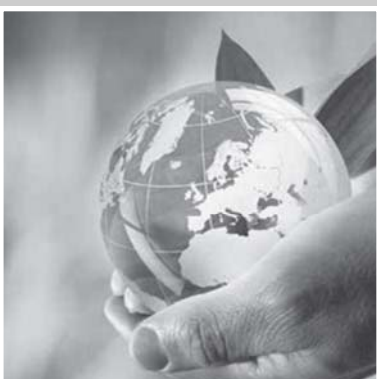
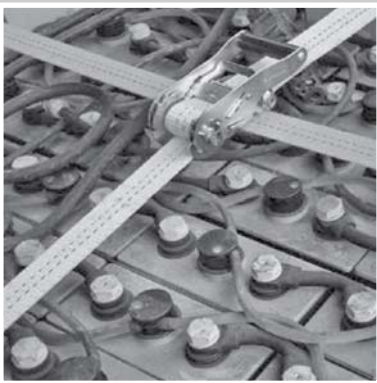


Biodiversity Assessment Report

Appendix N



Appendix N — Biodiversity Assessment Report

N



Biodiversity Assessment Report

Battery Recycling Facility

129 Mitchell Avenue Kurri Kurri

Prepared for Pymore Recyclers International Pty Ltd | 28 October 2016



Biodiversity Assessment Report

Battery Recycling Facility
129 Mitchell Avenue Kurri Kurri

Prepared for Pymore Recyclers International Pty Ltd | 28 October 2016

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Biodiversity Assessment Report

Final

Report J15156 BAR1 | Prepared for Pymore Recyclers International Pty Ltd | 28 October 2016

Prepared by **Eugene Dodd**

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Position Senior Ecologist

Position Associate Director - Executive Leader

Signature



Signature



Date 28 October 2016

Date 28 October 2016

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1 Introduction

1.1 Background

This Biodiversity Assessment Report (BAR) has been prepared by Eugene Dodd (an accredited BioBanking Assessor) for Pymore Recyclers International Pty Ltd's proposed used lead-acid battery (ULAB) recycling facility (the project) at 129 Mitchell Avenue, Kurri Kurri (the project area).

The facility would recycle approximately 60,000 tonnes per annum (tpa) of ULABs. The ULAB recycling plant would have four main processes – crushing, screening and separation; desulphurisation; crystallisation; and lead recovery. The entire process converts a ULAB into materials which are recycled for use in new products. Lead and plastics recovered are used in the production of new batteries. Sodium sulphate crystals, a by-product of ULAB recycling, can be readily used in other industries.

The project is State significant development (SSD) which requires development consent under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). A DA for SSD is required to be accompanied by an environmental impact statement (EIS). This BAR will be appended to the EIS.

A full project description is provided in the EIS.

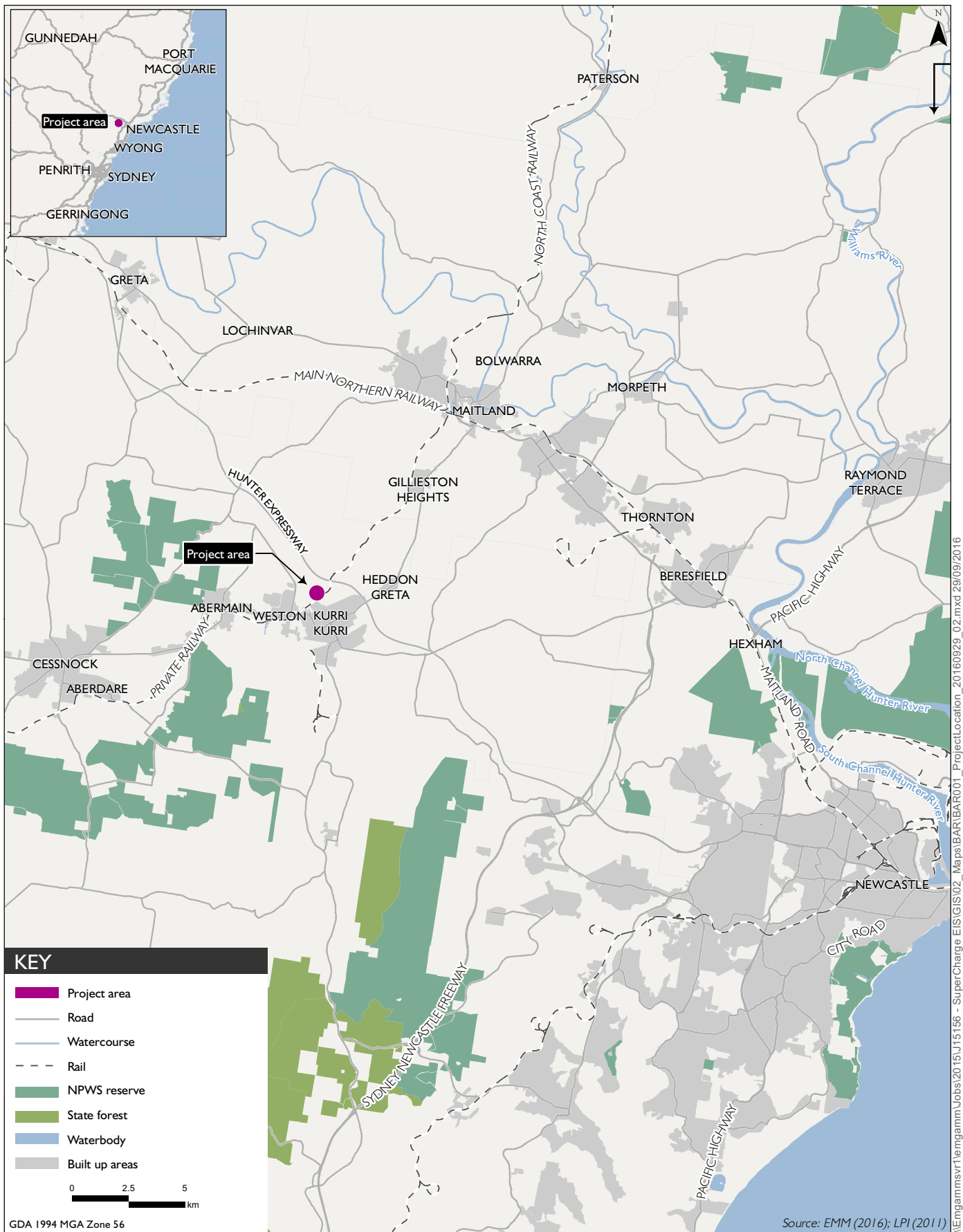
1.2 Project area

The project area is located at 129 Mitchell Avenue, Kurri Kurri and is legally described as Lots 796 and 797 in DP 39877 (refer to Figure 1.1). The project will occupy part of Lot 796 on which the Weston Aluminium Dross Recycling Plant (the aluminium plant) is located, which is part of an existing industrial estate (refer to Figure 1.2). The elevation of the project area is between 10 and 16 metres (m) Australian Height Datum (AHD), sloping from south to north in a gentle downwards gradient towards Swamp Creek, which is beyond the northern boundary.

The project area is in the Cessnock local government area (LGA), approximately 40 km north-west of Newcastle. The site is zoned IN3 Heavy Industrial under the *Cessnock Local Environmental Plan 2011* (Cessnock LEP).

Large areas of the project area are heavily disturbed with hardstand, gravel tracks, fill and storage of large pieces of industrial equipment and machinery. There are patches of remnant vegetation; however, these have been disturbed with partial clearing, weed invasion and canopy dieback prevalent.

For the purpose of this report, the part of the project area which will be subjected to ground disturbance under the project is defined as 'the disturbance area'.



Location of the project
 Kurri Kurri Battery Recycling Facility
 Biodiversity Assessment Report

Figure 1.1

1.3 Local context

The project area is located in an existing industrial estate and surrounding land uses include the aluminium plant to the west, a waste water treatment facility 750 m to the east, and the decommissioned Hydro Aluminium Kurri Kurri Smelter 1.3 km to the north. The residential areas of Kurri Kurri and Weston are approximately 650 m to the south-east and 1 kilometre (km) to the west of the project area, respectively. The Hunter Expressway is situated approximately 550 m to the north-east, providing connections to Newcastle to the south-east and the New England Highway to the north.

The project area abuts a vegetated creek corridor (Swamp Creek) to the north. Swamp Creek, located approximately 70 m from the northern boundary, flows to the north-east, joining the Hunter River approximately 12 km from the project area.

1.4 Purpose of this document

This Biodiversity Assessment Report (BAR) is a supporting document to the EIS, and has been prepared in accordance with the *Framework for Biodiversity Assessment (FBA): NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014). It also assesses matters of national environmental significance (MNES), specifically listed species and communities and migratory species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

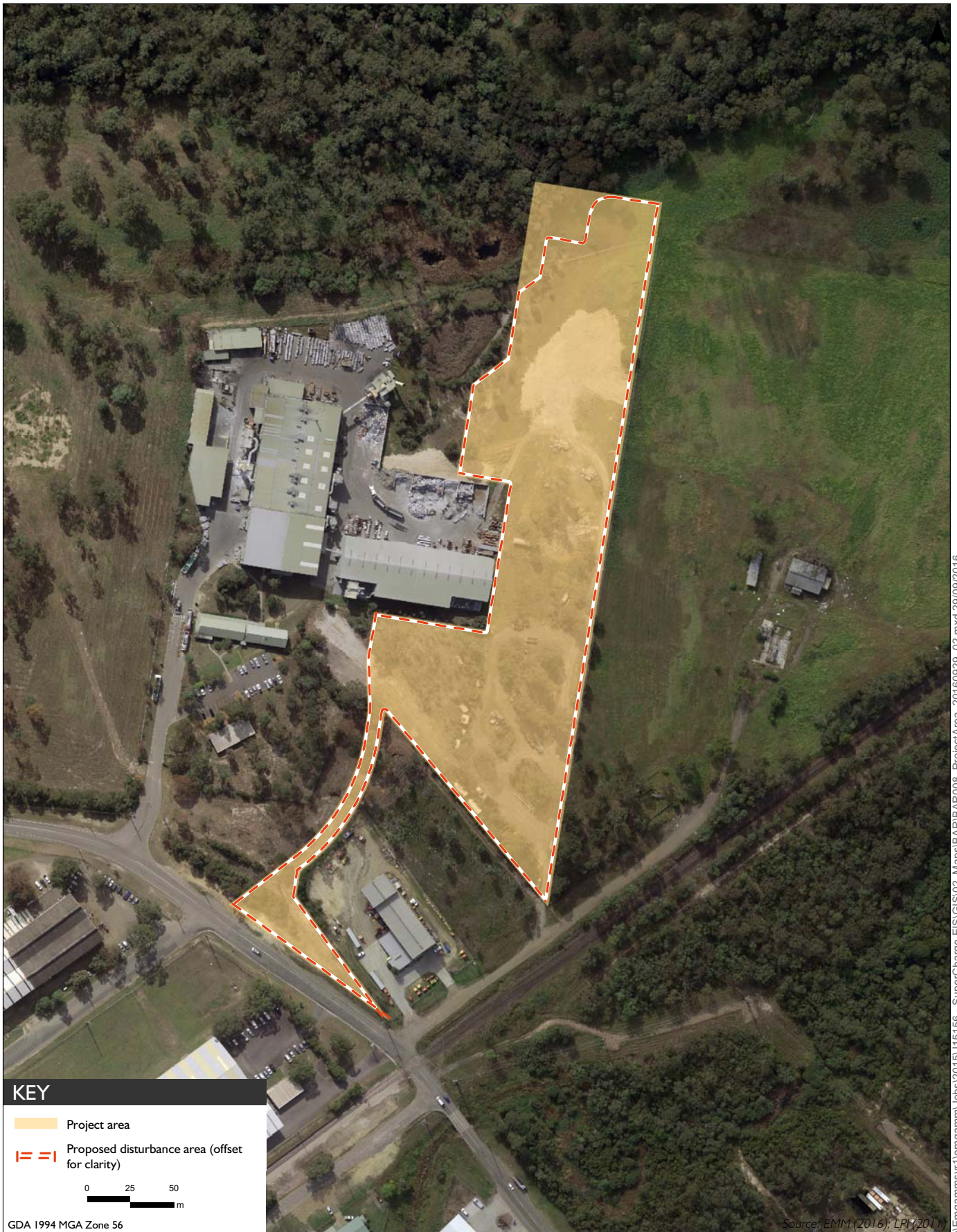
A referral has also been made to the Commonwealth for assessment of MNES under the EPBC Act. This was submitted to the department on 21 September 2016.

1.5 Secretary's Environmental Assessment Requirements

Secretary's Environmental Assessment Requirements (SEARs) for the project were issued on 18 March 2016 (reference SSD 7520), providing project specific requirements from DP&E and other relevant agencies. The biodiversity specific component of the SEARs included the following:

An assessment of the proposal under the Framework for Biodiversity Assessment (October 2014) if necessary, and an assessment of any potential impacts on any riparian vegetation and any groundwater dependent ecosystems.

As native vegetation and other biodiversity values occur within the project area, it is considered necessary to follow the FBA and produce a BAR. Section 4.3 of the BAR considers the potential impacts of the project on riparian vegetation and groundwater dependant ecosystems (GDEs).



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The project area and disturbance footprint

Kurri Kurri Battery Recycling Facility
Biodiversity Assessment Report

Figure 1.2

2 Methods

2.1 Database searches

The following databases and vegetation mapping were reviewed to identify biodiversity values relevant to the project:

- Office of Environment and Heritage (OEH) BioNet Atlas of NSW Wildlife (10 km radius of the project area, hence referred to as the locality) for previous threatened species records (search undertaken 16/02/2016);
- Commonwealth Department of Environment and Energy (DoEE) Protected Matters Search Tool (10 km radius) for MNES, including threatened species records (search undertaken 12/09/2016);
- vegetation mapping from Vegetation of the Cessnock-Kurri Region, Cessnock LGA, New South Wales: Survey, Classification and Mapping (Bell and Driscoll 2007);
- profiles for NSW and Commonwealth listed threatened biodiversity (OEH 2016a, DoEE 2016a, RBGDT 2016);
- NSW Vegetation Information System Classification Database (VIS Classification Database) and Vegetation Benchmarks Database (OEH 2016b);
- Threatened Species Profile Database (OEH 2016c);
- Vegetation Benchmarks Database (OEH 2016d); and
- The Directory of Important Wetlands of Australia (DIWA) (DoEE 2016b).

A list of NSW *Threatened Species Conservation Act 1995* (TSC Act) and EPBC Act-listed subject species and communities was collated as a result of the desktop searches, which informed the scope of field surveys.

2.2 Field survey

2.2.1 Overview

Field surveys were completed in accordance with the methods described in the FBA (OEH 2014) (refer to Table 2.1 for further detail). Threatened species and populations identified from the desktop review (PMST and Bionet) and the BioBanking Credit Calculator were targeted in accordance with *Threatened Species Survey and Assessment: Guidelines for developments and activities* (working draft) (DEC 2004), where appropriate.

A preliminary site inspection was completed on 18 February 2016 by an EMM ecologist. The purpose of this investigation was to assess potential ecological constraints for the project including Threatened Ecological Communities (TECs) and threatened species. The vegetation mapping for the project area was verified and refined, providing an opportunity to conduct a preliminary BioBanking Credit calculation for the project area. This informed the further field survey required, including the number of vegetation plots required and candidate species which require targeted surveys.

Due to timing constraints, survey was not possible for some species credit species predicted by the BioBanking Credit Calculator. Another survey event is planned for November 2016. This is described further in Section 3.10.3.

The bulk of the survey effort was conducted in May, with further targeted survey conducted in August 2016, to target the flowering period of the Newcastle Doubletail. The survey locations for specific survey effort are shown on Figure 2.1.

Table 2.1 Ecological investigation completed

Date	Primary survey purpose	Personnel	Weather
18 February 2016	Preliminary site investigation: vegetation mapping and constraints assessment	One EMM ecologist	Sunny and warm, with a minimum temperature of 19.5°C and a maximum of 28°C
25 – 26 May 2016	Vegetation plots/transect Threatened flora Surveys Birds surveys	Two EEM ecologists	Between 9°C and 23 °C with drizzle on the morning of the 26 May
23 August 2016	Targeted survey for Newcastle Doubletail (<i>Diuris praecox</i>). Bird Survey	One EMM ecologist	Clear, with a minimum temperature of 6.6 °C and a maximum of 17.4 °C

Notes: 1. Temperatures were obtained from the Maitland weather station, BOM 2016.

The following table details the survey effort which was targeted to particular taxa. In addition to the below, all incidental sightings and signs of vertebrate fauna were recorded.

Table 2.2 EMM survey effort summary

Target taxa	Survey effort
Flora	Targeted flora surveys throughout all vegetated area of the project area, totalling 18 person hours. Three hours of this effort was dedicated to the Newcastle Doubletail during the August 2016 flowering season. As the project area is small with good access the entire proposed disturbance area was covered on multiple occasions and the chance of detecting threatened species was high.
Reptiles	Opportunistic turning of debris, including corrugated sheeting, 1 person hours, during May surveys and August survey.
Mammals	Spotlighting was undertaken by two people to target nocturnal mammals in the project area for one night between the hours of 18:00 and 19:30. The spotlighting survey effort totalled three person hours. Koala scat searches were completed at the base of each Earp's Gum and Forest Red Gum within the Project area, which were approximately 40 locations. Fauna habitat was assessed throughout the project area. Searches were undertaken for scats, tracks and other fauna signs. Opportunistic fauna sightings were also recorded.
Birds	Two diurnal bird surveys were completed between 15:00 and 16:00 on 25 May, and between 06:30 and 07:30 on 26 May 2016. A third bird survey was undertaken between 09:00 and 10:30 by one person on 23 August 2016. All bird species observed and heard throughout the surveys were also recorded. The diurnal bird survey effort totalled 4.5 person hours. Spotlighting was undertaken by two people to target nocturnal birds in the Project area for one night between the hours of 18:00 and 19:30. The spotlighting survey effort totalled three person hours.

2.2.2 Vegetation survey methods

Vegetation mapping and aerial imagery for the area were used to determine the likely vegetation types present within the project area prior to the field investigation. Floristic and structural vegetation data were collected from six 20 m by 50 m nested quadrats and transects in accordance with the FBA. All additional flora species observed outside quadrats were also recorded to assist in the identification of vegetation communities. Vegetation communities were identified to the most appropriate Plant Community Types (PCTs) and their corresponding Biometric Vegetation Types (BVTs) by analysis of plot data collected in the field. These vegetation communities were also differentiated on the basis of their condition, and mapped digitally, according to on the ground observations and aerial imagery. Figure 2.1 includes plot and transect location of vegetation communities and condition classes.

2.2.3 Targeted species surveys

i Candidate species

The BioBanking Credit Calculator predicted a total of 38 candidate species for the project area, comprising:

- 26 ecosystem credit species (ie species that can be reliably predicted by vegetation type); and
- 12 species credit species (ie species that cannot be reliably predicted by vegetation type, but are predicted to occur in the area).

a. Ecosystem credit species

The full list of ecosystem credit species are provided in Table 2.3. Many of the ecosystem species predicted to occur, may occur within the project area on a transient basis. Field surveys were not targeted to these species, as obtaining a confident negative result would require high levels of survey effort. In addition, the FBA does not require survey for ecosystem credit species, as these are assumed in the calculation of ecosystem credits. For these reasons, all of the 26 ecosystem species are assumed to occur within the project area.

Table 2.3 Predicted ecosystem credit species

Common name	Scientific name	Threatened species offset multiplier ¹	Likely to be on site?
Barking Owl	<i>Ninox connivens</i>	3.0	Yes
Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis subsp. gularis</i>	1.3	Yes
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus subsp. victoriae</i>	2.0	Yes
Bush Stone Curlew	<i>Burhinus grallarius</i>	2.6	Yes
Corbens Long-eared Bat	<i>Nyctophilus corbeni</i>	2.1	Yes
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	2.2	Yes
Eastern Freetail Bat	<i>Mormopterus norfolkensis</i>	2.2	Yes
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	2.0	Yes
Glossy Black-cockatoo	<i>Calyptorhynchus lathami</i>	1.8	Yes
Greater Broadnosed Bat	<i>Scoteanax rueppellii</i>	2.2	Yes

Table 2.3 Predicted ecosystem credit species

Common name	Scientific name	Threatened species offset multiplier ¹	Likely to be on site?
Grey-crowned Babbler (eastern subspecies)	<i>Pomatostomus temporalis subsp. temporalis</i>	1.3	Yes
Hooded Robin (south-eastern form)	<i>Melanodryas cucullata subsp. cucullata</i>	1.7	Yes
Little Eagle	<i>Hieraeetus morphnoides</i>	1.4	Yes
Little Lorikeet	<i>Glossopsitta pusilla</i>	1.8	Yes
Masked Owl	<i>Tyto novaehollandiae</i>	3.0	Yes
Painted Honeyeater	<i>Grantiella picta</i>	1.3	Yes
Powerful Owl	<i>Ninox strenua</i>	3.0	Yes
Speckled Warbler	<i>Chthonicola saggitata</i>	2.6	Yes
Spotted-tail Quoll	<i>Dasyurus maculatus</i>	2.6	Yes
Square-tailed Kite	<i>Lophoictinia isura</i>	1.4	Yes
Squirrel Glider	<i>Petaurus norfolcensis</i>	2.2	Yes
Swift Parrot	<i>Lathamus discolor</i>	1.3	Yes
Turquoise Parrot	<i>Neophema pulchella</i>	1.8	Yes
Varied Sitella	<i>Daphoenositta chrysoptera</i>	1.3	Yes
Yellow-bellied Glider	<i>Petaurus australis</i>	2.3	Yes
Yellow-bellied Sheath-tail Bat	<i>Saccolaimus flaviventris</i>	2.2	Yes

Notes: 1. The threatened species offset multiplier is the inverse of the species Tg value. The Tg value is the ability of a species to respond to improvements in site value at an offset site. The species with the highest threatened species offset multiplier determines the multiplication factor on the number of ecosystem credits.

b. Species credit species

Table 2.4 lists the species credit species generated by the BioBanking calculator and the approach taken to determine if they occur within the project area. Several species were excluded from further assessment due to a lack of suitable habitat, and/or being outside of their known distribution. The analysis for this can be found within the likelihood of occurrence (Appendix B). All of the species requiring targeted surveys were targeted during the appropriate survey season as specified in the BioBanking Credit Calculator, with the exception of the Leafless Tongue Orchid, Green and Golden Bell Frog, Common Planigale and Small Snake Orchid. Surveys are planned for November 2016 to target the optimal detection times of these species. For the purposes of this assessment, these four species have been assumed to be absent, based on the absence of suitable habitat or low habitat quality (see Appendix B, Table B.1). If the species are detected during targeted surveys in November 2016, the BioBanking calculations presented in this report will be updated and species credits will be calculated for the four species.

Table 2.4 **Species credit species**

Common name	Scientific name	Targeted survey conducted?	Required survey timing	Survey methods
Green and Golden Bell Frog	<i>Litoria aurea</i>	No (pending)	Aug - March	Habitat based to date. Diurnal searches and 3 nights of call playback, spotlighting during the breeding season proposed.
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	No (pending)	All year	Habitat based to date. Elliot trapping for 3 nights with 34 traps (102 trap hours) proposed for November 2016.
Koala	<i>Phascolarctos cinereus</i>	Yes	All year	Scat searches around all feed trees. Spotlighting during May (3 person hours)
Common Planigale	<i>Planigale maculata</i>	No (pending)	All year	Habitat based to date. Elliot trapping for 3 nights with 34 traps (102 trap hours) proposed for November 2016.
Bynoe's Wattle	<i>Acacia bynoeana</i>	Yes	Sept - March	Targeted flora transects during February.
Netted Bottle Brush	<i>Callistemon linearifolius</i>	Yes	Sept - March	Targeted flora transects during February.
Leafless Tongue-orchid	<i>Cryptostylis hunteriana</i>	No (pending)	Nov - Feb	Targeted surveys proposed for November '16
Rough Doubletail	<i>Diuris praecox</i>	Yes	July - Aug	Targeted orchid survey transects during August
Small Snake Orchid	<i>Diuris pedunculata</i>	No (pending)	Sept - Nov	Targeted surveys proposed for November '16
Slaty Red Gum	<i>Eucalyptus glaucina</i>	Yes	All year	Transects searches during May '16
Earps Gum	<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	Yes	All year	Transects searches during May '16
Small-flower Grevillea	<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Yes	All year	Transects searches during May '16

c. EPBC Act listed species

A protected matters search was undertaken. The search predicted that three threatened ecological communities, 22 fauna and 14 flora species may occur within 10 km of the site.

Targeted flora searches were completed for Slaty Red Gum and Earps Gum, and spotlighting surveys were completed for the Grey-headed Flying-fox. Targeted searches were completed for key tree species identified in the Regent Honeyeater and Swift Parrot recovery plans (DoE 2016; Birds Australia 2011).

Due to timing constraints, targeted surveys were not completed for the Leafless Tongue Orchid, Large-eared Pied Bat, Green and Golden Bell Frog or New Holland Mouse. Surveys for these species are planned for November 2016 to target their optimal detection periods.



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3 Landscape values

3.1 Overview

This chapter describes the landscape values as required by the FBA (OEH 2014). The landscape values are described in the following sections, and are shown on the site map (Figure 3.1) and location map (Figure 3.2).

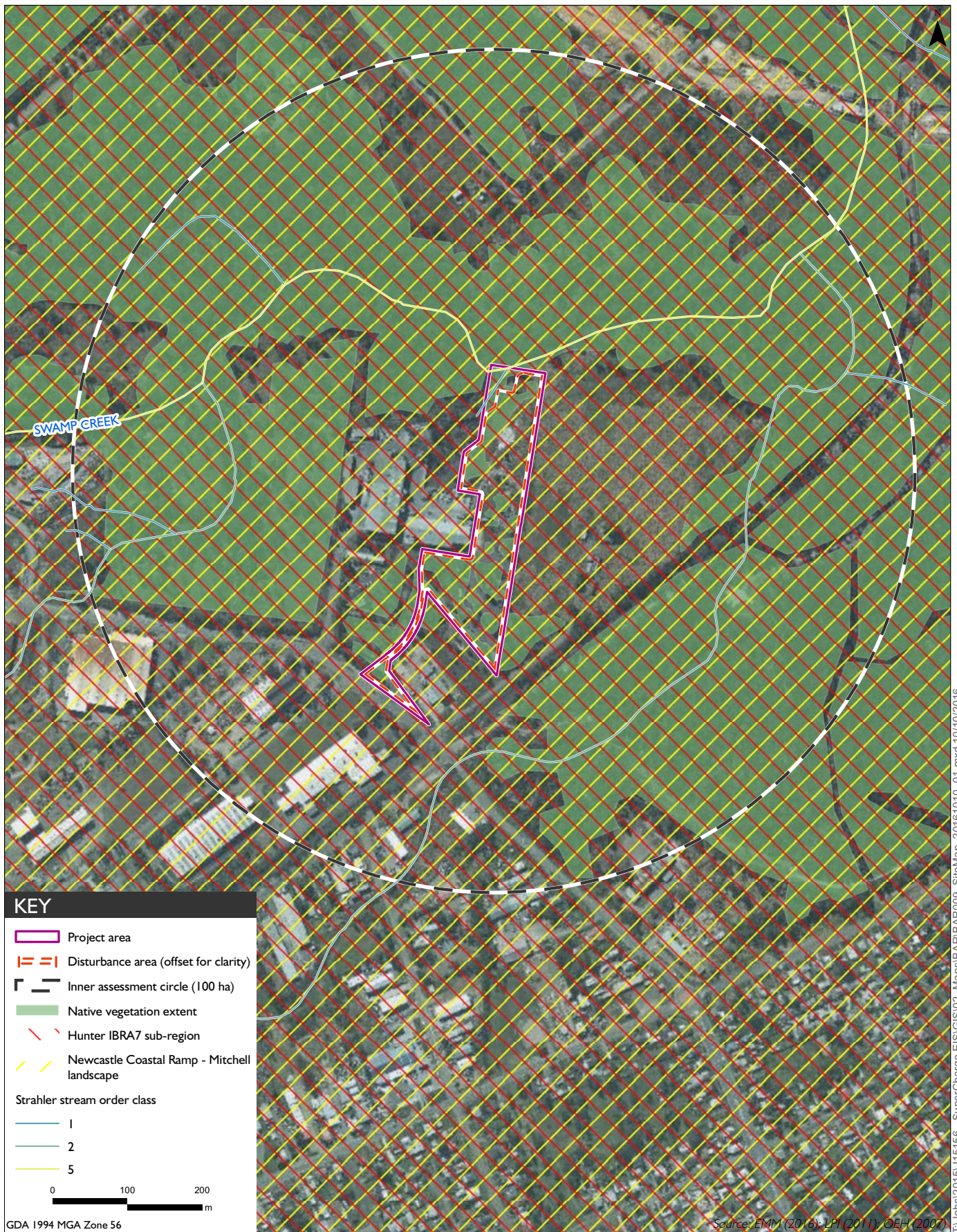
3.2 Native vegetation within the assessment circles

An inner assessment circle of 100 ha was placed around the centre of the project area, which encompassed all of the proposed disturbance area (refer to Figure 3.1). Accordingly the outer assessment circle was calculated at 1,000 ha. Native vegetation was mapped in the inner assessment circle from the field results and native vegetation in the outer assessment circle was extrapolated from regional mapping datasets.

Native vegetation cover is 51-55% and 31-35% in the inner and outer assessment circles prior to disturbance, respectively. Table 3.1 summarises the change in native vegetation cover in both the inner and outer assessment circles following disturbance.

Table 3.1 Native vegetation in the assessment circles before and after development

Assessment circle	Before development (ha)	Before development percent range	After development (ha)	After development percent range
Inner assessment circle	52.1	51-55%	50.5	46-50%
Outer assessment circle	320.8	31-35%	319.2	31-35%



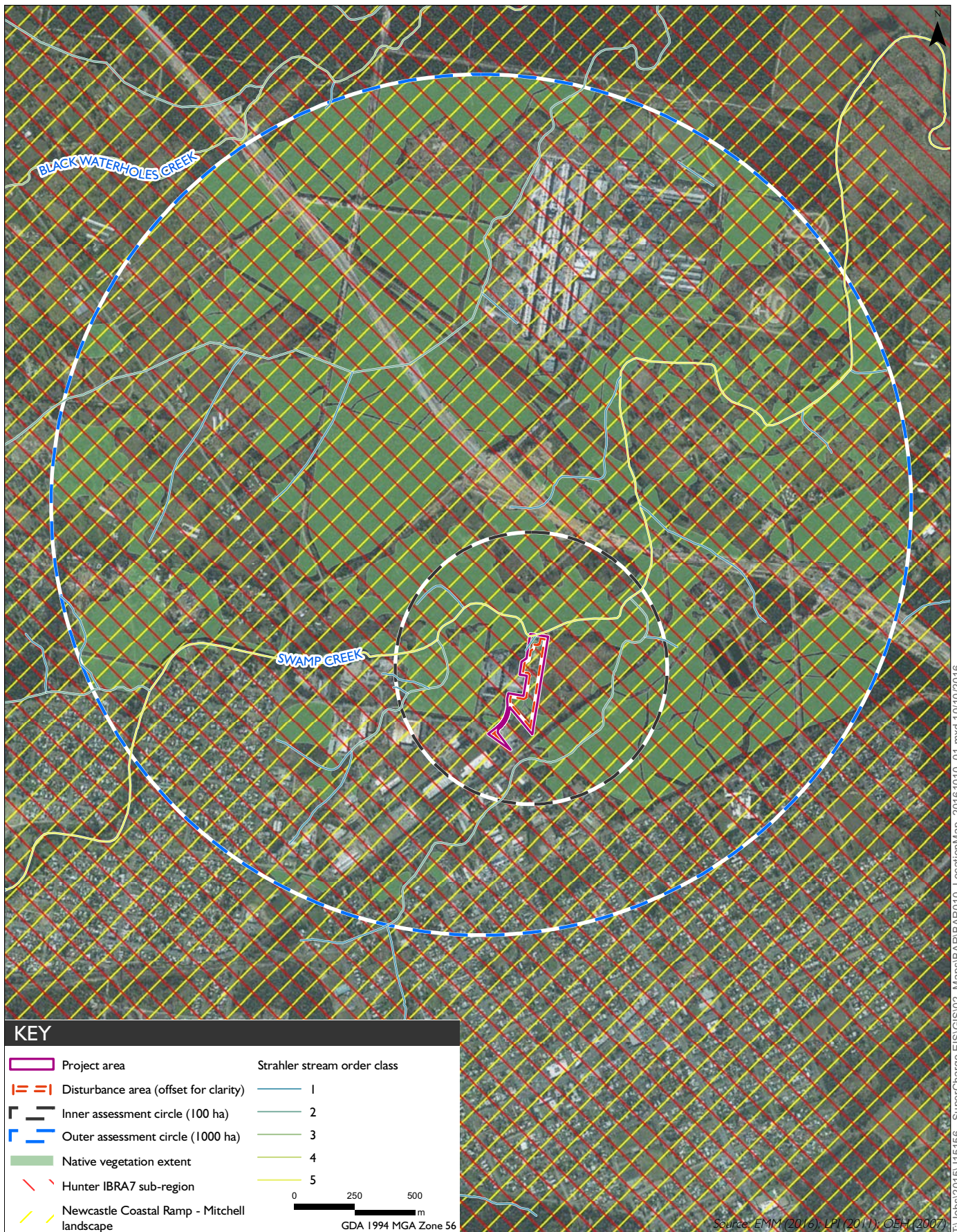
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Site map

Kurri Kurri Battery Recycling Facility
Biodiversity Assessment Report

Figure 3.1





Location map

Kurri Kurri Battery Recycling Facility
Biodiversity Assessment Report

Figure 3.2

3.3 Landscape features

The project area is situated on the northern periphery of Kurri Kurri, with industrial land use to the east and south. Exotic pasture occurs to the east of the project area with well connected forested areas to the south-east and north.

3.3.1 IBRA bioregion and subregion

The project is in the Sydney Basin IBRA Bioregion and the Hunter IBRA sub-region. It also falls within the Newcastle Coastal Ramp (Nrm) Mitchell Landscape. The catchment management authority is the Hunter/Central Rivers.

3.3.2 Rivers and streams

The nearest significant drainage line to the project area is Swamp Creek which occurs approximately 25 m north of the project area at its closest point. Swamp River is a fifth order stream which flows in a north easterly direction. This waterbody is further described in Section 3.5.2.ii.

3.3.3 National Parks and Conservation Areas

Werakata National Park is 4.5 km to the south east and 4.4 km east of the project area. This national park includes areas of Kurri Sand Swamp Woodland in the Sydney Basin Bioregion EEC, which has also been mapped within the project area.

3.3.4 Wetlands

No wetlands occur within the project area; however, a large wetland area exists downstream between Kurri Kurri and Maitland, associated with Swamp Creek.

The SEPP14 listed wetland and Ramsar Hunter Estuary Wetland, is approximately 45 km downstream of the project area, via Swamp Creek, Wallis Creek and the Hunter River. The Ramsar wetland is a MNES and has been assessed under EPBC guidelines with an assessment of significance provided in Appendix C.

3.3.5 Biodiversity links

The Chief Executive of OEH has not declared any state or regional biodiversity links. Therefore, no declared state or regional biodiversity links are present.

Swamp Creek, north of the project area, is a 5th order stream with a vegetated riparian buffer on either side of the stream. Accordingly, it represents a regionally significant biodiversity link in accordance with Table 10 of the FBA (OEH 2014). The project will not remove any native vegetation from this regionally significant biodiversity link, as it has been excluded from the disturbance area.

3.4 Plant community types

Vegetation in the project area was compared to all plant community types (PCTs) for the Hunter IBRA subregion to determine which PCTs occurred within the project area. This section provides the PCT description according to VIS Classification 2.1, followed by a description of the community characteristics found within the project area. A total of two communities were recorded, which are displayed in Figure 3.1:

- PCT 1633 Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area; and
- PCT 1594 Cabbage Gum-Rough-barked Apple grassy woodland on alluvial floodplains of the lower Hunter

The locality, landform and characteristic species of the communities within the project area were found to reflect the above communities, rather than those which had been previously mapped for the site by Bell and Driscoll (2007), these were:

- PCT 1065 Parramatta Red Gum – Narrow-leaved Apple shrubby woodland on sand near Kurri Kurri in the Hunter Valley, Sydney Basin Bioregion; and
- PCT 763 Cabbage Gum open forest or woodland on flats of the NSW North Coast Bioregion and New England Tableland Bioregion.

Information provided on the lineage of PCT 1633 in the data base states the following:

PCT1633 and PCT1065 are describing the same core community. The developers of PCT1065 have taken a broader view and have a more diverse upper stratum than that for PCT1633. PCT1065 is rated 'very low' for classification confidence (probably too conservative). PCT1633 has the advantage of considerably more plot data than was available for PCT 1065.

3.4.1 Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area

Vegetation formation: Dry Sclerophyll Forests (shrubby sub-formation)

Vegetation class: Sydney Sand Flats Dry Sclerophyll Forests

PCT: 1633 Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area

BVT: HU592 Parramatta Red Gum - Narrow-leaved Apple shrubby woodland on sand near Kurri Kurri in the Hunter Valley, Sydney Basin Bioregion

Condition class: Moderate – good and poor

TEC status: Kurri Sand Swamp Woodland in the Sydney Basin Bioregion Endangered Ecological Community

Disturbance area extent: 0.87 ha of moderate-good condition (woodland) and 0.61 ha poor condition (cleared woodland).

Category	Within known distribution
Estimate of pre-clearing area (Bell and Driscoll 2007)	2587 ha
Extant area (Bell and Driscoll 2007)	1304 ha
Estimated percentage cleared in the Cessnock-Kurri Kurri area (Bell and Driscoll 2007)	50.6%
Estimated percentage cleared in the Hunter Central Rivers major catchment area for PCT1633 (OEH 2016)	75%

Characteristic species of the PCT

Structure	Characteristic species
Upper stratum	Parramatta Red Gum (<i>Eucalyptus parramattensis</i>)+ Red Ironbark (<i>Eucalyptus fibrosa</i>)+ Narrow-leaved Apple (<i>Angophora bakeri</i>)+
Middle stratum	Prickly-leaved Paperbark (<i>Melaleuca nodosa</i>)+ Slender Tea-tree (<i>Leptospermum trinervium</i>) Thyme Honey-myrtle (<i>Melaleuca thymifolia</i>)+ Narrow-leaved Bottlebrush (<i>Callistemon linearis</i>)+ Bacon and Eggs (<i>Dillwynia retorta</i>)+ Leptospermum parvifolium (<i>Small-leaf Tea-tree</i>) Needlebush (<i>Hakea sericea</i>)+
Ground stratum	Wiry Panic (<i>Entolasia stricta</i>)+ <i>Aristida warburgii</i> + Oat Speargrass (<i>Anisopogon avenaceus</i>)+ Pale Mat-rush (<i>Lomandra glauca</i>)+ Needle Mat-Rush (<i>Lomandra cylindrica</i>)+

Notes 1. + denotes species which were recorded within the project area

Description of the PCT within the project area

This community dominates the southern half of the project area, occurring as a series of small to medium sized patches. It does not transition into any other native vegetation communities within the project area, instead, bordered by disturbed areas consisting of hardstand, gravel tracks and weedy exotic grassland. There is considerable variation in the community such as areas of dense mid-story cover, or open grassy areas with low shrub cover. This variation is likely to be due to a range of disturbance factors operating including partial canopy clearance, and the interactions between edge effects and patch size.

Two threatened species were recorded in this community; Earp's Gum (*E. parramattensis* subsp. *decadens*), which is listed as vulnerable under both the EPBC Act and the TSC Act and Slaty Red Gum (*Eucalyptus glaucina*) which is listed vulnerable under the TSC Act.

Moderate to good condition patches

All three characteristic upper stratum species for the PCT occur as co-dominants within the community; Earp's Gum (*E. parramattensis* subsp. *decadens*), Red Ironbark (*Eucalyptus fibrosa*) and Narrow-leaved Apple (*Angophora bakeri*). Other canopy species recorded include Blue-leaved Stringybark (*Eucalyptus agglomerata*) and Grey Gum which is an intermediate of two species *E. punctata* and *E. canaliculata*.

The canopy cover was variable from open to closed. This is likely to be due to varying levels of disturbance within the project area, including partial clearance. Regeneration of the canopy species was occasional; however, seedlings or saplings were recorded for all species across the project area.

A total of seven characteristic mid stratum species are listed for the PCT of which, five were recorded within the project area including; Prickly-leaved Paperbark (*Melaleuca nodosa*), Thyme Honey-myrtle (*Melaleuca thymifolia*), Narrow-leaved Bottlebrush (*Callistemon linearis*), Bacon and Eggs (*Dillwynia retorta*), and Needlebush (*Hakea sericea*). The mid stratum within this community was diverse with additional species to the characteristic species including, but not limited to; Swamp Wattle (*Acacia elongata*), Prickly Moses (*Acacia ulicifolia*), Narrow-leaved Geebung (*Persoonia linearis*), Bracelet Honey-myrtle (*Melaleuca armillaris*) and Tantoon (*Leptospermum polygalifolium*). Weed species within this stratum were limited to Easter Cassia (*Senna pendula* var. *glabrata*) and Camphor Laurel (*Cinnamomum camphora*), both of which were infrequent.

All five characteristic ground stratum species listed for the PCT were recorded within project area community. A large number of other native species were also recorded including; Purple Wiregrass (*Aristida ramosa*), *Deyeuxia quadriseta*, Three-awned Wiregrass (*Aristida vagans*), Yellow Buttons (*Chrysocephalum apiculatum*), Blueberry Lily (*Dianella revoluta* var. *revoluta*) and Blood Root (*Haemodorum planifolium*). Weeds were infrequent within the highest quality patches of the community, most common around the periphery of the smaller patches. The most common weed species were Catsear (*Hypochaeris radicata*), Lacey Ragweed (*Ambrosia tenuifolia*), and Rhodes Grass (*Chloris gayana*).



Photograph 3.1

Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area in Moderate to Good Condition

Poor condition patches

An area of this community had been recently cleared with the only the lowest ground strata remaining, and occasional scattered trees. The removed vegetation had been surveyed prior to the clearance and was found to be among the least disturbed and intact examples of the PCT within the project area, with a particularly diverse ground strata. The description of the community matched that of the description above.

Despite the recent clearance, it was considered that the area still constitutes the PCT with a strong ability to regenerate if disturbance is ceased. In the majority of the area the substrate had not been disturbed, with new growth observed from the bases of slashed plants, germination from the seed bank was also observed. In other areas the substrate had been disturbed and possibly graded. This would have damaged the soil structure and limited to regeneration to seed sources only. This would eventually regenerate to the PCT but would likely take considerable time and may result in a modified community composition and structure.

The poor condition patches also included an area at the north east of the project area, which has been modified by historic earthworks and landscape plantings. Despite this disturbance, the ground cover was mostly native with a species composition similar to that of the similar species planting of trees.



Photograph 3.2 Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area in Poor Condition

3.4.2 Cabbage Gum-Rough-barked Apple grassy woodland on alluvial floodplains of the lower Hunter

Vegetation formation: Forested Wetlands

Vegetation class: Coastal Floodplain Wetlands

PCT: 1594 Cabbage Gum-Rough-barked Apple grassy woodland on alluvial floodplains of the lower Hunter

BVT: HU808

Condition class: Moderate - good

TEC status: River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions Endangered Ecological Community,

Disturbance area extent: Does not occur within the disturbance area, only in the wider project area.

Category	Within known distribution
Estimate of pre-clearing area (Bell and Driscoll 2007)	14,249 ha
Extant area (Bell and Driscoll 2007)	555 ha
Estimated percentage cleared in the Cessnock-Kurri Kurri area (Bell and Driscoll 2007)	96.1%
Estimated percentage cleared in the Hunter Central Rivers major catchment area (OEH 2016)	0%

Characteristic species of the PCT

Structure	Characteristic species
Upper stratum	Cabbage Gum (<i>Eucalyptus amplifolia</i>)+ Rough-barked Apple (<i>Angophora floribunda</i>)+ Forest Red Gum (<i>Eucalyptus tereticornis</i>)+ Broad-leaved Apple (<i>Angophora subvelutina</i>)
Middle stratum	Silver-stemmed Wattle (<i>Acacia parvipinnula</i>)+ Sticky Cassinia (<i>Cassinia uncata</i>) Corkwood (<i>Duboisia myoporoides</i>) Hakea sericea (<i>Needlebush</i>)
Ground stratum	<i>Paspalidium distans</i> Common Couch (<i>Cynodon dactylon</i>) Two-colour Panic (<i>Panicum simile</i>) Matrush (<i>Lomandra confertifolia</i>)

Notes 1. + denotes species which were recorded within the project area

Description of the PCT within the project area

This community occurs at the extreme north-west corner of the project area, and is part of a large corridor of vegetation, occurring along Swamp Creek. This community will not be impacted by the proposal as no clearance is anticipated.

Rough-barked Apple (*Angophora floribunda*) and Forest Red Gum (*Eucalyptus tereticornis*) were the dominant canopy species recorded, with lesser amounts of Cabbage Gum (*Eucalyptus amplifolia*) also present outside of the project area. All three species are characteristic canopy stratum for this PCT. One other canopy species was recorded; River Oak (*Casuarina cunninghamiana*) which was most frequent either side of Swamp Creek (outside of the project area). One abundant weed species was recorded within this stratum; Camphor Laurel. The canopy cover of the community is relatively open on the southern margin, becoming closed along Swamp Creek to the north. No regeneration of any canopy species was recorded.

The mid stratum was relatively sparse with none of the characteristic mid stratum species recorded for this PCT. Three native mid-story species were present; Native Blackthorn (*Bursaria spinosa*), Tantoon (*Leptospermum polygalifolium*) and Sydney Golden Wattle (*Acacia longifolia*), all of which occurred infrequently as isolated individuals.

The latter two are likely to be as a result of regeneration from nearby landscape plantings and unlikely to naturally occur within the community. Weeds were common in this stratum and included Green Cestrum (*Cestrum parqui*), Camphor Laurel, Small-leaved Privet (*Ligustrum sinense*), Inkweed (*Phytolacca octandra*) and Tree Tobacco (*Solanum mauritianum*).

The ground stratum in this community was dense with no bare ground present. No characteristic species listed for the PCT were recorded. The most dominant native species was Bracken (*Pteridium esculentum*) followed by Basket Grass (*Oplismenus* sp.). Other native forbs and grasses were very infrequently recorded and included Lesser Joyweed (*Alternanthera denticulata*), Kidney Weed (*Dichondra repens*), Variable Glycine (*Glycine tabacina*) and Spiny-headed Matt Rush (*Lomandra longifolia*).

Exotic weed species coverage was higher than that of native species with Trad (*Tradescantia fluminensis*) heavily dominant in the heavily shadier areas. Other prevalent weed species included Side (*Sida rhombifolia*), Purpletop (*Verbena bonariensis*) and *Hydrocotyle bonariensis*.



Photograph 3.3 Cabbage Gum-Rough-barked Apple grassy woodland on alluvial floodplains of the lower Hunter

3.5 Areas which do not require assessment

3.5.1 Exotic grassland

This community is dominated by exotic grasses and forbs with no native canopy or mid stratum species, therefore, it cannot be assigned to a PCT. This vegetation type was recorded in the central and northern areas of the project area.

Midstorey species were limited to the exotic Green Cestrum, Lady-of-the-Night (*Cestrum nocturnum*) and Blackberry (*Rubus fruticosus aggregate*). Each species was limited to small patches and were not a dominant component.

Native ground cover species were limited to Bracken and Common Couch (*Cynodon dactylon*), both of which were abundant. These species are often abundant in disturbed areas and provide little ecological value. Exotic groundcover was dominated by Paspalum (*Paspalum dilatatum*), with other common weeds including Lacy Ragweed, Pigeon Grass (*Setaria sp.*), Purpletop (*Verbena bonariensis*) and Narrow-leaved Plantain (*Plantago lanceolata*).



Photograph 3.4 Exotic grassland in the north of the Project area

3.5.2 Cleared areas

The south-east of the project area has a network of tracks and gravel hardstand area used for vehicle access. Other unvegetated areas include a large patch in the north of the project area, which is composed of sandy earth. This has no native regeneration potential as was originally vegetated by exotic grassland.



Photograph 3.5 Cleared area in the north of the project area



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Plant community types

Kurri Kurri Battery Recycling Facility
 Biodiversity Assessment Report

Figure 3.3

3.6 Vegetation zones

Two vegetation zones occur in the disturbance area. While the Cabbage Gum Rough-barked Apple grassy woodland occurs in the project area, all direct impacts to this community will be avoided.

A summary of vegetation zones are provided in Table 3.2 and are shown on Figure 3.4. The required number of plots was completed for both vegetation zones.

Table 3.2 Vegetation zone summary

Vegetation zone	PCT	BVT	Area (ha)	Condition class	Site value score	Required survey effort	Plots completed
1	1633 Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri	HU592 Parramatta Red Gum - Narrow-leaved Apple shrubby woodland on sand near Kurri Kurri in the Hunter Valley, Sydney Basin Bioregion	0.87	Moderate - good	50.67	1 plot	2 plots
2	1633 Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri	HU592 Parramatta Red Gum - Narrow-leaved Apple shrubby woodland on sand near Kurri Kurri in the Hunter Valley, Sydney Basin Bioregion	0.61	Poor	37.33	1 plot	2 plots
Total			1.48			2 plots	4 plots

Notes 1. PCT – plant community type, BVT – biometric vegetation type.

3.7 Threatened ecological communities

Two TECs listed under the TSC Act have been recorded within the project area.

3.7.1 Kurri Sand Swamp Woodland in the Sydney Basin Bioregion endangered ecological community (KSSW)

PCT 1633 Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area, corresponds with the Kurri Sand Swamp Woodland in the Sydney Basin Bioregion Endangered Ecological Community (EEC) (KSSW). This community occurs within the Kurri Kurri - Cessnock area in the lower Hunter Valley, in the local government area of Cessnock, but may also occur elsewhere (OEH 2016). Earp’s Gum, Red Ironbark and Narrow-leaved Apple are characteristic canopy species for this EEC and were co-dominant canopy species within the PCT. Ground and mid stratum species as described in 3.3.1 also closely match the species typical to that of the EEC listing.

The poor condition component of this community is also considered to represent the EEC, as the scientific listing states 'disturbed remnants are considered to form part of the community including remnants where the vegetation would respond to assisted natural regeneration such as where the natural soil and associated seedbank is still at least partially intact'. The 'poor' condition vegetation within the project area is likely to respond well to assisted regeneration as it has been recently cleared and the majority of the seed bank and solid structure has been maintained. Furthermore, regeneration is likely to occur vegetatively from the slashed rootstock.

3.7.2 River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions Endangered Ecological Community

PCT 1594 Cabbage Gum-Rough-barked Apple grassy woodland on alluvial floodplains of the lower Hunter, corresponds with River-flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC (RFEF). This community occurs on silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains (OEH 2016). The canopy species recorded within the PCT are all characteristic canopy species of the EEC, although the composition of the tree stratum varies considerably throughout the widely distributed EEC. In assigning the EEC; canopy species and the landscape position were the main determinates given that the understorey was disturbed and primarily composed of exotic species. Very few examples of River-Flat Eucalypt Forest on Coastal Floodplains remain unaffected by weeds (OEH 2016), and although the condition affected it does not affect the listing of this EEC.

This community will not be impacted by the project as it is outside of the disturbance area.

3.7.3 EPBC Listed - Threatened Ecological Communities

Three EPBC listed TECs were predicted by the EPBC Act Protected Matters Search Tool to occur in the region. No EPBC listed EEC's were recorded in the project area. Justification for their absence is provided below:

- Central Hunter Valley eucalypt forest and woodland:
 - The canopy of the Central Hunter Valley eucalypt forest and woodland is dominated by one or more of the following four eucalypt species; Narrow-leaved ironbark (*Eucalyptus crebra*), Spotted Gum (*Corymbia maculata*), Slaty Gum (*E. dawsonii*) and Grey Box (*E. moluccana*). None of these species occur within the Project area and, therefore, the community does not occur.
- Hunter Valley Weeping Myall (*Acacia pendula*) Woodland:
 - The tree canopy of this Hunter Valley Weeping Myall Woodland is dominated by Weeping Myall (*Acacia pendula*), which was not recorded within the community and, therefore, this community does not occur.
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland:
 - This canopy stratum of White Box-Yellow-Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland is dominated by White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*) and Blakely's Red Gum (*E. blakelyi*) community, none of which occur within the project area. Any grassland within the project area is derived from Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area, rather than this community.

3.8 Flora

The total of 144 plant species were recorded within the project area, comprising 106 native species and 38 weeds species. The majority of floral diversity was associated with Parramatta Red Gum – Narrow-leaved Apple Community, with up to 90 native species recorded. Two threatened species were recorded with the project area; Earp’s Gum and Slaty Red Gum, refer to Figure 3.3. A full list of flora species recorded by EMM is provided in Appendix A, Table A.2.

3.9 Fauna

Native fauna species recorded within the project area comprised one frog, and 11 bird species. An additional six bird species and two macropods were observed adjacent to the project area (refer to Appendix A, Table A.2). One exotic mammal species was also observed adjacent to the project area; the Brown Hare (*Lepus europaeus*).

The majority of the project area is fenced with chain mesh and three strands of barbed wire on a return. This will substantially limit the movement of larger species such as Macropods within the project area. The areas in which larger animals can enter/exit the project area is largely limited to space below the entrance gate.

3.9.1 Fauna habitat

i Low Open Woodland

Low open woodland habitat within the project area corresponds with the PCT Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland. The canopy stratum, when in flower would provide foraging resources for nectivorous species including arboreal mammals and birds. Narrow-leaved Apple was flowering profusely at the time of the May survey, with occasional Earps Gum also flowering. The canopy stratum and dense mid stratum present in several patches of the project area may provide suitable structure for nest building birds. Very few hollows were recorded, which is likely to be a constraint on the abundance of hollow nesting birds, arboreal mammals and bats which use hollows for shelter and breeding.

The habitat considered holistically, has a very diverse flora assemblage with a large number of mid and ground stratum species. This is likely to correspond with a high ecological function and abundance of invertebrates which, in turn, would be expected to support insectivorous fauna species including a diversity of small woodland birds, such as Thornbills and Fairy Wrens.

Despite the fauna resources listed above, including flowering eucalyptus, field surveys recorded low bird diversity. Noisy Miners (*Manorina melanocephala*) were recorded in very high abundances and were observed defending their territory against other bird species such as Rainbow Lorikeets (*Trichoglossus moluccanus*), King Parrots (*Alisterus scapularis*) and Laughing Kookaburra (*Dacelo novaeguineae*).

These larger species are able to persist in the project area owing to their size. No small birds were observed within the project area during the entire survey period and it is likely they have been displaced by the Noisy Miners. Noisy Miners are able to exclude other small honeyeaters and insectivorous birds most effectively open in habitats, with partially cleared canopies, which is the case in this project area, with a partially thinned canopy and adjacent cleared land.

Earps Gum is listed as a koala feed tree by the Koala Recovery Plan (DECC 2008) in the north coast Koala Management Area (KMA), in which the project area is located. No Koala scats were recorded within the project area and the woodland is considered too patchy to be optimal for the species.

Koalas are likely to be excluded or strongly discouraged from occurring within the disturbance area due to the presence of a chainlink fence with three strands of barbed wire on an angled arm.

ii Riparian Forest

A small area of riparian forest exists in the north of the project area, which corresponds to the PCT 1594 Cabbage Gum-Rough-barked Apple grassy woodland on alluvial floodplains of the lower Hunter. The habitat within the project area has a canopy of regrowth trees which do not support any hollows, reducing their value for hollow dependant fauna.

Despite the mid and ground stratum being predominantly weedy, the habitat may support a wide variety of species transiently, given its connection to a large expanse of forest and associated wetland habitats. It is likely that other areas of this habitat, outside of the project area, are likely to offer areas of higher quality riparian forest, with the potential for hollow bearing trees to occur in remnant stands of vegetation. This community includes Forest Red Gum (*Eucalyptus teretecornis*) and Cabbage Gum (*Eucalyptus amplifolia*), both of which are primary feed tree for the Koala within the North Coast KMA. No koala or koala scats were observed within the project area.

Several bird species were recorded within this habitat, including Brown Thornbill (*Acanthiza pusilla*) in the periphery, Bell Miner (*Manorina melanophrys*), Grey Goshawk (*Accipiter novaehollandiae*), Azure Kingfisher (*Ceyx azureus*) and the White-bellied Sea-eagle (*Haliaeetus leucogaster*).

This habitat is not within the disturbance area and will not be impacted.

iii Waterbodies

a. Dam

A dam exists on the north-east boundary, just outside of the project area. It is shallow in depth and dominated by Cumbungi (*Typha orientalis*) across its entirety. There was very little or no open water present owing to the dense Cumbungi. Around the periphery of the dam, small trees and shrubs were present which are likely to represent a mixture of natural regeneration from adjacent communities and planted speices. These include Prickly-leaved Paperbark, Flax-leaved Paperbark (*Melaleuca linariifolia*) Black She-oak (*Allocasuarina littoralis*) and Bulloak (*Allocasuarina luehmannii*). This habitat it likely to support a number of frog species, with one common species, Eastern Common Froglet (*Crinia signifera*) heard calling.

b. Creek

Swamp Creek occurs north of the project area and is associated with the Riparian Forest described above. The creek bed and banks consists of consolidated silty sand, in slow flowing riffle and pool sequences. The water is relatively turbid and is heavily shaded. Very few macrophytes were observed with some filamentous algae present. It is anticipated that the creek will support a variety macroinvertebrates life and potentially fish species; however, none were observed.



Photograph 3.6 Swamp Creek

iv Exotic Grassland and Cleared Areas

Fauna may occur in these areas on a transient basis; however, they will not be dependent on these habitats and they offer little ecological value.

3.10 Threatened species

3.10.1 Database searches

The Atlas of NSW Wildlife (Bionet) highlighted eight plants, two frogs, 30 birds and 15 mammals listed under the TSC Act within a 10 km radius of the project area (refer to Appendix B and Figures 3.4 and 3.5). The protected matters search tool predicts that 14 plants, four frogs, one reptile, six birds and seven mammals listed under the EPBC Act may occur within 10 km of the project area. The likelihood that these species would occur in the project area was assessed (Appendix B).

3.10.2 Ecosystem credit species

A total of 26 ecosystem credit species were predicted by the BioBanking Credit Calculator. Of these, 11 species were conservatively considered as having the potential to occur within the project area, with the likelihood of occurrence provided in Appendix C.

One ecosystem credit species, the eastern subspecies of the Grey Crowned Babbler, was recorded within the project area. Three species with the maximum species multiplier possible (3.0) were considered as having the potential to occur within the project area; Masked Owl, Powerful Owl and Barking Owl.

3.10.3 Species credit species

A total of 12 species credit species were predicted by the BioBanking Credit Calculator. Their likelihood of occurrence was assessed at Appendix B, and a summary is provided in Table 3.3.

One species credit species, Earp's Gum was recorded within the project area, with 37 individuals recorded. All of the individuals recorded will require clearance for the project.

All of the other species credit species were considered unlikely to occur within the project area, based on habitat assessments or exclusion through targeted surveys. Three of these species are considered unlikely to occur in the project area due to the absence of suitable habitat (see Appendix B, Table B.1); however, will require targeted surveys in November 2016 to confirm their absence. These comprise:

- Eastern Pygmy Possum;
- Green and Golden Bell Frog; and
- Leafless Tongue Orchid.

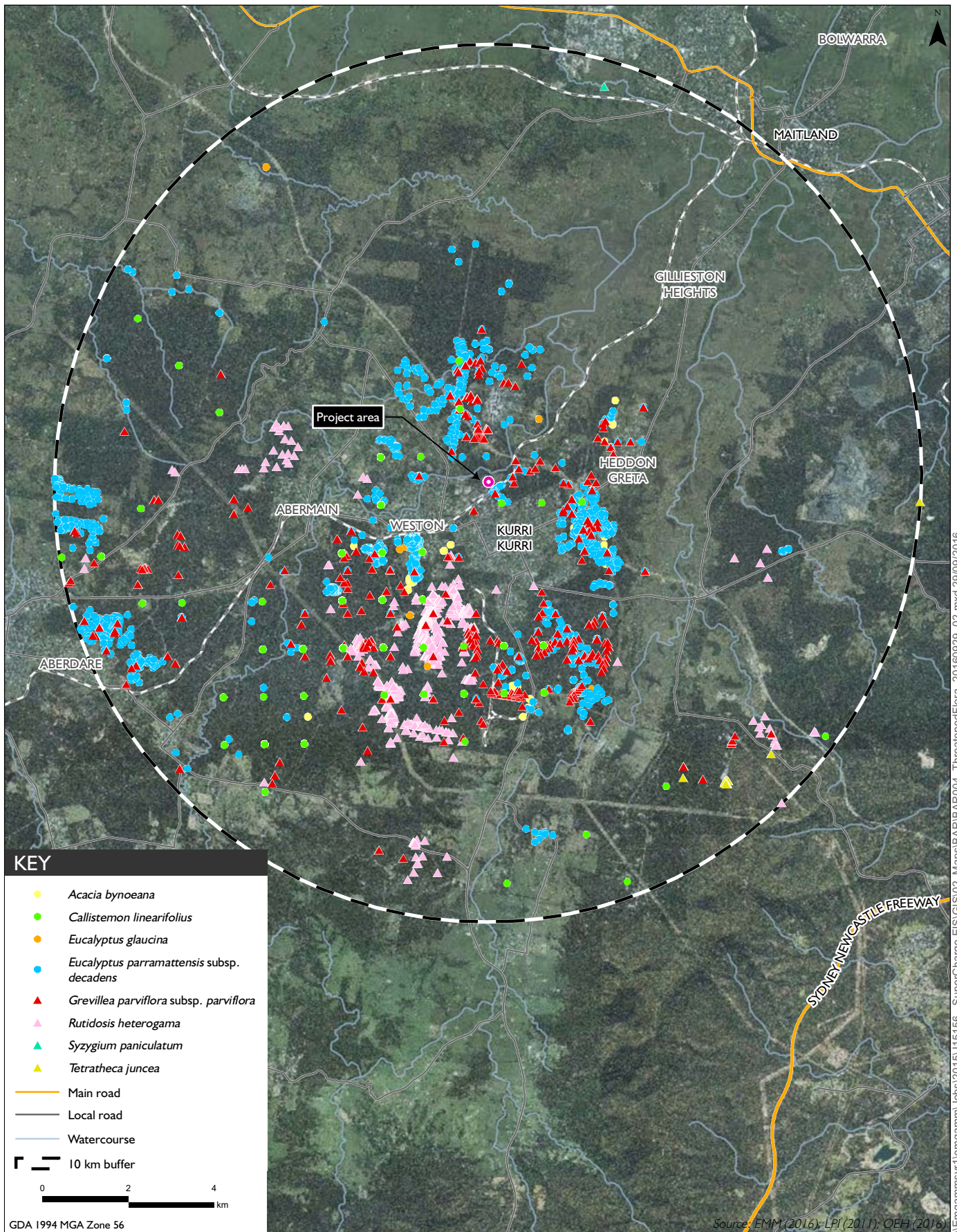
Currently these have been assumed to be absent, and accordingly no species credits have been generated for them. Targeted surveys will be undertaken in November 2016, during the optimal survey period for these species, which is determined by the BioBanking Credit Calculator. This will confirm if the species are indeed absent or, if present, species credits will be calculated and this assessment will be revised.

Table 3.3 Likelihood of occurrence summary for species credit species

Species	Likelihood of occurrence
Green and Golden Bell Frog	Unlikely. No suitable aquatic breeding habitat occurs within the project area.
Eastern Pygmy-possum	Unlikely. Nectivorous resources within the project area are sparse with a paucity of fallen timber and tree hollows which the species requires for shelter.
Koala	Unlikely. No sign of the species was recorded and the project area is fenced which is likely to exclude the species.
Common Planigale	Unlikely. The project area is outside of the species known range.
Bynoe's Wattle	Unlikely. Targeted survey did not record this species.
Netted Bottle Brush	Unlikely. Targeted survey did not record this species.
Leafless Tongue-orchid	Unlikely. The preferred woodland habitat for this species does not exist within the locality.
Rough Doubletail	Unlikely. Targeted survey did not record this species.
Small Snake Orchid	Unlikely. The project area is outside of the species known current range.
Slaty Red Gum	Unlikely. No living Slaty Red Gums were recorded within the project area, with one felled tree observed.
Earps Gum	Recorded. 37 trees were present within the development area, all of which will require clearance.
Small-flower Grevillea	Unlikely. Targeted survey did not record this species.

3.10.4 EPBC Act listed species

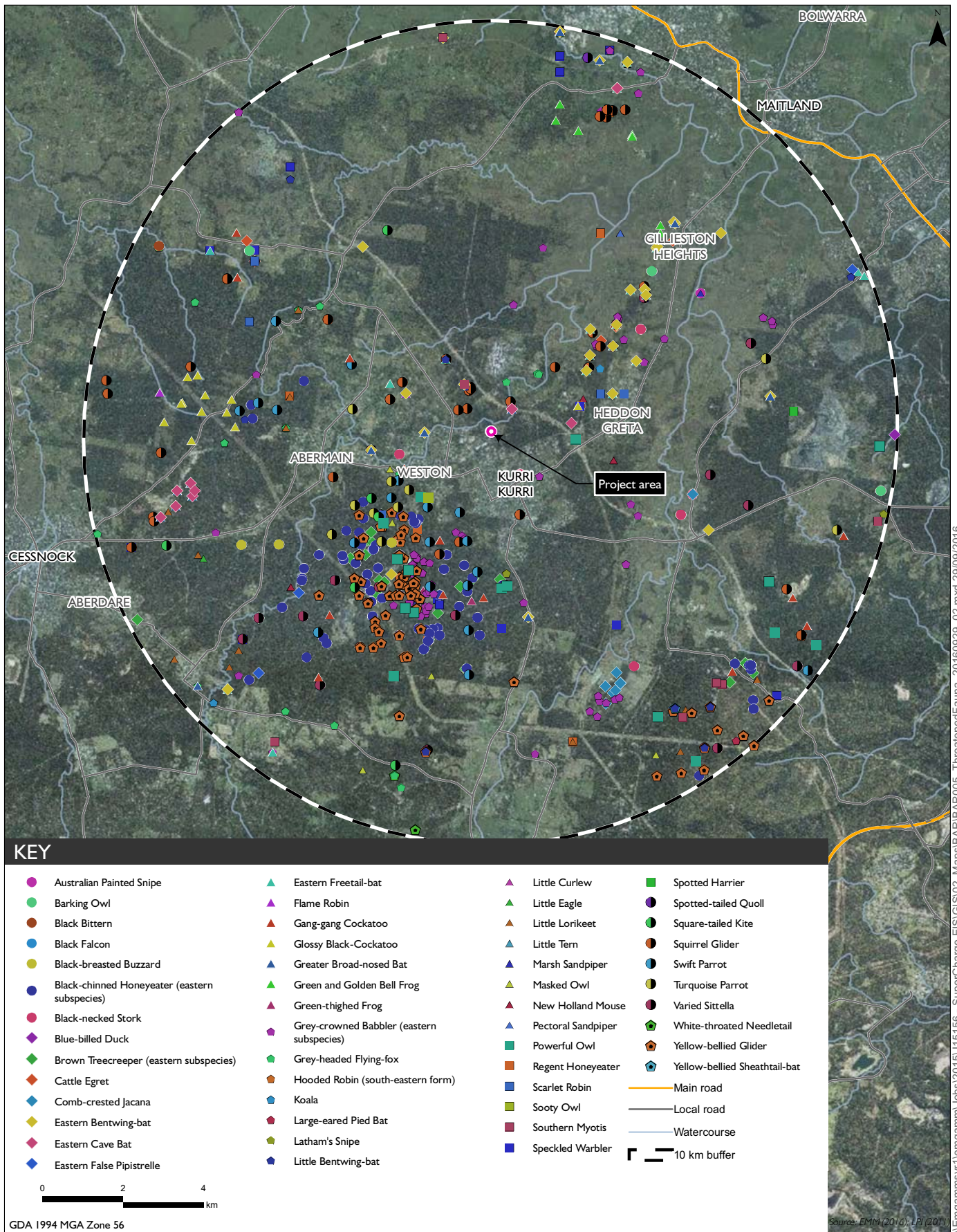
One EPBC Act threatened species, Earps Gum, was recorded in the project area. The likelihood of occurrence for all EPBC listed species are considered in Appendix B with seven species considered as having the potential to occur. These are summarised in Section 4.5 and assessments of significance are provided in Appendix C.



Threatened flora recorded within the locality

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Figure 3.4



Threatened fauna recorded within the locality

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Figure 3.5

4 Impact assessment

4.1 Direct impacts

4.1.1 Clearing of native vegetation and fauna habitat

The project will result in the loss of approximately 0.87 ha of moderate-good condition (woodland) and 0.61 ha (derived grassland) of Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633) to accommodate construction of the project and ancillary infrastructure, including the access roads, carpark, and a storm water basin. This vegetation type is estimated at 75% cleared in the Hunter/Central Rivers major catchment area, and 50.6% in the Cessnock-Kurri Kurri area (see Section 3.4.1). This community corresponds to the River-flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC.

The clearing of 1.48 ha of this vegetation type will only result in a minor increase to the clearing of this community. Clearing only contributes an additional 0.05% reduction of this vegetation type in the Cessnock-Kurri Kurri area.

The clearance of approximately 0.87 ha of the woodland form of Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland will result in the loss of potential foraging habitat for species such as the Yellow-bellied Shearwater, Eastern Pipistrelle, Little Lorikeet and Grey-crowned Babbler. The Grey crowned Babbler also has the potential to nest within the project area. Whilst a small risk, if not carefully managed injury or mortality could occur to fauna during clearing operations, especially if nesting birds are present.

4.1.2 Edge effects

Vegetation cover within the project area is patchy, with woodland areas heavily impacted by edge effects. Adjacent areas of woodland to the south-east of the project area are already subjected to edge effects, as they abut mostly cleared areas. The additional clearance for this project will not significantly increase edge effects given the high level of existing clearance. The woodland to the south-east of the project area has shown resistance to weed invasion despite a number of weed species existing within the project area. This is likely to be due to the intact nature of the woodland with a well developed vegetation structure and coverage of native species. Nevertheless, it is important that the vegetative material containing weeds should be appropriately managed during the construction phase of the project, to avoid invasion of weeds into adjacent habitats.

4.1.3 Indirect impacts

i Introduced species

No introduced fauna species were recorded in the project area, with large mammals such as the European Red Fox (*Vulpes vulpes*) and Feral Pig (*Sus scrofa*), likely discouraged by the chain link fencing which surrounds the project area. Once completed, the project will not provide habitat or a refuge for introduced species and it is not likely to have any effect on their abundance. The project will not provide any new opportunities for introduced species or provide any potential movement corridors which will benefit the species.

ii Noise

The project is adjacent to the aluminium facility which operates continuously. Other industrial sites occur to the south of the project area with roads and railways existing within close vicinity of the project area all of which contribute to background noise.

The project is likely to be in keeping with the surrounding land uses and will not represent a significant increase in ambient noise levels (EMM 2016a). Fauna within the vicinity of the project area are already likely to be acclimatised to industrial noise, and the project is not likely to exclude fauna from occurring in adjacent habitats. The continuous noise generated by the project is likely to enable fauna to acclimatise readily, if required, and considered preferable to sporadic high intensity noise events.

iii Fauna strike

The project is expected to result in a minor increase to traffic volume on the Mitchell Avenue and the adjacent road networks (EMM 2016b). This may also result in a minor increase in fauna strike, particularly for Kangaroos and Wallabies (*Macropus* spp.). The chance of vehicle strike is low immediately adjacent to the project area as traffic speeds are slow, owing to the present of stop signs adjacent to a level crossing. The increase of vehicles is not likely to cause a significant increase in fauna mortality given the already high levels of traffic within the vicinity.

4.2 Impacts requiring offsetting

The site for the project was chosen due to its zoning in an industrial area, its close proximity to road networks and the relatively high levels of existing disturbance within the project area. In order for the recycling facility to be able to process the required tonnage, the facility would be required to utilise almost the entire of the project area, limiting the ability to avoid constrained areas. The exception to this is in the north of the project area where a storm water basin has been moved from the north-western corner of the project area to the north-eastern boundary. This avoids the requirement to clear any riparian forest which corresponds with River-flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC. Further discussion on alternatives is provided in Section 5.1 of this report, and the EIS.

Despite disturbance within the site, patches of native woodland and native grassland exist which have a site score of greater than 17 (Table 3.2). Potential habitat for threatened species also exists within the woodland areas. For these reasons, offsetting is required in accordance with Section 3.3.1.3 of the FBA.

Direct impacts to biodiversity include vegetation clearing, loss of fauna and flora habitat, as well as possible habitat fragmentation, edge and barrier effects and fauna injury and mortality. Impacts will be restricted to the disturbance area.

The project would directly impact the following vegetation communities and potential habitat for ecosystem and species credit species:

- approximately 0.87 ha of moderate to good condition Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633);
- approximately 0.61 ha of moderate to good condition Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633) in a derived grassland form; and
- approximately 1.56 ha of habitat for Earps Gum.

Areas requiring offset are shown on Figure 4.1.

4.3 Areas that do not require offsets

Exotic grassland and cleared areas (described in Section 3.5) do not require further assessment or offsetting, as they cannot be attributed to any native PCT, or do not contain any native vegetation. Areas that do not require offsets are shown on Figure 4.2.

4.4 Matters for further consideration

No impacts related to the project meet the thresholds for matters for further consideration in accordance with Section 9.2.1.3 the FBA.

4.5 Impacts not assessed under the FBA

4.5.1 Groundwater dependent ecosystems and riparian areas

The SEARS require that GDEs are identified and any impacts likely to result from the project to be identified. The Atlas of Groundwater Dependent Ecosystems (BOM 2016) does not identify any GDEs in the project area. The River-flat Eucalypt Forest EEC, associated with Swamp Creek north of the project area may be supplemented by ground water flow and may be considered partially groundwater dependant.

The project will result an increase in the amount of impervious areas, given that the majority of the site will be buildings and hardstands. Runoff from these sources will be retained in a storm water basin to reduce contamination, with any discharges limited to clean water. The impact of these minor hydrological changes are not likely to significantly affect any GDEs, especially as the project comprises a very small proportion of the Swamp Creek catchment area. There are large vegetated, permeable areas in the vicinity of the project area which maintain groundwater recharge. In addition, groundwater will not be accessed for the project.

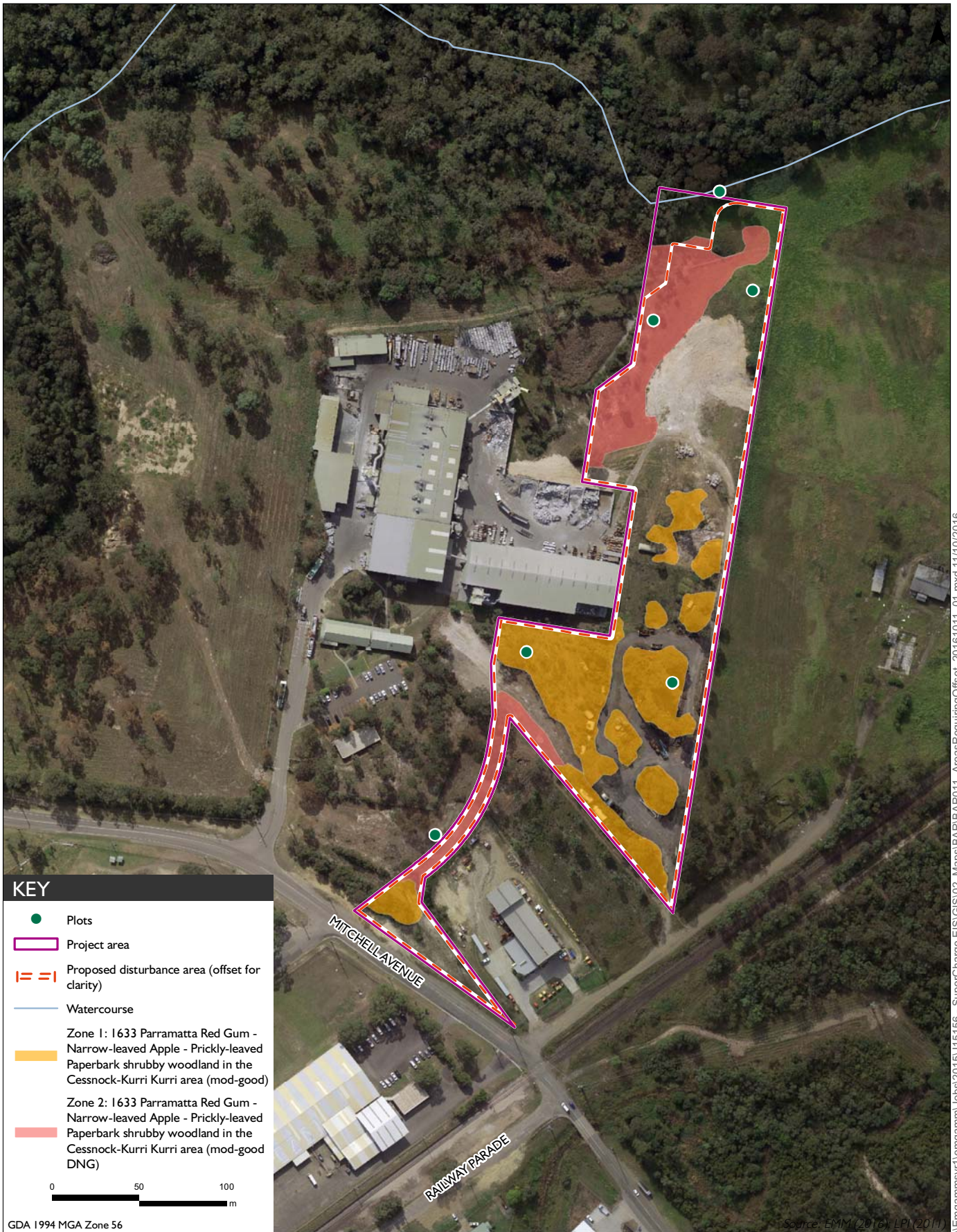
4.6 Matters of national environmental significance

A referral was prepared to address potential impacts of the project on MNES. The referral was lodged with DoEE on 21 September 2016. The following sections describe potential impacts of the project on MNES, as presented in the referral.

4.6.1 Threatened species

Assessments of significance were prepared for the following eight species (refer to Appendix C), in accordance with *Matters of National Environmental Significance: Significant impact guidelines 1.1 EPBC Act* (Commonwealth of Australia 2013):

- Slaty Red Gum (*Eucalyptus glaucina*);
- Earp's Gum (*Eucalyptus parramattensis subsp. decadens*);
- New Holland Mouse (*Pseudomys novaehollandiae*);
- Grey-headed Flying-fox (*Pteropus poliocephalus*);



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Areas that require offset
Kurri Kurri Battery Recycling Facility
Biodiversity Assessment Report

Figure 4.1



Areas that do not require offset

Kurri Kurri Battery Recycling Facility
Biodiversity Assessment Report

Figure 4.2

- Large-eared Pied Bat (*Chalinolobus dwyeri*);
- Green and Golden Bell Frog (*Litoria aurea*);
- Swift Parrot (*Lathamus discolor*); and
- Regent Honeyeater (*Anthochaera phrygia*).

All of the assessments concluded that there would be no significant impact on each respective MNES.

Habitat in the project area is unlikely to be important for the fauna species listed above, given the lack of optimal habitat (refer to Appendix B). If these species occur, it is likely to be on a transient basis only.

One felled Slaty Red Gum was recorded within the project area during the May 2016 site survey. However, no extant trees were found within the other areas of remnant vegetation within the project area and, therefore, no extant individuals will be impacted.

The key reason for submitting a referral is the requirement to clear Earps Gum. The population of Earp's Gum within the project area consists of 37 trees which are clustered in small patches of woodland or occur as scattered trees. It is likely that all of these trees will be cleared for the project. The trees within the project area are considered to be part of a large important population in accordance with the *Significant impact guidelines 1.1* (Commonwealth of Australia 2013). However, the Earp's Gum within the project area are not considered necessary for the long-term survival and recovery of this important population.

Habitat for Earps Gum within the project area consists of highly degraded and cleared land. There is little opportunity for this species to increase its extent in the project area, and recruitment was absent or occurring at very low levels. The subspecies viability within the project area is uncertain in the long term due to ongoing disturbance. The removal of the 37 trees will constitute a very small proportion of the important Kurri Kurri-Cessnock population and this impact is not considered significant.

A total of 15 migratory species were predicted by the PMST. Of the fifteen species assessed, seven were considered as having the potential to occur within the project area (Appendix B, Table B.1). Several of these species, such as the Fork-tailed Swift (*Apus pacificus*) and White-throated Needletail (*Hirundapus caudacutus*), have very large ranges with generalist habitat requirements and non-specific foraging requirements. The amount of vegetation clearance is likely to be negligible for these species and the project area does not offer particularly high quality habitat.

Several other migratory species have the potential to occur in the riparian forest only. This habitat, which only occurs on the northern boundary of the project area, will not be impacted by the project and, therefore, no impacts are anticipated.

There are no habitat values within the project area which are likely to be important for migratory species, nor any features which may cause large proportions of a species population to occur, such as a wetland. Therefore, the proposal will not have any significant impacts on any migratory species listed under the EPBC Act and no assessments of significance were produced.

4.6.2 Threatened ecological communities

Three EPBC listed TECs were predicted by the PMST to occur in the region. No EPBC listed EEC's were recorded. Justification for their absence is provided in the following sections.

i Central Hunter Valley eucalypt forest and woodland

The canopy of Central Hunter Valley eucalypt forest and woodland is dominated by one or more of the following four eucalypt species; Narrow-leaved ironbark (*Eucalyptus crebra*), Spotted Gum (*Corymbia maculata*), Slaty Gum (*E. dawsonii*) and Grey Box (*E. moluccana*). None of these species occur within the project area and, therefore, the community does not occur.

ii Hunter Valley Weeping Myall (*Acacia pendula*) Woodland

The tree canopy of Hunter Valley Weeping Myall Woodland is dominated by Weeping Myall (*Acacia pendula*), which was not recorded within the community and, therefore, this community does not occur.

iii White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland:

This canopy of White Box-Yellow Box-Blakely's Red Gum Woodland and Derived Native Grassland is dominated by White Box Yellow Box and Blakely's Red Gum community, none of which occur within the project area. Any grassland within the project area is derived from PCT Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area, rather than this community.

4.6.3 Nationally important wetlands

No wetlands of international importance (declared Ramsar wetlands), occur within the project area. The Hunter Estuary Wetlands Ramsar site (no. 24), occurs approximately 45 km downstream of the project area, via Swamp Creek, Wallis Creek and the Hunter River. The Hunter Estuary Wetlands Ramsar site is comprised of two components, Kooragang and Hunter Wetlands Centre Australia. The Kooragang component of the Hunter Estuary Wetlands Ramsar site is located in the estuary of the Hunter River, approximately 7 km north of Newcastle. Hunter Wetlands Centre Australia is 2.5 km from Kooragang. Although the sites are not contiguous they have significant linkages, hydraulically and by a vegetated wildlife corridor consisting of Ironbark Creek, the Hunter River and Ash Island (DoEE 2016).

The wetland will not be modified by the project, with the closest infrastructure over 50 m from the watercourse. Riparian vegetation either side of the creek will not be impacted by the project, with all clearance of riparian vegetation avoided through the design.

The ULAB recycling facility will store and process a number of imported materials, including ULAB and other chemicals, some of which may be classified to be hazardous requiring appropriate management. As a result there is potential for the project to export pollutants to the surrounding environment through a range of mechanisms, including stormwater runoff, accidental spills and leaks and airborne mobilisation of particulates. In recognition of these potential risks, the following stormwater management principles have been integrated into the project layout and concept design that has been prepared by the proponent, Pymore:

- All ULAB storage and processing will be undertaken in enclosed and bunded buildings.
- All wash-down water and water collected in building sumps will be separated from the stormwater drainage system.
- A stormwater management system will be established that captures initial runoff from the site in a Stormwater Capture Basin.

- A water treatment plant will be constructed to treat captured stormwater and all wash-down water produced. Treated water will be used in the ULAB recycling process.
- The stormwater drainage system will be designed to capture any accidental spills or fire water that may be produced in the event of a major fire at the site.

Importantly, the ULAB recycling process is a net user of water, and no liquid by-products are produced. This characteristic enables a contained surface water management system to be established, whereby stormwater runoff and wash-down water is captured and used in the ULAB recycling process. This eliminates any liquid waste streams and substantially reduces the volume of stormwater runoff that will be discharged from the site.

Water balance modelling undertaken to support the NSW EIS concluded that stormwater harvesting will reduce runoff volumes by between 49% (wet year) and 81% (dry year). The calculated long term average reduction is 60% of runoff. The stormwater system is designed to capture initial runoff during a rainfall period, which is more likely to contain elevated concentrations of pollutants than runoff that occurs after substantial rainfall. As a result, the stormwater capture and harvesting system is expected to substantially reduce any pollutant loads from the facility.

As noted above, the ULAB recycling process is a net user of water, and no liquid by-products are produced. Accordingly, the only waste water produced by the project will be from site amenities. Pymore propose to apply to Hunter Water Corporation to have the site connected to the local sewer. Accordingly, all waste water produced on-site will be discharged to the sewer. Pymore does not propose to discharge trade waste to the sewer.

The site drainage system will drain under gravity to the Stormwater Capture Basin. The Stormwater Capture Basin will be dewatered via pumping to the Untreated Water Holding Basin and will generally provide 510 m³ of storage. Accordingly, any spill or fire water discharge that enters the stormwater system is likely to be contained on-site in the Stormwater Capture Basin. It is noted that the volume of any spill or fire water produced would be substantially less than 510 m³.

If a spill or fire were to occur when the Stormwater Capture Basin is full (i.e. during or shortly after a substantial rainfall event), additional emergency storage could be achieved by manually blocking the detention basin outlet with sandbags.

The Stormwater Capture Basin is designed to capture initial runoff during a rainfall period, which is more likely to contain elevated concentrations of pollutants than runoff that occurs after substantial rainfall. As a result, there are not anticipated to be any significant changes to flows or changes to the water quality of Swamp Creek as a result of the project. Furthermore, the Ramsar site is a significant distance downstream with very large dilution factors involved. There will be no impact to the Ramsar wetlands as a result of the project.

An assessment of significance was completed for the Hunter Estuary Wetlands Ramsar site in accordance with the significant impact criteria for wetlands of international importance (Appendix C). The assessment concluded that impacts were unlikely to be significant for the Hunter Estuary Wetlands as the Ramsar site is located a significant distance downstream, with very large dilution factors involved. Any stormwater discharged from the site will have minimal contaminants owing to the proposed stormwater management system.

5 Impact avoidance and mitigation

5.1 Avoidance and minimisation

Selecting a site for the project required consideration of the following:

- appropriate landuse zoning;
- access to required services (water, gas and electricity); and
- proximity to major regional and State transport routes.

This limits the number of potential sites available for the project.

The project area has small patches of vegetation remaining; however the majority of the site is heavily disturbed. The proposed disturbance area occupies almost the entire project area; therefore, the scope to avoid areas of biodiversity value is limited. The exception to this is in the north of the project area where the storm water basin has been moved from the north-western corner of the project area to the north-eastern boundary. This avoids the requirement to clear any riparian forest (PCT: 1594 Cabbage Gum-Rough-barked Apple grassy woodland on alluvial floodplains of the lower Hunter). This community is a TSC Act listed EEC.

The community is not EPBC listed; however, it may provide habitat for EPBC listed species such as the Koala (*Phascolarctos cinereus*) given the presence of feed tree species. However, no evidence of Koala presence was detected during the field surveys. The habitat is also part of a continuous band of vegetation along Swamp Creek and is likely to act a biodiversity corridor.

The avoidance of this community will avoid any impacts occurring to the riparian forest and associated fauna habitat. The alternative location for the storm water basin was chosen in an area of exotic grassland with very low biodiversity value.

5.2 Mitigation

The mitigation measures in Table 5.1 will be implemented to minimise impacts of the project on biodiversity values.

Table 5.1 Mitigation measures

Impact	Environmental safeguard	Responsibility	Timing
Direct impact			
Clearing of native vegetation	The clearing limits are to be clearly delineated in the field. This is especially pertinent to the northern area of the site where all direct impacts on River Flat Eucalypt EEC will be avoided.	Construction manager	Prior to and during vegetation clearing
	The final design will be reviewed to determine if any Earps Gum can be retained. If any Earps Gum can be retained, an ecologist will mark them in the field and they will be fenced for the duration of the construction period.	Construction manager	Prior to and during vegetation clearing
Fauna injury and mortality	A clearing procedure will be prepared which details the methods to be implemented during clearing, including: <ul style="list-style-type: none"> • felling of hollow-bearing trees in the project area will follow a two-stage clearing protocol, where surrounding non-hollow vegetation is cleared 24 hours prior to the hollow trees to allow fauna time to move. 	Construction manager	Prior to and during works
	<ul style="list-style-type: none"> • Preclearance surveys should be completed to determine if any nesting birds are present. 	Construction manager	Prior to clearance
	<ul style="list-style-type: none"> • a suitably trained fauna handler will be present during hollow-bearing tree clearing to rescue and relocate displaced fauna if found on site. 	Construction manager	Prior to and during works
Indirect impact			
Erosion and sedimentation	Appropriate sediment and erosion controls will be implemented to ensure that there are no off-site impacts resulting from the recycling facility, particularly to Swamp Creek.	Construction manager Construction staff	Prior to, during, and following completion of works

6 Biodiversity credit report

6.1 Quantification of impacts

The impacts of the project were assessed according to the FBA and associated BioBanking Credit Calculator. This method allows for impacts on native vegetation and threatened flora and fauna to be quantified, so that a suitable and proportionate offset can be identified. The method details the offset requirements in terms of ecosystem and species credits.

Two vegetation zones were identified within the project area and both had site value scores of >17:

- Zone 1 Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633); and
- Zone 2 Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area, derived grassland form (PCT 1633).

Several ecosystem credit species were identified as having a low to moderate potential to occur in the project area and, therefore, have been assumed to be present in accordance with the FBA. The calculations assume that the vegetation to be impacted contains suitable habitat for the species outlined in Table 2.3. The species associated with both PCTs with the highest threatened species multiplier was the Barking Owl at 3.0, with the Powerful Owl and the Masked Owl also presenting the same multiplier.

A total of 58 ecosystem credits are required to compensate for the project's impacts on PCT 1633 and threatened species habitat (Table 6.1). A full Biobanking Calculator Credit Report is provided at Appendix D,

Table 6.1 Ecosystem credits required

Vegetation zone	PCT	Area (ha)	TEC?	Site value score	Ecosystem credit species with the highest multiplier	Credits required to offset impact
1	1633	0.87	Yes	50.67	Barking Owl - 3.0	38
2	1633	0.61	Yes	37.33	Barking Owl - 3.0	20
Total		1.48				8

One species credit species was recorded within the project area with the calculated species credits presented in Table 6.2.

Table 6.2 Species credits required

Scientific name	Common name	Threatened species offset multiplier	Species credits required
<i>Eucalyptus parramattensis subsp. decadens</i>	Earp's Gum	1.4	518
Total			518

Several species credit species were considered unlikely to occur within the project area, based on habitat assessment (Appendix B, Table B.1). These comprise:

- Common Planigale;
- Eastern Pygmy Possum;
- Green and Golden Bell Frog;
- Leafless Tongue Orchid; and
- Small Snake Orchid.

These species have been assumed absent in this assessment, and no credits have been calculated. Targeted surveys will be undertaken in November 2016, during the optimal survey period for these species which will confirm if the species are indeed absent. If present, species credits will be recalculated and reflected in the biodiversity offset package to be developed for the project.

7 Biodiversity offset strategy

7.1 Strategy

A biodiversity offset strategy will be prepared to identify offsets to compensate for the project's impacts. Preparation of this strategy will involve the following steps:

1. Identifying if suitable credits are available on the market to meet offset requirements;
2. Finding potential offset sites with the biodiversity values required to compensate for the project's impacts;
3. In the absence of suitable offset credits or properties, applying the variation criteria rules of the FBA and finding suitable offsets to meet the requirements and
4. payment into the BioBanking Trust Fund.

The BioBanking credit register was searched on 10 October 2016 for ecosystem credits issued for PCT 1633 and species credits for Earps Gum. No suitable ecosystem or species credits were available on the register at this time. Therefore, option 3 of the offset strategy will be considered.

Regional vegetation mapping indicates that a large patch of PCT 1161, which would also include Earps Gum as its main canopy species, occurs proximal to the project area, and directly north of Northcote St and south of the Hunter Expressway. Areas such as these will be investigated to determine if they are available for purchase as a land-based offset (ie option 2 of the offset strategy).

If a suitable offset area cannot be found that contains PCT 1161, the variation criteria will be applied (option 3 of the offset strategy, see Section 7.2). The BioBanking credit report states that PCT 1658 Rough-barked Apple - Narrow-leaved Ironbark - Blakely's Red Gum - Bull Oak - Coast Banksia woodland on sands of the Warkworth area would also form a suitable offset for the project. However, this PCT would not contain Earps Gum and, therefore, if this option is taken, species credits would have to be found elsewhere for Earps Gum.

If a land-based offset is not possible, a discussion would be held with OEH to determine if the proponent could pay into the BioBanking Trust Fund.

The biodiversity offset strategy will be finalised in consultation with OEH and Department of Planning and Environment (DP&E) within 12 months of obtaining project approval. Finalising the offset strategy post approval is driven by the need to obtain project approval prior to the client purchasing the site, as they are not currently the landowner. The land purchase contract is conditional on consent being granted for the project.

7.2 Application of the variation criteria

Under the FBA, the offset rules can be varied to match ecosystem credits, using credits generated by a PCT from the same vegetation formation as the PCT to which the required ecosystem credit relates. Where possible and if needed, the variation rules will be applied to the project and suitable PCTs in the same vegetation class will be identified prior to matching by formation. The application of the variation criteria, if needed, will be completed in consultation with OEH and DP&E.

7.3 Offset security

Any property identified for offsetting will be secured under a BioBanking agreement, in accordance with the FBA (OEH 2014).

8 Conclusion

The biodiversity values in the project area were assessed in accordance with the FBA. The project area has been previously disturbed by the storing of heavy machinery, dumping of fill, and laying of gravel tracks and hardstands. A total of 1.47 ha of native vegetation will be cleared in order to construct the recycling facility and associated infrastructure.

One PCT was identified the project area, Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633). This community occurs as patchy, partially cleared woodland in the central to southern regions of the project area, occupying 0.87 ha. A derived grassland form of this woodland also occurs within the project area occupying 0.61 ha. This is considered part of the same PCT as it has similar characteristic species and the potential to regenerate. This PCT corresponds to the Kurri Sand Swamp Woodland in the Sydney Basin Bioregion EEC, although does not confirm to any EPBC act TECs.

The woodland within the project area has the potential to support a range of ecosystem credit species (fauna), with one threatened species, the Grey-crowned Babbler recorded during the field surveys. The project's impacts on these communities and ecosystem credit species will be offset in accordance with the FBA.

One species credit species will be impacted by the project; Earp's Gum of which 37 individuals will be removed. This species is also listed as vulnerable under the EPBC. Assessments of significance for this species has concluded no significant impact, however a referral has been submitted to DoEE on a conservative basis. No other species credit species are anticipated to occur within the project area, however, further targeted surveys will be conducted in November 2017 within the optimal survey season to confirm this.

Construction of the project has the potential to result in direct and indirect impacts on biodiversity, including the clearing of native vegetation and habitat, erosion and sedimentation and weed invasion if not managed appropriately. A number of environmental safeguards have been proposed and these would minimise and/or mitigate potential biodiversity impacts from the project.

A total of 58 ecosystem credits and 518 species credits (Earp's Gum) are required to offset the project's impacts in accordance with the FBA. Investigations are underway to secure a suitable offset for the project. The biodiversity offset strategy for the project will be finalised in consultation with OEH, DP&E and DPI – Lands within 12 months of project approval.

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Appendix A

Field Data

Table A.1 Plot and opportunistic flora data

Scientific name	Common name	Cover abundance						Incidentally recorded species
		Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	
<i>*Ambrosia tenuifolia</i>	Lacey Ragweed			3		2	3	
<i>*Anagallis arvensis</i>	Scarlet Pimpernel					1		
<i>*Asparagus plumosus</i>	Climbing Asparagus Fern							X
<i>*Bidens pilosa</i>	Farmers Friend	1				2		
<i>*Briza maxima</i>	Quaking Grass	2						
<i>*Cestrum parqui</i>	Green Cestrum					2	1	
<i>*Cestrum nocturnum</i>	Lady-of-the-Night				1		1	
<i>*Chloris gayana</i>	Rhodes Grass		3	1				
<i>*Cinnamomum camphora</i>	Camphor Laurel			1	1	3		
<i>*Conyza sp.</i>		2	2					
<i>*Coryeopsis lanceolata</i>	Tickseed		2	1				
<i>*Cyperus sp.</i>						2		
<i>*Eragrostis curvula</i>	African Lovegrass		3					
<i>*Eragrostis erecta</i>	Panic Veldtgrass					3		
<i>*Hydrocotyle bonariensis</i>	Largeleaf Pennywort					2		
<i>*Hypochaeris radicata</i>	Catsear			2	2			
<i>*Hypochaeris radicata</i>	Catsear							X
<i>*Ligustrum sinense</i>	Small-leaved Privet			2		1		
<i>*Melinis repens</i>	Red Natal Grass							X
<i>*Olea europaea subsp. europaea</i>	European Olive			4				
<i>*Onopordum acanthium</i>	Scotch Thistle					1		
<i>*Panicum capillare</i>	Witchgrass	2						
<i>*Panicum sp.</i>	Panic Grass					2		
<i>*Paspalum dilatatum</i>	Paspalum	3	2	3			6	
<i>*Passiflora sp.</i>	Passionvine species					2		
<i>*Phytolacca octandra</i>	Inkweed					1		

Table A.1 Plot and opportunistic flora data

Scientific name	Common name	Cover abundance						Incidentally recorded species
		Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	
<i>*Plantago lanceolata</i>	Narrow-leaved Plantain		1	2			2	
<i>*Richardia stellaris</i>			1					
<i>*Rubus fruticosus aggregate</i>	Blackberry		2				1	
<i>*Senecio madagascariensis</i>	Fireweed	1	1	1	1			
<i>*Senna pendula var. glabrata</i>	Easter Cassia			1				
<i>*Setaria parviflora</i>	Pigeon Grass	4	4					
<i>*Setaria sp.</i>	Pigeon Grass			1			2	X
<i>*Sida rhombifolia</i>	Paddy's Lucerne					2	1	
<i>*Solanum mauritianum</i>	Tree Tabacco					2		
<i>*Solanum nigrum</i>	Black Nightshade						1	
<i>*Sonchus olearaceus</i>	Sowthistle							X
<i>*Tradescantia fluminensis</i>	Trad					5		
<i>*Verbena bonariensis</i>	Purpletop					3	2	
<i>Acacia elongata</i>	Swamp Wattle							X
<i>Acacia falcata</i>	Sickle Wattle							
<i>Acacia implexa</i>	Hickory Wattle		3					X
<i>Acacia longifolia</i>	Sydney Golden Wattle					1		
<i>Acacia podalyriifolia</i>	Silver Wattle							
<i>Acacia ulicifolia</i>	Prickly Moses			2	2			X
<i>Acacia parvipinnula</i>	Silver-stemmed Wattle							X
<i>Adiantum sp.</i>	Maidenhair Fern					2		X
<i>Allocasuarina littoralis</i>	Black She-oak		3					
<i>Allocasuarina luehmannii</i>	Bulloak		3					
<i>Alternanthera denticulata</i>	Lesser Joyweed					2		X
<i>Angophora bakeri</i>	Narrow-leaved Apple							
<i>Angophora floribunda</i>	Rough-barked Apple					3		

Table A.1 Plot and opportunistic flora data

Scientific name	Common name	Cover abundance						Incidentally recorded species
		Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	
<i>Anisopogon avenaceus</i>	Oat Speargrass							
<i>Aristida ramosa</i>	Purple Wiregrass				3			X
<i>Aristida vagans</i>	Three-awned Wiregrass				3			
<i>Aristida warburgii</i>			3					
<i>Banksia integrifolia</i>	Coastal Banksia			3				X
<i>Bursaria spinosa</i>	Native Blackthorn					2		X
<i>Callistemon linearis</i>	Narrow-leaved Bottlebrush						X	X
<i>Callistemon pinifolius</i>	Pine-leaved Bottlebrush		1					
<i>Cassinia uncata</i>	Sticky Cassinia		2					
<i>Cassytha glabella</i>	Devils Twine		1					
<i>Casuarina cunninghamiana</i>	River Sheoak					2		
<i>Casuarina glauca</i>	Swamp Oak		3	2				
<i>Centella asiaticus</i>						2		
<i>Cheilanthes sieberi</i>	Poison Rock Fern	3	1		1			X
<i>Chrysocephalum apiculatum</i>	Yellow buttons				1			
<i>Clematis glycinoides</i>	Headache Vine					1		
<i>Cotula australis</i>	Carrot Weed			1				
<i>Cyathochaeta diandra</i>				1				X
<i>Cymbopogon refractus</i>	Barbed Wire Grass		2					
<i>Cynadon dactylon</i>	Couch	4	3	1	2		3	
<i>Desmodium varians</i>	Slender Tick Trefoil					1		
<i>Deyeuxia quadriseta</i>		1						
<i>Dianella caerulea</i>	Blue Flax-lilly					1		X
<i>Dianella revoluta var. revoluta</i>	Blueberry Lily	2	1	3	2			X
<i>Dichondra repens</i>	Kidney Weed					1		
<i>Digitaria ramularis</i>		3						X

Table A.1 Plot and opportunistic flora data

Scientific name	Common name	Cover abundance						Incidentally recorded species
		Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	
<i>Dillwynia retorta</i>	Bacon and Eggs	2		1				
<i>Echinopogon sp</i>	Hedgehog Grass					2		X
<i>Entolasia stricta</i>	Wiry Panic				3			
<i>Eragrostis brownii</i>	Brown's Lovegrass	2	2					
<i>Eragrostis sp</i>	Lovegrass				3			
<i>Eucalyptus agglomerata</i>	Blue-leaved Stringybark			2	2			
<i>Eucalyptus amplifolia</i>	Cabbage Gum		1					
<i>Eucalyptus canaliculata</i>				2				
<i>intermediate Eucalyptus punctata</i>	Grey Gum							
<i>Eucalyptus capitellata</i>	Brown Stringybark							
<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	3						
<i>Eucalyptus parramattensis subsp. decadens</i>	Earp's Gum	2		4				X
<i>Eucalyptus teretecornis</i>	Forest Red Gum					2		
<i>Eucalyptus glaucina</i>	Slaty Red Gum							
<i>Glycine tabacina</i>	Variable Glycine					2		
<i>Grevillea sericea subsp. sericea</i>	Silky Grevillea	2						
<i>Haemodorum planifolium</i>	Blood Root							
<i>Hakea sericea</i>	Needlebush		2					
<i>Hibbertia linearis</i>								
<i>Hibertia sp</i>					1			
<i>Hydrocotyle sibthorpioides</i>						1		
<i>Imperata cylindrica</i>	Spiny-headed Mat-rush							
<i>Isopogon anemonifolius</i>	Broad-leaf Drumsticks							
<i>Jacksonia scoparia</i>	Dogwood							
<i>Juncus usitatus</i>		2		3				

Table A.1 Plot and opportunistic flora data

Scientific name	Common name	Cover abundance						Incidentally recorded species
		Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	
<i>Lagenophora stipitata</i>	Blue Bottle-daisy	1	1					
<i>Lambertia formosa</i>	Mountain Devil							
<i>Lasiopetalum parviflorum</i>	Scaly Phebalium				1			
<i>Leptospermum morrisonii</i>			1					
<i>Leptospermum polygalifolium</i>	Tantoon					1		
<i>Leptospermum rotundifolia</i>	Round Leaf Tea-tree							
<i>Lomandra brevis</i>	Tufted Mat-rush				2			
<i>Lomandra confertifolia</i>	Mat-rush		2					
<i>Lomandra cylindrica</i>	Needle Mat-rush							
<i>Lomandra filiformis</i>	Wattle Mat-rush							
<i>Lomandra glauca</i>	Pale Mat-rush							
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush			2		2		
<i>Melaleuca armillaris</i>	Bracelet Honey-myrtle			3				
<i>Melaleuca linariifolia</i>	Narrow-leaved Paperbark		2	2	2			
<i>Melaleuca nodosa</i>	Prickly-leaved Paperbark	2	2	2				
<i>Melaleuca sieberi</i>	Siebers Paperbark			1	2			
<i>Melaleuca thymifolia</i>	Thyme Honey-myrtle			2				
<i>Notelaea longifolia</i>	Large Mock-olive							
<i>Notelaea ovata</i>		2						
<i>Oplismenus sp.</i>	Basket Grass					3		
<i>Oxalis perennans</i>		2						
<i>Oxalis sp</i>								
<i>Oxalis thompsoniae</i>		1						
<i>Ozothamnus diosmifolius</i>	Sago Bush	1						
<i>Panicum simile</i>	Two-colour Panic	3	3					
<i>Parsonsia straminea</i>	Monkey Rope			1				

Table A.1 Plot and opportunistic flora data

Scientific name	Common name	Cover abundance						Incidentally recorded species
		Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	
<i>Paspalidium distans</i>								
<i>Patersonia sericea</i>	Silky Purple-flag							
<i>Persicaria decipiens</i>	Slender Knotweed					1		
<i>Persoonia linearis</i>	Narrow-leaved Geebung							
<i>Pimelea linifolia</i>	Slender Rice Flower		1		1			
<i>Pomaderris sp.</i>								
<i>Pomax umbellata</i>			1					
<i>Pratia purpurascens</i>		3						
<i>Pteridium esculentum</i>	Bracken			1		4	4	
<i>Rubus parvifolius</i>	Native Raspberry					1		
<i>Rytidosperma fulvum</i>	Wallaby Grass	4	3	1				
<i>Rytidosperma pallidum</i>	Silvertop Wallaby Grass	3						
<i>Tricoryne elatior</i>	Yellow Autumn-lily		1					
<i>Velleia spathulata</i>		1						
<i>Xanthorrhoea glauca</i>	Grass Tree							

Notes 1. *denotes introduced species

2. Key to cover abundance - 1 - <5%, few individuals, 2 - <5%, many individuals, 3 - 5 - 25%, 4 - 26-50%, 5 - 51-75%, 6 - 76-100%

3. Key to incidental records - X – present

Table A.2 **Transect data**

Transect /plot	Native plant species	Native canopy cover	Native midstorey cover	Native ground cover (grass)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
1	22	12.5	0	60	0	10	10	0	1	4	357436	6369177	56
3	25	0	5	50	0	10	10	0	1	0	357440	6369401	56
4	22	11.5	4.4	40	0	10	50	0	1	0	357352	6369194	56
5	16	1	0	50	0	0	10	0	1	0	357300	6369090	56

Table A.3 Fauna recorded within the project area

Scientific Name	Common Name	EPBC Act	TSC Act	Comment
Frogs				
<i>Crinia signifera</i>	Eastern Common Froglet			
Birds				
<i>Acanthiza pusilla</i>	Brown Thornbill			
<i>Accipiter novaehollandiae</i>	Grey Goshawk			Observed, flying over riparian forest off-site.
<i>Alisterus scapularis</i>	Australian King-Parrot			
<i>Anas superciliosa</i>	Pacific Black Duck			Observed, flying over the project area and did not land.
<i>Ceyx azureus</i>	Azure Kingfisher			Riparian woodland, outside project area
<i>Corvus coronoides</i>	Australian Raven			
<i>Cracticus nigrogularis</i>	Pied Butcherbird			
<i>Cracticus tibicen</i>	Australian Magpie			
<i>Haliaeetus leucogaster</i>	White-bellied Sea Eagle			Observed, flying along Swamp Creek, off-site
<i>Malurus cyaneus</i>	Superb Fairy Wren			
<i>Manorina melanocephala</i>	Noisy Miner			Very abundant throughout the project area.
<i>Manorina melanophry</i>	Bell Miner			Aural record, within riparian forest, offsite
<i>Platycercus eximius</i>	Eastern Rosella			
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler		V	Two birds observed during August 2016 survey.
<i>Rhipidura albiscapa</i>	Grey Fantail			
<i>Threskiornis spinicollis</i>	Straw-necked Ibis			Outside of the project area
<i>Trichoglossus moluccanus</i>	Rainbow Lorrikeet			
Mammals				
* <i>Lepus europaeus</i>	Brown Hare			Outside of the project area
<i>Macropus giganteus</i>	Eastern Grey Kangaroo			Outside of the project area
<i>Macropus rufogriseus</i>	Red-necked Wallaby			Outside of the project area

Notes: 1. * denotes an exotic species..
2. TSC Act Status –V –Vulnerable.

Appendix B

Threatened species assessment of occurrence

Table B.1 Threatened species assessment of occurrence

Scientific Name	Common Name	Listing		Source			Species habitat, behaviour and records relevant to the project area	Likelihood of occurrence	Impact
		TSC Act	EPBC Act	Bionet	Species Credit	PMST			
Frogs									
<i>Litoria aurea</i>	Green and Golden Bell Frog	E	V	y	y	y	Inhabits marshes, dams and stream-sides, particularly those containing bulrushes (<i>Typha spp.</i>) or spikerushes (<i>Eleocharis spp.</i>). Optimum habitat includes water-bodies several dams that are unshaded, free of predatory fish such as Plague Minnow (<i>Gambusia holbrooki</i>), have a grassy area nearby and diurnal sheltering sites available. Some sites occur in highly disturbed areas (OEH 2016). This species was most recently recorded in 2008, approximately 7.8 km from the project area. One shallow dam exists within the north of the project area. It is considered unsuitable breeding habitat for the species given that it is heavily shaded, with no open water and a dense bulrushes throughout. For the majority of the year the dam is likely to be either very shallow or dry.	Unlikely	No
<i>Litoria brevipalmata</i>	Green-thighed Frog	V		y			Occur in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain. Prefers wetter forests in the south of its range, but extends into drier forests in northern NSW. Breeding occurs following heavy rainfall from spring to autumn, with larger temporary pools and flooded areas preferred. Frogs may aggregate around breeding sites and eggs are laid in loose clumps among waterplants, including water weeds. The larvae are free swimming. The frogs are thought to forage in leaf-litter (OEH 2016). The closest record is 4.3 km (2002). The habitat within the project area is not likely to be suitable for this species as there were no breeding depressions observed and there is a lack of leaf litter.	Unlikely	No

<i>Litoria littlejohni</i>	Littlejohn's Tree Frog	V	V			y	This species is restricted to sandstone woodland and heath communities at mid to high altitude. It forages both in the tree canopy and on the ground, with eggs and tadpoles mostly found in still or slow flowing pools that receive extended exposure to sunlight, but will also use temporary isolated pools (OEH 2016). The species has not been recorded in the locality, the project area is at low attitude and outside of the species known distribution.	Unlikely	No
<i>Mixophyes balbus</i>	Stuttering Frog	E	V			y	This species occurs in rainforest and wet tall open forest on plateaus, foothills and escarpment on the eastern side of the Great Dividing Range. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor. Eggs are laid on rock shelves or shallow riffles in small, flowing stream (OEH 2016). The species has not been recorded in the locality and no suitable habitat is present on the site.	Unlikely	No
<i>Mixophyes iteratus</i>	Giant Barred Frog	E	E			y	This species are found along freshwater streams with permanent or semi-permanent water, typically at lower elevation. Moist riparian habitats such as rainforest or wet sclerophyll forest are favoured for the deep leaf litter that they provide (OEH, 2016). The species has not been recorded within the locality and suitable habitat is absent from the project area.	Unlikely	No
Reptiles									
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	E	V			y	The species is largely confined to Triassic and Permian sandstones within the coast and ranges in an area within approximately 250 km of Sydney (OEH 2016). It occurs in sclerophyll woodland with sandstone outcrops preferring ridges, buffs and slopes with a north west aspect. Thermally suitable microhabitat may be a limiting resource for the species (DoE 2016). The species has not been recorded within the locality and no suitable sandstone habitat exists.	Unlikely	No

Birds									
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	CE	y		y	This species has a patchy distribution, mainly confined to the two main breeding areas and surrounding fragmented woodlands, however the species can also undertake large-scale nomadic movements in the order of hundreds of kilometres (OEH 2016). A number of records exist within the locality and the species has the potential to fly over or utilise seasonal foraging resources within the project area. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. The Regent Honeyeater is a generalist forager, which mainly feeds on the nectar from a wide range of eucalypts and mistletoes. Key eucalypt species include Mugga Ironbark (<i>E.sideroxylon</i>), Yellow Box (<i>E.melliodora</i>), Blakely's Red Gum (<i>E. blakelyi</i>), White Box (<i>E. albens</i>) and Swamp Mahogany (<i>E. robusta</i>). Also utilises: <i>Eucalyptus microcarpa</i> , <i>E. punctata</i> , <i>E. polyanthemos</i> , <i>E. moluccana</i> , <i>E. crebra</i> , <i>E. caleyi</i> , <i>C. maculata</i> , <i>E.mckieana</i> , <i>E. macrorhyncha</i> , <i>E. laevopinea</i> , and <i>Angophora floribunda</i> . This species may occasionally fly over the project area but is unlikely to utilise the majority of the project area for foraging due to the presence of the highly territorial Noisy Miner. There is also a paucity of the preferred feed tree species, although Rough barked Apple may be utilised in the riparian corridor. The riparian woodland will not be impacted by the proposal.	Potential	No -as riparian forest will not be impacted.
<i>Botaurus poiciloptilus</i>	Australasian Bittern	E	E			y	This species occurs in permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (<i>Typha</i> spp.) and spikerushes (<i>Eleocharis</i> spp.). This species has not been recorded within the locality and the dam within the project area does not provide suitable habitat given its small size and ephemeral nature.	Unlikely	No
<i>Burhinus grallarius</i>	Bush Stone-curlew	E				y	Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. The habitat within the project area is considered poor, given the lack of fallen timber and high disturbance levels present. There are no records of this species in the vicinity of the project area.	Unlikely	No

<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V		y			In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas (OEH 2016). The species nests in the trunks, limbs or dead spouts of tall living trees, especially eucalypts, often near water. Several records exist within the locality and the species has the potential to occur within the project area given it is highly mobile and has broad foraging requirements.	Potential	Potential
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V		y			The species inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (<i>Allocasuarina littoralis</i>) and Forest Sheoak (<i>A. torulosa</i>) are important foods. Dependent on large hollow-bearing eucalypts for nest sites (OEH 2016). Foraging resources for this species are largely absent, however the species may occasionally fly over the project area or shelter within the site. Suitable breeding hollows were not observed within the project area.	Unlikely	No
<i>Chthonicola sagittata</i>	Speckled Warbler	V		y			This species frequents a wide range of <i>Eucalyptus</i> dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area (OEH 2016). This species has been recorded approximately 2.5 km NE of the Project area. The project area is fragmented and disturbed which lowers the habitat quality for this species. Furthermore the project area is dominated by Noisy Miner which is likely to exclude this species.	Unlikely	No
<i>Circus assimilis</i>	Spotted Harrier	V		y			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 (OEH, 2016). Owing to the broad habitat requirements, this species may occasionally fly over or forage within the project area	Potential	Potential

<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V		y			This species is found in eucalypt woodlands and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabiting woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey. Fallen timber is an important part of foraging habitat and tree hollows are required for nesting (OEH 2016). This species has been recorded 2.6 km from the Project area. The project area has a paucity of tree hollows and the project area is dominated by Noisy Miner which is likely to exclude this species.	Unlikely	No
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V		y			Distribution in NSW is nearly continuous from the coast to the far west. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland (OEH 2016). This species has been recorded within 2.2 km south east of the Project area. The project area is fragmented and disturbed which lowers the habitat quality for this species. Furthermore the project area is dominated by Noisy Miner which is likely to exclude this species.	Unlikely	No
<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E	E			y	This species typically occurs in dense, coastal vegetation. The distribution has contracted to three disjunct areas of south-eastern Australia, none of which are close to the Project area (OEH, 2016). .	Unlikely	No
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E		y			Floodplain wetlands of the major coastal rivers are the key habitat in NSW for this species (OEH, 2016). Suitable habitat does not exist on site and no records exist within the locality.	Unlikely	No
<i>Falco subniger</i>	Black Falcon	V		y			This species is typically found in arid and semi-arid zones and has not been recorded within the locality.	Unlikely	No

<i>Glossopsitta pusilla</i>	Little Lorikeet	V		y			This species forages primarily in the canopy of open Eucalyptus forest and woodland, also utilising Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Nomadic movements are common, influenced by season and food availability (OEH 2016). This species has been recorded 1.5 km south of the project area and the woodland areas may provide seasonally available foraging resources for this species.	Potential	Potential
<i>Grantiella picta</i>	Painted Honeyeater	V	V			y	The species inhabits mistletoes in eucalypt forests/woodlands, riparian woodlands of black box and river red gum, box-ironbark-yellow gum woodlands, acacia-dominated woodlands, paperbarks, casuarinas, callitris, and trees on farmland or gardens. The species exhibits seasonal north-south movements governed principally by the fruiting of mistletoe, with many birds moving after breeding to semi-arid regions such as north-eastern South Australia, central and western Queensland, and central Northern Territory (DoE 2016). The species has not been recorded within the habitat and there is a lack of preferred tree species within the Project area.	Unlikely	No
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard	V		y			Typically occurs inland, especially along timbered watercourses, also within grasslands and sparsely timbered woodlands. Three records of this species have been recorded within the locality, however the species is typically found further inland and is likely to be close to the limit of its range. The habitat within the project area is sub-optimal.	Unlikely	No
<i>Hieraaetus morphnoides</i>	Little Eagle	V		y			Found throughout the Australian mainland except for the most densely forested parts of the Dividing Range escarpment. Inhabits open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees in remnant vegetation (OEH 2016). The species has been recorded within 3.3 km south west of the Project area, however the habitat within the Project area is sub-optimal.	Unlikely	No

<i>Irediparra gallinacea</i>	Comb-crested Jacana	V		y			This species inhabits permanent freshwater wetlands, either still or slow-flowing, with a good surface cover of floating vegetation, especially water-lilies, or fringing and aquatic vegetation (OEH, 2016). No suitable habitat exists within the project area.	Unlikely	No
<i>Ixobrychus flavicollis</i>	Black Bittern	V		y			Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. No suitable wetland habitat exists on site.	Unlikely	No
<i>Lathamus discolor</i>	Swift Parrot	E	E	y		y	Migrating in the autumn and winter months to south-eastern Australia. In NSW, mostly occurs on the coast and south west slopes in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations (OEH 2016). Favoured feed trees include winter flowering species such as Swamp Mahogany (<i>Eucalyptus robusta</i>), Spotted Gum (<i>Corymbia maculata</i>), Red Bloodwood (<i>C. gummifera</i>), Mugga Ironbark (<i>E. sideroxylon</i>), and White Box (<i>E. albens</i>). Several records of this species exist within the locality. Favoured feed trees do not exist within the project area and the abundance of noisy miner are likely to reduce the chance of this species occurring further.	Unlikely	No
<i>Lophoictinia isura</i>	Square-tailed Kite	V		y			Found in a variety of timbered habitats including dry woodlands and open forests, showing a particular preference for timbered watercourses (OEH 2016). Appears to occupy large hunting ranges of more than 100 km ² . Several records exist within the locality.	Potential	Potential
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	V		y			This species has a preference for lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses (OEH, 2016). The closest record of this species is 7.8 km north west of the Project area. No small insectivorous birds were found within the woodland areas of the project area and noisy miners are likely to exclude this species.	Unlikely	No

<i>Melithreptus gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V		y			This species occurs in drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (<i>Eucalyptus sideroxylon</i>), White Box (<i>E. albens</i>), Inland Grey Box (<i>E. microcarpa</i>), Yellow Box (<i>E. melliodora</i>), Blakely's Red Gum (<i>E. blakelyi</i>) and Forest Red Gum (<i>E. tereticornis</i>). The species also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees (OEH 2016). Multiple records of this species exist in the locality with the closest 2.3 km south east of the project area.	Potential	Potential
<i>Neophema pulchella</i>	Turquoise Parrot	V		y			Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Several records exist within the locality with the closest being 3 km to the east.	Potential	Potential
<i>Ninox connivens</i>	Barking Owl	V		y			Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 hectares, with 2000 hectares being more typical in NSW habitats (OEH 2016). Nest-hollow entrances are 2-35 m above the ground with a diameter of 20-46 cm and depth of 20-300 cm (NSW Scientific Committee 2003). Three records exist within the locality, the closest 5 km to the south east.	Potential	Potential
<i>Ninox strenua</i>	Powerful Owl	V		y			This species is widely distributed throughout the eastern forests from the coast inland to the tablelands with scattered, historical records from the western slopes and plains (OEH 2016). Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Generally requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. Nest in large tree hollows (at least 0.5 m deep), in large eucalypts (DBH of 80-240 cm) that are at least 150 years old. This species has been recorded 2km NE of the Project area.	Potential	Potential
<i>Numenius minutus</i>	Little Curlew		Mi	y			Little Curlews may gather in large flocks on coastal and inland grasslands and black soil plains in northern Australia, near swamps and flooded areas.	Unlikely	No

<i>Oxyura australis</i>	Blue-billed Duck	V		y			The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. No suitable habitat exists within the project area.	Unlikely	No
<i>Petroica boodang</i>	Scarlet Robin	V		y			The Scarlet Robin is primarily a resident in forests and woodlands, but some adults and young birds disperse to more open habitats after breeding. In autumn and winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation (OEH 2016). The closest record of this species is over 7 km to the north east. No small insectivorous birds were found within the woodland areas of the project area and noisy miners are likely to exclude this species.	Unlikely	No
<i>Petroica phoenicea</i>	Flame Robin	V		y			Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. The groundlayer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense. In winter, birds migrate to dry forests, open woodlands and in pastures and native grasslands, with or without scattered trees (OEH 2016). This species was not recorded and no other small insectivorous birds were found within the woodland areas of the project area, likely to be due to exclusion due to territorial Noisy Miners/	Unlikely	No
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V		y			Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. (OEH 2016) This species has been recorded within the project area.	Recorded	Yes
<i>Rostratula australis</i>	Australian Painted Snipe	E	E	y		y	The species inhabits shallow terrestrial freshwater wetlands, including temporary and permanent lakes, swamps and claypans (OEH2016). No suitable habitat for this species exists within the project area.	Unlikely	No
<i>Sternula albifrons</i>	Little Tern	E	Mi	y			The Little Tern is a strongly migratory coastal seabird which usually fishes in very shallow water only a few centimetres deep, often over the advancing tideline or in brackish lagoons and saltmarsh creeks. It has the most inshore distribution of all terns (birdlife 2016). No habitat exists within the project area.	Unlikely	No

<i>Tyto novaehollandiae</i>	Masked Owl	V		y			Lives in eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. The closest record of this species is 2.4 km to the south east. The species may use the project area for foraging.	Potential	Potential
<i>Tyto tenebricosa</i>	Sooty Owl	V		y			Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation; hunts by night for small ground mammals or tree-dwelling mammals such as the Common Ringtail Possum (<i>Pseudocheirus peregrinus</i>) or Sugar Glider (<i>Petaurus breviceps</i>). Nests in very large tree-hollows. No suitable habitat exists within the project area for this species.	Unlikely	No
Mammals									
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V			y		This species is found in a broad range of habitats from rainforest through sclerophyll forest to heath. Key foraging resources for this species includes nectar and pollen collected from banksias, eucalypts and bottlebrushes. The species is known to shelter in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum (<i>Pseudocheirus peregrinus</i>) dreys or thickets of vegetation, (e.g. grass-tree skirts). Nests are typically built in tree hollows but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks. The project area is not likely to support this species as: nectivorous resources occur in low densities, mainly restricted to eucalypts and angophoras which are patchily distributed throughout the project area. There is a poorly developed mid story within the project area and a paucity of fallen timber and tree hollows. This lack of shelter would leave the species susceptible to high levels of predation and unlikely to be able to persist within the project area.	Unlikely	No
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	y		y	This species roosts in caves, crevices in cliffs, old mine workings, frequenting low to mid-elevation dry open forest and woodland, especially in gullies. Females have been recorded raising young in maternity roosts in roof domes in sandstone caves and overhangs. Records of this species exist approximately 2.5 km north east of the project area and the species may have the potential to pass over or forage within the project area. There is no breeding habitat.	Potential	Potential

<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	y	y	This species has been recorded from a wide range of habitats, unlogged forest or forest that has been less disturbed by timber harvesting is preferable. Habitat requirements include suitable den sites such as hollow logs, tree hollows, rock outcrops or caves. Individuals require an abundance of food, such as birds and small mammals, and large areas of relatively intact vegetation through which to forage. Home ranges are estimated to be 620–2560 ha for males, and 90–650 ha for females (DOE 2016). This species is unlikely to occur considering the fragmented and partially cleared nature of the project area. There is very little shelter for the species and a lack of potential den sites.	Unlikely	No
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V		y		This species is typically found in tall, mature, wet forest. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. The species hunts flying insects above or just below the tree canopy (OEH 2016). This species may occur within the riparian forest, but is unlikely to occur with other habitat types.	Potential	No -as riparian forest will not be impacted.
<i>Miniopterus australis</i>	Little Bentwing-bat	V		y		Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and Banksia scrub. Generally found in well-timbered areas. Roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. Often share roosting sites with the Eastern Bentwing-bat and, in winter, the two species may form mixed clusters. In NSW the largest maternity colony is in close association with a large maternity colony of Eastern Bentwing-bats and appears to depend on the large colony to provide the high temperatures needed to rear its young. Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer. Only five nursery sites /maternity colonies are known in Australia (OEH 2015).	Potential	Potential

<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V		y			This species typically hunts in forested areas, catching moths and other flying insects above the tree tops. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures (OEH 2016). This species forms discrete populations centred on a maternity cave with specific temperature and humidity regimes that is used annually in spring and summer for the birth and rearing of young. At other times of the year, populations disperse within about 300 km range of maternity caves (OEH 2016). This species may occur within the project area, though no suitable roosting or breeding habitat is present.	Potential	Potential
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V		y			Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally. Potential to occur within the project area though breeding resources are largely absent.	Potential	Potential
<i>Myotis macropus</i>	Southern Myotis	V		y			Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. This species may occur along swamp creek but unlikely to occur in other areas.	Potential	No -as riparian forest will not be impacted.
<i>Nyctophilus corbeni</i>	Corben's Long-eared Bat	V	V				Inhabits a variety of vegetation types, including mallee, Bulloke (<i>Allocasuarina leuhmanni</i>) and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. This species is not known from near coastal habitats and is typically associated with the Murray-Darling Basin and the Pilliga scrub region of NSW.	Unlikely	No

<i>Petaurus australis</i>	Yellow-bellied Glider	V		y			This species typically occurs in tall, mature eucalypt forest in regions of high rainfall. It inhabits a wide range of forest types but prefers resource rich forests where mature trees provide nesting hollows and tree species composition provides year-round continuity of food resources. Yellow-bellied Glider family groups occupy large home ranges of approximately 20-85 hectares and the area of un-fragmented habitat required to support a minimum viable population has been estimated at 15 000 ha to 35 000 ha (OEH 2016). Suitable habitat for this species does not exist in the project area.	Unlikely	No
<i>Petaurus norfolcensis</i>	Squirrel Glider	V		y			This species requires hollow-bearing, floriferous eucalypt open forests and woodlands with a Banksia or Acacia shrub layer, that provide den sites in tree cavities and a good winter supply of nectar. Large trees with abundant hollows are critical elements (OEH 2016). The project area contains sparse Banksia and acacia and very few hollows are present. The project area is unlikely to support the species.	Unlikely	No
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	E	V			y	This species occupies rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north (OEH 2016). This species has not been recorded in the locality and no potential habitat occurs.	Unlikely	No
<i>Phascolarctos cinereus</i>	Koala	V	V	y	y	y	This species inhabits eucalypt woodlands and forests and feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species (OEH 2016). Primary feed trees for this species listed within the North Coast Koala Management Area, includes Parramatta Red Gum (<i>Eucalyptus parramattensis</i>) and Forest Red Gum both of which will occur within the project area. Few Koala have been recorded within the locality of the project area and no scats were recorded during site surveys. The project area is also fenced with chainlink with a barbed-wire return which is likely to further minimise the chance of the species occurring within the project area.	Unlikely	No

<i>Planigale maculata</i>	Common Planigale	V			y		The Common Planigale is not listed as having specific habitat requirements as it is found in inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water (OEH, 2016). The species is nocturnal sheltering during the day in saucer-shaped nests built in crevices, hollow logs, beneath bark or under rocks. The Common Planigale has been most frequently recorded in coastal northern NSW with fewer records along the mid-north coast. The southernmost record of this species is close to Clareval, which is 70 km north east of the project area (Bionet, 2016). It is very unlikely that this species occurs within the project area given that it is located outside of its know range. Furthermore the habitat present is considered poor, as it is highly fragmented with large open areas, likely to leave this species open to predation.	Unlikely	No
<i>Potorous tridactylus</i>	Long-nosed Potoroo	V	V			y	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature (OEH 2016). This species has not been recorded within the locality and it likely to be absent from the area.	Unlikely	No
<i>Pseudomys novaehollandiae</i>	New Holland Mouse		V	y		y	This species occurs in coastal areas and up to 100 km inland on sandstone country (OEH 2016). At inland sites the species frequents heathland and open woodland with a heathland understorey. Potential habitat exists within the project area for this species.	Potential	Potential
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	y		y	The Grey-headed Flying-fox occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps (OEH 2016). This species has been recorded within the locality and suitable habitat exists within the project area.	Potential	Potential
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	V		y			The species is wide-ranging, found across northern and eastern Australia. It has broad habitat requirements foraging in most habitat types, from open grassland to over forest canopies (OEH 2016). This species has been recorded within the locality and suitable habitat exists within the project area.	Potential	Potential

<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V		y				This species utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. The species is typically tree roosting although may also roost in buildings. The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range (OEH 2016). This species has been recorded in the locality.	Potential	Potential
<i>Vespadelus troughtoni</i>	Eastern Cave Bat	V		y				A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals (OEH 2016). Occasionally found along cliff-lines in wet eucalypt forest and rainforest. There are no suitable roosting sites in the vicinity of the project area and the species is not likely to occur within the project area.	Unlikely	No
Flora										
<i>Acacia bynoeana</i>	Bynoe's Wattle	E	V	y	y	y		Occurs in heath or dry sclerophyll forest on sandy soils. Prefers open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstory species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple. (OEH, 2016). Multiple records exist within the locality; the closest record is 2.3 km to the SE. Not recorded within the project area.	Unlikely	No
<i>Angophora inopina</i>	Charmhaven Apple	V	V			y		Occurs most frequently in four main vegetation communities: (i) Eucalyptus haemastoma–Corymbia gummifera–Angophora inopina woodland/forest; (ii) Hakea teretifolia–Banksia oblongifolia wet heath; (iii) Eucalyptus resinifera–Melaleuca sieberi–Angophora inopina sedge woodland; (iv) Eucalyptus capitellata–Corymbia gummifera–Angophora inopina woodland/forest (OEH, 2016). No records exist within the locality and the species was not recorded	Unlikely	No
<i>Asterolasia elegans</i>		E	E			y		The species occurs in wet sclerophyll forest on moist hillsides. No records exist within the locality and the project area is outside the known range for this species. No suitable habitat exists.	Unlikely	No

<i>Callistemon linearifolius</i>	Netted Bottle Brush	V		y	y		Grows in dry sclerophyll forest on the coast and adjacent ranges. Multiple records exist within the locality, with the closest 400 m south east of the project area. Not recorded within the project area.	Unlikely	No
<i>Cryptostylis hunteriana</i>	Leafless Tongue-orchid	V	V		y	y	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland (OEH, 2016). The larger populations typically occur in woodland dominated by Scribbly Gum (<i>Eucalyptus sclerophylla</i>), Silvertop Ash (<i>E. sieberi</i>), Red Bloodwood (<i>Corymbia gummifera</i>) and Black Sheoak (<i>Allocasuarina littoralis</i>). The species has not been recorded within the locality and the preferred habitat for this species does not exist within the locality.	Unlikely	No
<i>Diuris praecox</i>	Rough Doubletail		V		y		This species is known from an area of coastal NSW between Bateau Bay and Smiths Lake. Its habitat includes hills and slopes of open forests which have a grassy to fairly dense understorey. Exists as subterranean tubers most of the year. It produces leaves and flowering stems in winter. Surveys for this species were completed in August 2016 and the species was not recorded	Unlikely	No
<i>Diuris pedunculata</i>	Small Snake Orchid	E	E		y		This species is now confined to north east NSW, on the New England Tablelands, around Armidale, Uralla, Guyra and Ebor (OEH 2016). The Small Snake Orchid grows on grassy slopes or flats, often on peaty soils in moist areas. It is also known to occur on shale and trap soils, on fine granite, and among boulders. This species is unlikely to occur within the project area as it is a considerable distance outside of its current known range. Furthermore suitable habitat does not occur within the project area, with sandy soils present rather than the listed substrate types for the species.	Unlikely	No
<i>Eucalyptus glaucina</i>	Slaty Red Gum	V	V	y	y	y	Found only on the north coast of NSW and in separate districts: near Casino where it can be locally common, and farther south, from Taree to Broke, west of Maitland. Grows in grassy woodland and dry eucalypt forest in deep, moderately fertile and well-watered soils. Records exist 2.5 km to the south east. This species was recorded in	Recorded	No

<i>Eucalyptus parramattensis subsp. decadens</i>	Earps Gum	V	V	y	y	y	Generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey or as an emergent in dry or wet heathland. This species has been recorded within the project area.	Recorded	Yes
<i>Euphrasia arguta</i>	-	CE	CE			y	The species is known from grassy areas near rivers and has not been recorded in the locality .Not recorded within the project area.	Unlikely	No
<i>Euphrasia arguta</i>	-	CE	CE			y	The species is known from grassy areas near rivers and has not been recorded in the locality .Not recorded within the project area.	Unlikely	No
<i>Grevillea parviflora subsp. parviflora</i>	Small-flower Grevillea	V	V	y	y	y	Occurs in a range of vegetation types from heath and shrubby woodland to open forest (OEH, 2016). In the Hunter it has been recorded in Kurri Sand Swamp Woodland and records exist 340 m south east of the project area. Not recorded within the project area.	Unlikely	No
<i>Melaleuca biconvexa</i>	Biconvex Paperbark	V	V			y	This species generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. The species has not been recorded within the locality and was not recorded within the project area.	Unlikely	No
<i>Pterostylis gibbosa</i>	Illawarra Greenhood,	E	E			y	All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. In the Hunter region, the species grows in open woodland dominated by Narrow-leaved Ironbark, Forest Red Gum and Black Cypress Pine (<i>Callitris endlicheri</i> .) The species has not been recorded within the locality and habitat within the project area is not suitable.	Unlikely	No
<i>Rutidosia heterogama</i>	Heath Wrinklewort	V	V	y		y	Grows in heath on sandy soils and moist areas in open forest, and has been recorded along disturbed roadsides (OEH, 2016). A large number of records exist within the locality with a high density recorded approximately 2 km south east of the project area. Typically flowers in autumn. Not recorded within the project area.	Unlikely	No

<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E	V	y		y	The species occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities. Suitable habitat does not exist within the project area.	Unlikely	No
<i>Tetratheca juncea</i>	Black-eyed Susan	V	V	y		y	This species is usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover (OEH, 2016). The species has been recorded on south extent of the locality, with the project area being outside of the core distribution of this species.	Unlikely	No
<i>Thesium australe</i>	Austral Toadflax	V	V			y	This species occurs in grassland and woodland, often in damp sites. It is a root parasite on native grasses, most notably Kangaroo Grass (<i>Themeda triandra</i>)*. There are no records of this species within the locality.	Unlikely	No
TECs (EPBC listed)									
<i>Central Hunter Valley eucalypt forest and woodland</i>			CE			y	The canopy of the ecological community is dominated by one or more of the following four eucalypt species; Narrow-leaved ironbark (<i>Eucalyptus crebra</i>), Spotted Gum (<i>Corymbia maculata</i>), Slaty Gum (<i>E. dawsonii</i>) and Grey Box (<i>E. moluccana</i>). None of these species occur within the Project area and therefore the community does not occur.	Unlikely	No
<i>Hunter Valley Weeping Myall (Acacia pendula) Woodland</i>			CE			y	The tree canopy of this community is dominated by dominated by Weeping Myall (<i>Acacia pendula</i>), which was not recorded within the community and therefore this community does not occur.	Unlikely	No
<i>White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland</i>			CE			y	This canopy stratum of this community is dominated by White Box (<i>Eucalyptus albens</i>), Yellow Box (<i>E. melliodora</i>) and Blakely's Red Gum (<i>E. blakelyi</i>) community, none of which occur within the project area. Any grassland within the project area is derived from Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area, rather than this community.	Unlikely	No

Migratory Species (EPBC listed)									
<i>Apus pacificus</i>	Fork-tailed Swift	-	MiMa			y	A wide ranging species flying over almost all habitat types within NSW, records of this species exist within the locality.	Potential	No - a transient species, with non specific habitat requirements.
<i>Ardea alba</i>	Great Egret	-	MiWe			y	This species has been reported in a wide range of wetland habitats and occurs throughout NSW and beyond. Records of this species exist within the locality.	Potential	No - wetland habitat/dams will not be impacted.
<i>Ardea ibis</i>	Cattle Egret	-	MiWe	y		y	The species occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures. It uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora (DoE 2016). Records exist within the locality.	Potential	No - wetland habitat/dams will not be impacted.
<i>Cuculus optatus</i>	Oriental Cuckoo	-	MiTe			y	An uncommon non-breeding migrant to south east Australia, occurring in a wide range of habitats. Very few records exist within the locality.	Unlikely	No
<i>Gallinago hardwickii</i>	Latham's Snipe	-	MiWe			y	The species occurs in a wide variety of permanent and ephemeral wetlands. They usually occur in open, freshwater wetlands that have some form of shelter (usually low and dense vegetation) nearby. They generally occupy flooded meadows, seasonal or semi-permanent swamps, or open waters, but various other freshwater habitats can be used including bogs, waterholes, billabongs, lagoons, lakes, creek or river margins, river pools and floodplains (DoE 2016). The	Unlikely	No

<i>Hirundapus caudacutus</i>	White-throated Needletail	-	MiTe	y		y	In Australia, the species is almost exclusively aerial. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland (DoE 2016).	Potential	No. A transient species, with non specific habitat requirements.
<i>Monarcha melanopsis</i>	Black-faced Monarch	-	MiTe			y	The species mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest (DoE 2016). This species has the potential to occur within the riparian forest.	Potential	No - riparian habitat will not be impacted
<i>Monarcha trivirgatus</i>	Spectacled Monarch	-	MiTe			y	This species prefers thick understorey in rainforests, wet gullies and waterside vegetation, as well as mangroves. The species is not known from the locality and suitable habitat does not occur.	Unlikely	No
<i>Motacilla flava</i>	Yellow Wagtail	-	MiTe			y	This species is rarely recorded within NSW and is not anticipated to occur close to the Project area, given the majority of records are clustered around Newcastle and Sydney coastal regions.	Unlikely	No
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	-	MiTe			y	This species inhabits heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests (DoE 2016). Records of this species exist within the locality. This species has the potential to occur within the riparian forest.	Potential	No - riparian habitat will not be impacted
<i>Pandion haliaetus</i>	Osprey	-	MiWe			y	The species occurs in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish or saline water for foraging (DoE 2016). Not recorded within the locality.	Unlikely	No

<i>Rhipidura rufifrons</i>	Rufous Fantail	-	MiTe			y	In east and south-east Australia, the species mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts; usually with a dense shrubby understorey often including ferns. When on passage, they are sometimes recorded in drier sclerophyll forests and woodlands (DoE 2016). Records of this species exist within the locality. This species has the potential to occur within the riparian forest.	Potential	No - riparian habitat will not be impacted
<i>Tringa nebularia</i>	Common Greenshank	-	MiWe	y		y	Common Greenshanks are found both on the coast and inland, in estuaries and mudflats, mangrove swamps and lagoons, and in billabongs, swamps, sewage farms and flooded crops.	Unlikely	No

- Notes
1. BBCC - BioBanking Credit Calculator, NPWS Atlas - Atlas of NSW Wildlife, PMST - Protected Matters Search Tool.
 2. EPBC Act - Environment Protection and Biodiversity Conservation Act 1999, TSC Act - Threatened Species Conservation Act, FM Act - Fisheries Management Act 1994.
 3. CE - critically endangered, E - endangered, V - vulnerable, Mi - migratory.

Appendix C

Assessments of significance

C.1 Ramsar Wetland Hunter Estuary Wetland – ID no 245

No Wetlands of International Importance (declared Ramsar wetlands), occur within the project area. The Hunter Estuary Wetlands Ramsar site (no 24), occurs approximately 45 km downstream of the project area, via Swamp Creek, Wallis Creek and the Hunter River.

The Hunter Estuary Wetlands Ramsar site is comprised of two components, Kooragang and Hunter Wetlands Centre Australia. The Kooragang component of the Hunter Estuary Wetlands Ramsar site is located in the estuary of the Hunter River, approximately 7 km north of Newcastle. Hunter Wetlands Centre Australia is 2.5 km from Kooragang. Although the sites are not contiguous they have significant linkages, both hydraulically and by a wildlife corridor consisting of Ironbark Creek, the Hunter River and Ash Island (DoEE 2016).

C.1.1 An action is likely to have a significant impact on the ecological character of a declared Ramsar wetland if there is a real chance or possibility that it will result in;

i areas of the wetland being destroyed or substantially modified

The recycling facility and associated infrastructure will be limited to a discrete footprint of 3.23 ha, which is located approximately 45 km upstream of the wetland. No areas of the wetland will be directly destroyed or modified by the project.

ii substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration and frequency of ground and surface water

The project is not expected to result in a substantial and/or measurable change in the wetland's existing hydrological regimes. The project area is small and does not represent a significant proportion of the Hunter Estuary wetland catchment. The project area will be located above the 2,000 year flood limit and all ULABs and recycling infrastructure will be placed above the probable maximum flood (PMF) level. Therefore, the risk of any accidental inputs to watercourses is very low.

All storm water will be captured in the holding tank which overflows to the detention pond. Untreated process water will be reused in the facility. There will be discharges during heavy periods of rain. Stormwater harvesting will reduce runoff volumes by 49% (in wet years) and 81% (in dry years). The calculated long term average reduction is 60% of runoff. The stormwater system is designed to capture initial runoff during a rainfall period, which is more likely to contain elevated concentrations of pollutants than runoff that occurs after substantial rainfall. As a result, the stormwater capture and harvesting system is expected to substantially reduce any pollutant loads from the facility.

Accordingly, there are not anticipated to be any significant changes to flows or changes to the water quality of Swamp Creek as a result of the project. Furthermore, the Ramsar site is a significant distance downstream with very large dilution factors involved and there are not impacts to the hydrological regime anticipated. No changes will be detectable at the wetland receptor.

iii the habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected

The project area does not provide important habitat for wetland species, with impacts limited to terrestrial habitats only. Furthermore, there are not anticipated to be any indirect impacts on habitat associated with Swamp Creek to the north of the project area and the risk of accidental inputs to watercourses and downstream wetlands is very low. Accordingly, the project is unlikely to result in downstream impacts on native species inhabiting Hunter Estuary Wetland.

- iv a substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health, or

The project area is within a 1 in 2,000 year flood limit. Appropriate erosion and water controls are included within the design of the recycling facility, including a storm water detention dam, used to store and settle runoff from hardstand and roofs. Furthermore, the Ramsar site is a significant distance downstream with very large dilution factors involved. There is not anticipated to be a substantial or measurable change to water quality in the Hunter Estuary Wetland as a result of the project.

- v an invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.

Works will not be undertaken within wetland habitats adjacent to the project area (ie Swamp Creek) and therefore the risk of spreading invasive species (if present within Swamp Creek) to the Hunter Estuary Wetland is negligible.

C.1.2 Conclusion

The project's impacts will be restricted to a small terrestrial area and impacts on local watercourses and/or wetlands will be avoided. Accordingly, there will be no impacts to the ecological character of the Hunter Estuary Wetlands, which is over 45 km downstream from the project.

C.2 Swift Parrot (*Lathamus discolor*) and Regent Honeyeater (*Anthochaera phrygia*) and – Critically endangered

The Swift Parrot has the potential to occur within the locality during autumn and winter, migrating to its Tasmanian breeding grounds in summer. In NSW the species mostly occurs on the coast and south-west slopes in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations (OEH 2016). Key feed tree species identified by the National Recovery Plan for the Swift Parrot (Birds Australia 2011) comprise Yellow Gum (*Eucalyptus leucoxylon*), Red Ironbark (*E. tricarpa*), Mugga Ironbark (*E. sideroxylon*), Inland Grey Box (*E. microcarpa*), White Box (*E. albens*), Yellow Box (*E. melliodora*), Swamp Mahogany (*E. robusta*), Forest Red Gum (*E. tereticornis*), Blackbutt (*E. pilularis*) and Spotted Gum (*Corymbia maculata*). These key feed tree species are absent from the project area. The species may occasionally forage on one winter flowering Eucalypt, Broad-leaved Ironbark (*Eucalyptus fibrosa*) which was present in small quantities in the project area. However, as only a few Broad-leaved Ironbarks were present and they are not a key feed tree identified by the recovery plan, the Regent Honeyeater is not considered to be dependent on habitat in the project area.

The Regent Honeyeater has a patchy distribution, mainly confined to the four main breeding areas in NSW (Capertee Valley, Hunter Valley and the Bundarra-Barraba districts) and other breeding areas in the Mudgee-Wollar and Pillaga Woodlands districts. The species can also undertake large-scale nomadic movements in the order of hundreds of kilometres (OEH 2016). A number of records exist within the locality, with the closest record 3 km to the south-east of the project area. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regionally the Lower Hunter Spotted Gum forest has been shown to provide a valuable resource for this species (OEH 2016). These regionally important vegetation types are absent from the project area.

The Regent Honeyeater is a generalist forager, which mainly feeds on the nectar from a wide range of eucalypts and mistletoes, targeting those which flower most profusely. Key eucalypt species identified in the National Recovery Plan for the Regent Honeyeater (DoE 2016) comprise Mugga Ironbark, Yellow Box, White Box, Yellow Gum, Spotted Gum, Swamp Mahogany, Needle-leaf Mistletoe (*Amyema cambagei*) which grows on River Oak (*Casuarina cunninghamiana*), Box Mistletoe (*A. miquellii*) and Long-flower Mistletoe (*Dendrophthoe vitellina*). None of these key tree or mistletoe species are present within the area to be impacted.

Nests are usually constructed in the canopy of mature trees with rough bark including Ironbarks, She-oaks and Rough-barked Apple (*Angophora floribunda*). A small number of Broad-leaved Ironbarks will be removed from the project area. As there are only a few Broad-leaved Ironbark individuals, they are not considered to represent breeding habitat for the species. Rough-barked Apples and River She-oaks are present along Swamp Creek, which may represent non-core breeding habitat for the species. These areas have been specifically avoided by the design, and will not be impacted by the project.

Native bird diversity was very low during the field surveys with no small birds observed, except within the dense weed riparian forest in the north of the project area. It is likely that the overabundance of the Noisy Miner is one of the main causes of the low diversity observed. The aggressive exclusion of birds from potential woodland and forest habitat by over-abundant Noisy Miners is a key threatening process listed under the EPBC act.

Native vegetation to be removed from the project area is unlikely to be important to this species given the absence of key feed tree species, the high levels of disturbance and the presence of large numbers of the territorial Noisy Miner.

C.2.1 An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

vi lead to a long-term decrease in the size of a population;

Potential habitat within project area is considered sub-optimal for both species, given the absence of preferred feed trees as identified in the species recovery plans (DoE 2016; Birds Australia 2011), partial clearance of canopy species and the patchiness of the habitat.

It is unlikely that either species are reliant on foraging resources within the project area, nor are any substantial numbers of either species likely to occur within the project area. In addition, the area of potential Regent Honeyeater breeding habitat (not part of a key or other breeding area identified in the recovery plan) on Swamp Creek will not be impacted. As such, there is not likely to be any population level impacts.

vii reduce the area of occupancy of the species;

A total area of 0.87 ha of potential habitat that does not include any key tree or mistletoe species identified in the Swift Parrot or Regent Honeyeater recovery plans (Birds Australia 2011; DoE 2016) will be removed as a result of the project. Both of these species are wide ranging, typically occurring in areas where profuse flowering of feed trees is occurring. It is unlikely that the loss of a small area of sub-optimal foraging habitat will significantly reduce the occupancy of the species. Additionally, the area of potential breeding habitat (not part of a key or other breeding area identified in the recovery plan) for the Regent Honeyeater along Swamp Creek will not be directly or indirectly impacted by the project.

viii [fragment an existing population into two or more populations;](#)

These species are highly mobile and able to cross open areas. The loss of 0.86 ha of potential foraging habitat will not cause any fragmentation effects.

ix [adversely affect habitat critical to the survival of a species;](#)

Habitat critical to the survival of the Regent Honeyeater includes, any breeding or foraging habitat in areas where the species is likely to occur (as defined in Figure 1 of the National Recovery Plan (DoE 2016)); and any newly discovered breeding or foraging locations.

The Hunter Valley region is considered to include critical habitat for the species. However the habitat which will be removed consists of sub-optimal foraging habitat only, as it is partially cleared and does not include key feed tree species identified in the National Recovery Plan for the Regent Honeyeater (DoE 2016). While Rough-barked Apple that may comprise breeding habitat for the species (outside the key and other breeding areas identified in the recovery plan) are present along Swamp Creek, these areas have been specifically avoided by the design and will not be impacted by the project.

Habitats of particular importance to the Swift Parrot are outlined in the recovery plan for the species (Birds Australia 2011); including:

- for nesting,
- by large proportions of the Swift Parrot population,
- repeatedly between seasons (site fidelity), or
- for prolonged periods of time (site persistence).

As the project area is within mainland Australia there is no potential for nesting occur. The species has not been recorded within the project area or the immediate vicinity and there is no evidence of prolonged occurrence, repeat use or large number of the species occurring.

Therefore, the project will not affect any habitat critical to the survival of the Regent Honeyeater or Swift Parrot.

x [disrupt the breeding cycle of a population;](#)

The Swift Parrot breeds within Tasmania and has no potential to breed within the project area.

The Regent Honeyeater main breeding sites in NSW are the Capertee Valley, Hunter Valley and Bundarra-Barraba (DoE 2016). It is considered unlikely that the breeding would occur within the areas to be impacted by the project. While Rough-barked Apple that may comprise breeding habitat for the species (outside the key and other breeding areas identified in the recovery plan) are present along Swamp Creek in the north of the project area, these areas have been specifically avoided by the design and will not be impacted by the project. Therefore, if present in this area, the species breeding cycle will not be disrupted. modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;

The species have not been recorded within the project area and if they occur it is likely to be on a transient basis only, passing through to more optimal areas of foraging habitat. The clearance of 0.87 ha of sub-optimal foraging habitat is not likely to cause any discernible impact to either species, and the species will remain largely unaffected by the project. The area of potential Regent Honeyeater habitat along Swamp Creek has been specifically avoided by the design and will not be impacted by the project.

xi result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;

Of most relevance to the project area is the very high abundance of the native Noisy Miner, which exclude the species from potential foraging habitat. Competition from the Noisy Miner is recognised as a threat to the Regent Honeyeater in the National Recovery Plan for the Regent Honeyeater (DoE 2016).

This species is already prevalent in the area and the removal of their habitat is not likely to significantly increase their numbers in retained areas of habitat. The competitive advantage of species is less in more intact habitats which occur in the vicinity of the project area.

xii introduce disease that may cause the species to decline;

Disease is not known to be a key threat to the Regent Honeyeater, although the Swift Parrot may be susceptible to Psittacine beak and feather disease (Pbfd) (DoEE 2012). The project is unlikely to have any impact on the prevalence of the virus as it is not expected to change the movements of psittacine species significantly or cause sufficient stress to the species such that a disease outbreak would occur. Any psittacine species currently occurring in the project area will also forage in the wider vicinity and any displacement effect will be minimal.

xiii interfere with the recovery of the species.

The recovery of the Regent Honeyeater is closely linked the extent and quality of habitat, and actions include the protection of intact (high quality) areas of Regent Honeyeater breeding and foraging habitat (DoE 2016). Potential habitat to be removed within the project/ area is not considered high quality as key tree species are absent from the area to be disturbed and it is very unlikely that any individuals are reliant on the habitat. While there is potential breeding habitat in the Rough-barked Apple along Swamp Creek, the design specifically avoids impacts to this area.

The key action within the recovery plan for the Swift Parrot (Birds Australia 2011), which is relevant to the project, is the management and protection of Swift Parrot habitat at the landscape scale. The habitat within the project area is unlikely to be important for this species and there is expected to be no impact on its recovery as the result of the project.

C.2.2 Conclusion

The habitat to be removed is unlikely to be important for these species and the project is not anticipated to have a significant impact on the Regent Honeyeater or Swift Parrot. The area of potential breeding habitat for the Regent Honeyeater has been specifically avoided by the design, and therefore will not be impacted by the project.

C.3 Green and Golden Bell Frog (*Litoria aurea*) – Vulnerable

This species inhabits marshes, dams and stream-sides, particularly those containing bulrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.).

Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. Some sites occur in highly disturbed areas (OEH 2016). The closest population, considered 'probably extant' (DoEE 2016), is part of the Middle Hunter Population, sub-population Wentworth Swamp. Individuals within this population were last recorded in 2008, in two areas close to Gillieston Heights and Farley. Wentworth Swamp is considered to represent an important population of the species.

Possible breeding habitat within the vicinity of the project area is limited to a shallow dam to the north east of the proposed disturbance area. It is considered unsuitable breeding habitat for the species given that it is heavily shaded, with no open water and a dense bulrushes throughout. For the majority of the year the dam is likely to be either very shallow or dry. Therefore, an important population of the species is unlikely to occur in the project area.

An assessment of significance has been completed for this species on a conservative basis owing to the presence of a downstream sub-population at Wentworth Swamp, which is considered to be an important population in accordance with Commonwealth of Australia (2013).

The Significant Impact Guidelines for the vulnerable Green and Golden Bell Frog (DEWHA 2009) were used during the preparation of this assessment of significance.

C.3.1 An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

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

The species is not predicted to occur in the project area given the absence of suitable habitat, and therefore direct impacts are unlikely.

The closest known sub-population (and important population) is approximately 7.5 km downstream of the project area at Wentworth Swamp. Potential indirect impacts of the project will be limited to surface water runoff from roofs and hardstands, which will be managed.

Runoff will be managed with a stormwater basin, reducing the level of contaminants reaching watercourses such as Swamp Creek. Wetlands also exist downstream of the project area, which will provide a large dilution of the Swamp Creek flows, prior to the known Green and Golden Bell Frog population.

It is anticipated that there will be no impacts to water quality and hydrology at the Wentworth Swamp as a result of the project. Therefore, it follows that there will be no impacts on the important downstream Green and Golden Bell Frog populations as a result of the project.

xv reduce the area of occupancy of an important population;

No habitat for this species will be cleared and there will be no reduction in their area of occupancy.

xvi fragment an existing important population into two or more populations;

The species is unlikely to occur within the project area or move through it due to the absence of suitable habitat, and is unlikely to contain an important population of the species. No fragmentation effects are anticipated and there will be no break in continuity of habitat, as defined in the significant impact guidelines (DEWHA 2009). Additionally, the habitat of the important population at Wentworth Swamp will not be fragmented by the project.

xvii adversely affect habitat critical to the survival of a species;

No critical habitat has been declared for the Green and Golden Bell Frog under the EPBC Act. The nearest important population at Wentworth Swamp is considered to represent habitat critical to the survival of the species, which includes wetland breeding sites, with surrounding terrestrial foraging habitat. As direct impacts will not occur at Wentworth Swamp and potential indirect impacts are not predicted to occur, habitat critical to the survival of the species will not be adversely affected by the project.

xviii disrupt the breeding cycle of an important population;

No breeding habitat has been identified within the project area, therefore no impacts to the species breeding cycle is anticipated. As no direct impacts will occur and indirect impacts are not predicted for the important population at Wentworth Swamp, the breeding cycle of the important population will not be disrupted by the project.

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

Clearance will be restricted to terrestrial habitat which is not likely to support the species given the absence of aquatic breeding habitat. The clearance within the project area is not likely to cause decline of the species. No direct impacts will occur at Wentworth Swamp as a result of the project.

xx result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat;

The introduced Eastern Mosquito fish (*Gambusia holbrooki*) preys on Green and Golden Bell Frog tadpoles and is known to limit the breeding success of this species. As the construction work will occur within terrestrial areas only and impacts to riparian and aquatic habitats are avoided by the design, the project will not introduce Eastern Mosquito Fish into downstream Green and Golden Bell Frog habitats.

xxi introduce disease that may cause the species to decline; or

Chytridiomycosis is an infectious disease which is spread by the Chytrid Fungus (*Batrachochytrium dendrobatidis*). Chytrid Fungus is widespread within Australia and can result in mortality of the Green and Golden Bell Frog. The fungus persists within water and damp soils. As impacts to riparian and aquatic habitats are avoided by the design, the risk of introducing or spreading the disease is low.

xxii interfere substantially with the recovery of the species.

The project area is unlikely to provide suitable habitat for the species and therefore the removal of terrestrial vegetation is unlikely to adversely impact on the species recovery.

C.3.2 Significant impact thresholds for the Green and Golden Bell Frog

In accordance with the Significant Impact Guidelines for the vulnerable Green and Golden Bell Frog (DEWHA 2009), significant impacts are considered possible if actions meet any of the following thresholds:

1. The removal or degradation of aquatic or ephemeral habitat either where the Green and Golden Bell Frog has been recorded since 1995 or habitat that has been assessed as being suitable according to these guidelines. This can include impacts from Chytrid Fungus and/or Eastern Mosquito Fish originating off-site.

2. The removal or degradation of terrestrial habitat within 200 m of habitat identified in Threshold 1.

3. Breaking the continuity of vegetation fringing ephemeral or permanent waterways or other vegetated corridors linking habitats meeting the criteria in Threshold 1.

The project area does not contain suitable aquatic or ephemeral habitat for the species, and the project will not remove or degrade aquatic or ephemeral habitat where Green and Golden Bell Frogs have been recorded since 1995, and therefore does not trigger Threshold 1. As the project area does not contain habitat as described in Threshold 1, it also does not trigger Threshold 2 or 3.

C.3.3 Conclusion

The Green and Golden Bell Frog is unlikely to occur within the project area. The project does not trigger any of the thresholds described in the Significant Impact Guidelines for the vulnerable Green and Golden Bell Frog (DEWHA 2009). Potential indirect impacts will be managed, and therefore downstream impacts to the important population at Wentworth Swamp are not predicted to result from the project.

C.4 Grey-headed Flying-fox (*Pteropus poliocephalus*) – Vulnerable

The Grey-headed Flying-fox occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps (OEH 2016). The species occurs as a single, continuous population across its range and therefore important populations cannot be identified for the species. Roosting camps represent important habitat for the species, however these are absent from the project area. The species may occasionally forage within the project area as it is wide ranging and has been recorded within 1 km of the project area and the presence of eucalypt trees.

C.4.1 An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

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

The Grey-headed Flying-fox occurs as a single population across its range, and therefore important populations cannot be identified for the species.

Roosting camps are absent from the project area, and therefore breeding habitat and breeding activities will not be affected by the project. This species is highly mobile and able to exploit foraging resources over large areas of NSW.

As breeding habitat is absent from the project area, and only a small amount of potential foraging habitat represents will be removed, the project will not lead to a long-term decrease in the Grey-headed Flying-fox population.

xxiii reduce the area of occupancy of an important population;

The Grey-headed Flying-fox occurs as a single population across its range, and therefore important populations cannot be identified for the species.

This species occurs throughout eastern NSW and beyond, moving large distances to exploit seasonal foraging resources. As breeding habitat is absent from the project area, and a small area (0.87 ha) of sub-optimal foraging habitat will be removed, the project will not reduce the area of occupancy for the Grey-headed Flying-fox population.

xxiv fragment an existing important population into two or more populations;

The Grey-headed Flying-fox occurs as a single population across its range that is highly mobile. Therefore, the project will not fragment the Grey-headed Flying-fox population.

xxv adversely affect habitat critical to the survival of a species;

Roosting sites are considered to represent habitat critical to the survival of the Grey-headed Flying-fox. As these are absent from the project area, the project will not adversely affect habitat critical to the survival of the species.

Foraging resources for this species are likely to be restricted to seasonal exploitation of flowering Eucalypts and Angophora. These foraging resources within the project area are not likely to be important to the species, as the trees are relatively sparse and represent a small area compared to the much larger areas of woodland and forest within the vicinity.

xxvi disrupt the breeding cycle of an important population;

This species breeds in large camps typically within 20 km of a regular food source and commonly found in gullies, close to water and in vegetation with a dense canopy. Mating, birth and raising young occur within the camps. No camps occur within the project area, and therefore no impact to the breeding cycle will occur.

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

The habitat within the project area is not important for the species as roosting camps are absent and foraging resources are limited. Therefore, the project will not modify, destroy, remove, isolate or decrease the availability or quality of Grey-headed Flying-fox habitat such that they would decline.

xxviii result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat;

Parts of the project area are weedy, exacerbated by a history of heavy machinery movements and earthworks within the project area. As the project will clear and develop the majority of vegetated parts of the project area that may represent potential Grey-headed Flying-fox habitat weeds are unlikely to become established in these areas.

Of more relevance are the indirect impacts to the adjacent woodland east of the project area, which may provide habitat for the species. This area of woodland has shown resilience to weed infiltration with very few weed species observed. Given the apparent resilience, and inclusion of appropriate weed control and hygiene measures during construction, it is unlikely that invasive species will become established in areas of potential Grey-headed Flying-fox habitat.

xxix introduce disease that may cause the species to decline; or

A small proportion of the Grey-headed Flying-fox carries Hendravirus and Lyssavirus. As roosting camps with large aggregations of the species are absent from the project area and limited foraging habitat is available, the removal of vegetation for the project is considered unlikely to cause sufficient stress to the population such that a disease outbreak would occur.

xxx interfere substantially with the recovery of the species.

The project area does not represent important habitat for the species, as roosting camps are absent and foraging habitat is limited. Therefore, the project will not interfere substantially with the recovery of the species.

C.4.2 Conclusion

Grey-headed Flying-fox roosting camps are absent from the project area. The Grey-headed Flying-fox is likely to forage within the project area on a transient basis only. The foraging habitat is sub-optimal its loss will not cause any significant impacts to the species. Therefore, the project will not result in significant impacts for the Grey-headed Flying-fox.

C.5 Large-eared Pied Bat (*Chalinolobus dwyeri*) – Vulnerable

This species roosts in caves, crevices in cliffs, old mine workings. Such roosting habitat is absent from the project area.

Foraging habitat includes low to mid-elevation dry open forest and woodland, especially in gullies and in riparian corridors. Records of this species exist approximately 2.5 km north-east of the project area and the species may have the potential to forage along Swamp Creek in the north of the project area. This area has been specifically avoided by the design and will not be directly impacted by the project. Indirect impacts including runoff will be managed.

Important habitat for the species has been identified as roosting areas with foraging habitats (vegetated riparian corridors) in close proximity. As roosting habitat is absent from the project area and surrounds, the area does not contain an important population of the Large-eared Pied Bat.

C.5.1 An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

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

Important populations of this species are centred around roosting areas. No suitable roosting areas exist within the project area or vicinity and it is likely that if the species occurs within the project area it is only on a transient basis. The species may forage along the riparian corridor of Swamp Creek, which will not be directly or indirectly impacted by the project. Therefore, the project will not lead to a long-term decrease in an important population of Large-eared Pied Bats.

xxxii reduce the area of occupancy of an important population;

An important population of the Large-eared Pied Bat is absent from the project area and surrounds. Therefore, the project will not reduce the area of occupancy for an important population of Large-eared Pied Bats.

xxxiii fragment an existing important population into two or more populations;

An important population of the Large-eared Pied Bat is absent from the project area, and therefore the project will not fragment and important population of the species.

The species may use the riparian corridor along Swamp Creek, north of the project area, as a movement corridor. This will not be impacted by the project and no significant fragmentation impacts are anticipated.

xxxiv adversely affect habitat critical to the survival of a species;

Habitats critical to the survival of the Large-eared Pied Bat includes areas that contain breeding and roosting sites (disused mines and caves), and surrounding forest for foraging. Such habitat is absent from the project area, and therefore the project will not adversely affect habitat critical to the survival of the Large-eared Pied Bat.

xxxv disrupt the breeding cycle of an important population;

An important population of the Large-eared Pied Bat is absent from the project area. Breeding occurs in caves and old mine workings which are absent from the project area. Therefore, the project will not disrupt the breeding cycle of an important population of the species.

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

The project area does not contain breeding habitat for the Large-eared Pied Bat. The species may forage along Swamp Creek in the north of the project area.

xxxvii result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat;

Parts of the project area are weedy, exacerbated by a history of heavy machinery movements and earthworks within the project area. As the project will clear and develop the majority of vegetated parts of the project area, there is potential for weed invasion in vegetation to be retained in the north of the project area, which may represent a movement corridor for the Large-eared Pied Bat.

This area of woodland was inspected during the survey and despite the prevalence of weeds the remaining parts of the project area, has shown resilience to weed infiltration with very few weed species observed. Given the apparent resilience, and inclusion of appropriate weed control and hygiene measures during construction, it is unlikely that any significant impacts will occur as a result of invasive species in the potential movement corridor for the Large-eared Pied Bat.

xxxviii introduce disease that may cause the species to decline; or

Like other microbat species, the Large-eared Pied Bat may be susceptible to Australian Bat Lyssavirus, a rabies-like disease. However, given the absence of breeding habitat and the species expected use of the north of the project area as a movement corridor on its way to other areas, the project is not expected to cause sufficient stress to the Large-eared Pied Bat such that a disease outbreak would occur.

xxxix interfere substantially with the recovery of the species.

As the project will not remove any breeding habitat and foraging/movement habitat is likely to be restricted to vegetation along Swamp Creek which will be retained, the project will not interfere substantially with the recovery of the species.

C.5.2 Conclusion

The project area does not contain important habitat for the Large-eared Pied Bat given the absence of suitable breeding habitat. Foraging and movement habitat is likely to be restricted to vegetated parts of Swamp Creek, which will not be impacted by the project. Therefore, the project will not result in a significant impact for the Large-eared Pied Bat.

C.6 Slaty Red Gum (*Eucalyptus glaucina*) – Vulnerable

One felled Slaty Red Gum was recorded observed during the May 2016 site survey. No extant trees were found within the other areas of remnant vegetation within the project area. The Kurri Sands Swamp Forest to the east of the project area is potential habitat for the species.

C.6.1 Consideration of Important Population

The significant impact criteria refer to important populations of a species and therefore it is important to establish if the individual trees within the project area are part of an important population. In accordance with Matters of National Environmental Significance: Significant impact guidelines 1.1 (Commonwealth of Australia 2013), an 'important population' is a population that is necessary for a species' long-term survival and recovery. There are no such important populations identified for this species, therefore the population of Slaty Red Gum will be considered against the following factors outlined in Commonwealth of Australia (2013).

- key source populations either for breeding or dispersal

Slaty Red Gum within the Kurri Kurri area are likely to be important for maintaining a local seed source and ensuring persistence of the species in the region through regeneration.

- populations that are necessary for maintaining genetic diversity, and/or

Slaty Gum within the Hunter Valley is presumed to have a more continuous historical extent and genetic diversity is likely to be relatively homologous.

- populations that are near the limit of the species range.

Slaty Red Gum in the Kurri Kurri region are close to the limit of the southern range.

It is not known if Slaty Red Gum in the Kurri Kurri region are considered a distinct population or a subpopulation of a much larger Hunter Valley population which extends almost as far as Denman and Singleton. As the Kurri Kurri occurrence of the Slaty Red Gum is close to its southern limit, a conservative approach has been taken for the assessment and it is presumed that the Slaty Red Gum in the vicinity of the project area are part of an important population.

C.6.2 An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

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

No standing Slaty Red Gum were found within the project area, therefore no loss of individuals is anticipated as a result of the project. There will be no decrease in size for this population as a result of the project.

xli reduce the area of occupancy of an important population;

The project will result in clearance of 1.45 ha of potential habitat for this species. As the species does not occur within the project area this is not considered a loss of occupancy area for the population.

The habitat within the project area is disturbed and has only supported a single previously felled tree with no observed regeneration.

xlii fragment an existing important population into two or more populations;

The project area is already patchy with cleared areas present. There is no evidence to suggest that the project area provides a link between important populations with the closest records of the species to the 1.4 km to the north-east and 2.5 km to the south-east. Significant barriers exist between these areas, including the urban areas of Weston-Kurri Kurri and the Hunter Expressway.

xliii adversely affect habitat critical to the survival of a species;

The habitat which will be cleared is not likely to be important to this species, as it has previously supported a single tree. Other habitats within the Kurri Kurri region, close to Weston, support higher densities of this species and may represent the core population/subpopulation within the region. Communities where it occurs as a dominant canopy species include, the Hunter Valley Footslopes Slaty Gum Woodland.

xliv disrupt the breeding cycle of an important population;

The project will only remove the potential for the species to regenerate from seed within the project area, as there are no Slaty Red Gum individuals present. The high levels of disturbance within the project area reduce the likelihood of any tree reaching maturity and therefore is already an unviable part of population. No impact to the breeding cycle of this species will occur outside of the project area.

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

The removal of the habitat will not impact any individuals and therefore it is not likely to cause a decline in the species prevalence. It is noted that there is the potential for the seed sources to be present in the southern area of the project area. The chance of regeneration is low however due to ongoing disturbance and management within the project area. The impact of the project is considered negligible for this species and not likely to contribute to its decline.

xlvi result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat;

Parts of the project area are weedy, exacerbated by a history of heavy machinery movements and earthworks within the project area. Considering the proposal will clear and develop the majority of vegetated areas within the project area, weeds are unlikely to be an issue. Of more relevance are the indirect impacts to the woodland, east of the project area which may provide habitat for Slaty Red Gum. This area of woodland has shown resilience to weed infiltration with very few weed species observed. Given the apparent resilience, and inclusion of appropriate weed control and hygiene measures during construction, it is unlikely that any significant impacts will occur as a result of invasive species.

xlvii introduce disease that may cause the species to decline; or

Slaty Red Gum have not been noted as being particularly susceptible to disease. As no soil or other vegetative materials will be introduced to project area, the project will not introduce disease to the area that may cause the species to decline.

xlviii interfere substantially with the recovery of the species.

The project area is unlikely to be important for the species recovery given that potential habitat is limited to small patches surrounded by disturbed vegetation and hardstand areas. This restricts the potential of the project area to assist in the regeneration and recovery of this subspecies.

C.6.3 Conclusion

The loss of potential habitat for the species is not likely to impact this species considering the high levels of disturbance present, and the small area of loss (1.45 ha). Larger areas of potential habitat of more optimal habitat exist within the immediate vicinity of the project area.

C.7 New Holland Mouse (*Pseudomys novaehollandiae*) – Vulnerable

This species occurs in coastal areas and up to 100 km inland on sandstone country (OEH 2016). At inland sites the species frequents heathland and open woodland with a heathland understorey. Deep and soft soils are preferred by this species, which aids burrowing.

Small patches of woodland within the project area may provide suitable habitat for the species given the presence of sandy soils. These patches are located on the edge of a larger area of suitable habitat which occurs off site.

The closest record of this species is 2.3 km to the north-east with other records also existing to the east and south-west. Disturbance of habitat does not necessarily preclude this species from occurring within the project area given that a peak in abundance has been demonstrated several years after disturbance of a community, such as by bushfire or sand mining (DoEE 2016). Notwithstanding the project area is fragmented into patches of remnant vegetation interspersed with hardstand which is likely to leave the species vulnerable to predation. The amount of potential habitat within the project area is unlikely to be sufficient in size to support the species in isolation. If the species is present within the project area it is only likely to be persist in association with the higher condition and much larger area of Kurri Sands Swamp Woodland to the south-east of the project area.

C.7.1 Consideration of Important Population

The significant impact criteria refer to important populations of a species and therefore it is important to establish if the New Holland Mouse is part of an important population. In accordance with Matters of National Environmental Significance: Significant impact guidelines 1.1 (Commonwealth of Australia 2013), an 'important population' is a population that is necessary for a species' long-term survival and recovery. There are no such important populations identified in a recovery plan for this species, therefore the population of New Holland Mouse will be considered against the following factors outlined in Commonwealth of Australia (2013).

Fifteen subpopulations of the species have been identified in the Cessnock area, with an estimated total abundance of between 2500 and more than 8000 individuals (SPRAT 2016). The location or size of these sub-populations are not available, and therefore this assessment focuses on the two main populations of the species that have been identified at Kurri Kurri-Cessnock and Tomalpin. The assessment is provided in the following sections.

- key source populations either for breeding or dispersal;

The population within the Hunter region is likely to be part of a continuous but fragmented large population which extends from Sydney, north to Taree. Records within the Kurri Kurri area and wider middle Hunter region occur sporadically and in low densities. It is unlikely that the Kurri Kurri region provides a key source population, with much higher densities of records in the Newcastle to Port Stephens Region (ALA, 2016).

- populations that are necessary for maintaining genetic diversity, and/or

Genetic evidence indicates that the New Holland Mouse once formed a single continuous population on mainland Australia and the distribution of recent subfossils further suggest that the species has undergone a large range contraction since European settlement (OEH 2016). Given homogenous genetics of the species, the local population is not necessary for maintaining genetic diversity.

- populations that are near the limit of the species range.

The Kurri Kurri region is within the centre of the species range in NSW.

C.7.2 Summary

Considering the above statements, The New Holland Mouse within the Kurri Kurri region is not part of an important population.

C.7.3 An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

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

If the species occurs within the project area its area of occupancy is likely to be restricted to woodland areas of the project area which are 0.87 ha in size. The loss of this small area of habitat is not likely to significantly decrease the population size of this species. Large areas of more optimal habitat exists to the south east of the project area. Furthermore, the New Holland Mouse within the Kurri Kurri region is not part of an important population.

The loss of 0.87 ha of sub-optimal habitat is not likely to significantly reduce the occupancy of the population within the vicinity. Large areas of less disturbed Kurri Sands Swamp Woodland exist to the south east of the project area. Furthermore, the New Holland Mouse within the Kurri Kurri region is not part of an important population.

- l fragment an existing important population into two or more populations;

The habitat to the west of the project area is fragmented, mostly cleared and unlikely to support the New Holland Mouse. Currently the project area offers little connectivity for the species therefore the clearance of vegetation will not have any significant effect on fragmentation. Furthermore, the New Holland Mouse within the Kurri Kurri region is not part of an important population.

- li adversely affect habitat critical to the survival of a species;

Critical habitat has not been listed for this species. The habitat within the project area is sub-optimal for the species owing to small islands of habitat occurring, which are surrounded by cleared areas and hardstands. The project area is a small area of potentially suitable habitat, on the edge of a larger area of suitable habitat.

- lii disrupt the breeding cycle of an important population;

All potential habitat within the project area will be removed (0.87 ha). More optimal breeding habitat for the species extends off the site, and the habitat at the project area only represents a small patch on the edge of this habitat. There are no anticipated impacts on adjacent habitats and the breeding cycle will remain unaffected in these areas. Furthermore, the New Holland Mouse within the Kurri Kurri region is not part of an important population.

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

The 0.87 ha of potential habitat which will be removed, is a very small proportion of the potential habitat available for this species. More optimal habitat for the species extends off the site, and the habitat within the project area only represents a small patch on the edge of this habitat. The effect on the species is likely to be negligible.

- liv result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat;

The project area will be cleared and replaced with infrastructure, which will not provide any habitat for invasive species. The project is not likely to alter exotic predator abundance in adjacent habitats.

- lv introduce disease that may cause the species to decline; or

The New Holland Mouse is not known to be threatened by disease. Vehicle movements and heavy machinery have been used within the project area for an extended period of time and the project is unlikely to introduce any novel pathogens to the area.

- lvi interfere substantially with the recovery of the species.

The habitat within the project area is not likely to be important to the species and recovery is more likely to be associated with preservation of optimal habitat and reduction of predators such as the European Fox (*Vulpes vulpes*) and Domestic Cat (*Felis catus*).

C.7.4 Conclusion

If the New Holland Mouse occurs within the project area it is only likely to be in association with the more optimal adjacent woodland to the south east. It is only likely to occur in low abundances given the disturbed nature of the habitat. The small area of clearance required, is not likely to significantly impact this species.

C.8 Earp's Gum (*Eucalyptus parramattensis* subsp. *decadens*) – Vulnerable

C.8.1 Consideration of Important Population

The significant impact criteria refer to important populations of a species and therefore it is important to establish if the individual trees within the project area are part of an important population. In accordance with Matters of National Environmental Significance: Significant impact guidelines 1.1 (Commonwealth of Australia 2013), an 'important population' is a population that is necessary for a species' long-term survival and recovery. There are no such important populations identified in a recovery plan for this species, therefore the population of Earp's Gum will be considered against the following factors outlined in Commonwealth of Australia (2013).

Fifteen subpopulations of the species have been identified in the Cessnock area, with an estimated total abundance of between 2500 and more than 8000 individuals (SPRAT 2016). The location or size of these sub-populations are not available, and therefore this assessment focuses on the two main populations of the species that have been identified at Kurri Kurri-Cessnock and Tomalpin. The assessment is provided in the following sections.

- key source populations either for breeding or dispersal;

The population of Earp's Gum within the project area consists of 37 trees which are clustered in small patches of woodland or occurring as scattered trees. High levels of disturbance occur adjacent to the small woodland patches, including buildings, hardstands, discarded industrial equipment storage, dumping of fill material and exotic grassland. This limits the ability of the trees to provide a source of dispersal for subspecies. Recruitment of the subspecies is limited to the small patches of woodland within the immediate vicinity, and therefore unlikely to support expansion of the species into other areas. To the south and east of the project area a large and continuous patch of woodland exists, which is likely to provide habitat for a substantial number of the subspecies. This is a more optimal source population, given its large patch size and good connectivity to other areas of woodland.

- populations that are necessary for maintaining genetic diversity, and/or

The population of Earp's Gum would have originally formed a continuous swathe of woodland stretching both east and west of the project area. Earp's Gum within the project area would be homologous with the extant population to the east of the project area. Earp's Gum within the project area does not represent an important reservoir of genetic diversity.

- populations that are near the limit of the species range.

Two key populations exist for this subspecies; the Kurri Kurri-Cessnock population and the Tomalpin population. The project area is within part of the Kurri Kurri-Cessnock population and can be considered in part of its core range. The individuals on site are not near the limit of the subspecies range.

i Summary

Considering the above statements, Earp's Gum within the project area is part of the larger Kurri Kurri-Cessnock important population of the species.

C.8.2 Assessment of Significance

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

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

Up to 37 trees will be removed which constitutes a small proportion of the important Kurri Kurri-Cessnock population (2500 to 8000 individuals). This reduction in population size is considered a low magnitude impact and unlikely significantly impact the overall size of the Kurri Kurri- Cessnock population. Several trees within the project area had severe canopy dieback and recruitment within the project area was low. The subspecies viability within the project is uncertain in the long term.

lviii reduce the area of occupancy of an important population

1.45 ha of habitat for Earp's Gum will be cleared, however this constitutes a small proportion of the area of occupancy for the Kurri Kurri-Cessnock population. This population occurs with an area of approximately 18 km by 17 km and therefore the reduction of habitat is considered negligible.

The habitat within the project area consists of small patches of woodland surrounded by highly degraded and cleared land. There is little opportunity for this subspecies to increase its range and recruitment was absent or occurring at very low levels. The subspecies viability within the project area is uncertain in the long term owing to ongoing disturbance.

lix fragment an existing important population into two or more populations

Large aggregations of this species exist as sub-populations within the overall Kurri Kurri-Cessnock population. The project area does not provide any links between these sub-populations and there will be no fragmentation of the population. Furthermore the occurrence of Earp's Gum is patchy within the project area, interspersed with disturbed areas of dumped fill, weedy grassland and discarded machinery. The area to the west of the project area is mostly cleared with existing connectivity considered poor.

lx adversely affect habitat critical to the survival of a species

The habitat within the project area consists of small patches of woodland surrounded by highly degraded and cleared land. There is little opportunity for this subspecies to increase its range and recruitment was absent or occurring at very low levels. The subspecies viability within the project area is uncertain in the long term and the habitat is not considered important to the subspecies. Large areas of intact habitat are present to the east of the project area. The subspecies also occurs in the protected Werakata National Park.

lxi disrupt the breeding cycle of an important population

The clearance of 37 trees will remove a seed source in the immediate vicinity only. This is considered a negligible impact to the important population as mature Earp's Gum exist in adjacent habitats, which will help to ensure persistence of the population. No impact to the breeding cycle of this species will occur outside of the project area

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

The action will remove approximately 1.45 ha of known habitat for the subspecies. This is a very small proportion of the total habitat for the subspecies which occurs within two disjunct areas. The Kurri Kurri population is bordered by Cessnock/Kurri Kurri in the north and Mulbring—Abedare in the south (NSW OEH, 2012).

Large aggregations of the subspecies are also located in the Tomalpin area (NSW OEH) which is bounded by Salt Ash and Tanilba Bay in the north and Williamstown and Tomago in the south (NSW OEH, 2012). The removal of a small amount of disturbed habitat is likely to have a negligible impact on the subspecies, with loss of the subspecies limited to 37 individuals.

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

Parts of the project area are weedy, exacerbated by a history of heavy machinery movements, earthworks within the project area and the dumping of fill material. Considering the proposal will clear and develop the majority of vegetated areas within the project area, weeds are unlikely to be an issue. Of more relevance are the indirect impacts to the woodland, east of the project area which provide habitat for Earps' Gum. This area of woodland has shown resilience to weed infiltration with very few weed species observed. Given the apparent resilience, and inclusion of appropriate weed control and hygiene measures during construction, it is unlikely that any significant impacts will occur as a result of invasive species.

lxiv introduce disease that may cause the species to decline, or

Earps' Gum have not been noted as being particularly susceptible to disease, however appropriate construction controls should be implemented to avoid bringing contaminated soils or vegetative material onto the site.

lxv interfere substantially with the recovery of the species.

The subspecies occurs in small patches surrounded by disturbed vegetation and hardstand areas, limiting the potential to assist in the regeneration and recovery of this subspecies. Clearance of trees within the project area is not likely to affect recovery of the subspecies, especially as larger areas of intact woodland will remain to the east of the project area, which will maintain an ongoing seed source for regeneration.

C.8.3 Conclusion

In accordance with the significance impact guidelines, the removal of up to 37 Earps' Gum from the project area will not cause a significant impact to the vulnerable subspecies.

Appendix D

BioBanking Calculator Credit Report

Biodiversity credit report



This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 27/09/2016

Time: 2:58:46PM

Calculator version: v4.0

Major Project details

Proposal ID: 191/2016/3928MP

Proposal name: Battery Recycling Facility

Proposal address: 129 Mitchell Avenue Kurri Kurri NSW 2327

Proponent name: Pymore Recyclers International Pty Ltd

Proponent address: Level 40 1 Farrer Place Sydney NSW 2000

Proponent phone:

Assessor name: Eugene Dodd

Assessor address: LEVEL 4 45 WATT ST Newcastle NSW 2300

Assessor phone: 0427 566 396

Assessor accreditation: 191

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area	1.48	59.00
Total	1.48	59

Credit profiles

1. Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area, (HU847)

Number of ecosystem credits created	59
IBRA sub-region	Hunter

Offset options - Plant Community types	Offset options - IBRA sub-regions
<p>Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area, (HU847)</p> <p>Rough-barked Apple - Narrow-leaved Ironbark - Blakely's Red Gum - Bull Oak - Coast Banksia woodland on sands of the Warkworth area, (HU872)</p>	<p>Hunter</p> <p>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs</p>

Summary of species credits required

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Eucalyptus parramattensis subsp. decadens	Eucalyptus parramattensis subsp. decadens	37.00	518

Appendix E

Protected matters search tool results



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 12/09/16 15:53:35

[Summary](#)

[Details](#)

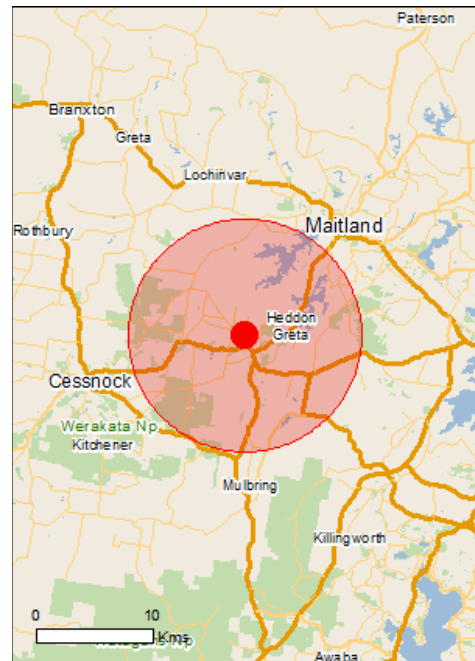
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

[Coordinates](#)

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	35
Listed Migratory Species:	13

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	4
Commonwealth Heritage Places:	None
Listed Marine Species:	19
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	3
Regional Forest Agreements:	1
Invasive Species:	49
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Hunter estuary wetlands	10 - 20km upstream

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Central Hunter Valley eucalypt forest and woodland	Critically Endangered	Community may occur within area
Hunter Valley Weeping Myall (Acacia pendula) Woodland	Critically Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community may occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Frogs		
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence within area
Litoria littlejohni Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat may occur within area
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
Mixophyes iteratus Giant Barred Frog, Southern Barred Frog [1944]	Endangered	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat likely to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Plants		
Acacia bynoeana Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat known to occur within area
Angophora inopina Charmhaven Apple [64832]	Vulnerable	Species or species habitat likely to occur within area
Asterolasia elegans [56780]	Endangered	Species or species habitat likely to occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus glaucina Slaty Red Gum [5670]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus parramattensis subsp. decadens Earp's Gum, Earp's Dirty Gum [56148]	Vulnerable	Species or species habitat known to occur within area
Euphrasia arguta [4325]	Critically Endangered	Species or species

Name	Status	Type of Presence
Grevillea parviflora subsp. parviflora Small-flower Grevillea [64910]	Vulnerable	habitat may occur within area Species or species habitat known to occur within area
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat may occur within area
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area
Rutidosia heterogama Heath Wrinklewort [13132]	Vulnerable	Species or species habitat likely to occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Pocket-less Brush Cherry, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat likely to occur within area
Tetraloche juncea Black-eyed Susan [21407]	Vulnerable	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area

Reptiles

Hoplocephalus bungaroides Broad-headed Snake [1182]	Vulnerable	Species or species habitat likely to occur within area
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Listed Migratory Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
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Migratory Marine Birds

Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
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Migratory Terrestrial Species

Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
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Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
--	--	---

Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
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Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
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Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
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Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
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Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
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Name	Threatened	Type of Presence
Migratory Wetlands Species		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [[Resource Information](#)]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name

Commonwealth Land -
Commonwealth Land - Airservices Australia
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Telstra Corporation Limited

Listed Marine Species [[Resource Information](#)]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Cuculus saturatus Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur

Name	Threatened	Type of Presence within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Sugarloaf	NSW
Werakata	NSW
Werakata	NSW
Regional Forest Agreements	[Resource Information]
Note that all areas with completed RFAs have been included.	
Name	State
North East NSW RFA	New South Wales

Invasive Species**[Resource Information]**

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur

Name	Status	Type of Presence
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		within area Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus densiflorus Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.80565 151.47722

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Parks and Wildlife Commission NT, Northern Territory Government](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Atherton and Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

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