter sites appropriate for that species (ie. nest boxes). The relevance of the marked HBTs and requirements for ecological clearing supervision must be communicated to the supervisor responsible for the clearing contractors.

It is recommended that night lighting be installed as far from the retained bushland habitats on Lot 7314 as possible and that such lighting be directed away from such habitats to minimise nocturnal light spill.

A Biodiversity Management Plan (BMP) is to be incorporated into the project Construction Environmental Management Plan (CEMP) to include the mitigation measures outlined above.

Yours faithfully

*Isaac Mamott*

Isaac Mamott

Director, Principal Botanist

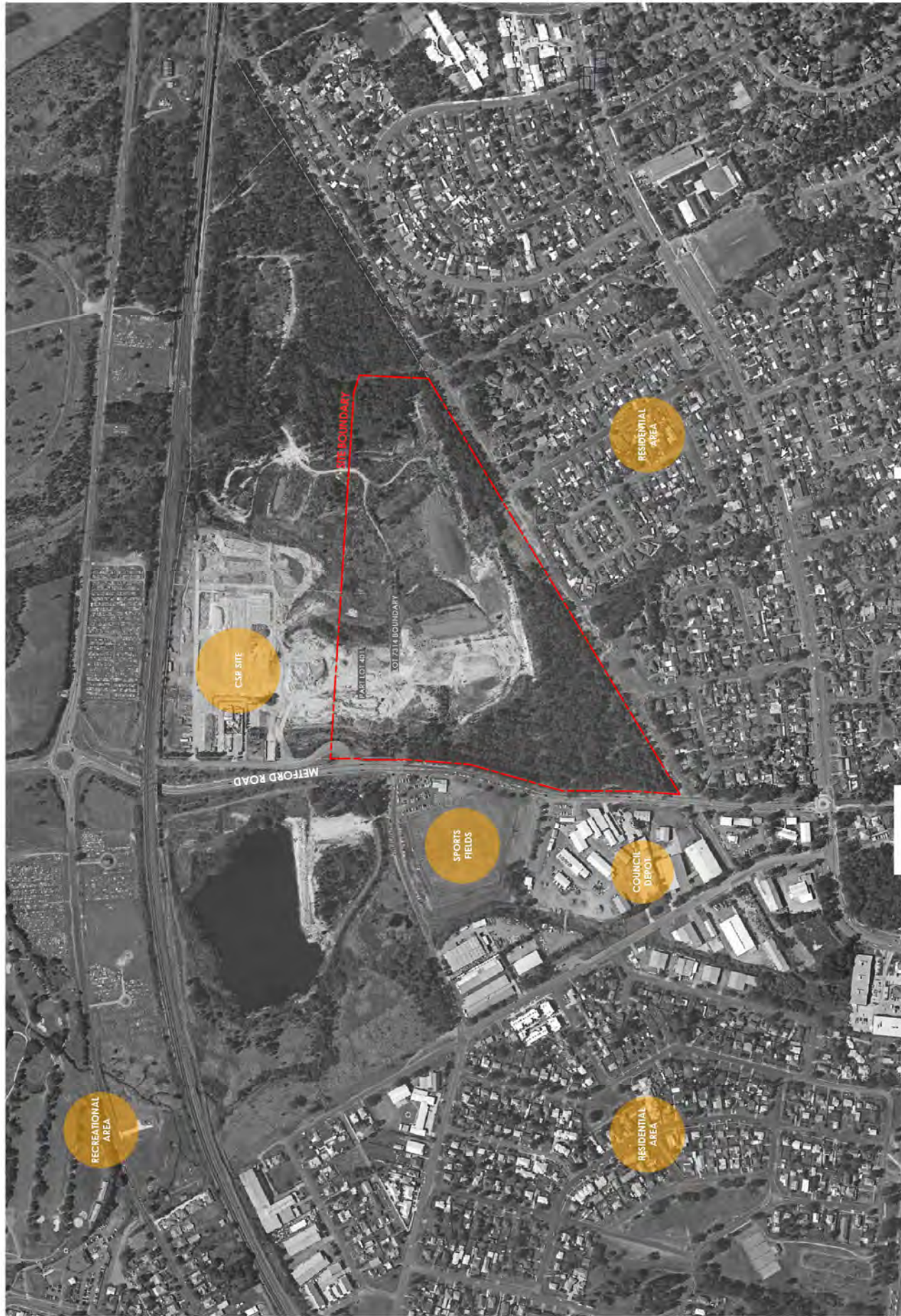
**BAM Assessor (BAAS18008)**

**BBAM Assessor (0081)**

Attachment A	BDAR Figures
Attachment B	General Flora and Fauna (2014)
Attachment C	Completed BAM field data sheets
Attachment D	Forest Fauna Peer Review Report (2018)
Attachment E	BAM-C Biodiversity Credit Reports
Attachment F	SEPP Assessments

**Attachment A**  
**BDAR Figures**











- LEGEND**
- SSR BOUNDARY LINE
  - PROPOSED STAGE 2 PROJECT INFLUENCE LINE
- VEGETATION PROPOSED TO BE CLEARED IN STAGE 2**
- ZONE 1 - PCT ID 1562 (MEDIUM) - 0.45ha
  - ZONE 2 - PCT ID 1569 (POOR) - 0.33ha
- TREES RETAINED - UNDERSTORY CLEARING ONLY
- SAMPLE LOCATION
  - SAMPLE LOCATION



Development Site Boundary



Project Influence Area



Threatened Fauna Locations

- Greater broadbent Bat
- Large Bentwing Bat
- Grey headed Flying Fox
- Large footed (Southern) Myotis
- Litter Bentwing Bat
- Litter Lark
- Squirrel Glider



DATE: 10/10/2018  
DRAWN: [Name]  
CHECKED: [Name]  
DATE: 10/10/2018

MULTIPLEX

MANAGING CONTRACTOR  
PROJECT MANAGEMENT  
ARCHITECTURE  
ENGINEERING & CONSTRUCTION  
HYDRAULICS & FIRE

CBRE

BVW

TTW

MECHANICAL

ELECTRICAL

NEWCASTLE

HEALTH

NSW

NEWCASTLE

HEALTH

INFRASTRUCTURE

NEWCASTLE

HEALTH

INFRASTRUCTURE

NEWCASTLE

HEALTH

INFRASTRUCTURE

NEWCASTLE

HEALTH

INFRASTRUCTURE

NEWCASTLE

HEALTH

INFRASTRUCTURE

NEWCASTLE

HEALTH

INFRASTRUCTURE

NEWCASTLE

HEALTH

INFRASTRUCTURE

NEWCASTLE

HEALTH

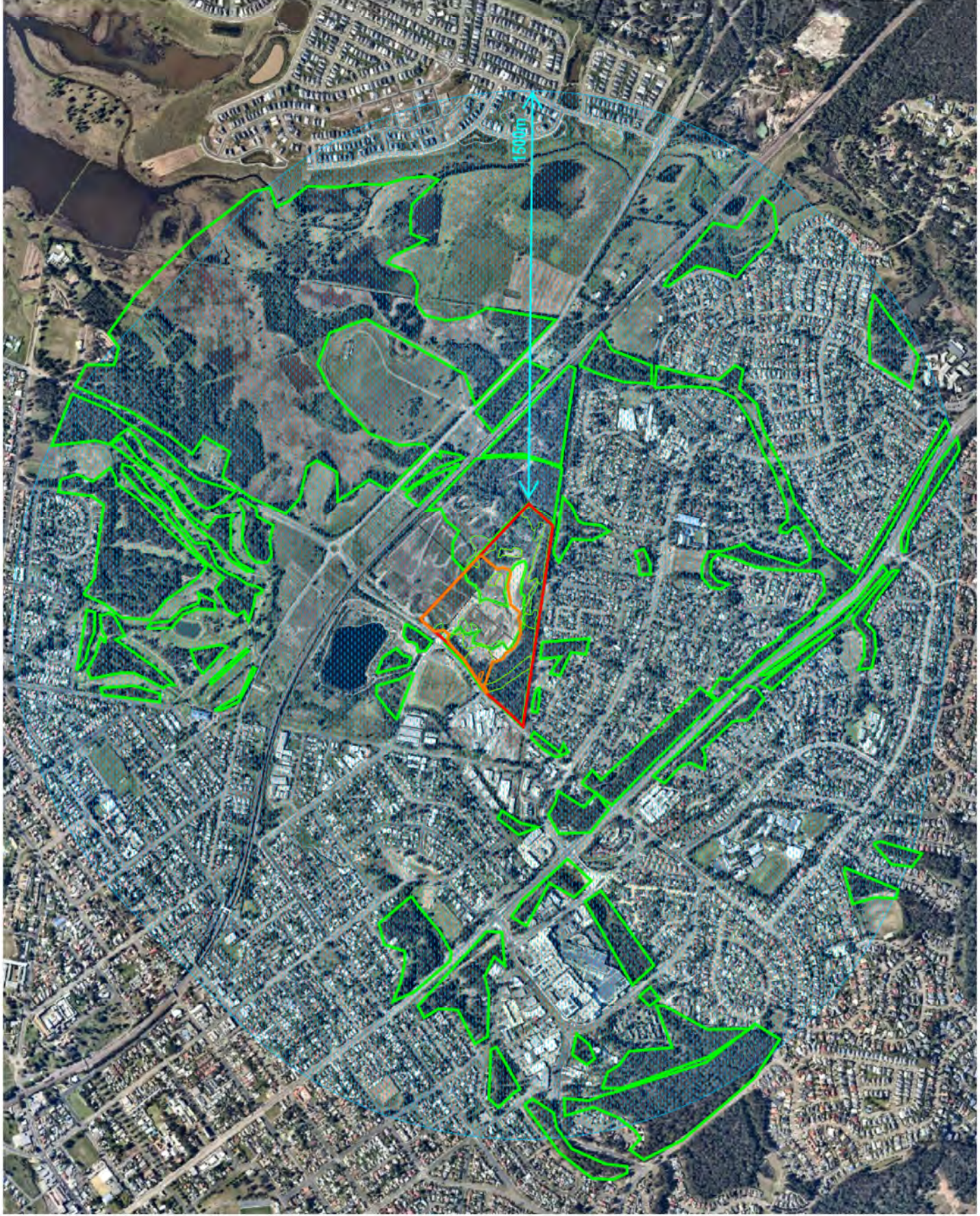
INFRASTRUCTURE



FIGURE 4 -  
THREATENED SPECIES  
LOCATION MAP



FIGURE 5 -  
 NATIVE VEGETATION  
 1500M BUFFER







MANAGING CONTRACTOR  
**MULTIPLEX**  
 PROJECT MANAGEMENT  
**CBRE**  
 ARCHITECTURE  
**BVA**  
 STRUCTURE & CIVIL  
**ITW**  
 HYDRAULIC & PIPE  
 MECHANICAL  
 ELECTRICAL

CLIENT  
**Health NSW**  
 NEW MATLAND HOSPITAL  
 Metford Road, Metford

FIGURE 6 -  
 SQUIRREL GLIDER  
 SPECIES POLYGON MAP



- LEGEND**
- SSI BOUNDARY LINE
  - PROPOSED STAGE 2 PROJECT (REFURBISH) LINE
  - VEGETATION PROPOSED TO BE CLEARED IN STAGE 2
  - SQUIRREL GLIDER HABITAT AREAS TO BE CLEARED IN STAGE 2 - 0.75 ha
  - TREES RETAINED - UNDERSTOREY CLEARING (ONLY)



**Attachment B**  
**General Flora and Fauna (2014)**

# **FLORA AND FAUNA ASSESSMENT**

*“the old brickworks site”*

**Metford Road  
Metford, NSW**

**October 2014**



*General Flora and Fauna*

# **FLORA AND FAUNA ASSESSMENT**

Including an account of factors contained in s5A EP&A Act 1979 (the **7 Part Test**)

## **Client**

Health Infrastructure (NSW Government)

## **For Proposed Development at**

the old brickworks site, including

Lot 1, DP 1197061

Lot 1, DP 1195590

Lot 401, DP 755237

Lot 266, DP 755237

Lot 7314, DP 1162607

Metford Road

Metford, NSW

## **As requested by**

Adam Bishop

KMH Environmental

Level 1, 81 Hunter Street, NSW, 2300

**October 2014**

---

**Reference: GFF 14341**

Prepared by

**General Flora and Fauna (GFF)**

Greg and Judy Little

PO Box 277

The Junction, NSW, 2291

Ph. 02 49581911

Principle Consultant

-

Greg Little

BSc

## **CONTENTS**

1.0	INTRODUCTION	Page	1
1.1	Background		1
1.2	Proposed Development		1
1.3	Scope		1
1.4	Literature Search		2
1.5	Licenses and Approvals		2
1.6	Survey Limitations		2
2.0	SITE DESCRIPTION		3
2.1	General site description		3
3.0	METHODS		4
3.1	Habitat		4
3.2	Corridors		4
3.3	Disturbance		4
3.4	Weeds		4
3.5	Stratification Units		4
3.6	Vegetation		4
3.7	Fauna		5
3.8	Threatened Species & Assessment of Significance (8 Part Test)		8
3.9	Endangered Populations and Ecological Communities and Critical Habitat		8
3.10	Locally & Regionally Significant species		9
3.11	EPBC Act - Matters		9
3.12	Koala Habitat		9
4.0	RESULTS		10
4.1	Habitat		10
4.2	Corridors		11
4.3	Disturbances		11
4.4	Weeds		11
4.5	Stratification Units		11
4.6	Vegetation		12
4.7	Fauna		13
4.8	Threatened Species & Assessment of Significance (7 Part Test)		15
4.9	Endangered Populations, Ecological Communities and Critical Habitat		16
4.10	Significant species and communities		17
4.11	EPBC Act - Matters		18
4.12	Koala Habitat		18
5.0	DISCUSSION		19
5.1	Mitigating measures		22
6.0	CONCLUSION		23
6.1	Recommendations		23

## 7.0 REFERENCES

## 8.0 FIGURES

Figure - 1	Location of study site
Figure - 2	Aerial photo of study site
Figure - 3	General layout, habitat trees and threatened species
Figure - 4	Fauna trap and survey locations
Figure - 5	Vegetation transects and plots
Figure - 6	Areas of clearing, conserving and corridors

## 9.0 TABLES

Table-1	Owl-call playback results
Table-2	Spotlighting results
Table-3	Reptile search results
Table-4	Frog search results
Table-5	Frog call playback
Table-6	Tracks, scats and signs results
Table-7	Bat call detection results

## 10.0 APPENDICES

Appendix A	Flora Species List
Appendix B	Fauna Species List
Appendix C	Site visit record
Appendix D	Vegetation Transect and Plot data
Appendix E	Regionally Significant species and communities
Appendix F	EPBC Act matters
Appendix G	Threatened species recorded within 10km of study site
Appendix H	Assessment of Significance (7 part test)
Appendix I	Fauna Trapping results
Appendix J	Bird Sample Plot results
Appendix K	Photographs over site
Appendix L	Koala Habitat Assessment
Appendix M	Hollow bearing tree data
Appendix N	Threatened species co-ordinates



# **FLORA AND FAUNA ASSESSMENT**

Over

the old brickworks site, including  
Lot 1, DP 1197061; Lot 1, DP 1195590; Lot 401, DP 755237;  
Lot 266, DP 755237; Lot 7314, DP 1162607  
Metford Road  
Metford, NSW

October 2014

## **1.0 INTRODUCTION**

### **1.1 Background**

This report describes the findings of a vascular flora and vertebrate fauna survey over the above mentioned site (the “site”), on which development is proposed, and assesses the likely impact of the proposed development on threatened species, populations and ecological communities.

The study site is located within the **Maitland City Council** LGA and is zoned

**RU2 Rural Landscape**

### **1.2 Proposed Development**

The proposed development will -

- Clear a portion of native vegetation from the site
- construction of a Regional Hospital Precinct with associated roadways, parking and landscaping etc
- Retain on the site as much of the existing native forest vegetation as possible

### **1.3 Scope**

For the purposes of this assessment, the survey was limited mainly to the site, however, circumstances on adjacent and nearby land is considered. Fauna and flora on the site was surveyed by observation, trapping, spotlighting, vegetation transects and plots etc.

Methods used for the survey are in general accordance with methods detailed in Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC, 2004) and with the LHCCREMS Flora and Fauna Survey Guidelines, Lower Hunter Central Coast Region 2002 (Murray *et al*, 2002).

The potential affect of the proposed development on threatened species, populations or ecological communities was assessed by the Assessment of Significance under s5A of the *EP&A Act 1979* otherwise known as the 7 Part Test, (**Appendix H**).

Recommendations are made to minimize the impact of the proposed development on the local environment generally but particularly threatened species and endangered ecological communities.

#### **1.4 Literature Search**

A literature search generated the following information applicable to the site –

- a list of threatened flora and fauna species from the Bionet wildlife database recorded from within 10km of the study area.
- Flora and Fauna Survey Guidelines from the Lower Hunter and Central Coast Regional Environmental Management Strategy.
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities, Working Draft, (DEC, 2004).
- An EPBC Act Protected Matters Report from the Department of the Environment and Heritage web site.
- Vegetation Survey, Classification and Mapping for the Lower Hunter and Central Coast Region (LHCCREMS, 2003)
- The Maitland Greening, Plan Stage 2, Part B, Maitland City Council (MCC, 2002).
- Documents, reports and books etc may be referred to for information on aspects of the local area and identification, distribution and ecology of flora and fauna encountered in this study (see **7.0 References**).

#### **1.5 Licences and Approvals**

This flora and fauna survey was conducted under:

- NSW NPWS Scientific Licence number **SL 100973**
- Animal Research Authority issued by the Director-General of NSW Agriculture.
- Approval of the Animal Care and Ethics Committee of the Director-General of NSW Agriculture.

#### **1.6 Survey Limitations**

It is unlikely that all the species of terrestrial flora and vertebrate fauna, including threatened species, using or likely to use the site would be found during the field survey for this assessment.

## **2.0 SITE DESCRIPTION**

### **2.1 General site description**

The “site”, found between East Maitland and Thornton (**Fig-1**) in the Maitland City Council LGA, is a triangular shaped area of land of approximately 42 hectares (**Fig-2**). Off the north boundary of the site is the Main Northern Railway, beyond which is East Maitland Cemetery, vacant vegetated land, Raymond Terrace Road and East Maitland Common. Off the south boundary is a powerline easement, beyond which are residential dwellings of the Metford suburb. Off the west boundary is Metford Road, beyond which is Fieldsend Oval and industrial land.

Landform in the north and central portions of this site is highly disturbed having undergone considerable modification by earthworks and extraction for the brickworks that previously operated on the site.

The west portion of the site slopes gently from a broad crest down to a broad shallow drainage depression running northwards across the centre east of the site. The east portion of the site slopes gently down the north.

There is no permanent watercourse through the site. Broad shallow drainage depressions on the site direct surface water northwards to enter wetlands of East Maitland Common, then via Four Mile Creek eventually into the Hunter River, east of Morpeth. Man-made ponds are found on the central drainage depression and as settling ponds in the centre north portion of the site.

Aerial photographs (**Fig-2**) show the site supports remnants of native forest vegetation in the east portion and south-west corner of the site. These remnants of native vegetation have had a history of disturbance including partial clearing, indicated by the lack of large old and hollow bearing trees across the site. Weeds are common across the site. However, in some parts of the site forest vegetation retains much of the original structural and floristic diversity that provides habitat for common and threatened native flora and fauna. Native vegetation in the local region is heavily fragmented by clearing for farmland, roads, residential and industrial purposes. Vegetation remnants on the site are completely isolated from extensive areas of native vegetation to the north and only tenuously connected by broken corridors to areas of native vegetation to the south.

According to soil landscape maps (Matthei, 1995) land across the site is “undulating low hills and rises on Permian sediments”, located mostly on Beresfield (be) “Residual Landscape” and partially on Cockle Creek (cc) “Alluvial Landscape”.

## **3.0 METHODS**

### **3.1 Habitat**

During this survey, attention was given to habitat found throughout the site. A diversity of habitats which include overstorey, understorey and groundcover vegetation, hollow bearing trees, ponds, lakes, streams, creeks, drainage lines, wetlands, mangroves, mud flats, rock outcrops, cliffs, caves, large rocks, rock piles, dense and open vegetation, flowering and fruiting trees, fallen timber, leaf litter and bark litter etc are all important habitat components for a wide range of flora and fauna.

Note was taken of the broad habitat types and any valuable or sensitive habitat found on the site that may be impacted on by the proposed development.

### **3.2 Corridors**

Investigation of the site as a potential corridor was made by site inspection and review of maps and aerial photographs. Comment is made as to whether the site forms an important corridor or is part of a broad corridor of vegetation or part of a fragmented chain of remnant islands or stepping stones of vegetation and whether the proposed development is likely to compromise the corridor.

### **3.3 Disturbances**

Obvious existing disturbances and possible historical disturbances on the site and disturbances indicated in available literature may be mentioned in this report. Disturbances may include any level of disturbance such as complete or partial clearing, stock grazing, tracks, fencing, roads, weeds, rubbish, bushfire etc.

### **3.4 Weeds**

Weed species, whether native or introduced plants or animals, that are found on the site are recorded and the extent of infestation is noted and will be discussed.

### **3.5 Stratification Units**

Site “stratification units” according to DEC guidelines (DEC, 2004) will be determined according to topography, landforms, vegetation types and habitats across the site.

### **3.6 Vegetation**

Aerial photograph (**Fig-2**) interpretation and ground truthing is performed to map the “broad” vegetation communities found on the study site. Broad vegetation types for the site, local area and region are described according to the vegetation survey, classification and mapping of the LHCCREMS (2003).

Standard vegetation transects and vegetation plots are used across the site to gain information on the vegetation communities present. Details of the vegetation transects and plots are found in Appendices and figures of this report. Transects were located to encompass the greatest variety of landform and vegetation on the site. Plots were located near transects and generally to sample each perceived broad vegetation type.

Threatened plant searches were conducted by “parallel line technique” and by “random meander” (Cropper, 1993) through likely habitat on the site.

All terrestrial and wetland plants (generally not algae or bryophytes) found on the study site were identified and recorded (**Appendix A**) at least to genus level. Plants were collected from the site for identification during transect and plot surveys over the site and opportunistically while moving about the site performing other activities.

### **3.7 Fauna**

Fauna survey design and methods suggested in the LHCCREMS (Murray et al, 2002) and DECC (DEC, 2004) guidelines were employed. Trap, survey locations and results are indicated and presented in Figures, Appendices and Tables of this report:

- (a) Elliot “A” small terrestrial mammal traps. 60 traps across Spotted Gum Ironbark Forest (20 east & 20 west), Red Gum Forest (10) and rehabilitation area (10) were set over 4 nights, giving 240 trap nights. These were placed on the ground in appropriate locations on the study site, each about 10 to 20m apart. The traps were baited with a mixture of peanut butter, rolled oats, honey and vanilla essence and were covered in plastic bags if it was likely to rain. Dead leaves, paperbark or grass were placed in each trap as nest material for animals. Traps were checked for captured animals and rebaited if necessary early each morning.
- (b) Elliot B arboreal mammal traps. 22 traps were set across the site, Spotted Gum Ironbark Forest (10 east & 6 west), Red Gum Forest (6) were set over minimum 3 nights, giving 66 trap nights. These were positioned on the site in areas likely to support populations of arboreal mammals such as gliders. Traps were also located where they are less visible to people and therefore less vulnerable to disturbance and theft. They were baited with a mixture of peanut butter, rolled oats, honey and vanilla essence and attached to a platform at a height of just over two meters. Dead leaves, paperbark or grass were placed in each trap as nesting material and traps were covered in plastic bags if rain was likely. A 50% honey and water mixture was sprayed onto the tree trunk around and above each trap. They were checked for captured animals early every morning and re baited if necessary.
- (c) Cage traps (medium, terrestrial) and Elliot B terrestrial traps. 8 cage traps and 5 Elliot B traps were set on the ground over a minimum of 3 nights across the site, Spotted Gum Ironbark Forest (4 east & 3 west), Red Gum Forest (3) and rehabilitation area (3) were set over minimum of 3 nights, giving 39 trap nights. These were baited with a mixture of peanut butter, rolled oats, honey and vanilla essence plus a piece of apple. One cage trap at each location was also baited with chicken meat. Traps were covered with a piece of carpet for sun and rain protection and were checked for captured animals and rebaited if necessary early every morning.
- (d) Hair trap tubes. 24 large (90mm) and 24 small (40mm) hair trap tubes were set in sets of six pairs across the site. These are set on the ground at the base of trees (90mm) and up the trunk of the same tree at about 2m (40mm), at each of four locations on the site.
- (e) Harp traps, to capture insectivorous bats, were each set over two nights at four separate locations across the site.
- (f) String lining for insectivorous bats was not performed at this site as no suitable pond location was available.
- (g) Bat call detection devices (Anabats). 2 units were used on each of three separate nights for a minimum of four (4) hours each per night, depending on the weather. Anabats were used at suitable fixed locations on the site and while hand held and walking about the site.
- (h) Cameras, collecting daylight and infrared night images. Four cameras activated by movement were installed at several locations about the site and left in the field for two to four nights. A chicken meat bait and the rolled oats bait mixture were place at two to three meters from each camera.
- (i) Nocturnal spotlight searches. Performed for more than 3 hours, at least 1 hour on each of three nights, over the study site, using a 50 watt hand held spotlight powered by a portable 12 volt rechargeable battery. A typical spotlighting transect followed tracks and gaps in vegetation throughout the site. Additional spotlighting occurred while otherwise moving about the site performing other activities during the night.
- (j) Owl-call playback. Was performed on two (2) nights at two separate locations near the centre of the site. Calls of the Powerful Owl, Masked Owl, Sooty Owl and Barking Owl were played out

early in the evening. Several minutes of quiet were allowed prior to the calls and again after the calls before searching nearby trees, with a spotlight, for owls that have been attracted by the calls.

- (k) Call playback of Bush Stone-curlew calls was performed at the same time and location of owl call playback.
- (l) Frog-call playback for the threatened frogs was performed on two separate nights over potentially suitable habitat for locally threatened Green and Golden Bell Frogs.
- (m) Listening. From time to time spotlighting or other activities are interrupted by periods of still and quiet listening for animal calls and the sounds of animal movement in vegetation and on the ground.
- (n) Diurnal (daytime) searches for reptiles were performed by using binoculars to search logs and track edges etc, raking leaf and bark litter and searching under logs, bark and rubbish etc. Any species found, including those observed incidentally, were recorded.
- (o) Nocturnal and diurnal searching for frogs was performed by investigating potential habitat at the edge of ponds on the site and by listening for calls. Any species observed or heard incidentally was recorded. Any unfamiliar frog calls would be tape recorded and compared against commercially available recordings.
- (p) Eight (8) bird sample plots, 20 minutes each, were performed across the study site, often while conducting other activities, during periods when bird activity was high, usually in the morning or late afternoon. Incidental bird records were gained by observation and listening, both nocturnally and diurnally, while performing other activities about the study site. Any unfamiliar bird calls would be tape recorded and compared against commercially available recordings.
- (q) Signs of the presence of species by indications such as scats, tracks, scratches, diggings, fallen fruit and flower buds, chewed casuarina cones, burrows, nests, bones, skins etc were noted. Where determined the apparent species was recorded but noted that this may be unconfirmed unless the identification is positive.

The following threatened fauna survey methods are DEC (2004) survey guidelines.

**PLEASE NOTE - the DECC guidelines are for effort per 50 to 100 hectares of Stratification Unit, this site is approximately 42 hectares in area.**

## Frogs

Table 5.3, DEC

Method	Minimum Effort	Survey Period	This survey
Day habitat search	One hour per SU	According to seasonal activity of target sp.	Yes
Night habitat search	30 minutes, two separate occasions, per SU	According to seasonal activity of target sp.	Yes
Nocturnal call playback	One call playback, for each species, on two separate nights	According to seasonal activity of target sp.	Yes
Night watercourse search	Two hours per 200m of water body edge	According to seasonal activity of target sp.	Yes

SU = Stratification Unit

## Reptiles

Table 5.4, DEC

Method	<u>Effort / SU up to 100ha</u>	Survey Period	This survey
Habitat search	30 min search on two separate days targeting specific habitat	November to March, preferred	Yes
Pitfall traps	24 trap nights, 6 traps x 4 consecutive nights	November to March, preferred	No, soil too hard and no threatened reptiles likely at this site



Spotlighting	30 minute search two separate occasions	November to March, preferred	Yes
--------------	---	------------------------------	-----

SU = Stratification Unit

**Birds (diurnal)** Table 5.5, DEC

Method	Minimum Effort	Survey Period	This survey
Area search	All birds recorded in 1ha area over 20 minutes	All year	Yes
Wetland census	1 hour census, dawn or dusk, each wetland	All year	Yes
Water source census	20 minute census, dawn or dusk, each water source	All year	Yes

SU = Stratification Unit

**Birds (nocturnal)** Table 5.7, DEC

Method	Minimum Effort	Survey Period	This survey
Call playback (night)	<ul style="list-style-type: none"> <li>Sites separated by 800 – 1000m</li> <li>5 different night visits per site for Powerful Owl, Barking Owl &amp; Grass Owl</li> <li>6 different night visits per site for Sooty Owl</li> <li>8 different night visits per site for Masked Owl</li> </ul>	All year	<ul style="list-style-type: none"> <li>Powerful Owl</li> <li>Masked Owls</li> <li>Barking Owl</li> <li>Sooty Owl</li> <li>Bush Stone-curlew</li> <li>Two nights</li> </ul>
Day habitat search	<ul style="list-style-type: none"> <li>Search for pellets and hollows</li> <li>Flush Bush Stone-curlew by walking through potential habitat</li> </ul>	All year	Yes
Stag watching	Watch potential roost or breeding hollows for 30 minutes prior to dark and 60 minutes after dark	All year	No
Spotlighting	Search for Plains Wanderer & Bush Stone-curlew by foot or vehicle	All year	Yes

SU = Stratification Unit

**Mammals (non flying)** Table 5.8, DEC

<u>Method</u>	<b>Effort / SU up to 50ha plus additional effort for every 100ha</b>	<b>Animal sampled</b>	<b>This survey</b>
Small Elliot Traps (Ell A)	120 trap nights over 3-4 consecutive nights	Small mammals	Yes
Large Elliot Traps (Ell B)	100 trap nights over 3-4 consecutive nights	Medium to large mammals	As per cage traps
Arboreal Elliot Traps (Ell B)	24 trap nights over 3-4 consecutive nights	Arboreal mammals	Yes
Wire Cage Traps	24 trap nights over 3-4 consecutive nights	Medium to large mammals	Yes
Pitfall Traps & drift fence	24 trap nights over 3-4 consecutive nights	Small mammals	No, soil too hard, cameras used instead
Hair tubes	10 large and 10 small tubes in pairs, over minimum 4 nights	Small & medium mammals	Yes
Arboreal hair tubes	3 tubes in each of 10 habitat trees, up to 100 ha, minimum 4 nights	Arboreal mammals	Yes
Spotlighting on foot	1 hr x 1km / 200ha of SU, 2 nights	Arboreal & terrestrial mammals	Yes
Spotlighting from vehicle	1km of track @ 5km/hr / 200ha of SU, 2 nights	Arboreal & terrestrial mammals	No
Sand Plots	6 soil plots for 4 nights	Medium to large mammals	Cameras used instead
Call playback	2 sites (separate nights) / SU up to 200ha, plus 1 site / 100ha above	Gliders & koalas	No

	200ha		
Stag watching	Watch potential roost or breeding hollows, 30 minutes prior to dark & 60 minutes after dark	Gliders & possums	No
Search for scats and signs	30 minutes search	All mammals	Yes
Track search	1km of track, especially soft substrate	Medium to large mammals	Yes
Collection of predator scats	Opportunistic collection of predator scats for ID	All mammals	Yes scats identified on site

SU = Stratification Unit

**Bats** Table 5.10, DEC

Methods	Effort / 100ha SU, targeting preferred habitat	Survey Period	This survey
Harp Trapping	4 trap nights over 2 nights	October to March, preferred	Yes
Ultrasonic call recording	2 Anabats x 2 nights, recording entire night (or minimum 4 hrs)	October to March, preferred	Yes
Mist netting	For targeted survey: one net set min 2 hrs each of 2 nights	October to March, preferred	No
Trip Line	For targeted survey: min 2 hrs each of two nights	October to March, preferred	No
Spotlighting & transect walk	For targeted survey near likely food sources: min 2 hrs each of 2 nights	All year	Yes
Day habitat walk	Search for bat excreta at or near potential habitats	All year	Yes

SU = Stratification Unit

### **3.8 Threatened species & Assessment of Significance (7 Part Test)**

A list of threatened species from within a 10km radius of the study site (**Appendix G**) was obtained from the Bionet - Atlas of NSW Wildlife data. These species are found in Schedules of the Threatened Species Conservation Act 1995.

Search criteria : Public Report of all Valid Records of Threatened (listed on TSC Act 1995) Entities in selected area [North: -32.64 West: 151.48 East: 151.73 South: -32.89] returned a total of 5,604 records of 70 species. Report generated on 22/09/2014 11:28 AM

The factors contained in s5A of the Environmental Planning and Assessment Act 1979 (the **7 Part Test**) will be taken into account and applied to the threatened species as an Assessment of Significance (**Appendix H**).

Where no habitat is found on the study site or adjacent areas for a particular threatened species that species is indicated as such (**Appendix G**) and not addressed in the seven part test as that species is unlikely to utilise the site or be affected by the proposed development.

Some threatened species not in the Bionet database for the area but likely to be found in the area and likely to use habitat in the study area, may also be considered in this assessment.

### **3.9 Endangered Populations, Ecological Communities & Critical Habitat**

Lists of “endangered populations”, “endangered ecological communities” and “critical habitat” are found in the Threatened Species Conservation Act 1995 as follows:

- |                                       |                     |
|---------------------------------------|---------------------|
| • Endangered Populations -            | Schedule 1 (Part 2) |
| • Endangered Ecological Communities - | Schedule 1 (Part 3) |
| • Critical Habitat -                  | Part 3 of the Act   |

The above lists were reviewed and an assessment made of flora and fauna populations, ecological communities and habitat found on the site or adjacent areas to determine if the proposed development would have an impact on any listed endangered population, endangered ecological community or critical habitat.

### **3.10 Locally and Regionally Significant Species and Communities**

Due to their natural rarity or the historic extent of clearing there are a number of flora and fauna species and vegetation communities that are regionally or locally significant and may require some conservation consideration. Any regionally or locally significant species or communities found on the site or adjacent areas will be recorded and discussed. Regionally significant species and communities are those identified and listed by local government areas or councils.

The LHCCREMS, Flora and Fauna Survey Guidelines (Murray *et al*, 2002), lists regionally and locally significant species and communities for the region. The appropriate lists were reviewed for this report.

### **3.11 EPBC Act 1999 - Matters of National Environmental Significance**

Under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) an action will require approval from the Australian Government Environment Minister if the action has, will have or is likely to have, a significant impact on a matter of National Environmental Significance.

This component of the report will be guided by the Matters of National Environmental Significance – “Significant Impact Guidelines”, 1.1 Environment Protection and Biodiversity Conservation Act 1999.

### **3.12 Koala Habitat**

A Koala habitat assessment for the site is made as according to State Environmental Planning Policy No. 44 (NSW GIS, 2000), the site is over 1 hectare in area and is located within a Local Government Area (LGA) known to support populations of koalas (Schedule 1 of SEPP 44).

## **4.0 RESULTS**

### **4.1 Habitat**

Located on undulating to low hills and rises on coastal plain between the coast and ranges with low fertility soils and relatively humid near coastal location provides the environment for native vegetation found on the site and local region. Across the site is a partial cover of native dry sclerophyll forest vegetation some of which is in relatively good condition.

Native forest vegetation on the site provides forage, refuge and breeding habitat for native fauna. Vegetation itself provides leaves, flowers, nectar, pollen, fruit and seeds etc as forage for a wide range of vertebrate and invertebrate fauna and these are then prey for other fauna. Refuge and breeding habitat on the site includes tree canopies, understorey and thick groundcover vegetation, leaf litter, loose bark, fallen logs and tree hollows.

Twelve live and dead hollow bearing trees were recorded on this site (**Fig-3**), these are found in the south-east forest portion of the site. Information on these hollow bearing trees is found in **Appendix-M**. Trees with obvious hollows are not found elsewhere on the site. Live and dead hollow bearing trees with hollows, cracks and fissures etc are a “valuable” fauna resource on the site. Hollows on the site could potentially be used as refuge, nest, den, roost and breeding habitat by hollow dependent fauna such as owls, owl nightjars, cockatoos, parrots, possums, gliders, lizards, snakes, frogs and insectivorous bats.

Rock outcrop, cliffs and exposed bedrock is found on the site, however, it appears that most of this is from disturbances during previous use of the site. There are no caves associated with the rock outcrop and none found anywhere else on the site.

Two ephemeral drainage lines are found running across the site. A drainage line runs northwards across the centre of the site another runs north-west across the south-west corner of the site (**Fig-3**). The drainage lines are found in the base of broad shallow natural depressions of the gently undulating landscape of which the site is a part. These drainage lines direct intermittent surface water through the depressions. For much of their length the drainage lines are very shallow and do not have defined beds and banks. In some parts the drainage line and associated depression have been disturbed by earthworks or support ponds caused by construction of tracks or the rail line off the north of the site (**Fig-3**). While Four Mile Creek, several hundred meters east of the site, is listed as a “Prescribed Stream” (Gordon, 1977) neither of the drainage lines across the site are listed prescribed streams. The drainage lines are not marked on the 1:25,000 topographic map (Beresfield 9232-3N) covering the site. Furthermore, correspondence with a Water Regulation Officer of the Department of Primary Industries finds that “the site in question does not appear to contain any watercourses, or be located within 40m of any watercourses, and is therefore not considered to be waterfront land”. Therefore, the drainage lines across the site are not identified as streams. However, vegetation over and immediately adjacent to the drainage lines does support riparian vegetation as riparian land is described as including “gullies and dips which sometimes run with surface water” (Lovett & Price, 1999).

For most of the length of the drainage line across the south-west corner of the site (**Fig-3**) the “riparian vegetation” is little different to the forest vegetation through which it flows. The drainage line flowing north across the centre of the site does include two shallow man-made ponds. One is formed by earthworks for a track across the drainage line. If the track is removed the pond will likely dry up and disappear. The second pond is formed at the north

end of the drainage line where earthwork for the rail line appears to have caused a pond. Maybe a drain under the rail line is blocked by debris causing the ponding effect. These shallow ponds support wetland vegetation such as Cumbungi and Reeds. The central pond has an open water surface that at the time of this survey was covered with Azolla.

#### **4.2 Corridors**

Aerial photographs show that native vegetation in the local region is heavily fragmented and that native vegetation on the site is not part of a corridor of vegetation. Broken corridors through urban areas south and west of the site may provide a tenuous connection between native forest vegetation on the site and larger areas of native forest vegetation south of the site.

Much of the existing native forest vegetation remnants on the east and west portions of the site will be retained. A corridor of vegetation will be maintained along the south boundary and parts of the north boundary of the site to connect these remnants (**Fig-6**).

Additional plantings of local native trees, shrubs and groundcovers in existing gaps along the south boundary would enhance the usefulness of the corridor. Roads cutting through the corridor should be as narrow as possible and have trees and shrubs etc retained or planted as close as possible to the edge of the road to minimize the gap in the corridor.

#### **4.3 Disturbances**

The central and north portions of the site have been completely cleared and highly disturbed (**Fig-3**). In most of this area the original soil and the underlying bedrock has been removed. A central portion off the site has been “rehabilitated” by replanting with a mixture of local and non-local native plant species. The rehabilitated area is now heavily weed infested and of little use to native fauna.

Native forest vegetation on the east and west portions of the site is in relatively good condition, however, this vegetation has been disturbed to some level by partial clearing, earth works, tracks, rubbish, fencing, bushfire and weeds, plus the site may have been grazed in the past. Partial clearing is evidenced by the lack of large old hollow bearing trees across the site.

Ponds on the shallow drainage line through the centre-east of the site (**Fig-3**) are apparently a result of disturbances by a vehicular track and the embankment for the rail line off the north boundary.

#### **4.4 Weeds**

Most introduced exotic weeds on the site are herbs and grasses (**Graph-1**). Many weeds were recorded on the road reserve on the west edge of the site. High levels of weeds are associated with disturbed areas such as the rehabilitation area in the centre of the site as can be observed on review of **Graph-2** and **Fig-5**. Transects and plots through less disturbed forest vegetation on the site recorded relatively low levels of weeds (see TB to TE and P2 to P5). Impenetrable thickets of Lantana are found in some parts of the centre of the site. A heavy infestation of both Small-leaved Privet and Lantana are found over parts of the shallow drainage line in the south-west corner of the site.

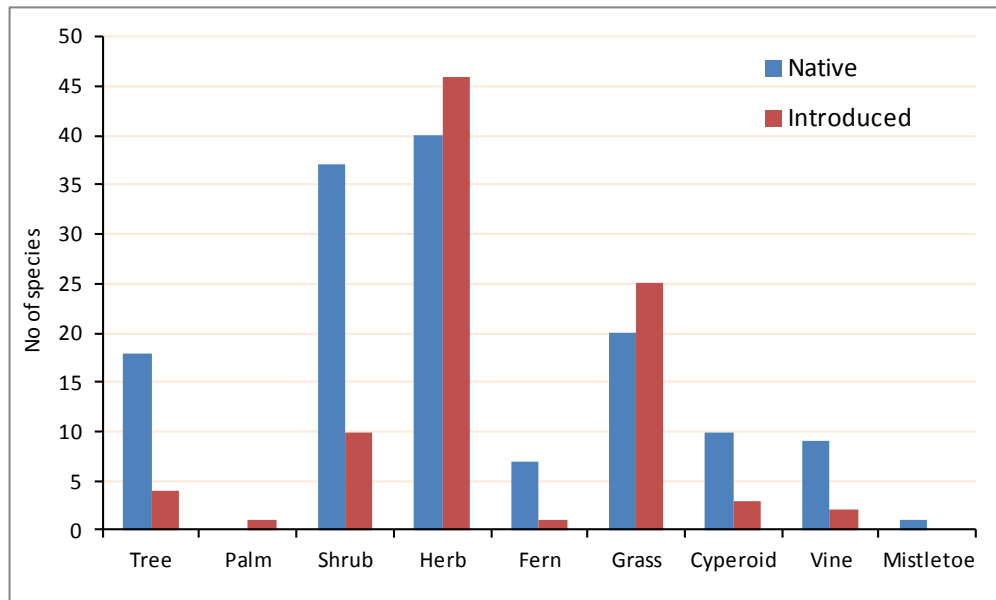
#### **4.5 Stratification Units**

This site is divided into three (3) broad Stratification Units, these being the forest vegetation, the rehabilitation area and the completely cleared (**Fig-3**). The forest includes Spotted Gum

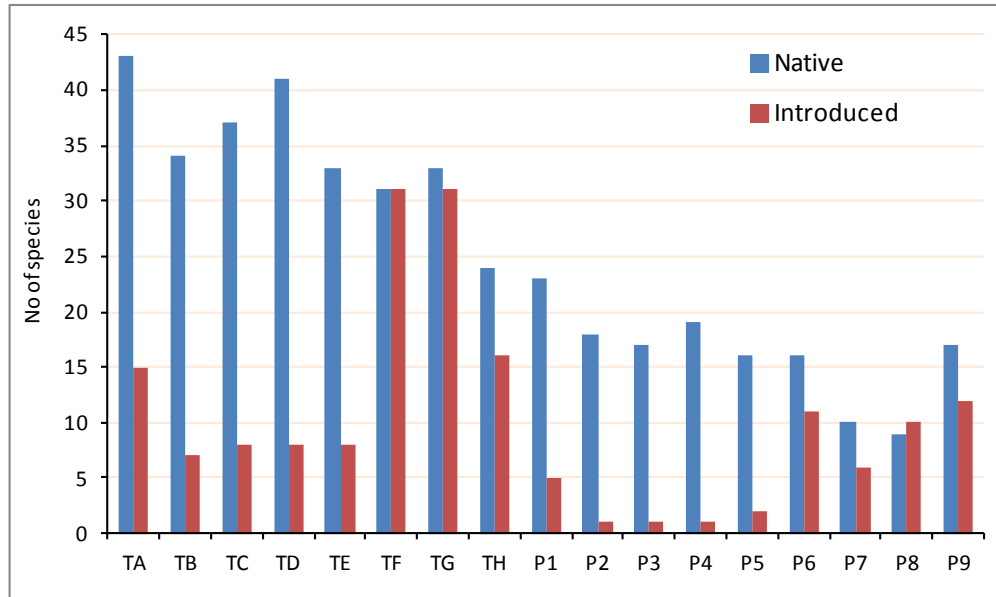


ironbark Forest and Red Gum Forest. The rehabilitation area includes regrowth and areas of replanting with native plants in an attempt at rehabilitation over heavily cleared and disturbed land. The completely cleared area is highly disturbed and supports no natural vegetation.

**Graph – 1** Showing proportion of native and introduced plant forms in vegetation on the site.



**Graph – 2** Showing proportions of native and introduced plants recorded in each transect (T) and plot (P).



#### **4.6 Vegetation**

234 plant species were recorded on the site during this survey, including 142 native and 92 introduced weed species. All plants recorded on the site are listed in **Appendix A**. A simple breakdown of the broad plant forms found across the site is presented in **Graph-1**. Relative numbers of native and introduced weed plants in survey plots and transects across the site are presented in **Graph-2**.

According to LHCCREMS (2003) vegetation mapping for the area, vegetation over the site is described as “Alluvial Tall Moist Forest” (MU5) and “Lower Hunter Spotted Gum Ironbark Forest” (MU17). However, investigation finds that the LHCCREMS (2003) mapping for this site is inaccurate and that the portion of the site mapped as Alluvial Tall Moist Forest should be mapped as “Hunter Lowlands Redgum Forest” (MU19). Lower Hunter Spotted Gum Ironbark Forest and Hunter Lowlands Redgum Forest are identified in **Fig-3** as “Spotted Gum Ironbark Forest” and “Red Gum Forest” respectively.

Forest communities on the site (**Fig-3**) support an overstorey of mostly small to medium sized, young and mature trees, up to about 20m. Spotted Gum (*Corymbia maculata*) and Broad-leaved Ironbark (*Eucalyptus fibrosa*) trees dominate the Spotted Gum Ironbark Forest community. Forest Red Gum (*E. tereticornis*) and Rough-barked Apple (*Angophora floribunda*) trees dominate the Red Gum Forest community. Within the understorey of both forest communities Blackthorn (*Bursaria spinosa*) is dominant in most forest parts except the east corner of the site. Other common shrubs in these communities include *Acacia elongata*, Falcate Wattle, Gorse Bitter Pea, Sydney Golden Wattle and Silver-stemmed Wattle. Groundcovers in most forest areas are dominated by Kangaroo Grass, Three-awned Spear Grass and *Entolasia stricta* plus a range of native herbs, ferns and low shrubs.

The rehabilitation and regrowth areas support a range of local and non-local native trees, shrubs, herbs and grasses over previously cleared land, areas of mixed soils, shallow man-made ponds and spoil piles. Trees such as Narrow-leaved Apple and Narrow-leaved Ironbark which may occur in the local region but not originally on the site have obviously been planted on the west edges of the completely disturbed areas and in the rehabilitation areas of the site. Trees and shrubs such as Forest Red Gum, Swamp She-oak, Ball Honeymyrtle and Snow-in-summer are also planted in this area. Much of the groundcover in the rehabilitation area is dominated by exotic weed grasses such as Rhodes Grass, Guinea Grass and Vasey Grass plus a variety of exotic herbs.

All ponds on the site appear to be either intentionally man-made, such as the settling ponds in the centre of the site, or caused by actions that impede the flow of drainage lines across the site. A number of small shallow ponds in the south-west corner of the site appear to be the result of past quarrying activity. These support a few water plants such as Tall Spike-rush. Two ponds on the centre drainage line support dense covers of Cumbungi plus a variety of over water plants such as native Water Ribbons and Knotweed. Open water areas in these ponds are covered in Azolla, a native water fern. The several settling ponds are either dry or include various densities of Cumbungi, Common Reed, Jointed Twig-rush, Tall Spike-rush, *Schoenoplectus validus*, *Bolboschoenus caldwellii* and Woolly Frogmouth plus the introduced Spiny Rush.

#### **4.7 Fauna**

116 species of native and introduced fauna were recorded on the site during this survey (**Chart-A**) including 106 native and 10 introduced species. All fauna recorded on or near the study site during this survey are listed in **Appendix B**.

##### **4.7.1 Mammals**

24 mammal species were recorded on the site during this survey of which 19 are native and 5 are introduced species (**Appendix B**). Larger native terrestrial mammals recorded on the site included only the Grey Kangaroo. Smaller terrestrial mammals recorded on the site included

Brown Antechinus and Swamp Rat (by hair tube only). Aboresal mammals recorded on the site included only Squirrel Glider and Feather-tailed Glider, however, other arboreal mammals such as common Sugar Gliders, Ring-tailed Possum and Brush-tail Possums could be recorded on the site. Flying mammals recorded on the site included Grey-headed Flying-fox plus thirteen (13) species of insectivorous bats. Grey-headed Flying-foxes were recorded flying over the site and heard in trees south-east of the site. These flying-foxes will feed in blossoms of Spotted Gum on the site when these trees are in flower, however, there was no roosting “camp” of these bats recorded on the site. Most of the insectivorous bats recorded on the site roost and breed in tree hollows and may be using hollows in trees on the site. Insectivorous bats such as Little Bentwing Bat, Large Bentwing Bat and Large-footed Myotis roost naturally in caves but also mines, culverts and under bridges etc. While foraging on the site these species will be roosting and breeding off site in the local region.

Introduced mammals recorded on the site included Black Rat, Cat, Dog, Fox, Brown Hare and Rabbit.

**Chart – A** Showing number of fauna species in each faunal group recorded on the site.

	<b>Natives</b>	<b>Introduced</b>	<b>Total</b>
<b>Mammals</b>	19	6	25
<b>Birds</b>	73	4	77
<b>Reptiles</b>	6	0	6
<b>Frogs</b>	8	0	8
<b>Fish</b>	0	1	1
<b>Total</b>	106	11	<b>117</b>

#### **4.7.2 Birds**

Most of the seventy three (73) native birds recorded on or about the site are typical bushland and semi rural birds of the local region. Four (4) introduced bird species were recorded on the site. More bird species are likely to be recorded during warmer months, especially when migratory species are present.

No owls were recorded on the site during this survey although owls are likely to forage for prey species on the site. There are a small number of larger old hollow bearing trees on the site that may provide suitable breeding or refuge habitat for some owl species. The only nocturnal bird recorded on the site was Tawny Frogmouth.

Of interest were the Yellow-tailed Black Cockatoos, King Parrot and Rose Robin. Yellow-tailed Black Cockatoos were recorded flying over the site. The large Yellow-tailed Black Cockatoos are unlikely to breed in larger hollow bearing trees on the site, however, this Cockatoo may occasionally forage in vegetation on the site. The Rose Robin is a well known altitudinal migrant, and was probably moving through the site on its way to the cooler ranges for summer.

Tree hollows on the site (**Fig-3**) may be important breeding habitat for native hollow nesting birds such as parrots, lorikeets, cockatoos, ducks, treecreepers, pardalotes, kingfishers and owls etc. An unidentified duck, possibly a Wood Duck, was observed leaving one of the tree hollows.

Several common water bird species were observed using ponds on the site including Wood Duck, Pacific Black Duck, Chestnut Teal, Little Pied Cormorant, White-faced Heron, White-necked Heron, Great Egret, White Ibis and Royal Spoonbill.

#### 4.7.3 Reptiles

Six (6) common reptile species were recorded on the site during this survey. These included Robust Skink, Garden Skink, Eastern Water Skink, Blue-tongued Lizard, *Carlia tetradactyla* and Bearded Dragon. Several other common reptiles are likely to be found on the site by day and night searches during warm weather.

#### 4.7.4 Frogs

Eight (8) common frog species were recorded on the site during this survey. These are all common frogs that were heard or observed in several different parts of the site, not just the ponds. At least a few other species of common frogs are likely to be found on the site during warm, wet weather night searches.

Targeted survey for Gold and Green Bell Frog (*Litoria aurea*) was conducted about ponds on the site during this survey. Further targeted survey for this species will be conducted during the rest of this year.

#### 4.7.5 Fish

Mosquito Fish (*Gambusia holbrooki*) were observed in most open pools of water in the drainage lines and the old settling ponds on the site. No native freshwater fish or eels were observed in ponds on the site.

### 4.8 Threatened Species & the Assessment of Significance (7 Part Test)

Seventy (70) threatened flora and fauna species are recorded on the Bionet Wildlife database within 10km of this site. Of these there is potential habitat on the site for about 44 species, including 12 threatened flora and 32 threatened fauna. Seven (7) threatened fauna species, as listed below, were recorded on the site during this survey. No threatened flora species were recorded on the site during this survey.

The following threatened fauna species were recorded on the study site:

• <i>Glossopsitta pusilla</i>	Little Lorikeet	V
• <i>Petaurus norfolcensis</i>	Squirrel Glider	V
• <i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V
• <i>Miniopterus australis</i>	Little Bentwing Bat	V
• <i>Miniopterus schreibersii oceanensis</i>	Large Bentwing Bat	V
• <i>Myotis macropus</i>	Large-footed Myotis	V

The above threatened fauna are addressed in the Assessment of Significance or 7 Part Test (**App-H**) of this report.

In summary, the above threatened species were recorded on the site and the site does support forage habitat for each of these species. Hollow bearing trees on the site (**Fig-3**) may also

provide refuge, breeding, nest and den habitat for the Little Lorikeet and the Squirrel Glider. The Grey-headed Flying-fox and the three insectivorous bat species are likely roosting off site and elsewhere in the local region. It was considered that much of the existing native forest vegetation and most of the hollow bearing trees will be conserved on the site as habitat for the above and other threatened species. Therefore, it was found that the life cycle of these threatened fauna species is unlikely to be disrupted by the proposed development such that a viable local population of the threatened species would be placed at risk of extinction.

Green and Golden Bell Frogs are best surveyed during warm wet nights. Some threatened plant species are easier to detect during certain months of the year when they are in flower. Further survey shall be conducted in suitable habitat across the site for these threatened species, on three separate occasions during the following indicated months. Results of these surveys will be provided as an addendum to this report.

Proposed survey months for threatened plants and Green and Gold Bell Frog.

Scientific Name	Common Name	J	F	M	A	M	J	J	A	S	O	N	D
<i>Cynanchum elegans</i>	White-flowered Wax Plant									s	s	s	
<i>Rutidosia heterogama</i>	Heath Wrinklewort										s	s	
<i>Tetradlea juncea</i>	Black-eyed Susan									s	s	s	
<i>Acacia bynoeana</i>	Bynoe's Wattle									s	s	s	
<i>Maundia triglochoides</i>												s	s
<i>Callistemon linearifolius</i>	Netted Bottle Brush									s	s	s	
<i>Eucalyptus parramattensis</i>	Parramatta Red Gum									s	s	s	
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly											s	s
<i>Persicaria elatior</i>	Tall Knotweed									s	s	s	
<i>Grevillea parviflora</i>	Small-flower Grevillea									s	s	s	
<i>Zannichellia palustris</i>										s	s	s	
<i>Litoria aurea</i>	Green and Golden Bell Frog										s	s	s

s = survey months

#### 4.9 Endangered Populations, Ecological Communities & Critical Habitat

These factors are dealt with fully in **Appendix H** of this report.

##### 4.9.1 Endangered Populations

This site does not support an Endangered Population. No threatened flora or fauna species found within 10km of the study site are part of an “endangered population” cited in Schedule 1, Part 2 Endangered Populations of the TSC Act 1995.

##### 4.9.2 Endangered Ecological Communities

This site does support two “Endangered Ecological Communities” (EEC’s) identified under Part 3 of Schedule 1 of the TSC Act 1995.

Lower Hunter Spotted Gum Ironbark Forest and Hunter Lowlands Redgum Forest, as recognized under LHCCREMS vegetation mapping (2003) are found across the site. Their distribution across the site is indicated in **Fig-3** as “Spotted Gum Ironbark Forest” and “Red Gum Forest” respectively. These vegetation communities are recognized as Endangered Ecological Communities and are addressed in **Appendix-H** of this report.

The two EEC's identified on the site are

- **Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion**
- **Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions**

Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion is found on the south-east and south-west corner portions and along much of the south edge of the site (**Fig-3**).

Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions is found either side of a shallow drainage depression in the centre north portion of the site (**Fig-3**).

The proposed development is unlikely to **have an adverse effect on the extent** of an ecological community such that its local occurrence is likely to be placed at risk of extinction.

The proposed development is unlikely to **substantially and adversely modify the composition** of an ecological community such that its local occurrence is likely to be placed at risk of extinction.

#### **4.9.3 Critical Habitat**

This site does not support Critical Habitat, as listed under Schedule 1A, Part 2 of the TSC Act 1995.

#### **4.10 Regionally and locally significant species and communities**

These are dealt with fully in **Appendix-E** of this report.

##### **4.10.1 Matters of Regional Significance**

Species of regional significance recorded on the site were –

<i>Triglochin microtuberosum</i>	Water Ribbons
<i>Calyptohynchus funereus</i>	Yellow-tailed Black Cockatoo
<i>Macropus giganteus</i>	Eastern Grey Kangaroo
<i>Vespadelus pumillus</i>	Eastern Forest Bat
<i>Pogona barbata</i>	Eastern Bearded Dragon
<i>Carlia tetradactyla</i>	Southern Rainbow Skink
<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog

The proposed development is unlikely to have a significant impact on the above regionally significant species.

A heavily cleared vegetation community, Hunter Lowland Redgum Forest, is found on the site. This vegetation community is addressed elsewhere in this report. Much of this vegetation community will be retained on the site.

Habitat corridors will be maintained between forest remnants on the west and east portions of the site.

##### **4.10.2 Matters of Local Significance**

Squirrel Gliders (*Petaurus norfolkensis*) were recorded during this survey in forest vegetation on the west portion of the site. Much of the existing forest vegetation on the site plus hollow



bearing trees will be retained on the site as forage, refuge and breeding habitat for Squirrel Gliders.

A number of hollow bearing “habitat” trees are found on the site, some of these trees are likely to be used by Squirrel Gliders. Most of the hollow bearing tree retained on the site by the proposed development.

The proposed development is unlikely to have a significant impact on matters of local significance (**Appendix E**).

#### **4.11 EPBC Act 1999 - Matters of National Environmental Significance**

The proposed development is assessed fully in **Appendix-F** of this report according to the Matters of National Environmental Significance – “Significant Impact Guidelines”, 1.1 Environment Protection and Biodiversity Conservation Act 1999.

The proposed development is unlikely to significantly impact Matters of National Environmental Significance under the EPBC Act that may potentially be found on the site.

#### **4.12 Koala Habitat**

Steps are followed in State Environmental Planning Policy No.44 – Koala Habitat Protection (SEPP No44) to determine if the site is “potential” or “core” Koala habitat (**Appendix-L**).

Two Koala feed tree species are found on the site, including Forest Red Gum and Grey Gum. The number of individual trees of these species combined probably exceeds 15% of the number of native trees on the site. Therefore, the site is potential Koala habitat.

The land, the site, is not core Koala habitat, therefore, no further provisions of the policy apply.

## **5.0 DISCUSSION**

Proposed development of this approximately 42ha site at the old brickworks site, Metford Road, Metford, will -

- Modify and prepare most of the existing disturbed land on the site for a “Regional Hospital” and larger Precinct
- Clear a limited area of existing native vegetation on the site for the “Regional Hospital Precinct” and associated Asset Protection Zone
- Retain on the site as much as possible of the existing native vegetation

Much of this site is already highly disturbed and cleared (**Fig-3**) plus parts of the existing native forest vegetation cover on the site is also disturbed by previous use of the site. The proposed development would modify most of the already highly disturbed portions of the site and may clear or partially clear some existing forest vegetation on the site. However, much of the existing forest vegetation on the site can be conserved, as habitat for threatened and common species, and remain connected by corridors of existing or planted native vegetation (**Fig-6**). Some or all of the man-made settling ponds and ponds on the drainage line will likely be retained as part of landscaping for the site.

Two native vegetation communities and a derived community are found across this site. Native forest vegetation is identified, according to LHCCREMS vegetation mapping, as “Lower Hunter Spotted Gum Ironbark Forest” over the east and west corner portions of the site and “Hunter Lowlands Redgum Forest” over the centre north portion of the site (**Fig-3**). The former is identified as Spotted Gum Ironbark Forest in **Fig-3**. The latter vegetation community is labelled as Red Gum Forest in **Fig-3**. The derived vegetation appears to be formed by “rehabilitation” replanting with local native plant species over mixed soils and cleared land plus self introductions from the adjacent native vegetation and a high infestation of exotic weeds.

Vegetation across the site supports approximately 234 plant species, including 142 native trees, shrubs, herbs, ferns, vines and grasses etc plus 92 exotic introduced species of mostly grasses and herbs. While disturbed by partial clearance, earthworks, weeds, fencing, rubbish and tracks etc the native forest vegetation across the site is in relatively good condition. Most trees on the site are young mature trees indicative of past clearing. Dominant trees of the Spotted Gum Ironbark Forest on the east and west corner portions of the site (**Fig-3**) include Spotted Gum and Broad-leaved Ironbark. Dominant trees in the Red Gum Forest of the centre north portion of the site include Forest Red Gum and Rough-barked Apple. The rehabilitation area supports clusters of mainly Forest Red Gum and Swamp She-oak trees over low shrubs and mostly exotic herbs and grasses.

Over one third of plants (39%) recorded on the site are exotic introduced weed species (**Appendix A** and **Graphs 1 & 2**). Most are grass and herbaceous weeds typically associated with disturbed land and are found mostly in the cleared and rehabilitated areas of the site (**Fig-3**). Introduced weeds are in lower numbers through less disturbed areas of forest vegetation and at relatively high levels in more disturbed parts of the site. Weeds such as Lantana and Small-leaved Privet form dense thickets in some areas. Several (9) noxious weed species are found across the site. Five species of noxious weeds were recorded on Transect A, reflecting disturbance in that area.

Several (12) hollow bearing trees with hollows in stems and branches plus cracks, fissures, crevices and loose bark are found in Spotted Gum Ironbark Forest in the east portion of the site (**Fig-3**). Live or dead hollow bearing trees are a valuable habitat resource for hollow dependent fauna, such as threatened Owls, Squirrel Gliders and insectivorous bats. Most of the hollow bearing trees will likely be retained even within Asset Protection Zones. Hollow bearing trees that are removed should be replaced with nest boxes.

Two ephemeral drainage lines are found running across the site. There is no permanent watercourse through the site. A drainage line runs northwards across the centre of the site another runs north-west across the south-west corner of the site (**Fig-3**). The drainage lines are found in the base of broad shallow natural depressions of the gently undulating landscape of which the site is a part. These drainage lines direct intermittent surface water through the depressions. For much of their length the drainage lines are very shallow and do not have defined beds and banks. In some parts the drainage line and associated depression have been disturbed by earthworks or support ponds caused by construction of tracks or the rail line off the north of the site (**Fig-3**). Neither of the drainage lines across the site are listed as Prescribed Streams (Gordon, 1977) and are not marked on topographic maps. According to the DPI the site does not contain a watercourse and is therefore not considered waterfront land. However, vegetation over and immediately adjacent to the drainage lines would be considered as riparian vegetation. Investigation found a distinct riparian vegetation type is not found over the drainage lines. Some wetland type plant species such as sedges, rushes and knotweeds plus herbaceous weeds such as Crofton Weed are growing in the damp soil of the drainage line. However, vegetation growing across the drainage line is the same as that growing in the adjacent forest community except at locations where infested with Lantana and Small-leaved Privet such as in the west corner of the site. The ponds formed on the drainage lines are likely to provide habitat for some common local frogs but are unlikely to be important habitat for threatened fauna.

A number of shallow man-made ponds are found on heavily disturbed land in the centre north of the site. These may have been constructed as settling ponds for sediment trapping and water clarification before discharging surface water from the site into the drainage line that flows northwards and eventually into the Hunter River via Four Mile Creek and East Maitland Common. Survey for Green and Golden Bell Frog (*Litoria aurea*) will confirm the presence or absence of this threatened frog in the ponds, including ponds on the drainage line, to determine if these ponds are an important wetland habitat that must be retained.

Aerial photographs show that native vegetation in the local region is heavily fragmented and that native vegetation on the site is not part of a distinct corridor of vegetation. A corridor of vegetation will be maintained along the south boundary and parts of the north boundary of the site to connect existing native forest vegetation remnants on the east and west portions of the site. Additional plantings of local native trees, shrubs and groundcovers in existing gaps along the south boundary would enhance the usefulness of the corridor. If roads are required that cut through the corridor then the roads should be as narrow as possible and have trees and shrubs etc retained or planted as close as possible to the edge of the road to minimize the gap in the corridor. Two separate narrow roads with an island of treed vegetation between would also be suitable. Wherever possible, corridors should preferably be 20m wide or wider.

One hundred and sixteen (116) fauna species (including 10 introduced species) were recorded on the site during this survey (**Appendix B** and **Chart A**). Most native fauna species recorded on the site were birds (73 species), mainly common birds typically found in native vegetation

and semi rural areas of the region. No owls were recorded on the site. Native terrestrial, arboreal and flying mammals (19 species) recorded on the site included Kangaroos, Gliders, Rat, Flying-fox and several species of insectivorous bats. Larger native mammals such as Grey Kangaroos may eventually disappear from bushland on the site. The only small terrestrial native mammal recorded on the site was the common Brown Antechinus and Swamp Rat. A relatively high number (13) of insectivorous bats were recorded on this site. More species of insect bats may be recorded on the site by further survey especially during warmer months. Arboreal mammals, Antechinus and most of the insectivorous bats use tree hollows as den, refuge and breeding habitat and some including threatened species may be using the relatively small number of hollow bearing trees in the study area. A small number of common reptiles were recorded on the site. These included a few species of small skinks, the Blue-tongued Lizard and Bearded Dragon. Further day and night surveys during warmer months are likely to record a few more common reptile species especially snakes on the site. Several species of common frog were recorded on the site, mainly around the ponds and drainage lines in the centre of the site. A few more common frog species are likely to be recorded on the site during warmer and wet weather. Introduced fauna recorded on the site included five (5) species of terrestrial mammals and four (4) species of birds. These included Black Rats, Dogs, Fox, Hare, Rabbits, Feral Pigeon, Turtle-dove, Starling and Indian Myna. Security staff also report seeing Cats on the site. Most of these introduced animals are in relatively low numbers. Dogs appear to visit the site from nearby houses. Foxes were observed during day and night survey and were recorded by trail cameras set on the site. Foxes and Cats probably account for the low number of small native terrestrial fauna that were recorded and the lack of native fauna such as Bandicoots.

Threatened species data from the NSW Bionet database listed 77 threatened flora and fauna species (**Appendix G**) within about 10km of the site. Of these 30 may potentially use habitat on the site and these are addressed in the Assessment of Significance (**Appendix H**). No threatened flora species were recorded on the site during the initial survey. Several (7) threatened fauna species were recorded on the site. Little Lorikeets are highly mobile and nomadic and may have just been moving through the area. They could potentially use hollows as nest habitat in hollow bearing trees on the site. Grey-headed Flying-foxes were recorded near the site and were heard in trees south-east of the site. However, Grey-headed Flying-foxes are likely to forage in eucalypt trees on the site when those trees are in flower and flowering Spotted Gums are especially favoured. They are known to fly over thirty kilometers out from roost camps to forage areas, and back again, each night. A daytime roost “camp” of Grey-headed Flying-foxes was not found on the site or adjacent areas. Grey-headed Flying-foxes and the four threatened insectivorous bats will likely also visit and forage through other forest remnants in the local region. Insectivorous bats are known to fly several kilometers from roost site to forage areas. Squirrel Gliders are confined to the local forest remnants and are dependent on the structural and floristic diversity of vegetation on the site for forage habitat plus hollows for refuge and breeding. They can only safely move between remnants when able to climb between the canopies or glide briefly between trees. If they have to go to ground to move between remnants they then become vulnerable to predators such as Foxes, Dogs and Cats.

Two Endangered Ecological Communities (EEC’s) identified on the site are “Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion”, mapped as Spotted Gum Ironbark Forest in **Fig-3**, and “Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions”, mapped as Red Gum Forest in **Fig-3**. The proposed development is unlikely to **have an adverse effect on the extent** of an ecological community

or to **substantially and adversely modify the composition** of an ecological community such that its local occurrence is likely to be placed at risk of extinction.

The Assessment of Significance (**Appendix H**) found that provided most of the existing forest (EEC) vegetation and hollow bearing trees on the site are retained, with corridors maintaining connection between the remnants, then threatened fauna species and EEC's, recorded on the site, are unlikely to be significantly affected by the proposed development.

### **5.1 Mitigation measures**

Ecological constraints to the proposed development of this site include

- Endangered Ecological Communities
- threatened species
- habitat for threatened species
- hollow bearing trees
- vegetation corridors

To mitigate ecological impacts of the proposed development on threatened species and endangered ecological communities, as much as possible of the existing native forest vegetation, identified as EEC's, and hollow bearing trees on the site must be conserved where possible. Existing native forest remnants on the east and west portions of the site must also be connected to allow easy and safe movement of threatened and common fauna between the remnants. This can be achieved by retaining a corridor of existing native vegetation, of preferred minimum width 20m, along the south and north boundary of the site (**Fig-6**). Hollow bearing trees on the site (**Fig-3**) must also be conserved as nest, den and refuge habitat for hollow dependent fauna, even if retained within APZ's where possible. Any hollow bearing trees removed must be compensated for by replacing hollows with an adequate number of nest boxes, two (2) suitable nest boxes for each hollow, installed in trees in forest nearby on the site. These measures will conserve habitat for threatened fauna species and conserve much of the EEC's.

The usefulness of corridors of vegetation along the south and north boundaries can be maintained by minimising any gaps put through the corridors by roads. Retaining existing native trees and shrubs plus planting additional native trees and shrubs to continue the corridor as close as possible to the road edge will minimize gaps. Additional plantings should be as dense as possible and at least as wide as the corresponding vegetation corridor.

For arboreal mammals such as threatened Squirrel Gliders a gap in a corridor is a point of vulnerability to predators such as Foxes and Cats. Currently there is a gap, where no trees are found, of at least 100m length in the corridor along the south boundary of the site. This should be a continuous corridor, approximately 20m wide, of trees and shrubs, where the tree canopies are close or touching. Ultimately, approximately one third of the existing native forest will be cleared from the site when the entire health precinct is developed. When the staged development of the precinct necessitates clearing of the EECs, the remaining east and west forest remnants should be made more viable habitat for threatened species, such as Squirrel Gliders, by connecting with a complete corridor of vegetation and planting of the breaks identified.

## **6.0 CONCLUSION**

This flora and fauna assessment finds that the old brickworks site at Metford Road, Metford supports an area of highly disturbed and completely cleared land, a partially rehabilitated and weed infested heavily disturbed area of land and remnants of two native forest vegetation communities, parts of which are in relatively good condition (**Fig-3**). Native forest vegetation across the site supports a diversity of native flora species. Hollows in a number of hollow bearing trees on the site provide nest, den and refuge habitat for a range of hollow dependent fauna. Native forest vegetation and hollow bearing trees on the site provide habitat for a variety of threatened and common native fauna many of which were recorded on the site. The site supports a number of man-made ponds and ponds caused by disturbance to a shallow drainage line running northwards across the site (**Fig-3**). These ponds can be modified if required by the proposed development unless the ponds are found to support a population of threatened species, such as Green and Gold Bell Frogs.

The two native forest vegetation communities on the site are Endangered Ecological Communities (EEC's) identified as "Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion" and "Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions".

As much as possible of the native forest vegetation on the site, plus hollow bearing trees, can be retained as habitat for threatened native fauna and to conserve remnants of the Endangered Ecological Communities.

The proposed development, with the adoption of mitigating measures (**5.1**), is unlikely to have a significant impact on threatened species, populations or ecological communities or their habitats.

Further survey for a number of threatened plants and the threatened Green and Gold Bell Frog will be conducted after completion of this report. Results of these additional surveys will be provided as an addendum to this report.

### **6.1 Recommendations:**

1. The proposed development adopt mitigating measures discussed in section **5.1** of this report
2. Retain on the site as much as possible of the native forest vegetation, an EEC
3. Retain on the site as much as possible of the EEC, the native forest vegetation
4. Retain all hollow bearing trees on the site, if any are removed then replace nearby with nest boxes
5. Retain suitably wide corridors of vegetation between forest remnants on the site
6. Sediment and erosion controls should be employed prior to any earth works and construction phases
7. Vehicles, machinery and building refuse associated with construction of the development project should not impinge on areas of retained native forest vegetation.
8. Landscaping on the site should use local native plant species
9. Noxious introduced exotic weeds should be eradicated from the site

Greg Little  
GENERAL FLORA AND FAUNA



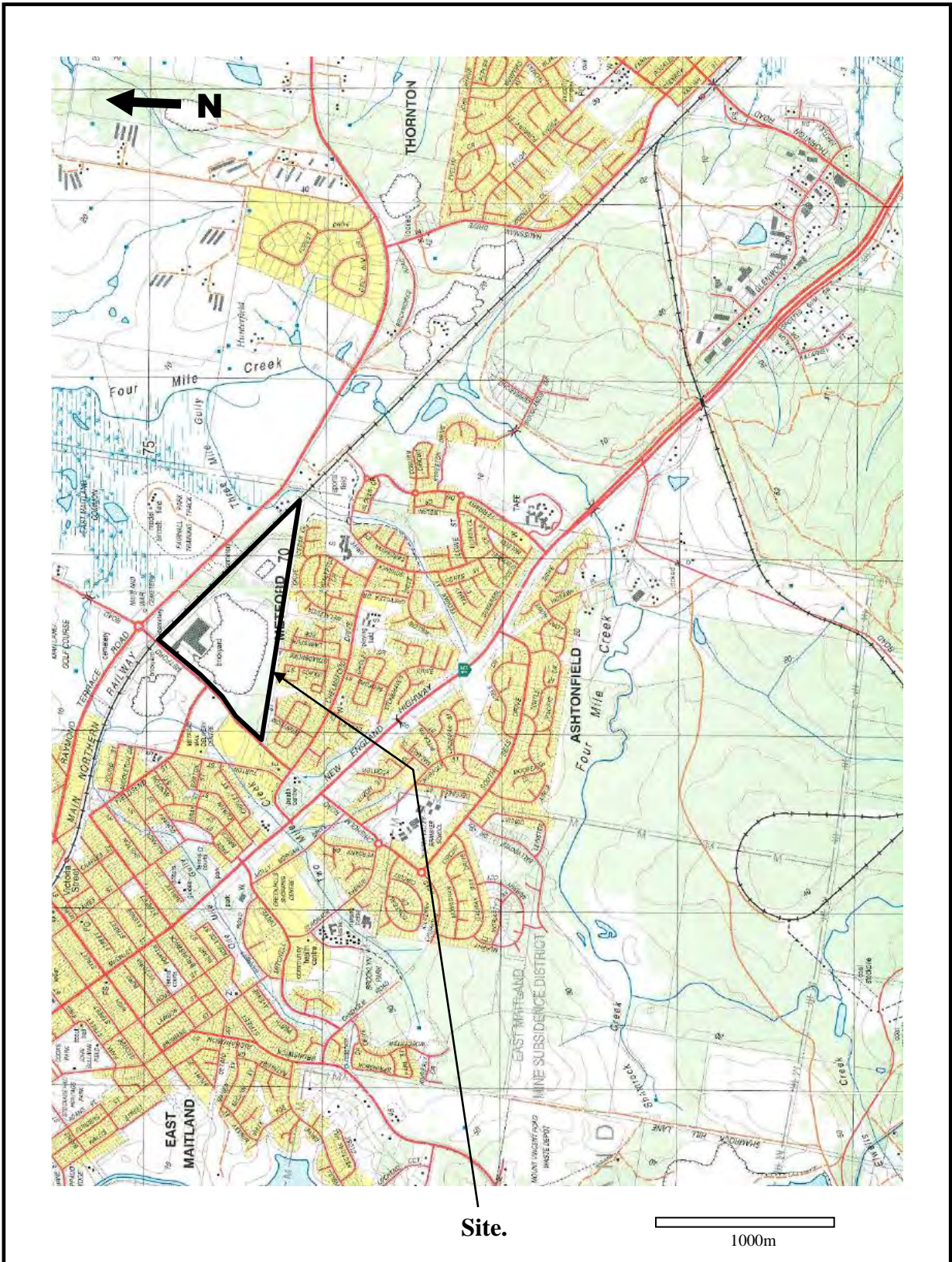
## 7.0 REFERENCES

- Auld, B.A. and Medd, R.W. (1996), *Weeds: An Illustrated Botanical Guide to the Weeds of Australia*. Inkata Press, Sydney.
- Bell S.A.J., (2002) *The Natural Vegetation of the Wyong Local Government Area, Central Coast, New South Wales: Vegetation Community Profiles*. Unpublished Final Report to Wyong Shire Council, December 2002, East Coast Flora Survey.
- Bell S.A.J., (2002a) *The Natural Vegetation of the Wyong Local Government Area, Central Coast, New South Wales: Technical Report*. Unpublished Final Report to Wyong Shire Council, August 2002, East Coast Flora Survey.
- Brooker, M.I.H. and Kleinig, D.A., (1999), *Field Guide to Eucalypts* (Vol. 1: South-eastern Australia), Bloomings Books, Hawthorn.
- Carolin, R. and Tindale, M., (1994), *Flora of the Sydney Region*, Reed, Sydney
- Churchill, S., (1998), *Australian Bats*, Reed New Holland, Sydney.
- Cogger, H.G. (2000). *Reptiles and Amphibians of Australia* (6th edn.). Reed International, New South Wales.
- DEC, (2004), *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities, (Working Draft)*, Department of Environment and Conservation (NSW)
- Eby, P., (1995), *The Biology and Management of Flying Foxes in NSW*, NSW NPWS, Hurstville.
- Fairley, A. and Moore, P., (1995), *Native Plants of the Sydney District*, Kangaroo Press, Botany, NSW.
- Gordon, A.R.L., (1977), *Restrictions on the Removal of Trees on New South Wales Watercourses*, Department of Conservation and Water Resources, NSW.
- Harden, G.J., Williams, J.B. and McDonald, W.J.F., (2006), *Rainforest Trees and Shrubs a Field Guide to Their Identification in Victoria, New South Wales and subtropical Queensland using vegetative features*, Gwen Harden Publishing, Nambucca Heads.
- Harden, G.J. (Ed), (2000), *Flora of New South Wales*, Vol 1, University of NSW Press, Sydney.
- Harden, G.J. (Ed), (2002), *Flora of New South Wales*, Vol 2, University of NSW Press, Sydney.
- Harden, G.J. (Ed), (1992), *Flora of New South Wales*, Vol 3, University of NSW Press, Sydney.
- Harden, G.J. (Ed), (1993), *Flora of New South Wales*, Vol 4, University of NSW Press, Sydney.
- Higgins, P.J. & Peter, J.M., (2002), *Handbook of Australian, New Zealand & Antarctic Birds*, Vol 6 *Pardalotes to Shrike-thrushes*, Oxford University Press, Melbourne.
- Higgins, P.J., Peter, J.M. and Steele, W.K., (2001), *Handbook of Australian, New Zealand & Antarctic Birds*, Vol 5 *Tyrant-flycatchers to Chats*, Oxford University Press, Melbourne.
- Hussey, B.M.J., Hobbs, R.J. and Saunders, D.A., (1991), *Guidelines for Bush Corridors*, Surrey Beatty & Sons, Chipping Norton.
- Jones, D.L., (2006), *A Complete Guide to Native Orchids of Australia, including the Island Territories*, Reed New Holland, Sydney.
- LHCCREMS, (2003), *Vegetation Survey, Classification and Mapping – Lower Hunter and Central Coast Region*. Lower Hunter and Central Coast Regional Environmental Management Strategy.

- Lovett, S. & Price, P. (Eds), (1999), *Riparian Land Management Technical Guidelines, Volume One: Principles of Sound Management*, LWDRRDC, Canberra.
- Marchant, S. & Higgins, P.J., (1993), *Handbook of Australian, New Zealand & Antarctic Birds, Vol 2 Raptors to Lapwings*, Oxford University Press, Melbourne.
- M.C.C., (2002), *The Maitland Greening Plan, Stage 2 Part B*, Maitland City Council.
- Menkhorst, P. & Knight, F., (2001), *A Field Guide to the Mammals of Australia*, Oxford University Press, Melbourne.
- Matthei, L. E., (1995), *Soil Landscapes of the Newcastle 1:100 000 Sheet Report*, Department of Land and Water Conservation, Sydney.
- Murray, M., Bell, S., Hoyer, G., (2002), *Flora and Fauna Survey Guidelines: Lower Hunter Central Coast Region 2002*, Lower Hunter & Central Coast Regional Environmental Management Strategy, NSW.
- NSW GIS, (2000), *State Environmental Planning Policy No.44 – Koala Habitat Protection*, NSW Government Information Service.
- Pizzey, G. and Knight, F., (2007), *The Graham Pizzey and Frank Knight Field Guide to the Birds of Australia*, Angus and Robertson, Sydney.
- Robinson, L. (1991). *Field Guide to the Native Plants of Sydney* (2nd edn.). Kangaroo Press Pty. Ltd., New South Wales.
- Sainty, G.R. & Jacobs, S.W.L., (1981), *Waterplants of New South Wales*, Water Resources Commission of NSW, Sydney.
- Strahan, R. (ed), (1998), *Complete Book of Australian Mammals*, Angus & Robertson, Sydney.
- Triggs, B. (1984), *Mammal Tracks and Signs-A Field Guide for South-eastern Australia*. Oxford University Press, Melbourne.
- Wheeler, D.J.B., Jacobs, S.W.L. and Whalley, R.D.B., (2002), *Grasses of New South Wales*, University of New England, Armidale.
- Williams, J.B. and Harden, G.J., (1984), *Rainforest Climbing Plants*, University of New England, Armidale.

## **8.0    FIGURES**

- Figure - 1      Location of study site on topographic map
- Figure - 2      Aerial photograph
- Figure - 3      General layout of site, vegetation and threatened species
- Figure - 4      Trap and survey locations
- Figure - 5      Vegetation transects and plots
- Figure - 6      Areas of clearing, conserving and corridors



**Figure 1** Showing location of site in relation to surrounding areas on a section of topographic map.

scanned from LPI NSW, 1:25 000 topo map, BERESFIELD 9232-3N, 3<sup>rd</sup> Edn





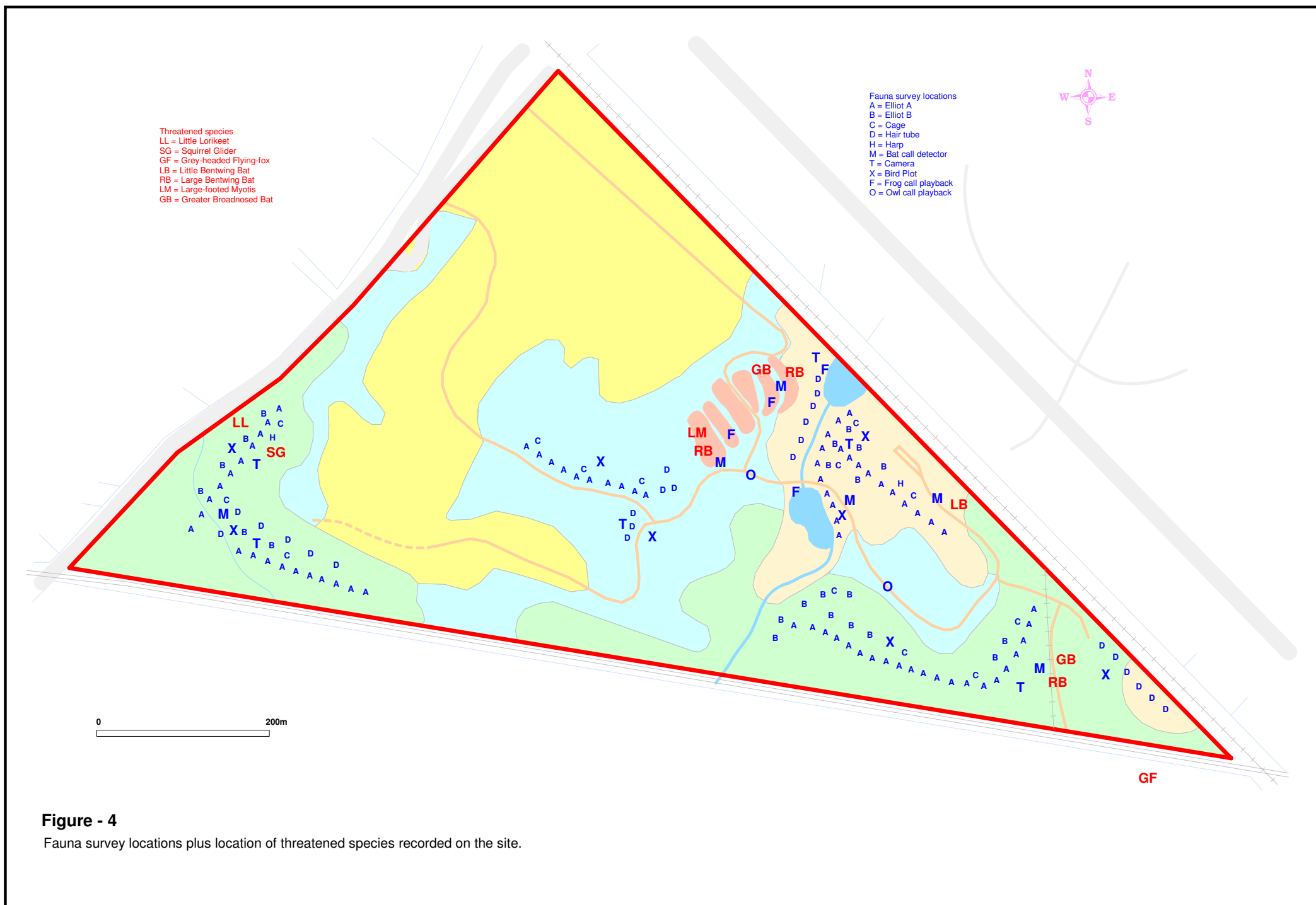
**Figure 2** Aerial photograph showing study site (yellow outline).

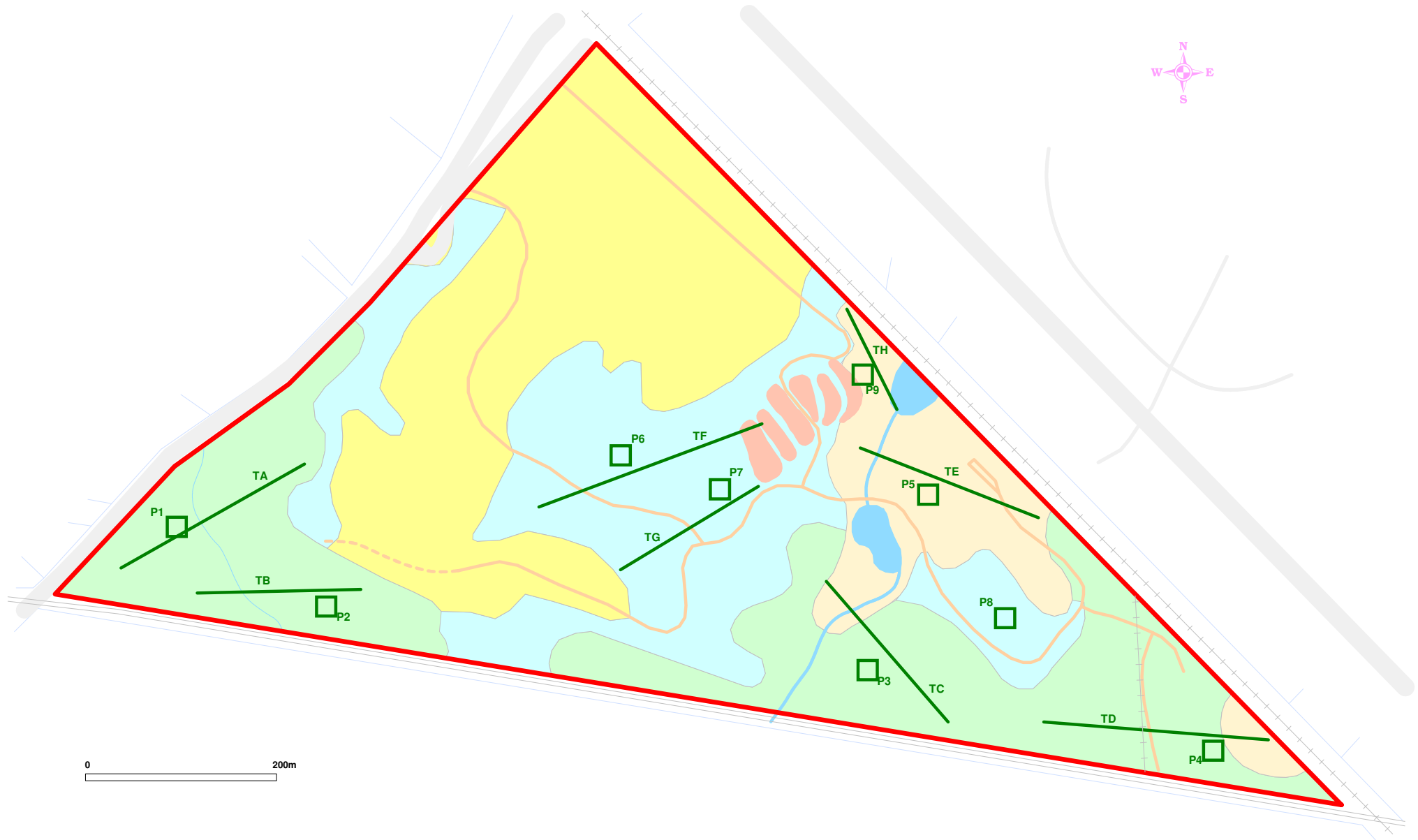




**Figure - 3**

General layout showing approximate distribution of disturbed areas and native vegetation across the site.





**Figure - 5**

Vegetation transects (T) and Plots (P) across the site.



**Figure - 6**

Showing approximate extent of clearing and modification for the proposed development plus extent of proposed partial clearing for Asset Protection Zones. Conserved forest and habitat will be connected by vegetated corridors.

## **9.0 TABLES**

Table-1	Owl-call and Bush Stone-curlew call playback
Table-2	Spotlighting
Table-3	Reptile search
Table-4	Frog search
Table-5	Frog call playback
Table-6	Tracks, scats and signs
Table-7	Bat call detection (Anabatting) results



## TABLES

**Location** - old brickworks site, Metford Road, Metford, NSW

**Table-1 Owl and Bush Stone-curlew call playback**

Date	Location	Species	Response
16.9.14	Centre east of site	Powerful Owl, Barking Owl, Masked Owl, Sooty Owl & Bush Stone-curlew	<ul style="list-style-type: none"> <li>No response</li> </ul>
24.9.14	Centre of site	Powerful Owl, Barking Owl, Masked Owl, Sooty Owl & Bush Stone-curlew	<ul style="list-style-type: none"> <li>No response</li> </ul>

**Table-2 Spotlighting**

Date	Location	Observations
16.9.14	Throughout vegetated parts of site	<ul style="list-style-type: none"> <li>Hare</li> <li>Rabbit</li> <li>Grey Kangaroo</li> <li>Frogs</li> </ul>
24.9.14	Throughout vegetated parts of site	<ul style="list-style-type: none"> <li>Hare</li> <li>Rabbit</li> <li>Feathertail Glider, SW corner</li> <li>Frogs</li> </ul>

**Table-3 Reptile search**

Date	Location	Method	Observations
9.9.14-12.9.14	Throughout site	Visual searches for reptiles sunning and foraging; turning rubbish, fallen timber and bark; raking in leaf litter, etc.	<ul style="list-style-type: none"> <li>Garden Skink</li> <li>Blur-tongued Lizard</li> <li>Bearded Dragon</li> <li>Eastern Water Skink</li> </ul>
15.9.14-19.9.14	Throughout site	Visual searches for reptiles sunning and foraging; turning rubbish, fallen timber and bark; raking in leaf litter, etc.	<ul style="list-style-type: none"> <li>Garden Skink</li> <li>Blue-tongued Lizard</li> <li>Robust Skink</li> <li><i>Carlia tetradactyla</i></li> <li>Eastern Water Skink</li> </ul>
23.9.14-25.9.14	Throughout site	Visual searches for reptiles sunning and foraging; turning rubbish, fallen timber and bark; raking in leaf litter, etc.	<ul style="list-style-type: none"> <li>Garden Skink</li> <li>Bearded Dragon</li> <li>Eastern Water Skink</li> </ul>

**Table-4 Frog search**

Date	Location	Method	Observations
16.9.14 Day & night	Man-made ponds & drainage line ponds	Day and night search of pond edges and pond vegetation and adjacent vegetation; turning bark, logs, leaf litter and rubbish; listening	<ul style="list-style-type: none"> <li><i>Crinia signifera</i></li> <li><i>Litoria fallax</i></li> <li><i>Litoria latopalmata</i></li> <li><i>Uperoleia laevigata</i></li> <li><i>Litoria peroni</i></li> <li><i>Limnodynastes tasmaniensis</i></li> </ul>
18.9.14	Man-made ponds & drainage line ponds	Day and night search of pond edges and pond vegetation and adjacent vegetation; turning bark, logs, leaf litter and rubbish; listening	<ul style="list-style-type: none"> <li><i>Litoria fallax</i></li> <li><i>Litoria latopalmata</i></li> </ul>
24.9.14 Day & night	Man-made ponds & drainage line ponds	Day and night search of pond edges and pond vegetation and adjacent vegetation; turning bark, logs, leaf litter and rubbish; listening	<ul style="list-style-type: none"> <li><i>Crinia signifera</i></li> <li><i>Litoria fallax</i></li> <li><i>Litoria latopalmata</i></li> <li><i>Litoria peroni</i></li> </ul>

**Table-5 Frog call playback**

Date	Location	Species	Observations
16.9.14	Over man-made ponds & drainage line ponds	Green and Gold Bell Frog ( <i>Litoria aurea</i> )	<ul style="list-style-type: none"> <li>No response</li> </ul>
24.9.14	Over man-made ponds & drainage line ponds	Green and Gold Bell Frog ( <i>Litoria aurea</i> )	<ul style="list-style-type: none"> <li>No response</li> </ul>

**Table-6 Tracks, scats and signs.**

Date	Location	Observations
9.9.14-25.9.14	Throughout site	<ul style="list-style-type: none"> <li>Grey Kangaroo scats</li> <li>Rabbit scats</li> <li>Dog scats</li> <li>Fox scats</li> <li>Chewed wattle stems – Yellow-tailed Black Cockatoo</li> </ul>

**Table-7 Bat call detection (Anabatting) results.**

Date of bat call collection	Conditions	Unit	Time	Location	Species recorded
16.9.14	Clear, still, mild	913	1800-2230	Over pond centre of site	<ul style="list-style-type: none"> <li><i>Vespadelus pumilis</i></li> <li><i>Scotorepens orion</i></li> <li><i>Chalinolobus gouldii</i></li> <li><i>Myotis macropus</i> #</li> <li><i>Miniopterus schreibersii</i> #</li> <li><i>Tadarida australis</i></li> </ul>

16.9.14	Clear, still, mild	914	1800-2230	Red Gum Forest - west	<ul style="list-style-type: none"> <li>• <i>Vespadelus vulturnus</i></li> <li>• <i>Vespadelus pumilis</i></li> <li>• <i>Scotorepens orion</i></li> <li>• <i>Nictophyllus sp.</i></li> <li>• <i>Chalinolobus gouldii</i></li> <li>• <i>Chalinolobus morio</i></li> </ul>
23.9.14	Clear, light breeze, mild	913	1800-0600	Spotted Gum Ironbark Forest south-west corner	<ul style="list-style-type: none"> <li>• nothing</li> </ul>
23.9.14	Clear, light breeze, mild	914	1800-0600	Spotted Gum Ironbark Forest south-east corner	<ul style="list-style-type: none"> <li>• <i>Scoteanax rueppellii</i> #</li> <li>• <i>Chalinolobus gouldii</i></li> <li>• <i>Miniopterus schreibersii</i> #</li> <li>• <i>Vespadelus vulturnus</i></li> <li>• <i>Mormopterus ridei</i></li> </ul>
24.9.14	Clear, still, warm	913	1800-2230	Over pond north centre of site	<ul style="list-style-type: none"> <li>• <i>Chalinolobus gouldii</i></li> <li>• <i>Scoteanax rueppellii</i> #</li> <li>• <i>Miniopterus schreibersii</i> #</li> <li>• <i>Vespadelus vulturnus</i></li> <li>• <i>Mormopterus ridei</i></li> </ul>
24.9.14	Clear, still, warm	914	1800-2230	Red Gum Forest - east	<ul style="list-style-type: none"> <li>• <i>Scotorepens orion</i></li> <li>• <i>Chalinolobus gouldii</i></li> <li>• <i>Vespadelus vulturnus</i></li> <li>• <i>Miniopterus australis</i> #</li> </ul>

## **10.0 APPENDICES**

- Appendix A Flora Species List
- Appendix B Fauna Species List
- Appendix C Site visit record
- Appendix D Vegetation Transect and Plot data
- Appendix E Regionally and Locally Significant species and communities
- Appendix F EPBC Act matters
- Appendix G Threatened species list
- Appendix H Assessment of Significance (the **7 Part Test**)
- Appendix I Fauna Trapping results
- Appendix J Bird Sample Plot results
- Appendix K Photographs over site
- Appendix L Koala Habitat Assessment
- Appendix M Hollow bearing tree locations
- Appendix N Threatened species co-ordinates

## APPENDIX - A

## Flora species list

All plant species on this list were recorded on the site during this survey.

Classification follows that of Flora of New South Wales, Vols 1-4, (Harden, 1990-93).

# = Threatened Species

& = recorded during additional surveys Sep - Dec 2013

ssp. = Subspecies, var. = Variety, \* = Introd n = Noxious weed plant in LGA.

r = Regionally Significant Plant Species

Scientific Name	Common Name	Transect						Plot					
		A	B	C	D	E	F	1	2	3	4	5	6
<b><u>FILICOPSIDA (Ferns)</u></b>													
ADIANTACEAE													
<i>Adiantum aethiopicum</i>	Maidenhair Fern			C									
AZOLLACEAE													
<i>Azolla pinnata</i>	Ferny Azolla												
DENSTAEDTIACEAE													
<i>Hypolepis muelleri</i>	Harsh Ground Fern			C		E							
SCHIZAEACEAE													
<i>Cheilanthes sieberi</i> ssp. <i>sieberi</i>	Mulga Fern	A	B	C	D	E	F		2		4		
SINOPTERIDACEAE													
<i>Pellaea falcata</i>	Sickle Fern												
<i>Pellaea viridis</i> *	Green Cliff Brake						F						
THELYPTERIDACEAE													
<i>Christella dentata</i>													
<b><u>MAGNOLIOPSIDA (Flowering Plants)</u></b>													
<b><u>Magnoliidae (Dicotyledons)</u></b>													
ACANTHACEAE													
<i>Pseuderanthemum variabile</i>	Pastel Flower												
AIZOACEAE													
<i>Carpobrotus glaucescens</i>	Pigface												
<i>Galenia pubescens</i> *	Galenia												
AMARANTHACEAE													
<i>Gomphrena celosioides</i> *	Gomphrena Weed												
APIACEAE													
<i>Centella asiatica</i>	Pennywort	A		C			F						6
<i>Foeniculum vulgare</i> *	Fennel						F						
<i>Hydrocotyle laxiflora</i>		A		C			F						
APOCYNACEAE													
<i>Parsonsia straminea</i> var. <i>straminea</i>	Common Silkpod	A	B	C		E		1					
ARALIACEAE													
<i>Hedera helix</i> *	English Ivy												
<i>Schefflera actinophylla</i> *	Umbrella Tree												
ASCLEPIADACEAE													
<i>Gomphocarpus fruticosus</i> *	Narrow Leaf Cotton Bush												
ASTERACEAE													
<i>Ageratina adenophora</i> *	Crofton Weed			C		E							
<i>Ambrosia artemisiifolia</i> *	Ragweed						F						6
<i>Aster subulatus</i> *	Bushy Starwort												
<i>Bidens pilosa</i> *	Cobbler's Pegs			C			F						
<i>Cassinia aculeata</i>	Common Cassinia		B										
<i>Chrysanthemoides monilifera</i> ssp. <i>rotundata</i> *	Bitou Bush	A											
<i>Chrysocephalum apiculatum</i>	Yellow Buttons				D								
<i>Cirsium vulgare</i> *	Spear Thistle						F						
<i>Conyza albida</i> *	Tall Fleabane				D		F						
<i>Dimorphotheca ecklonis</i>	Blue and White Daisy Bush												
<i>Epaltes australis</i>	Spreading Nut-heads				D								
<i>Facelis retusa</i> *													
<i>Gnaphalium americanum</i> *													
<i>Hypochaeris radicata</i> *	Flatweed	A				E	F				4		
<i>Ozothamnus diosmifolius</i>	White Dogwood	A	B		D	E	F	1			4	5	6
<i>Senecio madagascariensis</i> *	Fireweed	A		C	D		F						



Scientific Name	Common Name	Transect						Plot					
		A	B	C	D	E	F	1	2	3	4	5	6
<i>Senecio pterophorus</i> *	African Daisy						F						
<i>Silybum marianum</i>	Variegated Thistle												
<i>Soliva sessilis</i> *	Bindii		B										
<i>Sonchus asper</i> *	Prickly Sowthistle												
<i>Sonchus oleraceus</i> *	Milk Thistle						F						
<i>Taraxacum officinale</i> *	Dandelion						F						
<i>Vernonia cinerea</i> var. <i>cinerea</i>					D								
BIGNONIACEAE													
<i>Jacaranda mimosifolia</i> *	Jacaranda		B										
<i>Pandorea pandorana</i>	Wonga Vine	A	B			E		1					
CAESALPINIACEAE													
<i>Senna pendula</i> var. <i>glabrata</i> *	Senna												
CAMPANULACEAE													
<i>Wahlenbergia gracilis</i>	Native Bluebell				D								
CAPRIFOLIACEAE													
<i>Lonicera japonica</i> *	Japaneses Honeysuckle												
CARYOPHYLLACEAE													
<i>Stellaria media</i> *	Chickweed												
CASUARINACEA													
<i>Casuarina glauca</i>	Swamp She-oak						F						
CHENOPODIACEAE													
<i>Einadia hastata</i>	Berry Saltbush		B										
<i>Einadia trigonos</i>	Fishweed												
CONVOLVULACEAE													
<i>Dichondra repens</i>	Kidney Weed												
CRASSULACEAE													
<i>Bryophyllum delagoense</i> *	Mother-of-millions												
DILLENIACEAE													
<i>Hibbertia pedunculata</i>	Guinea Flower				D		F						
DROSERACEAE													
<i>Drosera peltata</i>	Sundew												
EPACRIDACEAE													
<i>Leucopogon juniperinus</i>	Bearded Heath	A	B			E			2	3			6
EUPHORBIACEAE													
<i>Breynia oblongifolia</i>	Breynia	A				E							
<i>Glochidion ferdinandi</i>	Cheese Tree	A	B	C		E		1	2				6
<i>Ricinus communis</i> *	Castor Oil Plant												
FABOIDEAE													
<i>Bossiaea prostrata</i>													
<i>Daviesia ulicifolia</i>	Gorse Bitter Pea	A	B	C	D	E	F	1	2		4	5	6
<i>Desmodium rhytidophyllum</i>				C									
<i>Dillwynia retorta</i>	Heathy Parrot Pea	A	B				F			3			
<i>Glycine clandestina</i>	Love Creeper				D				2				
<i>Hardenbergia violacea</i>	False Sasparrilla	A	B	C	D	E	F	1		3	4		
<i>Kennedia rubicunda</i>	Dusky Coral Pea						F						6
<i>Medicago polymorpha</i> *	Burr Medic												
<i>Medicago sativa</i> *	Lucerne						F						
<i>Oxylobium pulteneae</i>	Wiry Shaggy Pea												
<i>Pultenaea euchila</i>			B										
<i>Pultenaea retusa</i>													
<i>Pultenaea villosa</i>							F						
<i>Trifolium arvense</i> *	Hares Foot Clover												
<i>Trifolium repens</i> *	White Clover						F						
<i>Vicia sativa</i> ssp. <i>sativa</i> *	Vetch						F						
GERANIACEAE													
<i>Geranium homeanum</i>	Cranesbill												
GOODENIACEAE													
<i>Goodenia hederacea</i> var. <i>hederacea</i>	Violet-leaved Goodenia	A			D	E							
<i>Goodenia paniculata</i>	Swamp Goodenia						F						
HALORAGACEAE													
<i>Gonocarpus teucrioides</i>	Germander Raspswort												
LAMIACEAE													
<i>Stachys arvensis</i> *	Stagger Weed												
LAURACEAE													
<i>Cinnamomum camphora</i> *	Camphor Laurel	A											
LOBELIACEAE													

		Transect						Plot					
Scientific Name	Common Name	A	B	C	D	E	F	1	2	3	4	5	6
<i>Pratia purpurascens</i>	White Root	A	B	C	D	E	F		2	3	4	5	
LORANTHACEAE													
<i>Dendrophthoe vitellina</i>	Mistletoe	A			D	E		1					
MALVACEAE													
<i>Modiola caroliniana*</i>													
<i>Pavonia hastata*</i>	Pink Pavonia						F						
<i>Sida rhombifolia*</i>	Paddy's Lucerne						F						
MELIACEAE													
<i>Melia azedarach</i> var. <i>australasica</i>	White Cedar												
MIMOSOIDEAE													
<i>Acacia elongata</i> var. <i>elongata</i>		A	B	C	D	E	F	1	2	3	4	5	6
<i>Acacia falcata</i>	Falcate Wattle	A	B	C	D	E	F		2		4	5	
<i>Acacia fimbriata</i>	Fringe Wattle												
<i>Acacia irrorata</i>	Green Wattle	A		C	D	E	F	1				5	6
<i>Acacia longifolia</i>	Sydney Golden Wattle												
<i>Acacia parvippinula</i>	Silver-stemmed Wattle												
<i>Acacia ulicifolia</i>	Prickly Moses												
MYRTACEAE													
<i>Angophora bakeri</i>							F						6
<i>Angophora costata</i>	Smooth Barked Apple			C									
<i>Angophora floribunda</i>	Rough Barked Apple			C		E							
<i>Callistemon linearis</i>	Narrow-leaved Bottlebrush	A	B					1					
<i>Callistemon</i> sp. hort variety													
<i>Corymbia maculata</i>	Spotted Gum	A	B	C	D	E		1	2	3	4	5	
<i>Eucalyptus amplifolia</i>	Cabbage Gum												
<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark												
<i>Eucalyptus fibrosa</i> ssp. <i>fibrosa</i>	Broad-leaved Ironbark	A	B	C	D	E		1		3		5	
<i>Eucalyptus globoidea</i>	White Stringybark	A				E		1					
<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint												
<i>Eucalyptus punctata</i>	Grey Gum	A	B	C				1	2	3			
<i>Eucalyptus siderophloia</i>	Grey Ironbark												
<i>Eucalyptus tereticornis</i>	Forest Red Gum			C	D	E						5	
<i>Kunzea ambigua</i>	Tick Bush												
<i>Leptospermum polygalifolium</i>	Lemon-scented Tea Tree			C		E					4	5	6
<i>Lophostemon confertus</i>	Brush Box												
<i>Melaleuca armillaris</i> ssp. <i>armillaris</i>													
<i>Melaleuca lineariifolia</i>	Snow In Summer												
<i>Melaleuca nodosa</i>	Ball Honeymyrtle				D		F						6
<i>Melaleuca quinqueurvnia</i>	Broad-leaved Paperbark												
<i>Melaleuca sieberi</i>													6
<i>Melaleuca thymifolia</i>					D		F						
OCHNACEAE													
<i>Ochna serrulata*</i>	Ochna			C									
OLEACEAE													
<i>Ligustrum sinense*</i>	Small-leaved Privet	A	B			E		1					
<i>Notelaea longifolia</i>	Mock Olive	A	B										
<i>Olea europaea</i> subsp. <i>africana*</i>	Common Olive	A				E							
OXALIDACEAE													
<i>Oxalis</i> sp.*	Oxalis	A			D								
PHYTOLACCACEAE													
<i>Phytolacca octandra*</i>	Inkweed												
PITTOSPORACEAE													
<i>Billardiera scandens</i>	Apple Berry				D		F						
<i>Bursaria spinosa</i>	Blackthorn	A	B	C	D	E	F	1	2	3	4	5	
<i>Pittosporum undulatum</i>	Sweet Pittosporum	A	B		D			1	2		4		
PLANTAGINACEAE													
<i>Plantago lanceolata*</i>	Common Plantain			C	D		F						
POLYGONACEAE													
<i>Persicaria strigosum</i>	Spotted Knotweed												
<i>Polygonum aviculare*</i>	Wireweed												
<i>Rumex crispus*</i>	Dock						F						
PORTULACACEAE													
<i>Portulaca oleracea</i>	Pigweed												
PRIMULACEAE													
<i>Anagallis arvensis*</i>	Scarlet Pimpernel						F						
PROTEACEAE													

Scientific Name	Common Name	Transect						Plot					
		A	B	C	D	E	F	1	2	3	4	5	6
<i>Hakea sericea</i>	Bushy Needlebush	A											
RANUNCULACEAE													
<i>Clematis aristata</i>	Old Mans Beard	A		C		E	F	1				5	
<i>Ranunculus inundatus</i>	River Buttercup												
RHAMNACEAE													
<i>Alphitonia excelsa</i>	Red Ash	A											
ROSACEAE													
<i>Rubus ulmifolius*</i>	Blackberry	A											
RUBIACEAE													
<i>Pomax umbellata</i>	Pomax												
SANTALACEAE													
<i>Exocarpus cupressiformus</i>	Cherry Ballart		B	C									
SOLANACEAE													
<i>Cestrum parqui*</i>	Green Cestrum												
<i>Solanum mauritianum*</i>	Wild Tobacco Bush												
<i>Solanum nigrum*</i>	Black-berry Nightshade						F						
STYLIDIACEAE													
<i>Stylidium graminifolium</i>	Trigger Plant												
THYMELAEACEAE													
<i>Pimelea linifolia</i> ssp. <i>linifolia</i>	Slender Rice Flower						F						
VERBENACEAE													
<i>Lantana camara*</i>	Lantana	A	B	C	D	E	F	1	2	3		5	6
<i>Verbena bonariensis*</i>	Purple Top						F						6
<b><u>Liliidae (Monocotyledons)</u></b>													
AGAVACEAE													
<i>Yucca sp*</i>	Yucca												
ANTHERICACEAE													
<i>Caesia parviflora</i> var. <i>parviflora</i>	Pale Grass Lily												
<i>Laxmannia gracilis</i>	Slender Wire-lily												
ASPARAGACEAE													
<i>Protasparagus aethiopicus*</i>	Asparagus Fern	A	B					1					
COMMELINACEAE													
<i>Tradescantia albiflora*</i>	Wandering Jew			C		E							
CYPERACEAE													
<i>Baumea articulata</i>	Jointed Twig-Rush												6
<i>Bolboschoenus caldwellii</i>							F						
<i>Cyperus eragrostis*</i>	Umbrella Sedge						F						
<i>Eleocharis sphacelata</i>	Tall Spike-rush												
<i>Eleocharis sp.</i>													
<i>Fimbristylis dichotoma</i>													
<i>Lepidosperma laterale</i>	Sword-sedge			C									
<i>Ptilothryx deusta</i>			B	C	D				2	3			
<i>Schoenoplectus validus</i>							F						
HYDROCHARITACEAE													
<i>Ottelia ovalifolia</i>	Swamp Lily			C									
IRIDACEAE													
<i>Crocasmia X crocosmiiflora*</i>	Crocasmia												6
<i>Freesia sp.*</i>													
<i>Patersonia sp.</i>	Purple Flag												
<i>Romulea rosea</i> var. <i>australis*</i>	Onion Grass												
JUNCACEAE													
<i>Juncus acutus*</i>	Spiny Rush						F						
<i>Juncus cognatus*</i>													
<i>Juncus kraussii</i>	Sea Rush												
<i>Juncus usitatus</i>		A				E	F						6
LOMANDRACEAE													
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>			B										
<i>Lomandra longifolia</i>	Mat Rush	A			D		F						6
<i>Lomandra multiflora</i>		A	B	C	D	E		1		3	4		
LUZURIAGACEAE													
<i>Geitonoplesium cymosum</i>	Scrambling Lily	A						1					
ORCHIDACEAE													
<i>Caladenia carnea</i>	Pink Fingers												
<i>Caladenia catenata</i>	White Fingers	A	B	C	D			1		3		5	

Scientific Name	Common Name	Transect						Plot					
		A	B	C	D	E	F	1	2	3	4	5	6
<i>Calochilus sp.</i>	Beard Orchid	A											
<i>Microtis parviflora</i>	Slender Onion Orchid												
PHILYDRACEAE													
<i>Philydrum lanuginosum</i>	Woolly Frogmouth						F						
PHORMIACEAE													
<i>Dianella caerulea</i>	Paroo Lily	A			D	E		2			4		
POACEAE													
<i>Andropogon virginicus*</i>	Whisky Grass	A					F						6
<i>Aristida ramosa</i>	Three-awned Spear Grass			C	D						4		
<i>Aristida vagans</i>	Three-awned Spear Grass	A	B	C	D	E		2	3		4		
<i>Arundo donax*</i>	Giant Reed												
<i>Avena fatua*</i>	Wild Oats												
<i>Axonopus affinis*</i>	Carpet Grass												
<i>Briza maxima*</i>	Quaking Grass		B		D		F						
<i>Briza minor*</i>	Shivery Grass		B										
<i>Bromus catharticus*</i>	Prairie Grass												
<i>Chloris gayana*</i>	Rhodes Grass						F						6
<i>Cortaderia selloana*</i>	Pampas Grass	A				E						5	6
<i>Cymbopogon refractus</i>	Barbed Wire Grass		B		D								
<i>Cynodon dactylon*</i>	Couch					E	F	1					6
<i>Danthonia tenuior</i>	Wallaby Grass			C	D								
<i>Dichelachne micrantha</i>	Shorthair Plume Grass	A					F						
<i>Digitaria parviflora</i>	Smallflower Fingergrass	A			D								
<i>Echinochloa crus-gali*</i>	Barnyard Grass												
<i>Echinopogon caespitosus</i> var. <i>caespitosus</i>	Tufted Hedgehog Grass		B	C	D				2	3	4		
<i>Ehrharta erecta*</i>	Panic Veldt Grass												
<i>Entolasia stricta</i>		A	B	C	D	E		1	2	3	4	5	
<i>Eragrostis brownii</i>	Browns Love Grass												
<i>Eragrostis curvula*</i>	Love Grass												
<i>Eragrostis elongata</i>	Clustered Love Grass	A	B		D		F	1					
<i>Eragrostis tenuifolia*</i>	Elastic Grass												
<i>Hyparrhenia rufa</i> subsp. <i>altissima*</i>													
<i>Imperata cylindrica</i> var. <i>major</i>	Blady Grass					E							
<i>Microlaena stipoides</i>	Weeping Grass		B	C	D	E					4	5	
<i>Oplismenus aemulus</i>	Basket Grass												
<i>Panicum maximum</i> var. <i>maximum*</i>	Guinea Grass						F						6
<i>Panicum simile</i>	Two Colour Panic									3			
<i>Paspalidium distans</i>					D								
<i>Paspalum dilatatum*</i>	Paspalum				D								6
<i>Paspalum urvillei*</i>	Vasey Grass	A		C	D								6
<i>Pennisetum clandestinum*</i>	Kikuyu	A						1					
<i>Phragmites australis</i>	Common Reed												6
<i>Poa annua*</i>	Winter Grass												
<i>Poa labillardieri</i>	Tussock Grass												
<i>Rhynchelytrum repens*</i>	Red Natal Grass						F						
<i>Setaria gracilis*</i>	Slender Pigeon Grass						F						
<i>Setaria palmifolia*</i>	Palm Grass	A											
<i>Sporobolus creber</i>	Slender Rat's Tail Grass				D								
<i>Stenotaphrum secundatum*</i>	Buffalo Grass												
<i>Stipa pubescens</i>	Tall Speargrass												
<i>Themeda triandra</i>	Kangaroo Grass	A	B	C	D	E		1	2	3	4	5	
<i>Vulpia bromoides*</i>	Squirrel Tail Fescue												
TYPHACEAE													
<i>Typha orientalis</i>	Cumbungi	A		C		E	F						

## APPENDIX - B

## Fauna species list

The following fauna species are potentially found in the region and may utilise habitat on the study site. Common and threatened species recorded on the site are indicated.

R = Recorded this survey

? = Unconfirmed

# = Threatened Species

Scientific Name	Common Name		
<b><u>MAMMALS</u></b>			
<b>TACHYGLOSSIDAE</b>			
<i>Tachyglossos aculeatus</i>	Echidna		
<b>DASYURIDAE</b>			
<i>Antechinus stuartii</i>	Brown Antechinus		R
<i>Antechinus swainsonii</i>	Dusky Antechinus		
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll		
<i>Dasyurus viverrinus</i>	Eastern Quoll		
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale		
<i>Planigale maculata</i>	Common Planigale		
<i>Sminthopsis murina</i>	Common Dunnart		
<b>PERAMELIDAE</b>			
<i>Isodon macrourus</i>	Northern Brown Bandicoot		
<i>Perameles nasuta</i>	Long-nosed Bandicoot		
<b>PHASCOLARCTIDAE</b>			
<i>Phascolarctos cinereus</i>	Koala		
<b>VOMBATIDAE</b>			
<i>Vombatus ursinus</i>	Common Wombat		
<b>BURRAMYIDAE</b>			
<i>cercartetus nanus</i>	Eastern Pygmy-possum		
<b>PETAURIDAE</b>			
<i>Petaurus breviceps</i>	Sugar Glider		
<i>Petaurus norfolcensis</i>	Squirrel Glider	#	R
<b>PSEUDOCHEIRIDAE</b>			
<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum		
<b>ACROBATIDAE</b>			
<i>Acrobates pygmaeus</i>	Feathertail Glider		R
<b>PHALANGERIDAE</b>			
<i>Trichosurus vulpecula</i>	Common Brushtail Possum		
<b>MACROPODIDAE</b>			
<i>Macropus giganteus</i>	Eastern Grey Kangaroo		R
<i>Macropus rufogriseus</i>	Red-necked Wallaby		
<i>Wallabia bicolor</i>	Swamp Wallaby		
<b>PTEROPODIDAE (FRUIT BATS)</b>			
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	#	R
<i>Pteropus scapulatus</i>	Little red Flying-fox		
<b>EMBALLONURIDAE (SHEATHTAIL BATS)</b>			
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail Bat		
<b>RHINOLOPHIDAE (HORSESHOE BATS)</b>			
<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe Bat		
<b>VESPERTILIONIDAE (EVENING BATS)</b>			
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat		
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat		R
<i>Chalinolobus morio</i>	Chocolate Wattled Bat		R
<i>Miniopterus australis</i>	Little Bentwing Bat	#	R
<i>Miniopterus schreibersii</i>	Large Bentwing Bat	#	R
<i>Myotis macropus</i>	Large-footed Myotis	#	R
<i>Nyctophilus geoffroyi</i>	Lesser Longeared Bat		R



Scientific Name	Common Name	
<i>Nyctophilus gouldi</i>	Gould's Longeared Bat	
<i>Nyctophilus sp.</i>	Longeared Bat	R
<i>Scoteanax rueppellii</i>	Greater Broadnosed Bat	# R
<i>Scotorepens balstoni</i>	Inland Broadnosed Bat	
<i>Scotorepens orion</i>	Eastern Broadnosed Bat	R
<i>Vespadelus darlingtoni</i>	Large Forest Bat	
<i>Vespadelus pumilus</i>	Eastern Forest Bat	R
<i>Vespadelus regulus</i>	Southern Forest Bat	
<i>Vespadelus troughtoni</i>	Eastern Cave Bat	
<i>Vespadelus vulturnus</i>	Little Forest Bat	R
MOLOSSIDAE (FREETAIL BATS)		
<i>Mormopterus norfolkensis</i>	East-coast Freetail Bat	
<i>Mormopterus planiceps</i>	Southern Freetail Bat	
<i>Mormopterus ridei</i>	Eastern Freetail Bat	R
<i>Nyctinomus australis</i>	White-striped Freetail Bat	R
MURIDAE		
<i>Hydromys chrysogaster</i>	Water-rat	
<i>Melomys burtoni</i>	Grassland Melomys	
<i>Mus musculus*</i>	House Mouse	
<i>Pseudomys gracilicaudatus</i>	Eastern Chestnut Mouse	
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	
<i>Pseudomys oralis</i>	Hastings River Mouse	
<i>Rattus fuscipes</i>	Bush Rat	
<i>Rattus lutreolus</i>	Swamp Rat	R
<i>Rattus norvegicus*</i>	Brown Rat	
<i>Rattus rattus*</i>	Black Rat	R
CANIDAE		
<i>Canis familiaris*</i>	Domestic/feral Dog	R
<i>Canis lupus dingo</i>	Dingo	
<i>Vulpes vulpes*</i>	Fox	R
FELIDAE		
<i>Felis catus*</i>	Cat	R
LEPORIDAE		
<i>Lepus capensis*</i>	Brown Hare	R
<i>Oryctolagus cuniculus*</i>	Rabbit	R
EQUIDAE		
<i>Equus caballus*</i>	Horse	
SUIDAE		
<i>Sus scrofa*</i>	Pig	
BOVIDAE		
<i>Capra hircus*</i>	Goat	
<i>Bos taurus*</i>	Cattle	
<b><u>BIRDS</u></b>		
CASUARIIDAE		
<i>Dromaius novaehollandiae</i>	Emu	
MEGAPODIIDAE		
<i>Alectura lathamii</i>	Australian Brush-turkey	
PHASIANIDAE		
<i>Coturnix pectoralis</i>	Stubble Quail	
<i>Coturnix ypsilophora</i>	Brown Quail	
<i>Coturnix chinensis</i>	King Quail	
<i>Gallus gallus*</i>	Red Junglefowl (Domestic chicken)	
ANSERANATIDAE		
<i>Anseranas semipalmata</i>	Magpie Goose	
ANATIDAE		
<i>Dendrocygna eytoni</i>	Plumed Whistling-duck	

Scientific Name	Common Name	
<i>Dendrocygna arcuata</i>	Wandering Whistling-duck	
<i>Stictonetta naevosa</i>	Freckled Duck	
<i>Cygnus atratus</i>	Black Swan	
<i>Tadorna tadornoides</i>	Australian Shelduck	
<i>Chenonetta jubata</i>	Wood Duck	R
<i>Anas platyrhynchos</i> *	Mallard	
<i>Anas superciliosa</i>	Pacific Black Duck	R
<i>Anas rhynchos</i>	Australasian Shoveler	
<i>Anas gracilis</i>	Grey Teal	
<i>Anas castanea</i>	Chestnut Teal	R
<i>Anas querquedula</i>	Garganey	
<i>Malacorhynchus membranaceus</i>	Pink-eared Duck	
<i>Aythya australis</i>	Hardhead	
PODICIPEDIDAE		
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe	
<i>Poliocephalus poliocephalus</i>	Hoary-headed Grebe	
<i>Podiceps cristatus</i>	Great Crested Grebe	
ANHINGIDAE		
<i>Anhinga melanogaster</i>	Darter	
PHALACROCORACIDAE		
<i>Phalacrocorax melanoleucos</i>	Little Pied Cormorant	R
<i>Phalacrocorax varius</i>	Pied cormorant	
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant	
<i>Phalacrocorax carbo</i>	Great Cormorant	
PELECANIDAE		
<i>Pelecanus conspicillatus</i>	Australian Pelican	
ARDEIDAE		
<i>Egretta novaehollandiae</i>	White-faced Heron	R
<i>Egretta garzetta</i>	Little Egret	
<i>Egretta sacra</i>	Eastern Reef Egret	
<i>Ardea pacifica</i>	White-necked Heron	R
<i>Ardea alba</i>	Great Egret	R
<i>Ardea intermedia</i>	Intermediate Egret	
<i>Ardea ibis</i>	Cattle Egret	
<i>Butorides striatus</i>	Mangrove Heron	
<i>Nycticorax caledonicus</i>	Nankeen Night Heron	
<i>Ixobrychus minutus</i>	Little Bittern	
<i>Ixobrychus flavicollis</i>	Black Bittern	
<i>Botaurus poiciloptilus</i>	Australasian Bittern	
THRESKIORNITHIDAE		
<i>Plegadis falcinellus</i>	Glossy Ibis	
<i>Threskiornis molucca</i>	Australian White Ibis	R
<i>Threskiornis spinicollis</i>	Straw-necked Ibis	
<i>Platalea regia</i>	Royal Spoonbill	R
<i>Platalea flavipes</i>	Yellow-billed Spoonbill	
ACCIPITRIDAE		
<i>Pandion haliaetus</i>	Osprey	
<i>Aviceda subcristata</i>	Pacific Baza	
<i>Elanus axillaris</i>	Black-shouldered Kite	R
<i>Lophoictinia isura</i>	Square-tailed Kite	
<i>Milvus migrans</i>	Black Kite	
<i>Haliastur spheurnus</i>	Whistling Kite	R
<i>Haliastur indus</i>	Brahminy Kite	
<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle	
<i>Circus assimilis</i>	Spotted Harrier	
<i>Circus approximans</i>	Swamp Harrier	
<i>Accipiter fasciatus</i>	Brown Goshawk	R

	Scientific Name	Common Name	
	<i>Accipiter novaehollandiae</i>	Grey Goshawk	
	<i>Accipiter cirrhocephalus</i>	Collared Sparrowhawk	
	<i>Aquila audax</i>	Wedge-tailed Eagle	
	<i>Hieraaetus morphnoides</i>	Little Eagle	
FALCONIDAE			
	<i>Falco berigora</i>	Brown Falcon	
	<i>Falco longipennis</i>	Australian Hobby	R
	<i>Falco subniger</i>	Black Falcon	
	<i>Falco peregrinus</i>	Peregrine Falcon	
	<i>Falco cenchroides</i>	Nankeen Kestrel	R
RALLIDAE			
	<i>Gallirallus philippensis</i>	Buff-banded Rail	
	<i>Rallus pectoralis</i>	Lewins Rail	
	<i>Porzana pusilla</i>	Baillons Crake	
	<i>Porzana fluminea</i>	Australian Spotted Crake	
	<i>Porzana tabuensis</i>	Spotless Crake	
	<i>Porphyrio porphyrio</i>	Purple Swamphen	R
	<i>Gallinula tenebrosa</i>	Dusky Moorhen	
	<i>Fulica atra</i>	Eurasian Coot	
TURNICIDAE			
	<i>Turnix velox</i>	Little Button-quail	
	<i>Turnix varia</i>	Painted Button-quail	
SCOLOPACIDAE			
	<i>Gallinago hardwickii</i>	Latham's Snipe	
BURHINIDAE			
	<i>Burhinus grallarius</i>	Bush Stone-curlew	
RECURVIROSTRIDAE			
	<i>Himantopus himantopus</i>	Pied Stilt	
	<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet	
CHARADRIIDAE			
	<i>Euseyonis melanops</i>	Black-fronted Dotterel	
	<i>Vanellus miles</i>	Masked Lapwing	R
COLUMBIDAE			
	<i>Columba livia</i> *	Feral Pigeon	R
	<i>Columba leucomela</i>	White-headed Pigeon	
	<i>Streptopelia chinensis</i> *	Spotted Turtle-dove	R
	<i>Macropygia amboinensis</i>	Brown Cuckoo-dove	
	<i>Chalcophaps indica</i>	Emerald Dove	
	<i>Phaps chalcoptera</i>	Common Bronzewing	
	<i>Phaps elegans</i>	Brush Bronzewing	
	<i>Ocyphaps lophotes</i>	Crested Pigeon	R
	<i>Geopelia cuneata</i>	Diamond Dove	
	<i>Geopelia striata</i>	Peaceful Dove	
	<i>Geopelia humeralis</i>	Bar-shouldered Dove	R
	<i>Leucosarcia melanoleuca</i>	Wonga Pigeon	
	<i>Ptilinopus magnificus</i>	Wompoo Fruit-dove	
	<i>Ptilinopus superbus</i>	Superb Fruit-dove	
	<i>Ptilinopus regina</i>	Rose-crowned Fruit-dove	
	<i>Lopholaimus antarcticus</i>	Topknot Pigeon	
CACATUIDAE			
	<i>Calyptorhynchus lathami</i>	Glossy Black-cockatoo	
	<i>Calyptorhynchus funereus</i>	Yellow-tailed Black-cockatoo	R
	<i>Cacatua roseicapilla</i>	Galah	R
	<i>Cacatua tenuirostris</i>	Long-billed Corella	
	<i>Cacatua sanguinea</i>	Little Corella	R
	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	R
PSITTACIDAE			

Scientific Name	Common Name	
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	R
<i>Trichoglossus chlorolepidotus</i>	Scaly-breasted Lorikeet	
<i>Glossopsitta concinna</i>	Musk Lorikeet	
<i>Glossopsitta pusilla</i>	Little Lorikeet	# R
<i>Alisterus scapularis</i>	King Parrot	R
<i>Platycercus elegans</i>	Crimson Rosella	
<i>Platycercus eximius</i>	Eastern Rosella	R
<i>Lathamus discolor</i>	Swift Parrot	
<i>Psephotus haematonotus</i>	Red-rumped Parrot	
<i>Neophema pulchella</i>	Turquoise Parrot	
CUCULIDAE		
<i>Cuculus saturatus</i>	Oriental Cuckoo	
<i>Cuculus pallidus</i>	Pallid Cuckoo	
<i>Cacomantis variolosus</i>	Brush Cuckoo	
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo	R
<i>Chrysococcyx osculans</i>	Black-eared Cuckoo	
<i>Chrysococcyx basalis</i>	Horsefields Bronze-cuckoo	
<i>Chrysococcyx lucidus</i>	Shining Bronze-cuckoo	R
<i>Chrysococcyx minutillus</i>	Little Bronze-cuckoo	
<i>Eudynamys scolopacea</i>	Common Koel	
<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo	R
CENTROPODIDAE		
<i>Centropus phasianinus</i>	Pheasant Coucal	
STRIGIDAE		
<i>Ninox strenua</i>	Powerful Owl	
<i>Ninox connivens</i>	Barking Owl	
<i>Ninox novaeseelandiae</i>	Southern Boobook Owl	
TYTONIDAE		
<i>Tyto tenebricosa</i>	Sooty Owl	
<i>Tyto novaehollandiae</i>	Masked Owl	
<i>Tyto capensis</i>	Grass Owl	
<i>Tyto alba</i>	Barn Owl	
PODARGIDAE		
<i>Podargus strigoides</i>	Tawny Frogmouth	R
CAPRIMULGIDAE		
<i>Eurostopodus mystacalis</i>	White-throated Nightjar	
AEGOTHELIDAE		
<i>Aegotheles cristatus</i>	Owlet-nightjar	
APODIDAE		
<i>Hirundapus caudacutus</i>	Spine-tailed Swift	
<i>Apus pacificus</i>	Fork-tailed Swift	
ALCEDINIDAE		
<i>Alcedo azurea</i>	Azure Kingfisher	
HALCYONIDAE		
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	R
<i>Halcyon macleayii</i>	Forest Kingfisher	
<i>Todiramphus sanctus</i>	Sacred Kingfisher	R
MEROPIDAE		
<i>Merops ornatus</i>	Rainbow Bee-eater	
CORACIIDAE		
<i>Eurystomus orientalis</i>	Dollarbird	R
CLIMACTERIDAE		
<i>Cormobates leucophaeus</i>	White-throated Treecreeper	
<i>Climacteris erythropis</i>	Red-browed Treecreeper	
<i>Climacteris picumnus</i>	Brown Treecreeper	
MALURIDAE		
<i>Malurus cyaneus</i>	Superb Fairy-wren	R

Scientific Name	Common Name	
<i>Malurus lamberti</i>	Variegated Fairy-wren	R
<i>Stipiturus malachurus</i>	Southern Emu-wren	
PARDALOTIDAE		
<i>Pardalotus punctatus</i>	Spotted Pardalote	R
<i>Pardalotus striatus</i>	Striated Pardalote	R
<i>Sericornis citreogularis</i>	Yellow-throated Scrubwren	
<i>Sericornis frontalis</i>	White-browed Scrubwren	R
<i>Sericornis magnirostris</i>	Large-billed Scrubwren	
<i>Hylacola pyrrhopygia</i>	Chestnut-rumped Heathwren	
<i>Chthonicola sagittata</i>	Speckled Warbler	
<i>Smicrornis brevirostris</i>	Weebill	
<i>Gerygone mouki</i>	Brown Warbler	
<i>Gerygone olivacea</i>	White-throated Warbler	R
<i>Acanthiza pusilla</i>	Brown Thornbill	R
<i>Acanthiza reguloides</i>	Buff-rumped Thornbill	
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	R
<i>Acanthiza nana</i>	Yellow Thornbill	R
<i>Acanthiza lineata</i>	Striated Thornbill	R
MELIPHAGIDAE		
<i>Anthochaera carunculata</i>	Red Wattlebird	R
<i>Anthochaera chrysoptera</i>	Little Wattlebird	
<i>Plectorhyncha laceolata</i>	Striped Honeyeater	
<i>Philemon corniculatus</i>	Noisy Friarbird	R
<i>Xanthomyza phrygia</i>	Regent Honeyeater	
<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater	
<i>Manorina melanophrys</i>	Bell Miner	
<i>Manorina melanocephala</i>	Noisy Miner	R
<i>Meliphaga lewinii</i>	Lewins Honeyeater	R
<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater	R
<i>Lichenostomus virescens</i>	Singing Honeyeater	
<i>Lichenostomus melanops</i>	Yellow-tufted Honeyeater	
<i>Lichenostomus fuscus</i>	Fuscous Honeyeater	
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater	
<i>Melithreptus gularis</i>	Black-chinned Honeyeater	
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater	R
<i>Melithreptus lunatus</i>	White-naped Honeyeater	R
<i>Lichmera indistincta</i>	Brown Honeyeater	R
<i>Grantiella picta</i>	Painted Honeyeater	
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	
<i>Phylidonyris nigra</i>	White-cheeked Honeyeater	
<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill	R
<i>Myzomela sanguinolenta</i>	Scarlet Honeyeater	R
<i>Epthianura albifrons</i>	White-fronted Chat	
PETROICIDAE		
<i>Microeca fascians</i>	Jacky Winter	
<i>Petroica multicolor</i>	Scarlet Robin	
<i>Petroica rosea</i>	Rose Robin	R
<i>Eopsaltria australis</i>	Eastern Yellow Robin	
ORTHONYCHIDAE		
<i>Orthonyx temminckii</i>	Logrunner	
POMATOSTOMIDAE		
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler	
<i>Pomatostomus superciliosus</i>	White-browed Babbler	
CINCLOSOMATIDAE		
<i>Psophodes olivaceus</i>	Eastern Whipbird	
<i>Cinclosoma punctatum</i>	Spotted Quail-thrush	
NEOSITTIDAE		

Scientific Name	Common Name	
<i>Daphoenositta chrysoptera</i>	Varied Sittella	
PACHYCEPHALIDAE		
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	R
<i>Falcunculus frontatus</i>	Crested Shrike-tit	
<i>Pachycephala pectoralis</i>	Golden Whistler	R
<i>Pachycephala rufiventris</i>	Rufous Whistler	R
DICRURIDAE		
<i>Monarcha melanopsis</i>	Black-faced Monarch	
<i>Myiagra rubecula</i>	Leaden Flycatcher	
<i>Myiagra inquieta</i>	Restless Flycatcher	
<i>Grallina cyanoleuca</i>	Magpie-lark	R
<i>Rhipidura rufifrons</i>	Rufous Fantail	
<i>Rhipidura fuliginosa</i>	Grey Fantail	R
<i>Rhipidura leucophrys</i>	Willy Wagtail	R
<i>Dicrurus bracteatus</i>	Spangled Drongo	
CAMPEPHAGIDAE		
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	R
<i>Coracina papuensis</i>	White-bellied Cuckoo-shrike	
<i>Coracina tenuirostris</i>	Cicadabird	
<i>Lalage sueurii</i>	White-winged Triller	
ORIOOLIDAE		
<i>Oriolus sagittatus</i>	Olive-backed Oriole	R
<i>Sphecotheres viridis</i>	Figbird	R
ARTAMIDAE		
<i>Artamus leucorhynchus</i>	White-breasted Woodswallow	
<i>Artamus personatus</i>	Masked Woodswallow	
<i>Artamus superciliosus</i>	White-browed Woodswallow	
<i>Artamus cyanopterus</i>	Dusky Woodswallow	
<i>Artamus minor</i>	Little Woodswallow	
<i>Cracticus torquatus</i>	Grey Butcherbird	R
<i>Cracticus nigrogularis</i>	Pied Butcherbird	R
<i>Gymnorhina tibicen</i>	Australian Magpie	R
<i>Strepera graculina</i>	Pied Currawong	R
<i>Strepera versicolor</i>	Grey Currawong	
CORVIDAE		
<i>Corvus coronoides</i>	Australian Raven	R
<i>Corvus tasmanicus</i>	Forest Raven	
<i>Corvus mellori</i>	Little Raven	
<i>Corvus orru</i>	Torresian Crow	
CORCORACIDAE		
<i>Corcorax melanorhamphos</i>	White-winged Chough	
PTILONORHYNCHIDAE		
<i>Ailuroedus crassirostris</i>	Green Catbird	
<i>Sericulus chrysocephalus</i>	Regent Bowerbird	
<i>Ptilonorhynchus violaceus</i>	Satin Bowerbird	
ALAUDIDAE		
<i>Mirafrja javanica</i>	Singing Bushlark	
<i>Alauda arvensis*</i>	Skylark	
MOTACILLIDAE		
<i>Anthus novaeseelandiae</i>	Richards Pipit	
PASSERIDAE		
<i>Passer domesticus*</i>	House Sparrow	
<i>Taeniopygia guttata</i>	Zebra Finch	
<i>Taeniopygia bichenovii</i>	Double-barred Finch	R
<i>Neochmia temporalis</i>	Red-browed Finch	R
<i>Stagonopleura guttata</i>	Diamond Firetail Finch	
<i>Lonchura punctulata*</i>	Nutmeg Mannikin	



Scientific Name	Common Name	
<i>Lonchura castaneothorax</i>	Chestnut-breasted Mannikin	
FRINGILLIDAE		
<i>Carduelis carduelis</i> *	European Goldfinch	
DICAEIDAE		
<i>Dicaeum hirundinaceum</i>	Mistletoebird	R
HIRUNDINIDAE		
<i>Hirundo neoxena</i>	Welcome Swallow	R
<i>Hirundo nigricans</i>	Tree Martin	
<i>Hirundo ariel</i>	Fairy Martin	
PYCNONOTIDAE		
<i>Pycnonotus jocosus</i> *	Red-whiskered Bulbul	
SYLVIIDAE		
<i>Acrocephalus stentoreus</i>	Clamorous Reed-warbler	R
<i>Megalurus timoriensis</i>	Tawny Grassbird	
<i>Megalurus gramineus</i>	Little Grassbird	
<i>Cincloramphus mathewsi</i>	Rufous Songlark	
<i>Cincloramphus cruralis</i>	Brown Songlark	
<i>Cisticola exilis</i>	Golden-headed Cisticola	
ZOSTEROPIDAE		
<i>Zosterops lateralis</i>	Silvereye	R
MUSCICAPIDAE		
<i>Zoothra heinei</i>	Russet-tailed Thrush	
<i>Zoothra lunulata</i>	Bassian Thrush	
<i>Turdus merula</i> *	Blackbird	
STURNIDAE		
<i>Sturnus vulgaris</i> *	Starling	R
<i>Acridotheres tristis</i> *	Indian Myna	R
<b><u>REPTILES</u></b>		
CHELUIDAE		
<i>Chelodina longicollis</i>	Long-necked Turtle	
<i>Emydura macquarii gunabarra</i>	Hunter River Turtle	
GEKKONIDAE		
<i>Diplodactylus vittatus</i>	Stone Gecko	
<i>Oedura lesueurii</i>	Lesueur's Velvet Gecko	
<i>Oedura robusta</i>	Robust Velvet Gecko	
<i>Phyllurus platurus</i>	Southern Leaf-tailed Gecko	
<i>Underwoodisaurus milii</i>	Thick-tailed Gecko	
PYGOPODIDAE		
<i>Delma plebeia</i>		
<i>Lialis burtonis</i>	Burton's Legless Lizard	
<i>Pygopus lepidopus</i>	Common Scaly-foot	
AGAMIDAE		
<i>Amphibolurus muricatus</i>	Jacky Lizard	
<i>Physignathus lesueurii</i>	Eastern Water Dragon	
<i>Pogona barbata</i>	Bearded Dragon	R
VARANIDAE		
<i>Varanus varius</i>	Lace Monitor	
SCINCIDAE		
<i>Acritoscincus platynotum</i>	Red-throated Skink	
<i>Anomalopus swansoni</i>		
<i>Anomalopus verreauxi</i>		
<i>Calyptotis ruficauda</i>		
<i>Carlia tetradactyla</i>		R
<i>Carlia vivax</i>		
<i>Cryptoblepharus virgatus</i>		
<i>Ctenotus robustus</i>	Robust Skink	R

Scientific Name	Common Name	
<i>Ctenotus taeniolatus</i>	Copper-tailed Skink	
<i>Cyclodomorphus casuarinae</i>	She-oak Skink	
<i>Egernia cunninghami</i>	Cunninghams Skink	
<i>Egernia major</i>	Land Mullet	
<i>Egernia mcphreei</i>		
<i>Egernia striolata</i>	Tree Skink	
<i>Egernia whitii</i>	Whites Skink	
<i>Eulamprus heatwolei</i>		
<i>Eulamprus quoyii</i>	Eastern Water Skink	R
<i>Eulamprus tenuis</i>	Yellow-bellied Skink	
<i>Hemiergis decresiensis</i>		
<i>Hemisphaeriodon gerrardii</i>	Pink Tongued Skink	
<i>Lampropholis caligula</i>		
<i>Lampropholis delicata</i>	Garden Skink	R
<i>Lampropholis guichenoti</i>	Garden Skink	
<i>Lygisaurus foliorum</i>		
<i>Morethia boulengeri</i>		
<i>Ophioscincus truncatus</i>		
<i>Pseudemoia entrecasteauxii</i>		
<i>Pseudemoia platynota</i>	Red-throated Skink	
<i>Saiphos equalis</i>	Three-toed Skink	
<i>Saproscincus challengeri</i>	Challengers Skink	
<i>Saproscincus mustelinus</i>	Weasel Skink	
<i>Tiliqua scincoides</i>	Blue-tongued Lizard	R
TYPHLOPIDAE		
<i>Ramphotyphlops nigrescens</i>		
<i>Ramphotyphlops proximus</i>		
<i>Ramphotyphlops wiedii</i>		
BOIDAE		
<i>Morelia spilota spilota</i>	Diamond Python	
COLUBRIDAE		
<i>Dendrelaphis punctulata</i>	Green Tree Snake	
ELAPIDAE		
<i>Acanthophis antarcticus</i>	Common Death Adder	
<i>Austrelaps superbus</i>	Copperhead	
<i>Cacophis krefftii</i>	Dwarf Crowned Snake	
<i>Cacophis squamulosus</i>	Golden Crowned Snake	
<i>Demansia psammophis</i>	Yellow-faced Whip Snake	
<i>Furina diadema</i>	Red-naped Snake	
<i>Hemiaspis signata</i>	Black-bellied Swamp Snake	
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	
<i>Notechis scutatus</i>	Tiger Snake	
<i>Pseudechis porphyriacus</i>	Red-bellied Black Snake	
<i>Pseudonaja textilis</i>	Eastern Brown Snake	
<i>Rhinoplocephalus nigrescens</i>	Eastern Small-eyed Snake	
<i>Vermicella annulata</i>	Bandy-bandy	
<b><u>FROGS</u></b>		
MYOBATRACHIDAE		
<i>Adelotus brevis</i>	Tusked Frog	
<i>Crinia signifera</i>	Brown Froglet	R
<i>Limnodynastes dumerilii</i>	Banjo Frog	
<i>Limnodynastes ornatus</i>	Ornate Burrowing Frog	
<i>Limnodynastes peronii</i>	Striped Marsh Frog	R
<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog	R
<i>Mixophyes fasciolatus</i>	Great Barred Frog	
<i>Mixophyes balbus</i>	Great Barred Frog	

	Scientific Name	Common Name	
	<i>Mixophyes iteratus</i>	Great Barred Frog	
	<i>Paracrinia haswelli</i>	Haswells Froglet	
	<i>Pseudophryne bibronii</i>	Bibron's Toadlet	
	<i>Pseudophryne coriacea</i>	Red-backed Toadlet	
	<i>Uperoleia fusca</i>	Dusky Toadlet	
	<i>Uperoleia laevigata</i>	Smooth Toadlet	R
	<i>Uperoleia rugosa</i>	Eastern Burrowing Toadlet	
	<i>Uperoleia tyleri</i>	Tyler's Toadlet	
HYLIDAE			
	<i>Litoria aurea</i>	Green and Golden Bell Frog	
	<i>Litoria caerulea</i>	Green Tree Frog	
	<i>Litoria dentata</i>	Bleating Tree Frog	R
	<i>Litoria fallax</i>	Dwarf Green Tree Frog	R
	<i>Litoria freycineti</i>	Freycinet's Frog	
	<i>Litoria gracilentia</i>	Dainty Tree Frog	
	<i>Litoria jervisiensis</i>	Heath Frog	
	<i>Litoria latopalmata</i>	Broad-palmed Frog	R
	<i>Litoria lesueuri</i>	Lesueur's Frog	
	<i>Litoria nasuta</i>	Rocket Frog	
	<i>Litoria peronii</i>	Peron's Tree Frog	R
	<i>Litoria phyllochroa</i>	Green Leaf Tree Frog	
	<i>Litoria tyleri</i>	Tyler's Tree Frog	
	<i>Litoria verreauxii</i>	Verreaux's Tree Frog	
<b><u>FISH</u></b>			
POECILIIDAE			
	<i>Gambusia holbrooki</i>	Mosquito Fish	R
ANGUILLIDAE			
	<i>Anguilla reinhardtii</i>	Marbled Eel	
	<i>Anguilla australis</i>	Short-finned Eel	

**APPENDIX – C****Site Visit Record**

Site: old brickworks site, Metford Road, Metford, NSW

Date	Time	Weather conditions	Activity
9.9.14	0800-1530	Part cloud, still, mild-warm	Flora and fauna observations, threatened plant search, koala survey, reptile search, koala search
11.9.14	0800-1600	Clear, light breeze, mild	Flora and fauna observations, threatened plant search, vegetation transects & plots, bird plots, reptile search, koala search
12.9.14	0800-1600	Part cloud, still, mild, later overcast with showers	Flora and fauna observations, threatened plant search, vegetation transects & plots, bird plot, reptile search, koala search
15.9.14	0800-1600	Part cloud, light breeze, warm	Set traps, flora and fauna observations
16.9.14	0700-2230	Light cloud, still, warm, evening clear, still, mild	Check traps, set traps, flora and fauna observations, vegetation transects & plots, day & night frog search, frog call playback, owl call playback, reptile search, spotlighting, bat call collection
17.9.14	0700-1530	Light cloud, light breeze, mild	Check traps, set traps, flora and fauna observations, koala survey, threatened plant search, reptile search
18.9.14	0700-1500	Clear, light breeze, mild to warm	Check traps, flora and fauna observations, koala search, reptile search, threatened plant search, hollow bearing tree survey
19.9.14	0700-1500	Light cloud, light breeze, mild-warm	Check traps, pull in traps (not hair tubes), flora and fauna observations, threatened plant search, hollow bearing tree survey
23.9.14	0700-1600	Clear, still, warm	Set traps, check and pull in hair traps, flora and fauna observations, bat call detecting, reptile search
24.9.14	0700-2400	Clear, still, warm	Check traps, flora and fauna observations, collect bat call detectors, threatened plant search, reptile search, frog search, spotlighting, bat call detecting, night frog search, frog call playback, owl call playback
25.9.14	0800-1600	Light cloud, light breeze, warm	Check harp traps, pull in traps, collect cameras, flora and fauna observations

## APPENDIX - D

## Vegetation Transects and Plots

All vascular plant species observed along and within a few metres of each transect and within each plot are recorded in **Appendix A**. The locations of each transect and plot is indicated in a Figure of this report.

### Transect - A

<b>Identification:</b>	TA	<b>Date:</b>	12.9.14	<b>Length:</b>	~ 220m
<b>Location:</b>	Through forest in south-west portion of site (see Fig)				
<b>Landform:</b>	Slope				
<b>Aspect:</b>	northerly				
<b>Vegetation:</b>	Spotted Gum Ironbark Forest				
<b>Disturbance:</b>	Partial clearing, old tracks, old earthworks, rubbish, weeds				
<b>Comments:</b>	Transect runs across shallow drainage depression that is infested with Privet				

### Transect - B

<b>Identification:</b>	TB	<b>Date:</b>	11.9.14	<b>Length:</b>	~ 170m
<b>Location:</b>	Through forest in south-west portion of site (see Fig)				
<b>Landform:</b>	Slope				
<b>Aspect:</b>	westerly				
<b>Vegetation:</b>	Spotted Gum Ironbark Forest				
<b>Disturbance:</b>	Partial clearing, tracks, old earthworks, rubbish, weeds				
<b>Comments:</b>	This area of vegetation appears in relatively good condition				

### Transect - C

<b>Identification:</b>	TC	<b>Date:</b>	11.9.14	<b>Length:</b>	~ 190m
<b>Location:</b>	Through forest in south-east portion of site (see Fig)				
<b>Landform:</b>	Slope and shallow depression				
<b>Aspect:</b>	North-westerly				
<b>Vegetation:</b>	Spotted Gum Ironbark Forest				
<b>Disturbance:</b>	Partial clearing, weeds				
<b>Comments:</b>	This area of vegetation appears in relatively good condition				

**Transect - D**

<b>Identification:</b>	TD	<b>Date:</b>	11.9.14	<b>Length:</b>	~ 230m
<b>Location:</b>	Through forest in south-east portion of site (see Fig)				
<b>Landform:</b>	Slope				
<b>Aspect:</b>	North-easterly				
<b>Vegetation:</b>	Spotted Gum Ironbark Forest and Red Gum Forest				
<b>Disturbance:</b>	Partial clearing, fencing, weeds, rubbish & tracks				
<b>Comments:</b>	This area of vegetation appears in relatively good condition				

**Transect - E**

<b>Identification:</b>	TE	<b>Date:</b>	11.9.14	<b>Length:</b>	~ 200m
<b>Location:</b>	Through forest in north-east portion of site (see Fig)				
<b>Landform:</b>	Slope and shallow depression				
<b>Aspect:</b>	Northerly				
<b>Vegetation:</b>	Red Gum Forest				
<b>Disturbance:</b>	Partial clearing, earthworks, weeds, rubbish, tracks				
<b>Comments:</b>	Much of this area appears to have been heavily disturbed				

**Transect - F**

<b>Identification:</b>	TF	<b>Date:</b>	11.9.14	<b>Length:</b>	~ 240m
<b>Location:</b>	Through central portion of site (see Fig)				
<b>Landform:</b>	Flats and ponds				
<b>Aspect:</b>	No particular				
<b>Vegetation:</b>	Rehabilitation area, mostly grass and herb weeds, wetland plants				
<b>Disturbance:</b>	Complete clearing, highly disturbed, earthworks, man-made ponds, tracks, rubbish, weeds, replanting				
<b>Comments:</b>	Many of the “native” plants appear to be rehabilitation planting				

**Transect - G**

<b>Identification:</b>	TG	<b>Date:</b>	16.9.14	<b>Length:</b>	~ 170m
<b>Location:</b>	Through central portion of site (see Fig)				
<b>Landform:</b>	Flats and ponds				
<b>Aspect:</b>	No particular				
<b>Vegetation:</b>	Rehabilitation area, mostly grass and herb weeds, wetland plants				
<b>Disturbance:</b>	Complete clearing, highly disturbed, earthworks, man-made ponds, tracks, rubbish, weeds, replanting				
<b>Comments:</b>	Many of the “native” plants appear to be rehabilitation planting				



### Transect - H

<b>Identification:</b>	TH	<b>Date:</b>	16.9.14	<b>Length:</b>	~ 190m
<b>Location:</b>	Through forest in north-east portion of site (see Fig)				
<b>Landform:</b>	Disturbed land and ponds				
<b>Aspect:</b>	No particular				
<b>Vegetation:</b>	Red Gum Forest				
<b>Disturbance:</b>	Partial clearing, highly disturbed, earthworks, man-made ponds, tracks, rubbish, weeds, replanting				
<b>Comments:</b>	This area appears to be rehabilitated disturbed land; spoil of mixed soils				

### Plot - 1

Identification	P1		Date	12.9.14	
Location on site	In forest in south-west portion of site (see Fig)				
Plot size	20 x 20m (400m <sup>2</sup> )		Terrain slope	Gentle	
Landform element	slope				
Aspect	Northerly		Soil	Sandy, clay, loam	
Elevation (asl)	~ 25m		Erosion	None obvious	
Surface fragments	Cobbles and pebbles				
Disturbance	Partial clearing, old earthworks, rubbish, weeds				
Weeds	Kikuyu, Lantana, Small-leaved Privet				
Vegetation type	Forest				
Overstorey	Height	~ 25m		% cover	~ 60 %
Dominants -		Spotted Gum			
Understorey	Height	~ 5m		% cover	~ 20 %
Dominants -		Blackthorn, immatures of overstorey			
Groundcover	Height	~ 0.4m		% cover	~ 60 %
Dominants -		Entolasia stricta, Common Silkpod			
Comments	This forest area in relatively good condition				

**Plot - 2**

<b>Identification</b>	P2	<b>Date</b>	11.9.14
<b>Location on site</b>	In forest in south-west portion of site (see Fig)		
<b>Plot size</b>	20 x 20m (400m <sup>2</sup> )	<b>Terrain slope</b>	Gentle
<b>Landform element</b>	Slope		
<b>Aspect</b>	Westerly	<b>Soil</b>	Sandy, clay, loam
<b>Elevation (asl)</b>	~ 29m	<b>Erosion</b>	None obvious
<b>Surface fragments</b>	Roots, leaves & sticks		
<b>Disturbance</b>	Partial clearing, weeds		
<b>Weeds</b>	Lantana		
<b>Vegetation type</b>	Forest		
<b>Overstorey</b>	<b>Height</b>	~ 20m	<b>% cover</b> ~ 80 %
Dominants -	Spotted Gums		
<b>Understorey</b>	<b>Height</b>	~ 2m	<b>% cover</b> < 70 %
Dominants -	Blackthorn		
<b>Groundcover</b>	<b>Height</b>	~ 0.3m	<b>% cover</b> ~ 60 %
Dominants -	<i>Entolasia stricta</i> , <i>Ptilothryx deusta</i>		
<b>Comments</b>	This forest area in relatively good condition		

**Plot - 3**

<b>Identification</b>	P3	<b>Date</b>	11.9.14
<b>Location on site</b>	South-east edge of site		
<b>Plot size</b>	20 x 20m (400m <sup>2</sup> )	<b>Terrain slope</b>	gentle
<b>Landform element</b>	slope		
<b>Aspect</b>	North-westerly	<b>Soil</b>	Sandy, clay, loam
<b>Elevation (asl)</b>	~ 21m	<b>Erosion</b>	None obvious
<b>Surface fragments</b>	Roots, leaves & sticks		
<b>Disturbance</b>	Partial clearing, weeds		
<b>Weeds</b>	Lantana		
<b>Vegetation type</b>	Forest		
<b>Overstorey</b>	<b>Height</b>	~ 18m	<b>% cover</b> ~ 40 %
Dominants -	Spotted Gum, Bastard Mahogany		
<b>Understorey</b>	<b>Height</b>	~ 4m	<b>% cover</b> ~ 30 %
Dominants -	<i>Melaleuca nodosa</i>		
<b>Groundcover</b>	<b>Height</b>	~ 0.5m	<b>% cover</b> < 70 %
Dominants -	<i>Entolasia stricta</i>		
<b>Comments</b>	This forest area in relatively good condition		

**Plot - 4**

<b>Identification</b>	P4	<b>Date</b>	11.9.14
<b>Location on site</b>	South-east corner of site		
<b>Plot size</b>	20 x 20m (400m <sup>2</sup> )	<b>Terrain slope</b>	Gentle
<b>Landform element</b>	Slope		
<b>Aspect</b>	North-easterly	<b>Soil</b>	Sandy, clay, loam
<b>Elevation (asl)</b>	~ 16m	<b>Erosion</b>	None obvious
<b>Surface fragments</b>	Roots, leaves & sticks		
<b>Disturbance</b>	Partial clearing, weeds		
<b>Weeds</b>	Flatweed		
<b>Vegetation type</b>	Forest		
<b>Overstorey</b>	<b>Height</b>	~ 20m	<b>% cover</b> ~ 70 %
Dominants -	Spotted Gum		
<b>Understorey</b>	<b>Height</b>	~ 2m	<b>% cover</b> < 10 %
Dominants -	Falcate Wattle, <i>Acacia elongata</i>		
<b>Groundcover</b>	<b>Height</b>	~ 0.6m	<b>% cover</b> ~ 70 %
Dominants -	Kangaroo Grass		
<b>Comments</b>	This forest area in relatively good condition		

**Plot - 5**

<b>Identification</b>	P5	<b>Date</b>	11.9.14
<b>Location on site</b>	Centre north-east of site		
<b>Plot size</b>	20 x 20m (400m <sup>2</sup> )	<b>Terrain slope</b>	Gentle
<b>Landform element</b>	Slope		
<b>Aspect</b>	Northerly	<b>Soil</b>	Sandy, clay, loam
<b>Elevation (asl)</b>	~ 16m	<b>Erosion</b>	None obvious
<b>Surface fragments</b>	Cobbles, pebbles, sticks		
<b>Disturbance</b>	Partial clearing, earthworks, weeds		
<b>Weeds</b>	Lantana		
<b>Vegetation type</b>	Forest		
<b>Overstorey</b>	<b>Height</b>	~ 15m	<b>% cover</b> ~ 70 %
Dominants -	Forest Red Gum		
<b>Understorey</b>	<b>Height</b>	~ 3m	<b>% cover</b> ~ 60 %
Dominants -	Blackthorn		
<b>Groundcover</b>	<b>Height</b>	~ 0.6m	<b>% cover</b> < 50 %
Dominants -	Kangaroo Grass, Weeping Grass		
<b>Comments</b>			

### Plot - 6

<b>Identification</b>	P6	<b>Date</b>	11.9.14
<b>Location on site</b>	Centre of site		
<b>Plot size</b>	20 x 20m (400m <sup>2</sup> )	<b>Terrain slope</b>	Level
<b>Landform element</b>	Flats		
<b>Aspect</b>	No particular	<b>Soil</b>	Mixed, disturbed
<b>Elevation (asl)</b>	~ 12m	<b>Erosion</b>	Heavily disturbed land
<b>Surface fragments</b>	Cobbles & pebbles		
<b>Disturbance</b>	Complete clearing of natural vegetation, highly disturbed, earthworks, weeds		
<b>Weeds</b>	Many, Rhodes Grass and Guinea Grass		
<b>Vegetation type</b>	Rehabilitation area		
<b>Overstorey</b>	<b>Height</b>	~ 5m	<b>% cover</b> < 10 %
Dominants -	<i>Angophora bakeri</i>		
<b>Understorey</b>	<b>Height</b>	~ 2m	<b>% cover</b> < 20 %
Dominants -	<i>Acacia parvipinnula</i> , <i>Acacia elongata</i>		
<b>Groundcover</b>	<b>Height</b>	~ 0.8m	<b>% cover</b> ~ 100 %
Dominants -	Rhodes Grass, Guinea Grass		
<b>Comments</b>	A highly disturbed area		

### Plot - 7

<b>Identification</b>	P7	<b>Date</b>	16.9.14
<b>Location on site</b>	Centre of site		
<b>Plot size</b>	20 x 20m (400m <sup>2</sup> )	<b>Terrain slope</b>	Level
<b>Landform element</b>	Flats		
<b>Aspect</b>	No particular	<b>Soil</b>	Silt & gravel
<b>Elevation (asl)</b>	~ 11m	<b>Erosion</b>	None obvious
<b>Surface fragments</b>	Boulders, cobbles and pebbles		
<b>Disturbance</b>	Complete clearing of natural vegetation, highly disturbed, earthworks, man-made pond, weeds		
<b>Weeds</b>	Whisky Grass, Carpet Grass		
<b>Vegetation type</b>	Rehabilitation area		
<b>Overstorey</b>	<b>Height</b>	~ 6m	<b>% cover</b> ~ 20 %
Dominants -	Forest Red Gum		
<b>Understorey</b>	<b>Height</b>	~ 2m	<b>% cover</b> ~ 20 %
Dominants -	<i>Acacia elongata</i> , <i>Acacia parvipinnula</i>		
<b>Groundcover</b>	<b>Height</b>	~ 0.3m	<b>% cover</b> < 20 %
Dominants -	<i>Entolasia stricta</i> , Carpet Grass		
<b>Comments</b>	A highly disturbed area		

### Plot - 8

<b>Identification</b>	P8	<b>Date</b>	16.9.14
<b>Location on site</b>	South-east centre of site		
<b>Plot size</b>	20 x 20m (400m <sup>2</sup> )	<b>Terrain slope</b>	Level
<b>Landform element</b>	Flats		
<b>Aspect</b>	No particular	<b>Soil</b>	mixed
<b>Elevation (asl)</b>	~ 18m	<b>Erosion</b>	None obvious
<b>Surface fragments</b>	Cobbles & pebbles		
<b>Disturbance</b>	Complete clearing of natural vegetation, earthworks, rubbish, weeds		
<b>Weeds</b>	Couch, Whisky Grass, Rhodes Grass		
<b>Vegetation type</b>	Rehabilitation area		
<b>Overstorey</b>	<b>Height</b>	None	<b>% cover</b> NA
Dominants -	None		
<b>Understorey</b>	<b>Height</b>	~ 2m	<b>% cover</b> < 10 %
Dominants -	<i>Acacia parvipinnula</i>		
<b>Groundcover</b>	<b>Height</b>	~ 0.4m	<b>% cover</b> ~ 90 %
Dominants -	Couch, Whisky Grass, Rhodes Grass		
<b>Comments</b>	Cleared, heavily disturbed, rehabilitation area		

### Plot - 9

<b>Identification</b>	P9	<b>Date</b>	16.9.14
<b>Location on site</b>	North centre edge of site (see Fig)		
<b>Plot size</b>	20 x 20m (400m <sup>2</sup> )	<b>Terrain slope</b>	Level
<b>Landform element</b>	Bunding between ponds		
<b>Aspect</b>	No particular	<b>Soil</b>	Mixed soil
<b>Elevation (asl)</b>	~ 12m	<b>Erosion</b>	Mild at edges
<b>Surface fragments</b>	Cobbles and pebbles		
<b>Disturbance</b>	Cleared, heavily disturbed, man-made ponds, track, weeds		
<b>Weeds</b>	Rhodes Grass, Lantana		
<b>Vegetation type</b>	Forest		
<b>Overstorey</b>	<b>Height</b>	~ 8m	<b>% cover</b> ~ 20 %
Dominants -	Forest Red Gum, Swamp She-oak		
<b>Understorey</b>	<b>Height</b>	~ 3m	<b>% cover</b> ~ 50 %
Dominants -	Blackthorn, Lantana		
<b>Groundcover</b>	<b>Height</b>	~ 0.5m	<b>% cover</b> < 50 %
Dominants -	Rhodes Grass, Couch		
<b>Comments</b>	A heavily disturbed area		

The following matters are here addressed –

1. Matters of Regional Significance (Murray *et al*, 2002, p15)
2. Matters of Local Significance (Murray *et al*, 2002, p16)

---

## **1.0 Matters of Regional Significance**

### **1.1 Regionally Significant Species**

Regionally significant plant species are listed in the Flora and Fauna Survey Guidelines, Lower Hunter, (Murray *et al*, 2002).

Species of regional significance recorded on the site were –

#### Flora

<i>Triglochin microtuberosum</i>	Water Ribbons
----------------------------------	---------------

#### Fauna

<i>Calyptohynchus funereus</i>	Yellow-tailed Black Cockatoo
<i>Macropus giganteus</i>	Eastern Grey Kangaroo
<i>Vespadelus pumillus</i>	Eastern Forest Bat
<i>Pogona barbata</i>	Eastern Bearded Dragon
<i>Carlia tetradactyla</i>	Southern Rainbow Skink
<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog

Water Ribbons was recorded on a man-made pond in the centre east of the site located on a drainage line running from south to north through the site. Habitat for this species will likely be conserved on the site.

Much of the existing forest vegetation and some of the wetlands will be retained on the site as forage, refuge and breeding habitat for the Yellow-tailed Black Cockatoo, Eastern Grey Kangaroo, Eastern Forest Bat, Eastern Bearded Dragon, Southern Rainbow Skink and Spotted Marsh Frog.

The proposed development is unlikely to have a significant impact on matters of regional significance.

### **1.2 Vegetation communities that have been “heavily cleared”**

The following “heavily cleared vegetation community” listed in Appendix 5.7 (Murray *et al*, 2002) may occur on the site.

Hunter Lowland Redgum Forest (MU 19)

Trees representative of this vegetation community are found on the site. Some portions of this vegetation community are heavily disturbed and some areas of this vegetation community may



now be represented by replanting for site rehabilitation purposes. Parts of this vegetation community will be retained and conserved on the site.

### **1.3 Vegetation communities of less than 1000ha in extent**

None of the “vegetation communities of less than 1000 ha extent” listed in Appendix 5.8 (Murray *et al*, 2002) are found on the site.

### **1.4 Habitat corridors**

Aerial photographs show that vegetation in the local region is heavily fragmented by clearing for farm land, roads, rail lines, powerline easements, residential development etc.

Local corridors of vegetation, connecting native vegetation on the site to extensive areas of native vegetation south of the site, are interrupted and tenuous.

A corridor of vegetation can be retained along the south edge of the site as a corridor for the movement of native fauna such as Squirrel Gliders between remnants of native vegetation on the west and east portions of the site.

### **1.5 Impacts on rainforest vegetation, riparian vegetation and coastal wetlands**

This site does not support rainforest vegetation or coastal wetlands.

## **2.0 Matters of Local Significance**

---

### **2.1 Unique vegetation associations**

No unique vegetation associations are found on this site.

### **2.2 Significant habitat areas**

Investigation and survey work for this report found Squirrel Gliders (*Petaurus norfolkensis*) in forest vegetation on the west portion of the site. Squirrel Gliders were not observed elsewhere on the site but they are likely to use forest vegetation on the east portion of the site. Much of the existing native forest vegetation on the west and east portions of the site, including a number of hollow bearing trees, will be retained as habitat for Squirrel Gliders.

### **2.3 Habitat trees**

The site does support a number of trees bearing cracks, fissures and hollows that may provide refuge, den, nest and breeding habitat for a number of smaller common and threatened species such as insectivorous bats and Squirrel Gliders. The locations and coordinates of these hollow bearing trees are indicated in Figures and Appendices of this report.

Hollow bearing trees will be retained on the site in retained vegetation.

### **2.4 Specific local population centres of threatened species**

The site is not part of an area that is considered a specific local population centre for a particular threatened species.

### **2.5 Unique geological areas**

The site is not considered a unique geological feature and is not adjacent to or near a unique geological feature.

## **2.6 Local corridor areas**

Aerial photographs show that vegetation on the site is not part of a broad corridor of native vegetation connecting similar vegetation elsewhere in the local region.

A habitat corridor of existing and planted native vegetation will be retained along the south edge of this site.

## **2.7 Significant wetlands**

The site does not support a significant wetland nor is the site part of a SEPP 14 Coastal Wetland.

## **2.8 Local “icon” species or areas**

The site does not support a local icon species or area.

## **2.9 Vegetation communities of “Local Conservation Significance”**

Both vegetation communities on the site (**Fig-3**) are identified as endangered ecological communities and as such are dealt with elsewhere in this report.

Under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) an action will require approval from the Australian Government Environment Minister if the action has, will have or is likely to have, a significant impact on a matter of National Environmental Significance.

This component of the report will be guided by the Matters of National Environmental Significance – “Significant Impact Guidelines”, 1.1 Environment Protection and Biodiversity Conservation Act 1999.

**The matters of national environmental significance are:**

- World Heritage Properties
- National Heritage Places
- Wetlands of International Importance (Ramsar wetland)
- Nationally Threatened Species and Ecological Communities
- Migratory species (protected under international agreements ie CAMBA & JAMBA)
- Commonwealth Marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mining)
- A water resource, in relation to coal seam gas development and large coal mining development

**An EPBC Act Protected Matters Report was generated using the EPBC Act Protected Matters Search Tool on the Department of the Environment and Heritage web site.**

**Report created:** 21<sup>st</sup> September 2014  
**Search Type:** Point  
**Buffer:** 10 km  
**Coordinates:** -32.75947 151.6077

**Summary**

<b>World Heritage Properties:</b>	<b>None</b>
<b>National Heritage Places:</b>	<b>1</b>
<b>Wetlands of International Importance (Ramsar wetland):</b>	<b>1</b>
<b>Commonwealth Marine Areas:</b>	<b>None</b>
<b>Threatened Ecological Communities:</b>	<b>1</b>
<b>Threatened Species:</b>	<b>28</b>
<b>Migratory Species:</b>	<b>32</b>

## **a) World Heritage Properties**

---

### *Significant Impact Criteria*

An action is likely to have a significant impact on the World Heritage values of a declared **World Heritage property** if there is a real chance or possibility that it will cause:

- one or more of the World Heritage values to be lost
- one or more of the World Heritage values to be degraded or damaged
- one or more of the World Heritage values to be notably altered, modified, obscured or diminished

### *Response to criteria*

The site is not part of, adjacent to or within 10km of a World Heritage Property. The proposed development / action is unlikely to have a significant impact on World Heritage values.

## **b) National Heritage Places**

---

### *Significant Impact Criteria*

An action is likely to have a significant impact on the National Heritage values of a **National Heritage place** if there is a real chance or possibility that it will cause:

- one or more of the National Heritage values to be lost
- one or more of the National Heritage values to be degraded or damaged
- one or more of the National Heritage values to be notably altered, modified, obscured or diminished

### *Response to criteria*

**St Peters Anglican Church Group**, found on William St, East Maitland, is located over two kilometres (2km) north-west of the old brickworks site at Metford Rd, Metford.

The proposed development / action is unlikely to have a significant impact on National Heritage values.

## **c) Wetlands of International Importance (Ramsar wetland)**

---

### *Significant Impact Criteria*

An action is likely to have a significant impact on the ecological character of a declared **Ramsar wetland** if there is a real chance or possibility that it will result in:

- areas of the wetland being destroyed or substantially modified
- a substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration, and frequency of ground and surface water flows to and within the wetland
- the habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected
- a substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health, or
- an invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.

### *Response to criteria*

The site is located within 10km of a Ramsar wetland. The **Hunter Estuary Wetlands** are found greater than 8km directly to the south-east of the old brickworks, Metford Rd, Metford site. Surface water flow from the site will likely flow northwards through shallow heavily vegetated wetlands of the East Maitland Common then via Four

Mile Creek northwards into the Hunter River, about 5km north-east of the site. The river then meanders a further greater than 25km east and southwards to the Hunter Estuary Wetlands.

The proposed development / action is unlikely to have a significant impact on a Wetland of International Importance (Ramsar wetland).

#### **d) Commonwealth Marine Areas**

---

Note - the Commonwealth marine area is any part of the sea, including the waters, seabed, and airspace, within Australia's exclusive economic zone and/or over the continental shelf of Australia, that is not State or Northern Territory waters. The Commonwealth marine area stretches from 3 to 200 nautical miles from the coast.

##### *Significant Impact Criteria*

An action is likely to have a significant impact on the environment in a **Commonwealth Marine area** if there is a real chance or possibility that it will:

- result in a known or potential pest species becoming established in the Commonwealth marine area
- modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in a Commonwealth Marine area results
- have a substantial adverse effect on a population of a marine species or cetacean including its life cycle (for example, breeding, feeding, migration behavior, life expectancy) and spatial distribution
- result in a substantial change in air quality or water quality (including temperature) which may adversely impact on biodiversity, ecological integrity; social amenity or human health
- result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected, or
- have a substantial adverse impact on heritage values of the Commonwealth Marine area, including damage or destruction of an historic shipwreck.

##### *Response to criteria*

The site is not part of, adjacent to or within 10km of a Commonwealth Marine area. The proposed development / action is unlikely to have a significant impact on a Commonwealth Marine area.

#### **e) Threatened Ecological Communities**

---

##### *Significant Impact Criteria*

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
- fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines
- adversely affect habitat critical to the survival of an 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
- 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
- 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 mobilization of fertilizers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of a species in the ecological community, or

- interfere with the recovery of an ecological community.

#### *Response to criteria*

The site is not part of a critically endangered or endangered ecological community identified as **White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland**. The proposed development / action is unlikely to have a significant impact on a critically endangered or endangered ecological community.

#### **f) Threatened species**

---

##### *Significant Impact Criteria*

An action is likely to have a significant impact on a **critically endangered or endangered species** if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of a population
- reduce the area of occupancy of the species
- fragment an existing population into two or more populations
- adversely affect habitat critical to the survival of a species
- disrupt the breeding cycle of a population
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species habitat
- introduce disease that may cause the species to decline, or
- interfere with the recovery of the species.

#### *Response to criteria*

42 threatened species under the EPBC Act are known for the local region within 10km of the study site.

Listed Threatened Species of flora or fauna for which there is potential habitat on the site and that are likely to be recorded on or near the study site include:

<b>Birds</b>		
<i>Xanthomyza Phrygia</i>	Regent Honeyeater	Endangered
<b>Frogs</b>		
<i>Litoria aurea</i>	Green and Golden Bell Frog	Vulnerable
<b>Mammals</b>		
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Vulnerable
<b>Plants</b>		
<i>Acacia bynoeana</i>	Bynoe's Wattle	Vulnerable
<i>Grevillea parviflora ssp parviflora</i>	Small-flower Grevillea	Vulnerable
<i>Persicaria elatior</i>	Knotweed	Vulnerable
<i>Rutidosia heterogama</i>	Heath Wrinklewort	Vulnerable
<i>Tetratheca juncea</i>	Black-eyed Susan	Vulnerable

The Regent Honeyeater visits the coast during times of forage resource shortage in its normal inland NSW range and potentially forage in flowering eucalypts on the site. The proposed development is unlikely to significantly affect this species as much of the existing native forest vegetation will be retained on the site as forage habitat for this species.

Green and Golden Bell Frogs (*Litoria aurea*) could potentially be found in the man-made ponds and wetlands on the site. However, this frog was not recorded on the site during recent survey. The proposed development is unlikely to significantly affect this species, some of the ponds and wetlands will be retained on the site as habitat for this species.



Grey-headed Flying-foxes (*Pteropus poliocephalus*) are likely to use flowering eucalypt trees on the site as forage habitat. No roost “camp” of this species was found or observed on the site or adjacent areas. This species is likely to forage on blossoms in flowering eucalypt trees on the site but roosts in a day time “camp” elsewhere in the local region. Considering that many existing eucalypt trees will be retained in native forest vegetation on the site the proposed development is unlikely to have a significant impact on this species.

No EPBC Act listed threatened plants were found on the site during threatened plant surveys across the site. These flora species are addressed elsewhere in this report resulting in further survey during the flowering period of these plants being conducted across the site. Considering that much of the habitat for these plants will be retained on the site the proposed development is unlikely to have a significant impact on these endangered flora species.

The proposed development / action is unlikely to have a significant impact on critically endangered or endangered species.

## **g) Migratory Species**

---

### *Significant Impact Criteria*

An action is likely to have a significant impact on a **migratory species** if there is a real chance or possibility that it will:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behavior) of an ecologically significant proportion of the population of a migratory species.

### *Response to criteria*

32 migratory species, listed under the EPBC Act, are known for the local region within 10km of the study site. None of the Listed Migratory Species are likely to use the site as forage, refuge or breeding habitat. However, some of the terrestrial migratory species may use the remnants of native forest vegetation as a stepping stone during the migratory period. Much of the existing native forest vegetation on the site will be retained.

The proposed development / action is unlikely to have a significant impact on a migratory species.

## APPENDIX - G

## Threatened species

Data gained from the Bionet website of the NSW Government Office of Environment and Heritage  
Records are from within **10km** radius of the study site.

Site - old brickworks site, Metford Road, Metfor

369551 E 6374532 N

September 2014

E1 = Schedule 1 Endangered; E2 = Schedule 1, Part 2 Endangered; E4A = Schedule 1A, Part 4, Critically Endangered  
V = Schedule 2 Vulnerable.

Y = Yes; P = Potential; N = No

Scientific name	Common name	Legal Status	Habitat on site	Record on site
<b>Flora</b>				
1 <i>Cynanchum elegans</i>	White-flowered Wax Plant	E1	P	N
2 <i>Rutidosia heterogama</i>	Heath Wrinklewort	V	Y	N
3 <i>Tetraloche juncea</i>	Black-eyed Susan	V	Y	N
4 <i>Acacia bynoeana</i>	Bynoe's Wattle	E1	Y	N
5 <i>Maundia triglochoides</i>		V	P	N
6 <i>Callistemon linearifolius</i>	Netted Bottle Brush	V	Y	N
7 <i>Eucalyptus camaldulensis</i>	Eucalyptus camaldulensis	E2	N	N
8 <i>Eucalyptus glaucina</i>	Slaty Red Gum	V	Y	N
9 <i>Eucalyptus parramattensis ssp. decadens</i>		V	Y	N
10 <i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E1	P	N
11 <i>Cymbidium canaliculatum</i>	Cymbidium canaliculatum	E2	N	N
12 <i>Persicaria elatior</i>	Tall Knotweed	V	Y	N
13 <i>Grevillea parviflora ssp. parviflora</i>	Small-flower Grevillea	V	Y	N
14 <i>Euphrasia arguta</i>		E4A	N	N
15 <i>Zannichellia palustris</i>		E1	Y	N
<b>Fauna</b>				
16 <i>Litoria aurea</i>	Green and Golden Bell Frog	E1	Y	N
17 <i>Litoria littlejohni</i>	Littlejohn's Tree Frog	V	N	N
18 <i>Anseranas semipalmata</i>	Magpie Goose	V	N	N
19 <i>Oxyura australis</i>	Blue-billed Duck	V	N	N
20 <i>Stictonetta naevosa</i>	Freckled Duck	V	N	N
21 <i>Ptilinopus magnificus</i>	Wompoo Fruit-Dove	V	N	N
22 <i>Ptilinopus regina</i>	Rose-crowned Fruit-Dove	V	N	N
23 <i>Pterodroma solandri</i>	Providence Petrel	V	N	N
24 <i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E1	N	N
25 <i>Botaurus poiciloptilus</i>	Australasian Bittern	E1	P	N
26 <i>Ixobrychus flavicollis</i>	Black Bittern	V	P	N
27 <i>Hamirostra melanosternon</i>	Black-breasted Buzzard	V	N	N
28 <i>Hieraaetus morphnoides</i>	Little Eagle	V	Y	N
29 <i>Lophoictinia isura</i>	Square-tailed Kite	V	Y	N
30 <i>Pandion cristatus</i>	Eastern Osprey	V	N	N
31 <i>Falco subniger</i>	Black Falcon	V	Y	N
32 <i>Haematopus longirostris</i>	Pied Oystercatcher	E1	N	N
33 <i>Irediparra gallinacea</i>	Comb-crested Jacana	V	N	N
34 <i>Rostratula australis</i>	Australian Painted Snipe	E1	N	N
35 <i>Calidris ferruginea</i>	Curlew Sandpiper	E1	N	N
36 <i>Limosa limosa</i>	Black-tailed Godwit	V	N	N
37 <i>Sternula albifrons</i>	Little Tern	E1	N	N
38 <i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V	N	N
39 <i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	V	N	N
40 <i>Glossopsitta pusilla</i>	Little Lorikeet	V	Y	Y
41 <i>Lathamus discolor</i>	Swift Parrot	E1	P	N
42 <i>Neophema pulchella</i>	Turquoise Parrot	V	N	N
43 <i>Ninox connivens</i>	Barking Owl	V	P	N
44 <i>Ninox strenua</i>	Powerful Owl	V	Y	N
45 <i>Tyto longimembris</i>	Eastern Grass Owl	V	N	N

Scientific name	Common name	Legal Status	Habitat on site	Record on site
46 <i>Tyto novaehollandiae</i>	Masked Owl	V	Y	N
47 <i>Tyto tenebricosa</i>	Sooty Owl	V	P	N
48 <i>Climacteris picumnus victoriae</i>	Brown Treecreeper (east ssp)	V	N	N
49 <i>Chthonicola sagittata</i>	Speckled Warbler	V	P	N
50 <i>Anthochaera phrygia</i>	Regent Honeyeater	E4A	Y	N
51 <i>Epthianura albifrons</i>	White-fronted Chat	V	N	N
52 <i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (east ssp)	V	Y	N
53 <i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (east ssp)	V	Y	N
54 <i>Daphoenositta chrysoptera</i>	Varied Sittella	V	Y	N
55 <i>Petroica boodang</i>	Scarlet Robin	V	Y	N
56 <i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	P	N
57 <i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V	P	N
58 <i>Phascolarctos cinereus</i>	Koala	V	Y	N
59 <i>Petaurus australis</i>	Yellow-bellied Glider	V	N	N
60 <i>Petaurus norfolcensis</i>	Squirrel Glider	V	Y	Y
61 <i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	Y	Y
62 <i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V	Y	N
63 <i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V	Y	N
64 <i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	Y	N
65 <i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	Y	N
66 <i>Miniopterus australis</i>	Little Bentwing-bat	V	Y	Y
67 <i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V	Y	Y
68 <i>Myotis macropus</i>	Southern Myotis	V	Y	Y
69 <i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	Y	Y
70 <i>Vespadelus trougtoni</i>	Eastern Cave Bat	V	Y	N

The Assessment of Significance is also known as the 7 Part Test of s5A *EPA Act 1979*

### **H1 Questions of the 7 Part Test**

The following is taken directly from section 5A of the *Environmental Planning and Assessment Act 1979* and is known as the “**7 Part Test**”. Each of the following seven factors (a – g) will be applied in turn to each of the threatened species (**Appendix G**) that are known to inhabit the site or have potential habitat on the site.

#### **5A Significant effect on threatened species, populations or ecological communities, or their habitats.**

For the purposes of this Act and, in particular, in the administration of sections 78A, 79C (1) and 112, the following factors 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:

- (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,**
- (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,**
- (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,**
- (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,**
- (e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),**
- (f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement 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.**

## **H2 Threatened species to be assessed**

The factors of s5A of the EPA Act (the **7 Part Test**) are, in this appendix, applied to each of the following threatened species for which there is or may potentially be habitat on the site (see **Appendix G**).

	<b>Scientific name</b>	<b>Common name</b>	<b>Legal Status</b>
1	<i>Cynanchum elegans</i>	White-flowered Wax Plant	E1
2	<i>Rutidosia heterogama</i>	Heath Wrinklewort	V
3	<i>Tetraloche juncea</i>	Black-eyed Susan	V
4	<i>Acacia bynoeana</i>	Bynoe's Wattle	E1
5	<i>Maundia triglochoides</i>		V
6	<i>Callistemon linearifolius</i>	Netted Bottle Brush	V
8	<i>Eucalyptus glauca</i>	Slaty Red Gum	V
9	<i>Eucalyptus parramattensis ssp. decadens</i>		V
10	<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E1
12	<i>Persicaria elatior</i>	Tall Knotweed	V
13	<i>Grevillea parviflora ssp. parviflora</i>	Small-flower Grevillea	V
15	<i>Zannichellia palustris</i>		E1
16	<i>Litoria aurea</i>	Green and Golden Bell Frog	E1
25	<i>Botaurus poiciloptilus</i>	Australasian Bittern	E1
26	<i>Ixobrychus flavicollis</i>	Black Bittern	V
28	<i>Hieraaetus morphnoides</i>	Little Eagle	V
29	<i>Lophoictinia isura</i>	Square-tailed Kite	V
31	<i>Falco subniger</i>	Black Falcon	V
40	<i>Glossopsitta pusilla</i>	Little Lorikeet	r V
41	<i>Lathamus discolor</i>	Swift Parrot	E1
43	<i>Ninox connexa</i>	Barking Owl	V
44	<i>Ninox strenua</i>	Powerful Owl	V
46	<i>Tyto novaehollandiae</i>	Masked Owl	V
47	<i>Tyto tenebricosa</i>	Sooty Owl	V
49	<i>Chthonicola sagittata</i>	Speckled Warbler	V
50	<i>Anthochaera phrygia</i>	Regent Honeyeater	E4A
52	<i>Meliphaga gularis gularis</i>	Black-chinned Honeyeater (east ssp)	V
53	<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (east ssp)	V
54	<i>Daphoenositta chrysoptera</i>	Varied Sittella	V
55	<i>Petroica boodang</i>	Scarlet Robin	V
56	<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V
57	<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V
58	<i>Phascogale cinerea</i>	Koala	V
60	<i>Petaurus norfolcensis</i>	Squirrel Glider	r V
61	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	r V
62	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V
63	<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V
64	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V
65	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V
66	<i>Miniopterus australis</i>	Little Bentwing-bat	r V
67	<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	r V
68	<i>Myotis macropus</i>	Southern Myotis	r V
69	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	r V
70	<i>Vespadelus troughtoni</i>	Eastern Cave Bat	V

r = recorded on site this survey

### **H3 Application of the 7 Part Test**

#### **(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,**

##### **1. *Cynanchum elegans***

Potentially suitable habitat for this species may be found on the study site. However this species was not found on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This climber, with stems to about 1m long, is found in rainforest gullies, scrub and scree slopes from the Gloucester district to the Wollongong area and inland to Mt Dangar (Harden, 1992).

##### **2. *Rutidosia heterogama***

##### **Heath Wrinklewort**

Potentially suitable habitat for this species may be found on the site. No individuals of this species were found on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This perennial herb grows mostly in heath, chiefly in coastal districts from Maclean to the Hunter Valley, flowering mainly in autumn (Harden, 1992).

##### **3. *Tetradlea juncea***

##### **Black-eyed Susan**

Potentially suitable habitat for this species may be found on the site. No individuals of this species were found on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers primarily dense undisturbed understorey vegetation beneath an open forest dominated by *Angophora costata*, *Corymbia gummifera* and *Eucalyptus capitellata* (Payne, 1998). *Tetradlea juncea* appears to favour a southerly or easterly aspect on ridge tops or upper slopes on clayey soils derived from conglomerates beneath dry open forest or woodland dominated by a Smooth-barked Apple/Bloodwood alliance. The species flowers from July to December (Murray *et al*, 2002).

##### **4. *Acacia bynoeana***

##### **Bynoe's Wattle**

Potentially suitable habitat for this species may be found on the study site. However this species was not found on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This very small shrub prefers heath and dry sclerophyll forests on sandy soils (Harden, 1991) and is readily distinguished from other *Acacia* species by its branches and phyllodes which are covered with rough coarse hairs. It flowers from September to March, growing in typically very infertile and well drained sandy and sandy clay soils. *Acacia bynoeana* appears to most typically occur on sandy soils derived from Hawkesbury Sandstone in tall open shrubland or low open woodland.

##### **5. *Maundia triglochinoides***

Potentially suitable habitat for this wetland species may occur in ponds on the study site. However this species was not found on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This wetland perennial grows in freshwater swamps and shallow streams (Sainty & Jacobs, 1981) and occurs northwards from about Sydney to Queensland.

**6. *Callistemon linearifolius***

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species is found growing in “dry sclerophyll forest on the coast and adjacent ranges, chiefly from the Georges River to the Hawkesbury River” (Harden, 2002). It is also found north to the Nelson Bay area.

**8. *Eucalyptus glauca***

**Slaty Red Gum**

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This Eucalypt is found in grassy woodland on deep, moderately fertile and well watered soil from Taree to Broke (Plantnet - NSW Flora Online).

**9. *Eucalyptus parramattensis***

**Parramatta Red Gum**

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This Eucalypt is found in dry sclerophyll woodland on sandy soils in low, often wet sites (Plantnet - NSW Flora Online).

**10. *Syzygium paniculatum***

**Magenta Lilly Pilly**

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species grows in subtropical and littoral rainforest on sandy soils or stabilized dunes near the sea at widely separated localities between Bulahdelah and Jervis Bay (Plantnet - NSW Flora Online).

**12. *Persicaria elatior***

**Tall Knotweed**

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species grows in damp places, usually on the margin of standing water as very scattered occurrences along coastal NSW and in SE Qld (Plantnet - NSW Flora Online).

**13. *Grevillea parviflora* ssp. *Parviflora***

**Small-flowered Grevillea**

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.



This species is known to occur in sandy to clay loam in moist heath or woodland, rarely on sandstone and is found in the regional vegetation type of Coastal Foothills Spotted Gum – Ironbark Forest (Murray *et al*, 2002). It occurs in light clay soils in woodland (NSW Scientific Committee, 1999).

**15. *Zannichellia palustris***

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers “fresh to brackish, still to slowly moving waters”, (Final determination 980612a). The species prefers semi permanent (standing at least 6 months), open bodies of still or slow moving fresh or brackish water (Personal communications, Mary Greenwood, Hons. student, Newcastle University, studying *Zannichellia palustris*).

**16. *Litoria aurea***

**Green and Gold Bell Tree Frog**

Habitat for this species may be found in ponds on the study site. Some areas of dense reeds and cumbungi are found on the site and permanent or semi permanent open ponds of fresh water are also found on the site. The species was not heard or found after nocturnal and diurnal, searches during dry and wet weather. Some suitable ponds on the site will be retained thereby conserving habitat on the site for this species.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers grassy areas near to open unshaded, still, shallow, ephemeral and unpolluted water bodies with sandy or rocky substrate, aquatic plants such as *Typha sp.* and free of predatory fish, such as *Gambusia sp.* with a range of diurnal shelters including vegetation and rocks (Pyke & White, 1996). The species also spends time exposed, sunning itself.

**25. *Botaurus poiciloptilus***

**Australasian Bittern**

Habitat for this species may be found on the study site. Reed beds and fringing vegetation on some ponds on the site may provide habitat for this species although this bird prefers more extensive areas of reed and cumbungi. No individuals of this species were heard or observed or otherwise recorded on the study site during this survey. Some ponds with reed bed areas are likely to be retained thereby conserving habitat on the site for this species.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers water in tall reed beds, sedges, rushes, cumbungi, lignum, drains in tussocky paddocks, saltmarsh, brackish wetlands and is seldom in trees (Pizzey, 1998). Dense and usually extensive reed-beds, especially cumbungi, at margins of lagoons, swamps, sluggish rivers and also tussocky wet paddocks (Serventy, 1985).

**26. *Ixobrychus flavicollis***

**Black Bittern**

Potential habitat for this species may be found on the site. This species could forage at the edge of ponds on the study site. This species was not recorded on the study site during this survey. Some ponds are likely to be retained on the site thereby conserving habitat on the site for this species.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species is found in terrestrial wetlands and estuarine and littoral habitats. Forages at edge of still or flowing water usually in permanent wetlands fringed by dense vegetation. It breeds in densely vegetated wetlands in secluded places where nests are built in leafy trees overhanging water (Marchant & Higgins, 1998).

**28. *Hieraaetus morphnoides***

**Little Eagle**

Potential forage, refuge and breeding habitat for this species may be found on the site. This species was not recorded on the site during this survey. Much of the existing forest vegetation will be retained on the site thereby conserving potential habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers plains, foothills, open forests, woodlands and scrublands, River Red Gums on watercourses and lakes (Pizzey & Knight, 2007). Typically found in woodlands, forested land and open country extending into arid zones of Australia; feeds mostly on vertebrates, often rabbits; nests in open woodland, mallee and tree lined watercourses (Marchant & Higgins, 1993).

**29. *Lophoictinia isura***

**Square-tailed Kite**

Potential forage and breeding habitat for this species may be found on the site. This species was not recorded on the site during this survey. Much of the existing forest vegetation will be retained on the site thereby conserving potential forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers heathlands, woodlands, forests, tropical and subtropical rainforest, timbered watercourses, hills and gorges (Pizzey & Knight, 2007). Typically found in forested and wooded lands of tropical and temperate Australia; many common vegetation associations used; in southern Australia predominantly eucalypt open forest and woodland; feeds mostly on passerines and foliage insects and sometimes small mammals and lizards; nests often near water in forest or open woodland in tree to about 18m (Marchant & Higgins, 1993).

**31. *Falco subniger***

**Black Falcon**

Potential forage, refuge and breeding habitat for this species may be found on the site. This species was not recorded on the site during this survey. Much of the existing forest vegetation will be retained on the site thereby conserving potential habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers plains, grasslands, foothills, timbered watercourses and wetland environments (Pizzey & Knight, 2007). Typically found wooded lands, open country and terrestrial wetlands of tropical and temperate Australia; feeds mostly on small terrestrial birds but also mammals, reptiles and insects; nests in large living or dead trees on flat plains or floodplains, isolated trees or in trees fringing creeks and waterholes (Marchant & Higgins, 1993).

**40. *Glossopsitta pusilla***

**Little Lorikeet**

Potential forage and breeding habitat for Little Lorikeets may be found on the site. This species was recorded on the study site during this survey. This species will visit flowering eucalypts on the site and trees with potential nest hollows suitable for this species are found on the site. Much of the existing forest vegetation will be retained on the site, including hollow bearing trees, thereby conserving potential forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

Little Lorikeets are nomadic and prefer dry, open eucalypt forests and woodlands, feeding primarily on nectar and pollen of tall flowering eucalypts plus sometimes *Angophora* and *Melaleuca*, plus fruits of mistletoes (Higgins 1999). They nest in hollows mostly in living, smooth-barked eucalypts (Higgins 1999). Can appear at a location at any time of year to feed on flowering eucalypts.

**41. *Lathamus discolor***

**Swift Parrot**

Potential forage habitat for this species may be found on the site. Individuals of this species may be transitory visitors to the flowering eucalypts on the site during winter months. During summer it lives and breeds only in Tasmania. No individuals of the species were recorded on the site during this survey. Much of the existing forest vegetation will be retained on the site thereby conserving potential forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers timbered country where there are flowering trees and breeds in Tasmania (Readers Digest, 1982). Swift Parrots migrate to the south east parts of the Australian mainland during the winter months and is apparently nomadic in response to food resources then returns to Tasmania to breed during spring and summer (Higgins, 1999). Food for this species is mainly nectar, mostly from eucalypts but also includes psyllids, lerps, seeds and fruit (Higgins, 1999). Swamp Mahogany (*Eucalyptus robusta*) trees are an important winter food source for this species.

**43. *Ninox connivens***

**Barking Owl**

Potential forage and refuge habitat for this species is found on the site. Hollow bearing trees are found on the site and trees with potentially suitable large hollows as breeding or roost habitat for this owl are found on the site. The site may provide suitable forage habitat for this species as part of a larger foraging area. The Barking Owl was not recorded on the site during this survey. Owl call playback during this survey did not elicit a response from this species on or near the site and the species was not heard calling on or near the site. Much of the existing forest vegetation will be retained on the site, including hollow bearing trees, thereby conserving some potential habitat for this species and its prey species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers open forests, woodlands, paperbark woodlands, dense scrubs, foothills, river red gums, other large trees near watercourses in open country (Pizzey, 1998). Ideal habitat for this species is open country with a choice of large trees for roosting and nesting (Hollands, 1991). Barking Owls feed primarily on insects but include birds and mammals such as gliders and rabbits in the diet during breeding when large hollows in live eucalypts are required (Garnett and Crowley, 2000). Feeds mainly on insects outside of breeding season and more birds and mammals during breeding (Higgins, 1999). It appears that most mammals preyed on are smaller arboreal mammals.

**44. *Ninox strenua***

**Powerful Owl**

Potential forage and refuge habitat for this species is found on the site. However, tall large trees with suitably large hollows as breeding habitat for this owl are not found on the site. The Powerful Owl was not recorded on the site during this survey. Owl call playback during this survey did not elicit a response from this species on or near the site and the species was not heard calling on or near the site. However, this owl is likely to utilise the site as part of a larger foraging area in search of prey species such as Brush-tailed Possums, Ring-tail Possums, Squirrel Gliders, Kookaburras and Rosellas etc which are likely to be found on the site. Much of the existing forest vegetation on the site will be retained thereby conserving potential forage and refuge habitat for this species and its prey species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers to occupy a large territory of between 300 and 1500 hectares in mountain forests, gullies and forest margins, sparser hilly woodlands, coastal forests, woodlands, scrubs etc (Higgins, 1999). The Powerful Owl always roosts in the open, on a branch, during the day and when roosting in dense vegetation may be low to the ground (Hollands, 1991). Powerful Owls feed mainly on Common Ring-tail Possums and Greater Gliders but also Common Brush-tail Possum, Squirrel Gliders and birds including White Cockatoos (Higgins, 1999). The nest site is typically a large vertical hollow such as broken off trunks of trees but also in horizontal or hollow spouts, usually in living trees but sometimes in dead trees (Higgins, 1999).

**46. *Tyto novaehollandiae***

**Masked Owl**

Forage, breeding and refuge habitat for this species may be found on the site. Several hollow bearing trees are found on the site. Larger hollows in trees as refuge and breeding habitat for this owl are found on the site. The Masked Owl was not recorded on the site during this survey. Owl call playback during this survey did not elicit a response from this species on or near the site and the species was not heard calling on or near the site. This owl may utilise the site as part of a larger foraging area in search of typical prey species such as Rats. Much of the existing forest vegetation on the site will be retained, including hollow bearing trees, thereby conserving potential habitat for this species and its prey species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers forests, open woodlands, farmlands with large trees, adjacent cleared country, timbered watercourses, paperbark woodlands and caves (Pizzey & Knight, 2007). The species is mostly recorded in open forest and woodland with a sparse understorey adjacent to open habitats such as cleared farmland, grassland, sedgeland and wetlands etc (Higgins, 1999). Studies indicate that this species will utilise a territory greater than 1000 hectares (Higgins, 1999). Feeds mainly on small to medium terrestrial mammals such as rats but also some arboreal mammal species and birds (Higgins, 1999). Masked Owls nest in “a large hollow in a living or dead tree” (Hollands, 1991) and generally roost in hollows during the day.

**47. *Tyto tenebricosa***

**Sooty Owl**

Forage, breeding and refuge habitat for this species may be found on the site. Several hollow bearing trees are found on the site. Larger hollows in trees as refuge and breeding habitat for this owl are found on the site. The Masked Owl was not recorded on the site during this survey. Owl call playback during this survey did not elicit a response from this species on or near the site and the species was not heard calling on or near the site. This owl may utilise the site as part of a larger foraging area in search of typical prey species such as Squirrel Gliders and Rats. Much of the existing forest vegetation on the site will be retained, including hollow bearing trees, thereby conserving potential habitat for this species and its prey species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers tall wet forests in east and south east facing mountain gullies with a dense understorey layer (Pizzey & Knight, 2007); deep moist gullies in eucalypt forest, usually with big, old, smooth-barked gums with an understorey of tree ferns and Lilly Pilly (Hollands, 1991). This species forages for both arboreal species such as Sugar Gliders and terrestrial species such as rats and breeds in larger hollow bearing trees (Newton *et al*, 2002).

**49. *Chthonicola sagittata***

**Speckled Warbler**

Potential refuge, forage and breeding habitat for this species may be found on the study site. This species was not recorded on the study site during this survey. Much of the existing forest vegetation on the site will be retained and not disturbed thereby conserving potential refuge, forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This readily observed sedentary species refuges, forages and breeds mainly in drier woodlands with tussocks, fallen logs, branches and rocks (Pizzey & Knight, 2007). Found mainly in grassy ground layer of dry sclerophyll forests and woodlands, often with scattered shrubs in understorey, mainly on slopes of the Great Divide, rarely reported from the coast (Higgins & Peter, 2002).

**50. *Xanthomyza Phrygia***

**Regent Honeyeater**

Potential habitat for this species may be found on the study site. This species could potentially be an irregular and transitory visitor to the eucalypts, when in flower, on the study site from its preferred habitat west of the Great Divide. The species was not found on the study site during this survey. It will be recommended to retain areas of native vegetation on the site thereby retaining potential forage habitat for this species.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This migratory species prefers dry open forest and woodlands with a range of eucalypt species, especially ironbarks (Morcombe, 2000), but will also utilise farmland, streets and gardens (Pizzey, 1998). Found mainly on and west of the Great Divide in NSW with few recent records of the species on the coasts although the species will visit the coast, possibly in response to poor food supply in core breeding areas (Higgins *et al*, 2001).

**52. *Melithreptus gularis gularis***

**Black-chinned Honeyeater**

Potential habitat for this species may be found on the study site. This species may be an irregular and transitory visitor to the eucalypts, when in flower, on the study site from its preferred habitat west of the Great Divide. The species was not found on the study site during this survey. It will be recommended to retain and not disturb forest vegetation on the site thereby conserving potential habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This nomadic species prefers forest and woodland of eucalypts, paperbarks and tree lined watercourses of arid regions (Morcombe, 2000). This seasonally nomadic species prefers drier eucalypt forests and woodlands, timber on watercourses, often with no understorey, scrubs and Ironbark forests on the western slopes (Pizzey, 1998).

**53. *Pomatostomus temporalis temporalis***

**Grey-crowned Babbler**

Potential refuge, forage and breeding habitat for this species may be found on the study site. This species was not recorded on the study site during this survey. Much of the existing forest vegetation on the site will be retained and not disturbed thereby conserving potential refuge, forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This readily observed sedentary species is found in open forests, woodlands, scrublands, farmlands and outer suburbs (Pizzey & Knight, 2007). Found mainly in open forests and woodlands with an open shrub layer, sparse groundcover, fallen timber and leaf litter (Higgins & Peter, 2002).

**54. *Daphoenositta chrysoptera***

**Varied Sittella**

Potential refuge, forage and breeding habitat for this species may be found on the study site. This species was not recorded on the study site during this survey. Much of the existing forest vegetation on the site will be retained and not disturbed thereby conserving potential refuge, forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This readily observed species is found in open eucalypt forests and woodlands, mallee, inland acacia and coastal tea-tree scrubs (Pizzey & Knight, 2007). Found mainly in eucalypt forests and woodlands, usually with rough-barked trees such as stringybarks and ironbarks (Higgins & Peter, 2002).

**55. *Petroica boodang***

**Scarlet Robin**

Potential refuge, forage and breeding habitat for this species may be found on the study site. This species was not recorded on the study site during this survey. Much of the existing forest vegetation on the site will be retained and not disturbed thereby conserving potential refuge, forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This readily observed species is found in foothill forests, woodlands, watercourses and in autumn and winter more open habitats including golf courses, parks, gardens and orchards (Pizzey & Knight, 2007). Found mainly in eucalypt forests and woodlands with an open understorey, in autumn and winter may disperse to more open habitats including urban areas (Higgins & Peter, 2002).

**56. *Dasyurus maculatus***

**Spotted-tailed Quoll**

Potential forage habitat for this species may be found on the site. Prey species such as birds, reptiles and small mammals, including possums and rats are likely found on the site. The species was not recorded on the site during this survey. A portion of the existing vegetation on the site will be retained thereby conserving potential forage habitat for this species and its prey species on the site.

The life cycle of the species is unlikely to be disrupted such that a viable local population of the species would be placed at risk of extinction.

This nocturnal species prefers rainforest, open forest, woodland and coastal heathland (Strahan, 1998) and requires hollow logs, caves or rock crevices as shelter and breeding dens. The Spotted-tailed Quoll is an opportunistic carnivore that preys on birds, reptiles and small mammals, including gliders, possums and rats etc and also scavenges on carrion (NSW DECC Threatened Species profile).

**57. *Phascogale tapoatafa***

**Brush-tailed Phascogale**

Potentially suitable habitat for this species may be found on the study site. Hollows potentially suitable for this species are found on the site. Brush-tailed Phascogales were not recorded on the study site during this survey. Much of the existing forest vegetation on the site will not be disturbed by the proposed development thereby conserving potential refuge, forage and breeding habitat for this species on the site. However, considering the isolation of vegetation on the site from extensive areas of native vegetation then this species is unlikely to be found on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers open forest with sparse ground cover (Strahan, 1995) and dry sclerophyll forest and open woodlands that contain hollow bearing trees (Maxwell *et al*, 1996). The carnivorous and nocturnal Brush-tailed Phascogale forages, preferentially in rough barked trees, for prey such as spiders, centipedes, beetles and cockroaches plus nectar and occasionally small vertebrates (NSW DECC Threatened Species profile).

**58. *Phascogale cinerea***

**Koala**

Potential forage and refuge habitat for this species is found on the study site. Preferred koala feed trees are found on the site. However, no koalas or signs of koalas were observed on the site during this survey. There are only two (2) records in the Bionet wildlife database of koalas within 5km of the site. Much of the existing forest vegetation on the site including Koala feed trees, will not be disturbed by the proposed development thereby conserving potential habitat for this species on the site. However, considering the isolation of vegetation on the site from extensive areas of native vegetation then this species is unlikely to be found on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development on the site such that a viable local population of the species would be placed at risk of extinction.

This species has a widespread but patchy distribution in eastern NSW (Ellis & Etheridge, 1993) and is usually associated with eucalypt forests throughout the range with marked local and regional preferences for various eucalypt species as feed trees (Strahan, 1998). Koala home ranges can vary from male to female and depending on the palatability and nutritional value of the feed trees. They are generally from less than 2 to greater than 3 hectares but in areas of low preferred tree densities can be up to 100 hectares (Martin and Handasyde, 1999). Koalas are known to feed on a wide variety of eucalypt and other tree species however in Schedule 2 of SEPP No 44 is a list of ten “primary koala feed trees”.

**66. *Petaurus norfolkensis***

**Squirrel Glider**

Potential forage, refuge, breeding and den habitat for this species is found on the site. Squirrel Gliders were recorded during trapping and spotlighting surveys on this site. Trees with potentially suitable hollows for this species as den or breeding habitat are found on the site and the site contains vegetation with mixed aged eucalypt trees with a range of species and understorey shrubs including wattles as forage habitat for this species. Much of the existing native forest vegetation on the site, including hollow bearing trees, will be retained thereby conserving forage, refuge and breeding habitat for this species on the site. Corridors of vegetation will be retained between the forest patches on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers open forest or woodland with hollow bearing, mature or mixed aged stands with several eucalypt species (Murray, 1996). It inhabits dry sclerophyll forest and woodland and is absent from dense coastal ranges (Strahan, 1998). It forages in eucalypt trees and shrubs such as wattles primarily for insects (Menkhorst, 1995) but also sap, nectar and pollen and utilises old trees with hollows for den habitat (Strahan, 1998). This glider “is known to travel up to 1km from foraging areas to a preferred hollow” (Menkhorst, 1995).

**61. *Pteropus poliocephalus***

**Grey-headed Flying-fox**

Forage habitat for this species is found on the site. Grey-headed Flying-foxes were heard on nearby land during this survey. Grey-headed Flying-foxes are likely to forage in flowering eucalypt trees, especially Spotted Gums, when these trees are in flower on the site. The site does not support a daytime roost (camp) of this species. A portion of the existing forest vegetation on the site will be retained thereby conserving forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species feeds on the blossoms of a large range of eucalypt and non-eucalypt tree and shrub species; rainforest fruit species comprise a small proportion of the diet of flying-foxes in NSW (Eby, 1995). Grey-headed Flying-foxes roost in large numbers during the day in “camps” that have a history of irregular or permanent use over many years (Eby, 1995). This bat will fly over 30km from the camp to foraging areas (Menkhorst, 1995).

**62. *Saccolaimus flaviventris***

**Yellow-bellied Sheath-tailed-Bat**

Forage habitat for this species may be found over the study site. Potentially suitable hollow bearing trees are found on the site for this species to breed and roost in. Open areas on the site are available for this species as forage habitat and forage habitat is available on farmland and wetland areas north of the site. This species was not recorded on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This widespread species forages for insects above the canopy and roosts in tree hollows (Strahan, 1998). Insectivorous bats are known to travel widely from roost trees to favoured forage areas.

**63. *Mormopterus norfolkensis***

**Eastern Freetail Bat**

Forage, roost and breeding habitat for this species is found on the site. This species was not recorded on the site during this survey. Some hollow bearing trees on the site could potentially be used by this species as roost and breeding habitat. Much of the existing forest vegetation on the site, including hollow bearing trees, will be retained thereby conserving forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species forages in dry eucalypt forest and woodland (Strahan, 1998). The species apparently roosts in tree hollows and forages in openings and gaps in the forest (Churchill, 1998). Very little is known about this species.

**64. *Chalinolobus dwyeri***

**Large-eared Pied Bat**

Forage habitat for this species may be found on the site. This species was not recorded on the site during this survey. There are no caves or mines on the site in which individuals or a population would roost or breed. Much of the existing vegetation on the site will be retained thereby conserving forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species forages in tall open eucalypt forest, dry sclerophyll forest, woodland, wet sclerophyll forest and rainforest and roosts predominantly in caves and mines (Churchill, 1998).

**65. *Falsistrellus tasmaniensis***

**Eastern False Pipistrelle**

Potential habitat for this species may be found on the site although the species is more common at higher elevations. Individuals or a population of the species may forage about the tree canopy of the study site or utilise the hollow bearing trees on the site for roosting or breeding. This species was not recorded on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species inhabits sclerophyll forests, at cool elevations (Strahan, 1995). It forages within or just below the tree canopy, from the ranges to the coast and prefers wet habitats where trees are more than 20m high and generally roost in hollow trunks of eucalypt trees though they have been recorded in caves (Churchill, 1998).

**66. *Miniopterus australis***

**Little Bent-wing Bat**

Forage habitat for this species may be found on the site. This species was recorded on the site during this survey. There are no caves, mines or large culverts on the site in which individuals or a population would roost or breed.



Much of the existing forest vegetation on the site will be retained thereby conserving forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species forages, between the shrub and canopy layers, in tall open eucalypt forest, dry sclerophyll forest, woodland, wet sclerophyll forest, rainforest and melaleuca swamps and roosts and breeds in caves and mines (Churchill, 1998).

**67. *Miniopterus schreibersii oceanensis***

**Large Bent-wing Bat**

Forage habitat for this species may be found on the site. This species was recorded on the site during this survey, however, there are no caves or mines on the site in which individuals or a population would roost or breed. Much of the existing vegetation on the site will be retained thereby conserving forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This fast flying species forages, above the canopy layer, in tall open eucalypt forest, dry sclerophyll forest, woodland, wet sclerophyll forest, rainforest, melaleuca swamps and over grasslands and roosts and breeds in caves, mines and culverts (Churchill, 1998).

**68. *Myotis macropus***

**Southern Myotis**

Forage habitat for this species may be found in the study area. This species was recorded over ponds on the site during this survey. There are no caves, mines or large culverts on the study site in which individuals or a population would roost and breed. This species will forage over open water on ponds on the site and may roost in culverts of drains etc nearby or caves and mines in the local region. Some of the ponds with open water will likely be retained on the site, however, there are other open surface water ponds in the local area over which this species may forage.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species forages for insects over streams and pools in mangroves, paperbark swamps, rainforest, wet and dry sclerophyll forest and open woodland. The species roosts in caves but is also known to roost in tree hollows, vegetation, Pandanus, under bridges, in mines, tunnels and stormwater drains (Churchill, 1998).

**69. *Scoteanax rueppellii***

**Greater Broad-nosed Bat**

Forage, roost and breeding habitat for this species is found on the site. This species was recorded on the site during this survey. Some hollow bearing trees on the site could potentially be used by this species as roost and breeding habitat. Much of the existing forest vegetation on the site, including hollow bearing trees, will be retained thereby conserving forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This slow flying species forages within 20m of the ground along tree lines often adjacent to cleared paddocks and prefers moist gullies in mature coastal forest but also forages in gullies of dry sclerophyll forest, woodland, wet sclerophyll forest and roosts in hollow tree trunks and branches (Churchill, 1998).

**46. *Vespadelus troughtoni***

**Eastern Cave Bat**

Forage habitat for this species may be found on the study site. This species was not recorded on the site during this survey. There are no caves or mines on the study site in which individuals or a population would roost or breed. Much of the existing forest vegetation on the site will be retained thereby conserving forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species forages in tall open eucalypt forest, dry sclerophyll forest, woodland, wet sclerophyll forest and rainforest and roosts predominantly in caves and mines (Churchill, 1998).

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

No threatened flora or fauna species found within 10km of the study site are part of an “endangered population” cited in Schedule 1, Part 2 Endangered Populations of the TSC Act 1995.

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

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

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

The site does not support a “Critically Endangered Ecological Community” (CEEC) as listed under Schedule 1A, Part 2 of the TSC Act 1995.

According to vegetation mapping (LHCCREMS, 2003) and ground investigations the site does support an “Endangered Ecological Community” (EEC) identified under Part 3 of Schedule 1 of the TSC Act 1995.

The site supports two EEC’s, these are identified as

- **Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion**
- **Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions**

Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion is found on the south-east and south-west corner portions and along much of the south edge of the site (**Fig-3**). Much of this EEC is in relatively good condition and will be conserved by the proposed development. Some already disturbed parts at the edges of this EEC may be cleared or partially cleared for an Asset Protection Zone. Of the approximately 13.6 hectares of SGIF on the site about 3.9 hectares (28.7%) of SGIF would be cleared or disturbed by the APZ (as indicated in a plan provided 30.9.14). Clearing of approximately 3.9 hectares of this EEC from the site is an insignificant portion of the Regional (26,917 hectare) and Local (1204 hectare) occurrence of this EEC as of 2000. As of 2000, according to the Maitland Greening Plan (MCC, 2002), approximately 1204 hectares (9.5%) of the local pre 1750 extent of this EEC remained. A recommendation in the Maitland Greening Plan suggests the Conservation outcome for this EEC should be “No Net Loss”.

Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions is found either side of a shallow drainage depression in the centre north portion of the site (indicated as Red Gum Forest in **Fig-3**). Most of this EEC appears to have undergone some form of disturbance. Some heavily disturbed parts at the edges of this EEC may be cleared or partially cleared for an Asset Protection Zone. Much of the EEC will be retained by the proposed development. Most of the areas of this EEC to be cleared by the APZ are already

degraded or on disturbed land. The main core of this community on the site will be retained. Of the approximately 4.7 hectares of Red Gum Forest on the site about 2.0 hectares (42%) would be cleared or disturbed by the APZ (as indicated in a plan provided 30.9.14). Clearing of approximately 2.0 hectares of this EEC from the site is an insignificant portion of the Regional (4,856 hectare) and Local (670 hectare) occurrence of this EEC as of 2000. According to the Maitland Greening Plan (MCC, 2002), approximately 670 hectares (15%) of the local pre 1750 extent of this EEC remained as of 2000. A recommendation in the Maitland Greening Plan suggests the Conservation outcome for this EEC should be “No Net Loss”.

The proposed development is unlikely to **have an adverse effect on the extent** of an ecological community such that its local occurrence is likely to be placed at risk of extinction.

The proposed development is unlikely to **substantially and adversely modify the composition** of an ecological community such that its local occurrence is likely to 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, and**

According to plans provided, the proposed development will retain about 80% of the Spotted Gum Ironbark Forest and about 60% of the Red Gum Forest (**Fig-3**) on the north, east and west portions of the site. About one third of the existing native forest vegetation on the site will be removed or modified as a result of the proposed action.

**(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**

Connectivity will be retained between areas of retained native forest vegetation on the east and west portions of the site. There are no corridors to forest vegetation north of the site and only broken corridors to vegetation off the south of the site. Land surrounding the site is already heavily cleared and fragmented. An area of habitat is unlikely to become fragmented or isolated from other areas of habitat as a result of the proposed action

**(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 relatively small area of forest vegetation proposed to be cleared for development on the site is unlikely to be significant or important to local threatened species, populations and ecological communities. However, it is here recognised that the cumulative impact of clearing many small areas of native vegetation over time is likely to be significant.

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

The site and adjacent areas are not “critical habitat” as described and listed in the Register of Critical Habitat kept by the Director General of the Department of Environment and Conservation.

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

There are few State or Federal recovery plans (draft or final) available for threatened species in the local region and none available for threatened insectivorous bats. For the following species that may be affected by the proposed development recovery plans are available –

- Grey-headed Flying-fox
- Koala
- Regent Honeyeater
- Large forest owls

Conserving much of the native vegetation on the site is likely to be consistent with the objectives of recovery plans for the above mentioned species.

Threat abatement plans are available for –

- Red Fox
- Bitou Bush
- Plague Minnow

These species were found or are already likely to be found on or near the site, however, the proposed development is unlikely to introduce or intentionally encourage these species into the area.

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

The following Key Threatening Processes are listed in Schedule 3 of the Threatened Species Conservation Act 1995.

- I. **Alteration of habitat following subsidence due to longwall mining** – the proposed development is not longwall mining and will not cause alteration of habitat following subsidence due to longwall mining
- II. **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands** – the proposed development is unlikely to alter flow regimes of creeks, rivers and streams.
- III. **Anthropogenic Climate Change** – clearing of a small area of vegetation from the site is unlikely to contribute significantly to anthropogenic climate change. However the cumulative impact of clearing many small areas may have a significant impact. It will be recommended to minimize clearing.
- IV. **Bushrock removal** – It will be recommended to not disturb natural bushrock where not necessary and not to remove natural bushrock from the site.
- V. **Clearing of native vegetation** - Loss of the small area of native vegetation from the site for the proposed development is unlikely to immediately threaten the survival or evolutionary development of species, populations or ecological communities or their habitats. However clearing of vegetation from the study site may contribute over time to the cumulative impact of native vegetation loss and fragmentation in the local area.
- VI. **Competition and grazing by feral European Rabbit, *Oryctolagus cuniculus*** – the proposed development is unlikely to intentionally cause the introduction of feral rabbits into the local area. Feral rabbits are already found on the site.

- VII. **Competition and habitat degradation by Feral Goats, *Capra hircus*** - the proposed development is unlikely to intentionally cause the introduction of feral Goats into the local area.
- VIII. **Competition from feral honey bees, *Apis mellifera*** - the proposed development is unlikely to intentionally cause the release of feral honey bees into the local area.
- IX. **Death or injury to marine species following capture in shark control programs on ocean beaches** – not applicable.
- X. **Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments** – the proposed development is unlikely to release anthropogenic debris into the marine or estuarine environment.
- XI. **Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners** – the proposed development is unlikely to intentionally encourage psyllids and Bell Miners onto the site.
- XII. **Herbivory and environmental degradation caused by feral deer** - the proposed development is unlikely to intentionally encourage or release deer onto the site.
- XIII. **High frequency fire** – the proposed development is unlikely to introduce a high fire regime to native vegetation in the local area.
- XIV. **Importation of Red Imported Fire Ants *Solenopsis invicta*** – the proposed development is unlikely to intentionally or knowingly import Red Fire Ants into the local area
- XV. **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations** – the proposed development is unlikely to intentionally cause infection of psittacine (parrot) species in the local area with Psittacine Circoviral Disease.
- XVI. **Infection of frogs by amphibian chytrid causing the disease chytridiomycosis** – the proposed development is unlikely to cause the intentional spread of chytridiomycosis.
- XVII. **Infection of native plants by *Phytophthora cinnamomi*** - the proposed development is unlikely to intentionally cause infection of native plants by *Phytophthora cinnamomi* in the local area
- XVIII. **Introduction of the Large Earth Bumblebee *Bombus terrestris*** – the proposed development is unlikely to intentionally cause the introduction of the Large Earth Bumblebee into the local environment.
- XIX. **Invasion and establishment of Scotch Broom (*Cytisus scoparius*)** - the proposed development is unlikely to intentionally infect the site with Scotch Broom.
- XX. **Invasion and establishment of Lantana (*Lantana camara*)** – the site already contains extensive patches of Lantana.
- XXI. **Invasion and establishment of Cane Toad (*Bufo marinus*)** – these amphibians are not found on the site and the proposed development is unlikely to cause the introduction of Cane Toads to the site or local area.
- XXII. **Exotic Vines and Scramblers** – A small number of exotic vines and scramblers are already found on the site. The proposed development will be encouraged to not use exotic plants in gardens and as landscaping for the site.
- XXIII. **Invasion of native plant communities by African Olive (*Olea europaea*)** - the proposed development is unlikely to intentionally introduce African Olive to native vegetation on the site or the local area. This plant is already found on the site.
- XXIV. **Invasion of native plant communities by *Chrysanthemoides monilifera*** - the proposed development is unlikely to intentionally introduce *C. monilifera* to native vegetation on the site or the local area. This plant is already found on the site.

- XXV. **Invasion of native plant communities by exotic perennial grasses** – exotic perennial grasses are already present on the site, especially in disturbed areas of the site.
- XXVI. **Invasion of the Yellow Crazy Ant, (*Anoplolepis gracilipes*)** - the proposed development is unlikely to intentionally introduce Yellow Crazy Ants to native vegetation on the site or the local area.
- XXVII. **Loss of hollow bearing trees** – the proposed development will minimize the number of hollow bearing trees disturbed or removed.
- XXVIII. **Loss or degradation (or both) of sites used for hill-topping by butterflies** – the proposed development is unlikely to destroy vegetation on higher ground that may be utilised by butterflies for hill-topping.
- XXIX. **Predation and hybridisation by Feral Dogs, (*Canis lupus familiaris*)** – the proposed development is unlikely to intentionally cause predation and hybridisation by feral dogs.
- XXX. **Predation by *Gambusia holbrooki* (Plague Minnow or Mosquito Fish)** - the Plague Minnow is already present in ponds on the site but is unlikely to be further encouraged or protected by the proposed development.
- XXXI. **Predation by the European Red Fox *Vulpes Vulpes*** – the Fox is already present in the local area but is unlikely to be further encouraged or protected by the proposed development.
- XXXII. **Predation by the Feral Cat *Felis catus*** - the Feral Cat is likely already present in the local area but is unlikely to be further encouraged or protected by the proposed development.
- XXXIII. **Predation by the Ship Rat *Rattus rattus* on Lord Howe Island** – not applicable.
- XXXIV. **Predation, habitat degradation, competition and disease transmission by Feral Pigs *Sus scrofa*** – The proposed development is unlikely to cause the introduction or spread of feral pigs into the local area.
- XXXV. **Removal of dead wood and dead trees** – the proposed development is likely to cause the removal of some dead wood on the ground and small dead trees from that part of the site being developed.

The Assessment of Significance is also known as the 7 Part Test of s5A *EPA Act 1979*

### **H1 Questions of the 7 Part Test**

The following is taken directly from section 5A of the *Environmental Planning and Assessment Act 1979* and is known as the “**7 Part Test**”. Each of the following seven factors (a – g) will be applied in turn to each of the threatened species (**Appendix G**) that are known to inhabit the site or have potential habitat on the site.

#### **5A Significant effect on threatened species, populations or ecological communities, or their habitats.**

For the purposes of this Act and, in particular, in the administration of sections 78A, 79C (1) and 112, the following factors 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:

- (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,**
- (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,**
- (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,**
- (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,**
- (e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),**
- (f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement 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.**



## **H2 Threatened species to be assessed**

The factors of s5A of the EPA Act (the **7 Part Test**) are, in this appendix, applied to each of the following threatened species for which there is or may potentially be habitat on the site (see **Appendix G**).

	<b>Scientific name</b>	<b>Common name</b>	<b>Legal Status</b>
1	<i>Cynanchum elegans</i>	White-flowered Wax Plant	E1
2	<i>Rutidosia heterogama</i>	Heath Wrinklewort	V
3	<i>Tetraloche juncea</i>	Black-eyed Susan	V
4	<i>Acacia bynoeana</i>	Bynoe's Wattle	E1
5	<i>Maundia triglochinos</i>		V
6	<i>Callistemon linearifolius</i>	Netted Bottle Brush	V
8	<i>Eucalyptus glauca</i>	Slaty Red Gum	V
9	<i>Eucalyptus parramattensis ssp. decedens</i>		V
10	<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E1
12	<i>Persicaria elatior</i>	Tall Knotweed	V
13	<i>Grevillea parviflora ssp. parviflora</i>	Small-flower Grevillea	V
15	<i>Zannichellia palustris</i>		E1
16	<i>Litoria aurea</i>	Green and Golden Bell Frog	E1
25	<i>Botaurus poiciloptilus</i>	Australasian Bittern	E1
26	<i>Ixobrychus flavicollis</i>	Black Bittern	V
28	<i>Hieraaetus morphnoides</i>	Little Eagle	V
29	<i>Lophoictinia isura</i>	Square-tailed Kite	V
31	<i>Falco subniger</i>	Black Falcon	V
40	<i>Glossopsitta pusilla</i>	Little Lorikeet	r V
41	<i>Lathamus discolor</i>	Swift Parrot	E1
43	<i>Ninox connivens</i>	Barking Owl	V
44	<i>Ninox strenua</i>	Powerful Owl	V
46	<i>Tyto novaehollandiae</i>	Masked Owl	V
47	<i>Tyto tenebricosa</i>	Sooty Owl	V
49	<i>Chthonicola sagittata</i>	Speckled Warbler	V
50	<i>Anthochaera phrygia</i>	Regent Honeyeater	E4A
52	<i>Meliphaga gularis gularis</i>	Black-chinned Honeyeater (east ssp)	V
53	<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (east ssp)	V
54	<i>Daphoenositta chrysoptera</i>	Varied Sittella	V
55	<i>Petroica boodang</i>	Scarlet Robin	V
56	<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V
57	<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V
58	<i>Phascogale cinerea</i>	Koala	V
60	<i>Petaurus norfolcensis</i>	Squirrel Glider	r V
61	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	r V
62	<i>Saccolaimus flaviventris</i>	Yellow-bellied Shearwater	V
63	<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V
64	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V
65	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V
66	<i>Miniopterus australis</i>	Little Bentwing-bat	r V
67	<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	r V
68	<i>Myotis macropus</i>	Southern Myotis	r V
69	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	r V
70	<i>Vespadelus troughtoni</i>	Eastern Cave Bat	V

r = recorded on site this survey

### **H3 Application of the 7 Part Test**

#### **(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,**

##### **1. *Cynanchum elegans***

Potentially suitable habitat for this species may be found on the study site. However this species was not found on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This climber, with stems to about 1m long, is found in rainforest gullies, scrub and scree slopes from the Gloucester district to the Wollongong area and inland to Mt Dangar (Harden, 1992).

##### **2. *Rutidosia heterogama***

##### **Heath Wrinklewort**

Potentially suitable habitat for this species may be found on the site. No individuals of this species were found on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This perennial herb grows mostly in heath, chiefly in coastal districts from Maclean to the Hunter Valley, flowering mainly in autumn (Harden, 1992).

##### **3. *Tetradlea juncea***

##### **Black-eyed Susan**

Potentially suitable habitat for this species may be found on the site. No individuals of this species were found on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers primarily dense undisturbed understorey vegetation beneath an open forest dominated by *Angophora costata*, *Corymbia gummifera* and *Eucalyptus capitellata* (Payne, 1998). *Tetradlea juncea* appears to favour a southerly or easterly aspect on ridge tops or upper slopes on clayey soils derived from conglomerates beneath dry open forest or woodland dominated by a Smooth-barked Apple/Bloodwood alliance. The species flowers from July to December (Murray *et al*, 2002).

##### **4. *Acacia bynoeana***

##### **Bynoe's Wattle**

Potentially suitable habitat for this species may be found on the study site. However this species was not found on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This very small shrub prefers heath and dry sclerophyll forests on sandy soils (Harden, 1991) and is readily distinguished from other *Acacia* species by its branches and phyllodes which are covered with rough coarse hairs. It flowers from September to March, growing in typically very infertile and well drained sandy and sandy clay soils. *Acacia bynoeana* appears to most typically occur on sandy soils derived from Hawkesbury Sandstone in tall open shrubland or low open woodland.

##### **5. *Maundia triglochinoides***

Potentially suitable habitat for this wetland species may occur in ponds on the study site. However this species was not found on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This wetland perennial grows in freshwater swamps and shallow streams (Sainty & Jacobs, 1981) and occurs northwards from about Sydney to Queensland.

**6. *Callistemon linearifolius***

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species is found growing in “dry sclerophyll forest on the coast and adjacent ranges, chiefly from the Georges River to the Hawkesbury River” (Harden, 2002). It is also found north to the Nelson Bay area.

**8. *Eucalyptus glauca***

**Slaty Red Gum**

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This Eucalypt is found in grassy woodland on deep, moderately fertile and well watered soil from Taree to Broke (Plantnet - NSW Flora Online).

**9. *Eucalyptus parramattensis***

**Parramatta Red Gum**

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This Eucalypt is found in dry sclerophyll woodland on sandy soils in low, often wet sites (Plantnet - NSW Flora Online).

**10. *Syzygium paniculatum***

**Magenta Lilly Pilly**

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species grows in subtropical and littoral rainforest on sandy soils or stabilized dunes near the sea at widely separated localities between Bulahdelah and Jervis Bay (Plantnet - NSW Flora Online).

**12. *Persicaria elatior***

**Tall Knotweed**

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species grows in damp places, usually on the margin of standing water as very scattered occurrences along coastal NSW and in SE Qld (Plantnet - NSW Flora Online).

**13. *Grevillea parviflora* ssp. *Parviflora***

**Small-flowered Grevillea**

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species is known to occur in sandy to clay loam in moist heath or woodland, rarely on sandstone and is found in the regional vegetation type of Coastal Foothills Spotted Gum – Ironbark Forest (Murray *et al*, 2002). It occurs in light clay soils in woodland (NSW Scientific Committee, 1999).

**15. *Zannichellia palustris***

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers “fresh to brackish, still to slowly moving waters”, (Final determination 980612a). The species prefers semi permanent (standing at least 6 months), open bodies of still or slow moving fresh or brackish water (Personal communications, Mary Greenwood, Hons. student, Newcastle University, studying *Zannichellia palustris*).

**16. *Litoria aurea***

**Green and Gold Bell Tree Frog**

Habitat for this species may be found in ponds on the study site. Some areas of dense reeds and cumbungi are found on the site and permanent or semi permanent open ponds of fresh water are also found on the site. The species was not heard or found after nocturnal and diurnal, searches during dry and wet weather. Some suitable ponds on the site will be retained thereby conserving habitat on the site for this species.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers grassy areas near to open unshaded, still, shallow, ephemeral and unpolluted water bodies with sandy or rocky substrate, aquatic plants such as *Typha sp.* and free of predatory fish, such as *Gambusia sp.* with a range of diurnal shelters including vegetation and rocks (Pyke & White, 1996). The species also spends time exposed, sunning itself.

**25. *Botaurus poiciloptilus***

**Australasian Bittern**

Habitat for this species may be found on the study site. Reed beds and fringing vegetation on some ponds on the site may provide habitat for this species although this bird prefers more extensive areas of reed and cumbungi. No individuals of this species were heard or observed or otherwise recorded on the study site during this survey. Some ponds with reed bed areas are likely to be retained thereby conserving habitat on the site for this species.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers water in tall reed beds, sedges, rushes, cumbungi, lignum, drains in tussocky paddocks, saltmarsh, brackish wetlands and is seldom in trees (Pizzey, 1998). Dense and usually extensive reed-beds, especially cumbungi, at margins of lagoons, swamps, sluggish rivers and also tussocky wet paddocks (Serventy, 1985).

**26. *Ixobrychus flavicollis***

**Black Bittern**

Potential habitat for this species may be found on the site. This species could forage at the edge of ponds on the study site. This species was not recorded on the study site during this survey. Some ponds are likely to be retained on the site thereby conserving habitat on the site for this species.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species is found in terrestrial wetlands and estuarine and littoral habitats. Forages at edge of still or flowing water usually in permanent wetlands fringed by dense vegetation. It breeds in densely vegetated wetlands in secluded places where nests are built in leafy trees overhanging water (Marchant & Higgins, 1998).

**28. *Hieraaetus morphnoides***

**Little Eagle**

Potential forage, refuge and breeding habitat for this species may be found on the site. This species was not recorded on the site during this survey. Much of the existing forest vegetation will be retained on the site thereby conserving potential habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers plains, foothills, open forests, woodlands and scrublands, River Red Gums on watercourses and lakes (Pizzey & Knight, 2007). Typically found in woodlands, forested land and open country extending into arid zones of Australia; feeds mostly on vertebrates, often rabbits; nests in open woodland, mallee and tree lined watercourses (Marchant & Higgins, 1993).

**29. *Lophoictinia isura***

**Square-tailed Kite**

Potential forage and breeding habitat for this species may be found on the site. This species was not recorded on the site during this survey. Much of the existing forest vegetation will be retained on the site thereby conserving potential forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers heathlands, woodlands, forests, tropical and subtropical rainforest, timbered watercourses, hills and gorges (Pizzey & Knight, 2007). Typically found in forested and wooded lands of tropical and temperate Australia; many common vegetation associations used; in southern Australia predominantly eucalypt open forest and woodland; feeds mostly on passerines and foliage insects and sometimes small mammals and lizards; nests often near water in forest or open woodland in tree to about 18m (Marchant & Higgins, 1993).

**31. *Falco subniger***

**Black Falcon**

Potential forage, refuge and breeding habitat for this species may be found on the site. This species was not recorded on the site during this survey. Much of the existing forest vegetation will be retained on the site thereby conserving potential habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers plains, grasslands, foothills, timbered watercourses and wetland environments (Pizzey & Knight, 2007). Typically found wooded lands, open country and terrestrial wetlands of tropical and temperate Australia; feeds mostly on small terrestrial birds but also mammals, reptiles and insects; nests in large living or dead trees on flat plains or floodplains, isolated trees or in trees fringing creeks and waterholes (Marchant & Higgins, 1993).

**40. *Glossopsitta pusilla***

**Little Lorikeet**

Potential forage and breeding habitat for Little Lorikeets may be found on the site. This species was recorded on the study site during this survey. This species will visit flowering eucalypts on the site and trees with potential nest hollows suitable for this species are found on the site. Much of the existing forest vegetation will be retained on the site, including hollow bearing trees, thereby conserving potential forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

Little Lorikeets are nomadic and prefer dry, open eucalypt forests and woodlands, feeding primarily on nectar and pollen of tall flowering eucalypts plus sometimes *Angophora* and *Melaleuca*, plus fruits of mistletoes (Higgins 1999). They nest in hollows mostly in living, smooth-barked eucalypts (Higgins 1999). Can appear at a location at any time of year to feed on flowering eucalypts.

**41. *Lathamus discolor***

**Swift Parrot**

Potential forage habitat for this species may be found on the site. Individuals of this species may be transitory visitors to the flowering eucalypts on the site during winter months. During summer it lives and breeds only in Tasmania. No individuals of the species were recorded on the site during this survey. Much of the existing forest vegetation will be retained on the site thereby conserving potential forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers timbered country where there are flowering trees and breeds in Tasmania (Readers Digest, 1982). Swift Parrots migrate to the south east parts of the Australian mainland during the winter months and is apparently nomadic in response to food resources then returns to Tasmania to breed during spring and summer (Higgins, 1999). Food for this species is mainly nectar, mostly from eucalypts but also includes psyllids, lerps, seeds and fruit (Higgins, 1999). Swamp Mahogany (*Eucalyptus robusta*) trees are an important winter food source for this species.

#### **43. *Ninox connivens***

#### **Barking Owl**

Potential forage and refuge habitat for this species is found on the site. Hollow bearing trees are found on the site and trees with potentially suitable large hollows as breeding or roost habitat for this owl are found on the site. The site may provide suitable forage habitat for this species as part of a larger foraging area. The Barking Owl was not recorded on the site during this survey. Owl call playback during this survey did not elicit a response from this species on or near the site and the species was not heard calling on or near the site. Much of the existing forest vegetation will be retained on the site, including hollow bearing trees, thereby conserving some potential habitat for this species and its prey species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers open forests, woodlands, paperbark woodlands, dense scrubs, foothills, river red gums, other large trees near watercourses in open country (Pizzey, 1998). Ideal habitat for this species is open country with a choice of large trees for roosting and nesting (Hollands, 1991). Barking Owls feed primarily on insects but include birds and mammals such as gliders and rabbits in the diet during breeding when large hollows in live eucalypts are required (Garnett and Crowley, 2000). Feeds mainly on insects outside of breeding season and more birds and mammals during breeding (Higgins, 1999). It appears that most mammals preyed on are smaller arboreal mammals.

#### **44. *Ninox strenua***

#### **Powerful Owl**

Potential forage and refuge habitat for this species is found on the site. However, tall large trees with suitably large hollows as breeding habitat for this owl are not found on the site. The Powerful Owl was not recorded on the site during this survey. Owl call playback during this survey did not elicit a response from this species on or near the site and the species was not heard calling on or near the site. However, this owl is likely to utilise the site as part of a larger foraging area in search of prey species such as Brush-tailed Possums, Ring-tail Possums, Squirrel Gliders, Kookaburras and Rosellas etc which are likely to be found on the site. Much of the existing forest vegetation on the site will be retained thereby conserving potential forage and refuge habitat for this species and its prey species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers to occupy a large territory of between 300 and 1500 hectares in mountain forests, gullies and forest margins, sparser hilly woodlands, coastal forests, woodlands, scrubs etc (Higgins, 1999). The Powerful Owl always roosts in the open, on a branch, during the day and when roosting in dense vegetation may be low to the ground (Hollands, 1991). Powerful Owls feed mainly on Common Ring-tail Possums and Greater Gliders but also Common Brush-tail Possum, Squirrel Gliders and birds including White Cockatoos (Higgins, 1999). The nest site is typically a large vertical hollow such as broken off trunks of trees but also in horizontal or hollow spouts, usually in living trees but sometimes in dead trees (Higgins, 1999).

#### **46. *Tyto novaehollandiae***

#### **Masked Owl**

Forage, breeding and refuge habitat for this species may be found on the site. Several hollow bearing trees are found on the site. Larger hollows in trees as refuge and breeding habitat for this owl are found on the site. The Masked Owl was not recorded on the site during this survey. Owl call playback during this survey did not elicit a response from this species on or near the site and the species was not heard calling on or near the site. This owl may utilise the site as part of a larger foraging area in search of typical prey species such as Rats. Much of the existing forest vegetation on the site will be retained, including hollow bearing trees, thereby conserving potential habitat for this species and its prey species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers forests, open woodlands, farmlands with large trees, adjacent cleared country, timbered watercourses, paperbark woodlands and caves (Pizzey & Knight, 2007). The species is mostly recorded in open forest and woodland with a sparse understorey adjacent to open habitats such as cleared farmland, grassland, sedgeland and wetlands etc (Higgins, 1999). Studies indicate that this species will utilise a territory greater than 1000 hectares (Higgins, 1999). Feeds mainly on small to medium terrestrial mammals such as rats but also some arboreal mammal species and birds (Higgins, 1999). Masked Owls nest in “a large hollow in a living or dead tree” (Hollands, 1991) and generally roost in hollows during the day.

**47. *Tyto tenebricosa***

**Sooty Owl**

Forage, breeding and refuge habitat for this species may be found on the site. Several hollow bearing trees are found on the site. Larger hollows in trees as refuge and breeding habitat for this owl are found on the site. The Masked Owl was not recorded on the site during this survey. Owl call playback during this survey did not elicit a response from this species on or near the site and the species was not heard calling on or near the site. This owl may utilise the site as part of a larger foraging area in search of typical prey species such as Squirrel Gliders and Rats. Much of the existing forest vegetation on the site will be retained, including hollow bearing trees, thereby conserving potential habitat for this species and its prey species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers tall wet forests in east and south east facing mountain gullies with a dense understorey layer (Pizzey & Knight, 2007); deep moist gullies in eucalypt forest, usually with big, old, smooth-barked gums with an understorey of tree ferns and Lilly Pilly (Hollands, 1991). This species forages for both arboreal species such as Sugar Gliders and terrestrial species such as rats and breeds in larger hollow bearing trees (Newton *et al*, 2002).

**49. *Chthonicola sagittata***

**Speckled Warbler**

Potential refuge, forage and breeding habitat for this species may be found on the study site. This species was not recorded on the study site during this survey. Much of the existing forest vegetation on the site will be retained and not disturbed thereby conserving potential refuge, forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This readily observed sedentary species refuges, forages and breeds mainly in drier woodlands with tussocks, fallen logs, branches and rocks (Pizzey & Knight, 2007). Found mainly in grassy ground layer of dry sclerophyll forests and woodlands, often with scattered shrubs in understorey, mainly on slopes of the Great Divide, rarely reported from the coast (Higgins & Peter, 2002).

**50. *Xanthomyza Phrygia***

**Regent Honeyeater**

Potential habitat for this species may be found on the study site. This species could potentially be an irregular and transitory visitor to the eucalypts, when in flower, on the study site from its preferred habitat west of the Great Divide. The species was not found on the study site during this survey. It will be recommended to retain areas of native vegetation on the site thereby retaining potential forage habitat for this species.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This migratory species prefers dry open forest and woodlands with a range of eucalypt species, especially ironbarks (Morcombe, 2000), but will also utilise farmland, streets and gardens (Pizzey, 1998). Found mainly on and west of the Great Divide in NSW with few recent records of the species on the coasts although the species will visit the coast, possibly in response to poor food supply in core breeding areas (Higgins *et al*, 2001).

**52. *Melithreptus gularis gularis***

**Black-chinned Honeyeater**

Potential habitat for this species may be found on the study site. This species may be an irregular and transitory visitor to the eucalypts, when in flower, on the study site from its preferred habitat west of the Great Divide. The species was not found on the study site during this survey. It will be recommended to retain and not disturb forest vegetation on the site thereby conserving potential habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This nomadic species prefers forest and woodland of eucalypts, paperbarks and tree lined watercourses of arid regions (Morcombe, 2000). This seasonally nomadic species prefers drier eucalypt forests and woodlands, timber on watercourses, often with no understorey, scrubs and Ironbark forests on the western slopes (Pizzey, 1998).

**53. *Pomatostomus temporalis temporalis***

**Grey-crowned Babbler**

Potential refuge, forage and breeding habitat for this species may be found on the study site. This species was not recorded on the study site during this survey. Much of the existing forest vegetation on the site will be retained and not disturbed thereby conserving potential refuge, forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This readily observed sedentary species is found in open forests, woodlands, scrublands, farmlands and outer suburbs (Pizzey & Knight, 2007). Found mainly in open forests and woodlands with an open shrub layer, sparse groundcover, fallen timber and leaf litter (Higgins & Peter, 2002).

**54. *Daphoenositta chrysoptera***

**Varied Sittella**

Potential refuge, forage and breeding habitat for this species may be found on the study site. This species was not recorded on the study site during this survey. Much of the existing forest vegetation on the site will be retained and not disturbed thereby conserving potential refuge, forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This readily observed species is found in open eucalypt forests and woodlands, mallee, inland acacia and coastal tea-tree scrubs (Pizzey & Knight, 2007). Found mainly in eucalypt forests and woodlands, usually with rough-barked trees such as stringybarks and ironbarks (Higgins & Peter, 2002).

**55. *Petroica boodang***

**Scarlet Robin**

Potential refuge, forage and breeding habitat for this species may be found on the study site. This species was not recorded on the study site during this survey. Much of the existing forest vegetation on the site will be retained and not disturbed thereby conserving potential refuge, forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This readily observed species is found in foothill forests, woodlands, watercourses and in autumn and winter more open habitats including golf courses, parks, gardens and orchards (Pizzey & Knight, 2007). Found mainly in eucalypt forests and woodlands with an open understorey, in autumn and winter may disperse to more open habitats including urban areas (Higgins & Peter, 2002).

**56. *Dasyurus maculatus***

**Spotted-tailed Quoll**

Potential forage habitat for this species may be found on the site. Prey species such as birds, reptiles and small mammals, including possums and rats are likely found on the site. The species was not recorded on the site during this survey. A portion of the existing vegetation on the site will be retained thereby conserving potential forage habitat for this species and its prey species on the site.

The life cycle of the species is unlikely to be disrupted such that a viable local population of the species would be placed at risk of extinction.

This nocturnal species prefers rainforest, open forest, woodland and coastal heathland (Strahan, 1998) and requires hollow logs, caves or rock crevices as shelter and breeding dens. The Spotted-tailed Quoll is an opportunistic carnivore that preys on birds, reptiles and small mammals, including gliders, possums and rats etc and also scavenges on carrion (NSW DECC Threatened Species profile).



**57. *Phascogale tapoatafa***

**Brush-tailed Phascogale**

Potentially suitable habitat for this species may be found on the study site. Hollows potentially suitable for this species are found on the site. Brush-tailed Phascogales were not recorded on the study site during this survey. Much of the existing forest vegetation on the site will not be disturbed by the proposed development thereby conserving potential refuge, forage and breeding habitat for this species on the site. However, considering the isolation of vegetation on the site from extensive areas of native vegetation then this species is unlikely to be found on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers open forest with sparse ground cover (Strahan, 1995) and dry sclerophyll forest and open woodlands that contain hollow bearing trees (Maxwell *et al*, 1996). The carnivorous and nocturnal Brush-tailed Phascogale forages, preferentially in rough barked trees, for prey such as spiders, centipedes, beetles and cockroaches plus nectar and occasionally small vertebrates (NSW DECC Threatened Species profile).

**58. *Phascogale cinerea***

**Koala**

Potential forage and refuge habitat for this species is found on the study site. Preferred koala feed trees are found on the site. However, no koalas or signs of koalas were observed on the site during this survey. There are only two (2) records in the Bionet wildlife database of koalas within 5km of the site. Much of the existing forest vegetation on the site including Koala feed trees, will not be disturbed by the proposed development thereby conserving potential habitat for this species on the site. However, considering the isolation of vegetation on the site from extensive areas of native vegetation then this species is unlikely to be found on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development on the site such that a viable local population of the species would be placed at risk of extinction.

This species has a widespread but patchy distribution in eastern NSW (Ellis & Etheridge, 1993) and is usually associated with eucalypt forests throughout the range with marked local and regional preferences for various eucalypt species as feed trees (Strahan, 1998). Koala home ranges can vary from male to female and depending on the palatability and nutritional value of the feed trees. They are generally from less than 2 to greater than 3 hectares but in areas of low preferred tree densities can be up to 100 hectares (Martin and Handasyde, 1999). Koalas are known to feed on a wide variety of eucalypt and other tree species however in Schedule 2 of SEPP No 44 is a list of ten “primary koala feed trees”.

**66. *Petaurus norfolkensis***

**Squirrel Glider**

Potential forage, refuge, breeding and den habitat for this species is found on the site. Squirrel Gliders were recorded during trapping and spotlighting surveys on this site. Trees with potentially suitable hollows for this species as den or breeding habitat are found on the site and the site contains vegetation with mixed aged eucalypt trees with a range of species and understorey shrubs including wattles as forage habitat for this species. Much of the existing native forest vegetation on the site, including hollow bearing trees, will be retained thereby conserving forage, refuge and breeding habitat for this species on the site. Corridors of vegetation will be retained between the forest patches on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers open forest or woodland with hollow bearing, mature or mixed aged stands with several eucalypt species (Murray, 1996). It inhabits dry sclerophyll forest and woodland and is absent from dense coastal ranges (Strahan, 1998). It forages in eucalypt trees and shrubs such as wattles primarily for insects (Menkhorst, 1995) but also sap, nectar and pollen and utilises old trees with hollows for den habitat (Strahan, 1998). This glider “is known to travel up to 1km from foraging areas to a preferred hollow” (Menkhorst, 1995).

**61. *Pteropus poliocephalus***

**Grey-headed Flying-fox**

Forage habitat for this species is found on the site. Grey-headed Flying-foxes were heard on nearby land during this survey. Grey-headed Flying-foxes are likely to forage in flowering eucalypt trees, especially Spotted Gums, when these trees are in flower on the site. The site does not support a daytime roost (camp) of this species. A portion of the existing forest vegetation on the site will be retained thereby conserving forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species feeds on the blossoms of a large range of eucalypt and non-eucalypt tree and shrub species; rainforest fruit species comprise a small proportion of the diet of flying-foxes in NSW (Eby, 1995). Grey-headed Flying-foxes roost in large numbers during the day in “camps” that have a history of irregular or permanent use over many years (Eby, 1995). This bat will fly over 30km from the camp to foraging areas (Menkhorst, 1995).

**62.      *Saccolaimus flaviventris***

**Yellow-bellied Sheath-tailed-Bat**

Forage habitat for this species may be found over the study site. Potentially suitable hollow bearing trees are found on the site for this species to breed and roost in. Open areas on the site are available for this species as forage habitat and forage habitat is available on farmland and wetland areas north of the site. This species was not recorded on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This widespread species forages for insects above the canopy and roosts in tree hollows (Strahan, 1998). Insectivorous bats are known to travel widely from roost trees to favoured forage areas.

**63.      *Mormopterus norfolkensis***

**Eastern Freetail Bat**

Forage, roost and breeding habitat for this species is found on the site. This species was not recorded on the site during this survey. Some hollow bearing trees on the site could potentially be used by this species as roost and breeding habitat. Much of the existing forest vegetation on the site, including hollow bearing trees, will be retained thereby conserving forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species forages in dry eucalypt forest and woodland (Strahan, 1998). The species apparently roosts in tree hollows and forages in openings and gaps in the forest (Churchill, 1998). Very little is known about this species.

**64.      *Chalinolobus dwyeri***

**Large-eared Pied Bat**

Forage habitat for this species may be found on the site. This species was not recorded on the site during this survey. There are no caves or mines on the site in which individuals or a population would roost or breed. Much of the existing vegetation on the site will be retained thereby conserving forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species forages in tall open eucalypt forest, dry sclerophyll forest, woodland, wet sclerophyll forest and rainforest and roosts predominantly in caves and mines (Churchill, 1998).

**65.      *Falsistrellus tasmaniensis***

**Eastern False Pipistrelle**

Potential habitat for this species may be found on the site although the species is more common at higher elevations. Individuals or a population of the species may forage about the tree canopy of the study site or utilise the hollow bearing trees on the site for roosting or breeding. This species was not recorded on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species inhabits sclerophyll forests, at cool elevations (Strahan, 1995). It forages within or just below the tree canopy, from the ranges to the coast and prefers wet habitats where trees are more than 20m high and generally roost in hollow trunks of eucalypt trees though they have been recorded in caves (Churchill, 1998).

**66.      *Miniopterus australis***

**Little Bent-wing Bat**

Forage habitat for this species may be found on the site. This species was recorded on the site during this survey. There are no caves, mines or large culverts on the site in which individuals or a population would roost or breed.

Much of the existing forest vegetation on the site will be retained thereby conserving forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species forages, between the shrub and canopy layers, in tall open eucalypt forest, dry sclerophyll forest, woodland, wet sclerophyll forest, rainforest and melaleuca swamps and roosts and breeds in caves and mines (Churchill, 1998).

**67. *Miniopterus schreibersii oceanensis***

**Large Bent-wing Bat**

Forage habitat for this species may be found on the site. This species was recorded on the site during this survey, however, there are no caves or mines on the site in which individuals or a population would roost or breed. Much of the existing vegetation on the site will be retained thereby conserving forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This fast flying species forages, above the canopy layer, in tall open eucalypt forest, dry sclerophyll forest, woodland, wet sclerophyll forest, rainforest, melaleuca swamps and over grasslands and roosts and breeds in caves, mines and culverts (Churchill, 1998).

**68. *Myotis macropus***

**Southern Myotis**

Forage habitat for this species may be found in the study area. This species was recorded over ponds on the site during this survey. There are no caves, mines or large culverts on the study site in which individuals or a population would roost and breed. This species will forage over open water on ponds on the site and may roost in culverts of drains etc nearby or caves and mines in the local region. Some of the ponds with open water will likely be retained on the site, however, there are other open surface water ponds in the local area over which this species may forage.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species forages for insects over streams and pools in mangroves, paperbark swamps, rainforest, wet and dry sclerophyll forest and open woodland. The species roosts in caves but is also known to roost in tree hollows, vegetation, Pandanus, under bridges, in mines, tunnels and stormwater drains (Churchill, 1998).

**69. *Scoteanax rueppellii***

**Greater Broad-nosed Bat**

Forage, roost and breeding habitat for this species is found on the site. This species was recorded on the site during this survey. Some hollow bearing trees on the site could potentially be used by this species as roost and breeding habitat. Much of the existing forest vegetation on the site, including hollow bearing trees, will be retained thereby conserving forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This slow flying species forages within 20m of the ground along tree lines often adjacent to cleared paddocks and prefers moist gullies in mature coastal forest but also forages in gullies of dry sclerophyll forest, woodland, wet sclerophyll forest and roosts in hollow tree trunks and branches (Churchill, 1998).

**46. *Vespadelus troughtoni***

**Eastern Cave Bat**

Forage habitat for this species may be found on the study site. This species was not recorded on the site during this survey. There are no caves or mines on the study site in which individuals or a population would roost or breed. Much of the existing forest vegetation on the site will be retained thereby conserving forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species forages in tall open eucalypt forest, dry sclerophyll forest, woodland, wet sclerophyll forest and rainforest and roosts predominantly in caves and mines (Churchill, 1998).

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

No threatened flora or fauna species found within 10km of the study site are part of an “endangered population” cited in Schedule 1, Part 2 Endangered Populations of the TSC Act 1995.

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

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

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

The site does not support a “Critically Endangered Ecological Community” (CEEC) as listed under Schedule 1A, Part 2 of the TSC Act 1995.

According to vegetation mapping (LHCCREMS, 2003) and ground investigations the site does support an “Endangered Ecological Community” (EEC) identified under Part 3 of Schedule 1 of the TSC Act 1995.

The site supports two EEC’s, these are identified as

- **Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion**
- **Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions**

Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion is found on the south-east and south-west corner portions and along much of the south edge of the site (**Fig-3**). Much of this EEC is in relatively good condition and will be conserved by the proposed development. Some already disturbed parts at the edges of this EEC may be cleared or partially cleared for an Asset Protection Zone. Of the approximately 13.6 hectares of SGIF on the site about 3.9 hectares (28.7%) of SGIF would be cleared or disturbed by the APZ (as indicated in a plan provided 30.9.14). Clearing of approximately 3.9 hectares of this EEC from the site is an insignificant portion of the Regional (26,917 hectare) and Local (1204 hectare) occurrence of this EEC as of 2000. As of 2000, according to the Maitland Greening Plan (MCC, 2002), approximately 1204 hectares (9.5%) of the local pre 1750 extent of this EEC remained. A recommendation in the Maitland Greening Plan suggests the Conservation outcome for this EEC should be “No Net Loss”.

Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions is found either side of a shallow drainage depression in the centre north portion of the site (indicated as Red Gum Forest in **Fig-3**). Most of this EEC appears to have undergone some form of disturbance. Some heavily disturbed parts at the edges of this EEC may be cleared or partially cleared for an Asset Protection Zone. Much of the EEC will be retained by the proposed development. Most of the areas of this EEC to be cleared by the APZ are already

degraded or on disturbed land. The main core of this community on the site will be retained. Of the approximately 4.7 hectares of Red Gum Forest on the site about 2.0 hectares (42%) would be cleared or disturbed by the APZ (as indicated in a plan provided 30.9.14). Clearing of approximately 2.0 hectares of this EEC from the site is an insignificant portion of the Regional (4,856 hectare) and Local (670 hectare) occurrence of this EEC as of 2000. According to the Maitland Greening Plan (MCC, 2002), approximately 670 hectares (15%) of the local pre 1750 extent of this EEC remained as of 2000. A recommendation in the Maitland Greening Plan suggests the Conservation outcome for this EEC should be “No Net Loss”.

The proposed development is unlikely to **have an adverse effect on the extent** of an ecological community such that its local occurrence is likely to be placed at risk of extinction.

The proposed development is unlikely to **substantially and adversely modify the composition** of an ecological community such that its local occurrence is likely to 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, and**

According to plans provided, the proposed development will retain about 80% of the Spotted Gum Ironbark Forest and about 60% of the Red Gum Forest (**Fig-3**) on the north, east and west portions of the site. About one third of the existing native forest vegetation on the site will be removed or modified as a result of the proposed action.

**(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**

Connectivity will be retained between areas of retained native forest vegetation on the east and west portions of the site. There are no corridors to forest vegetation north of the site and only broken corridors to vegetation off the south of the site. Land surrounding the site is already heavily cleared and fragmented. An area of habitat is unlikely to become fragmented or isolated from other areas of habitat as a result of the proposed action

**(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 relatively small area of forest vegetation proposed to be cleared for development on the site is unlikely to be significant or important to local threatened species, populations and ecological communities. However, it is here recognised that the cumulative impact of clearing many small areas of native vegetation over time is likely to be significant.

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

The site and adjacent areas are not “critical habitat” as described and listed in the Register of Critical Habitat kept by the Director General of the Department of Environment and Conservation.

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

There are few State or Federal recovery plans (draft or final) available for threatened species in the local region and none available for threatened insectivorous bats. For the following species that may be affected by the proposed development recovery plans are available –

- Grey-headed Flying-fox
- Koala
- Regent Honeyeater
- Large forest owls

Conserving much of the native vegetation on the site is likely to be consistent with the objectives of recovery plans for the above mentioned species.

Threat abatement plans are available for –

- Red Fox
- Bitou Bush
- Plague Minnow

These species were found or are already likely to be found on or near the site, however, the proposed development is unlikely to introduce or intentionally encourage these species into the area.

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

The following Key Threatening Processes are listed in Schedule 3 of the Threatened Species Conservation Act 1995.

- I. **Alteration of habitat following subsidence due to longwall mining** – the proposed development is not longwall mining and will not cause alteration of habitat following subsidence due to longwall mining
- II. **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands** – the proposed development is unlikely to alter flow regimes of creeks, rivers and streams.
- III. **Anthropogenic Climate Change** – clearing of a small area of vegetation from the site is unlikely to contribute significantly to anthropogenic climate change. However the cumulative impact of clearing many small areas may have a significant impact. It will be recommended to minimize clearing.
- IV. **Bushrock removal** – It will be recommended to not disturb natural bushrock where not necessary and not to remove natural bushrock from the site.
- V. **Clearing of native vegetation** - Loss of the small area of native vegetation from the site for the proposed development is unlikely to immediately threaten the survival or evolutionary development of species, populations or ecological communities or their habitats. However clearing of vegetation from the study site may contribute over time to the cumulative impact of native vegetation loss and fragmentation in the local area.
- VI. **Competition and grazing by feral European Rabbit, *Oryctolagus cuniculus*** – the proposed development is unlikely to intentionally cause the introduction of feral rabbits into the local area. Feral rabbits are already found on the site.

- VII. **Competition and habitat degradation by Feral Goats, *Capra hircus*** - the proposed development is unlikely to intentionally cause the introduction of feral Goats into the local area.
- VIII. **Competition from feral honey bees, *Apis mellifera*** - the proposed development is unlikely to intentionally cause the release of feral honey bees into the local area.
- IX. **Death or injury to marine species following capture in shark control programs on ocean beaches** – not applicable.
- X. **Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments** – the proposed development is unlikely to release anthropogenic debris into the marine or estuarine environment.
- XI. **Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners** – the proposed development is unlikely to intentionally encourage psyllids and Bell Miners onto the site.
- XII. **Herbivory and environmental degradation caused by feral deer** - the proposed development is unlikely to intentionally encourage or release deer onto the site.
- XIII. **High frequency fire** – the proposed development is unlikely to introduce a high fire regime to native vegetation in the local area.
- XIV. **Importation of Red Imported Fire Ants *Solenopsis invicta*** – the proposed development is unlikely to intentionally or knowingly import Red Fire Ants into the local area
- XV. **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations** – the proposed development is unlikely to intentionally cause infection of psittacine (parrot) species in the local area with Psittacine Circoviral Disease.
- XVI. **Infection of frogs by amphibian chytrid causing the disease chytridiomycosis** – the proposed development is unlikely to cause the intentional spread of chytridiomycosis.
- XVII. **Infection of native plants by *Phytophthora cinnamomi*** - the proposed development is unlikely to intentionally cause infection of native plants by *Phytophthora cinnamomi* in the local area
- XVIII. **Introduction of the Large Earth Bumblebee *Bombus terrestris*** – the proposed development is unlikely to intentionally cause the introduction of the Large Earth Bumblebee into the local environment.
- XIX. **Invasion and establishment of Scotch Broom (*Cytisus scoparius*)** - the proposed development is unlikely to intentionally infect the site with Scotch Broom.
- XX. **Invasion and establishment of Lantana (*Lantana camara*)** – the site already contains extensive patches of Lantana.
- XXI. **Invasion and establishment of Cane Toad (*Bufo marinus*)** – these amphibians are not found on the site and the proposed development is unlikely to cause the introduction of Cane Toads to the site or local area.
- XXII. **Exotic Vines and Scramblers** – A small number of exotic vines and scramblers are already found on the site. The proposed development will be encouraged to not use exotic plants in gardens and as landscaping for the site.
- XXIII. **Invasion of native plant communities by African Olive (*Olea europaea*)** - the proposed development is unlikely to intentionally introduce African Olive to native vegetation on the site or the local area. This plant is already found on the site.
- XXIV. **Invasion of native plant communities by *Chrysanthemoides monilifera*** - the proposed development is unlikely to intentionally introduce *C. monilifera* to native vegetation on the site or the local area. This plant is already found on the site.

- XXV. **Invasion of native plant communities by exotic perennial grasses** – exotic perennial grasses are already present on the site, especially in disturbed areas of the site.
- XXVI. **Invasion of the Yellow Crazy Ant, (*Anoplolepis gracilipes*)** - the proposed development is unlikely to intentionally introduce Yellow Crazy Ants to native vegetation on the site or the local area.
- XXVII. **Loss of hollow bearing trees** – the proposed development will minimize the number of hollow bearing trees disturbed or removed.
- XXVIII. **Loss or degradation (or both) of sites used for hill-topping by butterflies** – the proposed development is unlikely to destroy vegetation on higher ground that may be utilised by butterflies for hill-topping.
- XXIX. **Predation and hybridisation by Feral Dogs, (*Canis lupus familiaris*)** – the proposed development is unlikely to intentionally cause predation and hybridisation by feral dogs.
- XXX. **Predation by *Gambusia holbrooki* (Plague Minnow or Mosquito Fish)** - the Plague Minnow is already present in ponds on the site but is unlikely to be further encouraged or protected by the proposed development.
- XXXI. **Predation by the European Red Fox *Vulpes Vulpes*** – the Fox is already present in the local area but is unlikely to be further encouraged or protected by the proposed development.
- XXXII. **Predation by the Feral Cat *Felis catus*** - the Feral Cat is likely already present in the local area but is unlikely to be further encouraged or protected by the proposed development.
- XXXIII. **Predation by the Ship Rat *Rattus rattus* on Lord Howe Island** – not applicable.
- XXXIV. **Predation, habitat degradation, competition and disease transmission by Feral Pigs *Sus scrofa*** – The proposed development is unlikely to cause the introduction or spread of feral pigs into the local area.
- XXXV. **Removal of dead wood and dead trees** – the proposed development is likely to cause the removal of some dead wood on the ground and small dead trees from that part of the site being developed.



## APPENDIX – I

## Fauna trapping results

Trap site locations and transects are indicated in figures of this report.

Site - old brickworks site, Metford Road, Metford, NSW  
Co-ordinates of site - (centre of site) 369551 E 6374532 N

M = Male F = Female

Note - For this survey, trapped fauna are released as soon as possible to reduce stress, unless handling is required for identification, therefore details such as sex and weight of individuals are often not recorded.

SGIF = Spotted Gum Ironbark Forest, RGF = Red Gum Forest, RA = Rehabilitation area.

### Trap results

Date	Trap location	Trap type	Species captured	Sex	Wgt (g)	Comment
15.9.14	See Fig	Ell A				Set traps
“	See Fig	Ell B				Set traps
“	See Fig	Cage				
“	See Fig	Camera				
16.9.14		Ell A	Nothing			
“		Ell B	Nothing			
“		Cage	Nothing			
“		Camera	Nothing			
“	See Fig	Harp				Set trap
17.9.14	SGIF west	Ell A2	Black Rat			
“		Ell B	Nothing			
“		Cage	Nothing			
“		Camera	Nothing			
“	RGF	Harp	Lesser Long-eared Bat	F		
18.9.14	SGIF west	Ell A1	Black Rat			
“	SGIF west	Ell B2	Squirrel Glider			
“		Cage	Nothing			
“		Camera	nothing			
“	SGIF west	Harp	Goulds Wattled Bat	F		Harp traps pulled in
19.9.14	SGIF west	Ell A4	Black Rat			
“		Ell B	Nothing			
“	SGIF west	Cage	Black Rat			
“	RGF	Camera	Fox			
“						All traps pulled in

**Camera trap results**

<b>Unit No</b>	<b>Date set</b>	<b>Date collected</b>	<b>Location</b>	<b>Species recorded</b>
TC01	15.9.14	19.9.14	SGIF – west	Nothing
TC01	23.9.14	25.9.14	Rehabilitation area	Nothing
TC02	15.9.14	19.9.14	RGF - east	Fox
TC02	23.9.14	25.9.14	SGIF – south-west	Nothing
TC03	23.9.14	25.9.14	SGIF – east	Fox
TC04	23.9.14	25.9.14	RGF - west	Fox

**Hair tube results**

<b>Date set</b>	<b>Date collected</b>	<b>Size &amp; type</b>	<b>Location</b>	<b>Mammal ID – definite/probable</b>
17.9.14	23.9.14	40mm arboreal	RGF east #1	Swamp Rat ( <i>Rattus lutreolus</i> ) - definite
17.9.14	23.9.14	40mm arboreal	RGF east #2	Swamp Rat ( <i>Rattus lutreolus</i> ) - definite
17.9.14	23.9.14	40mm arboreal	SGIF west #3	Swamp Rat ( <i>Rattus lutreolus</i> ) - definite

All birds heard or observed from the survey location were recorded.

**Bird sample - Plot 1**

**Date** - 11.9.14 **Time** - 0850-0910  
**Study area** - old brickworks site Metford Rd, Metford  
**Co-ordinates** - 369557E, 6374480N  
**Bird Plot location** - centre of site in rehabilitation area  
**Habitat description** - Rehabilitation area  
**Conditions** - clear, light breeze, mild

**Bird sample - Plot 2**

**Date** - 11.9.14 **Time** - 1510-1530  
**Study area** - old brickworks site Metford Rd, Metford  
**Co-ordinates** - 369128E, 6374487N  
**Bird Plot location** - south-west corner  
**Habitat description** - Forest  
**Conditions** - clear, light breeze, mild

**Bird sample - Plot 3**

**Date** - 12.9.14 **Time** - 1440-1500  
**Study area** - old brickworks site Metford Rd, Metford  
**Co-ordinates** - 370146E, 6374240N  
**Bird Plot location** - south-east corner  
**Habitat description** - Forest  
**Conditions** - overcast, still, mild

**Bird sample - Plot 4**

**Date** - 16.9.14 **Time** - 0730-0750  
**Study area** - old brickworks site Metford Rd, Metford  
**Co-ordinates** - 369894E, 6374277N  
**Bird Plot location** - south-east edge  
**Habitat description** - Forest  
**Conditions** - light cloud, still, warm

**Bird sample - Plot 5**

**Date** - 18.9.14 **Time** - 0820-0840  
**Study area** - old brickworks site Metford Rd, Metford  
**Co-ordinates** - 369868E, 6374493N  
**Bird Plot location** - north-east edge  
**Habitat description** - Red Gum Forest  
**Conditions** - clear, light breeze, mild

**Bird sample - Plot 6**

**Date** - 19.9.14 **Time** - 0720-0740  
**Study area** - old brickworks site Metford Rd, Metford  
**Co-ordinates** - 369838E, 6374423N  
**Bird Plot location** - centre east  
**Habitat description** - Red Gum Forest  
**Conditions** - light cloud, light breeze, mild

**Bird sample - Plot 7**

**Date** - 23.9.14 **Time** - 0810-0830  
**Study area** - old brickworks site Metford Rd, Metford  
**Co-ordinates** - 369617E, 6374394N  
**Bird Plot location** - centre of rehabilitation area  
**Habitat description** - rehabilitation area  
**Conditions** - clear, still, warm

**Bird sample - Plot 8****Date** - 23.9.14**Time** - 0840-0900**Study area** - old brickworks site Metford Rd, Metford**Co-ordinates** - 369133E, 6374396N**Bird Plot location** - south-west corner**Habitat description** - Forest**Conditions** - clear, still, warm

Scientific Name	Common Name	BP 1	BP 2	BP 3	BP 4	BP 5	BP 6	BP 7	BP 8
<i>Acanthiza lineata</i>	Striated Thornbill		2	3	4	5		7	8
<i>Acanthiza nana</i>	Yellow Thornbill								8
<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill			3					
<i>Acrocephalus stentoreus</i>	Reed Warbler	1				5			
<i>Anas superciliosa</i>	Pacific Black Duck	1							
<i>Colluricincla harmonica</i>	Grey Shrike-thrush								8
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike		2	3			6		
<i>Corvus coronoides</i>	Australian Raven				4	5	6	7	
<i>Dicaeum hirundinaceum</i>	Mistletoebird		2	3	4	5	6		8
<i>Gymnorhina tibicen</i>	Australian Magpie	1		3				7	
<i>Hirundo neoxena</i>	Welcome Swallow	1				5			
<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater		2	3	4	5	6	7	8
<i>Malurus cyaneus</i>	Superb Blue Wren	1	2					7	8
<i>Malurus lamberti</i>	Variegated Wren					5	6		
<i>Manorina melanocephala</i>	Noisy Miner		2	3					
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater		2	3	4	5	6		8
<i>Myzomela sanguinolenta</i>	Scarlet Honeyeater		2		4	5	6		
<i>Neochmia temporalis</i>	Red-browed Finch			3	4				
<i>Oriolus sagittatus</i>	Olive-backed Oriole					5			
<i>Pachycephala pectoralis</i>	Golden Whistler		2	3	4	5			8
<i>Pachycephala rufiventris</i>	Rufous Whistler	1	2		4	5	6		
<i>Pardalotus punctatus</i>	Spotted Pardalote	1	2	3	4	5	6		
<i>Phalacrocorax melanoleucos</i>	Little Pied Cormorant					5			
<i>Rhipidura fuliginosa</i>	Grey Fantail	1	2	3			6		
<i>Sericornis frontalis</i>	White-browed Scrubwren		2			5	6		
<i>Taeniopygia bichenovii</i>	Double-barred Finch							7	
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet				4	5	6		8
<i>Zosterops lateralis</i>	Silvereye	1	2	3	4	5	6	7	8





**A** View through Spotted Gum Ironbark Forest vegetation, south-east corner of site.



**B** View through Spotted Gum Ironbark Forest vegetation, south-west corner of site.





**C** View through Red Gum Forest vegetation in north centre portion of site.



**D** View northwards over rehabilitation area in centre of site.





**E** View over one of the man-made settling ponds in north centre of site.



**F** View over pond on drainage line across centre of site. Azolla, a water fern, here forms the reddish brown cover on the surface of the pond.

Site - old brickworks site on Metford Road, Metford, NSW, in Maitland City Council LGA.

Is the site in a LGA listed in Sch 1 of SEPP 44 - Yes

### **Step 1. Is the land “potential koala habitat”?**

*It must be assessed if the site is “potential koala habitat” in which “areas of native vegetation where the trees of types listed in Schedule 2 (of SEPP 44) constitute at least 15% of the total number of trees in the upper or lower strata of the tree component”. If none of the tree species listed in Schedule 2 are present or if these species constitute less than 15% of the total number of trees present, no further provisions of the policy apply to the DA.*

Are native tree species of types found in Sch 2 of SEPP 44 and listed below, found on the site.

• <i>Eucalyptus tereticornis</i>	Forest red gum	-	Yes
• <i>Eucalyptus microcorys</i>	Tallowwood	-	No
• <i>Eucalyptus punctata</i>	Grey Gum	-	Yes
• <i>Eucalyptus viminalis</i>	Ribbon or manna gum	-	No
• <i>Eucalyptus camaldulensis</i>	River red gum	-	No
• <i>Eucalyptus haemastoma</i>	Broad leaved scribbly gum	-	No
• <i>Eucalyptus signata</i>	Scribbly gum	-	No
• <i>Eucalyptus albens</i>	White box	-	No
• <i>Eucalyptus populnea</i>	Bimble box or poplar box	-	No
• <i>Eucalyptus robusta</i>	Swamp mahogany	-	No

No. of native trees in the study area - > 1,000

No. of Schedule 2 koala feed trees in the study area - > 150

Percentage (%) of Sch 2 koala feed trees in study area - > 15 %

Is the number of Sch. 2 koala feed trees greater than 15% - Yes

Is the study area “potential koala habitat” - Yes

**Further provisions of the policy apply as the study area is potential koala habitat.**

### **Step 2. Is the land “core koala habitat”?**

*If the site contains potential koala habitat then it must be determined if the site also contains “core koala habitat”. Further investigations for the existence of core koala habitat in the study area would be made by searching below, on or in koala feed trees, and other trees, for scats, scratches and the presence of koalas. The “Spot Assessment Technique” (Phillips, 1995) would be used if koalas are found to be utilising the study site, to determine the extent and level of use of feed trees by koalas over the site.*

*“Core koala habitat” means an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population (SEPP 44, def’n.).*

Were koalas observed on site during diurnal and nocturnal searches - No

Were female koalas with young observed on the site - No

Were trees with typical koala scratches observed on the site - No

Were koala scats found on the site beneath koala feed trees - No

Are there past records (ie NPWS database) of koalas on the site - No

Is the site **Core Koala Habitat** - No

**No further provisions of the policy apply as the study area is not core koala habitat.**



The location of the following hollow bearing trees is indicated in **Fig-3 & 6** of this report.

Hollow bearing trees for this survey are valued according to factors such as –

- High (H)** - tall, large, live or dead tree supporting large to small hollows, plus cracks and fissures; suitable for large to small fauna, especially threatened species, such as Black Cockatoos, forest owls, Squirrel Gliders and insectivorous bats.
- Medium (M)** - live or dead tree supporting smaller hollows plus cracks and fissures etc; potentially suitable for common and threatened species such as Possums, Squirrel Gliders and insectivorous bats.
- Low (L)** - small, live or dead tree supporting only small hollows, cracks, fissures and loose bark; suitable for smaller common and threatened species such as Squirrel Gliders, insectivorous bats, frogs and reptiles.

Ht = height; dbh = diameter at breast height

No.	Easting	Northing	Species	Ht (m)	dbh (m)	Value	Comment
1	370009	6374324	Spotted Gum <i>Corymbia maculata</i>	12	0.5	M	Main stem and main branch hollows
2	370043	6374334	Dead	10	0.4	M	Main stem and main branch hollows
3	369996	6374254	Spotted Gum <i>Corymbia maculata</i>	15	0.6	M	Main stem and main branch hollows
4	369987	6374254	Spotted Gum <i>Corymbia maculata</i>	22	0.7	M	Main stem and main branch hollows
5	369975	6374232	Dead	20	0.6	L	Cracks, fissures and loose bark
6	369950	6374241	Spotted Gum <i>Corymbia maculata</i>	25	0.5	L	Main branch hollows
7	369821	6374257	Grey Gum <i>Eucalyptus punctata</i>	18	0.8	M	Main branch hollows
8	369796	6374258	Dead	6	0.6	M	Main branch hollows
9	369784	6374270	Dead	6	0.5	M	Main branch hollows
10	369783	6374301	Spotted Gum <i>Corymbia maculata</i>	28	0.6	M	Main stem and main branch hollows
11	369806	6374302	Dead	7	0.6	M	Main stem hollows, cracks, fissures & loose bark & exotic bees nest
12	369822	6374318	Spotted Gum <i>Corymbia maculata</i>	28	1.0	M	Main stem and main branch hollows

Site - old brickworks site, Metford Road, Metford, NSW

Map zone - 56

Approximate co-ordinate locations of threatened species recorded on the site

<b><u>Species name</u></b>	<b><u>Common name</u></b>	<b><u>Easting</u></b>	<b><u>Northing</u></b>
<i>Glossopsitta pusilla</i>	Little Lorikeet	369140	6374519
<i>Petaurus norfolcensis</i>	Squirrel Glider	369182	6374489
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	370173	6374115
<i>Miniopterus australis</i>	Little Bentwing Bat	369958	6374436
<i>Miniopterus schreibersii</i>	Large Bentwing Bat	369678	6374492
<i>Miniopterus schreibersii</i>	Large Bentwing Bat	369773	6374583
<i>Miniopterus schreibersii</i>	Large Bentwing Bat	370079	6374238
<i>Myotis macropus</i>	Large-footed Myotis	369678	6374492
<i>Scoteanax rueppellii</i>	Greater Broadnosed Bat	369773	6374583
<i>Scoteanax rueppellii</i>	Greater Broadnosed Bat	370079	6374238

**End of Report**

## Addendum to

# **FLORA AND FAUNA ASSESSMENT – GFF 14341**

Over

the old brickworks site, including  
Lot 1, DP 1197061; Lot 1, DP 1195590; Lot 401, DP 755237;  
Lot 266, DP 755237; Lot 7314, DP 1162607  
Metford Road  
Metford, NSW

December 2014

### **Introduction**

An initial flora and fauna assessment report (**GFF 14341**) was completed for the old brickworks site at Metford Road, Metford in October 2014. The report identified that additional survey work for a number of threatened plants and a threatened frog was required.

Some threatened plant species are easier to detect during certain months of the year when they are in flower (**Table-1**). Green and Golden Bell Frogs (*Litoria aurea*) are best surveyed during warm wet nights during the months of October to January. The additional surveys were conducted through suitable habitat across the site for the threatened species, on three separate occasions during months indicated in **Table-1**.

The results of this additional survey work are here presented as an addendum to that initial report.

### **Site Visit Record**

Date	Time	Weather conditions	Activity
14.10.14 day	0800-1600	Overcast, still, warm, occasional showers	Threatened plant survey, Green and Gold Bell Frog survey, flora and fauna observations
14.10.14 night	1900-2200	Overcast, light breeze, mild	Green and Gold Bell Frog survey, bat call collection, flora and fauna observations
11.11.14 day	0800-1645	Overcast, light breeze, warm, showers	Threatened plant survey, Green and Gold Bell Frog survey, flora and fauna observations
11.11.12 night	2000-2230	Overcast, still, warm	Green and Gold Bell Frog survey, bat call collection, flora and fauna observations
9.12.14 day	0800-1630	Partial cloud, light breeze, warm-hot	Threatened plant survey, Green and Gold Bell Frog survey, flora and fauna observations
9.12.14 night	2000-2300	Overcast, still, warm	Green and Gold Bell Frog survey, bat call collection, flora and fauna observations

### **Methods**

Survey for the threatened plants and Green and Gold Bell Frogs was conducted according to DEC (2004) survey guidelines during the months indicated in **Table-1**.

**Table – 1** Proposed survey months (s) for threatened plants and frog. Coloured months show extent of flowering period for plants and survey period for the frog.

Scientific Name	Common Name	J	F	M	A	M	J	J	A	S	O	N	D
<i>Cynanchum elegans</i>	White-flowered Wax Plant										s	s	
<i>Rutidosia heterogama</i>	Heath Wrinklewort										s	s	
<i>Tetradlea juncea</i>	Black-eyed Susan										s	s	
<i>Acacia bynoeana</i>	Bynoe's Wattle										s	s	
<i>Maundia triglochoides</i>												s	s
<i>Callistemon linearifolius</i>	Netted Bottle Brush										s	s	
<i>Eucalyptus parramattensis</i>	Parramatta Red Gum										s	s	
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly											s	s
<i>Persicaria elatior</i>	Tall Knotweed										s	s	
<i>Grevillea parviflora</i>	Small-flower Grevillea										s	s	
<i>Zannichellia palustris</i>											s	s	
<i>Litoria aurea</i>	Green and Golden Bell Frog										s	s	s

Note, during threatened plant and frog survey across the site some additional plant and animal species were observed and recorded. Additional night survey for insectivorous bats was also conducted.

### ***Threatened plants***

Threatened plant searches were conducted by “parallel line technique” and by “random meander” (Cropper, 1993) through likely habitat on the site. For ease of survey, vegetation across the site was divided into manageable blocks delineated by fences, tracks, drainage lines or clearings etc. Each block is surveyed in turn.

### ***Threatened frogs***

Survey for Green and Golden Bell Frogs was conducted about potentially suitable habitat for this frog including the settling ponds and ponds associated with the drainage line across the centre of the site. Diurnal (day) survey for frogs was performed on each of three separate days by searching reeds and rushes in ponds and vegetation at the edge of ponds during still warm periods plus turning logs and rubbish etc in and near wet areas. Nocturnal (night) spotlight searches were conducted for over 2 hours on each of three nights using a 50 watt hand held spotlight powered by a portable 12 volt rechargeable battery or a suitable strong torch. Frog-call playback for Green and Golden Bell Frogs was performed over ponds on each of three separate nights. From time to time survey activities are interrupted by periods of still and quiet listening for frog calls.

## **Results**

### ***Threatened plants***

Dates and results of surveys for threatened plants conducted across the site are as follows.

14.10.14 no threatened plants recorded on the site  
 11.11.14 no threatened plants recorded on the site  
 09.12.14 no threatened plants recorded on the site

### ***Threatened frogs***

Dates and results of surveys for threatened Green and Gold Bell Frogs conducted on the site are as follows.

14.10.14	no threatened Green and Gold Bell Frogs recorded on the site
11.11.14	no threatened Green and Gold Bell Frogs recorded on the site
09.12.14	no threatened Green and Gold Bell Frogs recorded on the site

### ***Additional species***

A number of non threatened plants and animals were observed and recorded during survey activities about the site, these are presented in **Appendices A & B** of this Addendum report.

### **Discussion**

Field work for the initial survey of this site was conducted during September 2014. A list of 70 threatened species within 10km of the site (**App-G of GFF 14341**) was generated from the Bionet Wildlife database for consideration in the initial flora and fauna assessment (**GFF 14341**). For about 44 of these threatened species there was habitat or potential habitat on the site. Several threatened plants and a threatened frog with potential habitat on the site required “additional” survey during their flowering or breeding period (**Table-1** this report). Three additional diurnal and nocturnal surveys for these threatened species were conducted during October, November and December 2014.

The additional survey of potential habitat throughout the site for the threatened plants and Green and Gold Bell Frog did not find these threatened species on the site. Consequently, the results of the additional survey do not alter the findings and recommendations of the initial report (**GFF 14341**).

Findings of the Commonwealth EPBC Act matters (**App-F of GFF 14341**) remain unchanged. The proposed development is unlikely to have a significant impact on endangered species such as

<i>Acacia bynoeana</i>	Bynoe’s Wattle	Vulnerable
<i>Grevillea parviflora ssp parviflora</i>	Small-flower Grevillea	Vulnerable
<i>Persicaria elatior</i>	Knotweed	Vulnerable
<i>Rutidosia heterogama</i>	Heath Wrinklewort	Vulnerable
<i>Tetradlea juncea</i>	Black-eyed Susan	Vulnerable
<i>Litoria aurea</i>	Green and Golden Bell Frog	Vulnerable

Findings of the Assessment of Significance, or Seven Part Test, addressing s5A EPA Act 1979 (**App-H of GFF 14341**) remain unchanged. The life cycle of the following threatened species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

<i>Cynanchum elegans</i>	White-flowered Wax Plant	E1
<i>Rutidosia heterogama</i>	Heath Wrinklewort	V
<i>Tetradlea juncea</i>	Black-eyed Susan	V
<i>Acacia bynoeana</i>	Bynoe's Wattle	E1
<i>Maundia triglochinosoides</i>		V
<i>Callistemon linearifolius</i>	Netted Bottle Brush	V
<i>Eucalyptus parramattensis ssp. decadens</i>		V
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E1
<i>Persicaria elatior</i>	Tall Knotweed	V
<i>Grevillea parviflora ssp. parviflora</i>	Small-flower Grevillea	V
<i>Zannichellia palustris</i>		E1
<i>Litoria aurea</i>	Green and Golden Bell Frog	E1

Additional common plants and animals observed and recorded during additional survey activities about the site (**Appendices A & B** this report) also do not alter the findings and recommendations of the initial report (**GFF 14341**).

### **Conclusion**

The proposed development, with the adoption of mitigating measures (**5.1** of **GFF 14341**), is unlikely to have a significant impact on the above mentioned threatened species.

### **References**

Cropper, S.C., (1993), *Management of Endangered Plants*, CSIRO Publications, Melbourne.

DEC, (2004), *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities, (Working Draft)*, Department of Environment and Conservation (NSW)

## APPENDIX - A

## Flora species list (Addendum)

Plant species on this list were recorded on the site during additional survey.

Classification follows that of Flora of New South Wales, Vols 1-4, (Harden, 1990-93).

# = Threatened Species  
ssp. = Subspecies, var. = Variety, \* = Introduced.  
r = Regionally Significant Plant Species  
n = Noxious weed plant in LGA.

Scientific Name	Common Name
<b><u>FILICOPSIDA (Ferns)</u></b>	
BLECHNACEAE	
<i>Doodia aspera</i>	Rasp Fern
<b><u>MAGNOLIOPSIDA (Flowering Plants)</u></b>	
<b><u>Magnoliidae (Dicotyledons)</u></b>	
APOCYNACEAE	
<i>Nerium oleander*</i>	Oleander
EUPHORBIACEAE	
<i>Euphorbia peplus*</i>	Petty Spurge
FABOIDEAE	
<i>Indigofera australis</i>	
<i>Jacksonia scoparia</i>	Dogwood
RUBIACEAE	
<i>Galium aparine*</i>	Cleavers
<i>Opercularia diphylla</i>	Stinkweed
SCROPHULARIACEAE	
<i>Verbascum virgatum*</i>	Twiggy Mullein
STACKHOUSIACEAE	
<i>Stackhousia viminea</i>	
<b><u>Liliidae (Monocotyledons)</u></b>	
COMMELINACEAE	
<i>Commelina cyanea</i>	Scurvy Weed
IRIDACEAE	
<i>Homeria miniata*</i>	Two-leaved Cape Tulip



## APPENDIX - B

## Fauna species list (Addendum)

Fauna species on this list were recorded during additional survey of the site

? = Unconfirmed

# = Threatened Species

Scientific Name	Common Name
<b><u>MAMMALS</u></b>	
PSEUDOCHEIRIDAE	
<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum
<b><u>BIRDS</u></b>	
RALLIDAE	
<i>Gallinula tenebrosa</i>	Dusky Moorhen
CHARADRIIDAE	
<i>Elsayornis melanops</i>	Black-fronted Dotterel
CUCULIDAE	
<i>Eudynamys scolopacea</i>	Common Koel
CINCLOSOMATIDAE	
<i>Psophodes olivaceus</i>	Eastern Whipbird
DICRURIDAE	
<i>Myiagra rubecula</i>	Leaden Flycatcher
HIRUNDINIDAE	
<i>Hirundo ariel</i>	Fairy Martin
<b><u>REPTILES</u></b>	
CHELUIDAE	
<i>Chelodina longicollis</i>	Long-necked Turtle
SCINCIDAE	
<i>Eulamprus tenuis</i>	Yellow-bellied Skink
<b><u>FROGS</u></b>	
HYLIDAE	
<i>Litoria tyleri</i>	Tyler's Tree Frog

**Attachment C**  
**Completed BAM Plot Data Sheets**

## BAM Site – Field Survey Form

Site Sheet no:

Date		Survey Name	Plot Identifier	Recorders	
		NH Stage 2	BAM PLOT 1	IM	
Zone	Datum	IBRA region	Photo #	Zone ID	
NGA 56	GDA 94		1-6	1	
Easting	Northing	Dimensions	Orientation of midline from the 0 m point.		
369167	6374496	20 x 20 m nested 20 x 50 (0.1 ha)	S / SW		
Vegetation Class					Confidence:
hunter-macro dry sclerophyll forests					(H) M L
Plant Community Type					Confidence:
1592-spotted gum-red ironbark-grey gum forest lower hunter					(H) M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline. Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

lower hunter spotted gum ironbark forest

BAM Attribute (400 m <sup>2</sup> plot)	Sum values
Trees	3
Shrubs	12
Grasses etc.	12
Forbs	10
Ferns	1
Other	7
Count of Native Richness	
Trees	53
Shrubs	10.3
Grasses etc.	53
Forbs	14.4
Ferns	1.0
Other	3.9
Sum of Cover of native vascular plants by growth form group	
High Threat Weed cover	31.2

BAM Attribute (20 x 50 m plot)	# Tree Stems Count	Record number of living eucalypt* (Euc*) and living native non-eucalypt (Non Euc) stems separately
dbh	Euc*	Non Euc
large trees for Euc* & Non Euc	80 + cm	—
50 – 79 cm	—	—
30 – 49 cm	✓	—
20 – 29 cm	✓	—
10 – 19 cm	✓	—
5 – 9 cm	✓	n/a
< 5 cm	✓	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	6	total

Counts must apply to each size class when the number of living tree stems within the size class is ≤ 10. Estimates can be used when the number of living tree stems within a class is > 10. Estimates should draw from the number series: 10, 20, 30, ..., 100, 200, 300

For a multi-stemmed tree, only the largest living stem is included in the count/estimate. For hollows count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	40 30 5 50 50	2 - 1 2 3	- 15 - - -	- 10 - - -
Average of the 5 subplots	35	1.6	3	2

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

## Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief	low
Lithology	Soil Surface Texture	Soil Colour	Soil Depth	
Slope	Aspect	Site Drainage	Distance to nearest water and type	
siltstone/mudstone	clay-heavy	dark brown		
0-1°; flat	190°	moderate-good		

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			Lantana infestation; Privet infestation, urban remnant...
Other			adjoins construction site (NH) + metford rd.

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)



400 m <sup>2</sup> plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 6. 6 2019	NMH Stage 2	BANLOT ①	IM (Sclerophyll Flora)

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
f	<i>Corymbia maculata</i>	N	30	12	U	
f	<i>Eucalyptus punctata</i>	N	20	14	U	
s	<i>Acacia elongata</i>	N	2	20	M	
s	<i>Leucopogon juniperinus</i>	N	2	15	M	
s	<i>Lantana camara</i>	HTE	30	500+	M	
s	<i>Ozothamnus diosmifolius</i>	N	1	10	M	
e	<i>Cheilanthes sieberi</i>	N	1	200+	G	
f	<i>Dianella revoluta</i> - nrm. (mostly juvs).	N	5	200+	G	
g	<i>Entolasia stricta</i>	N	5	500+	G	
g	<i>Microlaena stipoides</i>	N	4	200+	G	
g	<i>Aristida ramosa</i>	N	4	50+	G	
g	<i>Sporobolus indicus</i>	E	0.1	2	G	
g	<i>Cymbopogon refractus</i>	N	4	30+	G	
s	<i>Bursaria spinosa</i>	N	2	50+	M	
r	<i>Lomandra longifolia</i>	N	1	30+	G	
f	<i>Pratia purpurascens</i>	N	2	150+	G	
g	<i>Aristida vagans</i>	N	5	20	G	
l	<i>Parsonia straminea</i>	N	0.2	20	all	
f	<i>Brunoniella pumilio</i>	N	1	2	G	
l	<i>Pandorea pandorana</i> (juv; int; adult leaves)	N	2	360+	G, M	
f	<i>Goodenia hederacea</i>	N	2	200	G	
f	<i>Oxperularia diphylla</i>	N	0.3	1	G	
l	<i>Hardenbergia violacea</i>	N	0.1	3	G, M	
s	<i>Acacia parvipinnula</i> - seedling (2).	N	0.1	2	M	
g	<i>Echinopogon caespitosus</i> ✓ (v. long awn).	N	4	20	G	1
v	<i>Lepidosperma laterale</i>	N	0.3	30+	G	
f	<i>Pomax umbellata</i>	N	2	4	G	
s	<i>Ligustrum sinense</i>	HTE	1	10	M	
s	<i>Pittosporum undulatum</i>	N	0.5	8	M	
g	<i>Themeda triandra</i>	N	4	5	G	
s	<i>Glochidion ferdinandi</i> - seedling, saplings.	N	0.1	4	M, G	
g	<i>Imperata cylindrica</i> var. <i>major</i>	N	5	100+	G	
g	<i>Eragrostis brownii</i>	N	4		G	
l	<i>Smilax</i> sp. (juv. leaves) - prob. <i>aristata</i> .	N	0.1	2	G	
g	<i>Panicum simile</i> ✓ (finely striolate palea, fertile lemma)	N	5	10	G	3
s	<i>Breynia oblongifolia</i> - sapling.	N	0.1	1	M, G	
f	<i>Goodenia bellidifolia</i> - ch.	N	0.1	4	G	
s	<i>Acacia falcata</i> - sapling.	N	0.2	3	G	
f	<i>Euchiton</i> sp.	N	1	10	G	2
f	<i>Senecio madagascariensis</i>	HTE	0.2	20	G	

GF Code: see Growth Form definitions in Appendix 1

N: native, E: exotic, HTE: high threat exotic

GF - circle code if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... 100% (foliage cover); Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...



400 m <sup>2</sup> plot: Sheet <u>2</u> of <u>2</u>	Survey Name	Plot Identifier	Recorders
Date <u>6.6.19</u>	<u>NHT Stage 2</u>	<u>SAMPLET ①</u>	<u>IM (Sclerophyll flora)</u>

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
f	<i>Wahlenbergia communis</i>	N	0.5	5	G	
f	<i>Oxalis</i> sp.	N	0.5	10	G	
t	<i>Eucalyptus fibrosa</i>	N	3	1	U	
s	<i>Callistemon linearis</i>	N	2	2	M	
s	<i>Pultenaea refusa</i>	N	0.2	1	M	
r	<i>Lomandra multiflora</i>	N	0.2	6	G	
s	<i>Daviesia obovatifolia</i> (seedling)	N	0.1	1	M	
g	<i>Digitaria breviglumis</i> ✓	N	5	5	G	5
g	<i>Dischelosia micrantha</i> ✓ (glumes long acuminate; hyaline margins).	N	4	3	G	4
PCT = 1592 Lower Hunter Spotted Gum						
— Lambark Forest						
BEC — Bc Act.						
occurrence — on siltstone/mudstone-derived clays.						
— extensive outcropping.						
— high % weed cover (lantana, privet, African olive outside plot). high lantana cover in plot.						

GF Code: see Growth Form definitions in Appendix 1

N: native, E: exotic, HTE: high threat exotic

GF — circle code if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...



Date		Survey Name		Plot Identifier		Recorders	
Zone	Datum	IBRA region		Photo #		Zone ID	
Easting	Northing	Dimensions		Orientation of midline from the 0 m point.			
Vegetation Class							Confidence: H M L
Plant Community Type							EEC: Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.  
 Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m <sup>2</sup> plot)		Sum values		BAM Attribute (20 x 50 m plot)			# Tree Stems Count		Record number of living eucalypt* (Euc*) and living native non-eucalypt (Non Euc) stems separately  * includes all species of <i>Eucalyptus</i> , <i>Corymbia</i> , <i>Angophora</i> , <i>Lophostemon</i> and <i>Syncarpia</i>  † Record total number of stems by size class with hollows (including dead stems/trees)
Count of Native Richness	Trees			dbh	Euc*	Non Euc	Hollows†		
	Shrubs			large trees for Euc* & Non Euc 80 + cm					
	Grasses etc.			50 – 79 cm					
	Forbs			30 – 49 cm					
	Ferns			20 – 29 cm					
	Other			10 – 19 cm					
Sum of Cover of native vascular plants by growth form group	Trees			5 – 9 cm			n/a		
	Shrubs			< 5 cm			n/a		
	Grasses etc.			Length of logs (m) (≥10 cm diameter, >50 cm in length)		total			
	Forbs								
	Ferns								
Other									
High Threat Weed cover									

Counts must apply to each size class when the number of living tree stems within the size class is ≤ 10. Estimates can be used when the number of living tree stems within a class is > 10. Estimates should draw from the number series: 10, 20, 30..., 100, 200, 300

For a multi-stemmed tree, only the largest living stem is included in the count/estimate. For hollows count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)				
Average of the 5 subplots				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

### Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)



## BAM Site – Field Survey Form

Site Sheet no:

Date		Survey Name		Plot Identifier		Recorders	
14 6 19		NH1 Stage 2 B&A		BAM PLOT 2		IH	
Zone	Datum	IBRA region	Photo #	Zone ID			
56	GDA 94	Sydney Basin		2			
Easting	Northing	Dimensions		Orientation of midline from the 0 m point.			
369225	6374581	10 x 40 nested in. 10 x 10		S/SW			
Vegetation Class		hunter-maclessy dry sclerophyll forests.				Confidence: H M L	
Plant Community Type		(1592) spotted gum-red ironbark-grey gum forest lower hunter				Confidence: H M L	

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline. Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m <sup>2</sup> plot)	Sum values
Trees	5
Shrubs	7
Grasses etc.	4
Forbs	4
Ferns	1
Other	5
Count of Native Richness	
Trees	42.1
Shrubs	30.6
Grasses etc.	7.3
Forbs	2.6
Ferns	0.1
Other	5.7
Sum of Cover of native vascular plants by growth form group	
High Threat Weed cover	78.1

BAM Attribute (20 x 50 m plot)	# Tree Stems Count	Record number of living eucalypt* (Euc*) and living native non-eucalypt (Non Euc) stems separately
dbh	Euc*	Non Euc
large trees for Euc* & Non Euc	80 + cm	
50 – 79 cm		
30 – 49 cm	✓	
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	n/a
< 5 cm	✓	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	42	total

Counts must apply to each size class when the number of living tree stems within the size class is ≤ 10. Estimates can be used when the number of living tree stems within a class is > 10. Estimates should draw from the number series: 10, 20, 30, ..., 100, 200, 300

For a multi-stemmed tree, only the largest living stem is included in the count/estimate. For hollows count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	80 85 85 60 75	2 3 2 15 -	- - - - -	- - 3 - -
Average of the 5 subplots	77	4.4	0	0.6

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

## Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type
siltstone / mudstone	clay	brown	low
0-2° - flat		moderate	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
* Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness	3	0	Lantana, olive, Privet infestation (>50% exotic cover) in plot.
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Metford Rd urban remnant would receive urban runoff. Very poor condition roadside remnant strip.



400 m <sup>2</sup> plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 14.6.19	NMH Stage 2 B&A	BAMPLOT (2)	IM

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
+	<i>Corymbia maculata</i>		20	22	U	
+	<i>Eucalyptus punctata</i>		10	6	U	
+	<i>Eucalyptus fibrosa</i>		7	3	U	
+	<i>Eucalyptus tereticornis</i>		5	4	U	
* g	<i>Erharta erecta</i>	HTE	5	300+	G	
* s	<i>Ligustrum sinense</i>	HTE	30	1000+	M	
* s	<i>Lantana camara</i>	HTE	30	1000+	M	
* s	<i>Olea europaea</i>	HTE	5	100+	M	
* s	<i>Pavonia hastata</i>	E	30	1000+	M	
* f	<i>Bidens pilosa</i>	HTE	5	300+	M	
s	<i>Acacia parvifolia</i>		3	10	M	
s	<i>Acacia elongata</i>		2	5	M	
* f	<i>Verbena bonariensis</i>	E	2	20+	M	
g	<i>Imperata cylindrica</i> var <i>major</i>		5	200+	G	
f	<i>Protea purpurascens</i>		2	100+	G	
g	<i>Cynodon dactylon</i>		2	100+	G	
s	<i>Pittosporum undulatum</i>		20	300+	M	
f	<i>Centella asiatica</i>		0.2	10	G	
f	<i>Oxalis</i> sp. - nrm. ( <i>perennans</i> )		0.2	30	G	
* f	<i>Plantago (lanceolata?)</i> - nrm. <sup>intact</sup>	E+	0.2	20	G	
* g	<i>Panicum</i> sp. (poss. <i>maximus</i> - no spikelets left on inflor.)	E+	5	300+	G	1
* s	<i>Ligustrum lucidum</i>	HTE	2	20	M	
s	<i>Breynia oblongifolia</i>		2	6	M	
l	<i>Pandorea pandorena</i>		3	50+	G, M	
l	<i>Geitonoplectrum cymosum</i>		2	20+	G, M	
* s	<i>Glochidion ferdinandi</i>		3	6	M	
* f	<i>Conyza</i> sp. (basal tuft)	E	1	6	M	
* f	<i>Senecio madagascariensis</i>	HTE	1	6	G	
+	<i>Synum glandulosum</i> - seedling.		0.1	1	G	
s	<i>Rursaria spinosa</i>		0.5	3	M	
f	<i>Dianella revoluta</i>		0.2	2	G	
e	<i>Selaginella uliginosa</i>		0.1	1	G	
l	<i>Clematis aristata</i>		0.5	6	G	
r	<i>Lomandra multiflora</i>		0.1	1	G	
* s	<i>Asparagus aethiopicus</i>	HTE	0.1	2	G	
s	<i>Notelaea venosa</i>		0.1	1	M	
g	<i>Entolasia stricta</i>		0.2	4	G	
g	<i>Microlaena stipoides</i>		0.1	2	G	
r	<i>Lomandra filiformis</i> <i>filiformis</i>		0.1	1	G	

GF Code: see Growth Form definitions in Appendix 1

N: native, E: exotic, HTE: high threat exotic

GF - circle code if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); **Note:** 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...



**Attachment D**  
**Forest Fauna Surveys Peer Review Report**

New Maitland Hospital  
Metford Rd, Metford

Peer Review of Biodiversity Assessment Report



Report to  
pitt&sherry

2 May2018

Forest Fauna Surveys Pty Ltd

New Maitland Hospital  
Metford Rd, Metford

Peer Review of Biodiversity Assessment Report

Report to

pitt&sherry

Michael Murray [B.Sc.(Hons)]  
**Forest Fauna Surveys Pty Ltd**  
51 Sheridan Avenue  
ADAMSTOWN HEIGHTS NSW 2289  
(02) 4946 2977  
[michael@forestfauna.com.au](mailto:michael@forestfauna.com.au)

**Acknowledgements.**

Isaac Mamott kindly provided information and assistance with the project.

**Document History**

Document No.	Prep. Date	Version	Checked by	Date
00386.a	20.04.2018	Draft v.1	A. Bishop	1 May 2018
00386.0	2 May 2018	FINAL	M. Murray	

# TABLE OF CONTENTS

EXECUTIVE SUMMARY .....	iii
1.0 introduction .....	1
1.1 Site Description .....	1
1.2 Scope of this Review .....	2
2.0 methodology .....	3
2.1 Review of Existing Literature.....	3
2.2 Site Assessment.....	3
3.0 results .....	5
3.1 Review of Existing Literature.....	5
3.2 Site Assessment.....	5
4.0 discussion .....	12
5.0 Recommendations.....	13
6.0 references.....	14

## List of Figures

Figure 1.	Lot 7314, New Maitland Hospital location, Metford Rd, Metford.....	2
Figure 2.	Habitat features, New Maitland Hospital location, Metford Rd, Metford .....	6
Figure 3.	Local distribution of Habitat patches to subject site, Metford Rd, Metford .....	9
Figure 4.	Habitat Patch linkage, Subject site to adjoining remnants, Metford Rd, Metford .....	10

## List of Tables

<b>Table 1.</b>	Habitat Tree description, New Maitland Hospital.....	6
<b>Table 2.</b>	Habitat Patch Analysis.....	8

## EXECUTIVE SUMMARY

This peer review was prepared to assess the adequacy of previous ecological investigations of the New Maitland Hospital site off Metford Road, Metford. The initial fauna survey was constrained in detection of fauna species due to being conducted mid-winter (August). However, surveys in 2014 were conducted to account for seasonal and cryptic fauna species, resulting in collation of a comprehensive dataset. No further fauna surveys are considered necessary in order to adequately assess the impact of the proposed development on threatened fauna.

The proposed action will result in the clearing of remnant forest, either for the building footprint or maintenance of an Asset Protection Zone (APZ). One threatened fauna species, the Squirrel Glider, was recorded within the development impact area, and one bird species (Little Lorikeet) and several microbat species are likely to forage within the remnant forest or adjacent open space. The species considered most likely to be impacted is the Squirrel Glider.

There was inconsistency in the mapping of habitat trees by previous ecological surveys, with 2 habitat trees mapped within the development / APZ area, also referred to as Area of Influence. An additional survey in April 2018 was conducted to review the mapping. Three habitat trees with hollows were identified within the Area of Influence. Each tree was assessed as potentially suitable for either the Squirrel Glider or tree roosting threatened microbats, based on the presence of tree hollows. Within the Area of Influence, thinning of trees is recommended for an asset protection zone (APZ). Subject to no loss of these habitat trees, the proposed action would not to impact upon the viability of any threatened species identified in the subject site or Metford Triangle. However, installation of species specific nest boxes is recommended should habitat trees in the Area of Influence require clearing.

The review of previous ecological assessments did not discuss in detail the significance of the subject site / Metford Triangle to the local population of Squirrel Glider. This species may be impacted by actions such as clearing of habitat trees and fragmentation of habitat. The report by pitt&sherry (2018) identified an area of infill planting, to improve connectivity of habitat between remnant forest on the subject site and larger Metford Triangle. However, no detailed assessment was conducted of the viability of that population, and what measures may assist in improving longer term conservation outcomes for the Metford Triangle population.

This review mapped and ground validated the size and inter-connectiveness of all habitat patches suitable for the Squirrel Glider in local area. This analysis is required at a strategic level (i.e. local Council) to assist in planning and management of threatened species in the subject site and wider LGA. Most forested remnants (or habitat patches) suitable for the Squirrel Glider in the wider local area, are fragmented by gap clearings and are small in size. However, corridor connectivity between patches is not considered to be isolating in some instances, such that movements of gliders between patches is possible.

It is considered possible that movement of gliders between the subject site / Metford Triangle, and the nearest larger habitat patch, may occur, suggesting persistence in the short to medium term (20 – 50 years). Habitat enhancement measures, such as supplementary plantings of the site and local vegetation corridors, may improve the connectivity, and hence, viability of this local population.

Within the subject site and Metford Triangle, threatening processes that may impact upon this population include the presence of barbed-wire on the perimeter fencing. Where this fencing intersects with forested habitat, fauna species that either fly or glide are at risk of entanglement with the wire. It is recommended that

any future fencing preclude the use of barbed-wire where fencing intersects bushland. Ideally, all existing barbed-wire fencing within the Metford Triangle that intersects bushland should also be removed, though it is understood this may be outside the control of Health Infrastructure.

It is considered by this review that no further survey work is required to address the assessment on impact on threatened species. As a result of this peer review and the additional surveys and assessment undertaken by the author, the findings and conclusions of the Biodiversity Assessment Report prepared by pitt&sherry are supported. The proposed hospital would not have a significant impact on threatened species. Recommendations are provided to help minimise potential impacts on threatened fauna.

## 1.0 INTRODUCTION

Health Infrastructure commissioned consultancy company pitt&sherry to prepare a Biodiversity Assessment Report (BAR) to accompany an Environmental Impact Statement (EIS) for the New Maitland Hospital project. The BAR report by pitt&sherry consolidates a number of previous ecological investigations on the site for the new hospital, which was previously a quarry and brickworks site. Additional ecological investigations were also undertaken by pitt&sherry (2018) in relation to biodiversity offsetting.

Forest Fauna Surveys Pty Ltd was commissioned by pitt&sherry to undertake a detailed peer review of the previous ecological assessment work, and also identify any gaps specific to the threatened Squirrel Glider *Petaurus norfolcensis*, which was detected on site. The Squirrel Glider is listed as vulnerable on the NSW *Biodiversity Conservation Act 2016*.

### 1.1 Site Description

The location of the New Maitland Hospital is located off Metford Road, Metford, in Maitland City LGA. The site [Lot 7314 and part Lot 401 DP 755237] covers an area of 19.0 hectares, and was part of the larger PGH / CSR brickworks land, referred to as the Metford Triangle (pitt&sherry, 2018). The proposal for the New Maitland Hospital will see the construction of a new building and associated infrastructure located in Lot 7314 and part Lot 401, adjacent to Metford Road (refer to **Figure 1** below). The works will require the clearing of 2.45 hectares of forested vegetation within an area referred to as Project Influence Area for the building footprint and associated works, and also an asset protection zone (pitt&sherry, 2018).

A detailed description of the vegetation communities and the site is presented in previous ecological assessments (pitt&sherry, 2018; General Flora and Fauna, 2014; GHD, 2013). Four vegetation communities are described for the larger Metford Triangle, including:

- Lower Hunter Spotted Gum-Ironbark Forest,
- Hunter Lowland Redgum Forest,
- Acacia regrowth / Rehabilitation Plantings over disturbed land, and
- Artificial wetlands (GHD, 2013; General Flora and Fauna 2014).

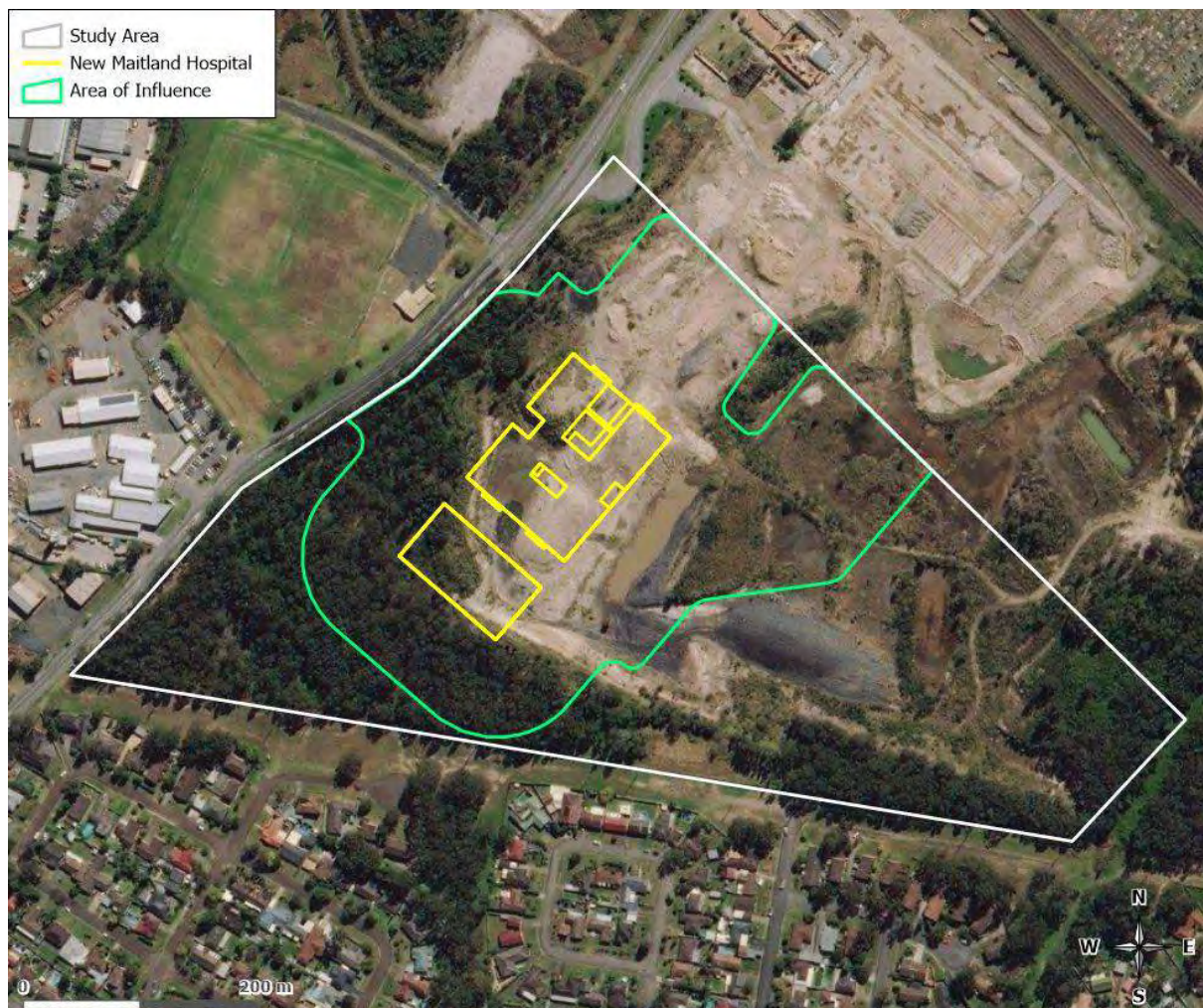
The ecological assessments have identified a number of threatened fauna on the site and larger Metford Triangle, including 1 bird species (Little Lorikeet) and 6 mammal species (Squirrel Glider, Little Bentwing-bat, Eastern Bentwing-bat, Greater Broad-nosed Bat, Large-footed Myotis, Grey-headed Flying-fox). The Squirrel Glider and Little Lorikeet were recorded within the subject site, with the remaining threatened fauna recorded in the south-eastern corner of the Metford Triangle.

The assessment by General Flora and Fauna (2014) located 12 habitat trees in the south-eastern corner of the Metford Triangle (outside of the subject site), whilst pitt&sherry (2018) located 5 habitat trees within the subject site. The 2014 assessment did not locate any habitat trees within the subject site (including the area of influence).



## 1.2 Scope of this Review

This review has been prepared to assess the previous ecological assessment works of GHD (2013), General Flora and Fauna (2014) and pitt&sherry (2018). The basis of the review is to consider the adequacy of previous assessments specific to threatened fauna, and whether the proposed action will impact upon threatened fauna. A particular focus was a local population of the threatened Squirrel Glider, which was recorded on the subject site. This report also provides recommendations to assist with conservation of this threatened species in the larger locality to the subject site.



**Figure 1.** Lot 7314, New Maitland Hospital location, Metford Rd, Metford



## 2.0 METHODOLOGY

### 2.1 Review of Existing Literature

A review of ecological assessments prepared for the subject site were reviewed. Those reports include the following:

GHD (2013). *APP Corporation, Metford Quarry and Brickworks Site, Flora and Fauna Assessment*. Report by GHD, September 2013.

General Flora and Fauna (2014a). *Flora and Fauna Assessment, "the old brickworks site", Metford Road, Metford*. Report to Health Infrastructure (NSW Government). October 2014.

General Flora and Fauna (2014b). *Addendum to Flora and Fauna Assessment, GFF 14341 Over the old brickworks site, Lot 1 DP 1197061; Lot 1 DP1195590; Lot 401 DP 755237; Lot 266 DP 755237; Lot 731 DP 1162607, Metford Road, Metford*. Report to Health Infrastructure (NSW Government). December 2014.

pitt&sherry (2018). *Biodiversity Assessment Report, The New Maitland Hospital, Metford, NSW*. Report to NSW Health Infrastructure by KMH Environmental and pitt&sherry, March 2018.

Records of threatened fauna, particularly the Squirrel Glider, were obtained from the BioNet database, Office of Environment and Heritage on 15 April 2018.

Reports relevant to the threatened Squirrel Glider include the *Lake Macquarie Squirrel Glider Planning and Management Guidelines, 2015* and *Squirrel Glider (Petaurus norfolcensis) Conservation Management Plan: Wyong Shire*. (Smith, 2002).

### 2.2 Site Assessment

This site assessment undertook 2 tasks;

- foot traverse of the Area of Influence to inspect habitat values of the remnant forest for threatened fauna, and
- field survey and gap analysis to quantify fragmentation of remnant forested patches within the subject site, larger Metford Triangle and all adjoining remnants.

#### 2.2.1 Habitat Features

Habitat features were located by walking the boundary of the subject site searching for mature trees with hollows and other features such as water bodies for frogs. The following data was recorded for each habitat tree:

- Tree species,
- Location recorded as easting and northing in GDA94 projection,
- diameter at breast height (dbh) (cm),
- height of tree (metres),
- % dead,
- number of major and minor limb spouts or hollows, number of trunk hollows or spouts, and
- assessment of likely fauna species to utilise hollows.

The assessment of likely fauna to utilise hollows was based on a size class of each hollow, where the following rating applied:

- Hollows with small openings <20mm or small fissures on dead branches, main trunk or split bark were classed as potential hollows for microchiropteran bats and small reptiles,
- Hollows with small openings >20mm <50 mm were classed as potential hollows for gliders and small birds (i.e. Squirrel Glider, Rainbow Lorikeet),
- Hollows with medium sized openings >50mm <150mm were classed as potential hollows for possums and larger birds (i.e. Eastern Rosella)
- Hollows with large openings >150mm diameter were classed as potential hollows for large birds such as owls, cockatoos and ducks, and reptiles such as Lace Monitor and Diamond Python.

### **2.2.2 Habitat Patch Analysis**

Habitat analysis refers to the mapping of all forested habitat fragments (hereafter referred to as *patches*) which provide habitat for the threatened Squirrel Glider. Initially, all forested patches adjoining the subject site (and Metford Triangle) were identified from GIS analysis of recent aerial photographs. All stands of remnant forest were mapped as a continuous polygon, providing there was no gap greater than 30m. Gaps greater than 30m were mapped as a separate GIS polygon, or forest patch. Recent records of Squirrel Glider in the locality were overlayed on the patches to analyse the spatial distribution of the local population in relation to the subject site.

Ground truthing of mapped forest patches was undertaken. The patches were assessed for habitat condition, height of canopy and estimate of forest age. Gaps between adjoining patches were inspected and measured using Laser range finder (Bushnell Yardage Pro), accurate to 1.0 metre. Gap widths were measured recording distance from opposite tree trunks at 1.5m height. Potential obstacles to gliders within the gaps (i.e. powerlines, barbed-wire fencing) recorded the height(s) and width of obstacles.

At each gap location visited, a waypoint was recorded using hand held GPS (Garmin 60Csx) and photograph recorded. Waypoints were downloaded to Manifold GIS and overlayed on recent aerial photographs for validation.

## 3.0 RESULTS

### 3.1 Review of Existing Literature

Two previous fauna surveys have been conducted on the subject site and the larger Metford Triangle. The initial fauna survey was undertaken in August 2013 over 2 nights (GHD, 2013). Timing for this survey is not ideal to record the diverse group of fauna species likely to utilise habitats on the subject site. For instance, microbats, reptiles and some frog species may be dormant at this time of year if conditions are cold. Section 2.2.4 of the GHD (2013) acknowledges the limitations of seasonality in the detection of fauna species, indicating that the survey was not designed to detect all species present at the site. No details such as weather conditions is presented in the GHD (2013) to assess the nocturnal temperatures and likely influence on fauna activity.

A total of 45 native fauna and 2 introduced species were detected by the survey, including 31 birds, no reptiles, 2 frogs and a number of microbat species. Two habitat trees were located within the current subject site, although the methodology by GHD (2013) restricted the searches to trees >100cm dbh. This approach will fail to detect habitat trees with smaller dbh that contain tree hollows. No raw data of habitat trees is presented in the report for subsequent analysis, i.e. tree species description, location coordinates, tree hollow description, etc.

The second fauna survey was conducted over several days and nights from 9 to 24 September 2014 (General Flora and Fauna, 2014a). This survey is more comprehensive in survey effort and duration, resulting in the detection of 73 bird species, 24 mammals, 6 reptiles and 8 frog species. Additional targeted surveys for the endangered Green & Golden Bell Frog *Litoria aurea* were conducted over 3 nights in October, November and December 2014. No evidence of the species was detected in these surveys, despite being optimal weather conditions for detection (General Flora and Fauna, 2014b).

Habitat tree mapping was conducted across the Metford Triangle and recorded 12 trees, all of which are located in the south-eastern corner of the Triangle. No trees were mapped for the south-western corner, which includes the subject site. Location coordinates and tree species descriptions is presented in Appendix M of the General Flora and Fauna report. The two habitat trees located by GHD (2013) in the subject site, were not included in the General Flora and Fauna report. In summary, the fauna survey conducted by General Flora and Fauna (2014) is comprehensive in survey effort for the subject site.

The additional habitat assessment by pitt&sherry (2018) is a consolidation of the existing data collated by both GHD (2013) and General Flora and Fauna (2014a, 2014b). It is considered by this review that no further survey work is required to address the assessment on impact on threatened species.

### 3.2 Site Assessment

The site assessment for this report is therefore restricted to the Area of Influence for the proposed New Maitland Hospital. A diurnal site visit was undertaken on 12 April 2018. The area encompassed within the Area of Influence was searched on foot recording the presence of any significant habitat features, particularly for the threatened Squirrel Glider. Any dams or significant water bodies were also assessed for suitability for the endangered Green & Golden Bell Frog.

### 3.2.1 Habitat Features

Within the Area of Influence, three habitat trees were located. A description and location of each tree is presented below in **Table 1**, and their location mapped in **Figure 2**.

**Table 1.** Habitat Tree description, New Maitland Hospital

Tree ID	Tree Species	DBH(cm)	Height (m)	% dead	Hollow Description	Suitability
HT_01	Spotted Gum	80	16	20	2 small branch	Glider
					Location	369169.07 E 6374455.48 N
HT_02	Spotted Gum	80	16	20	2 small trunk	Glider
					Location	369148.22 E 6374390.69 N
HT_03	Grey Gum	70	16	10	2 small branch	Glider / microbat
					Location	369199.22 6374383.67 N

All three trees contain only small sized hollows with less than 30mm openings, making them suitable for smaller arboreal vertebrates such as gliders, microbats, reptiles and frogs.



**Figure 2.** Habitat features, New Maitland Hospital location, Metford Rd, Metford

Habitat trees HT\_02 and HT\_03 appear to be in similar location to the two trees mapped in Figure 3-4 of the GHD (2013) report. However, there is no raw data in the GHD (2013) report to enable direct comparisons of tree species and or location coordinates. Pitt&Sherry also mapped 5 habitat trees within the study area (refer to Figure 8, p.32). All 5 trees occur outside of the area of influence for the project. Two trees are located along Metford Road, and three habitat trees are mapped along the southern boundary of the subject site. None of these habitat trees would be impacted by the proposed New Maitland Hospital works.

One water body was located within the Area of Influence. Dam\_1 is a small ephemeral body measuring 30 x 30m (approx.) which supports a number of emergent aquatic plants, including *Typha orientalis* and *Juncus sp.* Around the fringes of the dam is dense growth of Couch Grass *Cynodon dactylon*. Water depth was approximately 0.2 – 0.3 m depth. Despite the presence of emergent aquatic plants, this dam is unsuitable for the Green & Golden Bell Frog due to the ephemeral nature of this body. Whilst standing water was present at the time of fieldwork, this body would dry quickly following periods of low rainfall.

### **3.2.2 Habitat Patch Analysis**

A total of 34 habitat patches were assessed by either ground validation or GIS analysis to determine connectivity and size of habitat within the local Squirrel Glider population. A summary table of the habitat patch size is presented in **Table 2**, and also mapped in **Figure 3**.

**Table 2.** Habitat Patch Analysis

Patch ID	Area (ha)	Location	Viability Assessment
P1 - P2	8,17 (25)	Subject site and Metford Triangle	Low viability, good habitat, some infill planting needed, barbed wire fencing potential to impact local population
P3 - P5	2,2,1 (5)	North of Metford Triangle	Low viability, small remnants, highly fragmented
P6 - P8	4,7,1 (12)	NE of Metford Triangle	Low viability, small remnants, fragmented by railway and road
P9 – P11, P21	6,1,1 (8) ( 3)	Thornton suburb	Low viability, small fragmented patches, connectivity okay, infill planting required to improve corridor
P12 – P15	10,2,5,2 (19)	Thornton suburb	Very low viability, narrow linear fragmented patches, connectivity okay, very limited potential for improvement in habitat / corridor function.
P16 – P20	1,5,1,26,12 (45)	Green Hills	Low viability, several small fragmented patches, connectivity okay, number of recent glider records (2016), potential for connectivity to larger population off Mt. Vincent Road
P22 – P23	6,170 (176)	Thornton Industrial Park	Medium viability, Patch 22 isolated, Patch 23 high quality, large area, known historical glider population, potentially acts as large source population for subject site and Metford Triangle
P24 – P25,	101, 231 (332)	Thornton, Chisholm	Medium viability, Chisholm patches large in area, despite disturbance from clearing, known glider population. Thornton patch ~100ha, good quality habitat, some fragmentation and clearing within patch
P31 – P33	12,2,6 (20)	Thornton – Chisholm	Low viability, smaller patches fragmented although connectivity okay
P34	>1,800	Four Mile Creek	Significant local habitat patch, separated from Thornton Industrial patch by New England Highway (gap crossing 50m), high traffic volumes.





**Figure 3.** Local distribution of Habitat patches to subject site, Metford Rd, Metford

The subject site is located within a small habitat patch approximately 25 hectares in area (part of the Metford Triangle). Habitat linking to this small patch comprise a mosaic of equally small to very small habitat patches, separated by varying gap widths due to roadways, powerline easements, clearings for parklands, housing and the Main Northern Railway. The degree of fragmentation of habitat is very high within this context, with the nearest habitat patch >100 ha more than 1,800 metres to the east (Thornton Industrial patch). It is considered the most viable connection corridor between the subject site / Metford Triangle and nearest large habitat patch is to the east – south-east (refer to **Figure 4** below). Corridor linkage to the west and south is considered less viable due to absence of habitat and large cleared gaps in tree cover.





**Figure 4.** Habitat Patch linkage, Subject site to adjoining remnants, Metford Rd, Metford

The subject site / Metford Triangle Squirrel Glider population is considered a “sink” population, whereby individuals are continually lost (or drained) by natural and other factors (i.e. predation, injury). Recruitment of new individuals to this population, or “source” population, is likely to occur within the Thornton Industrial patch, despite tenuous connectivity between both habitat patches.

Within the wider locality, another “source” population is likely to exist within a large habitat patch south of Green Hills, but linkage between this population and the subject site / Metford Triangle is unlikely due to large cleared gaps (New England Highway, residential estates, clearing of habitat for expansion of nearby shopping centre).

Occupation rates of Squirrel Glider in habitat is strongly influenced by the size of the patches, degree of connectivity and habitat quality. Populations decline in abundance and density when patches fall below 100ha. Patches between 4 – 30 ha are considered at high risk of localised extinction, whilst patches 30 – 100ha at moderate risk, and >100ha at low risk in the short term (50 – 100 years)(Smith, 2002; LMCC, 2015). A remnant patch of habitat would need to exceed 400 hectares in area to ensure longer term survival of a viable local population (Goldingay *et al*, 2006).

Squirrel Gliders can move up to 1.0 km per night, with the longest recorded movement 1.9km (Sharpe & Goldingay, 2007). Gliders are reluctant to travel along the ground to cross open gaps in tree canopy, with gaps

>35m considered a potential barrier to crossing. For a Squirrel Glider to cross an open gap of 20m (such as a 2 lane roadway) in a single glide, a minimum tree height of 13m is required (Goldingay and Taylor, 2009), whilst a road canopy gap of 50m appears to be a complete barrier to glide crossings (van der Ree *et. al.*, 2010).

Despite the high degree of fragmentation in the Metford area, there is a number of recent records (since 2014) of the Squirrel Glider within the immediate area of the Metford Triangle. This would suggest that despite the high number of small fragments within proximity to the Metford Triangle, connectivity is sufficient between some remnants to either support a small population, or enable movement of individuals between patches.

The subject site comprises a small habitat patch approximately 8.0 hectares in area, which is separated from an adjoining forested patch in the Metford Triangle (16.8 ha) by a gap measuring 35m wide. However, within this gap there is 2 trees that would enable a glider to safely cross this gap without moving along the ground. The biodiversity assessment by pitt&sherry (2018) recommends infill planting of this area to improve habitat connectivity between the subject site and adjoining habitat patches (refer to Figure 11 – Supplementary Planting Location, pitt&sherry, p. 49). However, this review considers it unnecessary for installation of any glider poles to assist in movements across this gap. The significance of the larger 16.8 ha forest patch east of the subject site is the higher density of habitat trees in this remnant, and connectivity to adjoining habitat patches.

Beyond the subject site and Metford Triangle, the patches are small in area and highly fragmented. Movement of gliders to the south of the Metford Triangle is unlikely due to the very small size of the habitat patches (1.3 ha each), and obstacles such as electricity powerline easement (35m width) and perimeter barbed wire fencing. However, tree height on either side of the powerline easement is approximately 20m, enabling glides across this gap if required.

To the south-east of the Metford Triangle is a network of small habitat patches, which create a tenuous linkage to a large patch associated with the Thornton Industrial Park. This large remnant is about 170 ha in area and supports high quality habitat for the Squirrel Glider. The species has previously been trapped within this remnant (M. Murray, personal record). Due to the large size of this remnant patch, it is likely to support a viable local population in the shorter term (20 – 50 years).

Two gaps occur between the Thornton Industrial and Chisholm patch, the Main Northern Railway (47m) and Raymond Terrace Road (25m). Whilst the Main Northern Railway presents a large gap for gliders to cross, it has very limited additional barriers such as fencing and overhead powerlines. The railway does not have a high number of high speed rail movements, reducing the potential for gliders to collide with moving trains. Tree height at potential crossing points (25m) would enable single glides of up to 45 metres (glide angle = tree height x 1.8). This suggests the Main Northern Railway gap is not too wide to enable glider movements. The gap width of Raymond Terrace Road is only 25m, with trees to 15 – 20m tall at some potential crossing points. This road carries high traffic volumes, with increased risk of collisions between gliders and motor vehicles, particularly trucks.

The Thornton Industrial patch is separated from the Four Mile Creek habitat patch by the New England Highway. The Four Mile Creek patch is the most significant patch in the LGA for the Squirrel Glider and other threatened and protected fauna. The cleared gap of the highway is 55 metres at the narrowest point, with potential for glider crossings. However, this gap has very high traffic movements, particularly large trucks at night, which is likely to impact on glider crossings. It is therefore considered the New England Highway acts as a significant barrier to glider movements between subpopulations. Hence, the Thornton Industrial subpopulation has high significance to the subject site / Metford Triangle Squirrel Glider population. The longer term viability of the

subject site / Metford Triangle Squirrel Glider population is dependent upon connectivity between these two patches.

## 4.0 DISCUSSION

The previous ecological investigations on the subject site and larger Metford Triangle has resulted in collation of an extensive dataset of fauna species likely to occur within forested remnants. The initial fauna survey was constrained in the diversity of species detected, due to timing of the survey being conducted in mid-winter (August). However, a follow-up survey conducted in September to December 2014 was conducted to account for seasonal and cryptic fauna species. Further work by pitt&sherry addressed the requirements of biobanking and vegetation mapping, such that a comprehensive dataset has been collated for the subject site and larger Metford Triangle. Consequently, it is considered no further fauna survey or assessment is required.

Several impact assessments on threatened species by the proposed action (The New Maitland Hospital) have been prepared and are comprehensive in their detail. However, there has been modification to the initial development footprint, with the assessment by pitt&sherry (2018) providing the most relevant account of the proposed impact on threatened species. This report by Forest Fauna Surveys PL (2018) was prepared to review the adequacy of the previous ecological assessments, but also to undertake a detailed assessment of the action on particular threatened species, the Squirrel Glider.

The proposed action will result in the clearing of remnant forest, either for the building footprint or maintenance of an Asset Protection Zone (APZ). One threatened fauna species, the Squirrel Glider, was recorded within the development impact area, and one bird species (Little Lorikeet) and several microbat species are likely to forage within the remnant forest or adjacent open space.

There was some inconsistency in the mapping of habitat trees by previous ecological surveys, with 2 habitat trees mapped within the Area of Influence. Consequently, an additional survey was conducted in April 2018 to review the mapping. Three habitat trees with hollows were identified within the Area of Influence by this survey. Each tree was assessed as potentially suitable for either the Squirrel Glider or tree roosting threatened microbats, based on the presence of tree hollows. Within the Area of Influence, thinning of trees is recommended for the establishment of an asset protection zone (APZ). Subject to no loss of these habitat trees, the proposed action would not to impact upon the viability of any threatened species identified in the subject site or Metford Triangle.

However, if the habitat trees within the Area of Influence are to be removed, it is recommended that species specific nest boxes are installed in retained trees within the Area of Influence, or immediately adjoining forested remnant, to offset tree hollows lost by clearing.

The review of previous ecological assessments did not discuss in detail the significance of the subject site / Metford Triangle to the local Squirrel Glider population. This species may be potentially impacted by actions such as clearing of habitat trees and fragmentation of habitat. The report by pitt&sherry (2018) identified an area of infill planting, to improve connectivity of habitat between remnant forest on the subject site and larger Metford Triangle. This action is supported. However, no detailed assessment was conducted of the viability of that population, and what measures may assist in improving longer term conservation outcomes for the Metford Triangle population.

This review therefore undertook a detailed assessment of the size and inter-connectiveness of all habitat patches suitable for the Squirrel Glider in local area. Whilst this exercise involves assessment of a larger

population than could potentially be impacted by the proposed action, the analysis is required at a strategic level (i.e. local Council) to assist in planning and management of threatened species in the subject site and wider LGA.

This review identified that most forested remnants (or habitat patches) suitable for the Squirrel Glider in the wider local area, are fragmented by gap clearings and are small in size. However, corridor connectivity between patches is not considered to be isolating in some instances, such that movements of gliders between patches is possible. Therefore, it is considered that movement of gliders between the subject site / Metford Triangle, and the nearest larger habitat patch, may occur. This suggests that the subject site population may potentially persist in the short to medium term (20 – 50 years). Habitat enhancement measures, such as supplementary plantings of the site and local vegetation corridors, may improve the connectivity, and hence, viability of this local population.

Within the subject site and Metford Triangle, threatening processes that may impact upon this population include the presence of barbed-wire on the perimeter fencing. Where this fencing intersects with forested habitat, fauna species that either fly or glide are at risk of entanglement with the wire. It is recommended that any future fencing preclude the use of barbed-wire where fencing intersects bushland.

## 5.0 RECOMMENDATIONS

The author supports the management and mitigation measures identified in the pitt&sherry (2018) BAR including in respect of:

- Supplementary plantings within the predominantly cleared area along the southern boundary of Lot 7314 to facilitate greater movement for the Squirrel Glider.
- Clearing protocols designed to maximise retention of habitat trees while achieving bushfire protection objectives within the APZ.
- Pre-clearing surveys for threatened fauna if clearing outside the period late February to end of May (which is the non-breeding period for hollow dependant native fauna such as microbats).
- Ecological clearing supervision if clearing habitat trees
- Nest boxes be installed at a rate of 1:1 if pre-clearing surveys identify any hollow bearing trees targeted for removal, and the hollow is occupied or there is evidence of past occupation.

In addition, the following recommendations:

- Supplementary plantings of trees along the southern boundary of the subject site to improve connectivity as per pitt&sherry Figure 11.
- Thinning of trees in the Area for APZ's to be undertaken in a way that maximises retention of the habitat trees. If habitat trees are identified for removal, these should be subject to pre-clearing surveys by a fauna ecologist, and replacement of tree hollows with nest boxes where the hollows are deemed to be viable or presently used to support nesting fauna.
- All new fencing, including security fencing associated with the New Maitland Hospital, that will intersect remnant forest on the site, avoid use of barbed wire to avoid injury / mortality to all flying / gliding fauna. Ideally, all barbed-wire fencing on the Metford Triangle that intersects remnant bushland / corridors should be removed and replaced with single strand wire.

## 6.0 REFERENCES

- GHD (2013). *APP Corporation, Metford Quarry and Brickworks Site, Flora and Fauna Assessment*. Report by GHD, September 2013.
- General Flora and Fauna (2014a). *Flora and Fauna Assessment, "the old brickworks site", Metford Road, Metford*. Report to Health Infrastructure (NSW Government). October 2014.
- General Flora and Fauna (2014b). *Addendum to Flora and Fauna Assessment, GFF 14341 Over the old brickworks site, Lot 1 DP 1197061; Lot 1 DP1195590; Lot 401 DP 755237; Lot 266 DP 755237; Lot 731 DP 1162607, Metford Road, Metford*. Report to Health Infrastructure (NSW Government). December 2014.
- Goldingay, R.L., Sharpe, D.J., Beyer, G.L. and Dobson, M. (2006). Using ecological studies to understand the conservation needs of the squirrel glider in Brisbane's urban forest remnants. *Australian Mammalogy*, 28(2), 173-186.
- Goldingay, R.L. and Taylor, B.D. (2009). Gliding performance and its relevance to gap crossing by the squirrel glider *Petaurus norfolcensis*. *Australian Journal of Zoology*. 57(2), 99-104.
- LMCC (2015). *Lake Macquarie Squirrel Glider Planning and Management Guidelines 2015*. Prepared by Martin Fallding, Lake Macquarie City Council. June 2015.
- pitt&sherry (2018). *Biodiversity Assessment Report, The New Maitland Hospital, Metford, NSW*. Report to NSW Health Infrastructure by KMH Environmental and pitt&sherry, March 2018.
- Sharpe, D.J. and Goldingay, R.L. (2007). Home range of the Australian squirrel glider *petaurus norfolcensis*. *Journal of Mammalogy*, 88(6), 1515-1522.
- Smith, A.P. (2002). *Squirrel Glider Petaurus norfolcensis Conservation Management Plan, Wyong Shire*. Report to Wyong Shire Council. June 2002.
- van der Ree, R., Cesarini, S., Sunnucks, P., Moore, J.L., Taylor, A. (2010). Large gaps in canopy reduce road crossing by a gliding mammal. *Ecology and Society*, 15(4). 35.

**Attachment E**  
**BAM-C Credit Reports**



## Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00016427/BAAS18008/19/00016428	New Maitland Hospital Stage 2 SSI	04/07/2019
Assessor Name	Report Created	BAM Data version *
Isaac Mamott	28/08/2019	12
Assessor Number	BAM Case Status	Date Finalised
BAAS18008	Open	To be finalised
Assessment Revision	Assessment Type	
1	Part 5 Development (Small Area)	

\* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

## Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAI	Ecosystem credits
<b>Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter</b>								
1	1592_medium	66.9	0.4	0.25	High Sensitivity to Potential Gain	2.00		14

# BAM Credit Summary Report

2	1592_poor	54.8	0.3	0.25	High Sensitivity to Potential Gain	2.00		9
							<b>Subtotal</b>	<b>23</b>
							<b>Total</b>	<b>23</b>

## Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAIL	Species credits
<b><i>Petaurus norfolcensis</i> / <i>Squirrel Glider</i> ( <i>Fauna</i> )</b>						
1592_medium	66.9	0.43	0.25	2	False	14
1592_poor	54.8	0.33	0.25	2	False	9
					<b>Subtotal</b>	<b>23</b>



## BAM Biodiversity Credit Report (Like for like)

### Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00016427/BAAS18008/19/00016428	New Maitland Hospital Stage 2 SSI	04/07/2019
Assessor Name	Assessor Number	BAM Data version *
Isaac Mamott	BAAS18008	12
Proponent Names	Report Created	BAM Case Status
Rachel Mitchell	28/08/2019	Open
Assessment Revision	Assessment Type	Date Finalised
1	Part 5 Development (Small Area)	To be finalised

### Potential Serious and Irreversible Impacts

Nil

Nil

\* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

### Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

# BAM Biodiversity Credit Report (Like for like)

Predicted Threatened Species Not On Site

Name
<b>Phascolarctos cinereus</b> / Koala

## Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Lower Hunter Spotted Gum—Ironbark Forest in the Sydney Basin Bioregion	0.8	23.00

<b>1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter</b>	<b>Like-for-like credit retirement options</b>			
	Name of offset trading group	Trading group	HBT	IBRA region
	Lower Hunter Spotted Gum—Ironbark Forest in the Sydney Basin Bioregion This includes PCT's: 1590, 1592, 1593, 1600, 1602	-	No	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo.  or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

# BAM Biodiversity Credit Report (Like for like)

## Species Credit Summary

Species	Area	Credits
<b>Petaurus norfolcensis</b> / Squirrel Glider	0.8	23.00

<b>Petaurus norfolcensis</b> / Squirrel Glider	1592_medium	<b>Like-for-like credit retirement options</b>	
		Spp	IBRA region
		<b>Petaurus norfolcensis</b> /Squirrel Glider	Any in NSW
	1592_poor	<b>Like-for-like credit retirement options</b>	
		Spp	IBRA region
		<b>Petaurus norfolcensis</b> /Squirrel Glider	Any in NSW



## BAM Biodiversity Credit Report (Variations)

### Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00016427/BAAS18008/19/00016428	New Maitland Hospital Stage 2 SSI	04/07/2019
Assessor Name	Assessor Number	BAM Data version *
Isaac Mamott	BAAS18008	12
Proponent Name(s)	Report Created	BAM Case Status
Rachel Mitchell	28/08/2019	Open
Assessment Revision	Assessment Type	Date Finalised
1	Part 5 Development (Small Area)	To be finalised

\* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

### Potential Serious and Irreversible Impacts

Nil

Nil

### Additional Information for Approval

PCTs With Customized Benchmarks

No Changes



# BAM Biodiversity Credit Report (Variations)

Predicted Threatened Species Not On Site

Name
<b>Phascolarctos cinereus</b> / Koala

## Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Lower Hunter Spotted Gum—Ironbark Forest in the Sydney Basin Bioregion	0.8	23.00

<b>1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter</b>	<b>Like-for-like credit retirement options</b>			
	Name of offset trading group	Trading group	HBT	IBRA region
	Lower Hunter Spotted Gum—Ironbark Forest in the Sydney Basin Bioregion This includes PCT's: 1590, 1592, 1593, 1600, 1602	-	No	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo.  or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	<b>Variation options</b>			
	Formation	Trading group	HBT	IBRA region

## BAM Biodiversity Credit Report (Variations)

	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 3 or higher	No	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
--	---	------------------	----	--

### Species Credit Summary

Species	Area	Credits
<b>Petaurus norfolcensis</b> / Squirrel Glider	0.8	23.00

Petaurus norfolcensis/ Squirrel Glider	1592_medium	Like-for-like options		
		Spp		IBRA region
		Petaurus norfolcensis/Squirrel Glider		Any in NSW
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

## BAM Biodiversity Credit Report (Variations)

		Fauna	Vulnerable	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo.  or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1592_poor	<b>Like-for-like options</b>			
	Spp		IBRA region	
	Petaurus norfolcensis/Squirrel Glider		Any in NSW	
	<b>Variation options</b>			
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below		IBRA region
	Fauna	Vulnerable	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo.  or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.	

## Biodiversity payment summary report

Assessment Id	Payment data version	Assessment Revision	Report created
00016427/BAAS18008/19/00016428	61	1	28/08/2019
Assessor Name	Assessor Number	Proposal Name	BAM Case Status
Isaac Mamott	BAAS18008	New Maitland Hospital Stage 2 SSI	Open
	Assessment Type	Date Finalised	
	Part 5 Development (Small Area)	To be finalised	

### PCT list

Include	PCT common name	Credits
Yes	1592 - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	23

### Species list

Include	Species	Credits
Yes	<i>Petaurus norfolcensis</i> (Squirrel Glider)	23

### Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

## Biodiversity payment summary report

IBRA sub region	PCT common name	Baseline price	Dynamic coefficient	Market coefficient	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Hunter	<b>1592</b> - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter <b>Note: This PCT has trades recorded</b>	\$2,252.97	0.71782200	2.17841491	19.99%	\$20.00	1.0000	\$2,723.34	23	\$62,636.76
Subtotal (excl. GST)										<b>\$62,636.76</b>
GST										<b>\$6,263.68</b>
Total ecosystem credits (incl. GST)										<b>\$68,900.44</b>

### Species credits for threatened species

Species profile ID	Species	Threat status	Price per credit	Risk premium	Administrative cost	No. of species credits	Final credits price
10604	<b>Petaurus norfolcensis</b> (Squirrel Glider)	Vulnerable	\$434.47	19.9900%	\$20.00	23	\$12,450.37
Subtotal (excl. GST)							<b>\$12,450.37</b>
GST							<b>\$1,245.04</b>



## Biodiversity payment summary report

---

Total species credits (incl. GST)

\$13,695.41

Grand total

\$82,595.85

**Attachment F**  
**SEPP Assessments**



**SEPP 44 Assessment – Koala Habitat Protection  
Stage 2 New Maitland Hospital SSI – Attachment D**

**Land to which the policy applies**

The policy applies to all lands in Maitland LGA as per Schedule 1 of SEPP 44 and thus applies to the Stage 2 NMH proposal.

**Land to which Part 2 (development controls) of the SEPP 44 applies**

Part 2 of SEPP 44 applies to the Stage 2 NMH proposal given that the Stage 2 NMH proposal:

- is situated on lands with which the SEPP 44 policy applies;
- relates to a development application; and
- occurs on lands with an area greater than 1 hectare.

**Is the land potential Koala habitat?**

SEPP 44 defines *potential Koala habitat* as areas of native vegetation where the trees of the types listed in Schedule 2 (of the SEPP) constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. The Stage 2 NMH development site presently supports 0.76 ha of Lower Hunter Spotted Gum-Ironbark Forest (LHSGIF). The LHSGIF on the development site contains 2 tree species listed in Schedule 2 of the SEPP, these being *Eucalyptus punctata* (Grey Gum) and *Eucalyptus tereticornis* (Forest Red Gum). Based on data from 2 BAM plots recently conducted in June 2019 within extant vegetation on the development site, a portion of the site (southern section) showed 20% cover for Grey Gum whilst the central and northern portions of the site showed 10% and 5% cover for Grey Gum and Forest Red Gum, respectively. Consequently, at least a portion of the development site would be considered potential Koala habitat.

**Is the land core Koala habitat**

SEPP 44 defines *core Koala habitat* as an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population. The greater Metford triangle remnant (with which the development site forms a part of) was subject to detailed ecological investigations (surveys and assessment) in spring and summer 2014 (General Flora and Fauna 2014). General Flora and Fauna (2014) did not record any Koalas or evidence of them on the site as part of their investigations. A search of the Bionet atlas records (10km radius search centered on the Stage 2 development site) revealed a single Koala record in March 2017 in Morpeth near the Hunter River. The single Bionet Koala record is from the Wildlife Rehabilitation database and notes that the individual Koala was ‘stranded in an unsuitable environment’. The Lower Hunter Koala Study (EcoLogical Australia, 2013) furthermore does not identify any high or very high Koala priority habitat areas in the Maitland LGA and considers Maitland and Newcastle LGAs to be

significant ecological barriers to movement for the Koala between known populations at Cessnock/Lake Macquarie and Port Stephens. As such, the land subject to the Stage 2 NMH proposal is not considered to be core Koala habitat and thus no site or project-specific Koala Plan of Management would be required.

### **Draft SEPP (Environment)**

The NSW government has been working towards developing a new SEPP for the protection and management of the natural environment. Changes proposed include consolidating the following seven existing SEPPs:

- State Environmental Planning Policy No. 19 – Bushland in Urban Areas;
- State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011;
- State Environmental Planning Policy No. 50 – Canal Estate Development;
- Greater Metropolitan Regional Environmental Plan No. 2 – Georges River Catchment;
- Sydney Regional Environmental Plan No. 20 – Hawkesbury-Nepean River (No.2-1997);
- Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005; and
- Willandra Lakes Regional Environmental Plan No. 1 – World Heritage Property.

Based on our review of the Draft SEPP (Environment), the Draft policy does not apply to lands subject to the Stage 2 NMH proposal. HI may wish to seek confirmation from DPE in relation to the application of the Draft policy to the NMH proposal.

