Flora and fauna assessment of

185/195 Fifteenth Avenue,
West Hoxton,
New South Wales.

March 2015

Lesnok ENVIRONMENTAL

Cover photographs:
[TOP] The typical cleared nature of the subject site. Dam 1 can be seen in the background. Photograph taken looking south-west through the property.
[BOTTOM] One of the farm dams present. Photograph taken looking north-west into a stand of Cumberland Plain woodland.

Report prepared at the request of:

Western Sydney Parklands Trust

by

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			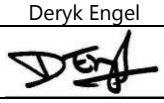	
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			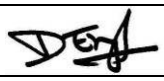	
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This report is prepared in accordance with the 6th Edition of the Commonwealth of Australia (2002) Style Manual.

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Glossary

Terms used throughout this report are:

- ASL — Above sea level.
- CBD — Central Business District.
- DECC — NSW Department of Environment and Climate Change (now known as the NSW Office of Environment and Heritage).
- DECCW — NSW Department of Environment, Climate Change and Water.
- DE — Commonwealth Department of the Environment.
- DEWHA — Department of Environment, Water, Heritage and the Arts (now known as DE).
- EPBC Act — Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
- EPA Act — NSW *Environmental Planning and Assessment Act 1979*.
- ha — Hectares.
- LGA — Local Government Area.
- m/mm/cm/km — Metres, millimetres, centimetres, kilometres.
- NSW — New South Wales.
- NPWS — NSW National Parks and Wildlife Service.
- OEH — NSW Office of Environment and Heritage.
- RMS — NSW Roads and Maritime Services.
- RoTAP — Rare of Threatened Australian Plant.
- SEPP — State Environmental Planning Policy.
- SIS — Species Impact Statement.
- TSC Act — NSW *Threatened Species Conservation Act 1995*.
- WSPT — Western Sydney Parklands Trust.

For the purpose of this investigation:

- Subject site is defined as 'the area encompassed within the boundaries of 185, and a portion of 195, Fifteenth Avenue, West Hoxton' (as per DECC 2007).
- Study area is defined as 'the subject site and the remaining portions of 195 Fifteenth Avenue, West Hoxton' (DECC 2007).
- The study region is considered to 'include the lands that surround the subject site for a distance of 10 km' (DECC 2007).
- The proposal is considered to include 'all activities likely to be undertaken within the area surveyed that permit the commercial development of 185, and a portion of 195, Fifteenth Avenue, West Hoxton' (DECC 2007).
- A local population of a threatened species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area (DECC 2007).
- An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:
    (a) key source populations either for breeding or dispersal
    (b) populations that are necessary for maintaining genetic diversity, and/or
    (c) populations that are near the limit of the species range (DE 2013a).

SUMMARY

At the request of Western Sydney Parklands Trust, a flora and fauna investigation has been carried out at 185 and 195 Fifteenth Avenue, West Hoxton, NSW. The investigation has been conducted as Western Sydney Parklands Trust wishes to develop a commercial precinct at this location.

The field surveys concentrated on determining the presence of any species, populations or communities listed (or currently being considered for listing) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and/or NSW *Threatened Species Conservation Act 1995* and assessing their reliance on the ecological resources present. Similarly, any species of regional significance were also considered.

By the completion of the field investigation of the study area, one migratory bird, the Cattle Egret (*Ardea ibis*), and one vulnerable mammal, the Grey-headed Flying-fox (*Pteropus poliocephalus*), listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* had been recorded. Three vulnerable animals, the Grey-headed Flying-fox, Eastern Bentwing Bat (*Miniopterus* (*schreibersii*) *orianae oceanensis*) and Little Eagle (*Hieraaetus morphnoides*), and one critically endangered ecological community, Cumberland Plain Woodland, listed under the NSW *Threatened Species Conservation Act 1995* had also been recorded.

Whilst targeted, but not recorded, potential habitat was recorded within the study area for four state listed vulnerable microchiropterans, these being Eastern Falsistrelle (*Falsistrellus tasmaniensis*), Large-footed Myotis (*Myotis macropus*), Greater Broad-nosed Bat (*Scoteanax rueppellii*), East-coast Freetail Bat (*Micronomus norfolkensis*).

No plants listed under the Schedules to either of the Acts recorded within the study area during the field survey. Whilst this is the case, potential habitat for the state and national listed plant, the Spiked Rice-flower (*Pimelea spicata*), was identified.

Of those ecological communities, plants and animals recorded, or considered likely to occur, the proposed development area (i.e. the subject site) is considered to only provide potential habitat for the Cattle Egret, Grey-headed Flying-fox and Little Eagle.

To assess the impacts of the development on the Cattle Egret, Grey-headed Flying-fox and Little Eagle, assessments of significance have been undertaken with reference to the criteria provided under both the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (i.e. the Significant Impact Guidelines) and Part 1, Section 5A of the NSW *Environmental Planning and Assessment Act 1979* (i.e. the seven part test). Based on the outcomes of the assessments prepared, the proposed development of the Fifteenth Avenue site is not considered to have a significant impact on the Cattle Egret, Grey-headed Flying-fox and Little Eagle. Therefore, the proposal need not be referred to the Minister for the Environment for approval. Similarly, the preparation of a SIS is not considered necessary.

During the course of the study, three plants and a bird that are of regional conservation significance within the western Sydney area were detected, these being:

- *Daviesia genistifolia*
- Spotted Knotweed (*Persicaria strigosum*)
- Spotted Gum (*Corymbia maculata*)
- Yellow-rumped Thornbill (*Acanthiza chrysorrhoa*).

In line with the principles of Ecologically Sustainable Development identified in Schedule 2 of the *Environmental Planning and Assessment Regulations*, several mitigation measures have been recommended to ensure that the proposed development of the site is undertaken in an ecologically sustainable manner.

In undertaking the study and preparing this report, the following has been considered and taken into account:

- correspondence received from the Department of Planning and Environment dated 11 February 2015 in regards to the project
- correspondence received from the NSW Office of Environment and Heritage dated 13 March 2014 in regards to the project
- correspondence received from Liverpool City Council dated 12 March 2014 in regards to the project, in particular the potential presence of Cumberland Plain Woodland at the study site
- correspondence received from the Department of Primary Industries dated 10 April 2014 in regards to the management of noxious weeds.

1. Introduction

At the request of the WSPT, a flora and fauna investigation has been undertaken at property numbers 185 and 195 Fifteenth Avenue, West Hoxton, NSW (Figure 1). The ecological investigation has been conducted as WSPT wishes to develop a commercial precinct at this site.

The development of the site would include the establishment of an internal road network, opportunities for commercial development and off street parking.

This proposal is to develop a commercial precinct, approximately 4 ha in area, this fronting Fifteenth Avenue. It is acknowledged that the northern portion of 185 and 195 Fifteenth Avenue currently contains a stand of regenerating Cumberland Plain Woodland and does not form part of the subject site.

The findings of this study are based on a flora and fauna investigation of both the subject site and study area, a literature review of previous studies undertaken in both the study region and this portion of the Liverpool LGA, the consultation of standard databases and the consideration of the relevant ecological legislation.

2. Legislative requirements

A number of state and Commonwealth Acts and policies are relevant to this study, these being listed in Table 1.

3. Environmental setting

The study area occurs within the Sydney suburb of West Hoxton. The site is located within the central portion of the Liverpool LGA, approximately 8.4 km west of its CBD. The study area, which is approximately 9 ha in size, is an amalgamation of six Lots. The subject site, which is approximately 4 ha in size, consists of three of these.

The study area is bounded by Fifteenth Avenue to the south, Twenty-seventh Avenue to the west, Flynn Avenue to the north and cleared grazing land and a residence to the east. Browns Reserve is located adjacent to the south-west corner of the site and it is noted that the land immediately adjacent to Fifteenth Avenue is proposed to be acquired by the RMS as part of a proposal to upgrade this roadway (Figure 2).

This portion of the Liverpool LGA is dominated by rural and semi-rural properties, open space areas and farms that are used for livestock grazing. However, to the south of the site, on the southern side of Fifteenth Avenue, a commercial area and residential subdivision is present. One kilometre east and south-east of the subject site are numerous residential subdivisions and their associated infrastructure; this development area being part of the south-west urban expansion of Sydney.

The subject site consists of:

- cleared areas that are grazed by cattle
- isolated patches of exotic weeds
- isolated native trees
- a bus depot.

Not to scale Source: Nearmap (2015)

Figure 1: Subject site (solid line) and study area (dashed line)

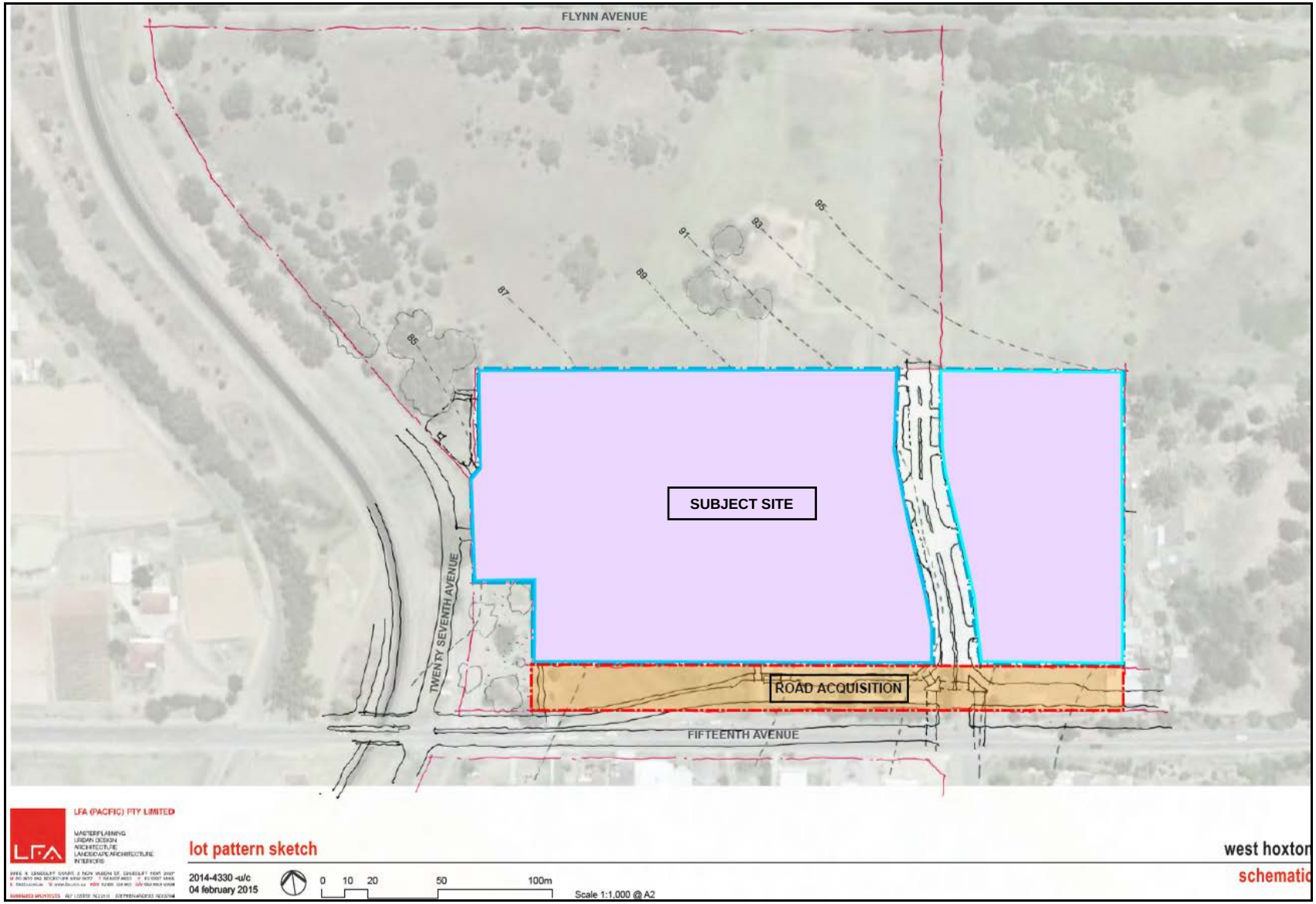


Figure 2: Subject site and road acquisition area

Table 1: Summary of legislative and policy requirements

Level	Relevant Legislation / Policy	Relevance to study area
Commonwealth	*Environment Protection and Biodiversity Conservation Act 1999*	Under this Act an action will require approval from the Minister if the action has, will have, or is likely to have, a significant impact on a matter of National environmental significance. Matters of National environmental significance include listed threatened species and ecological communities and migratory species protected under international agreements. Where applicable, the assessment criteria relevant to this Act must be drawn upon to determine whether there would be a significant effect on these species and hence whether referral to the Federal Environment Minister is required.
State	NSW *Environmental Planning and Assessment Act 1979*	Part 1, Section 5A of this Act requires that a determination be made as to whether a proposed action is likely to have a significant effect on species, populations and ecological communities listed on Schedules 1, 1A and 2 of the TSC Act. Where found, the assessment criteria relevant to this Act (these commonly referred to as the 'seven-part test') are to be drawn upon to determine whether there would be a significant effect on these species and hence whether a SIS is required.
	NSW *Threatened Species Conservation Act 1995/Amendment 2002*	This Act makes further provision with respect to the conservation of threatened species, populations and ecological communities of animals and plants.
	NSW *National Parks and Wildlife Act 1974*	This Act defines those species listed as protected in NSW. No assessment is required under this Act, however potential impacts of the proposed works on these species must be considered.
	NSW *Native Vegetation Act 2003/Regulation 2013*	According to Schedule 1, Part 3 - Urban Areas - of the Act, it is noted that the subject site is excluded from the operation of this Act.
	NSW *Noxious Weeds Act 1993*	Part 3, Division 1, Section 13 of this Act requires public authorities to control noxious weeds on their own land.

A portion of the subject site was noted to be mounded and to support irrigation piping. The presence of these features suggests that the site has been used as a market garden at some stage.

Within the study area, and beyond the limits of the subject site, a stand of eucalypt woodland occurs (Figure 1). Given the apparent even age of those regenerating eucalypts present, it would appear that the entire site has been previously cleared.

The southern portion of the subject site that fronts Fifteenth Avenue is cleared and currently being used as an informal carpark. A residence and bus depot is present in the south eastern portion of the subject site. The bus depot includes a sealed internal road, maintenance and cleaning sheds, the erection of security fencing and the removal of all vegetation present (Figure 1).

Two dams are present within the subject site, these varying in size and structure. Dam 1 is the larger of the two and measures approximately 30 m long and 20 m wide. This dam occurs at the southern limits of the subject site. Dam 2 is approximately 10 m long and 8 m wide and occurs at the north-western corner of the subject site, approximately 75 m north-west of Dam 1. Both of the dams are artificial and have earthen banks and beds. As the cattle that are present have access to the dams, the banks are trampled and disturbed. Both of the dams support open expanses of water, with Dam 2 supporting some aquatic vegetation. Each dam is of limited habitat value for all bar the most tolerant of native aquatic associated species (i.e. Australian Wood Duck [*Chenonetta jubata*]). It is noted that an ephemeral drainage line occurs immediately to the north of Dam 1, this traversing the site in a westerly direction. The vegetation associated with this drainage line consists of exotic grasses and some native emergent reeds. At the time of the field surveys, a small amount of water was observed within this drainage line.

The Sydney Water Supply Canal occurs approximately 30 m to the west of the site on the other side of Twenty-seventh Avenue. This canal runs in a north-south direction (Figure 1).

The topography of the property is gently sloping with a southerly aspect. Natural elevations within the area surveyed vary between 90 m ASL in the south and 100 m ASL in the north (adjacent to Flynn Avenue).

For reference, a photographic record of the study area has been provided (Appendix 1).

The soils of the study area have been mapped by Bannerman and Hazelton (1990) as belonging to the Luddenham Soil Landscape. The soils of this Landscape are derived from the Wianamatta Group - Ashfield and Bringelly Shales - and consist of Podzolic soils on crests and upper slopes, and Podzolic soils and Prairie Soils on lower slopes and near drainage lines (Bannerman and Hazelton 1990). These soils are moderately reactive, of moderate fertility and subject to a high erosion hazard for a non-concentrated flow (Bannerman and Hazelton 1990).

The area investigated occurs within the Western Sydney Parklands, this comprising of 5280 ha and stretching 27 km from Blacktown in the north to Leppington in the south. The next nearest conservation reserve is Kemps Creek; this being located approximately 2 km north-west of the subject site. This reserve covers an area of 129 ha. A number of Council managed parks and reserves occur within the study region, these including Browns and Cirillo Reserves and Grimson, Craik and Starr Parks.

The annual average rainfall in the region is around 868 mm with the greatest falls being experienced between January and March (Bureau of Meteorology 2015[1]). Average temperatures range from a winter low of 4.7 °C to a summer high of 28.2 °C (Bureau of Meteorology 2015).

Through reference to the listings provided under both the EPBC and TSC Acts, it is noted that no gazetted areas of critical habitat for any flora or fauna species, populations or communities occur within, or in the vicinity of, the study area. Critical habitats are areas of land that are crucial to the survival of particular endangered species, populations and/or ecological communities.

4. Literature review and field guides

To identify the diversity of vegetation communities and flora and fauna species known for, or potentially occurring in, the study area, previous ecological studies prepared in the surrounding region, and known databases, were consulted prior to the undertaking of any fieldwork. The identification of known or potentially occurring native species within this portion of the Liverpool

[1] Climate averages taken from Liverpool (Whitlam Centre), which closed 12 September 2001.

LGA, particularly those listed under the Schedules to the EPBC and/or TSC Acts, thereby permits the tailoring of the field survey strategies to the detection of these plants, animals and ecological communities, or the identification of their necessary vegetation associations and habitat types. The undertaking of a literature search also ensures that the results from surveys conducted during different climatic, seasonal and date periods are considered and drawn upon as required. This approach therefore increases the probability of considering the presence of all known and likely native species, particularly any plants and animals that are of regional, state and/or national conservation concern. This approach also avoids issues inherent with a one off 'snap shot' study.

The databases, studies and reports referred to include:

- the DE Protected Matters Search Tool (DE 2015)
- the OEH BioNet database [Atlas of NSW Wildlife] (OEH 2015a)
- the OEH Threatened Species website (OEH 2015b)
- Liverpool City Council's State of the Environment Report (Liverpool City Council 2009)
- the NSW NPWS's Urban Bushland Biodiversity Survey (UBBS) of Western Sydney (NPWS 1997)
- a flora and fauna assessment for a proposed rezoning and subdivision at Leppington (Lesryk Environmental Pty Ltd 2014a)
- a flora and fauna assessment for a proposed rezoning at Gledswood Hills (Lesryk Environmental Pty Ltd 2014b)
- a Review of Environmental Factors for the proposed vegetation removal along a section of Bringelly Road (Lesryk Environmental Pty Ltd 2010)
- a flora and fauna assessment for proposed temporary sedimentation basin sites at Cowpasture Road, Hoxton Park (Lesryk Environmental Pty Ltd 2008a)
- an ecological constraints analysis for the proposed upgrading of a section of the Camden Valley Way (Lesryk Environmental Pty Ltd 2008b).

Other reports and documents drawn on and/or referred to are provided within the bibliography section of this report.

When accessing the DE and OEH databases, the search area specified was a 10 km buffer around the study area. The data searches were carried out on the 20 June 2014 and reviewed on the 18 February 2015.

All these databases and reports were reviewed and drawn upon where relevant. Whilst reviewing these documents, particular attention was paid to identifying records of species listed under the Schedules of the EPBC or TSC Acts, plants, animals and ecological communities that have been recorded in the surrounding region and which may occur within, or in the vicinity of, the study area.

Field guides and standard texts used include:

- Harden (1992, 1993, 2000 and 2002) and Robinson (2003) (used for the identification of flora species)
- Cogger (2004) (reptiles and frogs)
- Simpson and Day (2008) (birds)
- Van Dyck and Strahan (2008) (non-flying mammals)
- Churchill (2008) (flying mammals)
- Triggs (1996) (scats and signs).

The naming of those species recorded or known for the region follows the nomenclature presented in these texts, or within the EPBC and TSC Acts.

It is noted that the current accepted scientific names for some of the threatened animals previously recorded in this locality are not consistent with the names used/provided under either the EPBC or TSC Acts. In these instances, the namings used within this report follow the current approved scientific conventions.

The conservation significance of those ecological communities, plants and animals recorded is made with reference to:

- the RoTAP publication (Briggs and Leigh 1996)
- the UBBS report (NPWS 1997)
- the EPBC and TSC Acts.

5. Results of the literature review

5.1. Flora

5.1. (a) Threatened flora species

The review of the DE and OEH databases (DE 2015, OEH 2015a) identified 25 plants that are listed under the Schedules of the EPBC and/or TSC Acts (Appendix 2). These plants have been previously recorded, or are considered to have habitat, within the study region. During the botanical survey, consideration was given to identifying the presence of one or more of these species within the study area, or any areas of their documented vegetation associations.

5.1. (b) Threatened ecological communities

With reference to the vegetation mapping undertaken for the Cumberland Plain (NPWS 2002a), a small portion of the subject site has been mapped as containing Shale Hills Woodland (Figure 3). A larger portion of this community is mapped as occurring within the north-western portion of the study area.

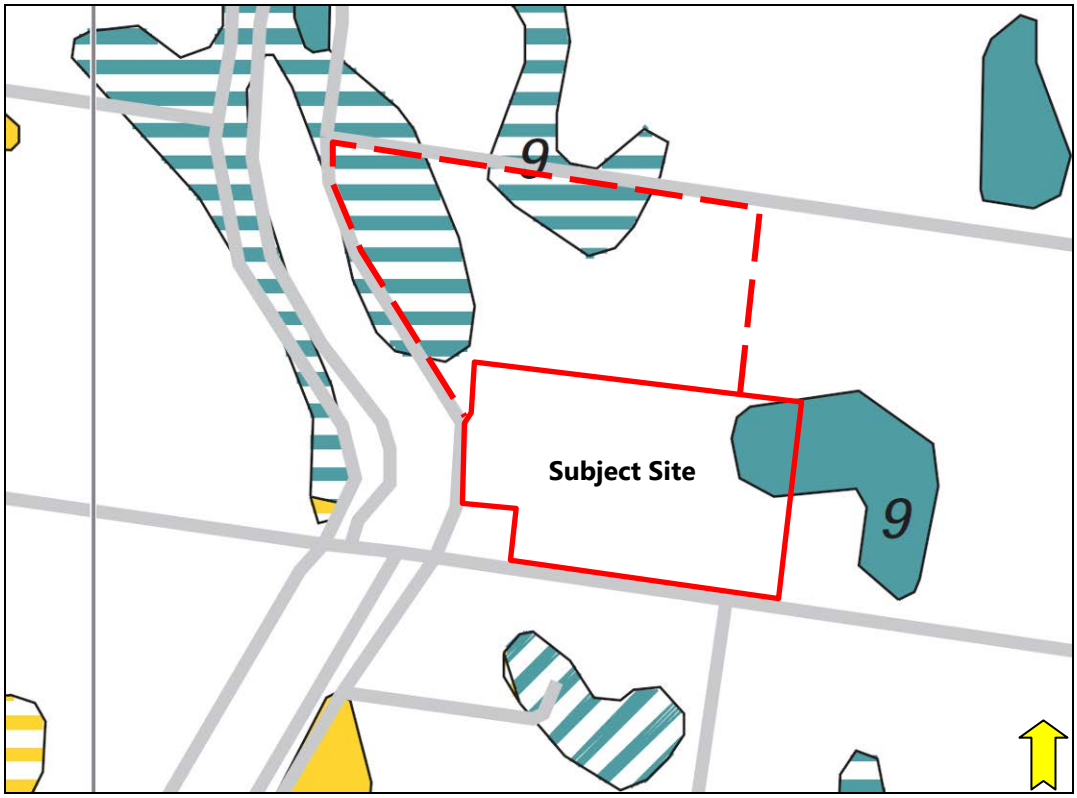
Shale Hills Woodland is part of the Cumberland Plain Woodland ecological community this being listed as critically endangered under the TSC Act.

Cumberland Plain Woodland also conforms to the critically endangered ecological community Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest that is listed under the EPBC Act.

5.2. Fauna

A review of the DE and OEH databases (DE 2015, OEH 2015a) identified 44 animals listed under the Schedules of the EPBC and/or TSC Acts that have been previously recorded, or are considered to have habitat, in the study region (Appendix 2).

Based on a consideration of the habitat needs of these threatened species (as provided in standard texts – refer to bibliography for those used), combined with the identification of those habitats present within the study area, there is the potential for some of the animals listed in Appendix 2 to occur within, or in the vicinity of, the subject site. As such, during the course of the field investigation(s), targeted surveys for these animals, or their necessary habitats, were undertaken.



Not to scale Source: NPWS (2002a)

Key

Cumberland Plain Woodland

9 - Shale Hills Woodland

10 - Shale Plains Woodland

Vegetation Condition Classes

Canopy Cover > 10% (Unless Remnant > 5ha, Where Canopy Cover > 5%)
(Areas mapped as classes: A, B, C, SA)

Canopy Cover < 10%
(Areas mapped as classes: Cmin, Tx, Txr)

Canopy Cover < 10% (Urban Areas)
(Areas mapped as class: Txu)

Note: Condition classes are shown as shading over the ecological community colour code. Example shown is for 1 – Shale/Sandstone Transition Forest (Low Sandstone Influence).

Figure 3: Vegetation communities mapped within, and near to, the study area (defined by red dashed line. Site boundary is only indicative)

6. Field survey methods

Field investigations of the study area were undertaken by Deryk Engel (B.Env.Sc.HONS) [zoologist] and Stephen Bloomfield (B.App.Sc.) [botanist] on 24 June and 3 July, 2014, and Stephen Bloomfield on 5 February 2015. For reference, the weather conditions experienced during these investigations were:

- 24 June - predominantly clear skies (less than 10% cloud cover), cool temperatures (12 °C) and strong winds
- 3 July - clear skies (less than 10% cloud cover), cold temperatures (6 °C) and calm conditions

- 5 February - overcast skies (90% cloud cover), mild temperatures (22 °C) and light winds.

The survey methods employed during the field investigations were generally based on the descriptions provided in the DECC's 2007 publication titled "Threatened species assessment guidelines: The assessment of significance". It is noted that the DECC guidelines do not provide advice on the use of either infrared cameras or Wildlife Acoustics SM2 Song Meter™. Therefore, information on the use of these was sourced from:

- the unit's user manual
- current scientific literature (Claridge *et al*. 2010, Engel and Burcher 2010, Meek *et al*. 2012)
- discussions held with Mr Alan Campbell of Bernview Environmental Consultants (Mr Campbell regularly hiring out these items).

The survey methods employed during the field investigation were:

- The identification of those dominant plants present within the study area.
- The identification of the structure of those vegetation communities and fauna habitats present.
- The direct observation of those fauna species present within, or close to, the Fifteenth Avenue property.
- Echolocation targeting microchiropterans.
- Use of an infrared camera.
- Use of a Wildlife Acoustics SM2 Song Meter™.
- The identification of those diurnal calls heard.
- Analysis of any carnivore scats collected, particularly those that contain hair and bone material.
- The identification of indirect evidence including scats, scratchings and diggings.
- Litter and ground debris searches for reptiles and amphibians.
- Ground debris, leaf litter and tree bark searches for the state listed Cumberland Plain Land Snail (*Meridolum corneovirens*)[2] and any sheltering reptiles and frogs.

Where required, a more detailed description on one or more of the survey methods employed is provided below.

Whilst the woodland to the north of the subject site is not considered to be directly, or indirectly, affected by the proposed development, it was considered appropriate to survey this vegetation to identify any animals that may potentially traverse the area to be developed (i.e. Large-footed Myotis [*Myotis macropus*]).

The purpose of the field investigations was to locate within the study area any plants, animals or vegetation communities that are of regional, state and/or national conservation significance, or any locations where these may potentially be present. When conducting the field investigations, the 'Random Meander Method' (as per Cropper 1993) was employed. This method is suitable for covering large areas and for locating any rare species, and their associated vegetation communities/habitat types.

Whilst conducting the site investigations, efforts were made to document the diversity, structure and value of those fauna habitats present within, and adjacent to, the study area. This involved assessing the structure of the vegetation communities and fauna habitats present and determining their significance for native species, particularly any that are of state and/or national

[2] It is noted that, due to its listing under the TSC Act, this is the only invertebrate targeted and, if found, identified.

conservation concern. Whilst conducting the habitat assessments, efforts were made to identify features such as known vegetation associations, geological features, feed trees, mature trees with hollows, aquatic environments and other habitat features important to the life cycle needs of those threatened species previously recorded in the study region (as listed in Appendix 2).

6.1. Study limitations

Access to all parts of the study area was possible, thereby ensuring that all portions of the site were sampled. In addition, no adverse weather conditions or relevant seasonal variables were encountered during the investigation. As such, no limitations to the success of the study were encountered.

6.2. Botanical survey

A variation of the 'Random Meander Method' was employed during the botanical survey. The investigation involved conducting foot traverses through those vegetation communities that occur within the property, concentrating particularly on the woodland portions of the site and those areas of the paddock that have been slashed and maintained. During these traverses, notes were made on the structure and floristic composition of the native vegetation present.

This method was employed within each habitat present until no new species were recorded.

Numerous plant specimens were collected for later identification using standard texts.

Based on the results of the literature review and the habitat requirements of those flora species identified as potentially occurring (Appendix 2), targeted investigations were also undertaken where areas of suitable habitat were observed.

6.3. Infrared camera

One Reconyx™ infrared camera was used during the course of the field investigations, this being placed within the study area on 24 June, and collected on 3 July, 2014. The camera was attached to a tree on the western side of Dam 2, located at the edge of a stand of Cumberland Plain Woodland in the western portion of the study area (Figure 4).

For reference, the Global Positioning System (GPS)[3] coordinates of the camera were Easting [E] - 299418; Northing [N] – 6244651.

The camera employs an active infrared system, this requiring an animal to 'break' an invisible 'beam'. The camera operates diurnally and nocturnally, and was set to a sensitivity level of high and a photo interval of 3/ten seconds. The camera was placed at a height of around 1.5 m above ground level and angled slightly downwards (as per the directions provided in the unit's instruction manual).

To entice animals into the camera's field of view, a lure scented with truffle oil was used. This was placed at a distance of around 3 m in front of the camera and secured to the ground by a large steel peg. This distance was selected as it is within the unit's motion detector coverage range. The lure is constructed from 250 mm long PVC piping, into which has been drilled a number of holes. Foam is placed within the piping and into this, the truffle oil is poured.

[3] System used: WGS84

Not to scale Source: Google Earth (2013)

Figure 4: Fauna survey locations

Key:
orange star = Anabat Express™
yellow triangle = Wildlife Acoustics SM2 Song Meter™
red square = Reconyx™ infrared camera

Based on a review of the unit's date stamp, it is noted that the camera was still operating at the time of collection.

By the completion of the field surveys, approximately nine days of infrared camera use had been accumulated.

6.4. Wildlife Acoustics SM2 Song Meter™

A Wildlife Acoustics SM2 Song Meter™ was set out on 24 June, and collected on 3 July, 2014. This device was set to record calls during two time intervals, these being from:

- 1900 to 2100
- 2300 to 0100.

The Wildlife Acoustics SM2 Song Meter™ was secured to a tree at a height of approximately 4 m above ground level. The tree selected occurs within a stand of Cumberland Plain Woodland, in the western portion of the study area (E - 299402; N - 6244716) (Figure 4).

Calls were analysed in-house using Cornell Laboratory of Ornithology's program 'Raven Pro 1.4™'.

By the completion of the field surveys, approximately 36 hours of Wildlife Acoustics SM2 Song Meter™ recording had been accumulated.

6.5. Echolocation

An Anabat Express™ echolocation detector was used to determine the presence of any microchiropterans (insectivorous bats) that may utilise the study area; the device set out on 24 June, and collected on 3 July, 2014. The echolocation unit was secured to the same tree as the Wildlife Acoustics SM2 Song Meter™, the unit also being placed at a height of 4 m above ground level (Figure 4). This location is considered to correspond to those habitats likely to be used by microchiropterans during their foraging and/or dispersal periods (i.e. a woodland and habitat ecotone). It is noted that this location is also approximately 30 m from a potential roosting site (i.e. a hollow-bearing tree).

Being programmable and waterproof, the Anabat Express™ unit was set to record microchiropteran calls between dusk (this being at 1654 at the time of the field investigation) and dawn (0701). The unit was placed out on site on the 24 June, and collected on the 3 July, 2014.

Any calls recorded were analysed in house using Anabat 6.3 computer software.

By the completion of the field surveys, approximately 126 hours of echolocation recording had been accumulated.

6.6. Cumberland Plain Land Snail investigation

In regards to the targeted searches for the state listed Cumberland Plain Land Snail, these were undertaken at various locations within the study area, particularly those areas where stands/patches of woodland were present. The searches involved lifting and looking underneath rocks, logs, natural/artificial ground debris and dried cow pats, as well as raking the leaf litter that occurs around the base of any of the eucalypts present.

The searches were conducted until:

- a Land Snail was identified (either a living individual or discarded shell)
- an interval of thirty minutes had passed.

By the completion of the field surveys, approximately thirty minutes of Cumberland Plain Land Snail searches had been accumulated. Given the condition of the site, its maintenance regime and grazing/occupation history, this length of time is considered more than adequate to determine if the Cumberland Plain Land Snail occurs as a resident population within the study area.

7. Results

7.1. Flora

7.1.1. Species recorded

By the completion of the flora survey, 62 native and exotic plants had been recorded (Appendix 3). In regards to the native species detected, none are listed, or currently being considered for listing, under the EPBC or TSC Acts. Similarly, none are a RoTAP.

With reference to the NPWS's UBBS (NPWS 1997), three of the plants recorded are considered to be of regional significance (Table 2).

Table 2: Regionally significant plant species recorded within the study area

Key:
V2 = vulnerable taxa which are uncommon (6-10 records)
V3 = vulnerable taxa which are common to widespread and are unlikely to become regionally extinct in the near future.

Common Name	GENUS Species	Significant	Recorded
	Daviesia genistifolia	V3	In association with the Cumberland Plain Woodland
Spotted Knotweed	*Persicaria strigosum*	V2	In association with Dam 2
Spotted Gum	*Corymbia maculata*	V3	Three individuals observed within the stands of Cumberland Plain Woodland

The woodland stand present beyond the area to be developed will provide habitat for both *Daviesia genistifolia* and Spotted Gum. However, as the dams are expected to be infilled as part of the proposal, no areas of habitat for the Spotted Knotweed will be retained within the subject site post-development. Whilst this is the case, this species is common in coastal areas along NSW and into Queensland (Robinson 2003). The habitat present within the subject site for this species is not considered to be of critical importance for its survival in the region.

Whilst none of the plants recorded are listed under either the EPBC or TSC Acts, it is considered that the study area provides potential habitat for the Spiked Rice-flower (*Pimelea spicata*). Potential habitat for this species is present beyond the subject site in the nearby eucalypt forest that occurs in the northern and western portions of the study area. Spiked Rice-flower is listed as endangered under both the EPBC and TSC Acts. This species occurs in open woodland of Grey Box (*Eucalyptus moluccana*), Narrow-leaved Ironbark (*E. crebra*), Blackthorn (*Bursaria spinosa*) and Kangaroo Grass (*Themeda australis*) on the Cumberland Plain between Marayong and Prospect Reservoir, and south through to Narellan and Douglas Park (OEH 2015c). The study area occurs within this species' distribution range.

Though potential habitat for Spiked Rice-flower is present within the study area, no individuals of this species were detected. There is the possibility for individuals to be present within the soil seedbank, and given the high level of regeneration of those additional native species observed, if present, Spiked Rice-flower could potentially resprout if the current level of grazing pressure was eased.

Whilst this is the case, no areas of suitable habitat occur within the subject site itself. Within the subject site, given the highly degraded and modified condition of the vegetation present, this

plant would not be present (including within the soil seed bank). Therefore, no further legislative assessment giving consideration to the criteria provided under the EPBC Act (Significant Impact Guidelines) and Part 1, Section 5A of the EPA Act (these commonly being referred to as the 'seven part test') has been undertaken.

7.1.1. (a) Noxious weeds

Of those introduced species recorded, nine are listed as noxious in the Liverpool LGA (as per the NW Act). For reference, these species, their threat class and relevant legal requirement are provided in Table 3.

It is noted that Blackberry, Lantana and African Boxthorn are the most common of the noxious weeds, these generally occurring as isolated clumps.

7.1.2 Plant communities

The site investigations indicated that the majority of the study area appears to have been previously cleared. With reference to Figure 3, it is noted that the stand of Cumberland Plain Woodland that is mapped as being present within the subject site (NPWS 2002a) has been removed due to the establishment of the bus deport (refer to Figure 4). As such, this mapping is not current or a true reflection of the existing condition of the study area.

Within the study area three vegetation communities were recorded, these being:

- Forest Red Gum - Grey Box open forest
- Exotic grassland
- Low dense shrubland.

A brief description of each follows, whilst their distribution is indicated on Figure 5.

7.1.2. (a) Forest Red Gum - Grey Box open forest

The Forest Red Gum - Grey Box open forest occurs predominantly within the northern and western portions of the study area, as well as along the Flynn Avenue road reserve (northern boundary of the property). No Forest Red Gum - Grey Box open forest occurs within the subject site.

The canopy consists of Forest Red Gum (*Eucalyptus tereticornis*) and Grey Box (*Eucalyptus molluccana*), as well as the occasional Spotted Gum (*Corymbia maculata*). Tree heights are between 10 m to 15 m high. The occasional emergent mature remnant tree is present, this reaching a height of 20 m high. A mid-storey of eucalypts, and in one area, Sydney Green Wattle (*Acacia decurrens*), reaches a height of 4 m to 6 m. The understorey is generally absent to sparse, and consists of Blackthorn (*Bursaria spinosa*) and *Dillwynia sieberi*, and the introduced plants African Boxthorn (*Lycium ferrocissimum*), Lantana (*Lantana camara*) and African Olive (*Olea europaea* subsp. *cuspidata*). This layer does not generally reach more than 1.5 m in height. The groundcover consists of a mixture of native and exotic grasses, herbs and forbs. Common native species include *Glycine spp.*, Kidney Weed (*Dichondra repens*) and Couch (*Cynodon dactylon*). Three-awn Speargrass (*Aristida ramosa*) and Bamboo Grass (*Austrostipa ramosissima*) occur nearer to the northern boundary. Common weeds include Parramatta Grass (*Sporobolus sp.*) and African Love Grass (*Eragrostis curvula*) (near the western boundary).

Table 3: Noxious weeds recorded on site

Species	Threat Class	Location on site	Legal Requirements
African Olive (*Olea europaea* subsp. *cuspidata*)	4	Primarily observed in the north-east corner and along the northern boundary of the study area.	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed.
African Boxthorn (*Lycium ferrocissimum*)	4	Observed within the woodland areas. Some isolated individuals present throughout the cleared portion of the site.	The plant must not be sold, propagated or knowingly distributed.
Blackberry (*Rubus fruticosus* agg. spp.)	4	Occurs as isolated clumps throughout the cleared portion of the site.	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed.
Bridal Creeper (*Asparagus asparagoides*)	4	Isolated occurrences observed along the northern perimeter of the study area.	The plant must not be sold, propagated or knowingly distributed.
Lantana (*Lantana camara*)	4	Occurs as isolated clumps throughout the cleared portion of the study area. Primarily within the north-east corner.	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread. A Weed of National Significance.
Mother of Millions (*Bryophyllum delagoense*)	4	Observed within the road reserve of twenty-seventh Avenue and Fifteenth Avenue. No individuals observed on site.	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed.
Prickly Pear (*Opuntia sp.*)	4	Isolated occurrence near street boundary of bus depot area.	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed.
Castor Oil Plant (*Ricinus communis*)	4	Isolated occurrence in centre of bus depot area.	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread.
Small-leaved Privett (*Ligustrum sinense*)	4	Isolated occurrences observed in the north of the study area.	The growth of the plant must be managed in a manner that continously inhibits the ability of the plant to spread.

Not to scale Source: Nearmap (2015)

Key

Forest Red Gum - Grey Box open forest

Low dense shrubland

Farm dam

Remainder of site = Exotic Grassland

Figure 5: Vegetation communities recorded within the study area

Given the even age of the majority of trees present, this community appears to have regenerated, presumably in response to cessation of produce cultivation or a reduction in grazing pressure.

As the community is quite open with a sparse to absent shrub layer, unrestricted grazing by cattle occurs within this vegetation type.

The condition of this community is considered to be moderate given:

- its good regeneration potential
- current level of grazing pressure
- the presence of those weeds that occur.

Management of the weeds present and the exclusion of cattle would increase the condition of this vegetation community.

7.1.2. (b) Exotic grassland

This community dominates the subject site.

The exotic grassland consists of introduced grasses, herbs and forbs that are approximately 20 cm high. Common species include Kikuyu Grass (*Pennisetum clandestimum*), Paddy's Lucerne (*Sida rhombifolia*), Vetch (*Vicia sp.*), Couch, Fireweed (*Senecio madagascariensis*), Sowthistle (*Sonchus oleraceus*), Scotch Thistle (*Cirsium vulgare*) and Lamb's Tongue (*Plantago lanceolata*).

The two dams present occur within this vegetation type. The vegetation associated with these includes those native and exotic grasses, herbs and forbs aforementioned, and a number of water associated species such as Common Rush (*Juncus usitatus*) and Cumbungi (*Typha orientalis*). The regionally significant Spotted Knotweed (*Persicaria strigosum*) also occurs in association with Dam 2.

The condition of this community is low.

7.1.2. (c) Low dense shrubland

Isolated areas of Blackberry (*Rubus fruticosus* agg. spp.) occur in the western portion of the subject site, these forming low dense shrublands that reach a height of 1.5 m. Lantana and African Boxthorn also occur in association with this community.

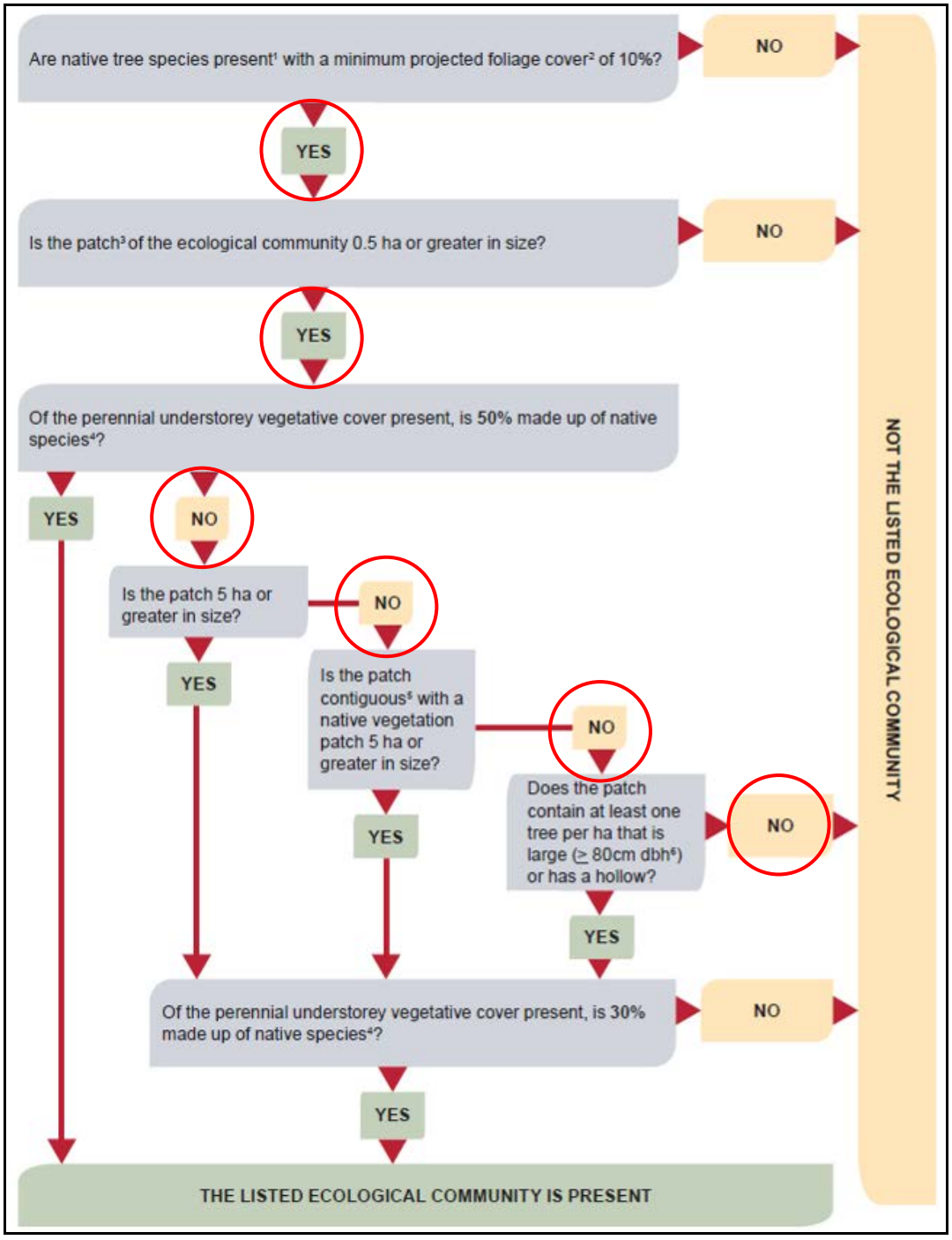
The condition of this community is low.

7.1.3 Conservation significance of the vegetation

With reference to the NSW Scientific Committee's determination for Cumberland Plain Woodland (OEH 2015d), the Forest Red Gum - Grey Box open forest is considered to conform to the description provided for this state listed critically endangered ecological community.

With reference to the guidelines prepared by DEWHA (2010) for assessing Cumberland Plain Shale Woodland and Shale Gravel Transition Forest (refer to Figure 6), the Forest Red Gum - Grey Box open forest within the study area is not considered to represent a viable, intact example of this critically endangered ecological community.

No areas of Forest Red Gum - Grey Box open forest are present within the subject site and none are expected to be adversely affected by the proposed development (either directly or indirectly). As such, it is not considered necessary to further consider the potential impact of the proposed development on this critically endangered ecological community. Therefore, no further legislative assessment giving consideration to the criteria provided under the EPBC Act (Significant Impact Guidelines) and Part 1, Section 5A of the EPA Act has been undertaken.



Extracted from DEWHA (2010)

Figure 6: Flowchart of key diagnostic features and condition thresholds to identify the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community. The red circles show the decision process followed that lead to the Forest Red Gum - Grey Box open forest on site not being considered to conform to the nationally listed critically endangered ecological community.

7.2. Fauna

7.2.1. Fauna species recorded during the field investigations

During the course of the field investigations five native mammals, 33 native birds and two amphibians were recorded within, or in close proximity to, the study area (Appendix 4). In addition, one introduced mammal, seven introduced birds and one introduced invertebrate were observed (Appendix 4).

In regards to the detection of those native species recorded:

- All of the microchiropterans were identified through the recording of their echolocation calls.
- The Grey-headed Flying-fox (*Pteropus poliocephalus*) was identified through the analysis of those calls recorded by the Wildlife Acoustics SM2 Song Meter™.
- All of the birds were observed within, adjacent to or flying over, the study area, or identified from their distinct calls.
- The Common Brushtail Possum (*Trichosurus vulpecula*) was identified through its characteristic scratchings that were observed on a smooth-barked tree.
- The Common Eastern Froglet (*Crinia signifera*) was heard calling in association with Dam 2, whilst Verreaux's Tree Frog (*Litoria verreauxii*) was identified through the analysis of those calls recorded by the Wildlife Acoustics SM2 Song Meter™.

In regards to those specific survey techniques employed during the field investigations:

- The infrared camera recorded photographs of a Magpie-lark (*Grallina cyanoleuca*) and the introduced European Cattle (*Bos taurus*).
- The Anabat units recorded calls that identified the presence of three species of microchiropteran.
- The Wildlife Acoustics SM2 Song Meter™ recorded the Grey-headed Flying-fox and Verreaux's Tree Frog, as well as a number of those common birds and frogs that were identified through use of the other survey methods.

Though targeted, no living or discarded Cumberland Plain Land Snail shells were observed. In addition, no habitat is available to this species within the subject site.

Of those native species recorded, four are listed under the Schedules of the EPBC and/or TSC Acts, these being the:

- Cattle Egret (*Ardea ibis*) - listed as migratory under the EPBC Act
- Grey-headed Flying-fox - listed as vulnerable under the EPBC and TSC Acts
- Eastern Bentwing Bat (*Miniopterus* (*schreibersii*) *orianae oceanensis*) - listed as vulnerable under the TSC Act
- Little Eagle (*Hieraaetus morphnoides*) - listed as vulnerable under the TSC Act.

For reference, the location where each of these species was detected is provided on Figure 7, whilst Appendix 2 provides a description of these animals' habitat needs and ecology. As the Grey-headed Flying-fox was not observed, or heard by a researcher whilst on site, the location of this species can not be determined. As such, the location at which it was recorded through use of the Wildlife Acoustics SM2 Song Meter™ has been included in Figure 7.

With reference to the NPWS's UBBS (NPWS 1997), one of the birds recorded, the Yellow-rumped Thornbill (*Acanthiza chrysorrhoa*), is considered to be of regional significance. Figure 7 provides the location of where this species was detected.

Not to scale Source: Google Earth (2013)

Key:

Green circle = Hollow-bearing tree
White triangle = Little Eagle
Blue triangle = Cattle Egret
Orange triangle = Yellow-rumped Thornbill
Yellow triangle = Eastern Bentwing Bat / Grey-headed Flying-fox

Figure 7: Hollow-bearing trees and threatened species locations

Whilst targeted, but not recorded, given the presence of hollow-bearing trees within the study area and the winter timing of the echolocation detection, there is the potential for hollow dependent microchiropterans to utilise the study area, in particular those hollow dependent microchiropterans listed under the TSC Act that have been previously recorded in the study region, these being:

- Eastern Falsistrelle (*Falsistrellus tasmaniensis*) - listed as vulnerable under the TSC Act
- Large-footed Myotis (*Myotis macropus*) - listed as vulnerable under the TSC Act
- Greater Broad-nosed Bat (*Scoteanax rueppellii*) - listed as vulnerable under the TSC Act
- East-coast Freetail Bat (*Micronomus norfolkensis*) - listed as vulnerable under the TSC Act.

None of those threatened or regionally significant species detected were recorded within the subject site.

In regards to the Cattle Egret, Grey-headed Flying-fox and Little Eagle, there is the potential for each of these species to forage within the subject site. Therefore, to consider the potential impact

of the proposed development of the subject site on these state and national listed species, assessments using the criteria provided under the EPBC Act (Significant Impact Guidelines) and Part 1, Section 5A of the EPA Act have been conducted (refer to Section 8).

In regards to the remaining threatened species recorded, or considered likely to occur, no foraging, sheltering or roosting habitat is available to any of these animals within the subject site. As such, it is not considered necessary to further consider the potential impact of the proposed development on any of these species. Therefore, no further legislative assessment has been undertaken.

7.2.2. Habitat types available for native fauna species

Four habitat types available for use by native fauna species were observed within the study area, these being:

- A grassland (corresponds to exotic grasslands 7.1.2. (b) above)
- Eucalypt woodland (corresponds to open forest 7.1.2. (a) above)
- Shrubland (corresponds to shrubland 7.1.2. (c) above)
- Aquatic environment.

For reference, a description of each of these is provided below, whilst their locations are identified on Figure 5.

7.2.2. (a) Grassland

This habitat dominates the subject site.

The grassland has been cleared and is currently being grazed. Several isolated shrubs and saplings (both exotic and native) are present within this habitat type, these being 1 m to 3 m in height.

The agricultural use of the site has resulted in the collection and removal of the majority of natural (e.g. fallen branches) and exotic (e.g. corrugated iron) ground debris. Therefore, this material is not present.

Associated with this environment is an off road track that leads to an area that contains a number of soil stockpiles and manure compost.

The highly disturbed and modified bus depot is also included within this habitat type.

7.2.2. (b) Eucalypt woodland

The eucalypt woodland is predominantly present within the northern and western portions of the study area. No woodland stands occur within the subject site.

The woodland supports trees that are generally 10 m to 15 m in height. The occasional emergent mature remnant tree is also present, this reaching a height of 20 m high. Four of the mature trees present were noted to contain, or potentially support, hollows (hollow diameter 50 mm) suitable for the life-cycle requirements of hollow-dependent native species (Figure 7). The middle storey is composed of regenerating eucalypt saplings that are 4 m to 6 m in height, this being of a medium to sparse density. The understorey is generally absent or composed of both native and

exotic shrubs and saplings to 1.5 m in height. The ground cover is composed of native and exotic grasses, herbs and forbs, these being grazed and of a high density. Leaf litter and natural ground debris is common, as is urban refuse in those areas adjacent to the road reserve.

7.2.2. (c) Shrubland

This habitat type occurs in the western portion of the subject site.

The shrubland occurs as isolated patches of dense, exotic vegetation that reach a height of approximately 1.5 m.

7.2.2. (d) Aquatic environment

Two farm dams are present within the subject site. Due to the presence of domestic livestock, the banks of each of these has been trampled and disturbed. Each of the dams support open water, with Dam 2 being the only one to support some aquatic vegetation. This vegetation is generally sparse. The dams have both been artificially created and support earthen banks and beds.

No fish were observed in either dam. Whilst this is the case, eels and exotic fish could potentially be present in either dam.

7.2.3. Fauna corridors

The study area is considered to be a part of a highly fragmented wildlife corridor that loosely follows the Sydney Water Canal. This corridor provides a link northwards into better vegetated areas of the Western Sydney Parklands, and Kemps Creek Nature Reserve to the north-west. Through open space to the west, the site is also very loosely connected to better vegetated areas in the south, this also being a part of the Western Sydney Parklands. The site would only be traversed by flying animals (i.e. birds and microchiropterans) and species highly tolerant of negotiating urban infrastructure (such as the Common Brushtail Possum).

It is noted that any animals utilising the link to the south would have to negotiate the high volumes of traffic that traverse Fifteenth Avenue.

8. Legislative considerations

8.1. Commonwealth - *Environment Protection and Biodiversity Conservation Act 1999*

By the completion of the field investigations two animals listed under this Act were recorded, these being:

- Cattle Egret (*Ardea ibis*) - listed as migratory
- Grey-headed Flying-fox – vulnerable.

No other fauna species, ecological communities or plants listed under the Act were recorded within the study area, nor are any considered likely to occur.

The following assessment guidelines prepared under the Act (DE 2013a) are used to determine whether the action (i.e. the proposed development of the subject site) has, will have, or is likely to

have, a significant impact on these matters of national environmental significance (i.e. migratory Cattle Egret and vulnerable Grey-headed Flying-fox).

Based on the conclusions reached in preparing the following assessments, it is considered that the proposed development of the subject site would not have a significant impact on either the Cattle Egret or Grey-headed Flying-fox. As such, it is not considered necessary that the proposal be referred to the Federal Minister for the Environment for further consideration or approval.

8.1. (a) Cattle Egret – migratory species

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.

The subject site is not considered to contain important habitat for the Cattle Egret. Therefore, no areas of important habitat would be substantially modified.

It is not considered that the Cattle Egret would be reliant upon the subject site for any of its necessary life cycle requirements. During the field investigations, no Cattle Egret breeding sites or colonies were recorded, only areas utilised by individuals during their foraging periods being observed.

- *result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.*

The proposed development would not result in invasive species that are harmful to the Cattle Egret becoming established within the subject site. Furthermore, the subject site is not considered to be important habitat for the Cattle Egret.

- *seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of a migratory species.*

The Cattle Egret individuals observed are unlikely to be a part of an ecologically significant proportion of the population. The proposed development is unlikely to disrupt the lifecycle of this species. During the field investigations, no Cattle Egret breeding sites were recorded, only areas utilised by individuals during their foraging periods being observed. It is not considered that the Cattle Egret would significantly rely upon the subject site for any of its necessary life cycle requirements.

8.1. (b) Conclusion

In regards to the above assessment factors, it is considered that the proposed development of the subject site is not likely to have a significant impact on the migratory Cattle Egret. Therefore, it is not considered necessary that the matter be referred to the Federal Minister for the Environment for further consideration and approval.

8.1. (c) Grey-headed Flying-fox - vulnerable species

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

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

The removal of a small number of trees that may potentially be utilised as a potential foraging resource would not decrease the size of an important population of this species in either the short or long term.

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

The proposal would not reduce the area of occupancy available to an important population of this species. No active or historic Flying-fox colonies were observed within the study area.

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

The Grey-headed Flying-fox's ability to fly and negotiate open spaces and urban infrastructure would ensure that the proposal does not fragment an existing population into two or more populations.

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

No habitat critical to the survival of this species was recorded within the study area.

- *disrupt the breeding cycle of an important population.*

No active or historic Flying-fox colonies were observed within the study area. The undertaking of the proposal would not disturb the breeding cycle of this species.

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

This species is not considered to be reliant upon the resources offered by the project site such that the removal of a small number of trees that may potentially be utilised as a potential foraging resource would cause the Grey-headed Flying-fox to decline.

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

The area is already modified, and as such is subject to the presence of exotic plants and animals. However, none of these are expected to be harmful to the Grey-headed Flying-fox. The proposed works are not expected to exacerbate the current situation, thereby resulting in the establishment of any invasive species that may be harmful to the Grey-headed Flying-fox.

- *introduce disease that may cause the species to decline.*

The proposal is unlikely to introduce diseases that may cause the Grey-headed Flying-fox to decline.

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

A National Recovery Plan (draft) for the Grey-headed Flying-fox has been prepared (DECCW 2009). The overall objectives of this plan are to:

- reduce the impact of threatening processes on Grey-headed Flying-foxes and arrest decline throughout the species' range
- conserve the functional roles of Grey-headed Flying-foxes in seed dispersal and pollination
- improve the standard of information available to guide recovery of the Grey-headed Flying-fox, in order to increase community knowledge of the species and reduce the impact of negative public attitudes on the species.

The scope of the proposed action would not affect any known roosting camps. The scope of works proposed would not be inconsistent with the objectives specified in this species' recovery plan, specifically the following:

- ***Objective 1.*** To identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes throughout their range.
    - No foraging habitat critical to the survival of the Grey-headed Flying-fox is present within the proposed areas of disturbance.
- ***Objective 2.*** To protect and increase the extent of key winter and spring foraging habitat of Grey-headed Flying-foxes.
    - No seasonal Grey-headed Flying-fox foraging habitat is present within the proposed areas of disturbance.
- ***Objective 3.***To identify roosting habitat critical to the survival of Grey-headed Flying-foxes.
    - No Grey-headed Flying-fox roosting sites are present within, or in close proximity to, the proposed areas of disturbance.
- ***Objective 4.***To protect and enhance roosting habitat critical to the survival of Grey-headed Flying-foxes.
    - No Grey-headed Flying-fox roosting sites are present within, or in close proximity to, the proposed areas of disturbance.

8.1. (d) Conclusion

The proposal is not considered to have a significant impact on the vulnerable Grey-headed Flying-fox or its habitat. Therefore, it is not considered necessary that the matter be referred to the Federal Minister for the Environment for further consideration and approval.

8.2. State - *Environmental Planning and Assessment Act 1979*

Part 1, Section 5A of the EPA Act requires the consideration of the impacts of a proposed action on threatened species, populations and communities listed under the TSC Act. These criteria are designed to determine whether there is likely to be a significant effect on these threatened species and communities, or their habitats, and consequently whether a SIS is required.

By the completion of the field investigation, one critically endangered ecological community, Cumberland Plain Woodland, and three vulnerable animals, the Grey-headed Flying-fox, Eastern Bentwing Bat and Little Eagle, listed under the TSC Act had been detected.

Whilst Cumberland Plain Woodland was recorded within the study area, no areas of this critically endangered ecological community were recorded within the subject site. Similarly, within the subject site, no foraging or roosting habitat for either the Eastern Bentwing Bat or those hollow-dependant microchiropterans that could potentially occur is present.

As such, seven part tests have only been prepared on the Grey-headed Flying-fox and Little Eagle.

Based on the outcomes of the following assessments, it is considered that the proposed development of the subject site would not have a significant impact on either the Grey-headed Flying-fox or Little Eagle. As such, it is not considered necessary that a SIS be prepared.

No other flora or fauna species listed under the TSC Act were recorded within the subject site. Similarly, none are considered likely to occur. The proposed development of the subject site is therefore not considered to have an adverse impact on any threatened plants or animals known to occur in the study region.

8.2. (a) Seven-part test – Grey-headed Flying-fox

(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*,

The Grey-headed Flying-fox was recorded through use of a Wildlife Acoustics SM2 Song Meter™ that was placed at the edge of the Cumberland Plain Woodland in the western portion of the study area. No active or historic Flying-fox colonies were observed within the study area, the species recorded only expected to have been detected whilst it was foraging within, or near to, the study area. Given that this species was not observed, or heard by a researcher whilst on site, it can not be determined whether the species was in or out of the study limits. Whilst this is the case, a small amount of suitable foraging habitat for the Grey-headed Flying-fox is present within the subject site. Nonetheless, the proposed development would not result in the removal of a significant proportion of the Grey-headed Flying-fox's foraging habitat such that a viable local population of this species is likely to be placed at risk of extinction.

Foraging habitat for this species is present in the northern and western portions of the study area, beyond the limits of the proposed development, this area being unaffected by the proposal.

(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*:

An 'endangered population' is defined as a 'population specified in Part 2 of Schedule 1' of the TSC Act. At the present time there are no endangered populations of this species listed under the Act.

(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 Grey-headed Flying-fox is not listed as an endangered ecological community.

(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*

It is estimated that the proposed development would result in the removal of a small number of trees that may potentially be utilised as a potential foraging resource. This is not considered significant given the amount that occurs within the study region, including those areas within conservation reserves. In addition, foraging habitat for this species is present in the northern and western portions of the study area, beyond the limits of the proposed development, this area being unaffected by the proposal. No active or historic Flying-fox colonies were observed within the study area. As such, none would be affected by the proposed development.

> (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*

The Grey-headed Flying-fox can easily negotiate open areas, urban environments and infrastructure. The proposal would therefore not have an impact on this species' foraging or movement patterns.

> (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*,

Given the limited structure and value of the habitat in its current state, the lack of any roosting habitat and the pressures placed on it from current land use practices and weed invasion, it is not considered that the habitat to be removed is important to the long-term survival of any Grey-headed Flying-fox individuals that are foraging in, or across, this locality.

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

No critical habitat will be adversely affected by the proposal. The study area is not listed as critical habitat under Part 3 Division 1 of the TSC Act.

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

A National Recovery Plan (draft) for the Grey-headed Flying-fox has been prepared (DECCW 2009). The overall objectives of this plan are to:

- reduce the impact of threatening processes on Grey-headed Flying-foxes and arrest decline throughout the species' range
- conserve the functional roles of Grey-headed Flying-foxes in seed dispersal and pollination
- improve the standard of information available to guide recovery of the Grey-headed Flying-fox, in order to increase community knowledge of the species and reduce the impact of negative public attitudes on the species.

The scope of the proposed action would not affect any known roosting camps. The scope of works proposed would not be inconsistent with the objectives specified in this species' recovery plan, specifically the following:

- ***Objective 1.*** To identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes throughout their range.
    - No foraging habitat critical to the survival of the Grey-headed Flying-fox is present within the proposed areas of disturbance.
- ***Objective 2.*** To protect and increase the extent of key winter and spring foraging habitat of Grey-headed Flying-foxes.
    - No seasonal Grey-headed Flying-fox foraging habitat is present within the proposed areas of disturbance.
- ***Objective 3.***To identify roosting habitat critical to the survival of Grey-headed Flying-foxes.
    - No Grey-headed Flying-fox roosting sites are present within, or in close proximity to, the proposed areas of disturbance.
- ***Objective 4.***To protect and enhance roosting habitat critical to the survival of Grey-headed Flying-foxes.
    - No Grey-headed Flying-fox roosting sites are present within, or in close proximity to, the proposed areas of disturbance.

(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.*

Currently 35 Key Threatening Processes for mainland NSW are listed under Schedule 3 of the TSC Act. In relation to the Grey-headed Flying-fox, of these, the 'clearing of native vegetation' would be applicable to the proposal. Whilst this is the case, the removal of a small number of native trees would not contribute significantly to this Key Threatening Process in regards to its local or regional presence.

8.2. (b) Expected impact on the Grey-headed Flying-fox

The proposal would remove a portion of the Grey-headed Flying-fox's foraging habitat. Given its size, location and condition, this habitat is not considered significant for the lifecycle requirements of this bat in either the locality or throughout its distribution range. Therefore, no significant areas of local or regional habitat would be removed or affected by the proposed development. The expected impacts associated with the proposal on the local status of the Grey-headed Flying-fox and its population are considered to be minimal and therefore the preparation of a SIS is not considered necessary.

8.2. (c) Seven-part test – Little Eagle

(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,

The Little Eagle was observed flying over the study area. As no nests typical of this species were observed on site, it is considered that this bird is only incorporating the subject site into its foraging home range.

The proposed development is expected to result in the removal and/or disturbance of approximately 3.5 ha of native and/or pastureland vegetation. This is not considered to adversely affect the life cycle of the Little Eagle such that its local population would be placed at risk of extinction.

Foraging habitat for this species is present in the northern and western portions of the study area, beyond the limits of the proposed development, this area being unaffected by the proposal.

(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,

An 'endangered population' is defined as a 'population specified in Part 2 of Schedule 1' of the TSC Act. At the present time there are no endangered populations of this species listed under the Act.

(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*

An endangered ecological community means an ecological community specified in Part 3 of Schedule 1 of the TSC Act. The Little Eagle is not listed as an endangered ecological community.

(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*

The proposed development is expected to result in the removal and/or disturbance of approximately 3.5 ha of native and/or exotic pastureland vegetation.

> *(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*

Areas of habitat would be fragmented. However, the Little Eagle can traverse large open areas and distances, and is considered to be tolerant of rural and urban developments (as observed

during the course of the field survey). As such, the gap that is to be created by the proposed development would not adversely affect the foraging and/or dispersal pattern of the Little Eagle.

> *(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*

Given the limited structure and value of the habitat in its current state and the pressures placed on it from current land use practices and weed invasion, it is not considered that the habitat that is to be removed is important to the long-term survival of any Little Eagle individuals that are foraging in the locality.

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

No critical habitat will be adversely affected by the proposal. The study area is not listed as critical habitat under Part 3 Division 1 of the TSC Act.

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

A recovery plan has not yet been drafted or finalised for the Little Eagle.

Under the Saving Our Species program, the Little Eagle has been assigned to the Landscape species management stream (OEH 2015e). A targeted approach for managing species within this stream is currently being developed by OEH; however, in the interim the following management actions have been identified for the Little Eagle:

- Raise awareness non-target poisoning from baits.
- Identify and secure appropriate habitat and improve management by erecting fences, adding supplementary planting, managing or reducing grazing, increasing size of habitat patches, planting stepping-stone linking patches and encourage the retention or placement of fallen logs, coarse woody debris and standing dead trees.
- Raise awareness of loss of habitat through population pressure and implement appropriate controls in areas subject to urban expansion, including identification of appropriate habitat and implementation of improved management.

None of these are relevant or applicable to the proposed development of the subject site.

(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

Currently 35 Key Threatening Processes for mainland NSW are listed under Schedule 3 of the TSC Act. In relation to the Little Eagle, of these, the 'clearing of native vegetation' would be applicable to the proposal. Whilst this is the case, the removal and/or disturbance of approximately 3.5 ha of native and/or exotic pastureland vegetation would not contribute significantly to this Key Threatening Process in regards to the local or regional presence of the Little Eagle.

8.2. (d) Expected impact on the Little Eagle

The proposal is not considered to have a significant impact on the local status of the Little Eagle. The works would not remove any significant portions of this species' foraging or nesting habitat. Therefore, it is not considered that the proposal would have a significant impact on this threatened species or its population. As such, the preparation of a SIS that further considers the impact of the proposal on the Little Eagle is not required.

8.3. State - State Environmental Planning Policy (Western Sydney Parklands) 2009

This SEPP aims to put in place planning controls that will enable the Western Sydney Parklands Trust to develop the Western Parklands into a multi-use urban parkland that facilitates the social, economic and environmental demands and concerns of this part of western Sydney.

As part of this SEPP, under Part 2, Section 14, an Environmental Conservation Areas map has been prepared, of which encompasses the study area (Figure 8). With reference to this mapping, it indicates that an area of environmental conservation occurs within the eastern portion of the subject site (i.e. 185 Fifteenth Avenue, Lot 345 DP 2475). Based on the results of the field investigations and ground truthing undertaken, this area falls within the bus depot site. This portion of the subject site has been cleared of native vegetation and now consists of hardstand areas, building infrastructure and weeds. No areas of environmental importance occur within this portion of the subject site.

As such, with reference to Section 14(2) of the SEPP, the proposed development is not considered to detract from the values of an environmental conservation area.

Figure 8: Mapping of Environmental Conservation Areas within, and near to, the study area

9. Conclusion

By the completion of the field investigation, one migratory bird, the Cattle Egret, and one vulnerable mammal, the Grey-headed Flying-fox, listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* had been recorded.

In regards to the NSW *Threatened Species Conservation Act 1995*, one critically endangered ecological community, Cumberland Plain Woodland, and three vulnerable animals, the Grey-headed Flying-fox, Eastern Bentwing Bat and Little Eagle, listed under this Act had been recorded.

Whilst targeted, but not recorded, potential habitat was recorded beyond the limits of the proposed development for four state listed vulnerable microchiropterans, these being Eastern Falsistrelle, Large-footed Myotis, Greater Broad-nosed Bat, East-coast Freetail Bat.

Whilst no plants listed under the Schedules to either of the Acts were recorded during the field survey, potential habitat for the state and national listed plant, the endangered Spiked Rice-flower, was recorded beyond the limits of the proposed development.

Given the lack of habitat within the subject site for Cumberland Plain Woodland, Spiked Rice-flower, Eastern Falsistrelle, Large-footed Myotis, Greater Broad-nosed Bat, East-coast Freetail Bat and Eastern Bentwing Bat, no legislative consideration was given to these ecological matters.

With reference to the assessment criteria provided under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and Part 1, Section 5A of the NSW *Environmental Planning and Assessment Act 1979*, the proposed development of the subject site is not considered to have a significant impact on the long-term viability of the Cattle Egret, Grey-headed Flying-fox or Little Eagle.

As such, referral of the matter to the Federal Minister for the Environment for further consideration or approval in relation to the proposal would not be necessary. Similarly, the preparation of a Species Impact Statement is not required.

During the course of the field survey, three plants and a bird that are of regional conservation significance were recorded. The development of the subject site would not further threaten the regional status of these species.

The adoption of those mitigation measures provided would ensure that the proposed development of 185 and 195 Fifteenth Avenue, West Hoxton is undertaken in an ecologically sustainable manner.

10. Recommendations

Based on the principles of Ecologically Sustainable Development, as identified in Schedule 2 of the Environmental Planning and Assessment Regulation, the following recommendations are provided:

- Any sheltering animals should be released in the stand of Cumberland Plain Woodland present within the north-western portion of the study area that is beyond the limits of the proposed development. Any injured wildlife should be transferred to a wildlife carer.

- Landscape works undertaken post-development should include a suite of locally occurring native species commensurate with the Cumberland Plain Woodland ecological community. The selection of those plants to be included in the development's landscaping works should be done in consultation with either an independent ecologist or landscape designer familiar with native species of the Cumberland Plain.

- Landscaping should aim at providing habitat resources for a number of those native species recorded or expected.

- In accordance with the regulations set out under the NW Act, the noxious weeds present on site should be subject to control measures in accordance with any relevant regional control plan or as directed by the Local Control Authority. The Local Control Authority in this case is Liverpool Council. The contact is likely to be Council's Noxious Weeds Officer.

- Due to the potential for both native (e.g. eels) and exotic fish to be present in the two dams, these should be drained in the following manner:

    1) Prior to their draining, fish traps should be established within each dam.
    2) Native fish caught in the fish traps should be relocated locally into a natural waterway.
    3) Exotic fish caught in the fish traps should be euthanised.
    4) Draining work to be undertaken during the late summer (March) and winter months when it is unlikely that any native fingerlings, and some adult fish (e.g. the eels) will be present (Eels likely to be present between October and January. At other times these animals will be at their oceanic breeding sites).
    5) During draining works, pumps are to be used.
    6) All suction hoses to be fitted with floats and filters. Mesh size of filters to be no greater than 10 millimetres (thereby preventing the downstream movement of fingerlings[4]).
    7) Water to be collected from each dam via a single, 'large' excavated hole.
    8) Any fish observed within the hole to be collected, large 'swimming pool' style nets to be used.
    9) Native fish collected to be relocated locally into a natural waterway, preferably downstream of the existing dam sites.
    10) Exotic fish collected from pool to be euthanised.
    11) All euthanised fish to be collected and disposed of appropriately (e.g. use of Council waste services)

[4] Whilst this mitigation measure is recommended, it is acknowledged that the movement of any fish through the internal workings of the pumps is likely to result in their demise.

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Appendix 1: Photographic record of the study area

Plate 1: The typical nature of the subject site, showing cleared areas, stands of woodland and Blackberry thickets.

Plate 2: The typical cleared nature of the subject site. Dam 1 can be seen in the background. Photograph taken looking south-west.

Plate 3: The character of Dam 1. Photograph taken looking south-west.

Plate 4: The character of Dam 2. Photograph taken looking south.

Plate 5: The Forest Red Gum – Grey-box open forest vegetation community commensurate with Cumberland Plain Woodland in the north-western portion of the study area. Photograph taken looking south-west.

Plate 6: The unformed carpark and sheds (background) along the southern boundary (Fifteenth Avenue). Photograph taken looking east.

Plate 7: The bus depot and associated infrastructure. Photograph taken looking north-east.

Plate 8: The cleared environment associated with the bus depot. Photograph taken looking north-west.

Appendix 2: Threatened flora and fauna species previously recorded or having habitat in the study region and a consideration of their 'likelihood of occurrence' within the study area

Key

E - Species listed as Endangered V - Species listed as Vulnerable EP – Endangered Population CE - Species listed as Critically Endangered M - Species listed as migratory

A State or Nationally listed threatened species is considered to have a:

- **High** likelihood of occurrence if it has been recorded within 10 km of the Fifteenth Avenue property and suitable habitat for this species is present within the subject site.

- **Moderate** likelihood of occurrence if they have a predicted occurrence (via the EPBC Act Protected Matters Search Tool or OEH geographic search) and there is suitable habitat present.

- **Low** likelihood of occurrence if suitable habitat for an animal is not present regardless of whether they have been recorded within 10 km, or have a predicted occurrence.

Species underlined are those which only the EPBC Protected Matters Search Tool predicted as having habitat in the search area (DE 2015). All other species have been recorded within 10 km of the subject site (OEH 2015a).

Habitat requirements were generally extracted from Frith (2007), Churchill (2008), Cogger (2004), Harden (1992-2002), Van Dyck and Strahan (2008) and OEH (2015b) with other references used being identified in the bibliography.

Common and Scientific Name	Legislation	Habitat*	Likelihood of Occurrence[5]
PLANTS			
Allocasuarina glareicola	EPBC (E) and TSC (E) Acts	Only in woodland of *Angophora bakeri* and *Eucalyptus sclerophylla*.	Low. There is no habitat within the study area for this plant.
Leafless Tongue-orchid *Cryptostylis hunteriana*	EPBC (V) and TSC (V) Acts	Occurs in a range of communities, including swamp-heath and woodland.	Low. There is no habitat within the study area for this plant.
Yellow Gnat-orchid *Genoplesium baueri*	EPBC (E) and TSC Acts (E)	Grows in sparse sclerophyll forest and moss gardens over sandstone.	Low. There is no habitat within the study area for this plant.
White-flowered Waxplant *Cynanchum elegans*	EPBC (E) and TSC (E) Acts	Usually occurs on the edge of dry rainforest. Other associated vegetation types include littoral rainforest; Coastal Tea-tree (*Leptospermum laevigatum)* – Coastal Banksia (*Banksia integrifolia* subsp. *integrifolia)* coastal scrub; Forest Red Gum (*Eucalyptus tereticornis)* aligned open forest and woodland; Spotted Gum (*Corymbia maculata)* aligned open forest and woodland; and Bracelet Honeymyrtle (*Melaleuca armillaris)* scrub to open scrub.	Low. There is no habitat within the study area for this plant.
Marsdenia viridiflora subsp. *viridiflora*	TSC Act (EP)	Occurs as very scattered plants in areas of remnant vegetation.	Low. There is no habitat within the study area for this plant.
Dillwynia tenuifolia	TSC Act (V,EP)	Castlereagh woodlands on Tertiary alluvial sediment.	Low. There is no habitat within the study area for this plant.
Downy Wattle *Acacia pubescens*	EPBC (V) and TSC (V) Acts	Open sclerophyll forest and woodland on clay soils.	Low. There is no habitat within the study area for this plant.

[5] For the site to support, and be important for the life cycle requirements of, a locally viable population of this species.

Common and Scientific Name	Legislation	Habitat*	Likelihood of Occurrence[5]
Wallangarra White Gum *Eucalyptus scoparia*	EPBC (V) and TSC (E) Acts	Found in open eucalypt forest, woodland and heaths on well-drained granite/rhyolite hilltops, slopes and rocky outcrops, typically at high altitudes.	Low. There is no habitat within the study area for this plant.
Haloragis exalata subsp. *exalata*	EPBC (V) and TSC (V) Acts	Appears to require protected and shaded damp situations in riparian habitats.	Low. There is no habitat within the study area for this plant.
Omeo Stork's-bill *Pelargonium* sp. *striatellum* (G.W.Carr 10345)	EPBC (E) Act	Just above the high water level of irregularly inundated or ephemeral lakes.	Low. There is no habitat within the study area for this plant.
Nodding Geebung *Persoonia nutans*	EPBC (E) and TSC (E) Acts	*Eucalyptus sclerophylla* woodland on sandy soil or low nutrient Tertiary sediments.	Low. There is no habitat within the study area for this plant.
Pultenaea parviflora	EPBC (V) and TSC (E) Acts	Dry sclerophyll open forest on heavy shale soils.	Low. There is no habitat within the study area for this plant.
Pultenaea pedunculata	TSC Act (E)	Woodland vegetation. Plants have also been found on road batters and coastal cliffs. On the Cumberland Plain the species is recorded from Cumberland Plain Woodlands, the shale-soil form of Shale Sandstone Transition Forests and Cooks River/Castlereagh Ironbark Forest.	Low. There is no habitat within the study area for this plant.
Siah's Backbone *Streblus pendulinus*	EPBC (E) Act	Warmer rainforests, chiefly along watercourses.	Low. There is no habitat within the study area for this plant.
Grevillea juniperina subsp. *juniperina*	TSC Act (V)	Grows in moist sites, often beside creeks, usually on acidic soils. Dry sclerophyll woodland - Cumberland Plain woodland and Castlereagh woodlands.	Low. There is no habitat within the study area for this plant.

Common and Scientific Name	Legislation	Habitat*	Likelihood of Occurrence[5]
Small-flower Grevillea *Grevillea parviflora* subsp. *parviflora*	EPBC (V) and TSC (V) Acts	Occurs in a range of vegetation types from heath and shrubby woodland to open forest. Grows in sandy or light clay soils usually over thin shales.	Low. There is no habitat within the study area for this plant.
Pimelea curviflora var. *curviflora*	EPBC (V) and TSC (V) Acts	Woodland and heath on clayey ridge-tops on sandstone south of the Hawkesbury River and in the Illawarra.	Low. There is no habitat within the study area for this plant.
Spiked Rice-flower *Pimelea spicata*	EPBC (E) and TSC (E) Acts	Substrates derived from Wianamatta Shale in open woodland of *Eucalyptus moluccana*, *E. crebra, Bursaria spinosa* and *Themeda australis*.	**High.** Species targeted but not recorded. Potential habitat present beyond the limits of the subject site. This species would not be reliant on the subject site for any of its lifecycle requirements.
Brown Pomaderris *Pomaderris brunnea*	EPBC (V) and TSC (V) Acts	Grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines.	Low. There is no habitat within the study area for this plant.
Illawarra Greenhood *Pterostylis gibbosa*	EPBC (E) and TSC (E) Acts	Known from Forest Red Gum woodland in the Illawarra.	Low. There is no habitat within the study area for this plant.
Sydney Plains Greenhood *Pterostylis saxicola*	EPBC (E) and TSC (E) Acts	Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where *Pterostylis saxicola* occurs are either shale/sandstone transitions or shale communities.	Low. There is no habitat within the study area for this plant.
Dark Greenhood	TSC Act (V)	Coastal heathland with Heath Banksia (*Banksia ericifolia*), and	Low.

Common and Scientific Name	Legislation	Habitat*	Likelihood of Occurrence[5]
Pterostylis nigricans		lower-growing heath with lichen-encrusted and relatively undisturbed soil surfaces, on sandy soils.	There is no habitat within the study area for this plant.
Woronora Beard-heath *Leucopogon exolasius*	EPBC (V) and TSC (V) Acts	Occurs in woodland on sandstone and is found along the upper Georges River area and in Heathcote National Park.	Low. There is no habitat within the study area for this plant.
Kangaloon Sun Orchid *Thelymitra sp.* Kangaloon (D.L. Jones 18108)	EPBC (CE) and TSC (CE) Acts	Only known from the southern tablelands of NSW where it occurs in swamps in sedgelands.	Low. Outside of species distribution range.
Austral Toadflax *Thesium australe*	EPBC (V) and TSC (V) Acts	Occurs in grassland or grassy woodland and is often found in damp sites in association with Kangaroo Grass.	Low. There is no habitat within the study area for this plant.
MAMMALS			
Spotted-tailed Quoll *Dasyurus maculatus*	EPBC (E) and TSC (V) Acts	Utilises a variety of habitats from wet and dry woodlands through to rainforests. Shelters in tree hollows, dense undergrowth, hollow logs and rock outcrops. Home range sizes for this species are known to be considerably large with males travelling up to 15km2 per night, and females between 3-4km^2 per night.	Low. There is no habitat within the study area for this animal.
Koala *Phascolarctos cinereus*	EPBC (V) and TSC (V) Acts	The Koala occupies areas of acceptable food trees in open eucalypt forests and woodlands. Areas of preferred feed trees appear to be restricted to sites that support high nutrient soils, areas that have historically been converted to farmland.	Low. There is no habitat within the study area for this animal.
Long-nosed Potoroo *Potorous tridactylus*	EPBC (V) and TSC (V) Acts	Habitats with a dense vegetation cover, such as rainforests or heathlands.	Low. There is no habitat within the study area for this animal.

Common and Scientific Name	Legislation	Habitat*	Likelihood of Occurrence[5]
Brush-tailed Rock-wallaby *Petrogale penicillata*	EPBC (E) and TSC (E) Acts	Areas containing numerous ledges, caves and crevices, cliffs (usually over 15m high) with many mid-level ledges and caves and/or overhangs. Also present where isolated rock stacks occur.	Low. There is no habitat within the study area for this animal.
Grey-headed Flying-fox *Pteropus poliocephalus*	EPBC (V) and TSC (V) Acts	The Grey-headed Flying Fox is a canopy-feeding frugivore, blossom-eater and nectarivore that inhabits a variety of habitats. Roosts and breeds communally in 'camps', with these camps containing between 500 to 5,000 individuals.	**High.** Species recorded. Given the lack of this species roosting habitat within the study area, this bat is expected to be foraging within the subject site. Relevant assessment has been undertaken (see Section 8).
Large-eared Pied Bat *Chalinolobus dwyeri*	EPBC (V) and TSC (V) Acts	Preferred habitat is timbered woodland and dry sclerophyll forest. Roost in caves, tunnels, mines if available or even the abandoned nests of the Fairy Martin.	Moderate. May potentially fly over, or forage within, the study area. However, this species would not be reliant on the study area for any of its lifecycle requirements.
Eastern Falsistrelle *Falsistrellus tasmaniensis*	TSC Act (V)	Usually roosts in hollow trunks of eucalypt trees although they have also been known to roost in caves and buildings. They usually inhabit sclerophyll woodlands with insect attracting plants, a relatively continuous canopy. They prefer wet habitats with trees of more than 20m.	**High.** Foraging and roosting habitat (hollow-bearing trees) present beyond the limits of the subject site. This species would not be reliant on the subject site for any of its lifecycle requirements.

Common and Scientific Name	Legislation	Habitat*	Likelihood of Occurrence[5]
Large-footed Myotis *Myotis macropus*	TSC Act (V)	Found where there is permanent and/or flowing water, the Large-footed Myotis is generally found in the coastal regions. Roosting in caves, disused tunnels, old buildings, tree hollows and dense riparian foliage, nearly always in the vicinity of suitable water bodies.	**High.** Foraging and roosting habitat (hollow-bearing trees) present beyond the limits of the subject site. This species would not be reliant on the subject site for any of its lifecycle requirements.
Greater Broad-nosed Bat *Scoteanax rueppellii*	TSC Act (V)	Preferring habitats which range from rainforests through to woodlands, this species usually roosts in tree hollows, though some individuals have been found in the roof spaces of old buildings.	**High.** Foraging and roosting habitat (hollow-bearing trees) present beyond the limits of the subject site. This species would not be reliant on the subject site for any of its lifecycle requirements.
Eastern Bentwing Bat *Miniopterus (schreibersii) orianae oceanensis*	TSC Act (V)	This species is the dominant cave-dwelling bat in south-eastern Australia. Occurs in a variety of habitats and roosts in caves, storm water channels, mines and houses. Feeds on insects caught on the wing from within eucalypt woodlands and forests.	**High**. Species recorded. No Foraging or roosting habitat present. This species would not be reliant on the subject site for any of its lifecycle requirements.
East-coast Freetail Bat *Micronomus norfolkensis*	TSC Act (V)	This species is known to predominantly roost during the day in tree hollows within dry eucalypt forest and woodlands.	**High.** Foraging and roosting habitat (hollow-bearing trees) present beyond the limits of the subject site. This species would not be reliant on the subject site for

Common and Scientific Name	Legislation	Habitat*	Likelihood of Occurrence[5]
			any of its lifecycle requirements.
New Holland Mouse *Pseudomys novaehollandiae*	EPBC Act (V)	The New Holland Mouse has been found from coastal areas and up to 100km inland on sandstone country. Prefers deeper top soils and softer substrates for digging burrows. This species is known to inhabit open heathland, open woodland with a heathland understorey and vegetated sand dunes. Due to the largely granivorous diet of the species, sites where the New Holland Mouse is found are often high in floristic diversity, especially leguminous perennials.	Low. There is no habitat within the study area for this animal.
BIRDS			
Cattle Egret *Ardea ibis*	EPBC Act (M)	Wet pasture with tall grass, shallow open wetland and margins, mudflats.	**High.** Species recorded. Whilst this species would not be reliant on the subject site for any of its lifecycle requirements the relevant assessment has been undertaken (see Section 8).
Great Egret *Ardea alba*	EPBC Act (M)	Wetland, flooded crops, pasture, dams, roadside ditches, estuarine mudflats, mangroves and reefs.	**High.** Species targeted but not recorded. This species would not be reliant on the subject site for any of its lifecycle requirements.
Australasian Bittern *Botaurus poiciloptilus*	EPBC (E) and TSC (E) Acts	The Australasian Bittern occupies shallow, vegetated freshwater or brackish swamps, usually dominated by tall, dense reed beds of *Typha sp.*, *Juncus sp.* and *Phragmites sp.* Nests on platforms of	Low. There is no habitat within the study area for this animal.

Common and Scientific Name	Legislation	Habitat*	Likelihood of Occurrence[5]
		reeds and rushes, usually built over water in dense cover.	
Bush-stone Curlew *Burhinus grallarius*	TSC Act (E)	Grassy woodland or lightly timbered open country.	Low. There is no habitat within the study area for this animal.
Latham's Snipe *Gallinago hardwickii*	EPBC Act (M)	Wet, treeless, tussocky grasslands, short grasses and/or marshes along freshwater streams and channels, though it can also be found in any vegetation around freshwater wetlands, in sedges, grasses, lignum, reeds and rushes, saltmarshes, creek edges, crops and pastures.	Low. There is no habitat within the study area for this animal.
Australian Painted Snipe *Rostratula australis*	EPBC (M,E) and TSC (E) Acts	This species prefers shallow freshwater swamps.	Low. There is no habitat within the study area for this animal.
Australian Fairy Tern *Sternula nereis*	TSC Act (V)	Nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. Roosts on beaches at night.	Low. There is no habitat within the study area for this animal.
White-bellied Sea-Eagle *Haliaeetus leucogaster*	EPBC Act (M)	Large rivers, fresh and saline lakes, reservoirs, estuaries, coastal seas, islands.	Low. May potentially fly over the study area. However, this species would not be reliant on the study area for any of its lifecycle requirements.
Spotted Harrier *Circus assimilis*	TSC Act (V)	Occurs in grassy open woodland including *Acacia* and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	Low. May potentially fly over the study area. However, this species would not be reliant on the study area for any of

Common and Scientific Name	Legislation	Habitat*	Likelihood of Occurrence[5]
			its lifecycle requirements.
Little Eagle *Hieraaetus morphnoides*	TSC Act (V)	Occupies open eucalypt forest, woodland or open woodland; occasionally She-oak or acacia, and riparian woodlands of interior NSW.	**High.** Species recorded. Whilst this species would not be reliant on the study area for any of its lifecycle requirements the relevant assessment has been undertaken (see Section 8).
Black Falcon *Falco subniger*	TSC Act (V)	Semi-arid and arid interior. Uses tree-lined watercourses and isolated stands of trees.	Low. There is no habitat within the study area for this animal.
Gang-gang Cockatoo *Callocephalon fimbriatum*	TSC Act (V)	Tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests through to more open eucalypt forests and woodlands.	Moderate. May potentially fly over, or forage within, the study area. However, this species would not be reliant on the study area for any of its lifecycle requirements.
Little Lorikeet *Glossopsitta pusilla*	TSC Act (V)	Eucalyptus forest and woodland, particularly along water courses.	Low. There is no habitat within the study area for this animal.
Swift Parrot *Lathamus discolor*	EPBC (E) and TSC (E) Acts	The Swift Parrot over-winters on the mainland and breeds in Tasmania in spring/summer. The Swift Parrot inhabits eucalypt forests, feeds on eucalypt nectar, and possibly lerps, and breeds in the hollows of mature and senescent trees. When over-wintering on the mainland, this species is dependent on winter-flowering eucalypt species, communities of which it will often return to regularly.	Moderate. May potentially fly over, or forage within, the study area. However, this species would not be reliant on the study area for any of its lifecycle requirements.

Common and Scientific Name	Legislation	Habitat*	Likelihood of Occurrence[5]
Speckled Warbler *Chthinicola sagittata*	TSC Act (V)	Eucalypt and cypress woodlands with an open grassy and shrubby understorey often associated with gullies and rocky ridges.	Low. There is no habitat within the study area for this animal.
Varied Sittella *Daphoenositta chrysoptera*	TSC Act (V)	Eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	Low. There is no habitat within the study area for this animal.
Flame Robin *Petroica phoenicea*	TSC Act (V)	Close-cropped pastoral land adjacent to woodland.	Low. There is no habitat within the study area for this animal.
White-throated Needletail *Hirundapus caudacutus*	EPBC Act (M)	Associated with the east coast highlands, coastal plains and the hinterlands of arid inland Australia.	Low. May potentially fly over the study area. However, this species would not be reliant on the study area for any of its lifecycle requirements.
Fork-tailed Swift *Apus pacificus*	EPBC Act (M)	Drinks from inland lakes, and rain water puddles.	Low. May potentially fly over study area. However, this species would not be reliant on the study area for any of its lifecycle requirements.
Rainbow Bee-eater *Merops ornatus*	EPBC Act (M)	The Rainbow Bee-eater inhabits open forests and woodlands, often near water bodies. This bird roosts at night in shrubs. They are breeding migrants to Australia, nesting in burrows dug into sandy banks or bare, flat ground.	Low. There is no habitat within the study area for this animal.

Common and Scientific Name	Legislation	Habitat*	Likelihood of Occurrence[5]
Eastern Bristlebird *Dasyornis brachypterus*	EPBC (E) and TSC (E) Acts	Dense, low vegetation including heath and open woodland with a heathy understorey.	Low. There is no habitat within the study area for this animal.
Regent Honeyeater *Anthochaera phrygia*	EPBC (M,E) and TSC (CE) Acts	Open forests, woodlands, timbered watercourses, and a variety of other habitat types. This species feeds primarily on four eucalypt species, Red Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Yellow Box (*E. melliodora*) and Yellow Gum (*E. leucoxylon*) as well as heavy infestations of mistletoe (*Amyema spp*.).	Low. There is no habitat within the study area for this animal.
Rufous Fantail *Rhipidura rufifrons*	EPBC Act (M)	Rainforests, moist sclerophyll forests and vegetated riparian corridors	Low. There is no habitat within the study area for this animal.
Satin Flycatcher *Myiagra cyanoleuca*	EPBC Act (M)	Eucalypt woodlands, forests and timbered watercourses.	Low. There is no habitat within the study area for this animal.
Black-faced Monarch *Monarcha melanopsis*	EPBC Act (M)	Rainforest and wet eucalypt forest.	Low. There is no habitat within the study area for this animal.
Spectacled Monarch *Monacrha trivirgatus*	EPBC Act (M)	Rainforest, mangroves, moist gloomy gullies of dense eucalypt forest.	Low. There is no habitat within the study area for this animal.
Australian Reed-Warbler *Acrocephalus australis*	EPBC Act M	Reedbeds.	Low. There is no habitat within the study area for this animal.

Common and Scientific Name	Legislation	Habitat*	Likelihood of Occurrence[5]
REPTILES			
Broad-headed Snake *Hoplocephalus bungaroides*	EPBC (V) and TSC (E) Acts	The Broad-headed Snake is confined to the Hawkesbury Sandstone formations within the wider Sydney basin. The Broad-headed Snake shelters under exfoliated material, also in rock crevices and caves during the day.	Low. There is no habitat within the study area for this animal.
AMPHIBIANS			
Giant Burrowing Frog *Heleioporus australiacus*	EPBC (V) and TSC (V) Acts	The Giant Burrowing Frog is mostly restricted to areas of Hawkesbury Sandstone. This association with sandstone outcrops appears to be quite an important feature of this species ecology being found in association with hanging sandstone shelves and the upper laterals of creeks that run through heathland and woodland. The species has also been found within Button Grass Swamps. This species lives in small semi-permanent to slightly flowing streams, breeding in sandy river bank burrows during the summer and autumn months. Giant Burrowing Frogs are not found in creeks affected by stormwater or other pollutants.	Low. There is no habitat within the study area for this animal.
Green and Golden Bell Frog *Litoria aurea*	EPBC (V) and TSC (E) Acts	The Green and Golden Bell Frog's habitat requirements include water bodies with a lack of well-developed emergent vegetation, free of chemical contamination and no introduced fish species. The Green and Golden Bell Frog has several specific habitat requirements including the presence of diurnal shelter, basking sites and refuge sites for hibernation over winter (non-mown areas or other dense vegetation in which to shelter), feeding areas, aquatic breeding and spawning areas.	Low. There is no habitat within the study area for this animal.
Southern Bell Frog *Litoria raniformis*	EPBC (V) and TSC (E) Acts	Usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and	Low. There is no habitat within the study area for this animal.

Common and Scientific Name	Legislation	Habitat*	Likelihood of Occurrence[5]
		river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat.	
INVERTERBRATES			
Cumberland Plain Land Snail *Meridolum corneovirens*	TSC Act (E)	The Cumberland Plain Land Snail occurs within dry woodlands and forests, (most commonly found in Cumberland Plain Woodland) where it shelters under leaf litter, logs, urban refuse and decaying matter. Where possible it will burrow into loose soil. The Cumberland Plain Land Snail is a detritus feeder, and is often found feeding on fungi. Breeding is related to climatic conditions, this species being dependent on precipitation for breeding opportunities.	**High.** Species targeted but not recorded. This species would not be reliant on the subject site for any of its lifecycle requirements.

Appendix 3: Flora species recorded

Key
* - introduced species
[R] –regionally significant species (UBBS 1997)
[N] - species listed under the *Noxious Weeds Act 1993*

	GENUS Species	**Common Name**
MAGNOLIOPSIDA - DICOTYLEDONS		
Apiaceae	*Foeniculum vulgare* *	Fennel
Araceae	*Monstera deliciosa* *	Swiss Cheese Plant
Asclepiadaceae	*Araujia hortorum* *	Moth Plant
	Gomphocarpus fruiticosus *	Narrow-leaf Cotton Bush
Asteraceae	*Bidens pilosa* *	Farmers Friend
	Cirsium vulgare *	Scotch Thistle
	Conyza bonariensis *	Fleabane
	Senecio madagascariensis *	Fireweed
	Sonchus oleraceus *	Sowthistle
Basellaceae	*Anredera cordifolia* *	Madeira Vine
Brassicaceae	*Brassica sp.* *	
Cactaceae	*Opuntia sp.* * [N]	Prickly-pear
Convolvulaceae	*Dichondra repens*	Kidney Weed
Crassulaceae	*Bryophyllum delagoense* * [N]	Mother of Millions
Euphorbiaceae	*Ricinus communis* * [N]	Castor Oil Plant
Fabaceae: Faboideae	*Daviesia genistifolia* [R]	
	Dillwynia sieberi	
	Glycine clandestina	Love Creeper
	Glycine tabacina	Love Creeper
	Medicago sp. *	A Medic
	Vicia sp. *	Vetch
Fabaceae: Mimosoideae	*Acacia decurrens*	Sydney Green Wattle
	Acacia parramattensis	Parramatta Green Wattle
Malvaceae	*Sida rhombifolia* *	Paddy's Lucerne
	Morus sp. *	Mulberry Tree
Myrtaceae	*Corymbia maculata* [R]	Spotted Gum
	Eucalyptus globoidea	White Stringybark
	Eucalyptus molluccana	Grey Box
	Eucalyptus tereticornis	Forest Red Gum
	Melaleuca armillaris subsp. *armillaris*	Bracelet Honeymyrtle
Oleaceae	*Ligustrum sinense* * [N]	Small-leaved Privett
	Olea europaea subsp. *cuspidata* * [N]	African Olive
Oxalidaceae	*Oxalis sp.* *	Oxalis
Pittosporaceae	*Bursaria spinosa*	Blackthorn
Plantaginaceae	*Plantago lanceolata* *	Lamb's Tongue
Polygonaceae	*Persicaria strigosum* [R]	Spotted Knotweed

	GENUS Species	**Common Name**
	Rumex sp. *	Dock
Proteaceae	*Grevillea robusta* *	Silky Oak
Rosaceae	*Rubus fruticosus* agg. spp. * [N]	Blackberry
Solanaceae	*Lycium ferrocissimum* * [N]	African Boxthorn
	Solanum nigrum *	Black-berry Nightshade
	Solanum sp. *	
Verbenaceae	*Lantana camara* * [N]	Lantana
	Verbena bonariensis *	Purpletop
	Verbena sp. *	
MAGNOLIOPSIDA - MONOCOTYLEDONS		
Arecaceae	*Syagrus romanzoffiana* *	Cocos Palm
Asparagaceae	*Asparagus asparagoides* * [N]	Bridal Creeper
Juncaceae	*Juncus usitatus*	Common Rush
Poaceae	*Aristida ramosa*	Three-awn Speargrass
	Austrostipa ramosissima	Bamboo Grass
	Bromus catharticus *	Prairie Grass
	Chloris gayana *	Rhodes grass
	Cynodon dactylon	Couch
	Eragrostis curvula *	African Love Grass
	Microlaena stipoides	Weeping Grass
	Paspalum dilatatum *	Paspalum
	Paspalum urvillei *	Vasey Grass
	Pennisetum clandestimum *	Kikuyu Grass
	Rhytidosperma sp.	A Wallaby Grass
	Setaria sp. *	Pigeon Grass
	Sporobolus sp. *	Parramatta Grass
Typhaceae	*Typha orientalis*	Cumbungi

Appendix 4: Fauna species recorded, or known to occur, in the vicinity of the study area

Source of Records

1 = Species recorded during present study
2 = OEH (2015a)
3 = Lesryk Environmental Consultants (2014a)
4 = Lesryk Environmental Consultants (2010)
5 = Lesryk Environmental Consultants (2008a)

Key

A - species listed under the EPBC Act
F - migratory Family listed under the EPBC Act
M - species listed as migratory listed under the EPBC Act
B - species listed under the TSC Act
E - species is endangered
V - species is vulnerable
* - introduced species

A	B	Common Name	Family and Scientific Name	1	2	3	4	5
		MAMMALS						
			Tachyglossidae					
		Short-beaked Echidna	*Tachyglossus aculeatus*		x			
			Dasyuridae					
E	V	Spotted-tailed Quoll	*Dasyurus maculatus*		x			
			Phascolarctidae					
V	V	Koala	*Phascolarctos cinereus*		x			
			Petauridae					
		Sugar Glider	*Petaurus breviceps*		x			
			Pseudocheiridae					
		Common Ringtail Possum	*Pseudocheirus peregrinus*		x			
			Phalangeridae					
		Common Brushtail Possum	*Trichosurus vulpecula*	x	x			x
			Macropodidae					
		Eastern Grey Kangaroo	*Macropus giganteus*		x			
		Swamp Wallaby	*Wallabia bicolor*		x			
			Pteropodidae					
V	V	Grey-headed Flying-fox	*Pteropus poliocephalus*	x	x			
		Little Red Flying-fox	*Pteropus scapulatus*		x			
			Vespertilioidae					
		Gould's Wattled Bat	*Chalinolobus gouldii*		x			
		Chocolate Wattled Bat	*Chalinolobus morio*		x			
	V	Eastern Falsistrelle	*Falsistrellus tasmaniensis*		x			
	V	Large-footed Myotis	*Myotis macropus*		x			
		Lesser Long-eared Bat	*Nyctophilus geoffroyi*		x			
		Gould's Long-eared Bat	*Nyctophilus gouldi*		x			
		Long-eared Bat	*Nyctophilus sp.*	x				
	V	Greater Broad-nosed Bat	*Scoteanax rueppellii*		x			

A	B	Common Name	Family and Scientific Name	1	2	3	4	5
		Eastern Broad-nosed Bat	*Scotorepens orion*		x			
		Large Forest Bat	*Vespadelus darlingtoni*		x			
		Southern Forest Bat	*Vespadelus regulus*		x			
		Little Forest Bat	*Vespadelus vulturnus*	x	x			
			Miniopteridae					
	V	Eastern Bentwing Bat	*Miniopterus* (*schreibersii*) *orianae oceanensis*	x	x			
			Molossidae					
		White-striped Freetail Bat	*Austronomus australis*		x			
	V	East-coast Freetail Bat	*Micronomus norfolkensis*		x			
		Eastern Freetail Bat	*Mormopterus ridei*		x			
			Muridae					
		* House Mouse	*Mus musculus*		x			
		* Brown Rat	*Rattus norvegicus*		x			
		* Black Rat	*Rattus rattus*		x			
		Dingo	*Canis lupus dingo*		x			
		* Fox	*Vulpes vulpes*		x			
		* Dog	*Canis familiaris*		x			
			Felidae					
		* Feral Cat	*Felis catus*		x			
			Leporidae					
		* Rabbit	*Oryctolagus cuniculus*		x	x		
		* Brown Hare	*Lepus capensis*		x			
			Equidae					
		* Horse	*Equus caballus*		x			
			Suidae					
		* Pig	*Sus scrofa*		x			
			Bovidae					
		* European Cattle	*Bos taurus*	x	x			
		* Goat	*Capra hircus*		x			
		* Domesticated Sheep	*Ovis aries*		x			
		BIRDS						
			Phasianidae					
		Stubble Quail	*Coturnix pectoralis*		x			
		Brown Quail	*Coturnix ypsilophora*		x			
F			**Anatidae**					
		Black Swan	*Cygnus atratus*		x			
		Pacific Black Duck	*Anas superciliosa*	x	x	x		
		* Mallard	*Anas platyrhynchos*		x			
		Grey Teal	*Anas gracilis*	x	x			
		Chestnut Teal	*Anas castanea*		x			
		Hardhead	*Aythya australis*		x			
		Australian Wood Duck	*Chenonetta jubata*	x	x	x		
			Podicipedidae					
		Australasian Grebe	*Tachybaptus novaehollandiae*	x	x	x		

A	B	Common Name	Family and Scientific Name	1	2	3	4	5
			Phalacrocoracidae					
		Pied Cormorant	*Phalacrocorax varius*		x			
		Little Pied Cormorant	*Phalacrocorax melanoleucos*		x			
		Great Cormorant	*Phalacrocorax carbo*		x			
		Little Black Cormorant	*Phalacrocorax sulcirostris*		x			
			Anhingidae					
		Darter	*Anhinga novaehollandiae*		x			
			Pelecanidae					
		Australian Pelican	*Pelecanus conspicillatus*		x	x		
			Ardeidae					
		White-necked Heron	*Ardea pacifica*		x		x	
		White-faced Heron	*Egretta novaehollandiae*	x	x	x	x	
M		Cattle Egret	*Ardea ibis*	x	x			
M		Great Egret	*Ardea alba*		x			
		Little Egret	*Egretta garzetta*		x			
		Intermediate Egret	*Ardea intermedia*		x			
		Nankeen Night-Heron	*Nycticorax caledonicus*		x			
			Threskiornidae					
		Australian White Ibis	*Threskiornis molucca*		x		x	
		Straw-necked Ibis	*Threskiornis spinicollis*		x			
		Royal Spoonbill	*Platalea regia*		x			
F			**Accipitridae**					
		Pacific Baza	*Aviceda subcristata*		x			
		Black-shouldered Kite	*Elanus axillaris*		x			
		Whistling Kite	*Haliastur sphenurus*		x			
		Wedge-tailed Eagle	*Aquila audax*		x			
	V	Little Eagle	*Hieraaetus morphnoides*	x	x			
		Brown Goshawk	*Accipiter fasciatus*		x			
		Collared Sparrowhawk	*Accipiter cirrocephalus*		x			
		Grey Goshawk	*Accipiter novaehollandiae*		x			
	V	Spotted Harrier	*Circus assimilis*		x			
		Swamp Harrier	*Circus approximans*		x			
			Rallidae					
		Buff-banded Rail	*Gallirallus phillippensis*		x			
		Baillon's Crake	*Porzana pusilla*		x			
		Spotless Crake	*Porzana tabuensis*		x			
		Dusky Moorhen	*Gallinula tenebrosa*	x	x			
		Purple Swamphen	*Porphyrio porphyrio*		x			
		Eurasian Coot	*Fulica atra*		x			
			Burhinidae					
	E	Bush Stone-curlew	*Burhinus grallarius*		x			
F			**Charadriidae**					
		Masked Lapwing	*Vanellus miles*	x	x		x	x
		Black-fronted Dotterel	*Elseyornis melanops*		x			
F			**Scolopacidae**					

A	B	Common Name	Family and Scientific Name	1	2	3	4	5
M		Latham's Snipe	*Gallinago hardwickii*		x			
			Turnicidae					
		Painted Button-quail	*Turnix varius*		x			
			Columbidae					
		Topknot Pigeon	*Lopholaimus antarcticus*		x			
		* Rock Dove	*Columba livia*	x	x			
		* Spotted Dove	*Streptopelia chinensis*	x	x		x	
		Peaceful Dove	*Geopelia striata*		x			
		Bar-shouldered Dove	*Geopelia humeralis*		x			
		Crested Pigeon	*Ocyphaps lophotes*		x	x	x	
			Cuculidae					
		Pallid Cuckoo	*Cacomantis pallidus*		x			
		Fan-tailed Cuckoo	*Cacomantis flabelliformis*		x			
		Horsfield's Bronze-Cuckoo	*Chalcites basalis*		x			
		Shining Bronze-Cuckoo	*Chalcites lucidus*		x			
		Eastern Koel	*Eudynamys orientalis*		x			
		Channel-billed Cuckoo	*Scythrops novaehollandiae*		x			
			Strigidae					
		Southern Boobook	*Ninox novaeseelandiae*		x			
			Tytonidae					
		Eastern Barn Owl	*Tyto javanica*		x			
			Podargidae					
		Tawny Frogmouth	*Podargus strigoides*		x			
			Apodidae					
		White-rumped Swiftlet	*Colloclia spodiopygius*		x			
			Alcedinidae					
		Azure Kingfisher	*Ceyx azureus*		x			
			Halcyonidae					
		Laughing Kookaburra	*Dacelo novaeguineae*		x	x		
		Sacred Kingfisher	*Todiramphus sanctus*		x			
			Meropidae					
M		Rainbow Bee-eater	*Merops ornatus*		x			
			Coraciidae					
		Dollarbird	*Eurystomus orientalis*		x			
F			**Falconidae**					
	V	Black Falcon	*Falco subniger*		x			
		Peregrine Falcon	*Falco peregrinus*		x			
		Australian Hobby	*Falco longipennis*		x			
		Brown Falcon	*Falco berigora*		x			
		Nankeen Kestrel	*Falco cenchroides*		x			
			Cacatuidae					
		Yellow-tailed Black Cockatoo	*Calyptorhynchus funereus*		x			
	V	Gang-gang Cockatoo	*Callocephalon fimbriatum*		x			
		Galah	*Eolophus roseicapillus*	x	x		x	
		Long-billed Corella	*Cacatua tenuirostris*		x			

A	B	Common Name	Family and Scientific Name	1	2	3	4	5
		Little Corella	*Cacatua sanguinea*		x		x	
		Sulphur-crested Cockatoo	*Cacatua galerita*		x	x		
			Psittacidae					
		Rainbow Lorikeet	*Trichoglossus haematodus*	x	x			x
		Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*		x			
		Musk Lorikeet	*Glossopsitta concinna*		x			
	V	Little Lorikeet	*Glossopsitta pusilla*		x			
E	E	Swift Parrot	*Lathamus discolor*		x			
		Crimson Rosella	*Platycercus elegans*		x			
		Eastern Rosella	*Platycercus eximius*		x	x	x	
		Australian Ringneck	*Barnardius zonarius*		x			
		Red-rumped Parrot	*Psephotus haematonotus*	x	x	x	x	
			Climacteridae					
		White-throated Treecreeper	*Cormobates leucophaea*		x			
			Maluridae					
		Superb Fairy-wren	*Malurus cyaneus*	x	x		x	x
		Variegated Fairy-wren	*Malurus lamberti*		x			
			Meliphagidae					
		Red Wattlebird	*Anthochaera carunculata*	x	x		x	
		Little (Brush) Wattlebird	*Anthochaera chrysoptera*		x			
		Noisy Friarbird	*Philemon corniculatus*		x			
		Bell Miner	*Manorina melanophrys*	x	x			
		Noisy Miner	*Manorina melanocephala*	x	x	x	x	x
		Yellow-faced Honeyeater	*Lichenostomus chrysops*		x			
		White-eared Honeyeater	*Lichenostomus leucotis*		x			
		Fuscous Honeyeater	*Lichenostomus fuscus*		x			
		White-plumed Honeyeater	*Lichenostomus pencillatus*	x	x		x	x
		Brown-headed Honeyeater	*Melithreptus brevirostris*		x			
		White-naped Honeyeater	*Melithreptus lunatus*		x			
		New Holland Honeyeater	*Phylidonryis novaehollandiae*	x	x			
		Eastern Spinebill	*Acanthorhynchus tenuirostris*		x			
		Scarlet Honeyeater	*Myzomela sanguinolenta*		x			
			Pardalotidae					
		Spotted Pardalote	*Pardalotus punctatus*	x	x			x
		Striated Pardalote	*Pardalotus striatus*		x			
			Acanthizidae					
		White-browed Scrubwren	*Sericornis frontalis*		x	x		
	V	Speckled Warbler	*Chthinicola sagittata*		x			
		Weebill	*Smicrornis brevirostris*		x			
		White-throated Gerygone	*Gerygone albogularis*		x			
		Brown Gerygone	*Gerygone mouki*		x			
		Brown Thornbill	*Acanthiza pusilla*		x			
		Yellow Thornbill	*Acanthiza nana*	x	x		x	
		Striated Thornbill	*Acanthiza lineata*		x			x
		Buff-rumped Thornbill	*Acanthiza reguloides*		x			

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		Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*		x	x		
			Psophodidae					
		Eastern Whipbird	*Psophodes olivaceus*		x			
			Artamidae					
		White-browed Woodswallow	*Artamus superciliosus*		x			
		Dusky Woodswallow	*Artamus cyanopterus*		x			
		Grey Butcherbird	*Cracticus torquatus*	x	x	x		x
		Pied Butcherbird	*Cracticus nigrogularis*	x	x			
		Australian Magpie	*Cracticus tibicen*	x	x	x	x	x
		Pied Currawong	*Strepera graculina*		x			x
		Grey Currawong	*Strepera versicolor*		x			
			Campephagidae					
		Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	x	x		x	x
		White-winged Triller	*Lalage sueurii*		x			
			Neosittidae					
	V	Varied Sittella	*Daphoenositta chrysoptera*		x			
			Pachycephalidae					
		Crested Shrike-tit	*Falcunculus frontatus*		x			
		Grey Shrike-thrush	*Colluricincla harmonica*		x			
		Golden Whistler	*Pachycephala pectoralis*		x			
		Rufous Whistler	*Pachycephala rufiventris*		x			
			Oriolidae					
		Olive-backed Oriole	*Oriolus sagittatus*		x			
		Australasian Figbird	*Sphecotheres vieilloti*		x			
			Rhipiduridae					
		Grey Fantail	*Rhipidura albiscapa*	x	x	x		x
M		Rufous Fantail	*Rhipidura rufifrons*		x			
		Willie Wagtail	*Rhipidura leucophrys*	x	x	x	x	x
			Monarchidae					
		Leaden Flycatcher	*Myiagra rubecula*		x			
M		Satin Flycatcher	*Myiagra cyanoleuca*		x			
		Restless Flycatcher	*Myiagra inquieta*		x			
M		Black-faced Monarch	*Monarcha melanopsis*		x			
		Magpie-lark	*Grallina cyanoleuca*	x	x	x	x	x
			Corvidae					
		Australian Raven	*Corvus coronoides*	x	x	x	x	x
			Corcoracidae					
		White-winged Chough	*Corcorax melanorhamphos*		x			
			Petroicidae					
		Rose Robin	*Petroica rosea*		x			
	V	Flame Robin	*Petroica phoenicea*		x			
		Eastern Yellow Robin	*Eopsaltria australis*		x		x	
		Jacky Winter	*Microeca fascinans*	x	x			
			Hirundinidae					
		Welcome Swallow	*Hirundo neoxena*	x	x			x

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		Tree Martin	*Petrochelidon nigricans*		x			
		Fairy Martin	*Petrochelidon ariel*		x			
			Pycnonotidae					
		* Red-whiskered Bulbul	*Pycnonotus jocosus*	x	x			x
F			**Acrocephalidae**					
M		Australian Reed-Warbler	*Acrocephalus australis*		x			
F			**Megaluridae**					
		Tawny Grassbird	*Megalurus timoriensis*		x			
F			**Cisticolidae**					
		Golden-headed Cisticola	*Cisticola exilis*		x			
			Timaliidae					
		Silvereye	*Zosterops lateralis*	x	x	x		
F			**Turdidae**					
		* Common Blackbird	*Turdus merula*	x	x			
			Sturnidae					
		* Common Starling	*Sturnus vulgaris*	x	x	x	x	
		* Common Myna	*Sturnus tristis*	x	x	x	x	
			Nectariniidae					
		Mistletoebird	*Dicaeum hirundinaceum*	x	x	x	x	
			Motacillidae					
		Australasian Pipit	*Anthus naovaeseelandiae*		x			
			Fringillidae					
		* European Goldfinch	*Carduelis carduelis*	x	x			
			Passeridae					
		* House Sparrow	*Passer domesticus*		x		x	x
			Estrildidae					
		Double-barred Finch	*Taeniopygia bichenovii*		x			
		Red-browed Finch	*Neochmia temporalis*	x	x	x		
		* Nutmeg Mannikin	*Lonchura puntulata*		x			
		REPTILES						
			Chelidae					
		Eastern Snake-necked Turtle	*Chelodina longicollis*		x			
			Gekkonidae					
		Eastern Stone Gecko	*Diplodactylus vittatus*		x			
			Agamidae					
		Jacky dragon	*Amphibolurus muricatus*		x			
		Eastern Water Dragon	*Intellagama lesueurii (prev. Physignathus lesueurii)*		x			
		Eastern bearded dragon	*Pogona barbata*		x			
			Varanidae					
		Lace Monitor	*Varanus varius*		x			
			Scincidae					
		Red-throated Skink	*Acritoscincus platynotum (prev. Bassiana platynota)*		x			
		Wall Skink	*Cryptoblepharus virgatus*		x	x		

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		Eastern striped skink	*Ctenotus robustus*		x			
		Eastern Water Skink	*Eulamprus quoyii*		x			
		Yellow-bellied water-skink	*Eulamprus heatwolei*		x			
		Bar-sided forest-skink	*Eulamprus tenuis*		x			
		Grass Skink	*Lampropholis delicata*		x		x	x
		Garden Skink	*Lampropholis guichenoti*		x			
		Skink	*Lampropholis sp.*			x		
		Iridescent litter-skink	*Lygisaurus foliorum*		x			
		Weasel Skink	*Saproscincus mustelinus*		x			
		Common blue-tongued skink	*Tiliqua scincoides*		x		x	
			Typhlopidae					
		Blackish blind snake	*Ramphotyphlops nigrescens*		x			
			Pythonidae					
		Carpet python	*Morelia spilota*		x			
			Elapidae					
		Red-naped Snake	*Furina diadema*		x			
		Marsh snake	*Hemiaspis signata*		x			
		Tiger Snake	*Notechis scutatus*		x			
		Red-bellied Black Snake	*Pseudechis porphyriacus*		x			x
		Eastern Brown Snake	*Pseudonaja textilis*		x			
		AMPHIBIANS						
			Myobatrachidae					
		Common Eastern Froglet	*Crinia signifera*	x	x			x
		Eastern Banjo Frog	*Limnodynastes dumerilii*		x			
		Ornate Burrowing Frog	*Limnodynastes ornatus*		x			
		Striped Marsh Frog	*Limnodynastes peronii*		x			
		Spotted Grass Frog	*Limnodynastes tasmaniensis*		x			
		Brown Toadlet	*Pseudophryne bibronii*		x			
		Smooth Toadlet	*Uperoleia laevigata*		x			
			Hylidae					
		Bleating Tree Frog	*Litoria dentata*		x			
		Eastern Dwarf Tree Frog	*Litoria fallax*		x			
		Broad-palmed Frog	*Litoria latopalmata*		x			
		Peron's Tree Frog	*Litoria peronii*		x			
		Tyler's Tree Frog	*Litoria tyleri*		x			
		Verreaux's Tree Frog	*Litoria verreauxii*	x	x			
		INVERTERBRATES						
			Helicidae					
		* Common Garden Snail	*Helix aspersa*	x			x	
			Camaenidae					
	E	Cumberland Plain Land Snail	*Meridolum corneovirens*		x			
		FISH						
		* Mosquitofish	*Gambusia holbrooki*		x			