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Biodiversity Development Assessment Report**

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## Hunter Power Project

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### Document history and status

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**Certification under Section 6.15 of the Biodiversity Conservation Act 2016**

I, Chris Thomson (BAAS18058) certify that this Biodiversity Development Assessment Report and the accompanying finalised credit report dated 16 April 2021 has been prepared in accordance with the requirements of (and information provided under) the Biodiversity Assessment Method.

A handwritten signature in black ink, reading "Chris Thomson". The signature is written in a cursive style with a large, stylized 'C' and 'T'.

Chris Thomson – BAAS18058

16 April 2021

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## Glossary of terms

Terms	Definitions
APZ	The Asset Protection Zone is a 10 m buffer positioned adjacent to the Proposal Site boundary, where the site adjoins existing vegetation. This APZ has been planned to provide a fire protection zone.
Biodiversity Assessment Method	<p>The Biodiversity Assessment Method (BAM) is the assessment manual that outlines how an accredited person assesses impacts on biodiversity at development sites and stewardship sites. It is a scientific document that provides:</p> <ul style="list-style-type: none"> <li>▪ A consistent method for the assessment of biodiversity on a proposed development or major project, or clearing site</li> <li>▪ Guidance on how a proponent can avoid and minimise potential biodiversity impacts</li> <li>▪ The number and class of biodiversity credits that need to be offset to achieve a standard of 'no net loss' of biodiversity.</li> </ul>
Biodiversity credits	Ecosystem credits or species credits.
Biodiversity credit report	The report produced by the BAM Calculator (BAM-C) that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development / Proposal Site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site.
Biodiversity offsets	Management actions that are undertaken to achieve a gain in biodiversity values on areas of land in order to compensate for losses to biodiversity values from the impacts of development.
Biodiversity Offsets Scheme	A NSW government framework which creates a transparent, consistent, and scientifically based approach to biodiversity assessment and offsetting for development that is likely to have a significant impact on biodiversity.
Biodiversity Offset Strategy	A strategy for offsetting residual impacts associated with a development.
Biodiversity Assessment Method Calculator (BAM-C)	The computer program that provides decision support to assessors and proponents by applying the BAM, and which calculates the number and class of biodiversity credits required to offset the impacts of a development.
Bioregion	Bioregions are relatively large land areas characterised by broad, landscape-scale natural features and environmental processes that influence the functions of entire ecosystems. They capture the large-scale geophysical patterns across Australia. These patterns in the landscape are linked to fauna and flora assemblages and processes at the ecosystem scale.
Cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Refer to the proposals Secretary's Environmental Assessment Requirements for cumulative impact assessment requirements.
Direct impact	An impact on biodiversity values that is a direct result of vegetation clearance and loss of habitat for a development. It is predictable, usually occurs at or near to the Proposal Site and can be readily identified during the planning, design, construction, and operational phases of a development.

Terms	Definitions
Ecological community	An ecological community is a naturally occurring group of native plants, animals and other organisms living in a unique location. Ecological communities can be listed as threatened under the EPBC Act and/or BC Act.
Ecosystem credit	A measurement of the value of endangered ecological communities (EECs), critically endangered ecological communities (CEECs) and threatened species habitat for species that can be reliably predicted to occur with a plant community type (PCT). Ecosystem credits measure the loss in biodiversity values at a Proposal Site and the gain in biodiversity values at a biodiversity stewardship site.
Ecosystem credit species	Threatened species that can be reliably predicted to occur with a PCT, for which species-specific biodiversity credits are not required.
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population, or ecological community, including any biotic or abiotic component.
Indirect impact	<p>An impact on biodiversity values that occurs when development related activities affect threatened species, threatened species habitat, or ecological communities in a manner other than direct impact. Compared to direct impacts, indirect impacts often:</p> <ul style="list-style-type: none"> <li>▪ Occur over a wider area than just the site of the development</li> <li>▪ Have a lower intensity of impact in the extent to which they occur compared to direct impacts</li> <li>▪ Occur off site</li> <li>▪ Have a lower predictability of when the impact occurs</li> <li>▪ Have unclear boundaries of responsibility.</li> </ul>
Locality	This is defined as the area within a 10 km radius surrounding the Proposal Site.
Local population	The population that occurs in the Proposal Site. In cases where multiple populations occur in the Proposal Site and/or a population occupies part of the Proposal Site, impacts on the entirety of each population must be assessed separately.
MNES	A matter of national environmental significance (MNES) protected by a provision of Part 3 of the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act).
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils, and broad vegetation types, mapped at a scale of 1: 250,000.
Mitigation	Action to reduce the severity of an impact.
Mitigation measure	Any measure that facilitates the safe movement of wildlife and/or prevents wildlife mortality.
Patch	A patch is defined in the BAM as an area of intact native vegetation that occurs on the subject land. The patch may extend onto adjoining land beyond the Proposal Site of the subject land, and for woody ecosystems, includes native vegetation separated by $\leq 100$ m from the next area of intact native vegetation. For non-woody vegetation, this gap is reduced to $\leq 30$ m.

Terms	Definitions
Plant community type	A NSW plant community type identified using the plant community type (PCT) classification system. The PCT classification was created in 2011 by consolidating two existing community-level classifications: the NSW Vegetation Classification and Assessment database; and the Biometric Vegetation Types database used in NSW regulatory programs. The PCT classification is now maintained in the BioNet Vegetation Classification application. It is a way to classify vegetation types.
Population	A group of organisms, all of the same species, occupying a particular area.
Proposal Site	The area of land that is directly impacted on by a proposed development, including access roads, and areas used to store construction materials.
Sensitivity to gain class	The biodiversity risk weighting (Section 6.6 of the BAM) is one tool used in the Biodiversity Offsets Scheme to mitigate the risk in offsetting the loss of vegetation, threatened entities and/or their habitat. The biodiversity risk weighting does this by increasing the quantum of credits required at an impact site. Sensitivity to potential gain is based on life history characteristics and ecological information for a species.
Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection.
Species credit species	Threatened species that are assessed according to Section 5.22 of the BAM which may generate species-specific biodiversity credit requirements.
Study area	The Proposal Site and any other areas surveyed and assessed for biodiversity values which may be subject to indirect impacts.
Target species	A species that is the focus of a study or intended beneficiary of a conservation action or connectivity measure.
Threatened Biodiversity Data Collection	Part of the BioNet database, accessible from the BioNet website at <a href="http://www.bionet.nsw.gov.au">www.bionet.nsw.gov.au</a> .
Threatened species	A species listed under the NSW <i>Biodiversity Conservation Act 2016</i> (BC Act), NSW <i>Fisheries Management Act 1994</i> (FM Act) or EPBC Act.
Threatened ecological community	A community of different species associated with one another and sharing the same habitat, that is listed under the NSW <i>Biodiversity Conservation Act 2016</i> (BC Act), NSW <i>Fisheries Management Act 1994</i> (FM Act) and Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act). Threatened ecological communities are listed as endangered or critically endangered under the BC Act, or may be listed as vulnerable, endangered, or critically endangered under the EPBC Act.
1,500 m landscape buffer	The assessment area surrounding the Proposal Site includes the area of land in the 1,500 m landscape buffer around the Proposal Site. The study area is situated within the 1,500 m landscape buffer. The landscape buffer is an assessment area used to identify landscape features surrounding the Proposal Site to provide site context and to inform the likely habitat suitability of the Proposal Site.

Abbreviations	Definitions
aff.	Affinity (similarity in structure) with regard to species taxonomy
BAM	Biodiversity Assessment Method
BAM-C	BAM Calculator
BC Act	<i>Biodiversity Conservation Act 2016 (NSW)</i>
BDAR	Biodiversity Development Assessment Report
BOS	Biodiversity Offset Strategy
CEMP	Construction Environmental Management Plan
DPIE	Department of Planning, Industry and Environment (NSW)
DPI	Department of Primary Industries (NSW)
EEC	Endangered ecological community
EESG	Environment, Energy and Science Group (NSW DPIE)
EIS	Environmental Impact Statement
EP&A Act	<i>Environmental Planning and Assessment Act 1979 (NSW)</i>
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999 (Federal)</i>
FM Act	<i>Fisheries Management Act 1994 (NSW)</i>
IBRA	Interim Biogeographically Regionalisation of Australia
MNES	Matters of National Environmental Significance
OEH	Office of Environment and Heritage (replaced by EESG)
PCT	plant community type
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
sp.	Species (singular)
spp.	Species (plural)
SSI	State Significant Infrastructure
subsp.	Subspecies
TBDC	Threatened Biodiversity Data Collection (BioNet)
TECs	Threatened Ecological Communities
VIS	Vegetation Information System (BioNet Vegetation Classification)



## Executive Summary

Snowy Hydro Limited (Snowy Hydro) ('the Proponent') proposes to develop a gas fired power station near Kurri Kurri, NSW ('the Proposal'). Snowy Hydro is seeking approval from the NSW Minister for Planning and Public Spaces under Part 5, Division 5.2 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) State significant infrastructure.

The Proposal Site is located in Loxford in the Hunter Valley region of New South Wales, approximately three kilometres (km) north of the town of Kurri Kurri, approximately 30 km north west of Newcastle CBD and 125 km north of Sydney. The Proposal Site is located within the Cessnock City Council local government area (LGA). The Proposal Site forms part of the decommissioned Kurri Kurri aluminium smelter site, owned by Hydro Aluminium Kurri Kurri Pty Ltd (Hydro Aluminium), which ceased operation in late 2012 and was permanently closed in 2014. Demolition and site remediation works are ongoing but would be completed prior to construction of the Proposal.

The Secretary's Environmental Assessment Requirements (SEARs) for the Proposal application state:

- An assessment of the biodiversity values and the likely biodiversity impacts of the project in accordance with the NSW *Biodiversity Conservation Act 2016* (BC Act) the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR)
- The BDAR must document the application of the avoid, minimise, and offset framework including assessing all direct, indirect, and prescribed impacts in accordance with the BAM.

This Biodiversity Development Assessment Report (BDAR) has been prepared for the Proposal in accordance with the requirements of the BC Act and the BAM. This BDAR documents the results of the biodiversity assessment carried out for the development in line with the relevant State and Commonwealth environmental and threatened species legislation and policy. It also considers relevant matters under the NSW *Fisheries Management Act 1994*.

### Existing environment

The Proposal is planned to be constructed on a portion of the former Kurri Kurri aluminium smelter site, with 90 per cent of the Proposal footprint located on cleared land. Of the remaining 10 per cent (1.54 ha), 64 per cent of this land (1.09 ha) comprises regrowth and ground layer vegetation on formerly cleared or maintained power easements and historic fire protection zones. The impact to intact vegetation (0.40 ha) is a minor component of the development and it is evident that the Proposal has sought to avoid and minimise impacts to native vegetation by siting on a formerly used industrial site.

The Proposal Site is located within the Hunter sub-region of the Sydney Basin Bioregion. The subject land is located on the north-eastern edge of a large expanse of intact forest and woodland occupying much of the land between Kurri Kurri and Cessnock. This includes connectivity to the Werakata National Park to the west and the Aberdare State Forest located to the south-west of the subject land.

The 1,500 m landscape buffer used in this assessment is approximately 928.5 ha in size and contains approximately 484.7 ha of native vegetation (woody and non-woody vegetation). This results in a native vegetation cover in the landscape of approximately 52.2 per cent.

The landscape within and immediately surrounding the former Kurri Kurri aluminium site is highly modified and vegetation exists in different condition states ranging from intact, to regrowth (with no canopy) and low maintained vegetation within power easements (ground layer vegetation only). Two plant community types (PCTs) were identified in the Proposal Site:

- Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633)
- Typha rushland (PCT 1737).

PCT 1633 aligns with the Threatened Ecological Community (TEC) 'Kurri Sand Swamp Woodland' (listed as Endangered under the BC Act). The Kurri Sand Swamp Woodland is a low woodland or heathland, generally with a low open canopy rarely exceeding 15 m in height and a shrubby understorey. The overstorey is usually dominated by *Eucalyptus parramattensis* subsp. *decadens* (Earp's Gum) and *Angophora bakeri* (Narrow-leaved Apple) while other tree species that occur less frequently include *E. racemosa* (Narrow-leaved Scribbly Gum), *E. fibrosa* (Red Ironbark), *E. sp. aff. agglomerata* (Stringybark) and *Corymbia gummifera* (Red Bloodwood). 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 associated seedbank is still at least partially intact (NSW Scientific Committee, 2001). On this basis, all three condition states identified for PCT 1633 (i.e. intact, regrowth and ground layer only) have been identified as consistent with the listed ecological community.

PCT 1737 at the Proposal Site only occurs in man-made channels and drainage structures and therefore is not consistent with the Threatened Ecological Community – 'Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions' (Endangered under the BC Act).

Twelve candidate threatened plant species (species credits) were identified as having potential habitat on the Proposal Site by the Biodiversity Assessment Method Calculator (BAM-C) and a review of databases, and these species were targeted by survey. One of the target threatened plant species was found within or adjacent to the Proposal Site, namely *Eucalyptus parramattensis* subsp. *decadens* (Vulnerable under the EPBC Act and Vulnerable under the BC Act).

Eleven candidate threatened fauna species (species credits) were identified as having potential habitat on the Proposal Site by the BAM-C. One species was positively identified, the Southern Myotis (*Myotis macropus*), and a further species, the Common Planigale was assumed present based on the presence of suitable habitat, and the capture of the Yellow-footed Antechinus (*Antechinus flavipes*), which is typically associated with the same habitats.

The Regent Honeyeater and Swift Parrot were not identified from surveys at the Proposal Site, however both species are known to frequent the Kurri Kurri and Cessnock area (Birds Australia, 2013) and the 'important area mapping' for both species maps important habitat within the landscape buffer surrounding the Proposal Site. The Regent Honeyeater and Swift Parrot are identified in the Threatened Biodiversity Data Collection as potential serious and irreversible impacts (SAII) in relation to impacts on breeding habitat. The threshold identified is 'mapped important areas'. The important habitat mapped for the Swift Parrot does not overlay the Proposal Site. However, the intact area of PCT 1633 (0.40 ha) within the Proposal Site does intersect the important habitat mapped for the Regent Honeyeater across the broader Kurri Kurri and Cessnock area. In considering the impact on Regent Honeyeater from the Proposal, two factors are relevant:

- The total area of mapped important habitat in the Cessnock-Kurri Kurri area is around 415 ha, and the Proposal would directly impact around 0.40 ha of intact woodland
- The dominating canopy species at the Proposal Site include *Angophora bakeri* (Narrow-leaved Apple) and *Eucalyptus parramattensis* subsp. *decadens* (Earp's Gum), with a low density of *Eucalyptus agglomerata* (Stringybark). The Recovery Plan for the Regent Honeyeater identifies nine key foraging species, none of which are found in PCT 1633 or confirmed within the Proposal Site. In addition to this the plan also describes other tree species which may be regionally important, for example the Lower Hunter Spotted Gum Ironbark forest (also not present on the Proposal Site).

Based on available literature and current knowledge of habitat preferences for this Regent Honeyeater in the Hunter Valley, the habitat within the Proposal Site would not be considered important, despite overlaying a portion of the important habitat mapping, as it contains no key foraging species, with exception of low numbers of stringybark. Therefore, there are no significant impacts predicted to foraging habitat for the Regent Honeyeater as a result of the minor clearing required for this Proposal.

## Impact assessment

The potential for direct impacts to biodiversity is limited to clearing of a total of 1.54 ha of native vegetation and habitat. The development would not impact any areas of land that the Minister for Energy and Environment has declared as an area of outstanding biodiversity value in accordance with section 3.1 of the BC Act.

A key aspect of this Proposal is the very high degree of avoidance of impacts to native vegetation. The Proposal is planned to be constructed on the former Kurri Kurri aluminium smelter site, with around 90 per cent of the Proposal footprint located on cleared land. Of the remaining 10 per cent (1.54 ha), 64 per cent of this land comprises regrowth and ground layer vegetation on formerly cleared or maintained power easements and historic fire protection zones.

### Plant community types

Despite avoidance and minimisation measures, the Proposal Site would result in the direct removal of some native vegetation. This includes the development footprint, and adjacent land required for a 10 m wide Asset Protection Zone (APZ). The estimated clearing is approximately 1.54 ha consisting of the following PCTs:

- Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633) – 1.49 ha
- Typha rushland (PCT 1737) – 0.05 ha.

Around 1.09 ha of PCT1633 that is within the development footprint occurs within an existing power easement and APZ where vegetation is regularly maintained. The intact vegetation comprises the remaining 0.40 ha.

### Threatened Ecological Communities

One Threatened Ecological Community (TEC) listed under the BC Act would be impacted by the development:

- Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633) – 1.49 ha.

The areas of the TEC are mostly in low condition represented by native species within maintained power easements and regrowth from formerly cleared fire protection zones surrounding the former Kurri Kurri aluminium smelter site.

### Threatened species

Direct impacts on species credit threatened species habitat associated with the clearing of native vegetation is described in the table below.

Species name	Common name	EPBC Act	BC Act	Sensitivity to gain class	SAIL candidate	Area (ha) in Proposal Site or direct count
<i>Eucalyptus parramattensis subsp. decadens</i>	Earp's Gum	V	V	High	No	37 plants
<i>Myotis macropus</i>	Southern Myotis		V	High	No	0.40 ha
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	CE	High	Yes	0.40 ha
<i>Planigale maculata</i>	Common Planigale		V	High	No	0.40 ha

The potential for indirect impacts of the Proposal associated with noise and vibration, edge effects, dust and light pollution are assessed. For this Proposal the avoidance of vegetation and siting on former industrial land would lead to a reduced indirect impact.

### *Prescribed biodiversity impacts*

The potential for prescribed impacts associated with the Proposal were assessed considering the criteria discussed in the BAM. This includes discussion of impacts on karst, caves, crevices, cliffs and other features of geological significance, human made structures or non-native vegetation, habitat connectivity, water bodies, water quality hydrological processes, wind turbine strikes, and vehicle strikes. These features were either found to be absent, or any potential impacts low and negligible.

### **Mitigation and management**

Once all practicable steps to avoid or minimise impacts have been implemented at the detailed design phase, mitigation and management measures would be implemented to further lessen the potential ecological impacts of the Proposal development.

Biodiversity impacts during construction would be managed in accordance with a Construction Environmental Management Framework, which includes biodiversity management objectives to maximise workers' awareness of biodiversity values and avoid or minimise potential impacts to biodiversity.

The Construction Environmental Management Framework also requires the preparation and implementation of a Flora and Fauna Management Plan, including (but not limited to):

- Procedures for the demarcation and protection of retained vegetation, including all vegetation outside and adjacent to the construction footprint
- Measures to reduce disturbance to sensitive fauna
- Procedures for the clearing of vegetation and the relocation of flora and fauna, including pre-clearing surveys and hollow-bearing tree identification
- Procedures for dealing with unexpected finds of threatened species identified during construction
- Weed management measures in accordance with the *Biosecurity Act 2015*
- Pathogen management measures to prevent introduction and spread of amphibian chytrid fungus, *Phytophthora cinnamomi* and Exotic Rust Fungi
- Inspection and monitoring requirements.

### **Offsetting biodiversity impacts**

An offset is required for the impacts to PCTs and threatened (species credit) species and the biodiversity credit obligation has been calculated using the BAM-C and presented in this BDAR. Areas of the Proposal Site that do not possess PCTs have not been assessed and offset credits are not required. Similarly, vegetation zones that exhibit a low vegetation integrity score, below the threshold for a TEC (<15) and non-TEC community (<17) do not required offsets in accordance with the BAM. A summary of the biodiversity credit requirements for the development include:

- Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633) – 13 credits
- *Eucalyptus parramattensis subsp decadens* (Earp's Gum) – 74 credits
- *Myotis macropus* (Southern Myotis) – 9 credits
- *Anthochaera phrygia* (Regent Honeyeater) – 14 credits
- *Planigale maculata* (Common Planigale) – 9 credits.

# 1. Introduction

## 1.1 The Proposal

Snowy Hydro Limited (Snowy Hydro) ('the Proponent') proposes to develop a gas fired power station near Kurri Kurri, NSW ('the Proposal'). Snowy Hydro is seeking approval from the NSW Minister for Planning and Public Spaces under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) for the Proposal.

The Proposal involves the construction and operation of an open cycle gas turbine power station and electrical switchyard, together with other associated infrastructure. The power station would have a capacity of up to approximately 750 megawatts (MW) which would be generated via two heavy duty gas turbines. Although primarily a gas fired power station, the power station would also be capable of operating on diesel.

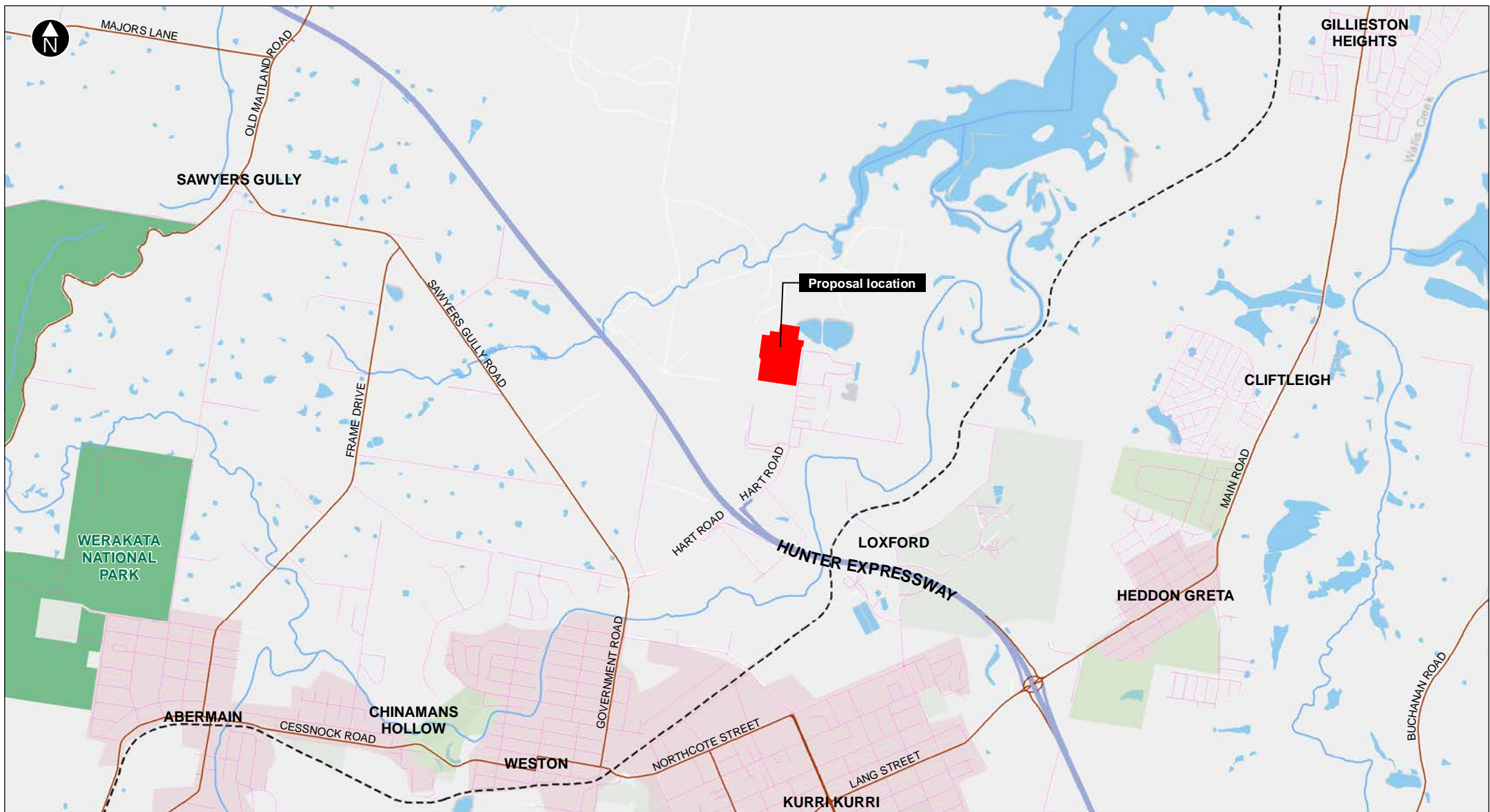
The Proposal would operate as a "peak load" generation facility supplying electricity at short notice when there is a requirement in the National Electricity Market. The major supporting infrastructure that is part of the Proposal would be a 132 kV electrical switchyard located within the Proposal Site. The Proposal would connect into existing 132 kV electricity transmission infrastructure located adjacent to the Proposal Site. A new gas lateral pipeline would also be required, and this would be developed by a third party and be subject of a separate environmental assessment and planning approval. Other supporting infrastructure elements of the Proposal include:

- Storage tanks and other water management infrastructure
- Fire water storage and firefighting equipment such as hydrants and pumps
- A permanent stormwater retention basin
- Maintenance laydown areas
- Diesel fuel storage tank(s) and truck unloading facilities
- Site access roads and car parking
- Office/administration, amenities, workshop/storage areas.

Construction activities are anticipated to commence early 2022 and the Proposal is intended to be operational by the end of 2023. Further description of the Proposal is provided in Chapter 2 of the Environmental Impact Statement.

The Proposal Site is located in the small suburb of Loxford in the Hunter Valley region of New South Wales, approximately three km north of the town of Kurri Kurri, approximately 30 km north west of Newcastle CBD and 125 km north of Sydney. The Proposal Site is located within the Cessnock City Council local government area (LGA). The Proposal Site is shown in Figure 1.1 and forms part of the former Kurri Kurri aluminium smelter, owned by Hydro Aluminium Kurri Kurri Pty Ltd (Hydro Aluminium), which ceased operation in late 2012 and was permanently closed in 2014. Demolition and site remediation works are ongoing but would be completed prior to construction of the Proposal.



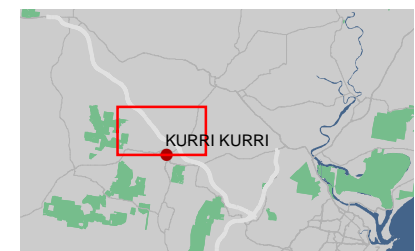


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|---|---|--|
| <span style="display: inline-block; width: 15px; height: 15px; background-color: red; margin-right: 5px;"></span> Proposal location   | <span style="display: inline-block; width: 15px; height: 15px; background-color: #f8d7da; margin-right: 5px;"></span> Urban areas | <span style="display: inline-block; width: 15px; height: 15px; background-color: #6c757d; margin-right: 5px;"></span> Motorway     |
| <span style="display: inline-block; width: 15px; height: 15px; background-color: #28a745; margin-right: 5px;"></span> National Parks and Wildlife Services estate / reserve | <span style="display: inline-block; width: 15px; height: 15px; background-color: #17a2b8; margin-right: 5px;"></span> Waterbodies | <span style="display: inline-block; width: 15px; height: 15px; background-color: #ffc107; margin-right: 5px;"></span> Main roads   |
| <span style="display: inline-block; width: 15px; height: 15px; background-color: #d4edda; margin-right: 5px;"></span> Recreation areas                                      |   | <span style="display: inline-block; width: 15px; height: 15px; border: 1px solid #ffc107; margin-right: 5px;"></span> Roads        |
|   |   | <span style="display: inline-block; width: 15px; height: 15px; border-top: 1px dashed #6c757d; margin-right: 5px;"></span> Railway |

0 1 2 km

1:40,000 at A4  
Coordinate System: GDA2020 MGA Zone 56

Data sources:  
Jacobs  
NSW Spatial Services



**Figure 1-1** Proposal location (regional)

## 1.2 Secretary's Environmental Assessment Requirements (SEARs)

An environmental impact statement (EIS) for the Proposal has been prepared under Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This Biodiversity Development Assessment Report (BDAR) has been prepared to support the EIS. The purpose of this report is to address the relevant sections of the Secretary's Environmental Assessment Requirements (SEARs) issued on 5 February 2021 (SSI 12590060). The report has also taken cognisance of any applicable agency comments. Table 1.1 outlines the SEARs relevant to this assessment.

Table 1.1: SEARs relevant to this assessment

Secretary's requirement
<p>Biodiversity – including:</p> <ul style="list-style-type: none"> <li>An assessment of the biodiversity values and the likely biodiversity impacts of the project in accordance with the NSW <i>Biodiversity Conservation Act 2016</i> (BC Act), the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR); and</li> <li>The BDAR must document the application of the avoid, minimise, and offset framework including assessing all direct, indirect, and prescribed impacts in accordance with the BAM</li> </ul>

## 1.3 Legislation context

In accordance with section 7.9 of the BC Act, an application for approval under Division 5.2 of the EP&A Act to carry out State Significant Infrastructure (SSI) must be accompanied by a BDAR unless the Planning Agency Head and the Environment Agency Head determine that the Proposal is not likely to have any significant impact on biodiversity values. The SEARs issued for the Proposal (Section 1.2 of this report) have determined the need for a BDAR. The Proposal has been declared critical State Significant Infrastructure (CSSI) in December 2020.

The Biodiversity Offsets Scheme applies to SSI projects unless the Secretary of DPIE and the Chief Executive of the Environment, Energy and Science Group (EESG) determine that the project is not likely to have a significant impact. This document is the BDAR for the Proposal as required under the Biodiversity Assessment Method (BAM). This BDAR documents the results of the biodiversity assessment undertaken for the Proposal in line with the relevant State and Commonwealth environmental and threatened species legislation and policy. This BDAR has been prepared by Chris Thomson (accreditation number BAAS18058), who is accredited under Section 6.10 of the BC Act as Biodiversity Assessment Method Assessors to apply the BAM in connection with the preparation of Biodiversity Stewardship Site Assessment Reports, BDARs, and Biodiversity Certification Assessment Reports pursuant to Part 6 of the BC Act. Internal technical review of this BDAR was conducted by Brenton Hays (accreditation number BAAS19068).

The BAM is structured around three primary stages:

- Stage 1 – Biodiversity assessment
- Stage 2 – Impact assessment (biodiversity values and prescribed impacts)
- Stage 3 – Improving biodiversity values.

This BDAR consists of Stage 1 and Stage 2 of the BAM. Stage 3 is only applicable for the purposes of an application for a biodiversity stewardship agreement and therefore is not covered in this BDAR.

Biodiversity Assessment Method Calculator (BAM-C) case number 00021056/BAAS18058/20/00021057 is associated with this BDAR.

This BDAR also addresses potential impacts to biodiversity listed under the *Fisheries Management Act 1994* (FM Act) and Matters of National Environmental Significance (MNES) identified in the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

## 1.4 Personnel

The work to prepare this BDAR was undertaken by appropriately qualified and experienced ecologists as outlined in Table 1.2.

Table 1.2: Personnel, role, and qualifications

Name	Role	Qualifications	Experience
Chris Thomson	Principal Ecologist – Technical lead, reporting, mapping, and GIS analysis	Graduate Certificate in Natural Resources Bachelor of Applied Science (Environmental Management) Accredited under section 6.10 of the Biodiversity Conservation Act 2016 as a Biodiversity Assessment Method Assessor (No. BAAS18058)	24 years professional ecological consultant in NSW
Brenton Hays	Senior Ecologist – Technical lead and review	Bachelor of Environmental Science and Management (Hons) Accredited under Section 6.10 of the BC ACT as a Biodiversity Assessment Method Assessor (No. BAAS19068)	7 years professional ecological consultant in NSW
Nicholas Bull	Principal Ecologist – Internal review	PhD in Ecology, Honours in Ecology Environmental Science Degree	23 years professional ecological consultant in SA and across Australia
Emma Weatherstone	Graduate Ecologist – Reporting	Bachelor of Environmental Science (Wildlife and Conservation Biology)	12 months experience in ecological consulting in NSW



## **2. Description of the Proposal**

### **2.1 Proposal components**

The Proposal involves the construction and operation of an open cycle gas turbine power station and electrical switchyard, together with other associated infrastructure. The power station would have a capacity of up to approximately 750 megawatts (MW) which would be generated via two heavy duty gas turbines. Although primarily a gas fired power station, the power station would also be capable of operating on diesel as required, if there were a constraint or unavailability in the natural gas system and there was a need to supply electricity to the National Electricity Market (NEM).

The Proposal would operate as a “peak load” generation facility supplying electricity at short notice when there is a requirement in the NEM. The major supporting infrastructure required, which is part of the Proposal, would be a new 132 kV electrical switchyard. Potable water, wastewater, access roads and stormwater connections would be required, and would be provided to the Proposal Site boundary. Power and other services would also be required during the construction phase of the Proposal.

The main elements of the Proposal are as follows:

- Large industrial frame gas turbines
- A connecting electrical switchyard
- Storage tanks and other water management infrastructure.
- Fire water storage and firefighting equipment such as hydrants and pumps.
- Maintenance laydown areas.
- Diesel fuel storage tank(s) and truck unloading facilities.
- Site access roads and car parking.
- Office/administration, amenities, workshop/storage areas; and
- Stormwater basin.

For gas operation, the Proposal would require connection to a new gas lateral and storage pipeline, which would connect into the existing Sydney to Newcastle Jemena Gas Networks (JGN) Northern Trunk gas transmission pipeline, with the tie in point to be located within the proximity of the Newcastle area. This new gas lateral would be developed, constructed and operated separately to this Proposal (by others) but would be required for the power station to operate. The gas lateral would be subject to a separate environmental assessment and planning approvals process, and is therefore not part of this Proposal, and is not investigated or assessed in this report.

### **2.2 Proposal location**

The Proposal Site is located in the small suburb of Loxford approximately three km north of the township of Kurri Kurri within the Cessnock City Council local government area. The location of the Proposal is shown in Figure 1.1. The Proposal Site is currently part of Lots 319 and 769 in Deposited Plan (DP) 755231 and known as 73 Dickson Road, Loxford. It is accessed via Hart Road and approximately 1.0 km from the M15 Hunter Expressway.

The Proposal Site is located at the site of the former Kurri Kurri aluminium smelter, owned by Hydro Aluminium, which operated from 1969 to 2012 and closed in 2014. Since the closure of the Kurri Kurri aluminium smelter, extensive remediation works have taken place at the site, including Stage 1 of a two-stage demolition program of existing structures, asbestos removal, and recycling of waste materials. The demolition and remediation works have included excavation and removal of concrete foundations and other elements of the former aluminium smelter, some of which had been originally constructed below ground level. The demolition and remediation works have therefore resulted in further disturbance to the Proposal Site.

The Proposal Site can be seen in more detail in Figure 2.1.

The Proposal Site is surrounded to the north, east and west by extensive native vegetation. Immediately south of the Proposal Site is part of the former Kurri Kurri aluminium smelter site (now cleared), native vegetation and the M15 Hunter Expressway. Further east and north are low-lying open rural land, Swamp Creek, Black Waterholes Creek, and the Swamp Creek wetlands, which lead to Wentworth swamps and are part of the extensive Hunter River floodplain. The Hunter River is about nine km north-east at Maitland. There are some sparse rural residential properties south and south-east of the Proposal Site, the nearest being located at Dawes Avenue, Loxford approximately 1.2 km south. The Kurri Kurri Speedway Club is on Dickson Road, Loxford about 800 m south-east of the Proposal Site.

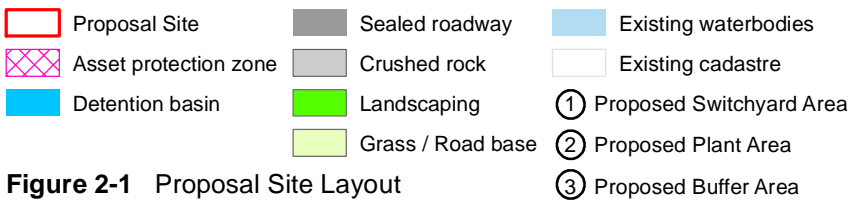
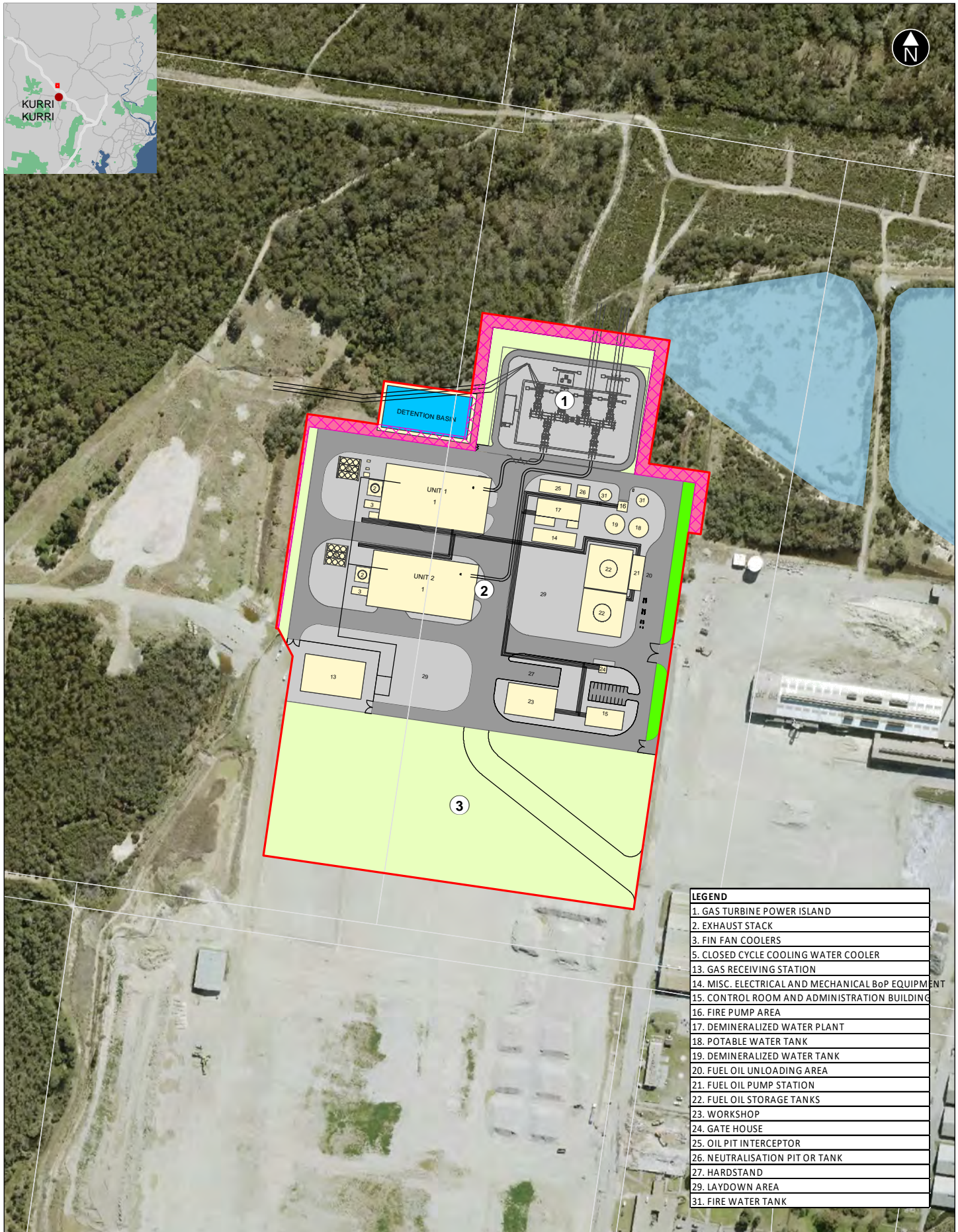
As shown in Figure 2.1, there are currently two large, shallow artificial ponds within the study area, adjacent to the Proposal Site. Surrounding the two ponds are gravel access roads and dense vegetation. The Proposal Site and surrounds are primarily flat. Natural drainage is north-west towards Black Waterholes Creek. The two ponds were constructed to capture stormwater runoff from the smelter site. The ephemeral ponds overflow and discharge as irrigation to the adjacent paddock north of the Proposal Site, owned by Hydro Aluminium.

## 2.3 Key terms used in this report

The following terms are discussed throughout the technical paper which aligns with terminology of the Biodiversity Assessment Method (BAM), and are defined as:

- **Proposal Site:** this area includes all areas to be directly impacted (see Figure 2.1). The Proposal Site is also known as the 'subject land' in the BAM. For the purposes of this BDAR, the term *Proposal Site* is used
- **Study area:** the study area is much larger than the Proposal Site and includes the Proposal Site and surrounding area within a 50 m buffer that may be subject to surface indirect impacts
- **Locality:** This is defined as the area within a 10 km radius surrounding the Proposal Site
- **Bioregion:** The study area is located in the Sydney Basin bioregion within the Hunter subregion (Thackway and Cresswell, 1995)
- **1,500 m landscape buffer:** The landscape buffer is an assessment area used to identify landscape features surrounding the Proposal Site to provide site context and to inform the likely habitat suitability of the Proposal Site (see Figure 3.1).





**Figure 2-1** Proposal Site Layout

### 3. Landscape features

#### 3.1 Bioregion and subregion

The Proposal Site is located within the Hunter sub-region of the Sydney Basin Bioregion as defined by Thackway and Cresswell (1995). A brief summary of the characteristic geology, landforms, soils and vegetation of the Hunter subregion (as it applies to the study area) is provided below as described by Morgan (2001). The landscape is predominantly rolling hills, wide valleys, with a meandering river system on a wide floodplain (Morgan 2001). Geology is dominated by a complex of Permian shales, sandstones, conglomerates, volcanic and coal measures, dominated on the north near the Proposal Site by the Hunter Thrust Fault. A variety of harsh texture contrast soils on slopes and deep sandy loam alluvium on the valley floors are characteristic of this subregion.

Vegetation in the Hunter sub-region is described broadly as being characterised by patches of rainforest brush in the lower valley, however vegetation is dominated by forest and open woodland of *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus moluccana* (Grey Box), *Eucalyptus punctata* (Grey Gum), *Corymbia maculata* (Spotted Gum), *Angophora costata* (Sydney Red Gum) and extensive of stands of *Casuarina glauca* (Swamp Oak) in upper reaches and foothills.

#### 3.2 NSW Landscapes

The study area is located on the Newcastle Coastal Ramp landscape as mapped by the NSW National Parks and Wildlife Service (NPWS) (2002) and described by the NSW Department of Environment and Climate Change (2001). The north-eastern corner of the 1,500 m landscape buffer falls within the Lower Hunter Channels and Floodplain landscape.

The Newcastle Coastal Ramp is characterised by undulating lowlands and low to steep hills on complex patterns of faulted and gently folded Carboniferous conglomerate, lithic sandstone, felspathic sandstone, and mudstone, general elevation 50 to 275 m, local relief 40 to 150 m. The landscape to the north and east of the Proposal Site is associated with the Lower Hunter Channels and Floodplain landscape and drainage from the Proposal Site eventually drains to the north-east connecting with this landscape which is characterised by floodplain and estuarine swamps on Quaternary alluvial estuarine sediments of the Hunter River estuary tract, general elevation 0 to 30 m with local relief <10 m.

#### 3.3 Rivers, streams, and estuaries

The study area is situated in the Hunter River catchment in NSW, which drains a total area of about 22,000 km<sup>2</sup> (EPA, 2013). The Hunter River flows in a south-westerly direction from Glenbawn Dam in the Liverpool ranges to meet Goulburn River near Denman. From Denman, the river flows generally in a south-easterly direction through Singleton and Maitland to the north of the Proposal Site before reaching the Tasman Sea at Newcastle (DIPNR, 2004). Elevations across the catchment vary from over 1,500 m above sea level in the mountain ranges, to less than 50 m above sea level on the floodplains of the lower valley.

The Proposal Site is located in proximity to three waterways, these include:

- Swamp Creek, which is a perennial waterway that flows south to north and is located about 900 m east of the Proposal Site at its nearest point
- An unnamed tributary of Black Waterholes Creek, which is an ephemeral waterway that flows generally south west to north east. The tributary of Black Waterholes Creek is immediately adjacent to the Proposal Site on the western boundary
- Black Waterholes Creek which is located downstream of the unnamed tributary and subsequently flows into Swamp Creek about 1.5 km downstream. Black Waterholes Creek is located about 800 m north of the Proposal Site at its nearest point.



All three waterways eventually converge to Swamp Creek which continues flowing north and drains a large network of low lying, floodplain environments known as Wentworth Swamp. Swamp Creek ultimately flows into Wallis Creek about 10 km downstream of the Proposal and Wallis Creek joins to the Hunter River a further 7 km downstream.

Other important water features within the study area are two large artificial clay borrow pits (both about 1 m deep) which have historically been used as water collection and treatment settling ponds as part of the stormwater management system for the Kurri Kurri aluminium smelter. These ponds are collectively known as the 'North Dam'. Following the closure of the Kurri Kurri aluminium smelter, the eastern most pond of the North Dam currently still receives site runoff, for which Hydro Aluminium is licenced (under their EPL) to discharge to an irrigation area that is located to the north of the Proposal Site. Both ponds of the North Dam currently have a combined capacity of approximately 129,500 m<sup>3</sup>.

### **3.4 Wetlands**

There are no natural wetlands within or immediately adjacent to the Proposal Site. Swamp Creek and Black Water Holes creek flow into the Swamp Creek wetland located on the north-eastern edge of the 1,500 m landscape buffer. The two clay borrow pits adjacent to the site are artificial wetlands.

### **3.5 Connectivity of habitat**

According to the BAM, for Proposal Sites, the assessor must identify the connectivity of different areas of habitat that may facilitate the movement of threatened species across their range. The Proposal Site is located on the north-east edge of a large expanse of forest and woodland occupying much of the land between Kurri Kurri and Cessnock. This includes connectivity to the Werakata National Park to the west and the Aberdare State Forest located to the south-west of the Proposal Site. These habitats are connected as there is woody vegetation separated by less than or equal to 100 m from the next area of intact native vegetation creating corridors.

Important habitat is mapped in the landscape buffer for two critically endangered bird species (BC Act and EPBC Act), namely the Regent Honeyeater (*Xanthomyza phrygia*) and Swift Parrot (*Lathamus discolor*) (refer Figure 5.4). The important area mapping for Regent Honeyeater includes the intact vegetation in proximity to the Proposal Site.

### **3.6 Areas of geological significance and soil hazard features**

Areas of geological significance generally include karst, caves, crevices, and cliffs. There are no areas of geological significance within or adjacent to the Proposal Site.

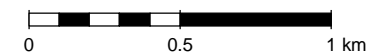
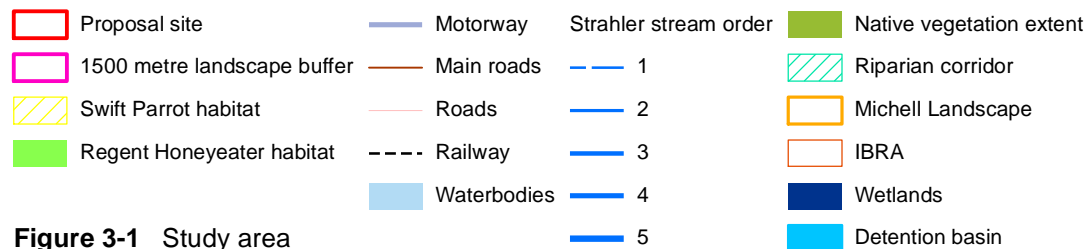
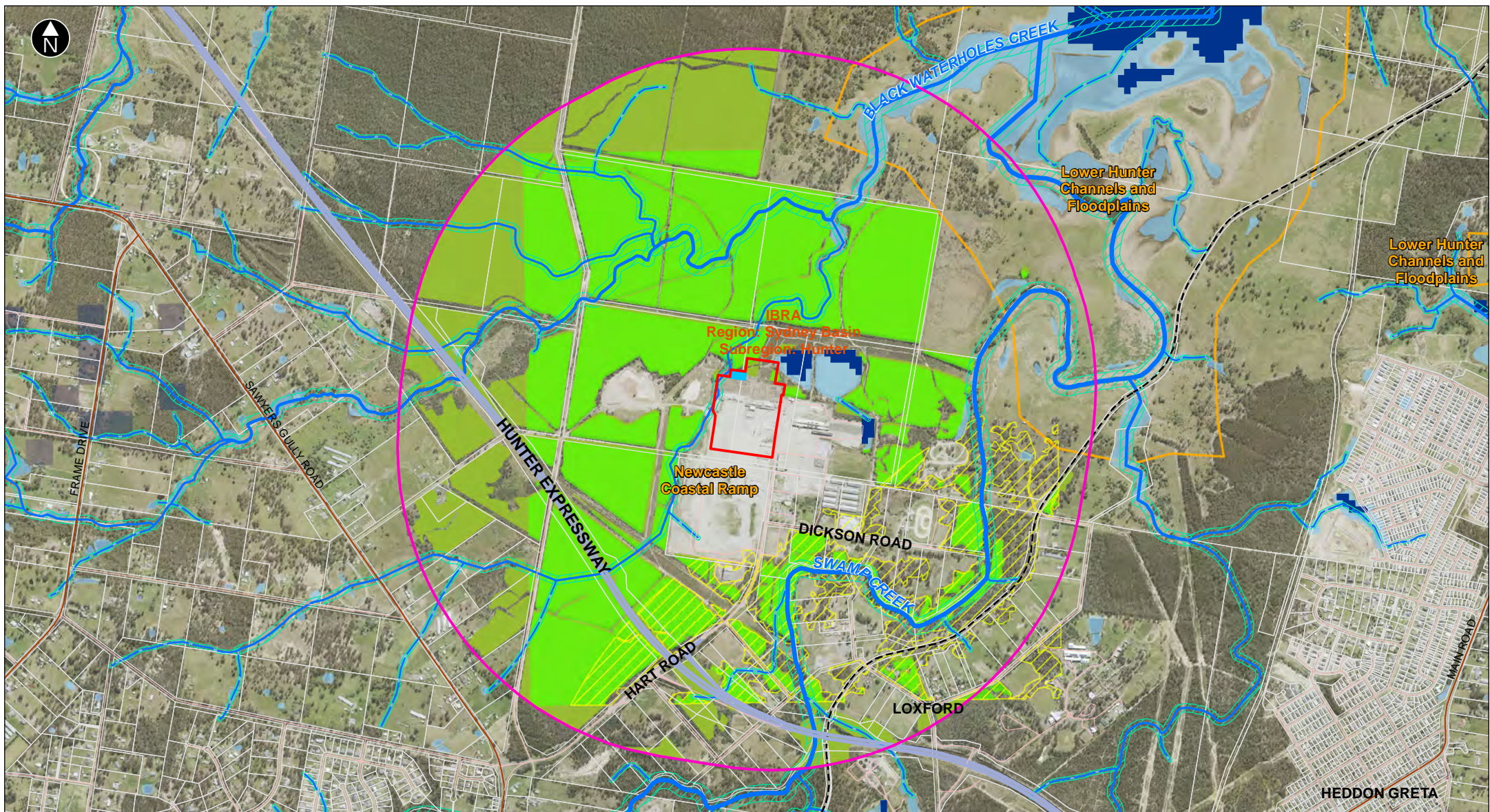
### **3.7 Areas of outstanding biodiversity value**

The Proposal Site does not contain any areas of outstanding biodiversity value listed on the register of declared areas of outstanding biodiversity value.

### **3.8 Native vegetation extent**

The 1,500 m landscape buffer is approximately 928.5 ha in size and contains approximately 484.7 ha of native vegetation (woody and non-woody vegetation). This area was calculated with a combination of available regional mapping (i.e. VIS\_ID 183 (Vegetation Information System)) and native vegetation mapped within the study area as part of this assessment. This results in a native vegetation cover in the landscape of approximately 52.2 per cent. Therefore, native vegetation cover in the landscape is in the '>30 – 70 per cent' cover class. These calculations are an approximation only based on existing regional mapping and aerial imagery.





1:25,000 at A4  
GDA2020 MGA Zone 56

**Data sources:**  
Jacobs  
Metromap (Aerometrex) 2020  
NSW Spatial Services



**Figure 3-1** Study area



## 4. Native vegetation

This section outlines the native vegetation within and directly adjacent to the Proposal Site.

### 4.1 Methods

#### 4.1.1 Background research and data sources

A database search and literature review were completed as part of the desktop assessment of the study area prior to the commencement of field surveys. The review focused on database searches, relevant ecological reports pertaining to the survey area and relevant Geographic Information System (GIS) layers. The review was used to prepare a list of plant community types (PCTs) and potential Threatened Ecological Communities (TECs), to inform survey effort required for both native vegetation and threatened species assessment.

The following databases were searched or viewed:

- BioNet NSW Vegetation Classification database (accessed October – December 2020)
- The federal Department of Agriculture, Water, and the Environment Protected Matters Search Tool (PMST) (accessed November 2020)
- Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems (GDE) (accessed October 2020)
- Department of Agriculture, Water, and the Environment directory of important wetlands (accessed November 2020).

Regional vegetation mapping, geology and soil mapping projects were reviewed including:

- *Vegetation of the Cessnock-Kurri Region – Extant VIS\_ID 183*
- *Vegetation Survey, Classification and Mapping – Lower Hunter and Central Coast Regional Environment Management Strategy* (Lower Hunter and Central Coastal Regional Environmental Management Strategy 2000)
- *Greater Hunter Native Vegetation Mapping: Version 4.0 IVS ID 3855* (State Government of NSW and Office of Environment and Heritage (OEH), 2010)
- *Soil landscapes of the Newcastle 1:100,000 Sheet* (Matthei L.E. 1995)
- *Australian Soil Classification (ASC) Soil Type map of NSW* (State Government of NSW and Office of Environment and Heritage (OEH), 2012).

Preliminary and provisional determinations to list species and ecological communities as threatened under the BC Act were viewed from the NSW Threatened Species Scientific Committee web resources. At the time of writing, there are no preliminary or provisional listings of relevance. The annual Final Priority Assessment List (FPAL) is the list of nominated species, ecological communities and key threatening processes that have been approved for assessment by the Minister responsible for the EPBC Act for a particular assessment year. These have a statutory timeframe in which the assessment must be completed.

#### 4.1.2 Mapping extent of native vegetation cover

The extent of native vegetation mapping in the Proposal Site was ground-truthed and mapped using up to date aerial imagery. Polygons were digitised in a GIS (ArcGIS 10.7) at a scale of between 1:1,000 and 1:5,000. The vegetation extent within the Proposal Site has been mapped as accurately as possible although some boundary errors may still exist.

To assess the percentage of the current extent of native vegetation, a landscape buffer of 1,500 m was placed around the boundary of the Proposal Site in accordance with Section 3.1 of the BAM. Per cent native vegetation cover in the landscape buffer was calculated using a combination of regional vegetation mapping and aerial imagery.

#### **4.1.3 Definition of native vegetation**

A plant is native to New South Wales if it was established in New South Wales before European settlement, including native planted vegetation. Under the BAM, native vegetation has the same meaning as in section 1.6 of the BC Act which states that native vegetation and clearing native vegetation have the same meanings as in Part 5A of the *Local Land Services Act 2013*. Part 5A 60B of the *Local Land Services Act 2013* defines the meaning of native vegetation as any of the following types of plants native to New South Wales:

- Trees (including any sapling or shrub or any scrub)
- Understorey plants
- Groundcover (being any type of herbaceous vegetation)
- Plants occurring in a wetland.

#### **4.1.4 Plant community type identification**

The type and distribution of PCTs within the Proposal Site were identified and mapped progressively during the field surveys. The identification of PCTs presented here in this BDAR is according to the NSW PCT classification as described in the BioNet Vegetation Classification database. Each PCT was assigned to the relevant corresponding Threatened Ecological Community (TEC) where applicable. A plot-based floristic vegetation survey, as described in Section 4.3 of the BAM, was carried out in areas where the vegetation was of sufficient size and shape to allow for plots to be completed. The plot-based floristic vegetation surveys were carried out over two days in October 2020.

#### **Stratification of native vegetation into survey units**

Using the existing vegetation mapping, survey sites (plots/midlines) were established within each area of mapped vegetation to provide a representative assessment of the vegetation prior to the field survey. Plots were also positioned to provide a wide spatial coverage of the Proposal Site and study area. Once the identification of PCTs had been finalised, each PCT was then divided into vegetation zones (an area of native vegetation that is the same PCT and has a similar broad condition state). The PCTs identified within the Proposal Site are described in detail in Section 4.2 of this BDAR.

Vegetation zones were identified within the area being subject to direct impact from the Proposal, which includes the Proposal Site boundary plus a 10 m Asset Protection Zone (APZ) positioned adjacent to the boundary (where the Proposal Site adjoins existing vegetation) which has been planned to provide a fire protection zone. The Proposal Site also makes allowance for a proposed stormwater basin which overlaps with the APZ (Figure 2.1). Existing vegetation within the APZ would be cleared to ground level with only low shrubs, grasses and forbs retained and regularly maintained, and the APZ is therefore assessed as a direct impact.

The vegetation within the Proposal Site has been assigned to a PCT as listed in the BioNet Vegetation Classification database based on the observed plant species composition, vegetation structure, landscape position, and underlying geology and soils.

#### **Plot based floristic vegetation survey and Vegetation Integrity Assessment**

A plot-based full floristic survey and Vegetation Integrity Assessment was carried out, according to the BAM, using a series of 20 x 20 m plots (or equivalent 400 m<sup>2</sup> area) nested inside a 20 x 50 m plot (or equivalent 1,000 m<sup>2</sup> area). In some situations, within small PCT patches, the entire patch was surveyed, or the assessment plot altered to account for the size of the vegetation zone, while maintaining a 400 m<sup>2</sup> plot. The location of each



plot/mid-line completed during the survey is illustrated in Figure 4.1. Plots/mid-lines were established to provide a representative assessment of the vegetation integrity of the vegetation zone, accounting for the level of variation in the broad condition state of the vegetation zone.

Four vegetation zones representing two PCTs were identified in the Proposal Site. An additional PCT 1740 Tall Spike Rush Freshwater Wetland occurs across the North Dam, adjacent to the Proposal Site. This community is within a small section of the 10 m buffer around the Proposal Site. Although the vegetation zone does fall within the 10 m buffer as part of the APZ, there would be no direct impact required for bush fire protection as this is an existing wetland. The remaining areas of the Proposal Site are cleared with existing infrastructure or comprise exotic / non-native vegetation. A summary of the PCTs present and the survey effort completed in each vegetation zone is provided in Table 4.1.

Table 4.1: Plant community types and vegetation zones identified in the Proposal Site

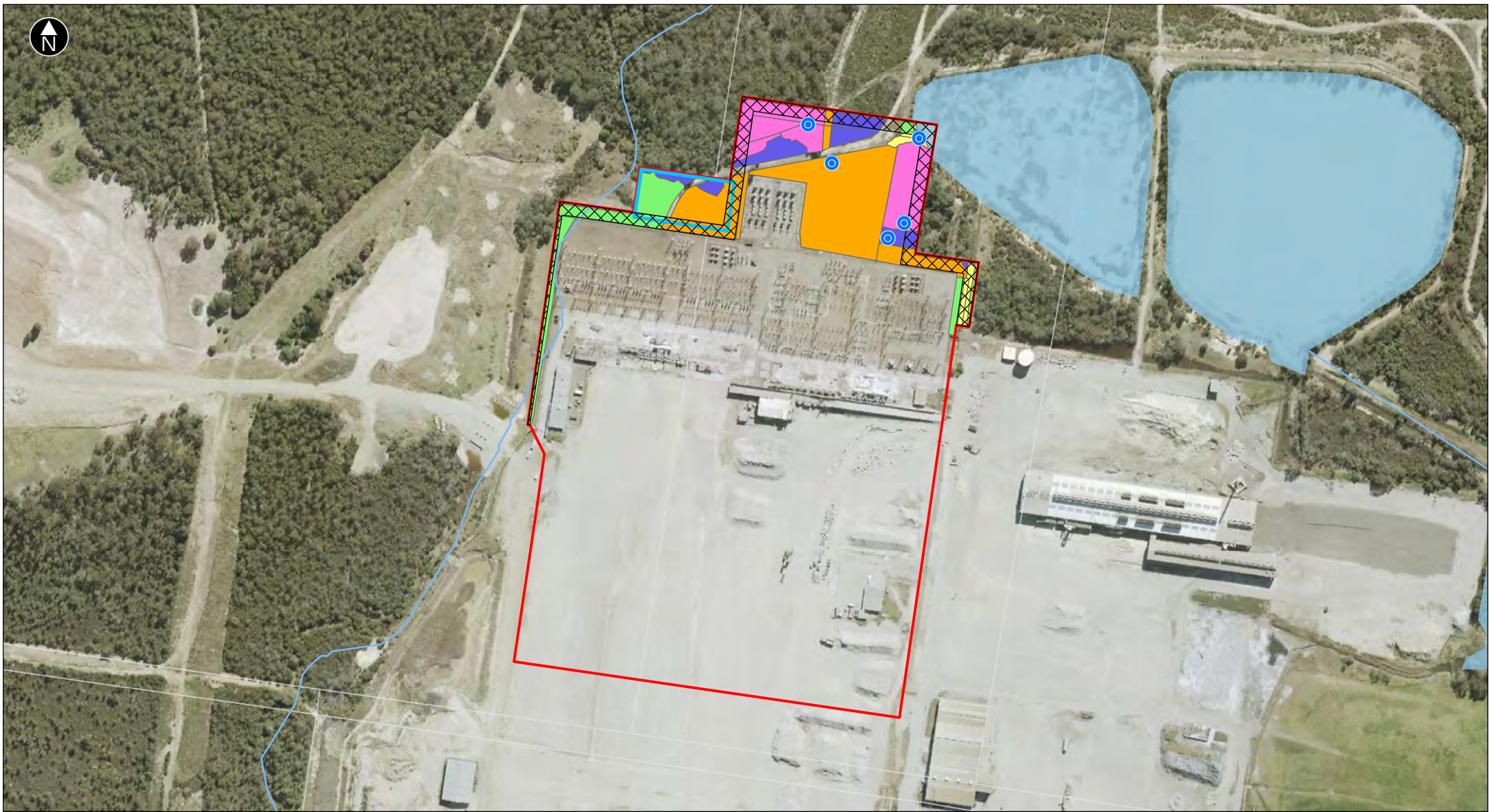
Vegetation zone	Plant community type ID No.	Plant community type name	Broad condition class	Vegetation zone area in Proposal Site	Minimum number of plots/mid-lines required	Number of plots/mid-lines completed
1	1633	Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area	Intact	0.40 ha	1	2
2	1633	Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area	Regrowth	0.21 ha	1	1
3	1633	Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area	Ground layer only	0.88 ha	1	1
4	1737	Typha rushland	Moderate	0.05 ha	1	1

#### 4.1.5 Survey limitations

The desktop assessment and field survey carried out for this BDAR provides a limited view into the ecological values of the Proposal Site present at the time of the survey. The diversity of flora and fauna species recorded from this study should not be seen to be comprehensive. It is unlikely that every species present within the Proposal Site has been recorded. The field survey aimed to sample the Proposal Site and a comprehensive inventory of species was not made. A period of several seasons or years is often needed to identify all the species present in an area, especially as some species are only apparent at certain times of the year (e.g. orchids or migratory birds) and require specific weather conditions for optimum detection (e.g. breeding and flowering periods). The conclusions of this report are therefore based upon available data and are indicative of the environmental condition of the Proposal Site at the time of the survey. Site conditions, including the presence of

threatened species, can change with time. To address this limitation, the assessment has aimed to identify the presence and suitability of the habitat for threatened species.

The vegetation within the Proposal Site has been assigned to the most likely PCT as they are described in the BioNet Vegetation Classification database. In many cases there are no sharp boundaries defining the transition between PCTs, so the mapping provided in this BDAR is supported by on ground floristic surveys and observations of potential ecotones. Plant communities are naturally variable and the boundaries between different PCTs on the Proposal Site overlap considerably with a gradual transition from one community to another. However, a choice must be made to map and assign a PCT to an area of the site. As mapping necessitates that a hard boundary is drawn to separate PCTs, boundaries of PCTs and vegetation zones have been mapped as best as possible based on observations made during the field survey and based on patterns observed on aerial photography. It is likely that the boundaries of PCTs and vegetation zones would change with time and in response to long-term variation in biophysical conditions on the Proposal Site such as rainfall and surface drainage patterns.



- Legend:**
- Proposal site
  - Vegetation integrity plots
  - Asset protection zone
  - Detention basin
  - Waterbodies
- Plant community type and vegetation zones**
- PCT 1633: Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area, Intact (Zone 1)
  - PCT 1633: Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area, Regrowth (Zone 2)

- PCT 1633: Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area, Groundlayer only (Zone 3)
- PCT 1737: Typha rushland, Moderate (Zone 4)
- Other, Exotic (non-native vegetation)

0 125 250 m

1:4,000 at A4  
Coordinate System: GDA2020 MGA Zone 56

**Data sources:**  
Jacobs  
Metromap (Aerometrex) 2020  
NSW Spatial Services



**Figure 4-1 Plant community types and vegetation zones**



## 4.2 Results

### 4.2.1 Plant community types

This BDAR describes PCTs in terms of their floristic composition, geological substrate, and relevant regional vegetation classification. The PCTs identified within the Proposal Site are listed in Table 4.2 and their distribution is outlined in Figure 4.1. Descriptions of the vegetation that occurs in the Proposal Site are provided in the following sections matched to the most likely PCT as described in the BioNet Vegetation Classification database.

In some cases, the vegetation on the Proposal Site does not strictly meet the definition of a PCT as per the BioNet Vegetation Classification database so the vegetation has been allocated to the PCT with which it most closely aligns. The mapping provided in this BDAR is supported by on ground observations and quantitative data. Vegetation integrity plot data is provided in Appendix C.

Table 4.2: Plant community types and vegetation zones identified in the Proposal Site footprint and adjacent APZ

Vegetation zone	Plant community type ID No.	Plant community type name	Broad condition class	Vegetation zone area (ha) Proposal Site (incl APZ)
1	1633	Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area	Intact	0.40 ha
2	1633	Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area	Regrowth	0.21 ha
3	1633	Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area	Ground layer only	0.88 ha
4	1737	Typha rushland	Moderate	0.05 ha
<b>TOTAL</b>				<b>1.54 ha</b>

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

**Vegetation formation:** Dry Sclerophyll Forest (Shrubby sub-formation)

**Vegetation class:** Sydney Sand Flats Dry Sclerophyll Forests

**Classification confidence level from VIS:** 2-High

**PCT percent cleared:** 75%

**Associated TEC (BC Act):** Kurri Sand Swamp Woodland in the Sydney Basin Bioregion

**Vegetation zones / survey effort / extent on site:**

- Zone 1 (Intact) / Two plots (VZ1\_Plot 1 and VZ1\_Plot 2)
- Zone 2 (Regrowth) / One plot (VZ2\_Plot 1)
- Zone 3 (Groundcover only) / One plot (VZ3\_Plot 1)

The Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633) is described in the BioNet Vegetation Classification database as a Dry Sclerophyll Forest. This community consists of intermittently swampy woodlands with a eucalypt-dominated overstorey. The mid-stratum is typically two layered and composed of sclerophyllous shrubs, where the ground cover is characterized by graminoids. This community ranges from North Rothbury south to Werakata National Park and east to just beyond Kurri Kurri. It is found mainly on conglomerate geologies and at altitudes up to 100 m.

The Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633) has a classification confidence level in the Vegetation Information System (VIS) of High. Therefore, classification of this vegetation to the PCT 1633 is relatively straightforward and the vegetation is not considered likely to be representative of any other PCT.

This PCT forms part of the Kurri Sand Swamp Woodland in the Sydney Basin Bioregion, which is listed as a threatened ecological community under the BC Act (listed as Endangered). This vegetation is not listed as a threatened ecological community under the EPBC Act.

The Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633) directly corresponds to the Parramatta Redgum – Narrow-leaf Apple Shrubby Woodland on sand near Kurri Kurri (MU 35a) as described in Bell and Driscoll (2007) and MU35 Kurri Sand Woodland in Hunter, Central & Lower North Coast Vegetation Classification and Mapping (HCRCMA, 2009). The vegetation in the study area fits the description for the MU35 well.

PCT 1633 in the Proposal Site exists as three vegetation zones including:

- Intact – A remnant woodland with an intact canopy and all structural layers present
- Regrowth – Areas of land that have previously been cleared and now comprise young regrowth, including low trees to 2 m and tall shrubs (regrowth)
- Ground layer only – vegetation with power easements and adjacent to the existing cleared Proposal Site that are regularly slashed and maintained and now comprise a diversity of native low ground cover species (ground cover only).

The vegetation is most likely to be PCT 1633 for the following reasons:

- *Angophora bakeri* and *Eucalyptus parramattensis* subsp. *decadens* are prominent in the canopy, with occasional occurrences of *Eucalyptus agglomerata* (likely sp. aff. *agglomerata*) and scattered low abundance of stunted small trees of *Eucalyptus fibrosa*
- Understorey vegetation comprises a range of Proteaceous and Fabaceous species, such as *Banksia spinulosa* var. *collina*, *Hakea sericea*, *Banksia oblongifolia* and *Lambertia formosa*
- The groundcover is predominantly grassy comprising species typical of PCT 1633 including *Aristida warburgii*, *Aristida ramosa*, *Entolasia stricta*, with sedges *Schoenus brevifolius*, *Ptilothrix deusta*, *Hypolaena fastigiata* and *Lepidosperma* spp.

A summary of the vegetation structure and floristics of PCT 1633 as it occurs in the study area is provided in the table below. The list of species recorded at each survey site is provided in Appendix A and reflects the local variation of species gathered from the survey.

Table 4.3: Floristic and structural summary of PCT 1633 within the Proposal Site

Vegetation layer	Dominant species
Tree canopy (upper stratum)	<i>Angophora bakeri</i> , <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> ; <i>E. agglomerata</i>
Midstorey (mid-stratum)	<i>Callistemon linearis</i> , <i>Callistemon linearifolius</i> , <i>Dillwynia retorta</i> , <i>Hakea sericea</i> , <i>Leptospermum parvifolium</i> , <i>Leptospermum trinervium</i> , <i>Melaleuca nodosa</i> , <i>Melaleuca thymifolia</i>
Groundcovers (ground stratum)	<i>Aristida warburgii</i> , <i>Entolasia stricta</i> , <i>Lomandra glauca</i> , <i>Scheonus brevifolius</i> , <i>Dampiera stricta</i> , <i>Hypolaena fastigata</i> , <i>Ptilothrix deusta</i>
Exotic species	<i>Briza maxima</i> , <i>Cenchrus clandestinus</i> , <i>Conyza bonariensis</i> , <i>Plantago lanceolate</i> , <i>Taraxacum officinale</i>
High Threat Weeds	<i>Cortaderia selloana</i>
Threatened plant species confirmed	<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> (vulnerable species EPBC Act and BC Act).

An additional PCT, Tall Spike Rush freshwater wetland (PCT 1740) occurs over the central portions of the large constructed dam to the east of the Proposal Site (constructed as part of the former Kurri Kurri aluminium smelter). A large wetland has formed over the deeper sections of the dam colonised almost exclusively by *Eleocharis sphacelata* to 2 m in height. The shallow margins of the dam comprise sedges and rushes typical of PCT 1737. This PCT is outside the Proposal Site and no plots were sampled. Potential prescribed impacts are assessed. The Tall spike Rush community adjacent to the study has a colonised the man-made dam and as such as does not correspond with the endangered Ecological Community - Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act).

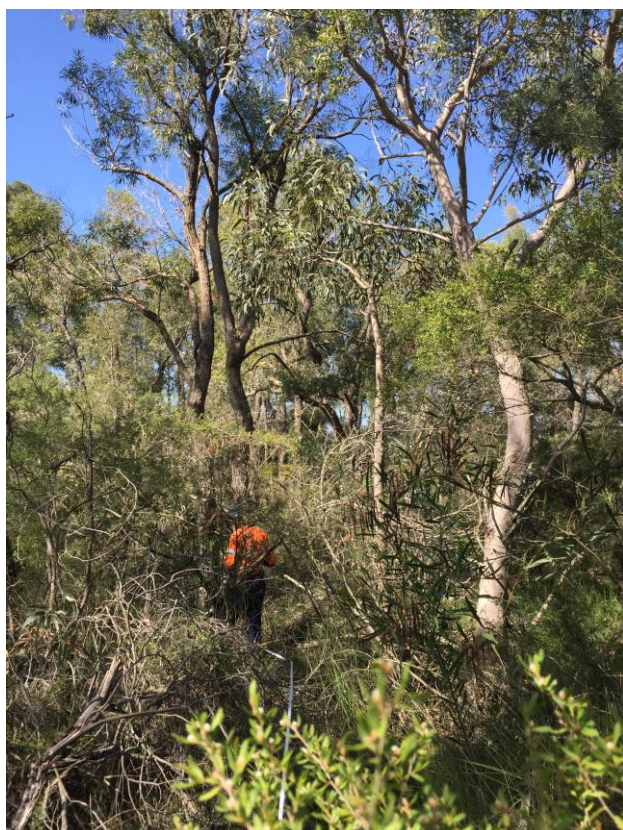


Photo 4-1: PCT 1633 – Vegetation Zone 1 (Intact) VZ1 Plot1



Photo 4-2: PCT 1633 – Vegetation Zone 2 (Regrowth) VZ2 Plot 1





Photo 4-3: PCT 1633 – Vegetation Zone 3 (Groundcover only) VZ3 Plot 1

### **Typha rushland (PCT 1737)**

**Vegetation formation:** Freshwater Wetlands

**Vegetation class:** Coastal Freshwater Lagoons

**Classification confidence level from VIS:** 2-High

**PCT percent cleared:** 70%

**Associated TEC (BC Act):** None, the vegetation in the study area is associated with artificial drainage structures

**Vegetation zones / survey effort / extent on site:**

- Zone 4 (Moderate) / One plot (VZ4\_Plot 1).

The Typha rushland (PCT 1737) is described in the BioNet Vegetation Classification database as a Freshwater Wetland. This community is dominated by Typha species; however, Melaleuca may occur as isolated emergent species, although this was not evident at the Proposal site. This community typically occurs at the margins of standing fresh water along the coast from about Woy Woy to Hexham. Substrates are generally sands and muds. Coastal occurrences have elevations of less than 50 m, where the western occurrence has an elevation of 367 m.

The Typha rushland PCT occurs in the shallow margins of the 'North Dam' also known as the spurge dam, which is a large constructed dam forming part of the former Kurri Kurri aluminium smelter infrastructure and located immediately east of the Proposal Site. PCT 1737 is also found in two constructed drains, one at the eastern extent of the Proposal Site, and a larger drainage line to the west of the Proposal Site (the majority is outside of the direct impact of the Proposal and a small area to the west is within the 10 m APZ). The larger drain is a constructed portion of a former natural tributary draining to the north to Blackwater Creek.

The rushlands in the east of the Proposal Site are dominated by Broadleaf Cumbungi (*Typha orientalis*), while the drain in the west comprises mostly Narrow-leaved Cumbungi (*Typha domingensis*). The vegetation is most likely to be PCT 1737 for the following reasons:

- The community occurs on the edges of a large standing freshwater dam (constructed 'North Dam'), and occurs in poorly drained areas subject to local flooding
- The ground cover contains typical species of PCT 1737 *Typha orientalis* (Broadleaf Cumbungi) and *Typha domingensis* (Narrow-leaved Cumbungi), as well as *Cladium procerum* (Cladium), *Cynodon dactylon* (Couch), *Persicaria strigosa* (Spotted Knotweed)
- While the PCT occurs in man-made channels and water bodies (consistent with PCT1071), *Phragmites australis* was absent across each area of rushland mapped in the Proposal Site and therefore the sedgeland vegetation is more consistent with PCT 1737 than PCT 1071.

A summary of the vegetation structure and floristics of PCT 1737 as it occurs in the study area is provided in the table below. The list of species recorded at each survey site is provided in Appendix A and reflects the local variation of species gathered from the survey.

As this PCT only occurs in man-made channels and drainage structures within the Proposal Site it is considered inconsistent with the Threatened Ecological Community - Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered BC Act). This vegetation is not listed as a threatened ecological community under the EPBC Act.

Table 4.4: Floristic and structural summary of PCT 1737 within the Proposal Site

Vegetation layer	Dominant species
Tree canopy (upper stratum)	None
Midstorey (mid-stratum)	None
Groundcovers (ground stratum)	<i>Typha orientalis</i> , <i>T. domingensis</i> , <i>Cladium procerum</i> , <i>Cynodon dactylon</i> , <i>Persicaria strigosa</i>
Exotic species	<i>Hydrocotyle bonariensis</i> , <i>Juncus cognatus</i> , <i>Onopordum acanthium</i> , <i>J. acutus</i>
High Threat Weeds	<i>Andropogon virginicus</i>





Photo 4-4: PCT 1737 – Vegetation Zone 4 (Moderate)  
VZ4 Plot 1, shallow edge of the North Dam



Photo 4-5: PCT 1737 – Vegetation Zone 4 (Moderate)  
Eastern side of development side

### Exotic / non-native vegetation

Around 0.3 ha of the Proposal Site comprises exotic / non-native vegetation that has established on the former Kurri Kurri aluminium smelter site within areas that were previously cleared of vegetation and not occupied by infrastructure. This includes fenced boundaries, and adjoining batters and slopes (see Photo 4-6 and Photo 4-7). Such areas are dominated mainly by exotic grasses (*Andropogon virginicus*, *Pennisetum clandestinum*, *Briza maxima* and *Hyparrhenia hirta*) and also comprise a diversity of exotic herbs and forbs.





Photo 4-6: Exotic vegetation on batter slope adjoining western boundary of the Proposal Site



Photo 4-7: Exotic vegetation adjoining eastern boundary of the Proposal Site and adjacent to the Typha wetland vegetation

#### 4.2.2 Vegetation zones and vegetation integrity score

A description of the vegetation zones identified within the Proposal Site and the corresponding vegetation integrity score developed from the BAM-C is presented in Table 4.5. The vegetation integrity survey plot data is provided in Appendix C.

Table 4.5: Vegetation zones and vegetation integrity scores for the Sydney Basin bioregion

Vegetation zone	Plant community type ID No.	Plant community type name	Broad condition class	Vegetation zone area in Proposal Site (ha)	Vegetation integrity score
1	1633	Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area	Intact	0.40 ha	46.5
2	1633	Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area	Regrowth	0.21 ha	35.4

Vegetation zone	Plant community type ID No.	Plant community type name	Broad condition class	Vegetation zone area in Proposal Site (ha)	Vegetation integrity score
3	1633	Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area	Ground layer only	0.88 ha	1.5
4	1737	Typha rushland	Moderate	0.05 ha	4.9
		<b>Total</b>		<b>1.54 ha</b>	

#### 4.2.3 Assessment of patch size

A patch is defined in the BAM as an area of intact native vegetation that occurs on the Proposal Site. The patch may extend onto adjoining land beyond the footprint of the Proposal Site, and for woody ecosystems, includes native vegetation separated by  $\leq 100$  m from the next area of intact native vegetation. For non-woody vegetation, this gap is reduced to  $\leq 30$  m. Patch size for each vegetation zone located on the Proposal Site was mapped in accordance with subsection 4.3.2 of the BAM using the following steps:

- Identify vegetation zones that will be included in the same patch
- Identify the boundary of any adjoining intact native vegetation which extends beyond the limit of the Proposal Site
- Digitise each patch in a GIS using separate polygons where multiple patches exist
- Calculate the area of each patch in hectares in a GIS.

The patch was then allocated to a patch size class (<5 ha, 5–24 ha, 25–100 ha or >100 ha). Patch size class is used as a filter in the BAM-C to predict threatened species likely to occur or use habitat on Proposal Site.

The Proposal Site has largely been cleared due to the decommissioning and demolition of the Kurri Kurri aluminium smelter, with the existing switchyard site also to be demolished prior to the power station construction. However, the identified vegetation zones located within the Proposal Site (Figure 4.1) form part of a very large network of intact forest extending to the north and east of the Proposal Site. While there is a network of easements and tracks in the landscape, these openings do not provide a barrier of more than 100 m between patches and the vegetation zones on the Proposal Site are part of a patch network >100 ha in area.

#### 4.2.4 Threatened ecological communities

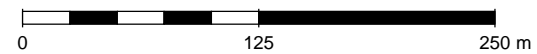
One Threatened Ecological Community (TEC) listed under the BC Act occurs in the Proposal Site and surrounding landscape, namely Kurri Sand Swamp Woodland in the Sydney Basin Bioregion (Endangered Ecological Community) (Figure 4.2).

The Kurri Sand Swamp Woodland in the Sydney Basin Bioregion corresponds to PCT 1633. 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 2016a). The Kurri Sand Swamp Woodland is a low woodland or heathland, generally with a low open canopy rarely exceeding 15 m in height and a shrubby understorey. The overstorey is usually dominated by *Eucalyptus parramattensis* subsp. *decadens* (Earp's Gum) and *Angophora bakeri* (Narrow-leaved Apple) while other tree species that occur less frequently include *E. racemosa* (Narrow-leaved Scribbly Gum), *E. fibrosa* (Red Ironbark), *E. sp. aff. agglomerata* (Stringybark) and *Corymbia gummifera* (Red Bloodwood). 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 associated seedbank is still at least partially intact (NSW Scientific Committee, 2001). On this basis, all three condition states identified for PCT 1633 (i.e. intact, regrowth and ground layer only) have been identified as consistent with the listed endangered ecological community.



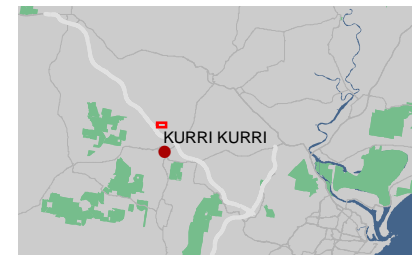


- Proposal site
- Asset protection zone
- Detention basin
- Waterbodies
- Threatened ecological communities (BC Act)
- Kurri Sand Swamp Woodland in the Sydney Basin Bioregion (BC Act)



1:4,000 at A4  
Coordinate System: GDA2020 MGA Zone 56

**Data sources:**  
Jacobs  
Metromap (Aerometrex) 2020  
NSW Spatial Services



**Figure 4-2** Threatened ecological communities

#### 4.2.5 Groundwater dependent ecosystems

The level of likely groundwater dependence of vegetation communities within the Proposal Site and surrounding landscape buffer has been assessed using the *Atlas of Groundwater Dependent Ecosystems* (GDEs) (Bureau of Meteorology, 2020) and the *Risk Assessment Guidelines for Groundwater Dependant Ecosystems* released by the NSW DPI (Kuginis *et al.*, 2012).

These data show no mapped aquatic GDEs within the Proposal Site or the 1,500 m landscape buffer. The Atlas of GDEs (Bureau of Meteorology, 2020) does not identify any GDEs on the actual Proposal Site, however identifies the surrounding vegetation as containing at least four moderate to high potential terrestrial GDE vegetation types. A comparison of the Atlas of GDEs dataset with the vegetation mapping in VIZ\_183 identifies these as:

- Parramatta Red Gum/Narrow-leaved Apple/Prickly-leaved Paperbark shrubby woodland in the Cessnock Kurri Kurri area
- Cabbage Gum/Rough-barked Apple grassy woodland on alluvial floodplains of the lower Hunter
- Spotted Gum – Broad-leaved Ironbark Grassy Open Forest of Dry Hills of the lower Hunter Valley, Sydney Basin
- Forest Red Gum-Grey Gum Dry Open Forest on Hills of the Lower Hunter Valley, Sydney Basin.

Of these four communities, only the Parramatta Red Gum/Narrow-leaved Apple/Prickly-leaved Paperbark shrubby woodland would be directly impacted by the Proposal. The remaining communities are outside of the area of influence. Table 4.6 outlines the level of groundwater dependence of the terrestrial ecosystems surrounding the Proposal Site.

Table 4.6: Potential groundwater dependent ecosystems within the Proposal Site and landscape buffer identified by the Atlas of GDE and regional vegetation mapping

GDE potential*	Associated Vegetation	GDE type**	PCT area in landscape buffer (ha)
High	Cabbage Gum/Rough-barked Apple grassy woodland on alluvial floodplains of the lower Hunter Valley	High facultative	50.9 ha
	Forest Red Gum-Grey Gum Dry Open Forest on Hills of the Lower Hunter Valley, Sydney Basin	High facultative	3.79 ha
Moderate	Parramatta Red Gum/Narrow-leaved Apple/Prickly-leaved Paperbark shrubby woodland in the Cessnock Kurri Kurri area	Proportional facultative	311.02 ha (1.49 ha in Proposal Site)
	Spotted Gum-Broad-leaved Ironbark Grassy Open Forest of Dry Hills of the Lower Hunter Valley, Sydney Basin	Proportional facultative	112.02 ha

\*GDE potential as recognised by the Atlas of GDEs (Bureau of Meteorology, 2020)

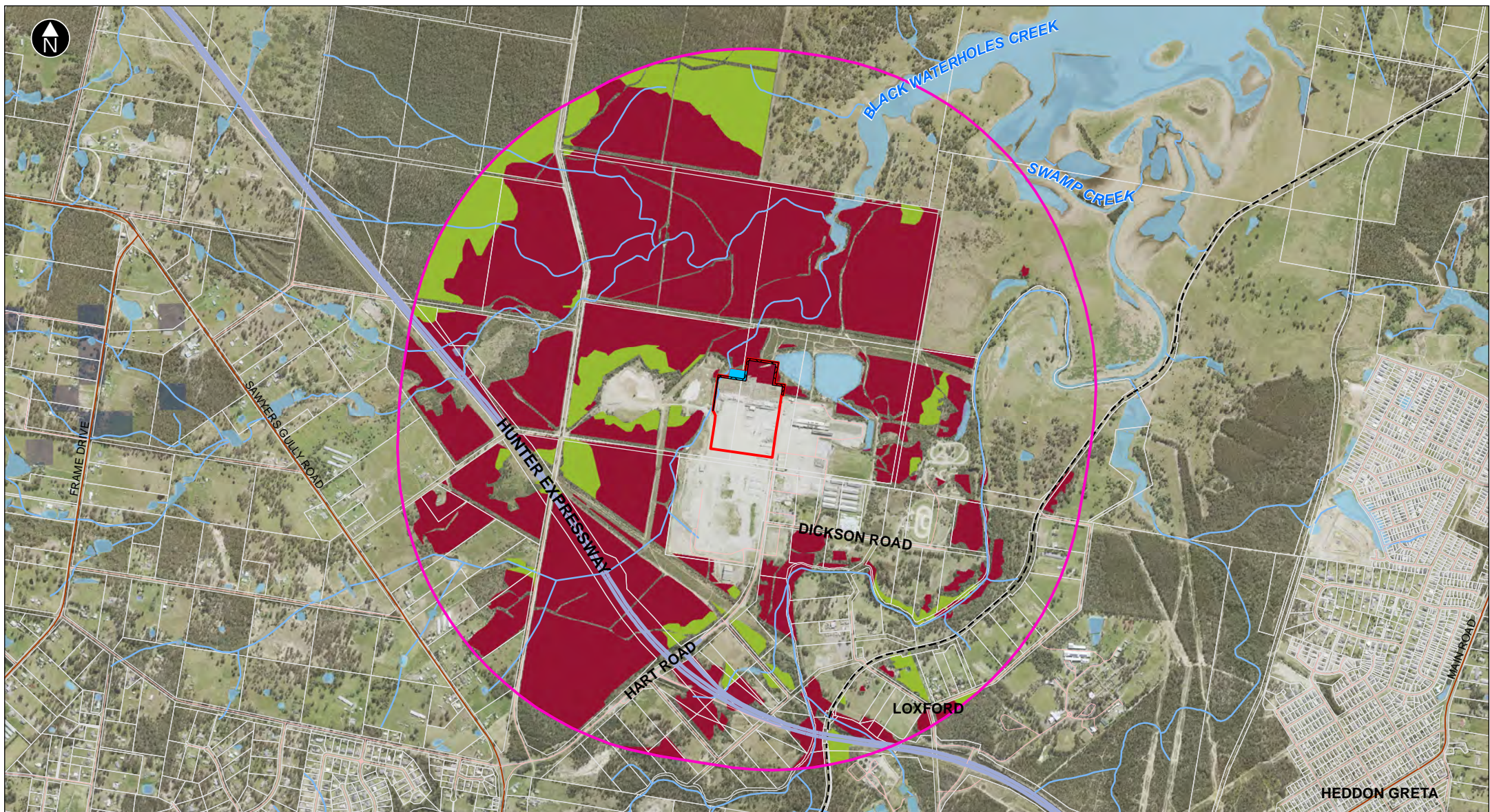
\*\*GDE type determined using *Risk Assessment Guidelines for Groundwater Dependant Ecosystems* released by the NSW DPI (Kuginis *et al.*, 2012).

Based on these results and data collected during field surveys undertaken for this assessment, there is potential for groundwater dependent terrestrial vegetation types to be present and impacted, particularly PCT 1633 – Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area. The PCTs identified in the Proposal Site and broader study area that correspond with terrestrial GDE mapping are shown in Figure 4.3. The PCTs 1737 and 1740 both occur in constructed artificial drainage structures and are unlikely to be GDEs, having no connection to groundwater.

Using the *Risk Assessment Guidelines for Groundwater Dependent Ecosystems* released by the NSW DPI (Kuginis *et al.*, 2012), it is unlikely that the PCTs shown in Table 4.6 have a total reliance on groundwater. PCT 1633 is the only potential GDE in the Proposal Site. This community is likely to be a proportional facultative GDE that depend on the subsurface presence of groundwater (often accessed via the capillary fringe – subsurface water just above the water table) for a proportion of their water requirements, particularly where an alternative source of water (i.e. rainfall) cannot be accessed to maintain ecological function. These facultative GDEs may use groundwater during periods of low flow or drought. The level of groundwater dependency would also likely change between the PCTs in different areas, i.e. proportional to opportunistic depending on the current groundwater level.

However, if the groundwater table is shallow where the potential GDE occurs, and there is no perched aquifer above the water table (separated from the water table by a layer of impermeable rock or sediment), then impacts on vegetation health may occur if groundwater is impacted by the Proposal.





- |                             |             |                          |
|-----------------------------|-------------|--------------------------|
| Proposal site               | Motorway    | Likely facultative GDE's |
| 1500 metre landscape buffer | Main roads  | Native vegetation extent |
| Detention basin             | Roads       |                          |
| Asset protection zone       | Railway     |                          |
|                             | Waterbodies |                          |

0 0.5 1 km

1:25,000 at A4  
GDA2020 MGA Zone 56

**Data sources:**  
Jacobs  
Metromap (Aerometrex) 2020  
NSW Spatial Services



**Figure 4-3** Groundwater dependent ecosystems



## 5. Threatened species

### 5.1 Habitat assessment

#### 5.1.1 Background research and data sources

The Biodiversity Assessment Method Calculator (BAM-C) was used to derive an initial list of candidate species for this assessment by entering likely PCTs based on regional vegetation mapping (VIS\_ID 183). The results were also supplemented with database searches and review of the Threatened Biodiversity Data Collection, to identify the threatened species that have been recorded by previous surveys or are considered likely to occur in the locality and Proposal Site. The BioNet and Protected Matters Search Tool (PMST) databases, accessed via the Threatened Biodiversity Data Collection and the PMST, were searched for records of threatened species with a 10 km buffer of the Proposal Site.

The following databases and information sources were reviewed to prepare a list of potential threatened species for survey:

- Biodiversity Assessment Method Calculator (BAM-C) – case number 00021057
- BioNet – the website for the Atlas of NSW Wildlife and Threatened Species Profile Database – searched November 2020
- Department of Agriculture, Water, and the Environment (DoAWE) Protected Matters database – searched November 2020
- NSW Biodiversity Values Map and Threshold Tool – reviewed November 2020
- Important Area Maps – reviewed November 2020.

Preliminary and provisional determinations to list species and ecological communities as threatened under the BC Act were viewed on the EESG NSW Threatened Species Scientific Committee website. At the time of writing, there are no preliminary or provisional listings of relevance to the Proposal. The annual Final Priority Assessment List of nominated species and ecological communities that have been approved for assessment by the Minister responsible for the EPBC Act was last reviewed in September 2020.

#### 5.1.2 Habitat types

This section describes the process of assessing the habitat types within the Proposal Site and broader study area and the habitat suitability assessment for threatened species as outlined in Section 5 of the BAM.

The broad habitat types identified within the Proposal Site, along with the corresponding PCT, are outlined in Table 5.1. Figure 5.1 shows the location of the habitat types within the Proposal Site and broader study area. Two vegetation classes (Keith, 2004) recognised as two broad habitat types were identified within the Proposal Site including:

- Sydney Sand Flats Dry Sclerophyll Forests (see Photo 5-1) – this habitat is typically an open eucalypt woodland, 10-15 m or (rarely) 20 m tall, with prominent shrubby understorey and sparse to moderate groundcover of sedges and grasses. It occurs in podsolised fluvial sand and silt deposits on former floodplains of flat or gently undulating terrain. Within the study area, the intact areas of dry sclerophyll forest comprise a very dense shrub layer with abundant woody debris, large trees are in low abundance, and only a small number of hollow-bearing trees occur. There are abundant nectar resources in the shrub layer which comprises a diversity of Proteaceous, Fabaceous and Myrtaceous plant species. Conversely, the regrowth and maintained areas of this habitat do not comprise a canopy cover, and mature shrubs and woody debris are absent, therefore providing reduced habitat value.

This habitat type contains mature trees, although a low density of hollow-bearing trees and standing dead trees. Also due to the low height of the trees in this community (generally 8-10 m) any hollows present are typically low in the canopy (< 4 m) and small (< 15 cm). One hollow-bearing tree was recorded in the Proposal Site, located on the outside edge of the proposed 10 m APZ in intact forest. The tree (*Eucalyptus parramattensis* subsp. *decadens*) is around 8 m tall, with a trunk hollow found to be 3.5 m above ground and around 30 cm diameter. An inspection of the hollow was conducted which indicated the hollow to be of shallow depth (<15 cm) and formed from a broken and burnt section of trunk. The trunk itself was not hollow. There was no nesting or denning material present and the hollow cavity was considered unlikely to have been used as a roost or nest site for a large forest owl or cockatoo (see Photo 5-2).

- Coastal Freshwater Lagoons (see Photo 5-3) – this habitat type is typically a mosaic of sedgeland and open water. It forms in depressions in coastal sand sheets and floodplains with free-standing water. The freshwater wetlands habitat within the study area occurs as two types, a shallow Typha dominated wetland habitat within the shallow margins of North Dam as well as covering artificial drainage structures and a taller spike rush dominated habitat that occupies the deeper sections across both surge ponds, adjacent the Proposal Site to the east. Both habitats provide dense emergent sedges and rushes providing cover for a diversity of frog and bird species.

Only the small area of Typha dominated shallow wetland occurs within the Proposal Site, while the deeper water associated with the surge pond is adjacent to the Proposal Site to the east and outside of the Proposal Site and APZ. The Typha wetland habitats in the Proposal Site are non-tidal artificial waterways that have been constructed for managing surface water runoff from the former Kurri Kurri aluminium smelter site and have become colonised by sedges and some smaller aquatic herbs. These habitats are ephemeral and small in area and provide very limited breeding or foraging habitat opportunities for aquatic dependent bird species. They are considered too degraded for migratory shorebird species such as Curlew Sandpiper and Great Knot, which generally occupy littoral and estuarine habitats. The area is not mapped as important habitat for migratory bird species.

Table 5.1: Summary of broad habitat types within the Proposal Site

Vegetation formation (Keith, 2004)	Vegetation class (Keith, 2004) / habitat type	Area (ha) in Proposal Site
Dry Sclerophyll Forests	Sydney Sand Flats Dry Sclerophyll Forests	1.49 ha (intact forest/ woodland habitat)
Freshwater Wetlands	Coastal Freshwater Lagoons	0.05 ha (part of much larger adjoining habitat)



Photo 5-1: An example of the Dry Sclerophyll Forests habitat type with shrubby understorey.

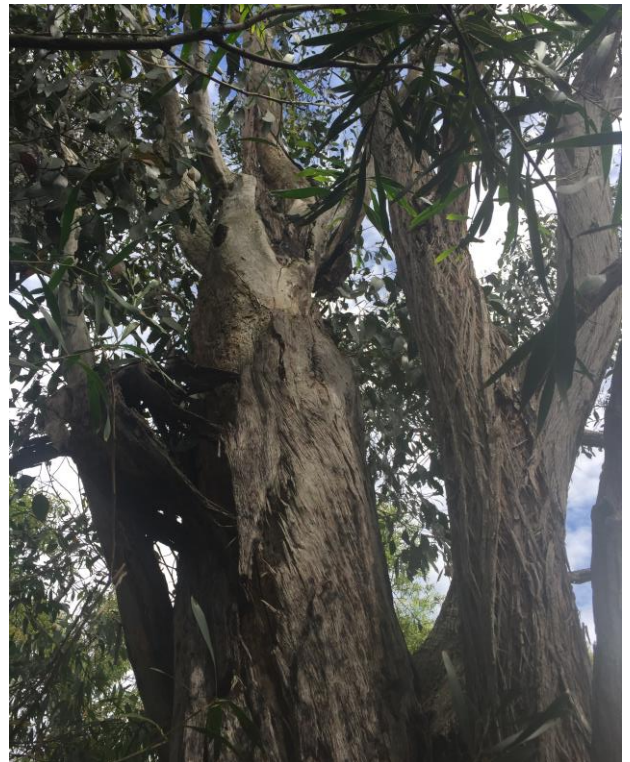


Photo 5-2: *Eucalyptus parramattensis* subsp (hollow-bearing tree on edge of the APZ).

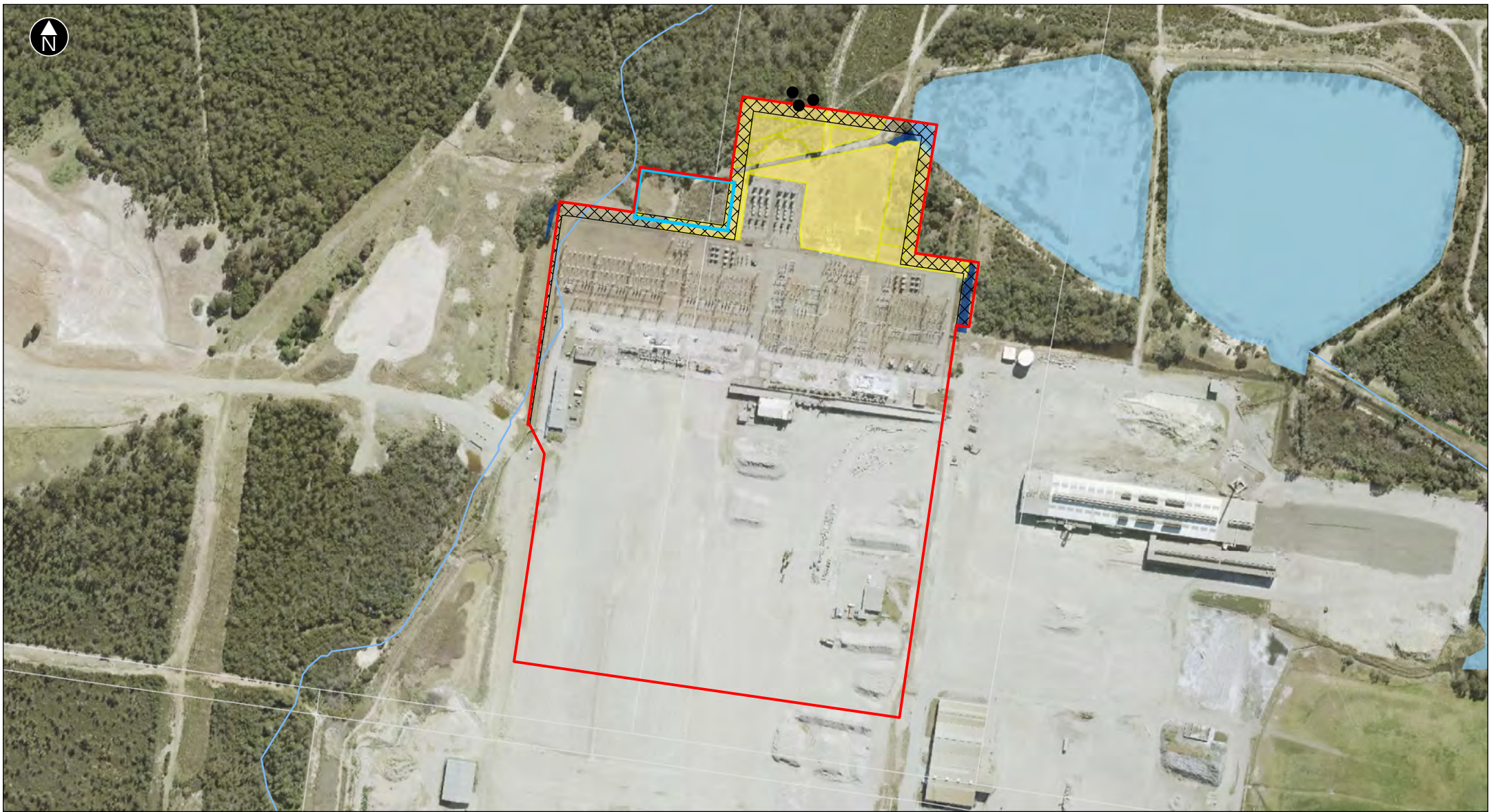


Photo 5-3: An example of Freshwater Wetlands habitat type within the study area. Shows *Typha* dominated shallow wetland in foreground, and taller spike rush in deeper section of the pond in the background.



Photo 5-4: *Typha* sedgeland – ephemeral drainage line.





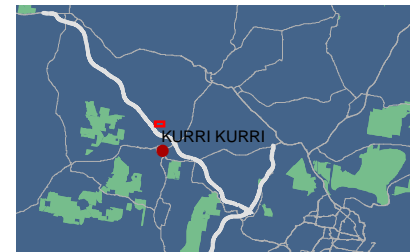
- Proposal site
- Waterbodies
- Hollow bearing Trees
- Broad habitat types (Keith, 2004)
- Dry sclerophyll forest with shrubby understorey
- Freshwater wetlands

- Asset protection zone
- Detention basin

0 125 250 m

1:4,000 at A4  
Coordinate System: GDA2020 MGA Zone 56

**Data sources:**  
Jacobs  
Metromap (Aerometrex) 2020  
NSW Spatial Services



**Figure 5-1** Habitat types and habitat features

### 5.1.3 Ecosystem credit species assessment

Ecosystem credit species are those threatened species where the likelihood of occurrence of a species or elements of the species' habitat can be predicted by vegetation surrogates and landscape features, or for which a targeted survey has a low probability of detection. Ecosystem credit threatened species have been assessed in conjunction with information about the Proposal Site context (Section 3 of the BAM), PCTs and vegetation integrity attributes (Chapter 4 of the BAM), and data from the Threatened Biodiversity Data Collection (Section 5 of the BAM).

The BAM-C was used to generate a list of the predicted threatened species that met the criteria outlined in Section 5.2.1.2 of the BAM. The results of the BioNet search and the federal Department of the Agriculture, Water and the Environment's PMST (Appendix F) were also used to inform development of the species list.

The initial list of predicted ecosystem credit species identified by the BAM-C is provided in Table 5.2. The full threatened species habitat suitability assessment is provided in Appendix A. Once the initial list of predicted ecosystem credit species was generated, the geographic limitations of each species (where applicable) were examined to see if they were met. Geographic limitations usually relate to altitude or topographic features and different geographic limitations can be described for different IBRA bioregion and subregions across a species' distribution. Where the Proposal Site is not within the geographic limitation described for a species, the species was removed from the predicted list of threatened species and no further assessment was undertaken.

In accordance with Paragraphs 5.2.2.1 – 5.2.2.4 (Step 2) of the BAM, an onsite assessment was undertaken to determine the presence of any habitat constraints or microhabitats for the threatened species predicted to occur on the Proposal Site. Some species do not have any identified habitat constraints, in which case this step was not undertaken. The justification for including or excluding ecosystem credit species from the assessment is provided in Table 5.2. The sensitivity to gain class is also identified, which considers the ability of a species to respond to improvements in habitat condition at an offset site.

The remainder of the ecosystem credit species outlined in Appendix A do have suitable habitat within and adjacent to the proposed Proposal Site, albeit limited in size, and would therefore need to be addressed in future assessment under the BAM. Under the BAM, targeted survey is not required for ecosystem credit species. However, in some circumstances, the Threatened Biodiversity Data Collection may identify that a species requires assessment for ecosystem credits and species credits (a dual credit species). This occurs where part of the habitat is assessed as a species credit (e.g. breeding habitat, or mapped locations identified as an important area that is used by a species). The remaining part of the habitat is assessed as an ecosystem credit (e.g. foraging habitat, unmapped locations used by a species). Therefore, some species are listed in both Table 5.2 and Table 5.3 as an ecosystem credit species and a species credit species.

Table 5.2: Summary of predicted ecosystem credit species that were assessed

Species name	Common name	EPBC Act *	BC Act *	Justification for inclusion / exclusion	Sensitivity to gain class
<b>Birds</b>					
<i>Anseranas semipalmata</i>	Magpie Goose	-	V	Included. The Proposal Site is east of Cessnock and the habitat within the surge pond may be potential for this species.	Moderate
<i>Botaurus poiciliptilus</i>	Australasian Bittern	E	E	Included. The Proposal Site is east of Cessnock, and the freshwater wetland habitats / PCTs are associated with this species.	Moderate



Species name	Common name	EPBC Act *	BC Act *	Justification for inclusion / exclusion	Sensitivity to gain class
<i>Calidris ferruginea</i>	Curlew Sandpiper (foraging)	CE	E	Excluded from the assessment as there is no suitable habitat in the Proposal Site for foraging and the study area is not within important habitat map.	High
<i>Calidris tenuirostris</i>	Great Knot (foraging)	CE	V	Excluded from the assessment as there is no suitable habitat in the Proposal Site for foraging and the study area is not within important habitat map.	High
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (foraging)	-	V	Included. May occur in study area on occasion and associated with the intact woodland habitat only, the low regrowth habitat is not suitable.	Moderate
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo (foraging)	-	V	Excluded from the assessment as there is no Allocasuarina / or Casuarina species (i.e. potential food resources) associated with PCT 1633, nor were these species identified at the Proposal Site.	High
<i>Chthonicola sagittata</i>	Speckled Warbler	-	V	Included. May occur in study area on occasion and associated with the intact woodland habitat only, the low regrowth habitat is not suitable.	High
<i>Circus assimilis</i>	Spotted Harrier	-	V	Excluded from the assessment as the habitat is not suitable for this species which occurs in grassy open woodland. The dense shrubby habitat is not suitable.	Moderate
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	-	V	Excluded from the assessment as there is no suitable habitat. Usually not found in woodlands with a dense shrub layer. The likelihood of this species occurring in the Proposal Site is considered low.	High
<i>Daphoenositta chrysoptera</i>	Varied Sittella	-	V	Included. This species is commonly seen in the locality and may forage in or over the vegetation in and adjacent to the Proposal Site. individuals would only be present in the intact woodland habitat.	Moderate
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	-	E	Included. The habitat within the surge ponds and Typha wetlands may be potential for this species.	Moderate
<i>Epthianura albifrons</i>	White-fronted Chat	-	V	Excluded from the assessment as there is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.	Moderate

Species name	Common name	EPBC Act *	BC Act *	Justification for inclusion / exclusion	Sensitivity to gain class
<i>Glossopsitta pusilla</i>	Little Lorikeet	-	V	Included. This species is commonly seen in the locality and may forage in or over the vegetation in and adjacent to the Proposal Site. Associated with the intact woodland only.	High
<i>Grantiella picta</i>	Painted Honeyeater	V	V	Excluded from the assessment as there is no habitat in the Proposal Site considered suitable for this species. Mistletoe is not present at a density of >5 / ha, which is a habitat constraint for this species identified by the TBDC.	Moderate
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (foraging)	M	V	Excluded from the assessment as there is no habitat in the Proposal Site considered suitable for this species for foraging. The large surge ponds (North Dam) are outside of the Proposal Site and would not be impacted, these may provide marginal habitat, although are not stocked with fish nor connected to natural waterways.	High
<i>Hieraaetus morphnoides</i>	Little Eagle (foraging)	-	V	Included. This species may fly over, perch or hunt in the intact woodland habitat identified on the Proposal Site on occasion. There is unlikely to be any suitable breeding habitat present.	Moderate
<i>Irediparra gallinacea</i>	Comb-crested Jacana	-	V	Excluded from the assessment as there is no wetland habitat that contains floating aquatic vegetation (habitat constraint).	Moderate
<i>Ixobrychus flavicollis</i>	Black Bittern	-	V	Included. The habitat within the surge ponds and Typha wetlands may be potential for this species.	Moderate
<i>Lathamus discolor</i>	Swift Parrot (foraging)	CE	E	Excluded. Important habitat for the Swift Parrot are woodland and forest containing winter flowering eucalypt species such as Spotted Gum ( <i>Corymbia maculata</i> ), Swamp Mahogany ( <i>Eucalyptus robusta</i> ) and Forest Red Gum ( <i>Eucalyptus tereticornis</i> ). None of these species are associated with the vegetation community (PCT1633) confirmed within the Proposal Site, and the habitat is not mapped as important.	Moderate
<i>Limicola falcinellus</i>	Broad-billed Sandpiper (foraging)	-	V	Excluded from the assessment as there is no suitable habitat in the Proposal Site for foraging and the study area is not within important habitat map.	High



Species name	Common name	EPBC Act *	BC Act *	Justification for inclusion / exclusion	Sensitivity to gain class
<i>Limosa limosa</i>	Black-tailed Godwit (foraging)	-	V	Excluded from the assessment as there is no suitable habitat in the Proposal Site for foraging and the study area is not within important habitat map.	High
<i>Lophoictinia isura</i>	Square-tailed Kite (foraging)	-	V	Included. This species may fly over, perch and hunt in the Proposal Site on occasion. There is unlikely to be any suitable breeding habitat present.	Moderate
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	-	V	Excluded from the assessment as there is no suitable habitat. Usually not found in woodlands with a dense shrub layer. The likelihood of this species occurring in the Proposal Site is considered low.	Moderate
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	-	V	Included. May occur in study area on occasion and associated with the intact woodland habitat only, the low regrowth habitat is not suitable.	Moderate
<i>Neophema pulchella</i>	Turquoise Parrot	-	V	Excluded from the assessment as there is no habitat in the Proposal Site considered suitable for this species.	High
<i>Ninox connivens</i>	Barking Owl (foraging)	-	V	Included. This species may fly over, perch and hunt in the Proposal Site on occasion. There is no suitable breeding habitat present.	High
<i>Ninox strenua</i>	Powerful Owl (foraging)	-	V	Included. This species may fly over, perch and hunt in the Proposal Site on occasion. There is no suitable breeding habitat present.	High
<i>Oxyura australis</i>	Blue-billed Duck	-	V	Excluded from the assessment as there is no habitat in the Proposal Site considered suitable for this species for foraging. The large surge ponds (North Dam) are outside of the Proposal Site and would not be impacted, these may provide marginal habitat	Moderate
<i>Pandion cristatus</i>	Eastern Osprey (foraging)	-	V	Excluded from the assessment as there is no habitat in the Proposal Site considered suitable for this species for foraging. The large surge ponds (North Dam) are outside of the Proposal Site and would not be impacted, these may provide marginal habitat, although are not stocked with fish nor connected to natural waterways.	Moderate

Species name	Common name	EPBC Act *	BC Act *	Justification for inclusion / exclusion	Sensitivity to gain class
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	-	V	Included. May occur in study area on occasion and associated with the intact woodland habitat and regrowth areas.	Moderate
<i>Rostratula australis</i>	Australian Painted Snipe	E	E	Included. The habitat within the surge ponds and Typha wetlands may be potential for this species.	Moderate
<i>Stictonetta naevosa</i>	Freckled Duck	-	V	Excluded from the assessment as there is no habitat in the Proposal Site considered suitable for this species for foraging. The large surge ponds (North Dam) are outside of the Proposal Site and would not be impacted, these may provide marginal habitat	Moderate
<i>Tyto longimembris</i>	Eastern Grass Owl	-	V	Excluded from the assessment as there is no habitat in the Proposal Site considered suitable for this species which is a dense shrubby woodland. The small area of Typha wetland is too small support nesting for this species	Moderate
<i>Tyto novaehollandiae</i>	Masked Owl (foraging)	-	V	Included. This species may fly over, perch and hunt in the Proposal Site on occasion. There are no suitable roost or nest trees present	High
<i>Xenus cinereus</i>	Terek Sandpiper (foraging)	-	V	Excluded from the assessment as there is no suitable habitat in the Proposal Site for foraging and the study area is not within important habitat map.	High
<b>Mammals</b>					
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	E	V	Included. This species is commonly seen in the locality and may forage in or over the vegetation in and adjacent to the Proposal Site. individuals would only be present in the intact woodland habitat.	High
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	-	V	Included. This species is most likely to forage in the woodland around the forest edges and over the surge ponds adjacent to the Proposal Site. However, there is no high-quality foraging habitat or breeding habitat in the Proposal Site.	High
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	-	V	Included. This species is most likely to forage in the woodland around the forest edges and over the surge ponds adjacent to the Proposal Site. However, there is no high-quality foraging habitat or breeding habitat in the Proposal Site.	High

Species name	Common name	EPBC Act *	BC Act *	Justification for inclusion / exclusion	Sensitivity to gain class
<i>Miniopterus australis</i>	Little Bent-winged Bat (foraging)	-	V	Included. This species is most likely to forage in the woodland around the forest edges and over the surge ponds adjacent to the Proposal Site. However, there is no high-quality foraging habitat or breeding habitat in the Proposal Site.	High
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat (foraging)	-	V	Included. This species is most likely to forage in the woodland around the forest edges and over the surge ponds adjacent to the Proposal Site. However, there is no high-quality foraging habitat or breeding habitat in the Proposal Site.	High
<i>Nyctophilus corbeni</i>	Corben's Long-eared Bat	V	V	Included. This species is most likely to forage in the woodland around the forest edges and over the surge ponds adjacent to the Proposal Site. However, there is no high-quality foraging habitat or breeding habitat in the Proposal Site.	High
<i>Petaurus australis</i>	Yellow-bellied Glider	-	V	Excluded from the assessment. There is no habitat in the Proposal Site considered suitable for this species. The tree canopy is < 10 m in height, and no suitable tree hollows	High
<i>Phascolarctos cinereus</i>	Koala (foraging)	V	V	Included. <i>Eucalyptus parramattensis subsp decadens</i> is a primary food tree species and a component of the PCT1633. Would only be associated with the intact forest habitat	High
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox (foraging)	V	V	Included. This species is assumed to occur based on the presence of suitable foraging habitat and the proximity of several camps within 50 km of the Proposal Site. There are no camps within the Proposal Site.	High
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	-	V	Included. This species is most likely to forage in the woodland around the forest edges and over the surge ponds adjacent to the Proposal Site. However, there is no high-quality foraging habitat or breeding habitat in the Proposal Site.	High
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	-	V	Included. This species is most likely to forage in the woodland around the forest edges and over the surge ponds adjacent to the Proposal Site. However, there is no high-quality foraging habitat or breeding habitat in the Proposal Site.	High

\* Key: CE = critically endangered, E = endangered, V = vulnerable, M = migratory

## 5.2 Species-credit species assessment

Threatened species for which the likelihood of occurrence of the species (or elements of suitable habitat for the species) cannot be confidently predicted by vegetation surrogates and landscape features, and which can be reliably detected by survey, are identified in the TBDC as species-credit species.

Habitat suitability is identified as the degree to which the habitat needs of threatened species are present at a particular site. Species-credit species have been assessed in conjunction with information collected about the site context of the Proposal Site (Section 3.2 of the BAM), on PCTs and vegetation integrity attributes in (Section 4 of the BAM), and data obtained from the Threatened Biodiversity Data Collection (Section 5 of the BAM).

The BAM defines species-credit species, for which are identified in the Threatened Biodiversity Data Collection, as those threatened species:

- For which the likelihood of occurrence of the species, or elements of suitable habitat for the species, cannot be confidently predicted by vegetation surrogates and landscape features
- Which can be reliably detected by survey.

Based on the assessment of habitat in the Proposal Site, and review of databases and published information, the species-credit species as outlined in Table 5.3 are considered 'candidate species' for the assessment, and these species are subject to habitat assessment to determine a list of target species for survey. The full threatened species habitat suitability assessment is provided in Appendix A.

Table 5.3: Candidate species-credit species identified by the BAM-C

Species name	Common name	EPBC Act*	BC Act*	Sensitivity to gain class
<b>Plants</b>				
<i>Acacia bynoeana</i>	Bynoe's Wattle	V	E	High
<i>Asperula asthenes</i>	Trailing Woodruff	V	V	High
<i>Callistemon linearifolius</i>	Netted Bottle Brush	-	V	Moderate
<i>Cryptostylis hunteriana</i>	Leafless Tongue-orchid	V	V	Moderate
<i>Eucalyptus glaucina</i>	Slaty Red Gum	V	V	High
<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	Earp's Gum	V	V	High
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea	V	V	High
<i>Maundia triglochinoides</i>	Maundia triglochinoides	-	V	High
<i>Melaleuca biconvexa</i>	Biconvex Paperbark	V	V	High
<i>Persicaria elatior</i>	Tall Knotweed	V	V	High
<i>Rutidosia heterogama</i>	Heath Wrinklewort	V	V	High
<i>Zannichellia palustris</i>	Zannichellia palustris	-	E	High
<b>Birds</b>				
<i>Burhinus grallarius</i>	Bush Stone-curlew	-	E	High
<i>Calidris ferruginea</i>	Curlew Sandpiper (Breeding)	CE	E	High

Species name	Common name	EPBC Act*	BC Act*	Sensitivity to gain class
<i>Calidris tenuirostris</i>	Great Knot (Breeding)	CE	V	High
<i>Collocephalon fimbriatum</i>	Gang-gang Cockatoo (Breeding)	-	V	High
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo (Breeding)	-	V	High
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (Breeding)	-	V	High
<i>Hieraaetus morphnoides</i>	Little Eagle (Breeding)	-	V	High
<i>Lathamus discolor</i>	Swift Parrot (breeding)	CE	E	Moderate
<i>Limicola falcinellus</i>	Broad-billed Sandpiper (Breeding)	-	V	High
<i>Limosa limosa</i>	Black-tailed Godwit (Breeding)	-	V	High
<i>Lophoictinia isura</i>	Square-tailed Kite (Breeding)	-	V	Moderate
<i>Ninox connivens</i>	Barking Owl (Breeding)	-	V	High
<i>Ninox strenua</i>	Powerful Owl (Breeding)	-	V	High
<i>Pandion cristatus</i>	Eastern Osprey (Breeding)	-	V	Moderate
<i>Tyto novaehollandiae</i>	Masked Owl (Breeding)	-	V	High
<i>Xenus cinereus</i>	Terek Sandpiper (Breeding)	-	V	High
<b>Mammals</b>				
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	-	V	High
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Very High
<i>Miniopterus australis</i>	Little Bent-winged Bat (Breeding)	-	V	Very High
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat (Breeding)	-	V	Very High
<i>Myotis macropus</i>	Southern Myotis	-	V	High
<i>Petaurus norfolcensis</i>	Squirrel Glider	-	V	High
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	V	E	Very High
<i>Phascolarctos cinereus</i>	Koala (breeding)	V	V	High
<i>Planigale maculata</i>	Common Planigale	-	V	High
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox (breeding)	V	V	High
<b>Frogs</b>				
<i>Crinia tinnula</i>	Wallum Froglet	-	V	Moderate
<i>Litoria aurea</i>	Green and Golden Bell Frog	V	E	High
<i>Litoria brevipalmata</i>	Green-thighed Frog	-	V	Moderate
<i>Uperoleia mahonyi</i>	Mahony's Toadlet	-	E	High
<b>Reptiles</b>				
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	-	V	High

\* Key: CE = critically endangered, E = endangered, V = vulnerable



### **5.2.1 Identifying geographic and habitat constraints**

Once the initial list of predicted candidate species-credit species shown in Table 5.3 was generated, this list was examined to determine if species should be removed from the list because the species is considered vagrant, out of geographic range or the habitat or microhabitat features are not present within the Proposal Site.

At this stage, the geographic limitations of each species (where applicable) were examined to see if they were met by the Proposal Site location. Where the Proposal Site is not within the geographic limitation described for a species, the species was removed from the candidate list of threatened species and no further assessment was undertaken.

In accordance with Paragraphs 5.2.1 – 5.2.4 (Step 2) of the BAM, an onsite assessment was undertaken to determine the presence of any habitat constraints or microhabitats for the threatened species predicted to occur on the Proposal Site. Some species do not have any identified habitat constraints, in which case this step was not undertaken.

A targeted survey was conducted to identify, map, and classify all hollow-bearing trees within the Proposal Site and the surrounding APZ. Given the small area of intact vegetation within the Proposal Site, the search involved two observers covering all areas of the intact forest on site, by searching parallel transects approximately 10 m apart across the entire area. Where a hollow-bearing tree was noted this was mapped and the characteristics of the hollow recorded (i.e. height above ground and hollow-size).

The species that were included or excluded based on habitat constraints or geographic limitations are outlined below in Table 5.4.

Table 5.4: Complete list of candidate species, showing assessment for those species with listed geographic or habitat constraints

Species name	Common name	EPBC Act	BC Act	Geographic limitation	Habitat constraint	Justification for inclusion / exclusion
<b>Plants</b>						
<i>Acacia bynoeana</i>	Bynoe's Wattle	V	E	None	No habitat constraints listed for this species	Included – Habitat is suitable for this species
<i>Asperula asthenes</i>	Trailing Woodruff	V	V	None	No habitat constraints listed for this species	Included – Habitat is suitable for this species
<i>Callistemon linearifolius</i>	Netted Bottle Brush	-	V	None	No habitat constraints listed for this species	Included – Habitat is suitable for this species
<i>Cryptostylis hunteriana</i>	Leafless Tongue-orchid	V	V	None	No habitat constraints listed for this species	Included – Habitat is suitable for this species
<i>Eucalyptus glaucina</i>	Slaty Red Gum	V	V	None	No habitat constraints listed for this species	Included – Habitat is suitable for this species
<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	Earp's Gum	V	V	None	No habitat constraints listed for this species	Included – Habitat is suitable for this species

Species name	Common name	EPBC Act	BC Act	Geographic limitation	Habitat constraint	Justification for inclusion / exclusion
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea	V	V	None	No habitat constraints listed for this species	Included – Habitat is suitable for this species
<i>Maundia triglochinoides</i>	Maundia	-	V	None	Riparian areas / drainage lines, water ponding, man-made dams, and drainage channels up to 1 m deep in Semi-permanent / ephemeral wet areas and swamps Shallow swamps up to 1 m deep in Waterbodies Shallow waterbodies up to 1 m deep	Included - Habitat constraint present in Proposal Site
<i>Melaleuca biconvexa</i>	Biconvex Paperbark	V	V	None	No habitat constraints listed for this species	Included – Habitat is suitable for this species

Species name	Common name	EPBC Act	BC Act	Geographic limitation	Habitat constraint	Justification for inclusion / exclusion
<i>Persicaria elatior</i>	Tall Knotweed	V	V	None	Semi-permanent / ephemeral wet areas, or within 50 m of Swamps, or within 50 m of waterbodies including wetlands, or within 50 m of waterbodies	Included - Habitat constraint present in Proposal Site
<i>Rutidosia heterogama</i>	Heath Wrinklewort	V	V	None	No habitat constraints listed for this species	Included – Habitat is suitable for this species
<i>Zannichellia palustris</i>	Zannichellia	-	E	None	Waterbodies Freshwater or slightly brackish estuarine areas (up to 10% of brackish water – the mixture of seawater and freshwater in estuaries)	Included - Habitat constraint present in Proposal Site
<b>Birds</b>						
<i>Burhinus grallarius</i>	Bush Stone-curlew	-	E	None	Fallen/standing dead timber including logs	Included - Habitat constraint present in Proposal Site
<i>Calidris ferruginea</i>	Curlew Sandpiper (Breeding)	CE	E	None	No habitat constraints listed for this species	Excluded – the Typha wetland habitats in the Proposal Site are non-tidal artificial waterways that have been constructed for managing surface water runoff and have become colonised by cumbungi. These habitats are ephemeral and small in area, and do not provide suitable breeding or foraging habitat for this species, which generally occupies littoral and estuarine habitats. The area is not mapped as important for this species and would be considered too degraded for this species



Species name	Common name	EPBC Act	BC Act	Geographic limitation	Habitat constraint	Justification for inclusion / exclusion
<i>Calidris tenuirostris</i>	Great Knot (Breeding)	CE	V	Within 5km of coast or tidal influenced water	No habitat constraints listed for this species	Excluded – the Proposal Site is further than 5 km from the coast. The Typha wetland habitats in the Proposal Site are non-tidal artificial waterways that have been constructed for managing surface water runoff
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (Breeding)	-	V	None	Hollow bearing trees. Eucalypt tree species with hollows greater than 9 cm diameter	Excluded – There is one trunk hollow present around 30 cm is diameter on edge of the APZ (see discussion in 5.1.2). This was inspected and no nesting material present. The tree was also observed on six occasions during the vegetation and trapping program and no signs of bird activity noted
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo (Breeding)	-	V	None	Hollow bearing trees. Living or dead tree with hollows greater than 15 cm diameter and greater than 5m above ground	Excluded – There is one trunk hollow present around 30 cm is diameter on edge of the APZ. (see discussion 5.1.2) this was inspected and no nesting material present. The tree was also observed on six occasions during the vegetation and trapping program and no signs of bird activity noted. The hollow is 3.5 m above ground
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (Breeding)	-	V	None	Living or dead mature trees within suitable vegetation within 1 km of rivers, lakes, large dams or creeks, wetlands, and coastlines	Included - Habitat constraint present in Proposal Site
<i>Hieraaetus morphnoides</i>	Little Eagle (Breeding)	-	V	None	Nest trees - live (occasionally dead) large old trees within vegetation	Excluded – Trees associated with PCT1633 in the Proposal Site are small and range from 5-8 m tall. There are no large live or dead trees

Species name	Common name	EPBC Act	BC Act	Geographic limitation	Habitat constraint	Justification for inclusion / exclusion
<i>Lathamus discolor</i>	Swift Parrot (breeding)	CE	E	None	As per mapped areas	Excluded – does not breed in NSW and the important habitat map does not cover the Proposal Site
<i>Limicola falcinellus</i>	Broad-billed Sandpiper (Breeding)	-	V	None	As per mapped areas	Excluded – Does not breed in NSW and the area is not mapped as important for this species and would be considered too degraded for this species
<i>Limosa limosa</i>	Black-tailed Godwit (Breeding)	-	V	None	As per mapped areas	Excluded – Does not breed in NSW and the area is not mapped as important for this species and would be considered too degraded for this species
<i>Lophoictinia isura</i>	Square-tailed Kite (Breeding)	-	V	None	Nest trees	Included – Search for nest sites conducted
<i>Ninox connivens</i>	Barking Owl (Breeding)	-	V	None	Hollow bearing trees. Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground	Excluded – There is one trunk hollow present around 30 cm is diameter on edge of the APZ. (see discussion 5.1.2) this was inspected and no nesting material present. The tree was also observed on two nocturnal surveys and no signs of bird activity noted. The hollow is 3.5 m above ground
<i>Ninox strenua</i>	Powerful Owl (Breeding)	-	V	None	Hollow bearing trees. Living or dead trees with hollow greater than 20 cm diameter	Excluded – There is one trunk hollow present around 30 cm is diameter on edge of the APZ. (see discussion 5.1.2) this was inspected and no nesting material present. The tree was observed on two nocturnal surveys and no signs of bird activity noted

Species name	Common name	EPBC Act	BC Act	Geographic limitation	Habitat constraint	Justification for inclusion / exclusion
<i>Pandion cristatus</i>	Eastern Osprey (Breeding)	-	V	None	Presence of stick-nests in living and dead trees (>15m) or artificial structures within 100 m of a floodplain for nesting)	Included – No large trees >15 m present in the habitat however electricity towers present within Proposal Site and in proximity to the 'North Dam'
<i>Tyto novaehollandiae</i>	Masked Owl (Breeding)	-	V	None	Hollow bearing trees. Living or dead trees with hollows greater than 20 cm diameter	Excluded – There is one trunk hollow present around 30 cm in diameter on edge of the APZ. (see discussion 5.1.2) this was inspected and no nesting material present. The tree was observed on two nocturnal surveys and no signs of bird activity noted
<i>Xenus cinereus</i>	Terek Sandpiper (Breeding)	-	V	None	As per mapped areas	Excluded – the area is not mapped as important for this species and would be considered too degraded for this species
<b>Mammals</b>						
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	-	V	None	No habitat constraints listed for this species	Included – Habitat is considered suitable for this species
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	None	Cliffs. Within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within 2 km of old mines or tunnels	Excluded – No cliffs or rocky areas located within two km of the study area
<i>Miniopterus australis</i>	Little Bent-winged Bat (Breeding)	-	V	None	Caves. Cave, tunnel, mine, culvert, or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave'. Observation type code 'E nest-roost', with numbers of individuals >500 or from the scientific literature.	Excluded – No cave, tunnel, or culvert. Any demolition of buildings with the Hydro Aluminium site has been approved previously

Species name	Common name	EPBC Act	BC Act	Geographic limitation	Habitat constraint	Justification for inclusion / exclusion
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat (Breeding)	-	V	None	Caves. Cave, tunnel, mine, culvert, or other structure known or suspected to be used for breeding including species records with microhabitat code 'IC – in cave'. Observation type code 'E nest-roost' with numbers of individuals >500	Excluded – No cave, tunnel, or culvert. Any demolition of buildings with the Hydro Aluminium site has been approved previously
<i>Myotis macropus</i>	Southern Myotis	-	V	None	Hollow bearing trees. Within 200 m of riparian zone. Other Bridges, caves, or artificial structures within 200 m of riparian zone and waterbodies. This include rivers, creeks, billabongs, lagoons, dams, and other waterbodies on or within 200m of the Proposal Site	Included – Four hollow-bearing trees with small hollows located within 200 m of the surge pond habitat adjacent to the Proposal Site
<i>Petaurus norfolcensis</i>	Squirrel Glider	-	V	None	No habitat constraints listed for this species	Included – habitat is suitable for this species
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	V	E	None	Land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliff lines	Excluded – No rocky areas located within 2 km of the study area
<i>Phascolarctos cinereus</i>	Koala (breeding)	V	V		Areas identified via survey as important habitat (see comments)	Included - habitat is suitable for this species
<i>Planigale maculata</i>	Common Planigale	-	V	None	No habitat constraints listed for this species	Included – habitat is suitable for this species
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox (breeding)	V	V	None	Breeding camps	Excluded – there are no breeding camps / roosting sites within the Proposal Site



Species name	Common name	EPBC Act	BC Act	Geographic limitation	Habitat constraint	Justification for inclusion / exclusion
<b>Frogs</b>						
<i>Crinia tinnula</i>	Wallum Froglet	-	V	None	No habitat constraints listed for this species	Included – No habitat constraints listed for this species. There are no acidic swamp areas, although surface water gathers after rain
<i>Litoria aurea</i>	Green and Golden Bell Frog	V	E	None	No habitat constraints listed for this species	Included – Habitat is suitable for this species
<i>Litoria brevipalmata</i>	Green-thighed Frog	-	V	None	No habitat constraints listed for this species	Excluded – the habitat is not considered suitable for this species
<i>Uperoleia mahonyi</i>	Mahony's Toadlet	-	E	None	No habitat constraints listed for this species	Included – Habitat is suitable for this species
<b>Reptiles</b>						
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	-	V	None	No habitat constraints listed for this species	Included – No habitat constraints listed for this species

\* Key: CE = critically endangered, E = endangered, EP = endangered population, V = vulnerable

### 5.2.2 Candidate species removed from the assessment

In accordance with Paragraphs 5.2.3.1 – 5.2.3.4 (Step 3) of the BAM, a field assessment was undertaken to determine whether the habitats within the Proposal Site were substantially degraded to the point that a candidate species is unlikely to utilise the Proposal Site (or specific vegetation zones). There were a number of threatened species returned from the BAM-C that are species-credit species if breeding habitat would be impacted (i.e. dual credit species). The Proposal Site does not contain breeding habitat for any of these identified species as follows:

- The Gang-gang Cockatoo requires hollow-bearing Eucalypt trees with hollows greater than 9 cm in diameter for breeding. There is one trunk hollow present around 30 cm in diameter on edge of the APZ. (see discussion Section 5.1.2) this was inspected and no nesting material present. The tree was also observed on six occasions during the vegetation and trapping program and no signs of bird activity noted. As such, the Gang-gang Cockatoo was removed from the candidate species list.
- The Glossy Black-Cockatoo requires living or dead trees with hollows greater than 15 cm diameter and greater than 5m above ground. There is one trunk hollow present around 30 cm in diameter on edge of the APZ. (see discussion Section 5.1.2) this was inspected and no nesting material present. The tree was also observed on six occasions during the vegetation and trapping program and no signs of bird activity noted. The hollow is 3.5 m above ground. As such, the Glossy Black-Cockatoo was removed from the candidate species list.
- Little Eagle breeding habitat is specified as live (occasionally dead) large old trees within suitable vegetation and the presence of a male and female; or female with nesting material; or an individual on a large stick nest in the top half of the tree canopy. There are no live large old trees within the Proposal Site that contain large stick nests. The habitats within the Proposal Site contain relatively small to moderate sized *Eucalyptus* spp. trees that are not suitable as nesting sites for the Little Eagle. Consequently, the Little Eagle was removed from the candidate species list.
- The Square-tailed Kite also requires nest trees for breeding. It is difficult to identify a Kite nest (there are many comparable sized stick nests built by other species), especially given Kites have large territories and other stick nesters will undoubtedly also be nesting where Kites might be recorded. Kites will need to be in attendance to confirm breeding sites. As discussed, there are no large old trees within the Proposal Site that contain large stick nests. Consequently, the Square-tailed Kite was removed from the candidate species list.
- The Barking Owl, Powerful Owl and Masked Owl all require living or dead trees with hollows greater than 20 cm diameter. There is one trunk hollow present around 30 cm in diameter on the edge of the APZ (see discussion Section 5.1.2). This was inspected and no nesting material present. The tree was also observed on two nocturnal surveys and no signs of bird activity noted. The hollow is 3.5 m above ground. As such, these three species were removed from the candidate species list.
- Breeding habitat for the Large-eared Pied Bat requires either cliffs or the Proposal Site to be within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within 2 km of old mines or tunnels. The Proposal Site does not contain cliffs and an assessment of a 2 km radius did not identify any of these breeding features. As such, the Large-eared Pied Bat was removed from the candidate species list.
- Breeding habitat for the Large Bent-winged Bat and Little Bent-winged Bat is highly specific and is restricted to cave systems. There are only five Little Bent-winged Bat nursery sites /maternity colonies known in Australia and a single maternity colony in NSW which is in close association with a large maternity colony of Large Bent-winged bats. The breeding colonies of the Little Bent-winged Bat and Large Bent-winged Bat are not in the Cessnock-Kurri area and would not be affected. As such, these species were removed from the candidate species list.
- There are no Grey-headed Flying-fox camps in the Proposal Site. The nearest camp is at East Cessnock, but this camp would not be affected. Consequently, the Grey-headed Flying-fox was removed from the candidate species list.

- The Green-thighed frog occurs 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. Breeding occurs following heavy rainfall from spring to autumn, with larger temporary pools and flooded areas preferred. Although surface water does gather after rain within the Proposal Site, the habitat is not considered suitable for this species. Furthermore, there are no records of this species within the locality of the Proposal.

Migratory species were also identified by the BAM-C as they have mapped important areas within the Proposal Site, however, these areas are not identified as breeding habitat. The Proposal Site does not contain suitable habitat for any of the migratory species identified as follows, and therefore were removed from the assessment:

- The Swift Parrot breeds in Tasmania. As such, it was removed from the candidate species list.
- The Black-tailed Godwit, Terek Sandpiper, Broad-billed Sandpiper, Great Knot, and Curlew Sandpiper are dual-credit migratory species that do not breed in Australia. The species-credit component of this species listing is mapped important areas. There are no mapped important areas within or near the Proposal Site and the small area of Typha sedgeland to be impacted by the Proposal is considered ephemeral and too degraded to provide important habitat for these species. These species were removed from the candidate species list.
- White-bellied Sea-Eagle breeding habitat is specified as live large old trees within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines and the presence of a large stick nest within tree canopy; or an adult with nest material; or adults observed duetting within breeding period. There are no live large old trees within the Proposal Site that contain large stick nests. The habitats within the Proposal Site contain relatively small to moderate sized *Eucalyptus* spp. trees that are not suitable as nesting sites for the White-bellied Sea-Eagle. Consequently, the White-bellied Sea-Eagle was removed from the candidate species list.

### 5.2.3 Candidate species added to the assessment

The following list of threatened species-credit species were not identified by the BAM-C, though are considered to have a moderate potential of occurring in the Proposal Site based on suitable habitat and/or database review of recorded sightings:

- The Regent Honeyeater (*Anthochaera phrygia*) was not identified by the BAM-C as being associated with the PCTs in the Proposal Site. The Regent Honeyeater is a dual credit species, with the species-credit component represented by mapped important areas. A map of important habitat has been prepared for this species under the provisions of the BAM and extends over a portion of the intact forest habitat on the Proposal Site, which includes PCT 1633 Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby intact woodland (part of Vegetation Zone 1; refer Figure 4.1).

According to the BAM, for dual credit species part of the habitat is assessed as a species-credit (e.g. breeding habitat or land mapped on an important habitat map for a species). In the case of the Regent Honeyeater, the important habitat map covers vegetation within the Proposal Site. Therefore, a survey is not required for the Regent Honeyeater and the species is assumed present. The species polygon is determined based on the entire area of important habitat that intersects the suitable vegetation in the Proposal Site.

For flora species, while parts of the Proposal Site comprise regrowth and cleared and maintained areas, these are all different condition states for the PCT 1633, and as such, threatened flora species that can be associated with this vegetation type as well as the Typha sedgeland community have been included. The list of candidate species assessed in detailed in Table 5.5.

### 5.2.4 Final list of candidate species for further assessment

The list of species retained for further assessment is shown in Table 5.5.

Table 5.5: Final list of candidate species for further assessment

Species name	Common name	EPBC Act	BC Act	Sensitivity to gain class	SAIL*	Relevant habitat in the study area
Plants						
<i>Acacia bynoeana</i>	Bynoe's Wattle	V	E	High	No	Highest quality habitat represented by the intact patches of PCT 1633, located to the east and west of the Proposal Site.
<i>Asperula asthenes</i>	Trailing Woodruff	V	V	High	No	
<i>Callistemon linearifolius</i>	Netted Bottle Brush	-	V	Moderate	No	
<i>Cryptostylis hunteriana</i>	Leafless Tongue-orchid	V	V	Moderate	No	
<i>Eucalyptus glaucina</i>	Slaty Red Gum	V	V	High	No	
<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	Earp's Gum	V	V	High	No	
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea	V	V	High	No	Marginal habitat located within the Typha sedgeland (PCT 1737), this habitat is ephemeral and man-made, therefore likelihood is low; however, these species were targeted to confirm if they were present.
<i>Melaleuca biconvexa</i>	Biconvex Paperbark	-	V	High	No	
<i>Maundia triglochinosoides</i>	Maundia	-	V	High	No	
<i>Persicaria elatior</i>	Tall Knotweed	V	V	High	No	
<i>Rutidosia heterogama</i>	Heath Wrinklewort	V	V	High	No	
<i>Zannichellia palustris</i>	Zannichelia	-	E	High	No	
Fauna						
<i>Burhinus grallarius</i>	Bush Stone Curlew	-	E	High	No	Potential habitat is associated with the intact patches of PCT 1633, located to the east and west of the Proposal Site.
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	-	V	High	No	
<i>Petaurus norfolcensis</i>	Squirrel Glider	-	V	High	No	
<i>Phascolarctos cinereus</i>	Koala	V	V	High	No	
<i>Planigale maculata</i>	Common Planigale	-	V	High	No	
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	-	V	High	No	Potential habitat is associated vegetation within 200 m of the storage ponds and the creek line to the west of the Proposal Site.
<i>Myotis macropus</i>	Southern Myotis	-	V	High	No	



Species name	Common name	EPBC Act	BC Act	Sensitivity to gain class	SAIL*	Relevant habitat in the study area
<i>Litoria aurea</i>	Green and Golden Bell Frog	V	E	High	No	Potential habitat within the Proposal Site is associated with the ephemeral Typha sedgelands (PCT1737) and low-lying areas of PCT1633 subject to ponding/inundation of surface water.
<i>Crinia tinnula</i>	Wallum Froglet	-	V	High	No	
<i>Uperoleia mahonyi</i>	Mahony's Toadlet	-	V	High	No	

### 5.2.5 Targeted species survey methods

After the candidate species list had been developed (see Section 5.2), targeted threatened species surveys were undertaken. The surveys undertaken for candidate threatened species of plants and animals are outlined in Section 5.2.5.

#### Threatened plant surveys

After the PCTs and finer scale habitats within the Proposal Site had been identified, and the threatened species habitat assessment had been undertaken, threatened plant surveys were undertaken targeted to the candidate species identified in Table 5.5.

The threatened flora surveys were guided by the methodology and effort described in *Surveying threatened plants and their habitats - NSW survey guide for the Biodiversity Assessment Method* (Department of Planning, Industry and Environment, 2020). The application of the described guidelines is not mandatory, but they provide an indication of the effort that is likely required. The main method adopted was walking parallel search transects (approximately 10-20 m spacing between observers) and with reference to the species prescribed survey timing in the BioNet Threatened Biodiversity Data Collection (TBDC). This approach was used to adequately cover the areas of potential habitat for the above listed species.

To identify habitats that were potentially suitable for the target species identified above, transects were walked through areas of suitable habitat, with a focus on the areas likely to be directly impacted. A description of potential habitat within the study area is provided for each species below:

Approximately 2 km was walked during the October and December 2020 flora surveys by a team of two ecologists. A summary of the survey effort based on the area of habitat for each target plant species is provided in Table 5.6. The location of tracks walked during the threatened plant surveys are illustrated in Figure 5.2.

Table 5.6: Summary of survey effort for threatened plant species

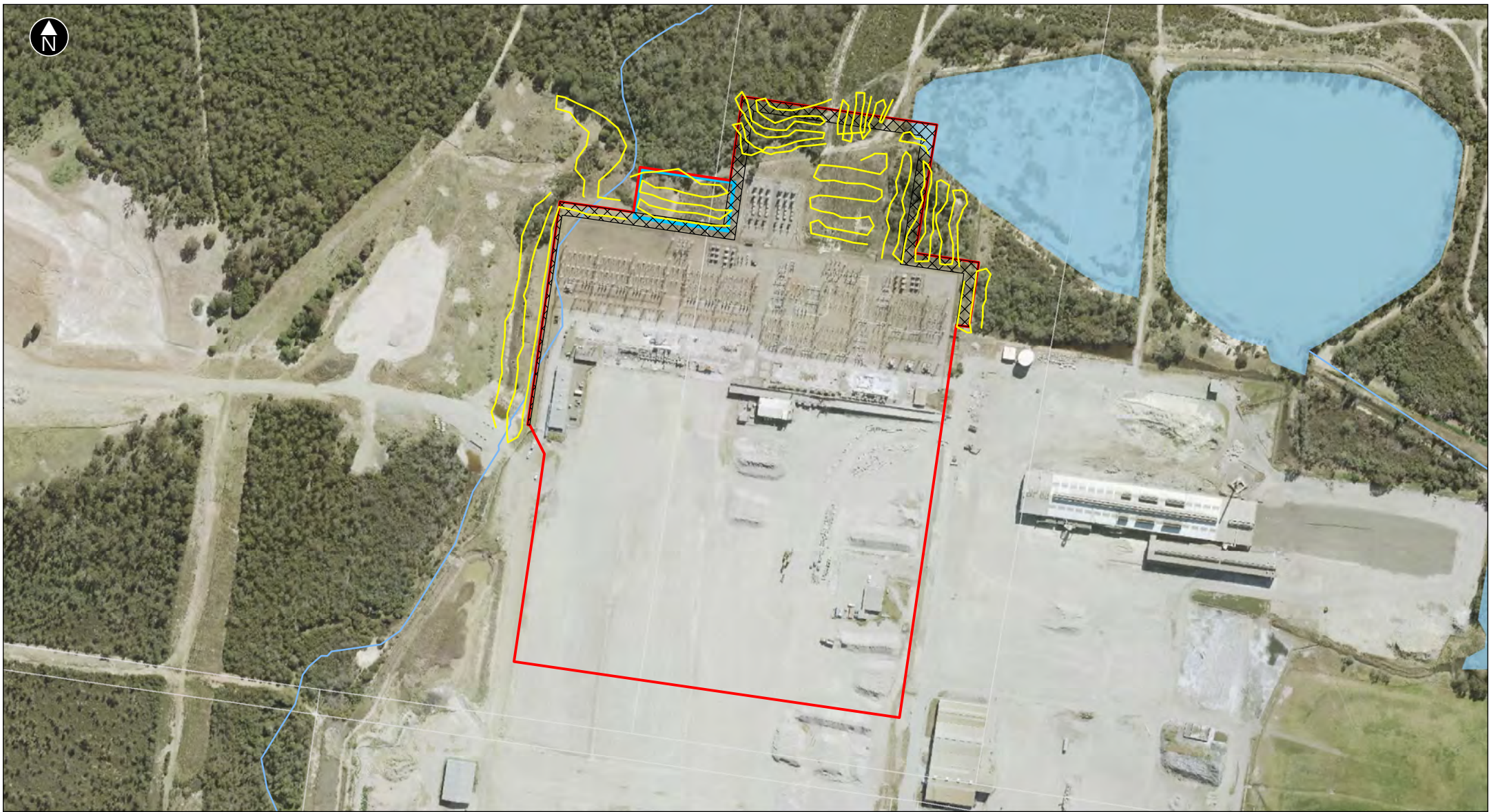
Species name	Common name	EPBC Act	BC Act	Habitat preferences and associated PCTs	Required survey period and survey guidelines	Survey completed – timing and effort
<i>Acacia bynoeana</i>	Bynoe's Wattle	V	E	Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia, and Narrow-leaved Apple. Associated with PCT1633 and could occur in all zones (1.96 ha)	All year Parallel traverse 5-10 m spacing 1-2 km length 2 person hours	Surveys completed in October and December 2020. Parallel field traverses through all vegetation zones associated with PCT1633, estimated at 1.5 km and approx. 2 person hours
<i>Asperula asthenes</i>	Trailing Woodruff	V	V	Occurs in damp sites, often along riverbanks. May be associated with the coastal freshwater wetland PCT1737 (0.13 ha)	October – December Parallel field traverse Up to 400-500 m 0.38 person hours	Survey completed in October and December 2020. Parallel field traverses along the PCT1737 Typha sedgeland on east and west side of the Proposal Site, estimated around 400 m and approx. 1-person hour
<i>Callistemon linearifolius</i>	Netted Bottle Brush	-	V	<i>Callistemon linearifolius</i> has been recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. This species has also been recorded within the Proposal Site. <i>Callistemon linearifolius</i> grows in dry sclerophyll forest of the coast and adjacent ranges. The study area contains habitat that meets the description for this species, where associated habitat listed for <i>Callistemon linearifolius</i> in the TBDC includes PCT 1633 (1.96 ha).	October – January Parallel traverse 5-10 m spacing 1-2 km length 2 person hours	Surveys completed in October and December 2020. Parallel field traverses through all vegetation zones associated with PCT1633, estimated at 1.5 km and approx. 2 person hours
<i>Cryptostylis hunteriana</i>	Leafless Tongue-orchid	V	V	<i>Cryptostylis hunteriana</i> is known to grow in a range of communities, including swamp-heath and woodland. Although it has not been recorded within the Proposal Site or locality, the study area contains habitat that meets the description for this species. Associated habitat listed for <i>Cryptostylis hunteriana</i> in the TBDC includes PCT 1633.	November – January Parallel traverse 5-10 m spacing 1-2 km length 2 person hours	Surveys completed in October and December 2020. Parallel field traverses through all vegetation zones associated with PCT1633, estimated at 1.5 km and approx. 2 person hours

Species name	Common name	EPBC Act	BC Act	Habitat preferences and associated PCTs	Required survey period and survey guidelines	Survey completed – timing and effort
<i>Eucalyptus glaucina</i>	Slaty Red Gum	V	V	Occurs in grassy woodland and dry eucalypt forest, grows no deep, moderately fertile, and well-water soils. Associated with PCT1633 and could occur in all zones (1.96 ha)	All year Parallel traverse 5-10 m spacing 1-2 km length 2 person hours	Surveys completed in October and December 2020. Parallel field traverses through all vegetation zones associated with PCT1633, estimated at 1.5 km and approx. 2 person hours
<i>Eucalyptus parramattensis subsp. decadens</i>	Earp's Gum	V	V	This species generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. <i>Eucalyptus parramattensis subsp. decadens</i> was recorded within the Proposal Site and is associated with the PCT 1633.	All year Parallel traverse 5-10 m spacing 1-2 km length 2 person hours	Surveys completed in October and December 2020. Parallel field traverses through all vegetation zones associated with PCT1633, estimated at 1.5 km and approx. 2 person hours
<i>Grevillea parviflora subsp. parviflora</i>	Small-flower Grevillea	V	V	<i>Grevillea parviflora subsp. parviflora</i> occurs in a range of vegetation types from heath and shrubby woodland to open forest and grows in sandy or light clay soils usually over thin shales. The study area contains habitat that meets the description for this species, where associated habitat listed for <i>Grevillea parviflora subsp. parviflora</i> in the TBDC includes PCT 1633.	August – November Parallel traverse 5-10 m spacing 1-2 km length 2 person hours	Surveys completed in October and December 2020. Surveys completed in October and December 2020. Parallel field traverses through all vegetation zones associated with PCT1633, estimated at 1.5 km and approx. 2 person hours
<i>Maundia triglochinosoides</i>	Maundia	-	V	Grows in swamps, lagoons, dams, channels, creeks, or shallow freshwater 30-60 cm deep on heavy clay, low nutrients. May be associated with the coastal freshwater wetland PCT1737 (0.13 ha)	Nov-March Parallel field traverse Up to 400-500 m 0.38 person hours	Survey completed in October and December 2020. Parallel field traverses along the PCT1737 Typha sedgeland on east and west side of the Proposal Site, estimated around 400 m and approx. 1-person hour

Species name	Common name	EPBC Act	BC Act	Habitat preferences and associated PCTs	Required survey period and survey guidelines	Survey completed – timing and effort
<i>Melaleuca biconvexa</i>	Biconvex Paperbark	V	V	<i>Melaleuca biconvexa</i> generally grows in damp places, often near streams or low-lying areas on alluvial soils or low slopes or sheltered aspects. May be associated with the coastal freshwater wetland PCT1737 and adjoining damp areas (0.13 ha)	All year Parallel field traverse Up to 400-500 m 0.38 person hours	Survey completed in October and December 2020. Parallel field traverses along the PCT1737 Typha sedgeland on east and west side of the Proposal Site, estimated around 400 m and approx. 1-person hour
<i>Persicaria elatior</i>	Tall Knotweed	V	V	The species usually grows in damp places, especially beside stream and lakes. Occasionally in swamp forest or associated with disturbance. May be associated with the coastal freshwater wetland PCT1737 (0.13 ha)	Dec-May Parallel field traverse Up to 400-500 m 0.38 person hours	Survey completed in October and December 2020. Parallel field traverses along the PCT1737 Typha sedgeland on east and west side of the Proposal Site, estimated around 400 m and approx. 1-person hour
<i>Rutidosia heterogama</i>	Heath Wrinklewort	V	V	Grows in heath on sandy soils and moist areas in open forest and has been recorded along disturbed roadsides. The study area contains habitat that meets the description for this species, where associated habitat listed for the species in the TBDC includes PCT 1633.	All year Parallel traverse 5-10 m spacing 1-2 km length 2 person hours	Surveys completed in October and December 2020. Surveys completed in October and December 2020. Parallel field traverses through all vegetation zones associated with PCT1633, estimated at 1.5 km
<i>Zannichellia palustris</i>	Zannichellia palustris	-	E	Grows in fresh or slightly saline stationary or slowly flowing water. May be associated with the coastal freshwater wetland PCT1737 (0.13 ha).	Dec – Jan Parallel field traverse Up to 400-500 m 0.38 person hours	Survey completed in October and December 2020. Parallel field traverses along the PCT1737 Typha sedgeland on east and west side of the Proposal Site, estimated around 400 m and approx. 1-person hour

Key: V = Vulnerable species, E = Endangered species



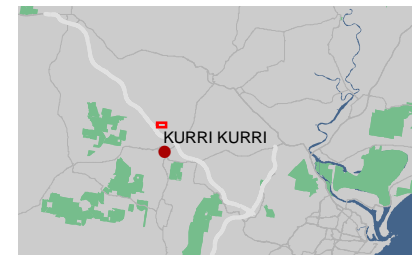


- Proposal site
- Flora transects
- Asset protection zone
- Waterbodies
- Detention basin



1:4,000 at A4  
Coordinate System: GDA2020 MGA Zone 56

**Data sources:**  
Jacobs  
Metromap (Aerometrex) 2020  
NSW Spatial Services



**Figure 5-2** Threatened plant surveys

### Threatened fauna surveys

Targeted surveys were undertaken for threatened fauna where potential habitat was identified within the Proposal Site. The primary focus was on targeting threatened species identified as candidate species-credit species. Surveys included diurnal and nocturnal effort using a stratified sampling approach that aimed to sample the range of habitats present. Opportunistic observations of threatened species were also recorded during survey activities and generally while present in the study area. Surveys were focused on areas within the Proposal Site and, where possible, also occurred in adjacent habitats that extended beyond the Proposal Site which may be indirectly impacted by the Proposal.

Fauna surveys were conducted during December 2020 using a combination of sampling techniques based on the required survey period and techniques detailed for each species in the BioNet Threatened Biodiversity Data Collection (TBDC) and methodology and effort as outlined in the document *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (Department of Environment and Conservation, 2004) and later guidelines including:

- Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians (Department of Environment and Climate Change, 2009)
- 'species-credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method (Office of Environment and Heritage, 2018)
- Survey Guidelines for Australia's Threatened Frogs (Department of the Environment Water Heritage and the Arts, 2010c).

Details of the specific survey techniques and effort applied are outlined in this section of the BDAR. Methods are described in relation to the habitat types sampled for the target species. The location of fauna survey techniques and effort are shown on Figure 5.3.

Important habitat is mapped in the 1,500 m landscape buffer for two critically endangered bird species (BC Act and EPBC Act), namely the Regent Honeyeater (*Xanthomyza phrygia*) and Swift Parrot (*Lathamus discolor*) (refer Figure 5.4). The important area mapping for Regent Honeyeater includes the intact vegetation in proximity to the Proposal Site and associated with PCT 1633. As the area of important habitat for the Regent Honeyeater intersects the Proposal Site, a survey is not required for the Regent Honeyeater and the species is assumed present. The species polygon is determined based on the vegetation zone at the Proposal site that impacts the important habitat.



Table 5.7: Summary of survey techniques and survey effort for threatened fauna species

Species name	Common name	EPBC Act	BC Act	Habitat preferences and associated PCTs	Required survey period and survey guidelines	Survey completed – timing, technique, and effort
<i>Burhinus grallarius</i>	Bush Stone Curlew	-	E	Potential habitat is associated with the intact patches of PCT 1633, located to the east and west of the Proposal Site.	<p>All year.</p> <p>Call playback, wait 5 minutes to hear call, play again and listen for another 5 minutes, followed by spotlighting. Species is mainly found in western slopes and plains and the Riverina, smaller numbers on Central and North Coast with increasing numbers in Tweed Valley. It may be easier to detect during breeding season (spring-summer), possibly calls all year, but it is unclear how well it responds to playback. The species was allocated to a species-credit as experts determined that it cannot be predicted to occur at a site based on vegetation surrogates but can be detected reliably from survey</p>	<p>Spotlighting by two ecologists over four nights: 16-17 and 22-23 December 2020 (16 person hours).</p> <p>Call playback at dusk used on each night from a central location.</p>
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	-	V	Potential habitat is associated with the intact patches of PCT 1633, located to the east and west of the Proposal Site, although the lack of tree hollows suggests that habitat is marginal.	<p>Oct-March.</p> <p>The recommended survey effort for small terrestrial mammals is 100 Elliott trap nights per stratification unit up to 50 ha in size (plus additional effort for every additional 100 ha).</p> <p>Spotlighting surveys should survey at least two 200 m transects per 5-ha site (or longer transects for larger sites). Maintain an interval of at least 100 m between the two transects in order to maximise the area surveyed, which is usually 1 km. the location of transects must be selected to sample appropriate habitats occurring within the subject site. Spotlight surveys along transects should be repeated on two separate nights where possible.</p> <p>Camera traps should be deployed for at least 14 nights, and approximately 10 cameras should be deployed per hectare. Camera traps should not be used as the only survey method and should always be used in conjunction with other standard survey techniques such as the Elliott trap and spotlighting</p>	<p>December survey. Area of intact forest sampled 0.4 ha</p> <p>20 ground based and 10 tree mounted Elliott traps were deployed for four nights (80 ground trap nights; 40 tree trap nights): 15-19 Dec 2020.</p> <p>Six cameras traps (StealthCam G34) were deployed over 24 nights from the 15 Dec 2020 to 12 January 2021 (144 camera trap nights).</p> <p>Spotlighting over four nights on the 16-17 and 22-23 December 2020 (16 person hours), covered all intact forest habitats.</p>

Species name	Common name	EPBC Act	BC Act	Habitat preferences and associated PCTs	Required survey period and survey guidelines	Survey completed – timing, technique, and effort
<i>Petaurus norfolcensis</i>	Squirrel Glider	-	V	Potential habitat is associated with the intact patches of PCT 1633, located to the east and west of the Proposal Site, although the lack of tree hollows suggests that habitat is marginal.	<p>All year.</p> <p>The recommended survey effort for arboreal mammals is 24 Elliott trap nights over 3 to 4 consecutive nights per stratification unit up to 50 ha in size (plus additional effort for every additional 100 ha).</p> <p>Spotlighting surveys should survey at least two 200 m transects per 5-ha site (or longer transects for larger sites). Maintain an interval of at least 100 m between the two transects in order to maximise the area surveyed, which is usually 1 km. Spotlight surveys along transects should be repeated on two separate nights where possible.</p> <p>Camera traps should be deployed for at least 14 nights, and approximately 10 cameras should be deployed per hectare. Camera traps should not be used as the only survey method and should always be used in conjunction with other standard survey techniques such as the Elliott trap and spotlighting.</p>	<p>December survey. Area of intact forest sampled 0.4 ha</p> <p>20 ground based and 10 tree mounted Elliott traps were deployed for four nights (80 ground trap nights; 40 tree trap nights): 15-19 Dec 2020.</p> <p>Six camera traps (StealthCam G34) were deployed over 24 nights from the 15 Dec 2020 to 12 January 2021 (144 camera trap nights).</p> <p>Spotlighting over four nights on the 16-17 and 22-23 December 2020 (16 person hours), covered all intact forest habitats.</p>
<i>Phascolarctos cinereus</i>	Koala	V	V	Potential habitat is associated with the intact patches of PCT 1633, located to the east and west of the Proposal Site. the primary food tree species, <i>E.parramattensis subsp. decadens</i> is present in PCT 1633	<p>All year.</p> <p>Spotlighting surveys should survey at least two 200 m transects per 5 ha site (or longer transects for larger sites). Maintain an interval of at least 100 m between the two transects in order to maximise the area surveyed, which is usually 1 km. Spotlight surveys along transects should be repeated on two separate nights where possible.</p> <p>Call playback, wait 5 minutes to hear call, play again and listen for another 5 minutes, followed by spotlighting.</p> <p>Scat surveys are recommended by searching up to 5 m around the base of the nearest tree and continue searching trees that radiate out from the waypoint until a minimum of 20 trees are searched at each site.</p>	<p>Koala scat searches were conducted at 10 sites on 17 December 2020. This involved randomly selecting a feed tree species within the disturbance area, and searching the nearest 20 trees in a radius around the central tree (as per Phillips and Callaghan 2011)</p> <p>Spotlighting over four nights on 16-17 and 22-23 December 2020 (16 person hours).</p>



Species name	Common name	EPBC Act	BC Act	Habitat preferences and associated PCTs	Required survey period and survey guidelines	Survey completed – timing, technique, and effort
<i>Planigale maculata</i>	Common Planigale	-	V	Potential habitat is associated with the intact patches of PCT 1633, located to the east and west of the Proposal Site.	<p>All year.</p> <p>The Common Planigale is a cryptic species that is difficult to detect. Survey any time of year. In addition to surveying for the Planigale, it is advisable to also survey for the Yellow-footed Antechinus (<i>Antechinus flavipes</i>), as research indicates that the presence of this Antechinus species at site generally indicates that the Planigale will either be absent, or present in very small numbers only. Survey must be undertaken using pitfall traps where the substrate allows. Occasionally, the substrate may be too rocky hard or inundated to allow the use of pitfall traps. In these circumstances, we strongly advise that an expert report should be obtained. Elliott traps should be used to detect whether the Yellow-footed Antechinus is present. However, Elliot trapping is not an effective method for detecting the Common Planigale and is not to be used as an alternative to pitfall trapping or an expert report. Should be delayed if heavy precipitation is forecast, to prevent drowning of this, or other species caught in trap. Pitfall trap design: Ideally, each pitfall trap array should comprise 10 m drift-fence with a 20 L or large bucket with a lid at either end. The lid should be elevated 2 to 3 cm (using sticks) above the lip of the bucket and be black in colour to encourage animals to move under it. Leaf litter and small twigs should be placed in the bottom of each bucket to provide shelter to trapped animals. Survey placement: Target the placement of traps on potential habitat within about 200 m of the ecotonal boundary of adjoining PCTs in or adjacent to dense grass cover, deep leaf litter and/or abundant logs where Planigales would be expected to be present under the prevailing conditions/upslope of the ecotone in wet conditions and downslope in dry conditions. Traps must remain in place for a minimum of four consecutive nights. Survey effort: a minimum of three pitfall trap arrays must be used for an area of potential habitat up to 1 ha. For potential habitat exceeding 4 ha in area, one additional pitfall trap must be used for every ha thereafter</p>	<p>Area of intact forest sampled 0.4 ha</p> <p>20 Ground-based Elliott traps were deployed for four nights (80 ground trap nights) in December 2020. These were designed to target the Yellow-footed Antechinus which was confirmed at Proposal Site. Trapping was targeted in the intact areas of PCT1633, and not regrowth or groundcover only, as logs and cover were absent in these habitats.</p> <p>Dedicated search under logs, woody debris (2 person hours)</p>

Species name	Common name	EPBC Act	BC Act	Habitat preferences and associated PCTs	Required survey period and survey guidelines	Survey completed – timing, technique, and effort
					<p>up to a maximum 10 pitfall trap arrays for any one patch of potential habitat. Where potential habitat patches are separated by 200 m or greater, the same survey effort must be applied in each patch. Elliott traps set to detect the Yellow-footed Antechinus in potential Common Planigale habitat must comprise two transects of 20 traps placed 10 m apart in the first ha and one additional transect of 10 traps for every ha thereafter up to a maximum of five transects of 10 traps, where potential Common Planigale patches are separated by 200 m or more, the same survey effort must be applied in each patch. Traps must be placed in or adjacent to dense grass cover, deep litter and/or abundant logs. If the combined mapped areas of potential habitat on the Proposal Site is greater than 10 ha, contact DPIE for a modified survey approach. You will need to provide DPIE with your plot field survey sheets and aerial mapping displaying the PCTs. Ecotonal areas and each vegetation zone. Provide information on the conditions of each vegetation zone as well as any other information that will assist DPIE to inform their decision.</p> <p>Pitfall traps need to be checked as soon as possible after first light (to reduce exposure and predation) and ideally, during the night as well, especially in the event of unforeseen rainfall events (to prevent drowning). Elliott traps must be closed during the day and re-opened at dusk.</p> <p>Polygon: the species polygon is drawn to 500 m either side of the PCT ecotonal boundary, or to the other PCT boundary, whichever is smaller.</p> <p>General: The ecotonal zone is the boundary between a 'wet' PCT and a 'dry' PCT. Under drier conditions, the species moves into the lower elevation 'wet' PCT, and under wetter conditions it moves upslope to the higher elevation 'dry' PCT.</p> <p>General: Habitat includes hollow logs, under bark, rocks, cracks in soil, grass tussocks or building debris.</p>	

Species name	Common name	EPBC Act	BC Act	Habitat preferences and associated PCTs	Required survey period and survey guidelines	Survey completed – timing, technique, and effort
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	-	V	Potential habitat is associated with the intact patches of PCT 1633, located to the east and west of the Proposal Site, although the lack of tree hollows suggests the habitat is only marginal.	Nov-March. Survey should be undertaken 1-2 days after rainfall and on humid nights.	Spotlighting over four nights on the 16-17, 22-23 December (16 person hours) during optimum conditions. Rainfall conditions are described in Section 6.3.2.1
<i>Myotis macropus</i>	Southern Myotis	-	V	Potential habitat is associated vegetation within 200 m of the storage ponds and the creek line to the west of the Proposal Site.	Oct-March. All surveys are to be undertaken during spring/summer from October – March. Harp trap or mist net is to be placed in areas of potential habitat. Harp traps are to be set beside or over pools of water along creeks or rivers. The minimum number of survey nights using harp traps is 4 nights per trap. Acoustic detection is to occur between October and March during spring/summer, for a duration of 4 nights.	Two harp traps were set to capture the target species for 4 nights over 14-17 December 2020 (8 trap nights). Traps were located to the west of the Proposal Site adjacent the storage pond, and on the tributary to the northwest of the Proposal Site. Two Anabats were deployed on the edge of the storage dam (west of the Proposal Site) on 4 nights over 14-17 December 2020 (8 bat detector nights).

Species name	Common name	EPBC Act	BC Act	Habitat preferences and associated PCTs	Required survey period and survey guidelines	Survey completed – timing, technique, and effort
<i>Litoria aurea</i>	Green and Golden Bell Frog	V	E	Potential habitat within the Proposal Site is associated with the ephemeral Typha sedgeland (PCT 1737) and low-lying areas of PCT 1633 subject to ponding/inundation of surface water	<p>Nov-March.</p> <p>All surveys should be undertaken within one week of heavy rainfall (&gt;50 mm in seven days) during spring/summer (October – March).</p> <p>Initial habitat assessment - surveys using a combination of call detection, call playback and spotlighting.</p> <p>A minimum of four nights under ideal conditions.</p> <p>Small wetlands (&lt;50 m at greatest length) should be covered in about one hour.</p> <p>Large sites should be sampled systematically.</p>	<p>Spotlighting over four nights on the 16-17 and 22-23 December.</p> <p>Call playback used at 50 m intervals along drainage areas, and flooded depressions.</p> <p>Rainfall over this period totalled 78 mm.</p> <p>The Typha dominated drainage line on the west side of the Proposal Site is around 150 m in length, and all other sedgeland habitats are small. These wetlands habitats were traversed by two ecologists on each of the four nights surveyed</p>
<i>Crinia tinnula</i>	Wallum Froglet	-	V		<p>All year.</p> <p>Aural-visual surveys, total effort for 500 m transect – 480 minutes, number of repeat surveys – 4.</p>	
<i>Uperoleia mahonyi</i>	Mahony's Toadlet	-	V		<p>Oct – March.</p> <p>Aural-visual surveys, total effort for 500 m transect – 480 minutes, number of repeat surveys – 4.</p>	



### Weather conditions

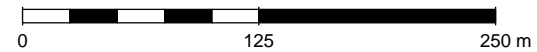
Fauna surveys were conducted between 14-22 December 2020, with the initial trapping program completed by 19 December 2020 and follow-up nocturnal surveys completed on 22 and 23 December 2020. A summary of the daily temperatures and rainfall preceding each day are provided in Table 5.8. A rainfall total of 78 mm occurred over the nine-day period of the survey, and conditions were considered optimum for the targeted frog species, with ephemeral drainage areas filled and water observed accumulating in depressions around the Proposal Site.

Table 5.8: Weather and rainfall conditions during fauna surveys (Maitland Airport AWS 061428)

Date	Min temp (°C)	Max temp (°C)	Wind (3pm)	Rainfall (24 hours)	Cumulative rainfall during survey	Moon phase (visibility)
14/12/20	17.9	24.6	E – 33 km/h	1.2 mm	1.2 mm	Waxing Crescent (0.7%)
15/12/20	18.3	24.5	ESE – 15 km/h	3.4 mm	4.6 mm	New Moon (0.1%)
16/12/20	20.5	32.1	ESE – 19 km/h	23.8 mm	28.4 mm	Waxing Crescent (2.3%)
17/12/20	21.8	32.2	WNW – 15 km/h	0 mm	28.4 mm	Waxing Crescent (7%)
18/12/20	20.9	32.2	NW – 17 km/h	0 mm	28.4 mm	Waxing Crescent (13.6%)
19/12/20	19.4	22.1	SSE – 31 km/h	11.2 mm	39.6 mm	Waxing Crescent (27%)
20/12/20	18.6	22.8	SSW – 19 km/hr	2.6 mm	42.2 mm	First Quarter (36%)
21/12/20	19.0	22.9	E – 22km/hr	1.2 mm	43.4 mm	First Quarter (46%)
22/12/20	18.7	28.5	NW – 31 km/h	34.6 mm	78 mm	First Quarter (55%)
23/12/20	14.4	26.2	SSE – 20 km/h	0 mm	78 mm	First Quarter (65%)

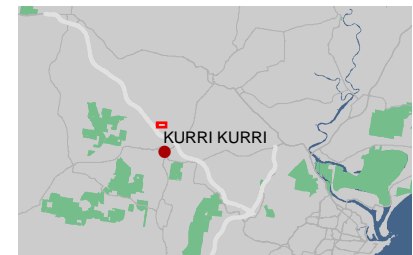


- |                       |                               |                        |
|-----------------------|-------------------------------|------------------------|
| Proposal site         | <b>Fauna survey locations</b> | Frog Call Playback     |
| Asset protection zone | Bat Call Detector             | Harp Trap              |
| Detention basin       | Camera trap                   | Koala scat search plot |
| Waterbodies           | Elliott Trap Lines            |                        |



1:4,000 at A4  
Coordinate System: GDA2020 MGA Zone 56

**Data sources:**  
Jacobs  
Metromap (Aerometrex) 2020  
NSW Spatial Services



**Figure 5-3** Targeted threatened fauna surveys



### 5.2.6 Targeted species survey results

#### Threatened flora

One threatened plant species was identified within the Proposal Site. *Eucalyptus parramattensis* subsp. *decadens* (Earps Gum) was identified within vegetation zone 1, associated with PCT 1633.

#### Threatened fauna

Targeted surveys were undertaken in December 2020 for Green and Golden Bell Frog, Wallum Froglet, Mahony's Toadlet, Southern Myotis, Bush Stone Curlew, Eastern Pygmy-possum, Squirrel Glider, Koala, Common Planigale and Pale headed Snake.

#### Green and Golden Bell Frog (*Litoria aurea*), Wallum Froglet (*Crinia tinnula*) and Mahony's Toadlet (*Uperoleia mahonyi*)

Potential habitat for the Green and Golden Bell Frog, Wallum Froglet and Mahony's Toadlet was identified within the Proposal Site associated with the ephemeral Typha sedgeland (PCT 1737) and low-lying areas of The Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633) subject to ponding/inundation of surface water.

The Green and Golden Bell Frog tends to inhabit marshes, dams, and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes waterbodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available.

Wallum Froglets are found in a wide range of habitats, usually associated with acidic swamps on coastal sand plains. They typically occur in sedgeland and wet heathlands. They can also be found along drainage lines within other vegetation communities and disturbed areas, and occasionally in swamp sclerophyll forests.

Current observations indicate that the Mahony's Toadlet inhabits ephemeral and semi-permanent swamps and swales on the coastal fringe of its range. They are associated with shallow ephemeral/semi-permanent water bodies that have a limited flow of water. Aquatic vegetation at breeding sites includes sedges (*Shoenoplectus* spp., *Baumea* spp. and *Lepironia articulata*) and Broadleaf Cumbungi (*Typha orientalis*).

Nocturnal surveys were conducted throughout the intact vegetation areas of the Proposal Site over four nights, between on 16 - 17 December 2020 and 22-23 December 2020. These surveys followed considerable rainfall over 7-9 days during and prior to the survey of 23 December (totalling 78 mm). Consequently, amphibian activity was very high during the surveys, particularly on 22 December and nine common species were recorded across the Typha wetlands and using flooded depressions on the edge of the PCT 1633.

The species recorded included *Litoria caerulea*, *Litoria dentata*, *Litoria fallax*, *Litoria latopalmata*, *Litoria peroni*, *Crinia signifera*, *Limnodynastes tasmaniensis*, *Limnodynastes peroni*, *Platyplectron ornatum* and *Uperoleia laevigata*.

The threatened Green and Golden Bell Frog, Wallum Froglet and Mahony's Toadlet were not identified during these surveys. Weather conditions during the survey period were ideal for these species and met the required survey periods and guidelines, and each of the species is assessed as absent from the habitat that was surveyed.

The distribution of the Green and Golden Bell Frog exists as a series of isolated populations within its former known range and has become very disjunct in the Hunter region. Since 2000 there have been two records of this species from within the locality (10 km radius database search zone). These were recorded in 2008 along Quarry Road, Farley NSW, which is approximately 5.5 km north-north-east of the Proposal Site. The closest extant key population of the Green and Golden Bell Frog is located at Kooragang Island, located approximately 25 km south east of the Proposal Site.

Based on the results of the targeted surveys, distribution of recent recorded sightings and the distance of the Kooragang Island key population, it is considered that the potential for the Green and Golden Bell Frog to occur within the Proposal Site is low. No species polygons have been developed for the Green and Golden Bell Frog.

The Wallum Froglet and Mahony's Toadlet were also not identified during targeted surveys within the Proposal Site. There have been no records of either species located within the locality (10 km radius database search zone).

With limited data on population size, population dynamics and genetic diversity within species, the relative importance of Wallum Froglet populations is difficult to ascertain. The closest population to the Proposal Site, which may be considered important because of its size, is the Myall Lakes National Park population, located approximately 80 km north east.

Similarly, the Mahony's Toadlet is endemic to the mid-north coast of NSW and is found between Kangy Angy and Seal Rocks. This species has been recorded in eight locations on sand beds in Port Stephens, Myall Lakes, and northern Central Coast areas. Sites include Wyrrabalong National Park, Tomago, Oyster Cove, Nelson Bay, Fingal Bay, Seal Rocks and Kangy Angy. No further populations are known. The Mahony's Toadlet is only predicted to occur within the locality of the Proposal, with no known records.

Based on the results of the targeted surveys, having no records of either the Wallum Froglet or the Mahony's Toadlet within the locality, and having regard for the distance to the nearest important populations, it is considered that the potential for both the Wallum Froglet and Mahony's Toadlet to occur within the Proposal Site is low and a species polygon has not been prepared.

#### **Southern Myotis (*Myotis macropus*)**

Surveys targeting the Southern Myotis were undertaken at the Proposal Site from 14 February to 17 December 2020, involving the use of harp traps (total eight trap nights at two locations) and two Anabat call detectors (total eight trap nights at two locations). Harp traps were placed in potential flyways, one along the westernmost storage pond and the second across the tributary to Black Waterholes Creek to the west of the Proposal Site, to capture foraging bats. Two Anabat Express (Titley Scientific) bat call detectors were also positioned along suitable habitat adjacent to the westernmost storage pond. Both Anabats were deployed for four nights each, from 14 to 17 December 2020. Refer to Figure 5.3 for survey locations. No bats were captured in the harp traps.

The two Anabat Express detectors recorded a total of 1,512 discernible calls over the four nights. Analysis of calls by Greg Ford (Balance Environmental) confidently identified 11 species from 1,371 of the calls (refer Table 5.9). A total of 32 calls of the Southern Myotis were positively identified. Four other BC Act threatened species were also positively identified, Greater Broad-nosed Bat, Little Bent-winged Bat, Large Bent-winged Bat and the Eastern Coastal Free-tailed Bat.

With the exception of the Southern Myotis, the remaining species are ecosystem-credit species (foraging), while both *Miniopterus* spp. are species-credit species where a roost site is present. The Proposal Site and buffer was searched for evidence of a cave roost or structure considered suitable for roosting bats, and this search confirmed that there are no roosting sites, or opportunities for cave-roosting within the Proposal Site and these cave roosting species are unlikely to breed within the study area.



Table 5.9: Results of bat call analysis (number of calls identified per species per detector-night)

Night	BC Act	Anabat 1				Anabat 2			
		14/12	15/12	16/12	17/12	14/12	15/12	16/12	17/12
Positively identified calls (n = 42)									
<i>Chalinolobus gouldii</i>		28	54	55	34	23	9	7	13
<i>Chalinolobus morio</i>		99	78	48	13	2	2	7	13
<i>Myotis macropus</i>	V	1	6	4	2	2	2	8	7
<i>Scotorepens orion</i>		1	0	1	2	0	0	3	3
<i>Scoteanax rueppellii</i>	V	1	0	1	2	0	0	0	1
<i>Miniopterus australis</i>	V	4	9	2	2	0	6	1	1
<i>Miniopterus orianae</i>	V	4	7	3	1	2	2	1	2
<i>Austronomus australis</i>		29	122	1	1	8	95	0	1
<i>Micronomus norfolkensis</i>	V	1	1	0	2	0	2	0	0
<i>Ozimops planiceps</i>		14	6	24	15	6	4	7	13
<i>Ozimops ridei</i>		43	61	110	61	30	31	63	41
Unresolved calls (n = 28)									
<i>Chalinolobus gouldii</i> or <i>Ozimops ridei</i>		6	18	13	12	14	9	4	5
<i>Ozimops ridei</i> or <i>Micronomus norfolkensis</i>		0	1	1	5	0	1	0	2
<i>Ozimops ridei</i> or <i>Ozimops planiceps</i>		4	6	4	10	5	5	3	3
<i>Scotorepens orion</i> or <i>Scoteanax rueppellii</i>		1	0	6	2	0	1	0	0

The Southern Myotis was positively identified foraging over the North Dam (surge pond) which is located to the immediate east of the Proposal Site. This habitat would not be removed or impacted by the Proposal. In developing the species polygon for Southern Myotis, a review of the Threatened Biodiversity Data Collection states:

*All habitat on the subject land where the subject land is within 200 m of a waterbody with pools / stretches 3 m or wider including rivers, creeks, billabongs, lagoons, dams, and other waterbodies on the subject land must be mapped. Use aerial imagery to map waterbodies with pools / stretches 3 m or wider on or within 200 m of the subject land. Species polygon boundaries should align with PCTs on the subject land to which the species is associated that are within 200 m of waterbodies mapped.*

The Threatened Biodiversity Data Collection lists all the PCTs in the Proposal Site as being associated habitat for the Southern Myotis, i.e.:

- Parramatta Red Gum – Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633)
- Typha rushland (PCT 1737)
- Tall Spike Rush freshwater wetland (PCT 1740). This PCT occurs outside the Proposal site.

The storage pond, and a section of the Typha wetland PCT on the western side of the Proposal Site, represent potential foraging habitat (i.e. pools >3 m wide). The Proposal Site contains native vegetation within 200 m of these suitable watercourses (including areas of PCT 1633, and PCT 1737) and are associated with the Southern Myotis. There are tree hollows associated with the intact vegetation zone (Zone 1 PCT 1633) and therefore potential for roosting by this species. The remaining vegetation zones from PCT 1633 (Zone 2 regrowth and Zone 3 groundlayer only), do not contain any mature canopy species, or tree hollows, and are therefore considered not providing and habitat value for Southern Myotis despite being within 200 m of the aquatic foraging habitat. These two vegetation zones were excluded from the BAM-C credit calculation.

The tributary to Black Waterholes Creek is an ephemeral waterway that flows generally south west to north east immediately adjacent to the Proposal Site on the western boundary. It is artificial and designed to drain runoff from areas of the former Kurri Kurri aluminium smelter which then runs into Black Waterholes Creek. The tributary contains few areas of open water or pools that meet the criteria as foraging habitat for this species. The exception is a large pool immediately above the culvert. Placing a 200 m buffer around this pool does not intersect any native vegetation that is within the Proposal Site for this Proposal.

The storage ponds contain deep sections of water, dominated by the Tall Spike Rush freshwater wetland community (PCT 1740). This vegetation covers the surface of the pool and would not be impacted, and therefore is not within the species polygon. Impacts to the habitat for the Southern Myotis are outlined in Section 9.1. The species polygon for the Southern Myotis is estimated at 0.40 ha and is shown in Figure 11.1.

#### **Common Planigale (*Planigale maculata*)**

The Common Planigale was not captured or observed from the targeted small mammal surveys at the Proposal Site, although pitfall trapping was not used, and Elliott trapping is not suitable for this species. The Common Planigale is associated with PCT 1633, and the Elliott trapping survey identified the Yellow-footed Antechinus. According to the TBDC, the presence of the Yellow-footed Antechinus suggests that the Common Planigale is also present. On this basis the Common Planigale is assumed present.

For the Common Planigale the species polygon included the area of intact woodland associated with Vegetation Zone 1 (0.40 ha). This habitat contains microhabitat features considered important for this species, including woody debris, tall groundcover vegetation, and structural complexity including shrubs, and trees. In contrast the regrowth and ground layer vegetation has been previously cleared, there is no remaining woody debris, and very simple structural complexity. This habitat is not expected to be preferred by this small mammal species, due to the lack of shelter and cover.

### **5.3 Serious and irreversible impact entities**

The concept of serious and irreversible impacts (SAIL) is fundamentally about protecting threatened entities that are most at risk of extinction from potential development. The Biodiversity Offsets Scheme recognises that there are some types of serious and irreversible impacts that the community expects would not occur except where the consent authority considers that this type of impact is outweighed by the social and economic benefits that a development will deliver to the State. The principles for determining SAIL are outlined in clause 6.7 of the *Biodiversity Conservation Regulation 2017*.

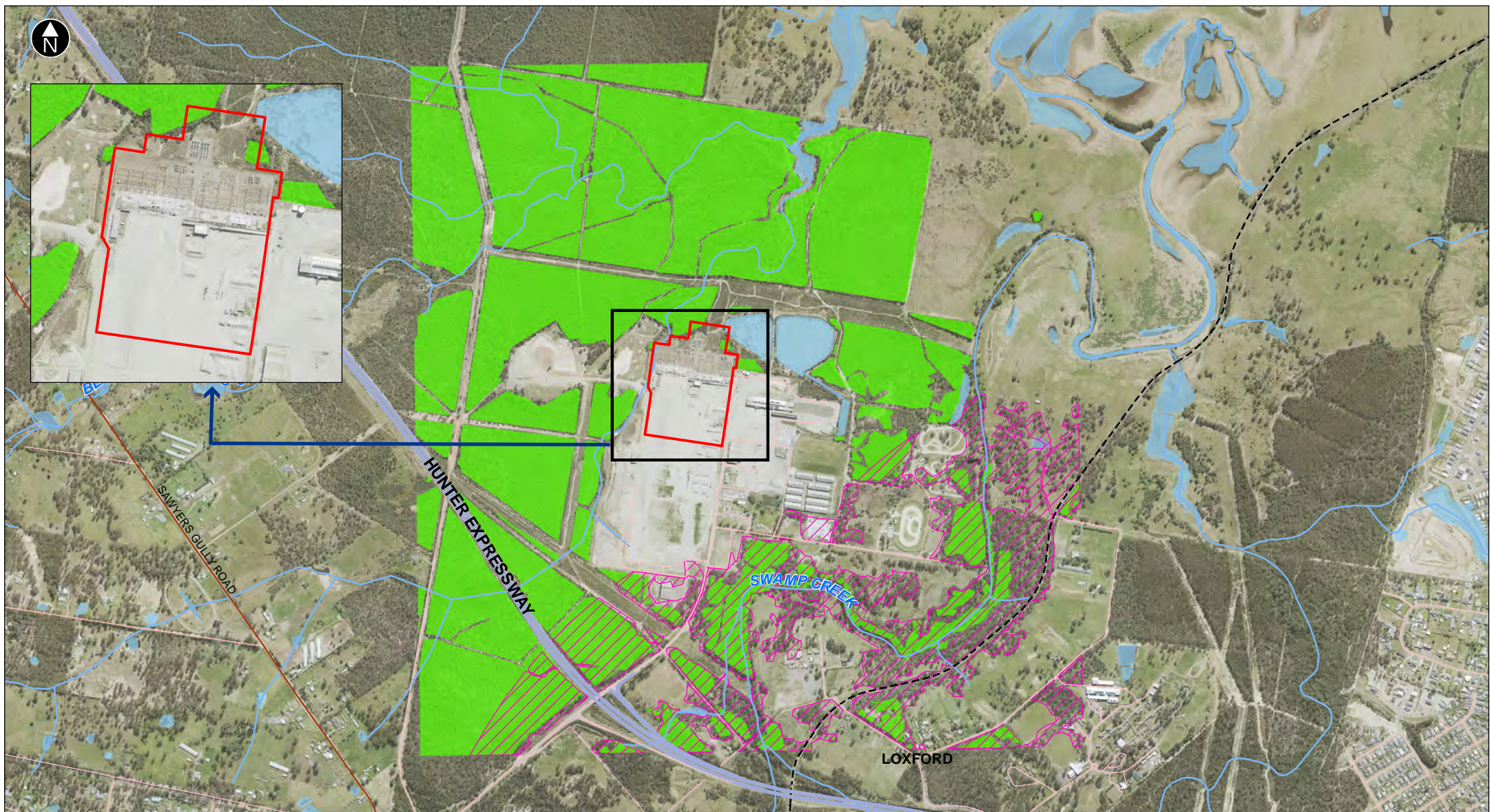
The BC Act permits the Minister for Planning to give consent to or approve State Significant Infrastructure which is likely to have serious or irreversible impacts. The Minister must take those impacts into consideration and determine whether there are any additional and appropriate measures that will minimise those impacts if consent or approval is to be granted.

The Regent Honeyeater and Swift Parrot were not identified from surveys at the Proposal Site, however both species are known to frequent the Kurri and Cessnock area (Birds Australia, 2013), and the important area mapping for these species maps important habitat within the Proposal Site (Regent Honeyeater) and landscape buffer (Regent Honeyeater and Swift Parrot) (see Figure 5.4).

The Regent Honeyeater and Swift Parrot are identified in the Threatened Biodiversity Data Collection as potential SAI, with the threshold being 'mapped important areas. Serious and irreversible impact thresholds provide guidance as to the level of impact that could be sustained by a threatened entity, beyond which a proposed impact is likely to contribute significantly to the risk of extinction. The impact threshold (i.e. one of the factors that the approval authority will consider) is identified as 'mapped important areas' for both species. For species at risk of a SAI, the assessor is required to address the assessment criteria in Subsection 9.1.2 of the BAM.

Although the Proposal would result in a marginal reduction of habitat, the impacts are predicted to be minimal as both the Regent Honeyeater and Swift Parrot are unlikely to use the study area consistently, and the impact is very minor in the context of the extent of habitat available to the species in the locality. The outcome of the assessment for both the Regent Honeyeater and the Swift Parrot concluded that the Proposal is unlikely to result in a significant impact for either species. The Proposal is also unlikely to reduce the population size or decrease the reproductive success of either species. The full assessment is detailed in Appendix G.



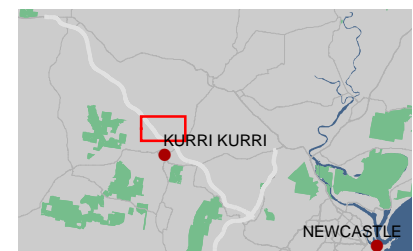


- |  |  |  |
|--|--|--|
| <span style="border: 2px solid red; padding: 2px;"> </span> Proposal site  | <span style="background-color: #00FF00; border: 1px solid black; padding: 2px;"> </span> Regent Honeyeater habitat | <span style="border-bottom: 2px solid blue; width: 20px; display: inline-block;"></span> Motorway    |
| <span style="background: repeating-linear-gradient(45deg, transparent, transparent 2px, pink 2px, pink 4px); border: 1px solid black; padding: 2px;"> </span> Swift Parrot habitat | <span style="border-bottom: 2px solid brown; width: 20px; display: inline-block;"></span> Main roads               | <span style="border-bottom: 2px solid orange; width: 20px; display: inline-block;"></span> Roads     |
|  | <span style="border-bottom: 2px dashed black; width: 20px; display: inline-block;"></span> Railway                 | <span style="background-color: #ADD8E6; border: 1px solid black; padding: 2px;"> </span> Waterbodies |

0 0.5 1 km

1:20,000 at A4  
GDA 1994 MGA Zone 56






**Data sources:**  
Jacobs  
Metromap (Aerometrex) 2020  
NSW Spatial Services



**Figure 5-4** Regent Honeyeater and Swift Parrot important areas map





- |   |  |   |
|---|--|---|
|  Proposal site | <b>Threatened species recorded (BC Act)</b>  |  Asset protection zone |
|  Waterbodies   |  <i>Eucalyptus parramattensis ssp. decadens</i> |  Detention basin       |

0 125 250 m

1:4,000 at A4  
Coordinate System: GDA2020 MGA Zone 56

**Data sources:**  
Jacobs  
Metromap (Aerometrex) 2020  
NSW Spatial Services



**Figure 5-5** Threatened species recorded

## 6. Aquatic assessment

Aquatic habitats within the Proposal Site and broader locality were assessed against the *Policy and guidelines for fish habitat conservation and management – Update 2013* (NSW Department of Primary Industries, 2013) and *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003). The Aquatic Ecology in Environmental Impact Assessment – EIA Guideline (Lincoln Smith, 2003) was used to guide the level of aquatic assessment required. There is enough existing information to describe the existing aquatic environment and to assess the quality and importance of the aquatic environments to be impacted by the development. As such, this assessment was based on a review of existing information and a habitat assessment.

Searches of databases, existing mapping and other literature were used to identify the locations of sensitive receptors. Sources included:

- Fisheries NSW Spatial Data Portal
- Protected Matters Search Tool
- Atlas of GDEs (Bureau of Meteorology, 2017)
- SEED – NSW Wetlands mapping
- SEPP (Coastal Management) 2018 – Interactive map viewer
- Australian Wetlands Database (Department of the Environment and Energy, 2019).

### 6.1 Existing environment

The Proposal Site is on the fringe of the Hunter River floodplain. There are no named or unnamed watercourses that intersect the boundaries of the Proposal Site. Named watercourses in the landscape buffer include:

- Black Waterholes Creek, located immediately to the west of the Proposal Site and which flows from south to north
- Swamp Creek, 900 m to the east of the Proposal Site, which flows in a northward direction
- Both Black Waterholes Creek and Swamp Creek drain to Wentworth Swamp about 1.5 km north of the Proposal Site, which drains to the Hunter River at Maitland.

Surface water from the Proposal Site is directed to constructed drains located to the east, west and south of the former Kurri Kurri aluminium smelter, via open channels and concrete subsurface drainage lines. The east, west and south surface water ponds are pumped to the two north ponds, located directly east of the Proposal Site, where excess surface water is discharged to an irrigation area under license from NSW Office of Environment and Heritage (EPL 1548) into Swamp Creek. The surface water dams were constructed by excavation into the residual underlying weathered bedrock. The two north ponds located directly east of the Proposal Site have previously been monitored, showing an elevated level of fluoride concentrations, likely pertaining to the flow from the former Kurri Kurri aluminium smelter sources such as the anode pile which was uncovered for a period of time.

The western side of the Proposal Site drains via overland runoff and pipes which drain to Black Waterholes Creek to the west. Open channels are located along the northern boundary of the Proposal Site, facilitating drainage to the artificial stormwater ponds and to Black Waterholes Creek.

Groundwater hydrology is likely to vary considerably across the Proposal Site due to the nature of the alluvial aquifer and drains installed across the Proposal Site. A shallow water table has previously been intercepted at between 1 m and 10 m below ground level however there may be up to three distinct aquifers present: shallow and deep alluvium and a bedrock aquifer. There may be areas of sub-artesian pressures caused by semi-confined aquifers. Groundwater mounding has been identified near the Proposal Site associated with the adjacent settling ponds and perhaps also associated with historic irrigation of storm water.



The 1,500 m landscape buffer also includes Swamp Creek, which is a perennial, fourth order stream (Strahler, 1952) and flows in a north easterly direction, approximately 950 m east of the development area, and some unnamed tributaries (see Figure 2.1 and Figure 3.1).

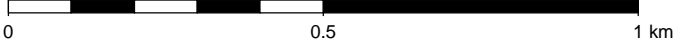
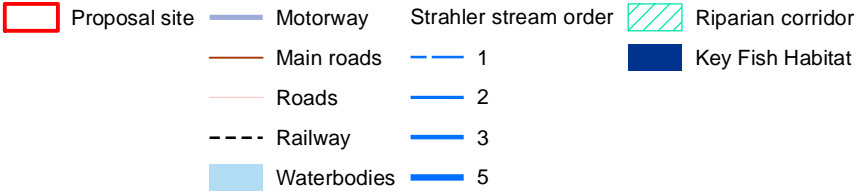
The proposed development would have no direct impacts to any aquatic environments.

## 6.2 Threatened fish

The desktop searches returned one threatened fish, Purple Spotted Gudgeon (*Mogurnda adspersa*) (endangered under the *Fisheries Management Act 1994*), as having the potential to occur within the locality. However, the Purple Spotted Gudgeon was not identified by the Protected Matters Search Tool based on the presence of modelled suitable habitat. An assessment of the likelihood of occurrence of all threatened species and endangered populations was undertaken to determine the potential for this species to occur within the Proposal Site (see Appendix A).

There is no mapped threatened fish habitat within the Proposal Site. However, both Black Waterholes Creek (west) and Swamp Creek (east) are listed as freshwater Key Fish Habitat (DPI, 2007), located within the landscape buffer (refer to Figure 6.1). The Fisheries NSW Spatial Data Portal lists the status of Swamp Creek as fair fish habitat. Threatened fish indicative habitat mapping (DPI, 2020) shows potential habitat for this species occurring within the disturbance area for the Purple Spotted Gudgeon (DPI, 2016). There are no Coastal wetlands as defined by the Coastal Management SEPP close to the Proposal Site, the closest being the Hunter Estuary Wetland, located approximately 45 km downstream. The Proposal would not impact on potential habitat for this species.





1:12,000 at A4  
GDA2020 MGA Zone 56

**Data sources:**  
Jacobs  
Metromap (Aerometrex) 2020  
NSW Spatial Services



**Figure 6-1** Aquatic habitats



## 7. Assessment for Matters of National Environmental Significance

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, and heritage places – defined as matters of national environmental significance. Matters relevant and applicable to this assessment include:

- World heritage properties
- National heritage places
- Wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed)
- Nationally threatened species and ecological communities
- Migratory species.

For threatened biodiversity and migratory species listed under the EPBC Act which were identified in habitats within the study area, or considered at least moderately likely to occur, significance assessments have been completed in accordance with the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of Environment, 2013) (see Appendix D and Figure 7.1). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is affected, and upon the intensity, duration, magnitude and geographic extent of the impacts (Department of Environment, 2013). Importantly, for a 'significant impact' to be 'likely', it is not necessary for a significant impact to have a greater than 50 per cent chance of happening; it is sufficient if a significant impact on the environment is a real or not a remote chance or possibility (Department of Environment, 2013). This advice has been considered while undertaking the assessments.

### 7.1 Wetlands of international and national importance

The Proposal Site and 1,500 m landscape buffer does not contain any wetlands of international or national importance. The nearest wetland of international importance is the SEPP14 listed wetland and Ramsar Hunter Estuary Wetland, identified by the PMST, located approximately 45 km downstream of the Proposal Site, via Swamp Creek, Wallis Creek, and the Hunter River. This is considered too great a distance to be affected directly or indirectly by the development.

### 7.2 Threatened ecological communities

According to the PMST the following EPBC Act listed TECs have been identified as may occur or likely to occur within the broader study area:

- Central Hunter Valley eucalypt forest and woodland (Critically Endangered) – may occur within area
- Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community (Endangered) – likely to occur within area
- Hunter Valley Weeping Myall (*Acacia pendula*) Woodland (Critically Endangered) – may occur within area
- Lowland Rainforest of Subtropical Australia (Critically Endangered) – may occur within area
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Critically Endangered) – may occur within area.

The vegetation survey completed for this Proposal has confirmed that none of these nationally threatened ecological communities occur within the Proposal site.

### 7.3 Threatened species

Twenty-one EPBC Act listed threatened plant species and twenty-three listed fauna species were identified in the PMST as having potential to occur in the locality or have associated habitats. Refer to Table 5.5 for a list of all EPBC Act listed species assessed and Appendix A for a list of species identified in the PMST. Seventeen of these EPBC listed plant species identified in the PMST were not found within or adjacent to the Proposal Site during the surveys undertaken for this BDAR. As such, these species are considered unlikely to be impacted.

Twenty EPBC listed fauna species were assessed as low or unlikely to occur, on basis of unsuitable habitat and lack of records in the locality. Targeted surveys for the remaining three EPBC Act listed threatened fauna were conducted for this BDAR and included targeted surveys for the Green and Golden Bell Frog, Koala, and the Grey-headed Flying-fox. Refer to Section 5.2.5 for details of survey effort undertaken and to Section 5.2.6 for the results of the surveys. The Green and Golden Bell Frog was not identified from the targeted surveys. Areas of habitat that match the description for preferred habitat are present within the shallow fringes of the artificial storage ponds to the east of the Proposal, as well as two constructed drains with contain tall sedges (*Typha spp*). A targeted survey was conducted for this species under optimum condition and seasonal period. No individuals were identified and the potential for the Green and Golden Bell Frog to occur within the Proposal Site is assessed as low.

Assessment of significance have been conducted for threatened species, populations and communities that were recorded in the Proposal Site during field surveys or were identified as having a moderate or higher potential to occur in the Proposal Site based on the presence of habitat. For threatened biodiversity listed under the EPBC Act, significance assessments have been completed in accordance with the EPBC Act Policy Statement 1.1 Significant Impact Guidelines (Department of Environment, 2013). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is affected, and upon the intensity, duration, magnitude and geographic extent of the impacts (Department of Environment, 2013). Importantly, for a 'significant impact' to be 'likely', it is not necessary for a significant impact to have a greater than 50 per cent chance of happening; it is sufficient if a significant impact on the environment is a real or not a remote chance or possibility (Department of Environment, 2013). This advice has been considered while undertaking the assessments.

The EPBC Act listed species subject to this assessment include:

- *Eucalyptus parramattensis subsp. decadens*
- Regent Honeyeater
- Swift Parrot
- Australasian Bittern
- Koala
- Grey-headed Flying-fox.

The conclusions of these assessments were that the proposed activity is not expected to have a significant impact on these threatened species.

#### 7.3.1 *Eucalyptus parramattensis subsp. decadens*

The vulnerable species *Eucalyptus parramattensis subsp. decadens* (Earp's Gum) was identified and mapped within the Proposal Site. The Proposal would directly impact 23 trees identified within the Proposal Site. Around 90 per cent of the Proposal would occur on an existing cleared, former industrial site. Within the remaining 10 per cent of the Proposal Site, small areas of intact and regrowth vegetation were identified to contain Earp's Gum. Trees were identified from a range of age classes, from small juvenile trees in regrowth areas within existing power easement (c.1-2 m tall) to mature trees 8-10 m tall in intact forest areas. The presence of regrowth trees demonstrates the resilience of this species to impacts and a self-sustaining population. A further 14 trees were identified from a 10 m buffer surrounding the Proposal Site that has been allocated for asset

protection zone (APZ), and these trees would also be impacted. Therefore, the total impact would be 37 trees. Of these, there are 9 immature trees that occur inside the maintained Ausgrid power transmission easement and which are already subject to approved regular slashing and trimming as required (5 within the construction footprint and 4 within the 10 m APZ buffer).

### 7.3.2 Regent Honeyeater

The Proposal would involve the direct impact of around 0.40 ha of intact PCT1633 – Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area, this vegetation is within the large area of mapped important habitat for this species in the Cessnock-Kurri Kurri area.

In considering the impact on Regent Honeyeater from the Proposal, two factors are relevant:

- 1) The total area of mapped important habitat in the Cessnock-Kurri area is around 415 ha, and the Proposal would directly impact around 0.40 ha of intact woodland, equating to approximately 0.18 per cent of the intact woodland.
- 2) The dominating canopy species at the Proposal Site include *Angophora bakeri* (Narrow-leaved Apple) and *Eucalyptus parramattensis* subsp. *decadens* (Earp's Gum), with a low density of *Eucalyptus agglomerata* (Stringybark). The Recovery Plan for the Regent Honeyeater identifies 9 key foraging species, none of which are found in PCT 1633 or confirmed in the Proposal Site. In addition to this, the plan also describes other tree species which may be regionally important, for example the Lower Hunter Spotted Gum Ironbark forest (not present on the Proposal Site), as well as flowering of species such as *Eucalyptus eugenoides* (thin-leaved stringybark) and other stringybark species and *Eucalyptus fibrosa* (Broad-leaved Ironbark). One juvenile *Eucalyptus fibrosa* (Red Ironbark) was found in land surrounding the Proposal Site (within 30 m) in addition to several *Eucalyptus agglomerata* (Stringybark) also found in the buffer area.

Based on available literature and current knowledge of habitat preferences for this species in the Hunter Valley, the habitat on the Proposal Site would not be considered important, despite overlaying a portion of the important habitat mapping, as it contains no key foraging species, with the exception of low numbers of stringybark. Therefore, there are no significant impacts predicted to foraging habitat for the Regent Honeyeater as a result of the minor clearing required for this Proposal.

### 7.3.3 Swift Parrot

Comparable with impacts described above, the Proposal would involve direct removal of around 0.40 ha of intact woodland. The Swift Parrot important areas map does not cover any vegetation within the Proposal Site. The species breeds in Tasmania during summer and migrates to south-eastern mainland Australia during the winter to forage, so there is not breeding habitat in the study area.

As a winter visitor to the Hunter Valley, important habitat for the Swift Parrot are woodland and forest containing winter flowering eucalypt species such as *Corymbia maculata* (Spotted Gum), *Eucalyptus robusta* (Swamp Mahogany) and *Eucalyptus tereticornis* (Forest Red Gum). None of these tree species are associated with the vegetation community (PCT1633) nor were confirmed in the Proposal site.

Vegetation communities and key tree species that provide important foraging habitat for Swift Parrot in NSW include *Eucalyptus sideroxylon* (Mugga Ironbark), *Eucalyptus microcarpa* (Grey Box), *Eucalyptus melliodora* (Yellow Box), *Eucalyptus albens* (White Box), *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus pilularis* (Blackbutt) and *Corymbia maculata* (Spotted Gum). None of these species are present in the Proposal site. Much of the mapped important areas in the locality for this species correspond with the Lower Hunter Spotted Gum Ironbark Forest which does not occur in the Proposal site. Based on available literature and current knowledge of habitat preferences for this species in the Hunter Valley, the habitat on the Proposal Site would not be considered important, as it contains no foraging species or important winter flowering tree species. Therefore, there are no significant impacts predicted for the Swift Parrot as a result of the minor clearing for this Proposal.

#### 7.3.4 Australasian Bittern

The Australasian Bittern is widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. The Australasian Bittern favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spike rushes (*Eleocharis* spp.). This species hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects, and snails.

The Australasian Bittern is considered likely to forage within the Proposal Site, namely within the *Typha* rushland community (PCT 1737). The impacts to the *Typha* rushland community, as a result of the Proposal, is estimated at 0.12 ha. Furthermore, there is also habitat within the study area consisting of the Tall Spike Rush freshwater wetland community (PCT 1740). This community exists within the deep sections of the north dam, providing potential foraging and breeding habitat for the Australasian Bittern, however this community would not be impacted by the Proposal and is located within the 10 m APZ boundary. Vegetation clearing, as a result of bushfire protection, would not occur within the Tall Spike Rush freshwater wetland community. However, there is the potential for indirect impacts to occur, such as runoff from the Proposal Site.

Local indirect effects of removal of riparian vegetation potentially include degraded water quality due to increased sediment-laden runoff, long term bank erosion, mobilisation of potential acid sulphate soils, decrease in food availability for aquatic biota and water birds and loss of bank-associated aquatic habitat such as overhangs and shade. The potential for impact to surrounding aquatic habitats can be reduced by implementing standard mitigation measures (see Section 10).

This species may occur within the Proposal Site on occasion; however, the likelihood is considered low, and furthermore, there have been no records of this species within the locality of the Proposal.

#### 7.3.5 Koala

Vegetation in the study area contains the primary Koala feed tree species *Eucalyptus parramattensis* subsp. *decadens* and occasional supplementary feed tree *Eucalyptus agglomerata* suggesting the potential for low density or transient Koala use. However, no evidence of frequent or recent use of the area to be impacted was noted from a comprehensive search for faecal pellets. The Proposal would impact 37 trees that are documented primary food tree species; however, this is a very minor impact in the context of the availability of habitat for this species. Nine of these trees are low regrowth that occur in the existing maintained power easement and are unlikely to be frequented or considered important for Koalas.

#### 7.3.6 Grey-headed Flying-fox

The Proposal would involve the direct impact of around 0.40 ha of intact PCT1633 – Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area, which provides potential foraging habitat for the Grey-headed Flying-fox.

There are no breeding / roost camps within the Proposal Site, the nearest being located in East Cessnock, where impacts would not occur as a result of the Proposal. However, the species has potential to use the intact forest habitat in the Proposal Site for foraging life-cycle activities.

The life cycle of the Grey-headed Flying-fox is unlikely to be dependent on the small area of intact habitat to be affected by the Proposal. This is because the habitat to be affected is very small in the scale of habitat available at this location and the Proposal would not impact on a known roost site. The Proposal Site is not part of a recognised movement corridor for this species, or other habitats important for the lifecycle of the Grey-headed Flying-fox such as staging points for migration. The movement of this species would not be affected, and the bioregional persistence of these species would not be detrimentally affected by the Proposal.



## 7.4 Migratory species

Based on the results of the PMST, 16 listed migratory species may occur in the broader locality (see Appendix A). One additional species was recorded from the BioNet search, Wedge-tailed Shearwater. Suitable habitat does not exist within the Proposal Site for most migratory species identified by the database searches. The following species are considered moderately likely to occur in, or adjacent to, the Proposal Site based on the presence of suitable habitats:

- Migratory marine birds – Fork-tailed Swift
- Migratory marine birds – Wedge-tailed Shearwater
- Migratory terrestrial species – White-throated Needletail
- Migratory terrestrial species – Black-faced Monarch
- Migratory terrestrial species – Yellow Wagtail
- Migratory terrestrial species – Satin Flycatcher
- Migratory terrestrial species – Rufous Fantail.

'Important habitat' for a migratory species is defined as (DoE, 2013):

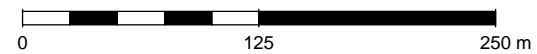
- Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species
- Habitat that is of critical importance to the species at particular life-cycle stages
- Habitat utilised by a migratory species which is at the limit of the species range
- Habitat within an area where the species is declining.

According to the guidance provided in the EPBC Act Policy Statement 3.21-Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (Department of the Environment, 2015), important habitats in Australia for migratory shorebirds under the EPBC Act include those recognised as nationally or internationally important. A wetland habitat should be considered internationally important if it regularly supports one per cent of the individuals in a population of one species or subspecies of waterbird, or a total abundance of at least 20,000 waterbirds. Nationally important wetland habitat includes wetlands that regularly support 0.1 per cent of the flyway population of a single species of migratory shorebird, or 2,000 migratory shorebirds, or 15 migratory shorebird species. The habitats in the Proposal Site are not important habitats for migratory birds.

An assessment of the likely occurrence of these species and the presence of important habitat is included in Appendix A. While some migratory species of bird are likely to use the Proposal Site and locality, the Proposal Site would not be classed as an 'important habitat'. A nationally significant proportion of a population would not be supported by the habitats in the Proposal Site. The development would not substantially modify, destroy, or isolate an area of important habitat for the migratory species and it would not seriously disrupt the lifecycle of an ecologically significant proportion of a population of migratory birds. The amount of vegetation clearance is likely to be negligible for these species and the Proposal Site does not offer particularly high-quality habitat.

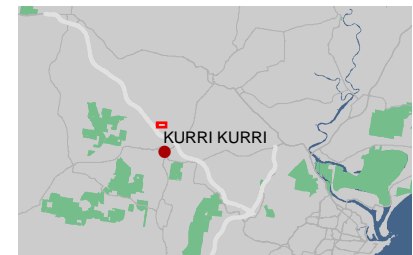


- Proposal site
- Asset protection zone
- Detention basin
- Waterbodies
- Threatened species recorded (EPBC Act)
- Eucalyptus parramattensis ssp. decandens



1:4,000 at A4  
Coordinate System: GDA2020 MGA Zone 56

**Data sources:**  
Jacobs  
Metromap (Aerometrex) 2020  
NSW Spatial Services



**Figure 7-1** Matters of National Environmental Significance



## 8. Impact avoidance and minimisation

This section of the BDAR demonstrates the efforts taken to avoid and minimise impacts on biodiversity values in accordance with Section 7 of the BAM.

Combined with appropriate mitigation measures and safeguards during construction and operation of the Proposal (which would be outlined in the Proposal's Construction Environmental Management Plan (CEMP)), the siting and planning of the Proposal is expected to be sufficient to ensure that the requirements to avoid and minimise impacts on biodiversity values as set out in Section 7 of the BAM are met.

A key part of management of biodiversity for this Proposal is the application of the 'avoid, minimise, mitigate and offset' hierarchy as follows:

- Avoid and minimise impacts as the highest priority
- Mitigate impacts where avoidance is not feasible or practicable in the circumstance
- Offset where residual, significant unavoidable impacts would occur (if required).

### 8.1 Avoiding and minimising impacts on native vegetation and habitat

The Proposal is deliberately planned to be constructed on the former Kurri Kurri aluminium smelter site to minimise impacts on the natural environment, including biodiversity values. The majority of the Proposal footprint (90 per cent) is located on cleared land. Of the remaining 10 per cent (1.54 ha), 64 per cent of this land (1.09 ha) comprises regrowth and ground layer vegetation with maintained power easement or fire protection zones. The impact to the intact vegetation (0.40 ha) is therefore a minor component of the development and it is evident that the Proposal has sought to avoid and minimise impacts to native vegetation.

The Proposal would not break apart continuous areas of the PCT 1633 (including *Eucalyptus parramattensis* subsp. *decadens*) into separate smaller fragments. Impacts would be limited to the edge of a large contiguous patch. Habitat connectivity is expected to remain in a similar state after completion of the Proposal and there is unlikely to be an alteration to community composition, altered species interactions, or altered ecosystem functioning in the locality due to the Proposal. Habitat fragmentation is not considered an important impact of the Proposal with regard to its context and intensity. The Proposal would result in minimal disturbance of native vegetation. Where this disturbance cannot be avoided, the intact vegetation proposed to be impacted would be of a small amount and would not contribute to further fragmentation.

There are no areas of land declared as an area of outstanding biodiversity value in accordance with section 3.1 of the BC Act that would be affected. Importantly, opportunities to further minimise native vegetation clearance would be refined during detailed design and reviewed as part of the pre-clearing process.

### 8.2 Avoiding and minimising prescribed biodiversity impacts

Some types of projects may have impacts on biodiversity values (as defined in the BC Act and *Biodiversity Conservation Regulation 2017*) in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat. For many of these impacts, the biodiversity values may be difficult to quantify, replace or offset, making avoiding and minimising impacts critical. Clause 6.1 of the *Biodiversity Conservation Regulation 2017* identifies actions that are prescribed as impacts to be assessed under the biodiversity offsets scheme as follows:

- a) impacts of development on the habitat of threatened species or ecological communities associated with:
  - i. karst, caves, crevices, cliffs, and other geological features of significance, or
  - ii. rocks, or
  - iii. human made structures, or
  - iv. non-native vegetation

- b) impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range
- c) impacts of development on movement of threatened species that maintains their life cycle
- d) impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining)
- e) impacts of wind turbine strikes on protected animals
- f) impacts of vehicle strikes on threatened species or on animals that are part of a TEC.

Importantly, the Proposal would have negligible impact on prescribed biodiversity values as:

- There would be no impacts to karst, caves, crevices, cliffs, and other geological features of significance
- There would be no impacts to rocks that provide habitat for threatened species
- The development is not a wind farm development so turbine strike is not an issue
- There would be some additional construction vehicle movements on existing roads and likely increased vehicle movements when the gas fired power station is operational due to the increase of employees. Additionally, the Proposal Site has a perimeter fence. Therefore, the incidence of vehicle strike due to the development is unlikely to be substantially increased from current levels.



## 9. Assessment of impacts

Direct impacts to biodiversity are limited to clearing of native vegetation and habitat. Indirect and other biodiversity-related potential impacts of the Proposal are identified below in Section 9.1, Section 9.2 and Section 9.3.

### 9.1 Direct impacts

#### 9.1.1 Native vegetation

Despite avoidance and minimisation measures (see Section 8.1), the Proposal Site would result in the direct removal of some native vegetation. This includes the development footprint, and adjacent land required for a 10 m wide Asset Protection Zone (APZ). The estimated clearing is approximately 1.54 ha consisting of the following PCTs:

- Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633) – 1.49 ha
- Typha rushland (PCT 1737) – 0.05 ha.

Around 1.09 ha of PCT 1633 that is within the development footprint occurs within an existing power easement and APZ where vegetation is regularly maintained (zones 2 and 3). The intact vegetation (zone 1) comprises the remaining 0.40 ha.

Table 9.1 provides a summary of the native vegetation clearing that would occur within the Proposal Site including the corresponding BC Act TEC (where applicable), and the vegetation integrity loss. The biodiversity credit requirements for these impacts are outlined in Section 12. Vegetation clearing as part of this Proposal would directly impact a Threatened Ecological Community (TEC) listed under the BC Act. No direct impacts would occur to TECs listed under the EPBC Act.

Table 9.1: Summary of native vegetation clearing within the Proposal Site

Zone	Plant community type / Zone	Plant community type name	Vegetation formation	PCT per cent (%) cleared (historically across range)	Corresponding Threatened Ecological Community (TEC) BC Act	Area (ha) in Proposal Site	Vegetation integrity loss
1	1633 Intact	Parramatta Red Gum - Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area – Intact	Dry Sclerophyll Forests (Shrubby sub-formation)	75%	Kurri Sand Swamp Woodland in the Sydney Basin Bioregion	0.40 ha	46.5

Zone	Plant community type / Zone	Plant community type name	Vegetation formation	PCT per cent (%) cleared (historically across range)	Corresponding Threatened Ecological Community (TEC) BC Act	Area (ha) in Proposal Site	Vegetation integrity loss
2	1633 Regrowth	Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area – Regrowth	Dry Sclerophyll Forests (Shrubby sub-formation)	75%	Kurri Sand Swamp Woodland in the Sydney Basin Bioregion	0.21 ha	35.5
3	1633 Groundlayer only	Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area – Ground layer only	Dry Sclerophyll Forests (Shrubby sub-formation)	75%	Kurri Sand Swamp Woodland in the Sydney Basin Bioregion	0.88 ha	1.5
4	1737 Moderate	Typha rushland - Moderate	Freshwater Wetlands	70%	Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	0.13 ha	4.9
<b>Total</b>						<b>1.54 ha</b>	<b>-</b>

Vegetation integrity is a relative score comparing the vegetation at a site with the 'best-on-offer' condition for that PCT in NSW. It represents the degree to which the composition, structure and function of the vegetation type at a site differs from a benchmark representing the mean of the best-on-offer condition plots for that PCT in NSW. Best-on-offer sites are those sites within the contemporary landscape with higher numbers of native plant species, greater structural complexity and replete with functional components, relative to other sites within the same vegetation type and bioregion. Hence, from Table 9.1 it can be seen that the clearing of 'intact' vegetation in PCT 1633 results in a greater vegetation integrity loss (46.5) than for the clearing of a larger area of 'ground layer' vegetation in the same PCT (1.5).

### 9.1.2 Threatened species and habitat

The direct impacts on threatened species habitat associated with the clearing of native vegetation are outlined in Table 9.2. Other impacts to threatened species habitat, including impacts to connectivity and species movement, impacts to non-native vegetation and disturbed areas, and impacts to water quality and hydrology are discussed in Section 9.2.

For the threatened plant species, *Eucalyptus parramattensis* subsp. *decadens*, a direct count of individuals located within the Proposal Site was made to quantify the impact of the Proposal for the species. This search and count focused on the area of the Proposal Site and the 10 m wide buffer (APZ) where this intersected with native vegetation and habitat for the species. The direct counts for this species are shown in Table 9.2. A species polygon was developed for this species in accordance with paragraph 5.2.5.3 of the BAM, by adding a 30 m buffer around the individual plants (see Figure 11.3).

For threatened fauna, the area of habitat (species polygon) associated with the species was calculated. For Southern Myotis, this included the area of intact native vegetation (zone 1) within a 200 m buffer around the North Dam that also intersected with the Proposal Site and APZ. The intact vegetation zone surrounding the dam may be used for breeding and roosting, on the basis that tree hollows are present. In contrast the regrowth vegetation (zone 2) and areas of maintained vegetation within the power easement (zone 3) were not included in the species polygon for Southern Myotis, for two reasons, firstly these immature habitats do not contain tree hollows, and therefore have limited habitat value for roosting and breeding by Southern Myotis, and secondly offsets are not required for zone 3 due to low VI score (<17). The species polygon does not include PCT1737 on basis that the small area of this PCT that intersects the Proposal Site, does not comprise open water, or pools >3 m wide and is therefore unlikely to be used for hunting.

For the Common Planigale the species polygon also included the area of intact woodland associated with Vegetation Zone 1. This habitat contains microhabitat features considered important for this species, including woody debris, tall groundcover vegetation, and structural complexity including shrubs, trees, and groundcovers. In contrast the regrowth and ground layer vegetation has been previously cleared, and there is no remaining woody debris, and very simple structural complexity. This habitat is not expected to be preferred by this small mammal species due to the lack of shelter and cover.

For the Regent Honeyeater, as the 'important habitat mapping' covers a portion of the Proposal Site, the species is assumed present. The species polygon therefore includes the area of habitat on the Proposal Site that intersects the important habitat map. This corresponds with the intact areas of vegetation mapped as Zone 1 of PCT 1633. The remaining part of the Proposal Site that is not within the important area mapping can be offset by ecosystem credits (e.g. foraging habitat, unmapped locations used by a species).

The Swift Parrot is not assumed present, on the basis that the important habitat mapping does not intersect vegetation within the Proposal Site and that the habitat present is not preferred or important foraging habitat for this species. As the Swift Parrot breeds in Tasmania, there is no breeding habitat present.

Table 9.2: Summary of direct impacts on threatened species-credit species habitat associated with the loss of native vegetation

Species name	Common name	EPBC Act	BC Act	Sensitivity to gain class	SAIL candidate	Area (ha) in Proposal Site or direct count
<i>Eucalyptus parramattensis subsp. decadens</i>	Earp's Gum	V	V	High	No	37 plants
<i>Myotis macropus</i>	Southern Myotis		V	High	No	0.40 ha
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	CE	High	Yes	0.40 ha
<i>Planigale maculata</i>	Common Planigale		V	High	No	0.40 ha

### 9.1.3 Serious and irreversible impacts (SAIL)

The Swift Parrot and Regent Honeyeater are identified as candidate species for serious and irreversible impacts (SAIL) as per Section 9.1 of the BAM. A detailed assessment was conducted for both species that addressed the criteria in Section 9.1.2 of the BAM. The outcome of the assessment for both the Regent Honeyeater and the Swift Parrot concluded that the Proposal is unlikely to result in a significant impact for either species. The Proposal is also unlikely to reduce the population size or decrease the reproductive success of either species. The full assessment is provided in Appendix G.

## 9.2 Indirect impacts

Section 2.4.1 of the BAM Stage 2 Manual defines indirect impacts as development related activities not associated with clearing for the Proposal Site. Section 8.2 of the BAM lists 16 potential indirect impacts that may result from construction and/or operation of a new development. The majority of these impacts that are applicable to this Proposal are discussed below. Though they cannot be quantified, the potential for those indirect impacts can be confidently minimised through the application of mitigation measures. The purpose of this section is to quantify the unavoidable indirect impacts that are associated with the changed abiotic conditions when new edges are created through previously intact vegetation.

The Proposal Site does not contain any large areas of native vegetation that would be broken up by the development and the Proposal Site has been placed predominantly on cleared land. The vegetation that would remain is already adjacent to existing cleared power easements and the existing cleared land used by the former Kurri Kurri aluminium smelter site. No further loss of vegetation integrity in adjoining retained areas of habitat is expected as a result of the Proposal, therefore no indirect impacts have been calculated.

Indirect impacts specifically refer to negative changes to the structure and function of retained vegetation adjacent to the Proposal as a result of changed abiotic factors such as increased light intensity and duration, increased exposure to wind, and weed invasion in edge habitats. These changes can have a negative impact on plant and animal species by changing habitat quality. The assessment of indirect impacts has been guided by Section 2.4.1 of the BAM Stage 2 manual.

### 9.2.1 Edge effects

The term edge effect refers to the boundary where two distinct habitats or ecosystems meet and where there is typically some overlap of environmental features from each habitat. Edge effects can impact microclimate, vegetation composition, weed spread and distribution, hydrology, dieback, soils, and fauna. The majority of the Proposal has been designed on the former Kurri Kurri aluminium smelter site, which has previously been disturbed and is no cleared of vegetation. The area of impact on native vegetation will be confined to the proposed switchyard area, where vegetation clearance would be minimal particularly as much of the footprint will sit on an existing power easement. Increased prevalence of weeds is predicted to have the greatest impact as



a result of the Proposal as the disturbance area would be marginally greater than what currently exists and there would be an increase in bare soil. The area of intact remnant vegetation predicted to be impacted by the Proposal would be marginal and is part of a larger patch, and therefore, would not contribute further to fragmentation.

### **9.2.2 Noise and vibration impacts**

Anthropogenic noise can alter the behaviour of animals or interfere with their normal functioning (Bowles, 1997). During construction of the Proposal there would likely be increased noise and vibration levels in the study area and immediate surrounds due to vegetation clearing, ground disturbance, machinery and vehicle movements, and general human presence. This impact would be temporary and long-term change in the distribution and abundance of fauna is not expected. Noise impacts during operation are expected to be minimal and associated within increased human presence at the Proposal Site, which may include day and night-time activity.

Construction activities would likely result in a small increase in ambient noise levels as well as potentially loud noises and vibration for short periods associated with earthworks. The noise and vibration from activities associated with the Proposal would potentially disturb resident fauna and may disrupt foraging, reproductive, or movement behaviours over the short term. The impacts from noise emissions are likely to be temporarily localised to the construction areas and not spread far. These emissions are not considered likely to have a significant, long-term, impact on wildlife populations outside the area of direct impact. Within the area of impact (including habitats immediately adjacent to the Proposal Site), some sensitive species (e.g. woodland birds) may avoid the noise and some more tolerant species, including small mammals, would habituate over the longer-term.

### **9.2.3 Dust pollution**

Elevated levels of dust may be deposited onto the foliage of vegetation adjacent to the Proposal activities. This has the potential to reduce photosynthesis and transpiration and cause abrasion and radioactive heating resulting in reduced growth rates and decreases in overall health of the vegetation. Consequently, changes in the structure and composition of plant communities and consequently the grazing patterns of fauna may occur.

Some level of dust is likely to be generated throughout the lifecycle of the Proposal due to the clearing of vegetation. Dust pollution is likely to be greatest during construction, during periods of earthworks, vegetation clearing, vehicle movements for construction activities and during adverse weather conditions (i.e. high wind) and would therefore be short-term. However, deposition of dust on foliage is likely to be highly localised, intermittent, and temporary (particularly during the wetter seasons) and is therefore not considered likely to result in a significant impact on vegetation species or communities.

### **9.2.4 Light pollution**

Ecological light pollution is the descriptive term for light pollution that includes direct glare, chronic or periodic increased illumination, and temporary unexpected fluctuations in lighting (including lights from passing vehicles), that can have potentially adverse effects on wildlife (Longcore and Rich, 2004). There would be lighting associated with the completed Proposal. However, lighting has already been associated at this specific location with the former Kurri Kurri aluminium smelter site for over 45 years, suggesting that any fauna in this location have become habituated to the light and the Proposal would not create a new source of impact. Therefore, the Proposal is unlikely to result in impacts on fauna as a result of light pollution.

### 9.2.5 Contaminant pollution

During the construction phase localised release of contaminants (i.e. hydraulic fluids, oils, drilling fluids, etc.) into the surrounding environment (including drainage lines) may accidentally occur. The most likely result of contaminant discharge would be the localised contamination of soil, waterways, and potential direct physical trauma to flora and fauna that come into contact with contaminants. Accidental release of contaminants is a low likelihood and if occurs would be localised and able to be managed.

### 9.2.6 Exhaust plumes

When operating, the Proposal will emit hot exhaust plume/s that may create a potential local hazard for birds and bats (including microbats and Grey-headed Flying-fox) flying in the air space immediately above the facility. There is very little data available from past studies in Australia or internationally to identify power station plume risk and predict the impact this may have on resident or migratory bird and bat species. The impact would depend primarily on the temperature of the plume as well as timing, extent, and duration. The fact that the majority of bird species are diurnal while bats are nocturnal suggest that the impact of the exhaust plume on these different fauna groups would depend on the time of day.

The stacks have a height of about 36 m and the gas has an exit velocity of approximately 25 m/s and temperature of around 600 degrees Celsius when operating on gas and less when operating on diesel. While the vertical velocity and temperatures decrease very rapidly with height, it is evident that the plume temperature would cause mortality for any birds and bats flying directly into the lowest area of the plume just above the stack.

A number of threatened bird and bat species have been identified in this assessment as known to occur or predicted to occur with the habitats surrounding the site, at least on occasion. There is no available research and monitoring data for bird and bat deaths associated with stack heat exhaust from gas-fired power stations, suggesting this impact is relatively infrequent and has had little research effort. The vertical flying patterns above ground for resident birds and bats would vary considerably for different species and this is likely influenced by the height of the canopy and height of prey species for insectivorous predators. The average height of the mature canopy surrounding the site is 6-10 metres and thus the majority of the forest dwelling bird and bat species present would be flying well below the stack height. This would encompass the majority of microbat species identified from the site surveys. However, at least some larger bird species capable of moving long distances may intersect the plume area.

Predicted impacts for these flying individuals would be highly localised immediately above the stacks while the plant is operating, which is expected to be about 2% of the time each year, up to a maximum of 12% of the time each year. The predicted mortality event would be very low, and it is reasonable to expect behavioural responses from both resident and birds and bats learning to avoid the exhaust plume over the medium to long term, such that long-term impacts would be negligible. Importantly, the site has not been identified to be situated in an important flight pathway for migratory birds.

The power station buildings, tanks, pipes, stacks and other structures may provide roosting or breeding habitat for various bird and bat species. Measures to limit this risk would be considered during the design and if required measures to discourage nest building would be included in the operational management plan for the facility.

## 9.3 Prescribed biodiversity impacts

This section identifies the potential prescribed biodiversity impacts on threatened species associated with the Proposal in accordance with Section 8.3 of the BAM. These are impacts that are in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat.

Table 9.3: Assessment of prescribed biodiversity impacts

Criteria	Assessment
Karst, caves, crevices, cliffs, and other features of geological significance	There are no occurrences of karst, caves, crevices and cliffs or other geological features of significance within the Proposal Site or threatened species or ecological communities associated with these features.
Human made structures or non-native vegetation	<p>There are three threatened fauna species identified at the Proposal Site that are known to use human made structures as habitat for roosting and breeding:</p> <ul style="list-style-type: none"> <li>Large Bent-winged Bat (<i>Miniopterus orianae oceanensis</i>)</li> <li>Little Bent-winged Bat (<i>Miniopterus australis</i>)</li> <li>Southern Myotis (<i>Myotis macropus</i>).</li> </ul> <p>The cave roosting bats are known to roost in cave-like human made structures including mine shafts, storm water channels, large culverts, buildings, and under bridges. There are no human made structures in the Proposal Site that would be suitable for these bats to use as roosting habitat.</p> <p>There are small areas of planted shrubs within the former smelter infrastructure areas, as well as exotic (non-native vegetation) in previously cleared areas of site. The habitat value for these features is considered very low. Invasive weed species (including high threat weeds) were noted in the edges of the intact forest and regrowth forest and along cleared tracks and land, although in very low abundance within the intact forest. Future weed invasion into adjoining habitats is possibly, although, based on observation with the intact areas of forest, this is predicted to be low.</p>
Habitat connectivity	<p>Habitat connectivity is identified as the degree to which a particular site connects different areas of habitat of threatened species to facilitate the movement of those species across their range. Threatened species movement is identified as the degree to which a particular site contributes to the movement of threatened species to maintain their lifecycle.</p> <p>In terms of habitat connectivity, the Proposal Site is located mainly within a highly disturbed and previously cleared landscape where the majority of habitats have been cleared. The habitat that is proposed to be impacted is on the edge of the Proposal Site and does not involve fragmenting habitat or areas of connecting for fauna. The proposed habitat removal would be considered a small amount on the edge of a large patch. This would not contribute further to fragmentation.</p> <p>Threatened species known from the locality, including the Grey-headed Flying-fox, Swift Parrot, Regent Honeyeater and Southern Myotis (and other threatened bats) are powerful flyers capable of covering large distances between habitat patches. The landscape of the locality in its current form is permeable to these species and habitat connectivity for these species would not be detrimentally affected, and the bioregional persistence of these species would not be detrimentally affected by the Proposal.</p>
Water bodies, water quality and hydrological processes	<p>The Proposal does not include any direct impacts to waterways or waterbodies. The Proposal is unlikely to directly impact on any areas that would affect the water quality and hydrological processes that sustain threatened species and threatened ecological communities.</p> <p>There is potential for indirect impacts to surrounding habitats from erosion and contaminated run-off from the Proposal. The main risk would be to the storage ponds designed to drain stormwater from the former Kurri Kurri aluminium smelter and the unnamed tributary to Black Waterholes Creek.</p>

Criteria	Assessment
	Construction activities adjacent to these areas, are most likely to have an impact on water quality (if not mitigated). This may affect downstream environments due to potential changes in water quality and geomorphology associated with the construction of the Proposal. The implementation of standard mitigation measures (i.e. sediment control, spill control) would control sediment and pollutants from any significant runoff events.
Wind turbine strikes	This prescribed impact is not applicable to the Proposal.
Vehicle strikes	Vehicle collision is a direct impact that reduces local population numbers and is a common occurrence in Australia. Mammals, reptiles, amphibians, and birds are all at risk of vehicle strike, particularly those common species (e.g. birds) that are tolerant of disturbance and remain in the Proposal Site. The risk of an increase in the frequency of vehicle strike due to the Proposal is low and would generally be limited to vehicle movements to and from construction site within the existing infrastructure area and the unsealed access roads entering from the north. These types of vehicle movements are not expected to directly lead to an increase in impacts from vehicle strikes.

## 9.4 Cumulative biodiversity impacts

The potential biodiversity impacts of the Proposal must be considered as a consequence of the construction and operation of the Proposal within the existing environment. The Proposal would not act alone in causing impacts to biodiversity. The incremental effects of multiple sources of impact (past, present and future) are referred to as cumulative impacts and provide an opportunity to consider the Proposal within a strategic context.

The cumulative impacts of historic vegetation clearing for agriculture, urban and industrial development would likely include continued loss of biodiversity in the Cessnock and Kurri Kurri area.

The rezoning, subdivision and industrial development of Hydro Aluminium Kurri Kurri Pty Ltd land is a major planning proposal by Regrowth Kurri Kurri to rezone approximately 329 ha of land at and around the former Kurri Kurri aluminium smelter from Rural Landscape (RU2) to residential and public recreation, business, heavy and general industrial, infrastructure and environmental conservation (B1, B5, IN1, IN3, R2, RE1 and SP2 (in part)), to reduce the minimum lot size from 40 ha to 450 m<sup>2</sup> (in part) and to identify the Proposal Site as an urban release area. The rezoning proposal affects land in both the Cessnock and Maitland local government areas. Under this plan, the power station Proposal Site would be designated Heavy Industrial. On 1 December 2020 the NSW Department of Planning, Industry and Environment issued a Gateway Determination enabling Cessnock City Council to place the Hydro Kurri Kurri Planning Proposal on public exhibition for a minimum of 28 days. Submissions closed on 1 February 2021.

The rezoning proposal is subject to further approval and physical works would be subject to lodgement and approval of separate development applications. Development applications for development of the land following rezoning and subdivision are not expected until 2023, by which time the power station is anticipated to be under construction or even in operation (late 2023). There are currently no development applications, nor any further detail around the type of future development that might occur adjacent to the Proposal Site. Therefore, potential cumulative impacts from the Regrowth Kurri Kurri rezoning, subdivision and industrial development have not been assessed. It is assumed, however, in terms of the applicable land use zoning of the Proposal Site and the likely adjacent future land use context, that the rezoning proposal would be approved.



## 10. Mitigation and Management of Impacts

Once all practicable steps to avoid or minimise impacts have been implemented at the detailed design phase, mitigation and management measures would be implemented to further lessen the potential ecological impacts of the Proposal.

In identifying these measures, it is recognised that site selection is the primary mitigation measure, and significant effort has gone into mitigating impacts on biodiversity through the selection of a former industrial site for the Proposal.

Biodiversity impacts during construction would be managed in accordance with a Construction Environmental Management Framework, which includes biodiversity management objectives to maximise workers' awareness of biodiversity values and avoid or minimise potential impacts to biodiversity.

The Construction Environmental Management Framework also requires the preparation and implementation of a Flora and Fauna Management Plan, including (but not limited to):

- Procedures for the demarcation and protection of retained vegetation, including all vegetation outside and adjacent to the construction footprint
- Measures to reduce disturbance to sensitive fauna
- Procedures for the clearing of vegetation and the relocation of flora and fauna, including pre-clearing surveys and hollow-bearing tree identification
- Procedures for dealing with unexpected finds of threatened species identified during construction
- Weed management measures in accordance with the *Biosecurity Act 2015*
- Pathogen management measures to prevent introduction and spread of amphibian chytrid fungus, *Phytophthora cinnamomi* and Exotic Rust Fungi
- Inspection and monitoring requirements.

Additional biodiversity mitigation measures are outlined in Table 10.1.

Table 10.1: Recommended biodiversity mitigation measures during pre-construction and construction

Potential Impacts	Reference	Recommended biodiversity mitigation measures
Impact to surrounding vegetation and threatened ecological communities	B1	The limits of the work zone, areas for parking and turning of vehicles and plant equipment would be accurately and clearly marked out prior to commencement of works. These areas would be located so that vegetation disturbance is minimised as much as possible and the drip-line of trees avoided.
	B3	Exclusion zones would be established around high-quality vegetation, particularly the location of Threatened Plant Species. Periodic monitoring would be undertaken to ensure all controls are in place and no inadvertent impacts are occurring.
	B3	Materials, plant, equipment, work vehicles and stockpiles would be placed to avoid damage to surrounding vegetation and will be outside tree drip-lines.
	B4	If any damage occurs to vegetation outside of the nominated work area, Snowy Hydro will be notified so that appropriate remediation strategies can be developed.

Potential Impacts	Reference	Recommended biodiversity mitigation measures
	B5	Erosion and sediment measures would be implemented in accordance with the principles and requirements in Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom 2004) and Volume 2D (NSW Department of Environment, Climate Change and Water 2008c), commonly referred to as the 'Blue Book'.
	B6	Construction personnel are to be informed of the environmentally sensitive aspects of the Proposal Site, including plans for impacted and adjoining areas showing vegetation communities; important flora and fauna habitat areas; and locations where threatened species, populations or ecological communities have been recorded.
Impact to native plants and animals including threatened species	B7	<p>A pre-clearing inspection will be undertaken 48 hours prior to any native vegetation clearing by a suitably qualified ecologist and the Contractor's Environmental Manager (or delegate). The pre-clearing inspection will include, as a minimum:</p> <ul style="list-style-type: none"> <li>▪ Identification of hollow bearing trees or other habitat features;</li> <li>▪ Identification of any threatened flora and fauna;</li> <li>▪ A check on the physical demarcation of the limit of clearing;</li> <li>▪ Implementation of the Erosion and Sediment Control Plan (ESCP) for the worksite, including erosion control structures; and</li> <li>▪ The completion of any other pre-clearing requirements required by any project approvals, permits or licences.</li> </ul> <p>The completion of the pre-clearing inspection will form a HOLD POINT requiring sign-off from the Contractor's Environmental Manager (or delegate) and a qualified ecologist.</p>
	B8	<p>Clearing will follow a two-stage process as follows:</p> <ul style="list-style-type: none"> <li>▪ Non-habitat trees to be cleared first after sign-off of the pre-clearing inspection; and</li> <li>▪ Habitat trees to be cleared no sooner than 48 hours after non-habitat trees have been cleared. A suitably qualified ecologist to be present on the Proposal Site during the clearing of habitat trees. Felled habitat trees to be left on the ground for 24 hours or inspected by the ecologist prior to further processing.</li> </ul>
	B9	A post clearance report, including any relevant Geographical Information System files, will be produced that validates the type and area of vegetation cleared including confirmation of the number of hollows impacted and the corresponding nest box requirements to offset these impacts.
	B10	Construction crews will be made aware that any native fauna species encountered must be allowed to leave site without being harassed and a local wildlife rescue organisation must be called for assistance where necessary.
	B11	Where possible, hollows will be cut out of hollow-bearing trees and re-established in large trees to mitigate the loss of hollow habitat on fauna. Re-establishing existing hollows into trees is more likely to encourage uptake than use of artificial nest boxes.

Potential Impacts	Reference	Recommended biodiversity mitigation measures
	B12	A procedure for dealing with unexpected presence of threatened species will be implemented during construction, including cessation of work and notification of the contractors appointed environmental representative and Snowy Hydro, determination of appropriate mitigation measures in consultation with the DPIE (including relevant relocation measures) and updating of ecological monitoring or offset requirements.
Impacts from introduction and spread of weeds	B13	<p>Weed control will be undertaken by suitably qualified and/or experienced personnel. This may include:</p> <ul style="list-style-type: none"> <li>▪ Manual weed removal in preference to herbicides.</li> <li>▪ Replacing non-target species removed/killed as a result of weed control activities.</li> <li>▪ Protecting non-target species from spray drift.</li> <li>▪ Using only herbicides registered for use within or near waterways for the specific target weed.</li> <li>▪ Applying herbicides during drier times when the waterway level is below the high-water mark.</li> <li>▪ Not applying herbicide if it is raining or if rain is expected.</li> <li>▪ Mixing and loading herbicides and cleaning equipment away from waterways and drains.</li> </ul>
	B14	Weed management is to be undertaken in areas affected by construction prior to any clearing works in accordance with the <i>Biosecurity Act 2015</i> to ensure they are not spread to the surrounding environment; including during transport disposal off-site to a licenced waste disposal facility.
	B15	All weeds, propagules, other plant parts and/or excavated topsoil material that is likely to be infested with weed propagules that are likely to regenerate will be treated on site or bagged, removed from site and disposed of at a licensed waste disposal facility.
Impacts from introduction and spread of plant pathogens	B16	All vehicles driving to and from the Proposal Site will follow a protocol to prevent the spread or introduction of phytophthora, namely vehicles should be clean, including the tyres and any equipment.

## 11. Impact summary

This section of the BDAR identifies the impact thresholds that the assessor must apply including:

- Impacts on a potential entity that are serious and irreversible impacts
- Impacts for which the assessor is required to determine an offset requirement
- Impacts that do not require further assessment by the assessor.

### 11.1 Serious and irreversible impacts (SAIL)

Two species, Regent Honeyeater and Swift Parrot are identified as candidate species for serious and irreversible impacts (SAIL), as per Section 9.1 of the BAM. Information required by Section 9.1 of the BAM is provided in Appendix G.

### 11.2 Impacts requiring offsets

The determination of impacts on the Proposal Site which require an offset was undertaken in accordance with section 9.2 of the BAM.

#### 11.2.1 Impacts on native vegetation and TECs (ecosystem credits)

An offset is required for the impacts to most of the native vegetation in the Proposal Site as outlined in Table 11.1. Complete removal of the vegetation within the Proposal Site would occur. The location of the vegetation zones that would be impacted is shown in Figure 11.3.

Table 11.1: Impacts to PCTs which require an offset

Veg zone	PCT	TEC	Area (ha)	VI loss
1	Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633) – Intact	Yes	0.40 ha	46.5
2	Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633) – Regrowth	Yes	0.21 ha	35.4

#### 11.2.2 Impacts on threatened species and their habitat

An offset is required for impacts to threatened species, this includes the direct loss of individuals from one plant species, *Eucalyptus parramattensis* subsp. *decadens* – 37 individuals, in addition to the loss of habitat associated with three threatened fauna species as outlined in Table 11.2. The location of this habitat is shown in Figure 11.1 and Figure 11.2.



Table 11.2: Impacts to threatened fauna species habitat which require an offset

Veg zone	PCT	Area (ha)	Habitat condition (VI) loss
<b>Southern Myotis (<i>Myotis macropus</i>)</b>			
1	Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633) – Intact	0.40 ha	46.5
<b>Regent Honeyeater (<i>Anthochaera phrygia</i>)</b>			
1	Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633) – Intact	0.40 ha	46.5
<b>Common Planigale (<i>Planigale maculata</i>)</b>			
1	Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633) – Intact	0.40 ha	46.5

### 11.3 Impacts not requiring offsets

An offset is not required for impacts where the vegetation integrity score is below those set out in paragraph 9.2.1 of the BAM for impacts on native vegetation and paragraph 9.2.2 of the BAM for impacts on threatened species. Impacts not requiring offset are described in Table 11.3.

The vegetation integrity score for the Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area – Ground layer only (PCT 1633) is 1.5 and the score for Vegetation Zone 4 Typha rushland is 4.9. As the vegetation integrity score for these vegetation zones is below the thresholds required for an offset, offsets are not required for these impacts to native vegetation. Similarly, as the vegetation integrity score for this vegetation zone is below 17 an offset is not required for this impact to habitat for the Southern Myotis. The location of these vegetation zones is shown in Figure 11.3.

Table 11.3: Impacts which do not require an offset

Veg zone	PCT	Area (ha)	VI score	VI score threshold*	Offset required
<b>Native vegetation</b>					
3	Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area – Ground layer only (PCT 1633)	0.88 ha	1.5	>15	No
4	Typha rushland (PCT 1737)	0.05 ha	4.9	>17	No
<b>Regent Honeyeater, Southern Myotis, and Common Planigale (excluded)</b>					
2	Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area – Regrowth (PCT 1633)	0.21 ha	35.4		No
3	Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area – Ground layer only (PCT 1633)	0.88 ha	1.5		No
4	Typha rushland (PCT 1737)	0.05 ha	4.9		No

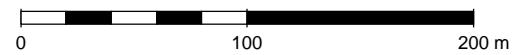
\*Note: Vegetation integrity score thresholds as set out by section 9.2 of the BAM

#### **11.4 Impacts that do not need further assessment**

An assessor is not required to assess areas of land on the disturbance area for ecosystem credits without native vegetation under Chapter 3 or Chapter 4 of the BAM. This section of the BAM is not applicable to the Proposal.

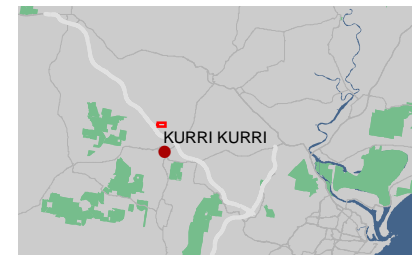


- Proposal site
- Southern Myotis
- Asset protection zone
- Detention basin
- Waterbodies



1:3,341 at A4  
Coordinate System: GDA2020 MGA Zone 56

**Data sources:**  
Jacobs  
Metromap (Aerometrex) 2020  
NSW Spatial Services



**Figure11-1** Southern Myotis species polygon





- Proposal site
- Regent Honeyeater
- Asset protection zone
- Common Planigale
- Detention basin
- Waterbodies

0 100 200 m

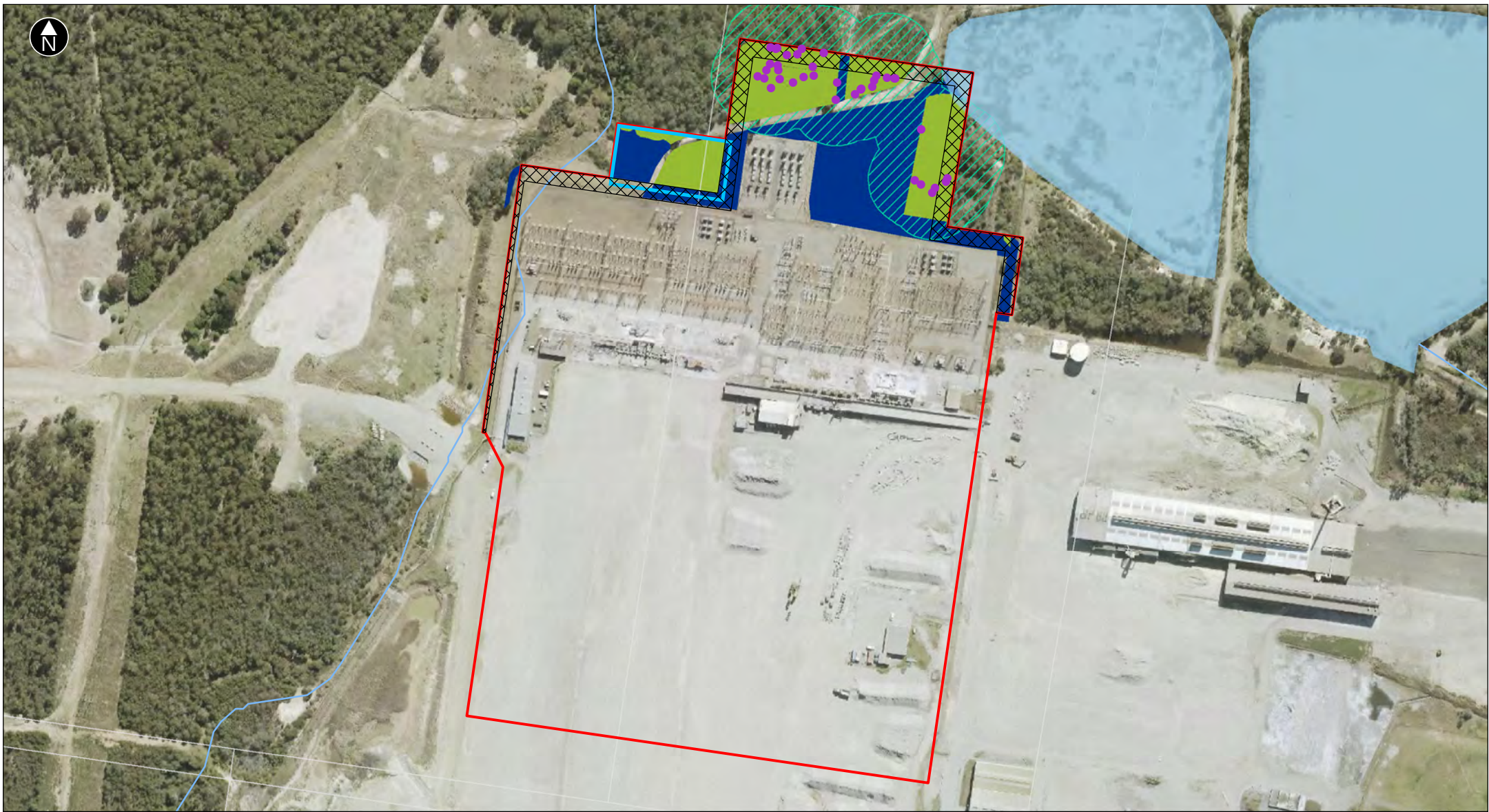
1:3,341 at A4  
Coordinate System: GDA2020 MGA Zone 56

**Data sources:**  
Jacobs  
Metromap (Aerometrex) 2020  
NSW Spatial Services



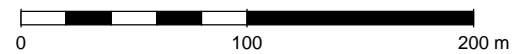
**Figure11-2** Regent Honeyeater and Common Planigale species polygon





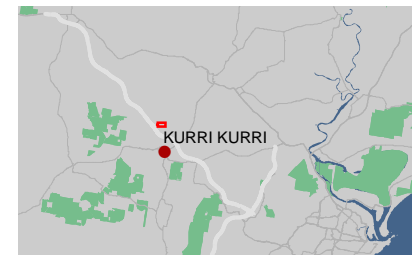
- Proposal site
- Asset protection zone
- Detention basin
- Waterbodies
- Impacts requiring offsets
- Impacts not requiring offsets

- Threatened species polygon - plants
- Threatened flora
- *Eucalyptus parramattensis ssp. decadens*



1:3,341 at A4  
Coordinate System: GDA2020 MGA Zone 56

**Data sources:**  
Jacobs  
Metromap (Aerometrex) 2020  
NSW Spatial Services



**Figure11-3** Impacts requiring offsets and impacts not requiring offsets

## 12. Biodiversity offsets

### 12.1 Ecosystem credits

A summary of the biodiversity credit requirements for the Proposal are provided below in Table 12.1 and Table 12.2. The credit report is provided in Appendix E.

Table 12.1: Ecosystem credits required

Veg zone	PCT	TEC	Credits	HBT	IBRA region
1	Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633) - Intact	Kurri Sand Swamp Woodland in the Sydney Basin. This includes PCTs 1633, 1635, 1650	9	Yes	Hunter, Ellerton, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomall, Upper Hunter, Wyong and Yengo, OR Any IBRA subregion that is within 100 km of the outer edge of the impacted site
2	Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633) - Regrowth	Kurri Sand Swamp Woodland in the Sydney Basin. This includes PCTs 1633, 1635, 1650	4	No	Hunter, Ellerton, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomall, Upper Hunter, Wyong and Yengo, OR Any IBRA subregion that is within 100 km of the outer edge of the impacted site
<b>Total</b>			<b>13</b>		

### 12.2 Species credits

Species credits are outlined below. Credits can be retired from anywhere in NSW.

Table 12.2: Species credits required

Species	Credits
<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> (Earp's Gum)	74
<i>Anthochaera phrygia</i> (Regent Honeyeater)	14
<i>Myotis macropus</i> (Southern Myotis)	9
<i>Planigale maculata</i> (Common Planigale)	9

### 12.3 Biodiversity offset strategy

The SEARs state that the BDAR must include details of the measures proposed to address the offset obligation as follows.

- The total number and classes of biodiversity credits required to be retired for the development/project
- The number and classes of like-for-like biodiversity credits proposed to be retired
- The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules
- Any proposal to fund a biodiversity conservation action
- Any proposal to conduct ecological rehabilitation (if a mining project)
- Any proposal to make a payment to the Biodiversity Conservation Fund.

Details of the credit requirements as per Point 1 and 2 of this requirement are outlined in Table 12.1 and Table 12.2 above. Following Proposal approval, Snowy Hydro would develop and implement a strategy for meeting the Proposal's offset credit obligation which would comprise a combination of sourcing credits from the offset credit market and payment to the Biodiversity Conservation Fund for any residual credits.



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## Appendix A. Habitat assessment

State and nationally listed threatened species identified from the literature review, database searches (BioNet and PMST) and Biodiversity Assessment Method Calculator (BAM-C), were considered in terms of their likelihood to occur in the habitats present within the survey area based on identified habitat requirements. The habitat suitability assessment for threatened species is provided in Table A.1 and Table A.2.

Table A.1: Habitat suitability assessment for threatened plant species

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Acacia bynoeana</i> (Bynoe's Wattles)	E	V	Found in central eastern NSW, from the Hunter District south to the Southern Highlands and west to the Blue Mountains. It has recently been found in the Colymea and Parma Creek areas west of Nowra. Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood ( <i>Corymbia gummifera</i> ), Scribbly Gum ( <i>Eucalyptus haemastoma</i> ), Drooping Red Gum ( <i>E. parramattensis</i> ), Old Man Banksia ( <i>Banksia serrata</i> ) and Small-leaved Apple ( <i>Angophora bakeri</i> ).	221 – BioNet  PMST  BAM-C	Moderate to High likelihood in Proposal Site. Known to occur in the broader locality and associated habitat present. Surveys did not identify this species.
<i>Asperula asthenes</i> (Trailing Woodruff)	V	V	This small herb occurs only in NSW. It is found in scattered locations from Bulahdelah north to near Kempsey, with several records from the Port Stephens/Wallis Lakes area. Occurs in damp sites, often along river banks.	BAM-C	Low in Proposal Site.  There is no habitat considered suitable for this species in the Proposal Site. Surveys did not identify this species

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Callistemon linearifolius</i> (Nettled Bottle Brush)	V	-	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Was more widespread across its distribution in the past. Some populations are reserved in Ku-ring-gai Chase National Park, Lion Island Nature Reserve, and Spectacle Island Nature Reserve. Further north it has been recorded from Yengo National Park and Werakata National Park. Grows in open dry sclerophyll forest on a substrate of sandy to clayey soils on sandstone on the coast and ranges e.g. with <i>Corymbia eximia</i> , <i>Eucalyptus punctata</i> , <i>E. umbra</i> , <i>Allocasuarina littoralis</i> , and <i>Angophora costata</i> .	587 – BioNet  BAM-C	High in Proposal Site. Known to occur in the broader locality and habitat considered suitable for this species in the Proposal Site. This species was not identified from targeted surveys.
<i>Cryptostylis hunteriana</i> (Leafless Tongue-orchid)	V	V	The Leafless Tongue Orchid has been recorded from as far north as Gibraltar Range National Park, south into Victoria around the coast as far as Orbost. Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. 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> ); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid ( <i>C. subulata</i> ) and the Tartan Tongue Orchid ( <i>C. erecta</i> ).	PMST	Moderate in Proposal Site. The habitat is considered suitable for this species in the Proposal Site. Target surveys did not identify this species.
<i>Cymbidium canaliculatum</i>	E	-	Scattered distribution across northern and eastern Australia, extending from Hunter River in NSW to Cape York and across northern NT and Queensland to the Kimberley region in WA. Typically grows in the hollows, fissures, trunks, and forks of trees in dry sclerophyll forest or woodland, where its host trees typically occur on Permian Sediments of the Hunter Valley floor.	2 – BioNet	Low in Proposal Site. There is no habitat considered suitable for this species in the Proposal Site.



Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Cynanchum elegans</i> (White-flowered Wax Plant)	E	E	Occurs from the Gloucester district to the Wollongong area and inland to Mt Dangar. Typically occurs in rainforest gullies, scrub, and scree slopes and at the ecotone between dry rainforest vegetation and dry subtropical forest/woodland communities. Other associated vegetation types include littoral rainforest; Coastal Tea-tree ( <i>Leptospermum laevigatum</i> ) – Coastal Banksia ( <i>Banksia integrifolia</i> subsp. <i>integrifolia</i> ) coastal scrub; Forest Red Gum ( <i>Eucalyptus tereticornis</i> ) aligned open forest and woodland; Spotted Gum ( <i>Corymbia maculata</i> ) aligned open forest and woodland; and Bracelet Honey myrtle ( <i>Melaleuca armillaris</i> ) scrub to open scrub.	PMST	Low in Proposal Site. There is no habitat considered suitable for this species in the Proposal Site.
<i>Dichanthium setosum</i> (Bluegrass)	V	V	<i>Dichanthium setosum</i> has been reported from mid-coastal to inland NSW and Queensland. <i>Dichanthium setosum</i> occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW, extending west to Narrabri. <i>Dichanthium setosum</i> is associated with heavy basaltic black soils and red-brown loams with clay subsoil.	PMST	Low in Proposal Site. There is no habitat considered suitable for this species in the Proposal Site.
<i>Diuris pedunculata</i> (Small Snake Orchid)	E	E	Confined to north east NSW. It was originally found scattered from Tenterfield south to the Hawkesbury River, but is now mainly found on the New England Tablelands, around Armidale, Uralla, Guyra and Ebor. The Small Snake Orchid grows on grassy slopes or flats. Often on peaty soils in moist areas. Also, on shale and trap soils, on fine granite, and among boulders.	1 – BioNet	Low in Proposal Site. There is no habitat considered suitable for this species in the Proposal Site.
<i>Eucalyptus glaucina</i> (Slaty Red Gum)	V	V	Found only on the north coast of NSW and in separate districts: near Casino where it can be locally common and farther south, from Taree to Broke, west of Maitland. Grows in grassy woodland and dry eucalypt forest. Grows on deep, moderately fertile, and well-watered soils.	6 – BioNet  PMST  BAM-C	Low in Proposal Site. There is no habitat considered suitable for this species in the Proposal Site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> (Earp's Gum)	V	V	There are two separate meta-populations of <i>E. parramattensis</i> subsp. <i>decadens</i> . The Kurri Kurri meta-population is bordered by Cessnock—Kurri Kurri in the north and Mulbring—Abedare in the south. Large aggregations of the subspecies are located in the Tomalpin area. The Tomago Sandbeds meta-population is bounded by Salt Ash and Tanilba Bay in the north and Williamtown and Tomago in the south. 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. It also occurs as an emergent in dry or wet heathland. Often where this species occurs, it is a community dominant. In the Kurri Kurri area, <i>E. parramattensis</i> subsp. <i>decadens</i> is a characteristic species of 'Kurri Sand Swamp Woodland in the Sydney Basin Bioregion', an endangered ecological community under the TSC Act. In the Tomago Sandbeds area, the species is usually associated with the 'Tomago Swamp Woodland' as defined by NSW NPWS (2000). Very little is known about the biology or ecology of this species. Flowers from November to January. Propagation mechanisms are currently poorly known. Seed dispersal is likely to be affected by wind and animals.	1143 – BioNet  PMST  BAM-C	This species was found present within the study area and is a dominant species associated with PCT1633
<i>Euphrasia arguta</i>	CE	CE	Historically, <i>Euphrasia arguta</i> has only been recorded from relatively few places within an area extending from Sydney to Bathurst and north to Walcha. Was rediscovered in the Nundle area of the NSW north western slopes and tablelands in 2008.  Historic records of the species noted the following habitats: 'in the open forest country around Bathurst in sub humid places', 'on the grassy country near Bathurst', and 'in meadows near rivers. Plants from the Nundle area have been reported from eucalypt forest with a mixed grass and shrub understorey; here, plants were most dense in an open disturbed area and along the roadside, indicating the species had regenerated following disturbance.	PMST	Low in Proposal Site.  There is no habitat considered suitable for this species in the Proposal Site. This species has not been recorded in the locality.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Grevillea parviflora</i> subsp. <i>Parviflora</i> (Small-flower Grevillea)	V	V	Sporadically distributed throughout the Sydney Basin with the main occurrence centred around Picton, Appin, and Bargo. Separate populations are also known further north from Putty to Wyong and Lake Macquarie on the Central Coast, and Cessnock and Kurri Kurri in the Lower Hunter. Grows in sandy or light clay soils usually over thin shales. Occurs in a range of vegetation types from heath and shrubby woodland to open forest. Found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests. Often occurs in open, slightly disturbed sites such as along tracks.	2393 – BioNet  PMST  BAM-C	High in Proposal Site. Known to occur in the broader locality and the habitat is considered suitable for this species in the Proposal Site. The species was not identified from the targeted survey
<i>Maundia triglochinoides</i> (Maundia triglochinoides)	V	-	Restricted to coastal NSW and extending into southern Queensland. The current southern limit is Wyong; former sites around Sydney are now extinct. Grows in swamps, lagoons, dams, channels, creeks, or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients. Flowering occurs during warmer months. Associated with wetland species e.g. Triglochin procerum.	BAM-C	Moderate in Proposal Site. Portions of the Typha wetland community are considered suitable for this species. This species was not identified from the targeted survey
<i>Melaleuca biconvexa</i> (Biconvex Paperbark)	V	V	Found only in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. Generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	BAM-C	Low in Proposal Site. Habitat not considered suitable for this species in the Proposal Site The species was not identified from the targeted survey.
<i>Persicaria elatior</i> (Tall Knotweed)	V	V	Tall Knotweed has been recorded in south-eastern NSW (Mt Dromedary (an old record), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW it is known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	PMST  BAM-C	Moderate in Proposal Site. The habitat is considered suitable for this species in the Proposal Site. This species has not been recorded in the locality.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Persoonia hirsuta</i> (Hairy Geebung)	E	E	<i>Persoonia hirsuta</i> is patchily distributed on the Central Coast and Tablelands of NSW, in an area bounded by Putty, Glen Davis and Gosford in the north, and Royal National Park (NP) and Hill Top in the south. It occurs in the Sydney coastal area (Gosford, Berowra, Manly and Royal NP), the Blue Mountains area (Springwood, Lithgow, and Putty) and the Southern Highlands (Balmoral, Buxton, Yanderra, and Hill Top). It is frequently found on ridge tops and the mid slopes of hills and rises in dry sclerophyll forest and woodland with a shrubby understorey, heath, shrubby thickets, and sandstone scrubs from near sea level to 600 m altitude. Associated canopy species include <i>Eucalyptus sclerophylla</i> , <i>Corymbia gummifera</i> , <i>Leptospermum trinervium</i> , <i>E. sieberi</i> , <i>E. punctata</i> , <i>E. sparsifolia</i> , <i>C. eximia</i> and <i>Banksia ericifolia</i> . It grows on sandy to stony soils derived from sandstone or very rarely on shale and is often found in disturbed areas, like along track edges.	PMST	Low in Proposal Site.  There is no habitat considered suitable for this species in the Proposal Site. This species has not been recorded in the locality.
<i>Prasophyllum</i> sp. <i>Wybong</i> ( <i>C. Phelps</i> ORG 5269)	-	CE	Endemic to NSW, it is known from near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell, Tenterfield, Currabubula and the Pilliga area. A perennial orchid, appearing as a single leaf over winter and spring. Flowers in spring and dies back to a dormant tuber over summer and autumn. Known to occur in open eucalypt woodland and grassland.	PMST	Low in Proposal Site.  There is no habitat considered suitable for this species in the Proposal Site. This species has not been recorded in the locality.
<i>Prostanthera cineolifera</i> (Singleton Mint Bush)	V	V	Restricted to only a few localities near Walcha, Scone, Cessnock and St Albans. Grows in open woodlands on exposed sandstone ridges. Usually found in association with shallow or skeletal sands.	PMST	Low in Proposal Site.  There is no habitat considered suitable for this species in the Proposal Site. This species has not been recorded in the locality.
<i>Pterostylis gibbosa</i> (Illawarra Greenhood)	E	E	Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra). It is apparently extinct in western Sydney which is the area where it was first collected (1803).	1 – BioNet  PMST	Low in Proposal Site.  There is no habitat considered suitable for this species in the Proposal Site.



Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Rhizanthella slateri</i> (Eastern Australian Underground Orchid)	V	E	Occurs from south-east Queensland to south-east NSW. In NSW, currently known from fewer than 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra. Habitat requirements are poorly understood, and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest.	PMST	Low in Proposal Site. There is no habitat considered suitable for this species in the Proposal Site. This species has not been recorded in the locality.
<i>Rutidosia heterogama</i> (Heath Wrinklewort)	V	V	Recorded from near Cessnock to Kurri Kurri with an outlying occurrence at Howes Valley. On the Central Coast it is located north from Wyong to Newcastle. There are north coast populations between Woolli and Evans Head in Yuraygir and Bundjalung National Parks. It also occurs on the New England Tablelands from Torrington and Ashford south to Wandsworth south-west of Glen Innes. Grows in heath on sandy soils and moist areas in open forest and has been recorded along disturbed roadsides.	1471 – BioNet  PMST  BAM-C	Moderate in Proposal Site. Known to occur in the broader locality. Surveys did not identify this species.
<i>Syzygium paniculatum</i> (Magenta Lilly Pilly)	E	V	The Magenta Lilly Pilly is found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. On the south coast it occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast it occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	PMST	Low in Proposal Site. There is no habitat considered suitable for this species in the Proposal Site. This species has not been recorded in the locality.
<i>Tetratheca juncea</i> (Black-eyed Susan)	V	V	Confined to the northern portion of the Sydney Basin bioregion and the southern portion of the North Coast bioregion in the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock. It is usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover. However, it has also been recorded in heathland and moist forest. The majority of populations occur on low nutrient soils associated with the Awaba Soil Landscape. While the species has a preference for cooler southerly aspects, it has been found on slopes with a variety of aspects. It generally prefers well-drained sites and occurs on ridges, although it has also been found on upper slopes, mid-slopes and occasionally in gullies.	PMST	Low in Proposal Site. There is no habitat considered suitable for this species in the Proposal Site. This species has not been recorded in the locality.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Thesium australe</i> (Austral Toadflax)	V	V	Found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass ( <i>Themeda australis</i> ).	PMST	Low in Proposal Site. There is no habitat considered suitable for this species in the Proposal Site. This species has not been recorded in the locality.
<i>Zannichellia palustris</i> (Zannichellia palustris)	E	-	A submerged aquatic plant. In NSW, known from the lower Hunter and in Sydney Olympic Park. Grows in fresh or slightly saline stationary or slowly flowing water. Flowers during warmer months. NSW populations behave as annuals, dying back completely every summer.	BAM-C	Low in Proposal Site. There is no habitat considered suitable for this species in the Proposal Site. This species has not been recorded in the locality.
<p>* Distribution and habitat requirement information adapted from: Australian Government Department of the Environment <a href="http://www.environment.gov.au/biodiversity/threatened/index.html">http://www.environment.gov.au/biodiversity/threatened/index.html</a>, NSW Office of Environment and Heritage <a href="http://www.environment.nsw.gov.au/threatenedspecies/">http://www.environment.nsw.gov.au/threatenedspecies/</a></p> <p><u>Key:</u> CE = critically endangered, E = endangered, V = vulnerable</p>					

Table A.2: Habitat suitability assessment for threatened animal species

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<b>Birds</b>					
<i>Anseranas semipalmata</i> (Magpie Goose)	V	-	Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges. Equally at home in aquatic or terrestrial habitats; often seen walking and grazing on land; feeds on grasses, bulbs and rhizomes. Activities are centred on wetlands, mainly those on floodplains of rivers and large shallow wetlands formed by run-off; breeding can occur in both summer and winter dominated rainfall areas and is strongly influenced by water level; most breeding now occurs in monsoonal areas; nests are formed in trees over deep water; breeding is unlikely in south-eastern NSW.	BAM-C	Low in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.
<i>Anthochaera Phrygia</i> (Regent Honeyeater)	CE	CE	The Regent Honeyeater that has a patchy distribution between south-east Queensland and central Victoria. It mostly inhabits inland slopes of the Great Dividing Range, in areas of low to moderate relief with moist, fertile soils. It is most commonly associated with box-ironbark eucalypt woodland and dry sclerophyll forest, but also inhabits riparian vegetation such as sheoak ( <i>Casuarina</i> sp.) where it feeds on needle-leaved mistletoe and sometimes breeds. It sometimes utilises lowland coastal forest, which may act as a refuge when its usual habitat is affected by drought. It also uses a range of disturbed habitats within these landscapes including remnant patches in farmland and urban areas and roadside vegetation. It feeds primarily on the nectar of eucalypts and mistletoes and, to a lesser extent, lerps and honeydew; it prefers taller and larger diameter trees for foraging. It is nomadic and partly migratory with its movement through the landscape being governed by the flowering of select eucalypt species. There are four known key breeding areas: three in NSW and one in Victoria. Breeding varies between regions and corresponds with flowering of key eucalypt and mistletoe species. It usually nests in horizontal branches or forks in tall mature eucalypts and Sheoaks.	135 – BioNet  PMST	High in Proposal Site.  Mapped areas of important habitat for Regent Honeyeater intersect the intact swamp woodland habitat within the Proposal Site, as well as immediately adjacent areas.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Artamus cyanopterus cyanopterus</i> (Dusky Woodswallow)	V	-	The Dusky Woodswallow has two separate populations. The eastern population is found from Atherton Tableland, Queensland south to Tasmania and west to Eyre Peninsula, South Australia. The other population is found in south-west Western Australia. The Dusky Woodswallow is found in open forests and woodlands and may be seen along roadsides and on golf courses.	3 – BioNet	Moderate. May forage over the Proposal Site and perch on trees.
<i>Botaurus poiciloptilus</i> (Australasian Bittern)	E	E	Occurs from south-east Queensland to south-east South Australia, Tasmania and the south-west of Western Australia. The Australasian Bittern's preferred habitat is comprised of wetlands with tall dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. It favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and reeds (e.g. Phragmites, Cyperus, Eleocharis, Juncus, Typha, Baumea, Bolboschoenus) or cutting grass (Gahnia) growing over a muddy or peaty substrate.	PMST  BAM-C	Moderate in Proposal Site. This species may occur in the creek habitat and in the storage ponds within the Proposal Site on occasion, however the likelihood is considered low as these habitats are small. There are no records of this species in the locality.
<i>Burhinus grallarius</i> (Bush Stone- curlew)	E	-	Open forests and woodlands with a sparse grassy ground layer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch.	BAM-C	Moderate in Proposal Site. The habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.



Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Calidris ferruginea</i> (Curlew Sandpiper)	E	CE, M	In Australia, Curlew Sandpipers occur around the coasts of all states and are also quite widespread inland, though in smaller numbers. They occur in Australia mainly during the non-breeding period but also during the breeding season when many non-breeding one-year old birds remain. Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh and in mangroves.	PMST  BAM-C	Low in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality and the important habitat mapping for migratory shorebirds does not cover the study area
<i>Calidris tenuirostris</i> (Great Knot)	V	CE	In NSW, the species has been recorded at scattered sites along the coast down to about Narooma. It has also been observed inland at Tullakool, Armidale, Gilgandra and Griffith. Occurs within sheltered, coastal habitats containing large, intertidal mudflats or sand flats, including inlets, bays, harbours, estuaries and lagoons. Often recorded on sandy beaches with mudflats nearby, sandy spits and islets and sometimes on exposed reefs or rock platforms. Migrates to Australia from late August to early September, although juveniles may not arrive until October-November.	BAM-C	Low in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality and the important habitat mapping for migratory shorebirds does not cover the study area

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Callocephalon fimbriatum</i> (Gang-gang Cockatoo)	V	-	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests with an acacia understorey. Also occur in subalpine Snow Gum woodland and occasionally in temperate or regenerating forest. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box ironbark assemblages, or in dry forest in coastal areas, occasionally feeding on exotic plant species on urban fringe areas. Favours old growth forest and woodland attributes for nesting and roosting. Nesting occurs in Spring and Summer with nests located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts.	2 – BioNet BAM-C	Moderate. May occur in study area on occasion in winter. No breeding habitat in Proposal Site.
<i>Calyptorhynchus lathami</i> (Glossy-black Cockatoo)	V	-	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia. 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. Inland populations feed on a wide range of Sheoaks, including Drooping Sheoak, <i>Allocasuarina diminuta</i> , and <i>A. gymnanthera</i> . Belah is also utilised and may be a critical food source for some populations. In the Riverina, birds are associated with hills and rocky rises supporting Drooping Sheoak, but also recorded in open woodlands dominated by Belah ( <i>Casuarina cristata</i> ).	30 – BioNet BAM-C	Low in Proposal Site. There is no habitat in the Proposal Site considered suitable for this species. There are no <i>Allocasuarina</i> sp. in the Proposal Site.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Chthonicola sagittate</i> (Speckled Warbler)	V	-	The Speckled Warbler lives in a wide range of Eucalyptus 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 re-growth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding. The rounded, domed, roughly built nest of dry grass and strips of bark is located in a slight hollow in the ground or the base of a low dense plant, often among fallen branches and other litter. A side entrance allows the bird to walk directly inside.	4 – BioNet  BAM-C	Low in Proposal Site.  Only four records in the locality suggests this species is quite rare and likely to stick to high-quality remnant woodland. There is no habitat in the Proposal Site considered suitable for this species the likelihood of this species occurring in the Proposal Site is considered low.
<i>Circus assimilis</i> (Spotted Harrier)	V	-	The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. 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.	BAM-C	Low in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Climacteris picumnus victoriae</i> (Brown Treecreeper (eastern subspecies))	V	-	Endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges. Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum ( <i>Eucalyptus camaldulensis</i> ) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains. Hollows in standing dead or live trees and tree stumps are essential for nesting.	4 – BioNet  BAM-C	Low in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species.
<i>Daphoenositta chrysoptera</i> (Varied Sittella)	V	-	The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticated bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. Nests in an upright tree fork high in the living tree canopy.	8 – BioNet  BAM-C	Moderate.  This species may forage and fly through the Proposal Site.



Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Ephippiorhynchus asiaticus</i> (Black-necked Stork)	E	-	In Australia, Black-necked Storks are widespread in coastal and subcoastal northern and eastern Australia, as far south as central NSW (although vagrants may occur further south or inland, well away from breeding areas). In NSW, the species becomes increasingly uncommon south of the Clarence Valley, and rarely occurs south of Sydney. Since 1995, breeding has been recorded as far south as Bulahdelah. Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries. Storks usually forage in water 5-30cm deep for vertebrate and invertebrate prey. Eels regularly contribute the greatest biomass to their diet, but they feed on a wide variety of animals, including other fish, frogs and invertebrates (such as beetles, grasshoppers, crickets and crayfish). Black-necked Storks build large nests high in tall trees close to water. Trees usually provide clear observation of the surroundings and are at low elevation (reflecting the floodplain habitat).	10 – BioNet  BAM-C	Low in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species.
<i>Epthianura albifrons</i> (White-fronted Chat)	V	-	The White-fronted Chat is found across the southern half of Australia, from southernmost Queensland to southern Tasmania, and across to Western Australia as far north as Carnarvon. Found mostly in temperate to arid climates and very rarely sub-tropical areas, it occupies foothills and lowlands up to 1000 m above sea level. In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas. Gregarious species usually found foraging on bare or grassy ground in wetland areas, singly or in pairs. They are insectivorous, feeding mainly on flies and beetles caught from or close to the ground. Have been observed breeding from late July through to early March, with 'open-cup' nests built in low vegetation. Nests in the Sydney region have also been seen in low isolated mangroves. Nests are usually built about 23 cm above the ground (but have been found up to 2.5 m above the ground).	BAM-C	Low in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Erythroriorchis radiatus</i> (Red Goshawk)	CE	V	This unique Australian endemic raptor is distributed sparsely through northern and eastern Australia, from the western Kimberley Division of northern Western Australia to north-eastern Queensland and south to far north-eastern NSW, and with scattered records in central Australia. The species is very rare in NSW, extending south to about 30°S, with most records north of this, in the Clarence River Catchment, and a few around the lower Richmond and Tweed Rivers. Formerly, it was at least occasionally reported as far south as Port Stephens. Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water, and are often found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers.	PMST	Low in Proposal Site. There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.
<i>Falco hypoleucos</i> (Grey Falcon)	E	-	Sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast.	PMST	Low in Proposal Site. There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.
<i>Glossopsitta pusilla</i> (Little Lorikeet)	V	-	In NSW it is found from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo, and Narrabri. The species forages primarily in the canopy of dry open eucalypt forest and woodland but also utilises paperbark ( <i>Melaleuca</i> sp.) dominated forests. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country (e.g. paddocks, roadside remnants) and urban trees also help sustain viable populations of the species. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited; riparian trees are often chosen, including non-eucalypt species such as she-oaks.	40 – BioNet  BAM-C	Moderate. This species may forage in trees in the Proposal Site on occasion.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Grantiella picta</i> (Painted Honeyeater)	V	V	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of birds, and almost all breeding, occur on the inland slopes of the Great Dividing Range in NSW, Victoria, and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amyema</i> .	PMST  BAM-C	Low in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.
<i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)	V	M	Distributed along the coastline (including offshore islands) of mainland Australia and Tasmania. Found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. Habitats occupied by the sea-eagle are characterised by the presence of large areas of open water (larger rivers, swamps, lakes, and the sea). It feeds opportunistically on a variety of fish, birds, reptiles, mammals, and crustaceans, and on carrion. It generally forages over large expanses of open water; this is particularly true of birds that occur in coastal environments close to the sea-shore. However, it will also forage over open terrestrial habitats (such as grasslands). Nests may be built in a variety of sites including tall trees (especially <i>Eucalyptus</i> species), bushes, mangroves, cliffs, rocky outcrops, crevices, on the ground or even on artificial structures.	3 – BioNet  BAM-C	Low in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species.
<i>Hieraaetus morphnoides</i> (Little Eagle)	V	-	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. Occupies open eucalypt forest, woodland, or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used.	1 – BioNet  BAM-C	Moderate.  This species may fly over and perch in the Proposal Site on occasion. There is unlikely to be any suitable breeding habitat present.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Hirundapus caudacutus</i> (White-throated Needletail)	-	V, M	Widespread in eastern and south-eastern Australia. Almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. They also commonly occur over heathland but less often over treeless areas, such as grassland or swamps.	PMST	Low. Likely to use airspace above the Proposal Site. Unlikely to utilise the affected vegetation or be impacted.
<i>Irediparra gallinacean</i> (Comb-crested Jacana)	V	-	Occurs on freshwater wetlands in northern and eastern Australia, mainly in coastal and subcoastal regions, from the north-eastern Kimberley Division of Western Australia to Cape York Peninsula then south along the east coast to the Hunter region of NSW, with stragglers recorded in south-eastern NSW (possibly in response to unfavourable conditions further north). Inhabit permanent freshwater wetlands, either still or slow-flowing, with a good surface cover of floating vegetation, especially water-lilies, or fringing and aquatic vegetation.	BAM-C	Low in Proposal Site. There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.
<i>Ixobrychus flavicollis</i> (Black Bittern)	V	-	The Black Bittern is found along the coastal plains within NSW, although individuals have rarely been recorded south of Sydney or inland. It inhabits terrestrial and estuarine wetlands such as flooded grasslands, forests, woodlands, rainforests and mangroves with permanent water and dense waterside vegetation. The Black Bittern typically roosts on the ground or in trees during the day and forages at night on frogs, reptiles, fish, and invertebrates. The breeding season extends from December to March. Nests are constructed of reeds and sticks in branches overhanging the water.	1 – BioNet  BAM-C	Low in Proposal Site. This species may occur in the creek habitats in the Proposal Site on occasion, however the likelihood is considered low.



Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Lathamus discolor</i> (Swift Parrot)	E	CE	The swift parrot breeds in Tasmania during the summer and the entire population migrates north to mainland Australia for the winter. Whilst on the mainland the swift parrot disperses widely to forage on flowers and psyllid lerps in eucalypt species, with the majority being found in Victoria and NSW. In NSW they forage in forests and woodlands throughout the coastal and western slopes regions each year. Coastal regions tend to support larger numbers of birds when inland habitats are subjected to drought. Non-breeding birds preferentially feed in inland box-ironbark and grassy woodlands, and coastal swamp mahogany ( <i>Eucalyptus robusta</i> ) and spotted gum ( <i>Corymbia maculata</i> ) woodland when in flower, otherwise often in coastal forests. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as <i>E. robusta</i> , <i>Corymbia maculata</i> , <i>C. gummifera</i> , <i>E. sideroxylon</i> , and <i>E. albens</i> . Commonly used lerp infested trees include <i>E. microcarpa</i> , <i>E. moluccana</i> and <i>E. pilularis</i> .	512 – BioNet PMST BAM-C	Low in Proposal Site. Important habitat includes woodland and forest containing winter-flowering eucalypt species, such as Spotted Gum ( <i>Corymbia maculata</i> ), Swamp Mahogany ( <i>Eucalyptus robusta</i> ) and Forest Red Gum ( <i>E. tereticornis</i> ). None of these species are associated with the vegetation community types confirmed at the Proposal Site and in the surrounding survey area.
<i>Limicola falcinellus</i> (Broad-billed Sandpiper)	V	-	The eastern form of this species breeds in northern Siberia before migrating southwards in winter to Australia. In Australia, Broad-billed Sandpipers overwinter on the northern coast, particularly in the north-west, with birds located occasionally on the southern coast. In NSW, the main site for the species is the Hunter River estuary, with birds occasionally reaching the Shoalhaven estuary. There are few records for inland NSW. Broad-billed Sandpipers favour sheltered parts of the coast such as estuarine sand flats and mudflats, harbours, embayment's, lagoons, saltmarshes, and reefs as feeding and roosting habitat. Occasionally, individuals may be recorded in sewage farms or within shallow freshwater lagoons. Broad-billed Sandpipers roost on banks on sheltered sand, shell, or shingle beaches.	BAM-C	Low in Proposal Site. There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality and the important habitat mapping for migratory shorebirds does not cover the study area

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Limosa limosa</i> (Black-tailed Godwit)	V	M	A migratory wading bird that breeds in Mongolia and Eastern Siberia and flies to Australia for the southern summer, arriving in August and leaving in March. In NSW, it is most frequently found at Kooragang Island (Hunter River estuary). Occurs in sheltered bays, estuaries and lagoons with large intertidal mudflats and sand flats. Also found at inland mudflats, swamps.	BAM-C	Low in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality and the important habitat mapping for migratory shorebirds does not cover the study area
<i>Lophoictinia isura</i> (Square-tailed Kite)	V	-	Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by <i>Eucalyptus longifolia</i> , <i>Corymbia maculata</i> , <i>E. elata</i> , or <i>E. smithii</i> . Individuals appear to occupy large hunting ranges of more than 100 km <sup>2</sup> . They require large living trees for breeding, particularly near water with surrounding woodland /forest close by for foraging habitat. Nest sites are generally located along or near watercourses, in a tree fork or on large horizontal limbs.	2 – BioNet  BAM-C	Moderate.  This species may fly over and perch in the Proposal Site on occasion. There is unlikely to be any suitable breeding habitat present.
<i>Melanodryas cucullata cucullata</i> (Hooded Robin (south-eastern form))	V	-	The Hooded Robin is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania. However, it is common in few places, and rarely found on the coast. Prefers 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. The nest is a small, neat cup of bark and grasses bound with webs, in a tree fork or crevice, from less than 1 m to 5 m above the ground.	BAM-C	Low in Proposal Site.  There is no habitat considered suitable for this species. Vagrant birds may appear on occasion. There are no records of this species in the locality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Melithreptus gularis</i> <i>gularis</i> (Black-chinned Honeyeater (eastern subsp.))	V	-	Extends south from central Queensland, through NSW, Victoria into south-eastern South Australia, though it is very rare in the last state. In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark ( <i>Eucalyptus sideroxylon</i> ), White Box ( <i>E. albens</i> ), Inland Grey Box ( <i>E. microcarpa</i> ), Yellow Box ( <i>E. melliodora</i> ), Blakely's Red Gum ( <i>E. blakelyi</i> ) and Forest Red Gum ( <i>E. tereticornis</i> ). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.	14 – BioNet  BAM-C	Low in Proposal Site. There is no habitat considered suitable for this species. Vagrant birds may appear on occasion.
<i>Neophema pulchella</i> (Turquoise Parrot)	V	-	Range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland.	38 – BioNet  BAM-C	Low in Proposal Site. There is no habitat in the Proposal Site considered suitable for this species.
<i>Ninox connivens</i> (Barking Owl)	V	-	Found throughout continental Australia except for the central arid regions. 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.	1 – BioNet  BAM-C	Moderate. This species may fly over, perch and forage in the Proposal Site on occasion. There is no suitable breeding habitat present.
<i>Ninox strenua</i> (Powerful Owl)	V	-	In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. Now at low densities throughout most of its eastern range, rare along the Murray River and former inland populations may never recover. The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation.	3 – BioNet  BAM-C	Moderate. This species may fly over, perch and hunt in the Proposal Site on occasion. There is no suitable breeding habitat present.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Numenius madagascariensis</i> (Eastern Curlew)	-	CE, M	Within Australia, the Eastern Curlew has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sand flats, often with beds of seagrass.	PMST	Low in Proposal Site. There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality and the important habitat mapping for migratory shorebirds does not cover the study area
<i>Oxyura australis</i> (Blue-billed Duck)	V	-	Endemic to south-eastern and south-western Australia. It is widespread in NSW, but most common in the southern Murray-Darling Basin area. Birds disperse during the breeding season to deep swamps up to 300 km away. It is generally only during summer or in drier years that they are seen in coastal areas. Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. It will fly if disturbed, but prefers to dive if approached. Partly migratory, with short-distance movements between breeding swamps and overwintering lakes with some long-distance dispersal to breed during spring and early summer. Usually nest solitarily in Cumbungi over deep water between September and February. They will also nest in trampled vegetation in Lignum, sedges or Spike-rushes, where a bowl-shaped nest is constructed. The most common clutch size is five or six. Males take no part in nest-building or incubation.	BAM-C	Low in Proposal Site. There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.
<i>Pandion cristatus</i> (Eastern Osprey)	V	-	The Osprey has a global distribution with four subspecies previously recognised throughout its range. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water.	BAM-C	Low in Proposal Site. There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.



Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Petroica boodang</i> (Scarlet Robin)	V	-	The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and re-growth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. This species' nest is built in the fork of tree usually more than 2 m above the ground; nests are often found in a dead branch in a live tree, or in a dead tree or shrub.	4 – BioNet	Low in Proposal Site. This species may occur in higher-quality vegetation around the Proposal Site and pass through it on occasion. However, there is no habitat in the Proposal Site considered suitable for this species.
<i>Petroica phoenicea</i> (Flame Robin)	V	-	The Flame Robin ranges from near the Queensland border to south-east South Australia and also in Tasmania. In NSW, it breeds in upland areas and in winter, many birds move to the inland slopes and plains. It is likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands. Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. The ground layer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense. Occasionally occurs in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgeland at high altitudes.	1 – BioNet	Low in Proposal Site. This species may occur in higher-quality vegetation around the Proposal Site and pass through it on occasion. However, there is no habitat in the Proposal Site considered suitable for this species.
<i>Pomatostomus temporalis</i> <i>temporalis</i> (Grey-crowned Babbler)	V	-	In NSW, the eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW. It may be extinct in the southern, central and New England tablelands. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Build and maintain several conspicuous, dome-shaped stick nests about the size of a football. A nest is used as a dormitory for roosting each night. Nests are usually located in shrubs or sapling eucalypts, although they may be built in the outermost leaves of low branches of large eucalypts. Nests are maintained year-round, and old nests are often dismantled to build new ones.	88 – BioNet  BAM-C	Moderate in Proposal Site. This species may fly over and perch in the Proposal Site on occasion. There is unlikely to be any suitable breeding habitat present.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Rostratula australis</i> (Australian Painted Snipe)	E	E, M	Most records are from south-east Australia, particularly the Murray Darling Basin, with scattered records across northern Australia. They generally inhabit shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum Muehlenbeckia or canegrass. Breeding habitat requirements may be quite specific; shallow wetlands with areas of bare wet mud and both low cover and canopy cover nearby; nest records nearly all from or near small islands in freshwater wetlands. Has also been recorded nesting in and near swamps, canegrass swamps, flooded areas including samphire, grazing land, among cumbungi, sedges and grasses; one nest has been found in the centre of a cow-pat in a clump of long grass.	PMST  BAM-C	Low in Proposal Site.  This species may occur in the drain habitat in the Proposal Site on occasion, however the likelihood is considered low.
<i>Stictonetta naevosa</i> (Freckled Duck)	V	-	Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	BAM-C	Low in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.
<i>Tyto longimembris</i> (Eastern Grass Owl)	V	-	Eastern Grass Owls have been recorded occasionally in all mainland states of Australia but are most common in northern and north-eastern Australia. In NSW they are more likely to be resident in the north-east. Eastern Grass Owl numbers can fluctuate greatly, increasing especially during rodent plagues. Eastern Grass Owls are found in areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains. They are also found in agricultural land (mainly sugar cane and sorghum, and rice fields in fallow) (Birdlife Australia).	BAM-C	Low in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Tyto novaehollandiae</i> (Masked Owl)	V	-	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution. Dry eucalypt forests and woodland typically prefers open forest with low shrub density. Requires old trees for roosting and nesting.	1 – BioNet  BAM-C	Moderate.  This species may fly over, perch and hunt in the Proposal Site on occasion. There is no suitable breeding habitat present
<i>Tyto tenebricosa</i> (Sooty Owl)	V	-	Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. Territories are occupied permanently. Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Nests are located in large tree-hollows.	2 – BioNet	Low in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species.
<b>Frogs</b>					
<i>Crinia tinnula</i> (Wallum Froglet)	V	-	Wallum Froglets are found along the coastal margin from Litabella National Park in south-east Queensland to Kurnell in Sydney. Wallum Froglets are found in a wide range of habitats, usually associated with acidic swamps on coastal sand plains. They typically occur in sedgeland and wet heathlands. They can also be found along drainage lines within other vegetation communities and disturbed areas, and occasionally in swamp sclerophyll forests. The species breeds in swamps with permanent water as well as shallow ephemeral pools and drainage ditches. Breeding is thought to peak in the colder months, but can occur throughout the year following rain. Eggs of 1.1-1.2mm are deposited in water with a pH of <6 and tadpoles take 2-6 months to develop into frogs. Wallum Froglets shelter under leaf litter, vegetation, other debris or in burrows of other species. Shelter sites are wet or very damp and often located near the water's edge. Males may call throughout the year and at any time of day, peaking following rain.	BAM-C	Low in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Heleioporus australiacus</i> (Giant Burrowing Frog)	V	V	The Giant Burrowing Frog is distributed in south-eastern NSW and Victoria and appears to exist as two distinct populations: a northern population largely confined to the sandstone geology of the Sydney Basin and extending as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria. Found in heath, woodland, and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter. Individual frogs occupy a series of burrow sites, some of which are used repeatedly. The home ranges of both sexes appear to be non-overlapping suggesting exclusivity of non-breeding habitat. Home ranges are approximately 0.04 ha in size.	PMST	Low in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.
<i>Litoria aurea</i> (Green and Golden Bell Frog)	E	V	Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations. These locations occur over the species' former range; however, they are widely separated and isolated. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven, and mid north coast (one an island population). There is only one known population on the NSW Southern Tablelands. Ephemeral and permanent freshwater wetlands, ponds, dams with an open aspect and fringed by Typha and other aquatics, free from predatory fish.	29 – BioNet BAM-C	Low in Proposal Site.  Surveys for this species were undertaken in suitable habitat around the Proposal Site. No frogs were detected. The closest known key population is at Kooragang Island. While there is still moderate potential that dispersing individuals may occur in habitats around the study area on occasion



Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Litoria brevipalmata</i> (Green-thighed Frog)	V	-	Isolated localities along the coast and ranges from just north of Wollongong to south-east Queensland. Green-thighed Frogs 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. It prefers wetter forests in the south of its range, but extends into drier forests in northern NSW and southern Queensland.	BAM-C	Low in Proposal Site. There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.
<i>Mixophyes balbus</i> (Stuttering Frog)	E	V	Occur along the east coast of Australia from southern Queensland to north-eastern Victoria. Found in rainforest and wet, tall open forest in the 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.	PMST	Low in Proposal Site. There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.
<i>Mixophyes iteratus</i> (Giant Barred Frog)	E	E	Giant Barred Frogs are found along freshwater streams with permanent or semi-permanent water, generally at lower elevation. Moist riparian habitats such as rainforest or wet sclerophyll forest are favoured for the deep leaf litter that they provide for shelter and foraging, as well as open perching sites on the forest floor. However, Giant Barred Frogs will also sometimes occur in other riparian habitats, such as those in drier forest or degraded riparian remnants, and even occasionally around dams. Breeding takes place from late spring to summer. It is a generalist feeder, with large insects, snails, spiders, and frogs included in its diet.	PMST	Low in Proposal Site. There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Uperoleia mahonyi</i> (Mahony's Toadlet)	E	-	Endemic to the mid-north coast of New South Wales (NSW) and to date has been found between Kangy Angy and Seal Rocks. Inhabits ephemeral and semi-permanent swamps and swales on the coastal fringe of its range. Known records occur in heath or wallum habitats almost exclusively associated with leached (highly nutrient impoverished) white sand. Also is known to occur in wallum heath, swamp mahogany-paperbark swamp forest, heath shrubland and Sydney red gum woodland. Known records are associated with shallow ephemeral/semi-permanent water bodies with limited flow of water. Aquatic vegetation at breeding sites includes sedges ( <i>Shoenoplectus</i> spp., <i>Baumea</i> spp. and <i>Lepironia articulata</i> ) and Broadleaf Cumbungi ( <i>Typha orientalis</i> ). Females have been recorded up to 400 m from water-bodies indicating moderate dispersal distances and use of multiple habitat types.	BAM-C	Moderate in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.
<b>Reptiles</b>					
<i>Delma impar</i> (Striped Legless Lizard)	V	V	Found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component. Also found in secondary grassland near Natural Temperate Grassland and occasionally in open Box-Gum Woodland. Habitat is where grassland is dominated by perennial, tussock-forming grasses such as Kangaroo Grass <i>Themeda australis</i> , spear-grasses <i>Austrostipa</i> spp. and <i>Poa</i> tussocks <i>Poa</i> spp., and occasionally wallaby grasses <i>Austrodanthonia</i> spp.	PMST	Low in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.
<i>Hoplocephalus bitorquatus</i> (Pale-headed Snake)	V	-	A patchy distribution from north-east Queensland to the north-eastern quarter of NSW. In NSW it has historically been recorded from as far west as Mungindi and Quambone on the Darling Riverine Plains, across the north west slopes, and from the north coast from Queensland to Sydney. The Pale-headed Snake is a highly cryptic species that can spend weeks at a time hidden in tree hollows. Found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest.	BAM-C	Moderate.  This species is most likely to forage in the woodland within the Proposal Site. Though species was not recorded during surveys. There are no records of this species in the locality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<b>Mammals</b>					
<i>Cercartetus nanus</i> (Eastern Pygmy-possum)	V	-	Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts, and bottlebrushes; soft fruits are eaten when flowers are unavailable. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum drays or thickets of vegetation, (e.g. grass-tree skirts); nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks. Important habitat requirements include trees with hollows >2 cm, loose bark of eucalypts or accumulations of shredded bark in tree forks for nesting; and associated vegetation types and with an understorey containing heath, banksias or myrtaceous shrubs and soft-fruited plants in rainforests.	BAM-C	Moderate in Proposal Site. This species is assumed to occur based on the presence of suitable foraging habitats. Though species was not recorded during surveys. There are no records of this species in the locality.
<i>Chalinolobus dwyeri</i> (Large-eared Pied Bat)	V	V	Forages over a broad range of open forest and woodland habitats, this species is a cave roosting bat which favours sandstone escarpment habitats for roosting, in the form of shallow overhangs, crevices and caves.	1 – BioNet  PMST  BAM-C	Moderate. This species is most likely to forage in the woodland around the creek line to the west of the Proposal and the storage ponds and may occur in the Proposal Site as it flies around. However, there is no high-quality foraging habitat or breeding habitat in the Proposal Site.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Dasyurus maculatus</i> (Spotted-tailed Quoll)	V	E	Wet and dry sclerophyll forests and rainforests, and adjacent open agricultural areas. Generally associated with large expansive areas of habitat to sustain territory size. Requires hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	PMST  BAM-C	Low in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.
<i>Falsistrellus tasmaniensis</i> (Eastern False Pipistrelle)	V	-	Prefers moist habitats, with trees taller than 20 m. Generally, roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	1 – BioNet BAM-C	Moderate.  The highest-quality foraging habitat is around the creek line to the west of the Proposal and the storage ponds, though this species may also forage around trees within the Proposal Site. No hollow-bearing trees were identified within the Proposal Site; however, some roosting habitat may be present. There is unlikely to be any breeding habitat in the Proposal Site.



Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Micronomus norfolkensis</i> (Eastern Coastal Free-tailed Bat)	V	-	Occur in dry sclerophyll forest and woodland east of the Great Dividing Range. Roosts mainly in tree hollows but will also roost under bark or in human-made structures.	6 – BioNet  BAM-C	High.  This species is most likely to forage in the woodland around the creek to the west of the Proposal and may occur in the Proposal Site as it flies around. However, there is no breeding habitat in the Proposal Site.
<i>Miniopterus australis</i> (Little Bent-winged Bat)	V	-	East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	8 – BioNet  BAM-C	High.  This species is most likely to forage in the woodland around the creek to the west of the Proposal and the storage ponds and may occur in the Proposal Site as it flies around. However, there is no breeding habitat in the Proposal Site.
<i>Miniopterus orianae oceanensis</i> (Large Bent-winged Bat)	V	-	Occurs on east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings, and other manmade structures.	3 – BioNet  BAM-C	High.  This species is most likely to forage in the woodland around the creek to the west of the Proposal and may occur in the Proposal Site as it flies around. However, there is no breeding habitat in the Proposal Site.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Myotis macropus</i> (Southern Myotis)	V	-	Roost in groups close to water in caves, mine shafts, hollow-bearing trees, and storm water channels, buildings, under bridges and in dense foliage. Forages over streams and pools catching insects and small fish.	3 – BioNet  BAM-C	High.  Targeted surveys for this species were undertaken as part of this assessment. No bats were trapped in harp traps. Bat call analysis concluded 32 recorded calls of this species. The highest-quality foraging habitat is around the creek to the west of the Proposal and the storage ponds, though this species may also forage around trees within the Proposal Site. There are no associated PCTs within 200m of a waterway in the Proposal Site.
<i>Nyctophilus corbeni</i> (Corben's Long-eared Bat)	V	V	Overall, the distribution of the south eastern form coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species. Inhabits a variety of vegetation types, including mallee, buloke ( <i>Allocasuarina luehmannii</i> ) and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark.	BAM-C	Moderate in Proposal Site.  This species is most likely to forage in the woodland around the creek to the west of the Proposal and may occur in the Proposal Site as it flies around. However, there is no high-quality foraging habitat or breeding habitat in the Proposal Site.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Pandion cristatus</i> (Eastern Osprey)	V	-	The Osprey has a global distribution with four subspecies previously recognised throughout its range. Favour coastal areas, especially the mouths of large rivers, lagoons, and lakes. Feed on fish over clear, open water.	BAM-C	Low in Proposal Site. There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.
<i>Petauroides volans</i> (Greater Glider)	-	V	The Greater Glider occurs in eucalypt forests and woodlands along the east coast of Australia from north-east Queensland to the Central Highlands of Victoria from sea level to 1200 m altitude. It feeds exclusively on eucalypt buds, flowers and mistletoe and favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species. It roosts in tree hollows, with a particular selection for large hollows in large, old trees. Individuals use multiple hollows and a relatively high abundance of tree hollows (at least 4-8 suitable hollows per hectare) seems to be needed for the species to persist. Individuals occupy relatively small home ranges with an average size of 1 to 3 ha, but the species has relatively low persistence in small forest fragments and disperses poorly across vegetation that is not native forest. Forest patches of at least 160 km <sup>2</sup> may be required to maintain viable populations.	PMST	Low in Proposal Site. There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.
<i>Petaurus australis</i> (Yellow-bellied Glider)	V	-	Found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Extract sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar.	9 – BioNet  BAM-C	Low in Proposal Site. There is no habitat in the Proposal Site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Petaurus norfolcensis</i> (Squirrel Glider)	V	-	The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. Inhabits mature or old growth Box, Box-Ironbark woodlands, and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey.	23 – BioNet  BAM-C	High in Proposal Site. This species is assumed to occur based on the presence of suitable foraging habitats. Though species was not recorded during surveys.
<i>Petrogale penicillata</i> (Brush-tailed Rock-wallaby)	E	V	This species prefers rocky habitats, including loose boulder-piles, rocky outcrops, steep rocky slopes, cliffs, gorges, and isolated rock stacks. It also utilises tree limbs. While it appears that most Brush-tailed Rock-wallaby colonies are on north-facing slopes and cliff lines, colonies have been found on south-facing cliffs in Kangaroo Valley, in the Macleay River Gorge, in the Warrumbungles and at Mt Kaputar, although usually in lower densities. Rocky outcrops appear crucial to current habitat selection by rock-wallabies; however, vegetation structure and composition is also considered to be an important factor. In many parts of their range, including at the Warrumbungles, rock-wallabies are closely associated with dense arboreal cover, especially fig trees. The vegetation on and below the cliff appear to be important to this species as a source of food and shelter and in some cases may provide some protection from predation. A range of vegetation types are associated with Brush-tailed Rock-wallaby habitat, including dense rainforest, wet sclerophyll forest, vine thicket, dry sclerophyll forest, and open forest.	PMST  BAM-C	Low in Proposal Site. There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.



Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Phascolarctos cinereus</i> (Koala) combined populations of Queensland, New South Wales, and the Australian Capital Territory	V	V	In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	4 – BioNet  PMST  BAM-C	Moderate in Proposal Site. The vegetation in the Proposal Site and in the surrounding survey area contains the primary Koala feed tree species <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> with the occasional supplementary feed tree <i>Eucalyptus agglomerata</i> . However, there was no evidence of recent use by the Koala of the area to be impacted was noted from a comprehensive search for faecal pellets. This species may pass through the Proposal Site on occasion, however the likelihood is considered low.
<i>Planigale maculata</i> (Common Planigale)	V	-	Coastal north-eastern NSW, coastal east Queensland, and Arnhem Land. The species reaches its confirmed southern distribution limit on the NSW lower north coast however there are reports of its occurrence as far south as the central NSW coast west of Sydney. Common Planigales inhabit rainforest, eucalypt forest, heathland, marshland, grassland, and rocky areas where there is surface cover, and usually close to water. They are active at night and during the day shelter in saucer-shaped nests built in crevices, hollow logs, beneath bark or under rocks.	BAM-C	Moderate in Proposal Site. The habitat is considered suitable for this species and the <i>Antechinus flavipes</i> was recorded. These species are frequently encountered at the same site. There are no records of this species in the locality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Potorous tridactylus</i> <i>tridactylus</i> (long-nosed Potoroo)	V	V	The long-nosed potoroo is found on the south-eastern coast of Australia, from Queensland to eastern Victoria and Tasmania, including some of the Bass Strait islands. 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. The fruit-bodies of hypogenous (underground-fruited) fungi are a large component of the diet of the Long-nosed Potoroo. They also eat roots, tubers, insects and their larvae and other soft-bodied animals in the soil.	PMST	Low in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.
<i>Pseudomys novaehollandiae</i> (New Holland mouse)	V	-	Distribution is fragmented across all eastern states of Australia, where it inhabits open heath lands, open woodlands with heath understorey and vegetated sand dunes.	3 – BioNet  PMST	Low in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species.
<i>Pteropus poliocephalus</i> (Grey-headed Flying-fox)	V	V	Generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths, and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young.	35 – BioNet PMST BAM-C	High.  This species is assumed to occur based on the presence of suitable foraging habitat and the proximity of several camps. There are no camps within the Proposal Site.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Saccolaimus flaviventris</i> (Yellow-bellied Sheath-tail-bat)	V	-	Wide-ranging species found across northern and eastern Australia. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.	BAM-C	Moderate.  The highest-quality foraging habitat is around the creek to the west of the study area, though this species may also forage around trees within the Proposal Site. No hollow-bearing trees were identified within the Proposal Site; however, some roosting habitat may be present. There is unlikely to be any breeding habitat in the Proposal Site.
<i>Scoteanax rueppellii</i> (Greater Broad- nosed Bat)	V	-	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings.	2 – BioNet  BAM-C	High.  The highest-quality foraging habitat is around the creek to the west of the study area, though this species may also forage around trees within the Proposal Site. No hollow-bearing trees were identified within the Proposal Site; however, some roosting habitat may be present. There is unlikely to be any breeding habitat in the Proposal Site.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Vespadelus troughtoni</i> (Eastern Cave Bat)	V	-	Found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. 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.	3 – BioNet	Moderate.  The highest-quality foraging habitat is around the creek to the west of the study area, though this species may also forage around trees within the Proposal Site. No hollow-bearing trees were identified within the Proposal Site; however, some roosting habitat may be present. There is unlikely to be any breeding habitat in the Proposal Site.
<b>Migratory species</b>					
<i>Actitis hypoleucos</i> (Common Sandpiper)	-	M	Found along all coastlines of Australia and in many areas inland, the Common Sandpiper is widespread in small numbers. The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats.	PMST	Low in Proposal Site.  There is no habitat considered suitable for this species.
<i>Apus pacificus</i> (Fork-tailed Swift)	-	M	Recorded in all regions of NSW. The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher.	PMST	Low in Proposal Site.  May fly over the Proposal Site on occasion but would not use the habitats and would not be impacted.
<i>Ardenna pacifica</i> (Wedge-tailed Shearwater)	-	M	The Wedge-tailed Shearwater breeds on the east and west coasts of Australia and on off-shore islands. The species is common in the Indian Ocean, the Coral Sea and the Tasman Sea.	2 – BioNet	Low in Proposal Site.  There is no habitat considered suitable for this species.



Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Calidris acuminata</i> (Sharp-tailed Sandpiper)	-	M	The Sharp-tailed Sandpiper spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage. Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation; this includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, salt pans and hypersaline salt lakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgeland and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries, or seashores, and also swamps and creeks lined with mangroves. They tend to occupy coastal mudflats mainly after ephemeral terrestrial wetlands have dried out, moving back during the wet season. Sometimes they occur on rocky shores and rarely on exposed reefs.	PMST	Low in Proposal Site. There is no habitat considered suitable for this species.
<i>Calidris melanotos</i> (Pectoral Sandpiper)	-	M	In New South Wales (NSW), the Pectoral Sandpiper is widespread, but scattered. Records exist east of the Great Divide, from Casino and Ballina, south to Ulladulla. West of the Great Divide, the species is widespread in the Riverina and Lower Western regions. Prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains, and artificial wetlands.	2 – BioNet PMST	Low in Proposal Site. There is no habitat considered suitable for this species.
<i>Cuculus optatus</i> (Oriental Cuckoo)	-	M	The Oriental cuckoo is a non-breeding visitor to Australia. Inhabits rainforest margins, monsoon forest, vine scrub and mangroves, wet sclerophyll forest or open Casuarina, Acacia or Eucalyptus woodlands. It frequently occurs at edges or ecotones between habitat types.	PMST	Low in Proposal Site. There is no habitat considered suitable for this species.
<i>Gallinago hardwickii</i> (Latham's Snipe)	-	M	Recorded along the east coast of Australia from Cape York Peninsula through to south-eastern South Australia. Occurs in permanent and ephemeral wetlands up to 2000 m above sea-level.	PMST	Low in Proposal Site. There is no habitat considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Hirundapus caudacutus</i> (White-throated Needletail)	-	M	Widespread in eastern and south-eastern Australia. Almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. They also commonly occur over heathland but less often over treeless areas, such as grassland or swamps.	PMST	Low in Proposal Site. May fly over the Proposal Site on occasion but would not use the habitats and would not be impacted.
<i>Monarcha melanopsis</i> (Black-faced Monarch)	-	M	Widespread in eastern Australia. 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.	PMST	Low in Proposal Site. There is no habitat considered suitable for this species.
<i>Monarcha trivirgatus</i> (Spectacled Monarch)	-	M	Occurs along the entire east coast of Australia. Breeds in dense scrub in gullies of coastal ranges.	PMST	Low in Proposal Site. There is no habitat considered suitable for this species.
<i>Motacilla flava</i> (Yellow Wagtail)	-	M	Rare but regular visitor around Australian coast, especially in the NW coast Broome to Darwin. Found in open country near swamps, salt marshes, sewage ponds, grassed surrounds to airfields, bare ground, occasionally on drier inland plains.	PMST	Low in Proposal Site. There is no habitat considered suitable for this species.
<i>Myiagra cyanoleuca</i> (Satin Flycatcher)	-	M	Widespread in eastern Australia and vagrant to New Zealand. Inhabit 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.	PMST	Low in Proposal Site. There is no habitat considered suitable for this species.
<i>Numenius minutus</i> (Little Curlew)	-	M	Little Curlews generally spend the non-breeding season in northern Australia from Port Hedland in Western Australia to the Queensland coast. The Little Curlew is most often found feeding in short, dry grassland and sedgeland, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools or areas seasonally inundated.	4 – BioNet	Low in Proposal Site. There is no habitat considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Pandion haliaetus</i> (Osprey)	-	M	The Osprey has a global distribution with four subspecies previously recognised throughout its range. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water.	PMST	Low in Proposal Site. There is no habitat considered suitable for this species.
<i>Rhipidura rufifrons</i> (Rufous Fantail)	-	M	Occurs in coastal and near coastal districts of northern and eastern Australia. In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as Tallow-wood ( <i>Eucalyptus microcorys</i> ), Mountain Grey Gum ( <i>E. cypellocarpa</i> ), Narrow-leaved Peppermint ( <i>E. radiata</i> ), Mountain Ash ( <i>E. regnans</i> ), Alpine Ash ( <i>E. delegatensis</i> ), Blackbutt ( <i>E. pilularis</i> ) or Red Mahogany ( <i>E. resinifera</i> ); usually with a dense shrubby understorey often including ferns.	PMST	Low in Proposal Site. There is no habitat considered suitable for this species.
<i>Sternula albifrons</i> (Little Tern)	E	M	Migrating from eastern Asia, the Little Tern is found on the north, east and south-east Australian coasts, from Shark Bay in Western Australia to the Gulf of St Vincent in South Australia. In NSW, it arrives from September to November, occurring mainly north of Sydney. Almost exclusively coastal, preferring sheltered environments; however, may occur several kilometres from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records). Nests in small, scattered colonies in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes and islands.	1 – BioNet	Low in Proposal Site. There is no habitat considered suitable for this species.
<i>Tringa nebularia</i> (Common Greenshank)	-	M	The Common Greenshank does not breed in Australia; however, the species occurs in all types of wetlands and has the widest distribution of any shorebird in Australia.	PMST	Low in Proposal Site. There is no habitat considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Xenus cinereus</i> (Terek Sandpiper)	V	M	A rare migrant to the eastern and southern Australian coasts, being most common in northern Australia, and extending its distribution south to the NSW coast in the east. The two main sites for the species in NSW are the Richmond River estuary and the Hunter River estuary. The latter has been identified as nationally and internationally important for the species. In Australia, has been recorded on coastal mudflats, lagoons, creeks, and estuaries. Favours mud banks and sandbanks located near mangroves, but may also be observed on rocky pools and reefs, and occasionally up to 10 km inland around brackish pools.	BAM-C	Low in Proposal Site.  There is no habitat in the Proposal Site considered suitable for this species. There are no records of this species in the locality.
<p>Distribution and habitat requirement information adapted from: Australian Government Department of the Environment <a href="http://www.environment.gov.au/biodiversity/threatened/index.html">http://www.environment.gov.au/biodiversity/threatened/index.html</a> NSW Office of Environment and Heritage <a href="http://www.environment.nsw.gov.au/threatenedspecies/">http://www.environment.nsw.gov.au/threatenedspecies/</a> and IUCN red list <a href="https://www.iucnredlist.org/">https://www.iucnredlist.org/</a>.</p> <p>Key: CE = critically endangered, E = endangered, V = vulnerable, M = migratory</p>					



## Appendix B. Floristic survey composition and structure data

Table B.1: Species and estimated cover recorded in each of the Vegetation Integrity survey plots

Species	GF code	Cover %				
		VZ1_Plot 1	VZ1_Plot 2	VZ2_Plot 1	VZ3_Plot 1	VZ4_Plot 1
<i>Acacia longifolia</i>	SG	5	5	0.5		
<i>Acacia sp.</i>	SG				0.1	
<i>Adiantum formosum</i>	EG	1				
<i>Andropogon virginicus</i>	HT			0.1		0.2
<i>Angophora bakeri</i>	TG	40	40	3		
<i>Astrotricha obovata</i>	SG	0.2	0.2	0.2		
<i>Banksia oblongifolia</i>	SG	0.5				
<i>Billardiera scandens</i>	OG			40		
<i>Bolboschoenus fluviatilis</i>	GG					2
<i>Briza maxima</i>	EX				0.1	
<i>Callistemon linearis</i>	SG	0.5	0.5	4		
<i>Cassytha glabella</i>	OG	0.2				
<i>Cenchrus clandestinus</i>	EX				0.1	
<i>Cheilanthes sieberi</i>	EG	0.1		0.1	0.1	
<i>Conospermum taxifolium</i>	SG			1		
<i>Conyza bonariensis</i>	EX			0.4		
<i>Cortaderia selloana</i>	HT	0.2				
<i>Cynodon dactylon</i>	GG				0.1	0.1

Species	GF code	Cover %				
		VZ1_Plot 1	VZ1_Plot 2	VZ2_Plot 1	VZ3_Plot 1	VZ4_Plot 1
<i>Cyperus exaltatus</i>	GG					4
<i>Dampiera stricta</i>	FG	0.1	0.1		0.2	
<i>Dianella revoluta</i>	FG	0.2		0.2	0.1	
<i>Dillwynia retorta</i>	SG		0.2	5		
<i>Dillwynia sp.</i>	SG			0.1		
<i>Drosera auriculata</i>	FG			0.5		
<i>Drosera spatulata</i>	FG				0.5	
<i>Eucalyptus parramattensis subsp. decadens</i>	TG	30	30			
<i>Gahnia clarkei</i>	GG	0.1				
<i>Gompholobium minus</i>	SG		0.1			
<i>Haemodorum corymbosum</i>	FG				0.1	
<i>Hakea sericea</i>	SG	7	7	0.2		
<i>Hydrocotyle bonariensis</i>	EX					0.1
<i>Hypolaena fastigiata</i>	GG	0.2	0.2	5		
<i>Hypolepis muelleri</i>	EG					0.5
<i>Isopogon anemonifolius</i>	SG		0.5			
<i>Juncus cognatus</i>	EX					3
<i>Laxmannia gracilis</i>	FG		0.2	0.1		
<i>Leptospermum polygalifolium</i>	SG	5				
<i>Leptospermum trinervium</i>	SG	50	50		0.2	

Species	GF code	Cover %				
		VZ1_Plot 1	VZ1_Plot 2	VZ2_Plot 1	VZ3_Plot 1	VZ4_Plot 1
<i>Lomandra glauca</i>	GG			0.4		
<i>Lomandra longifolia</i>	GG			0.1		
<i>Lomandra sp.</i>	GG				0.1	
<i>Melaleuca decora</i>	SG		0.2			
<i>Melaleuca nodosa</i>	SG		1		0.1	
<i>Onopordum acanthium</i>	EX					0.1
<i>Opercularia aspera</i>	FG		0.2	0.1		
<i>Plantago lanceolata</i>	EX				0.1	
<i>Pratia purpurascens</i>	FG	0.1				
<i>Ptilothrix deusta</i>	GG	0.1	0.1	30	1	
<i>Pultenaea retusa</i>	SG	0.2				
<i>Schoenoplectus validus</i>	GG					2
<i>Taraxacum officinale</i>	EX			0.1	1	
<i>Themeda triandra</i>	GG		5			
<i>Typha orientalis</i>	GG					80
<i>Xanthorrhoea fulva</i>	OG			0.1		
*GF code: TG = Tree, SG = Shrub, GG = Grass and grass-like, FG = Forb, EG = Fern, OG = Other, HT = High Threat weed, EX = Exotic						

## Appendix C. Vegetation integrity assessment plot data

Table C.1: Vegetation integrity assessment plot data for vegetation zones in the Sydney Basin bioregion

Plot	PCT	Area	Patch Size	Condition Class	Zone	Easting	Northing	Bearing	TS	SS	GS	FoS	FeS	OS	TC	SC	GC	FoC	FeC	OC	LT	HT	LC	LFL	TS 5-9	TS 10-19	TS 20-29	TS 30-49	TS 50-79	TR	HTE
VZ1_Plot 1	1633	0.23	101	Intact	56	357730	6371513.0	36	2	8	3	3	2	1	70.0	68.4	0.4	0.4	1.1	0.2	0	1	71.0	2.0	1	1	1	1	0	1	0.2
VZ1_Plot 2	1633	0.23	101	Intact	56	357656	6371588.0	269	2	10	3	3	0	0	70.0	64.7	5.3	0.5	0.0	0.0	0	0	95.2	0.0	1	1	1	1	0	1	0.0
VZ2_Plot 1	1633	0.11	101	Regrowth	56	357717	6371501.0	100	1	8	4	4	1	2	3.0	11.0	35.5	0.9	0.1	40.1	0	0	50.0	0.0	1	1	0	0	0	1	0.1
VZ3_Plot 1	1633	0.59	101	Ground cover only	56	357674	6371559.0	135	0	3	3	4	1	0	0.0	0.4	1.2	0.9	0.1	0.0	0	0	72.0	0.0	0	0	0	0	0	0	0.0
VZ4_Plot 1	1037	0.02	101	Moderate	56	357741	6371578.0	70	0	0	5	0	1	0	0.0	0.0	8.1	0.0	0.5	0.0	0	0	10.0	0.0	0	0	0	0	0	0	0.2

\* Key: TS: No. tree species, SS: No. shrub species, GS: No. grass species, FoS: No. forb species, FeS: No. fern species, OS: No. other species, TC: Tree cover (%), SC: Shrub cover (%), GC: Grass cover (%), FoC: Forb cover (%), FeC: Fern cover (%), OC: Other cover (%), LT: No. Large Trees, HT: No. Hollow trees, LC: Average Litter Cover (%), LFL: Length Fallen Logs (m), TS5-9: Tree Stem 5-9cm, TS10-19: Tree Stem 10-19cm, TS20-29: Tree Stem 20-29cm, TS30-49: Tree Stem 30-49cm, TS50-79: Tree Stem 50-79cm, TR: Tree Regeneration, HTE: High Threat Exotic cover (%).

## Appendix D. EPBC Act significance assessments

Assessment of significance have been conducted for threatened species, populations and communities that were recorded in the Proposal Site during field surveys or were identified as having a moderate or higher potential to occur in the Proposal Site based on the presence of habitat. For threatened biodiversity listed under the EPBC Act, significance assessments have been completed in accordance with the EPBC Act Policy Statement 1.1 Significant Impact Guidelines (Department of Environment, 2013). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is affected, and upon the intensity, duration, magnitude and geographic extent of the impacts (Department of Environment, 2013). Importantly, for a 'significant impact' to be 'likely', it is not necessary for a significant impact to have a greater than 50 per cent chance of happening; it is sufficient if a significant impact on the environment is a real or not a remote chance or possibility (Department of Environment, 2013). This advice has been considered while undertaking the assessments.

The EPBC Act listed species subject to this assessment include:

- *Eucalyptus parramattensis subsp. decadens*
- Regent Honeyeater
- Swift Parrot
- Australasian Bittern
- Koala
- Grey-headed Flying-fox.

The Green and Golden Bell Frog was not assessed as the species has not been confirmed on the Proposal Site and a population is not expected to occur.

When assessing Vulnerable species, the assessment centres around whether the population that would be impacted is an 'important population' or not. An 'important population' is a population that is necessary for a species' long-term survival and recovery (Department of Environment, 2013). This may include populations identified as such in recovery plans, and/or that are:

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

This definition of what constitutes an 'important population' has guided the assessments for Vulnerable species.

### D.1.1 *Eucalyptus parramattensis subsp. decadens*

There are two separate meta-populations of *E. parramattensis subsp. decadens*. The Kurri Kurri meta-population is bordered by Cessnock—Kurri Kurri in the north and Mulbring—Aberdare in the south. Large aggregations of the subspecies are located in the Tomalpin area. The Tomago Sandbeds meta-population is bounded by Salt Ash and Tanilba Bay in the north and Williamstown and Tomago in the south. It is estimated that a total in excess of 15000 plants are extant in the region, and possibly as many as 25000 plants

A total of 23 trees have been mapped within the Proposal Site boundary for the electrical switchyard, displaying a range of age classes from juvenile to large hollow bearing trees. A fire protection zone of up to 10 m may also be required around the Proposal Site, there are an additional 14 trees currently mapped within this 10 m buffer that would require trimming or slashing, indicating a total impact of around 37 trees. As assessment of significance is provided below for this species which indicated that the loss of trees would not constitute a significant impact to the Kurri-Cessnock metapopulation. Of the trees within the buffer zone, nine of these are already subject to ongoing maintenance within the power easement



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

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

The subspecies is only found in the lower Hunter Valley area, and so the two meta-populations would be considered an important population.

Based on the estimated construction Proposal Site, the Proposal would result in the direct clearing of about 23 trees. Considering a further 10 m buffer that may be indirectly impacted for a future fire protection zone, a further 14 trees may be impacted, which would result in a total of 37 trees. These trees exist in a range of age classes, from juvenile (1-2 m) and up to mature (10 m tall). The majority of trees to be impacted are young and vigorous growing regrowth. Trees were also noted under the power easement and are subject to regular maintenance activities, which highlights the resilience of the species.

It is estimated that a total in excess of 15000 plants are extant in the region, and possibly as many as 25000 plants. Therefore, the Proposal would decrease the size of the population, however this loss is very small in the context of the population, and not considered significant.

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

The subspecies is only found in the lower Hunter Valley area, and so the two meta-populations would be considered an important population. The Proposal would place permanent gas fired power station infrastructure over an area of approximately 1 ha of land currently available to this species, and therefore would decrease the area of occupancy, however this loss is very small in the context of the population, and not considered significant.

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

The impact of habitat loss is proposed on the edge of an existing large area of habitat, where this habitat adjoins a cleared power easement. The remaining area of habitat on the eastern side of the switchyard is an isolated patch of habitat surrounded on all sides by cleared and disturbed lands. The Proposal would not break apart continuous areas of the *Eucalyptus parramattensis* subsp. *decadens* species into separate smaller 'fragments'. Impacts would be limited to the edge of a large contiguous patch. Habitat connectivity is expected to remain in a similar state after completion of the Proposal and there is unlikely to be an alteration to community composition, altered species interactions, or altered ecosystem functioning in the locality due to the action. Habitat fragmentation is not considered an important impact of the action with regard to its context and intensity.

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

Due to the conservation significance of this species, all remaining patches and associated habitat within NSW are likely to be important for its survival. An impact of 37 trees has been calculated along the edge of the retained vegetation; this represents a very small impact in the context of the size of this population. Therefore, it is unlikely that the Proposal would adversely affect habitat critical to the survival of *Eucalyptus parramattensis* subsp. *decadens*.

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

The trees to be removed from the population would slightly reduce the pollination and breeding opportunities in the localised area. However, based on observations at the Proposal Site, and on review of records of this species in surrounding areas, which show very large numbers present, it is highly unlikely that the small loss of trees would impact on the recruitment of this species.

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

Where the species would be removed by the action, all abiotic factors (i.e. water, nutrients, and soil) would be permanently modified and/or destroyed through vegetation removal and construction of infrastructure. The Proposal may also modify abiotic factors of retained vegetation based on the proximity of its operations, though these modifications are likely to be very minor. Based on observations at the Proposal Site, and on review of records of this species in surrounding areas, which show very large numbers present, it is highly unlikely that the Proposal would lead to a decline of the species.

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

The composition of the species is likely to be modified as a result of the action through weed invasion and removal of vegetation. The patch of the species to be impacted is in moderate condition though exists on the edge of a cleared area, where weeds were noted. Some minor reduction in ecological function can be expected from indirect edge effects, although this is not expected to significantly impact on this tree species which is observed at the Proposal Site to be resilient from disturbance.

*Phytophthora* infects the roots of plants and has the potential to cause dieback. Machinery associated with vegetation clearance and subsequent construction for the Proposal has the potential to introduce and transmit weed propagules and *Phytophthora*. This is a potential indirect impact through the spread and transmission of weeds and pathogens into retained habitat.

These impacts can be mitigated through the development and implementation of suitable control measures for vehicle and plant hygiene but an impact, particularly from weeds, is likely. The Proposal mitigation strategy and environmental management procedures should include guidance for preventing the introduction and/or spread of weeds and disease-causing agents such as bacteria and fungi. Considering the current disturbance of vegetation adjacent to the study area, the Proposal is unlikely to cause a substantial reduction in the quality or integrity of the occurrence of this species.

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

A Draft Recovery Plan (DECCW NSW 2009) has been prepared for *Eucalyptus parramattensis subsp. decadens*. The Recovery Plan proposed for 2010–2020 aims to abate the identified threats and maintain the habitat of *Eucalyptus parramattensis subsp. decadens* across its natural range to ensure its long-term persistence in the wild. The main threats to this species and the priority actions required to address them are largely understood. The Conservation Advice sufficiently outlines the priority actions needed for this species and many of the threats affecting this species are best managed at a landscape scale, coordinated with management of other species.

## Conclusion

In summary, the Proposal is considered unlikely to have an adverse effect on the extent of *Eucalyptus parramattensis subsp. decadens* such that the local occurrence of it is likely to be placed at further risk of extinction. The impacts to this species are mostly moderate-quality vegetation, and a small isolated patch subject to a range of existing impacts. The impact is small when considered in the context the extent of this species within the broader locality. The highest quality vegetation in the study area would largely be avoided through design. Considering the context of this species and intensity of the potential impacts from the Proposal, an overall conclusion has been made that the Proposal is unlikely to result in a significant impact to this species.

### D.1.2 Regent Honeyeater (*Anthochaera phrygia*) (Critically endangered)

The Regent Honeyeater is critically endangered as its population has decreased to very low numbers. The number of mature birds that remain is estimated to be between 350 and 400. Many factors have contributed to the Regent Honeyeater's critically endangered status including fragmentation of key habitats such as temperate woodlands, small population size being vulnerable to disturbance and invasive and competitive species such as the Noisy Miner.

Ongoing clearing of woodland and forest containing the key eucalypt species preferred by regent honeyeaters is a major threat. Many remnants are degraded and likely missing important ecological features, such as large trees and/or high-quality nectar flows. Fragmentation may also expose breeding populations of regent honeyeaters to greater predation pressure and increased harassment from other aggressive honeyeaters.

Changes to nectar availability in the regent honeyeater's key eucalypt species affect the distribution and abundance of regent honeyeaters. Nectar availability is reduced through clearing, drought, fire, or presence/absence of competing species. Where fire intervals are too frequent, flowering events and maturation of nectar rich plant species may be reduced, resulting in a reduction of foraging resources for nectivorous birds.

The key habitats on the Cessnock-Kurri area for this species are typically associated with the lower Hunter Spotted Gum – Ironbark forests. It is evident that few areas across the entire range of the Regent Honeyeater appear to have been frequented to the extent that the Cessnock-Kurri woodlands have in recent years, which is outside of the recognised core breeding areas. Existing mapping of important areas of habitat for this species extend across the intact woodland on the Proposal Site. However, this mapping does not reflect the actual vegetation types that are present and is not consistent with the known important habitat for this species as reported in the recovery plan, and existing literature (e.g. Birdlife Australia 2013)

Ongoing clearing of woodland and forest containing the key eucalypt species preferred by regent honeyeaters is a major threat. The dominating canopy species at the Proposal Site include *Angophora bakeri* (narrow-leaved apple) and *Eucalyptus parramattensis* subsp. *decadens*, with a low density of *Eucalyptus agglomerate* (Stringybark). The Recovery Plan for the Regent Honeyeater identifies 9 key foraging species, none of which are found in PCT 1633 confirmed within the Proposal Site. In addition to this the plan also describes other tree species which may be regionally important, for example the Lower Hunter Spotted Gum Ironbark forest (not present on the Proposal Site), as well as flowering of species such as *Eucalyptus eugenoides* (thin-leaved stringybark) and other stringybark species and *Eucalyptus fibrosa* (broad-leaved ironbark). One juvenile *Eucalyptus fibrosa* was found in land surrounding the Proposal Site (within 30 m) in addition to several *Eucalyptus agglomerate* (Stringybark) also found in the buffer area.

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

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

In 2011, the Regent Honeyeater's population was estimated with medium reliability at 350–400 mature birds. The majority of these birds exist in the Bundarra-Barraba area and the Capertee Valley in NSW, and north-eastern Victoria. The impacts to a small area of lower quality potential foraging habitat in the study area (includes 0.40 ha of intact woodland direct and indirect impact) is considered unlikely to lead to a long-term decrease in the size of the Regent Honeyeater population as the work would not impact on the critical remaining strongholds of the species.

- **reduce the area of occupancy of the species**

The Regent Honeyeater is endemic to south-east Australia, where it is widespread but with an extremely patchy distribution. The Regent Honeyeater's area of occupancy is estimated at 300 km<sup>2</sup> but in NSW, the Regent Honeyeater has an area of occupancy of less than 200 km<sup>2</sup>.

The key habitats on the Cessnock-Kurri area for this species are typically associated with the lower Hunter Spotted Gum – Ironbark forests. It is evident that few areas across the entire range of the Regent Honeyeater appear to have been frequented to the extent that the Cessnock-Kurri woodlands have in recent years, which is outside of the recognised core breeding areas. Existing mapping of important areas of habitat for this species extend across the intact woodland on the Proposal Site. However, this mapping does not reflect the actual vegetation types that are present and is not consistent with the known important habitat for this species as reported in the recovery plan, and existing literature (e.g. Birdlife Australia 2013).

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

Importantly, the action would not result in fragmentation of habitat for the Regent Honeyeater. This species is highly mobile and capable of long-distance flight. However, movements between breeding populations are not frequent and most birds appear to remain in the breeding areas of Bundarra-Barraba area and the Capertee Valley in NSW, and north-eastern Victoria.

The action is considered unlikely to fragment existing populations as movement corridors within the locality would remain intact. The proposed impacts are on the edge of the mapped habitat and would not be significant to the breeding and dispersal or the genetic diversity of this species. Therefore, the Proposal is not expected to lead to fragmentation of habitat for this species.

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

The key habitats on the Cessnock-Kurri area for this species are typically associated with the lower Hunter Spotted Gum – Ironbark forests. It is evident that few areas across the entire range of the Regent Honeyeater appear to have been frequented to the extent that the Cessnock-Kurri woodlands have in recent years, which is outside of the recognised core breeding areas. Existing mapping of important areas of habitat for this species extend across the intact woodland on the Proposal Site. However, this mapping does not reflect the actual vegetation types that are present and is not consistent with the known important habitat for this species as reported in the recovery plan, and existing literature (e.g. Birdlife Australia 2013). The habitat to be removed is not considered critical for this species, given the absence of important foraging species.

- **disrupt the breeding cycle of a population**

The key breeding areas for the Regent Honeyeater are the Chiltern section of Chiltern-Mt Pilot National Park (NP), north-east Victoria; Capertee Valley, central east NSW; and the Bundarra-Barraba region, northern NSW. Other breeding areas include the Wangaratta-Mansfield region, Victoria; Warrumbungle NP, Pilliga forests and Mudgee-Wollar region, central north NSW; Hunter Valley and Clarence Valley, east NSW; and south-east Queensland.

While no nest sites were noted during the survey, these surveys were conducted outside the breeding period for Regent Honeyeater. There are no reported nesting sites from the Proposal Site, and there is a low likelihood that the small area within the Proposal Site boundary would be preferred for nesting, although can't be ruled out entirely. The chance of disrupting the breeding cycle is very low, and activities should be timed to avoid the breeding activities.

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

Ongoing clearing of woodland and forest containing the key eucalypt species preferred by regent honeyeaters is a major threat. The dominating canopy species at the Proposal Site include *Angophora bakeri* (narrow-leaved apple) and *Eucalyptus parramattensis subsp. decadens*, with a low density of *Eucalyptus agglomerata* (stringybark). The Recovery Plan for the Regent Honeyeater identifies 9 key foraging species, none of which are found in PCT 1633 confirmed within the Proposal Site. In addition to this the plan also describes other tree species which may be regionally important, for example the Lower Hunter Spotted Gum Ironbark forest (not present on the Proposal Site), as well as flowering of species such as *Eucalyptus eugenoides* (thin-leaved stringybark) and other stringybark species and *Eucalyptus fibrosa* (broad-leaved ironbark). One juvenile *Eucalyptus fibrosa* was found in land surrounding the Proposal Site (within 30 m) in addition to several *Eucalyptus agglomerata* (stringybark) also found in the buffer area.

The impacts to foraging and breeding habitat are minimal. This impact to habitat for from the Proposal is not expected to lead to a decline in the species in this region considering the large amount of higher quality foraging habitat available to local animals around the Kurri Kurri region.

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

The main invasive species harmful to habitat for the Regent Honeyeater is weeds. Noisy Miners and Bell Miners are abundant in the habitat which may make the habitat less suitable for the Regent Honeyeater due to competitive exclusion. The action may result in weed invasion and the removal of habitat may concentrate local miner populations increasing competition, however the vegetation removal would be minor. The management of invasive species would be managed under the construction environmental management plan and during operation.

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

There are no known disease issues affecting this species in relation to the action. The action would be unlikely to increase the potential for significant disease vectors to affect local populations.

Infection of native plants by *Phytophthora cinnamomi* has been identified as being spread by construction machinery. This water-borne mould infects the roots of plants and has the potential to cause dieback. Machinery associated with vegetation clearance and subsequent construction has the potential to transmit the fungus to remaining native vegetation remnants of the species. This is a potential indirect impact to the species through the transmission of pathogens into retained habitat near the facility. This can be mitigated through the development and implementation of suitable control measures for vehicle and plant hygiene and is unlikely to have a significant impact. It is the intention to use current best practice hygiene protocols as part of the CEMP to prevent the introduction or spread of pathogens.

The Proposal mitigation strategy and environmental management procedures would include guidance for preventing the introduction and/or spread of disease-causing agents such as bacteria and fungi.

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

The *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia)* (Department of Environment Climate Change and Water, 2009) lists a number of actions that are considered important to maintain populations of this species. The main threats to this species and the priority actions required to address them are largely understood. The Conservation Advice sufficiently outlines the priority actions needed for this species and many of the threats affecting this species are best managed at a landscape scale, coordinated with management of other species.

## Conclusion

The Regent Honeyeater would suffer a small reduction in extent of marginal (not preferred) habitat from the action. However, impacts are predicted to be minimal as this species is unlikely to use the study area consistently and the impact is very minor in the context of the extent of habitat available to this species in the locality. The action is unlikely to reduce the population size of the Regent Honeyeater or decrease the reproductive success of this species. After consideration of the factors above, an overall conclusion has been made that the action is unlikely to result in a significant impact to the Regent Honeyeater.

### D.1.3 Swift Parrot (*Lathamus discolor*) – (Critically endangered)

The Swift Parrot breeds in Tasmania during the Australian summer and the entire population migrates north to mainland Australia for the winter. During the winter migration period, the parrots disperse across a broad landscape, foraging on nectar and lerps in eucalypts mainly in Victoria and NSW. In New South Wales, Swift Parrots forage in forests and woodlands throughout the coastal and western slopes regions each year. Coastal regions tend to support larger numbers of birds when inland habitats are subjected to drought.



Vegetation communities and key tree species that provide important nesting and foraging habitat for Swift Parrots in NSW include *Eucalyptus sideroxylon* (Mugga Ironbark), *Eucalyptus microcarpa* (Grey Box), *Eucalyptus melliodora* (Yellow Box), *Eucalyptus albens* (White Box), *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus pilularis* (Blackbutt) and *Corymbia maculata* (Spotted Gum). The use of these habitats is dependent on prevailing climatic conditions and corresponding food availability. The production of lerp and nectar food resources in these habitats and the availability of nesting hollows are considered the main limiting factors to the species' survival and capacity to breed. Due to the variable production of nectar and lerps across this species' range, it is considered important to protect and manage a broad range of habitats to provide a range of foraging resources.

Increases in fire frequency pose a significant threat to avian communities. Where fire intervals are too regular, flowering events and maturation of nectar rich plant species may be reduced, resulting in a reduction of foraging resources for nectivorous birds. This is of particular concern in coastal New South Wales and in central Victoria where there is increasing residential and industrial development in close proximity to Swift Parrot habitat.

The Lower Hunter forests within the Cessnock-Kurri Kurri-Branxton area are of state significance for the nationally endangered Swift Parrot. There is known important foraging habitat present within the locality of the Proposal for the Swift Parrot, however there are no important Endangered Ecological Communities listed under the BC Act present on the Proposal Site for the Swift Parrot. The Swift Parrot is a winter visitor to the region and typically associated with flowering eucalyptus trees. Important habitat can include flowering Eucalyptus trees, such as the Spotted Gum and Swamp Mahogany. Neither of these species occur within the small area would be impacted as a result of this Proposal which is dominated by *Angophora bakeri* (narrow-leaved apple) and *Eucalyptus parramattensis subsp. decadens*. As there is a limited habitat value for this species within the Proposal Site, there is no significant impact expected.

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

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

The study area contains some potential low-quality foraging habitat for the Swift Parrot. While the habitat in the study area is not optimal, the loss of potential feed trees would directly affect the species opportunity to feed in the area. However, the study area is not considered a critical area for the Swift Parrot. The Swift Parrot may utilise trees in the study area for foraging intermittently when no other suitable inland (i.e. box ironbark woodlands) or coastal resources (i.e. Spotted Gum and Swamp Mahogany forests) are available. However, the loss of around 0.40 ha of low-quality habitat for this species would not lead to a long-term decrease in the size of the population.

The Swift Parrot does not breed in the study area and the extent of habitat remaining in the study area would provide sufficient resources to sustain future visitation, such that the action is unlikely to lead to a long-term decrease in the size of the population.

- **reduce the area of occupancy of the species**

As a specialist nectarivore dependent on flowering eucalypts, Swift Parrots are vulnerable to the loss of quantity and quality of key forage tree species. As a large-scale migrant, it has the ability to cover vast areas of its winter range, seeking suitable flowering eucalypt habitat. The species is an occasional visitor to the region and may utilise trees in the study area for foraging intermittently when no other suitable resources are available. However, no key winter flowering species were noted to occur within the Proposal Site, and therefore the Proposal is not expected to reduce the area of occupancy.

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

Importantly, the action would not result in fragmentation of habitat for the Swift Parrot. This species is highly mobile and as a regular behaviour flies long distances over open areas to move between suitable foraging habitats. The action would not affect the movement of the Swift Parrot between habitat patches or fragment the population. The action is considered unlikely to fragment existing populations as movement corridors within the

locality would remain intact. The proposed impacts are on the edge of the mapped habitat and would not be significant to the breeding and dispersal or the genetic diversity of this species.

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

Key habitats for this species on the coast and coastal plains of New South Wales include large stands of *Corymbia maculata* (Spotted Gum), *E. robusta* (Swamp Mahogany), *Eucalyptus gummifera* (Red Bloodwood) and *E. tereticornis* (Forest Red Gum) forests. None of these key winter flowering species were identified in the vegetation to be impacted which is dominated by *Angophora bakeri* (Narrow-leaved Apple) and *Eucalyptus parramattensis subsp. decadens* and therefore the habitat is the Proposal Site is not considered critical for this species.

- **disrupt the breeding cycle of a population**

The Swift Parrot is endemic to south-eastern Australia and breeds only in Tasmania and migrates to mainland Australia in autumn. As such, the action would not impact on breeding habitat for this species.

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

The Lower Hunter forests within the Cessnock-Kurri Kurri-Branxton area are of state significance for the nationally endangered Swift Parrot. There is known important foraging habitat present within the locality of the Proposal for the Swift Parrot, however there are no important Endangered Ecological Communities listed under the BC Act present on the Proposal Site for the Swift Parrot. The Swift Parrot is a winter visitor to the region and typically associated with flowering eucalyptus trees. Important habitat can include flowering Eucalyptus trees, such as the Spotted Gum and Swamp Mahogany. Neither of these species occur within the small area that would be impacted on as a result of this Proposal, which is dominated by *Angophora bakeri* (narrow-leaved apple) and *Eucalyptus parramattensis subsp. decadens*. As there is a limited habitat value for this species within the Proposal Site, there is no significant impact expected.

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

The main invasive species harmful to the habitat for the swift parrot is weeds. Noisy Miners and Bell Miners are abundant in the habitat which may make the habitat less suitable for the Swift Parrot due to competitive exclusion. The action may result in weed invasion and the removal of habitat may concentrate local miner populations increasing competition. The management of invasive species would be managed under the construction environmental management plan and during operation.

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

There are no known disease issues affecting this species in relation to the action. The action would be unlikely to increase the potential for significant disease vectors to affect local populations.

Infection of native plants by *Phytophthora cinnamomi* has been identified as being spread by construction machinery. This water-borne mould infects the roots of plants and has the potential to cause dieback. Machinery associated with vegetation clearance and subsequent construction has the potential to transmit the fungus to remaining native vegetation remnants of the species. This is a potential indirect impact to the species through the transmission of pathogens into retained habitat near the facility. This can be mitigated through the development and implementation of suitable control measures for vehicle and plant hygiene and is unlikely to have a significant impact. It is the intention to use current best practice hygiene protocols as part of the CEMP to prevent the introduction or spread of pathogens.

The Proposal mitigation strategy and environmental management procedures would include guidance for preventing the introduction and/or spread of disease-causing agents such as bacteria and fungi.

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

The *Draft National Recovery Plan for the Swift Parrot (Lathamus discolor)* (Department of Environment Climate Change and Water, 2009) outlines the following actions:

- 1) Identify the extent and quality of habitat
- 2) Manage and protect Swift Parrot habitat at the landscape scale
- 3) Monitor and manage the impact of collisions, competition, and disease
- 4) Monitor population and habitat.

The recovery actions listed above are largely not applicable to the action and the action is not expected to interfere substantially with the recovery of the species.

## Conclusion

The local population may suffer a small reduction in extent of suitable (low quality and not preferred) foraging habitat from the action, but no critical important habitat of the Swift Parrot would be impacted by the Proposal. The action is unlikely to reduce the population size of the Swift Parrot or decrease the reproductive success of this species. The action would not interfere with the recovery of the Swift Parrot. After consideration of the factors above, an overall conclusion has been made that the action is unlikely to result in a significant impact to the Swift Parrot.

### D.1.4 Australasian Bittern (*Botaurus poiciliptilus*) Endangered species

The Australasian Bittern is considered to potentially use habitat within the Proposal Site and associated with the Typha rushland community (PCT 1737). The impacts to the Typha rushland community are minor and estimated at 0.05 ha. Furthermore, the Tall Spike Rush freshwater wetland community (PCT 1740) also provides a large area of potential habitat, and this exists within the deep sections of the north dam outside the area of impact. This species may utilise the habitat within the Proposal Site on occasion; however, the likelihood that the small area of Typha sedgeland is utilised frequently, is considered low. There are no historic records of this species within the locality of the Proposal.

- **Lead to a long-term decrease in the size of a population**

Australasian Bittern is dependent on tall densely vegetated wetlands and creeks and has adapted to using modified or degraded wetlands including artificially constructed environments. It is estimated that there are less than 1,600 adults left in NSW. However, nesting locations for this species are not published and their location in relation to the study area is not known.

Indirect impacts would be associated with edge effects, light, and noise, these would be localised in relation to home range and territory. The number of individuals or pairs potentially affected is not known, however the small area of the Typha sedgeland to be impacted by the Proposal (0.05 ha) is minor in relation to the habitat and home range requirements of the species. There are considerably larger wetland habitats in the landscape buffer, that are likely better provide for the life-cycle requirements of this species. The very small size of the PCTs in the Proposal Site suggests that any use of this habitat would only be temporary, and the habitat is too small to support the ongoing life cycle needs for this large species.

- **Reduce the area of occupancy of the species**

The Australasian Bittern is widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Australasian Bittern favour permanent freshwater wetlands and riparian vegetation with tall, dense vegetation, particularly bulrushes (*Typha* spp.) and spike rushes (*Eleocharis* spp.). The Proposal would result in a direct impact to approximately 0.05 ha of potential habitat for the Australasian Bittern, comprising of the Typha rushland community. The proposed impact would be minor and not considered significant to the area of occupancy of this species.

The review of habitat availability and records of this species suggest that potential habitat is widespread throughout the region including dense vegetation on the margins of freshwater creeks, rivers and natural or artificial wetlands.

- **Fragment an existing population into two or more populations**

The Proposal would not result in isolation of remnant vegetation patches and would not create barriers to the movement of this species on either a patch or landscape scale. The actual Proposal Site is largely already currently cleared for historic industrial purposes and does not contain large areas of habitat for this species. The impacts which would occur as a result of the Proposal would be minor, restricted to the edge of larger potential habitat and would not contribute further to fragmentation.

There is limited data on the distribution of local and regional populations to identify if a population would be fragmented, however potential habitat would be traversed. This species is capable of dispersing across fragmented habitats including easements and cleared land.

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

The Proposal would result in the direct impact to approximately 0.05 ha of the Typha rushland community, which may provide potential foraging habitat for the Australasian Bittern. As discussed, this small area of marginal habitat is unlikely to be critical for any resident birds in this locality or provide critical habitat for new birds to establish a territory.

Swamp Creek and Black Waterhole creek flow into the Swamp Creek wetland located on the northern-eastern edge of the landscape buffer. It is assumed that these habitats have potential to contribute to the long-term maintenance of the species including maintaining genetic diversity and the long-term evolutionary development of the species. However, these habitats would not be impacted by the Proposal.

- **Disrupt the breeding cycle of a population**

The Proposal would result in a minor impact on potential foraging habitat for the Australasian Bittern, however, the Proposal Site shows no evidence or records of this species. Measures to minimise impacts on waterways during construction would be implemented as part of the construction environmental management plan.

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

Although there is no known species recorded of the Australasian Bittern within the Proposal Site, impacts would result in a decrease in potential wetland habitat including approximately 0.05 ha of the Typha rushland community. Considerably larger areas of suitable habitat containing Typha rushland, occur widely throughout the surrounding landscape. The potential impact from the Proposal is not expected to lead to a decline in the species in this region.

- **Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat**

The potential for weed invasion is considered possible with the Proposal and appropriate controls would be required during construction and operation of the Power Station to reduce this threat. Invasive species would be managed during construction under a CEMP and under normal site maintenance during operation.

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

Infection of native plants by *Phytophthora cinnamomi* has been identified as being spread by construction machinery. This water-borne fungus infects the roots of plants and has the potential to cause dieback. Machinery associated with vegetation clearance and subsequent construction for the Proposal has the potential to transmit the fungus to remaining native vegetation remnants of the species. This is a potential indirect impact to the species through the transmission of pathogens into retained habitat next to the Proposal. This can be mitigated through the development and implementation of suitable control measures for vehicle and plant hygiene and is

unlikely to have a significant impact. The Proposal's environmental management procedures would include guidance for preventing the introduction and/or spread of disease-causing agents such as bacteria and fungi.

- **Interfere with the recovery of the species.**

The *Draft National Recovery Plan for the Australasian Bittern (Botaurus poiciloptilus)* (Department of the Environment and Energy, 2019) outlines the following priorities:

- Taking prompt action is necessary in order to mitigate the key threats to Australasian Bittern and also provide valuable information to help identify long-term population trends
- Action would provide a more informed basis for the long-term management and recovery of Australasian Bittern
- Action is desirable, but not critical to the recovery of Australasian Bittern or assessment of trends in that recovery.

The Proposal would not conflict with the recovery of this species. The Proposal Site has been selected on the basis of avoiding high quality habitats for threatened fauna, and mitigation and offset measures would target threatened fauna. There are no priority sites for conservation of this species within the Proposal Site boundary.

## Conclusion

The Australasian Bittern would result in a small reduction of potential habitat of the Typha rushland community, totalling approximately 0.05 ha, as a result of the Proposal. Although no species has been recoded within the Proposal Site or the locality of the Proposal. Furthermore, potential habitat exists within the Proposal Site consisting of the Tall Spike Rush freshwater wetland community PCT 1740, which occurs across the deep sections of north dam; however, this habitat would not be impacted. The Proposal is considered unlikely to reduce the population size of the Australasian Bittern or decrease its reproductive success. The Proposal would not interfere with the recovery of the Australasian Bittern and would not contribute to the key threats to this species. After consideration of the factors above, the overall conclusion is made that the Proposal is unlikely to result in a significant impact to the Australasian Bittern. The impact to Australasian Bittern habitat from the Proposal is not considered to be of significance having regard to its context and intensity.

### D.1.5 Koala (*Phascolarctos cinereus*) Vulnerable species

The quality of Koala habitat depends on the proportion of known feed tree species in an area. Feed trees species are recognised in the *Koala Recovery Plan* (Department of Environment and Climate Change 2008c), and the OEH (2014). To investigate the presence and density of koala feed trees, the Koala Rapid Assessment Method (KRAM) (Woosnam-Merchez *et al.* 2012) was used. The KRAM was applied to the entire area of intact vegetation to be impacted (0.40 ha). The primary, secondary and supplementary Koala feed tree species as identified by the OEH for the Central Coast and North coast Koala Management Area were targeted during the habitat survey.

The vegetation in the study area contains the primary Koala feed tree species *Eucalyptus parramattensis subsp decadens* with the occasional supplementary feed tree *Eucalyptus agglomerata* (Stringybark) suggesting the potential for a low density or transient Koala use. however, no evidence of recent use of the area to be impacted was noted from a comprehensive search for faecal pellets.

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

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

An important population has not been identified at the Proposal Site. The Proposal would directly and indirectly impact on around 0.40 ha of intact habitat which includes around 23 potential feed tree species, the remaining tree species impacted are in low regrowth areas which are considered unlikely to be used by koalas. This is a very minor impact considering the extent of suitable habitat for this species in the surrounding area including the



widespread and abundant presence of *Eucalyptus parramattensis* in the surrounding landscape. The impact is not expected to lead to a long-term decrease on the size of a local population.

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

An important population has not been identified in the study area. The Proposal would directly impact on around 0.40 ha of intact forest vegetation which includes around 23 potential feed tree species. Remaining impacts to habitat and potential feed trees is within low regrowth not expected to be frequented by koalas.

This is a very minor impact considering the extent of suitable habitat for this species in the surrounding area including the widespread and abundant presence of *Eucalyptus parramattensis* in the landscape

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

The Proposal is considered unlikely to result in any further fragmentation of habitat for an important population. Vegetation removal is limited to the edge of existing cleared land and would not involve breaking up larger fragments of remnant vegetation.

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

Habitat critical to the survival of a species refers to areas that are necessary for activities such as:

- Foraging, breeding, roosting, or dispersal
- For the long-term maintenance of the species including the maintenance of other species essential to the survival of the species, such as pollinators
- To maintain genetic diversity and long-term evolutionary development
- For the reintroduction of populations or recovery of the species.

The habitat within the study area contains a primary feed tree species, however no recent evidence was observed to indicate regular use of this habitat by Koala, and on this basis, the habitat is not considered critical for local populations, and there is no evidence of an important population at this location.

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

There would be a minor impact on foraging habitat that does not show evidence of use by koalas. The small area of habitat (0.40 ha) within the study area is not considered to support a sedentary breeding population. No impacts to breeding Koalas are predicted.

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

The impacts from the Proposal are limited to removal of a small extent of potential Koala habitat that does not show any evidence of regular use. Considerably larger areas of suitable habitat containing *Eucalyptus parramattensis*, occur widely throughout the surrounding landscape. The potential impact from the Proposal is not expected to lead to a decline in the species in this region.

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

The potential for weed invasion was considered possible with a proposal of this nature and appropriate controls are required during construction and operation of the road to reduce this threat. The management of invasive species would be managed under the construction environmental management plan.

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

There are no known disease issues affecting this species in relation to the Proposal. The Proposal would be unlikely to increase feral animal abundance or the potential for significant disease vectors to affect local

populations. The Proposal is considered unlikely to introduce or result in the spread of chlamydiosis or Koala Retrovirus.

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

The Threatened Species Scientific Committee (2012) identifies threat abatement actions that would support the recovery of the Koala in Queensland, NSW and the ACT, including:

- Develop and implement a development planning protocol to be used in areas of Koala sub-populations or sub-population fragments to prevent loss of Koala sub-populations, habitat critical to the survival of the species and vital habitat connectivity
- Development plans should explicitly address ways to mitigate risk of vehicle strike when development occurs adjacent to, or within, Koala habitat
- Develop and implement a management plan to control the adverse impacts of predation on Koalas by dogs in urban, peri-urban, and rural environments
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them, if necessary
- Identify populations of high conservation priority
- Develop and implement options of vegetation recovery and re-connection in regions containing fragmented Koala populations, including inland regions in which Koala populations were diminished by drought and coastal regions where development pressures have isolated Koala populations
- Investigate formal conservation arrangements, management agreements and covenants on private land, and, for both Crown and private land, investigate and/or secure inclusion of habitat critical to the survival of the Koala in reserve tenure, if possible
- Engage with private landholders and land managers responsible for the land on which populations occur and encourage these key stakeholders to contribute to the implementation of conservation management actions
- Manage any other known, potential, or emerging threats such as a Bell Miner (*Manorina melanophrys*) Associated Dieback or Eucalyptus rust.

The Proposal is not expected to interfere substantially with the recovery actions identified for the Koala as listed above.

## Conclusion

The Koala would suffer a small reduction in extent of potential habitat from the Proposal, which constitutes a very minor impact in the context of the potential habitat available to this species in the Cessnock-Kurri area. Furthermore, the habitat in the Proposal Site was searched for evidence of koala use and there were no positive signs to suggest koalas are currently using the habitat to be impacted.

The Proposal is considered unlikely to reduce the population size of the Koala or decrease the reproductive success of this species in this locality if indeed populations do occur. The Proposal would not interfere with the recovery of the Koala and would not contribute to the key threats to this species. After consideration of the factors above, an overall conclusion has been made that the Proposal is unlikely to result in a significant impact to the Koala. The impact to koala habitat from the Proposal is not considered to be of significance having regard to its context and intensity.

### D.1.6 Grey-headed Flying-fox (*Pteropus poliocephalus*) Vulnerable species

The Grey-headed Flying-fox is considered to potentially use the intact area of forest impacted by this Proposal as potential foraging habitat, when trees are flowering and fruiting based on the presence of suitable foraging habitat, particularly *Eucalyptus parramattensis* subsp *decadens*, *Angophora bakeri* (narrow-leaved apple) and

*Eucalyptus fibrosa* (Red Ironbark). The desktop research and survey confirmed there are no roost camps present at the Proposal Site.

The Proposal would have impacts on the Grey-headed Flying-fox via direct impact on 0.40 ha of intact woodland within the Proposal Site, consisting of PCT 1633 – Parramatta Red Gum – Narrow leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area. The remaining low regrowth habitats also being impacted provide much lower value as potential foraging habitat. This loss of potential foraging habitat is very minor in the context of similar and better-quality foraging available throughout the Cessnock-Kurri Kurri locality.

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

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

The Grey-headed Flying-fox exists as one interconnected population along the eastern Australian coastal belt from Rockhampton in central Queensland to Melbourne in Victoria. As a result, for this assessment, the impact has been considered in terms of 'important habitat' as opposed to the presence of an 'important population'.

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

The desktop research and survey confirmed there are no roost camps present at the Proposal Site. The Proposal would have impacts on potential foraging habitat for the Grey-headed Flying-fox via direct loss of around 0.40 ha of intact woodland within the Proposal Site, consisting of PCT 1633 – Parramatta Red Gum – Narrow leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area. The remaining low regrowth habitats also being impacted provide much lower value as potential foraging habitat. This loss of potential foraging habitat is very minor in the context of similar and better-quality foraging habitat that is available in the Cessnock-Kurri Kurri locality and is not considered to lead to a long-term decrease the Grey-headed Flying-fox population.

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

The Grey-headed Flying-fox exists as one interconnected population along the eastern Australian coastal belt from Rockhampton in central Queensland to Melbourne in Victoria. The impact on this Proposal is minor and exists in a landscape that has a large extent of remaining vegetation (i.e. > 60 per cent). This minor impact (0.40 ha) is not expected to reduce the area of potential occupancy for the Grey-headed Flying-fox population.

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

As this species is highly mobile and capable of accessing spatially separated resources, this minor impact would not fragment habitat or divide a population.

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

The Grey-headed Flying-fox typically exhibits a very large home range and is known to travel distances of at least 50 km from roost sites to access seasonal foraging resources. There are no known roost camps within the study area and the Proposal Site does not provide critical roosting habitat.

The draft recovery plan for the Grey-headed Flying-fox identifies critical foraging habitat for this species as:

- Productive during winter and spring when food bottlenecks have been identified
- Known to support populations of >30,000 individuals, within an area of 50 km radius of a camp site
- Productive during the final weeks of gestation, and during the weeks of birth, lactation, and conception (Sept-May)

- Productive during the final stages of fruit development and ripening in commercial crops affected by Grey-headed Flying-foxes
- Known to be continuously occupied as a camp site.

Native vegetation within the study area may constitute foraging habitat, but the affected area of foraging habitat would represent a small percentage of the total extent of important foraging vegetation types present within a 50 km radius of the East Cessnock camp and the Raymond Terrace camp. Given the extensive nature of high-quality foraging habitats connected to the Proposal Site, including the Werakata National Park and the Aberdare State Forest, the Proposal is not expected to adversely affect foraging habitat critical to the survival of this species in this region.

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

The Proposal is not expected to disrupt the breeding cycle of an important population of the Grey-headed Flying-fox. There is no roost camp being disturbed and only minor loss of foraging habitat

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

The impacts to foraging habitat are minimal and no evidence of a roost camp has been identified from the study area. The impact of PCT 1633 is not expected to lead to a decline in the species in this region considering the large amount of higher quality foraging habitat available to local animals around the Cessnock-Kurri Kurri area.

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

The action is unlikely to result in an invasive species harmful to the Grey-headed Flying-fox becoming established in the habitat. The potential for weed invasion was considered possible with a Proposal of this nature and appropriate controls are required during construction and operation of the gas fired power station to reduce this threat. The management of invasive species would be managed under the construction environmental management plan and during operation of the facility using best practice methods.

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

There are no known disease issues affecting this species in relation to the action. The action would be unlikely to increase the potential for significant disease vectors to affect local populations.

Infection of native plants by *Phytophthora cinnamomi* has been identified as being spread by construction machinery. This water-borne mould infects the roots of plants and has the potential to cause dieback. Machinery associated with vegetation clearance and subsequent construction has the potential to transmit the fungus to remaining native vegetation remnants of the species. This is a potential indirect impact to the species through the transmission of pathogens into retained habitat near the facility. This can be mitigated through the development and implementation of suitable control measures for vehicle and plant hygiene and is unlikely to have a significant impact. It is the intention to use current best practice hygiene protocols to prevent the introduction or spread of pathogens. The Proposal's environmental management procedures would include guidance for preventing the introduction and/or spread of disease-causing agents such as bacteria and fungi.

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

The *Draft National Recovery Plan for the Grey-headed Flying-fox (Pteropus poliocephalus)* (Department of Environment Climate Change and Water, 2009) outlines the following actions:

- Identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes across their range
- Enhance winter and spring foraging habitat for Grey-headed Flying-foxes
- Identify, protect, and enhance roosting habitat critical to the survival of Grey-headed Flying-foxes

- Significantly reduce levels of deliberate Grey-headed Flying-fox destruction associated with commercial horticulture
- Provide information and advice to managers, community groups and members of the public that are involved with controversial flying-fox camps
- Produce and circulate educational resources to improve public attitudes toward Grey-headed Flying-foxes, promote the recovery program to the wider community and encourage participation in recovery actions
- Monitor population trends for the Grey-headed Flying-fox
- Assess the impacts on Grey-headed Flying-foxes of electrocution on powerlines and entanglement in netting and barbed wire and implement strategies to reduce these impacts
- Oversee a program of research to improve knowledge of the demographics and population structure of the Grey-headed Flying-fox
- Maintain a National Recovery Team to oversee the implementation of the Grey-headed Flying-fox National Recovery Plan.

The recovery actions listed above are largely not applicable to the action and the action is not expected to interfere substantially with the recovery of the species.

### **Conclusion**

The Proposal would have impacts on the Grey-headed Flying-fox via direct impact on 0.40 ha of intact woodland within the Proposal Site, consisting of PCT 1633 – Parramatta Red Gum – Narrow leaved Apple – Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area. The remaining low regrowth habitats also being impacted provide much lower value as potential foraging habitat. This loss of potential foraging habitat is very minor in the context of similar and better-quality foraging available throughout the Cessnock-Kurri Kurri locality. After consideration of the factors above, an overall conclusion has been made that the action is unlikely to result in a significant impact to the Grey-headed Flying-fox.



## **Appendix E. Biodiversity credit report**

## Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00021056/BAAS18058/20/00021057	Gas-fired Power Station Kurri Kurri	22/02/2021
Assessor Name	Report Created	BAM Data version *
Chris Thomson	15/03/2021	37
Assessor Number	BAM Case Status	Date Finalised
BAAS18058	Open	To be finalised
Assessment Revision	Assessment Type	
3	Major Projects	

\* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

## Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	BC Act Listing status	EPBC Act listing status	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAI	Ecosystem credits
<b>Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area</b>											
1	1633_Intact	Kurri Sand Swamp Woodland in the Sydney Basin Bioregion	46.5	46.5	0.4	Endangered Ecological Community	Not Listed	High Sensitivity to Potential Gain	2.00		9

# BAM Credit Summary Report

2	1633_Regrowth	Kurri Sand Swamp Woodland in the Sydney Basin Bioregion	35.4	35.4	0.21	Endangered Ecological Community	Not Listed	High Sensitivity to Potential Gain	2.00	4
3	1633_Ground-layer_only	Kurri Sand Swamp Woodland in the Sydney Basin Bioregion	1.5	1.5	0.88	Endangered Ecological Community	Not Listed	High Sensitivity to Potential Gain	2.00	0
									<b>Subtotal</b>	<b>13</b>
<b>Typha rushland</b>										
4	1737_Moderate	Not a TEC	4.9	4.9	0.05			Moderate Sensitivity to Potential Gain	1.75	0
									<b>Subtotal</b>	<b>0</b>
									<b>Total</b>	<b>13</b>

## Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAIL	Species credits
Anthochaera phrygia / Regent Honeyeater ( Fauna )								
1633_Intact	46.5	46.5	0.4	Critically Endangered	Critically Endangered	3	True	14
							Subtotal	14
Eucalyptus parramattensis subsp. decadens / Eucalyptus parramattensis subsp. decadens ( Flora )								
1633_Intact	N/A	N/A	28	Vulnerable	Vulnerable	2	False	56

## BAM Credit Summary Report

1633_Regrowth	N/A	N/A	9	Vulnerable	Vulnerable	2	False	18
							<b>Subtotal</b>	<b>74</b>
<b><i>Myotis macropus / Southern Myotis ( Fauna )</i></b>								
1633_Intact	46.5	46.5	0.4	Vulnerable	Not Listed	2	False	9
							<b>Subtotal</b>	<b>9</b>
<b><i>Planigale maculata / Common Planigale ( Fauna )</i></b>								
1633_Intact	46.5	46.5	0.4	Vulnerable	Not Listed	2	False	9
							<b>Subtotal</b>	<b>9</b>

## **Appendix F. Protected Matters Search Tool Report**





# 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: 02/11/20 16:11:46

- [Summary](#)
- [Details](#)

[Matters of NES](#)[Other Matters Protected by the EPBC Act](#)[Extra Information](#)
- [Caveat](#)
- [Acknowledgements](#)



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[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](#).

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	1
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	5
<a href="#">Listed Threatened Species:</a>	41
<a href="#">Listed Migratory Species:</a>	16

## 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.

<a href="#">Commonwealth Land:</a>	5
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	22
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Australian Marine Parks:</a>	None

## Extra Information

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

<a href="#">State and Territory Reserves:</a>	2
<a href="#">Regional Forest Agreements:</a>	1
<a href="#">Invasive Species:</a>	47
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">Key Ecological Features (Marine)</a>	None

# Details

## Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)		[ Resource Information ]
Name	Proximity	
<a href="#">Hunter estuary wetlands</a>	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
<a href="#">Central Hunter Valley eucalypt forest and woodland</a>	Critically Endangered	Community may occur within area
<a href="#">Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community</a>	Endangered	Community likely to occur within area
<a href="#">Hunter Valley Weeping Myall (Acacia pendula) Woodland</a>	Critically Endangered	Community may occur within area
<a href="#">Lowland Rainforest of Subtropical Australia</a>	Critically Endangered	Community may occur within area
<a href="#">White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland</a>	Critically Endangered	Community may occur within area

## Listed Threatened Species

[ Resource Information ]

Name	Status	Type of Presence
Birds		
<a href="#">Anthochaera phrygia</a> Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Botaurus poiciloptilus</a> Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Erythrotriorchis radiatus</a> Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Falco hypoleucos</a> Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Grantiella picta</a> Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Hirundapus caudacutus</a> White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Lathamus discolor</a> Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Rostratula australis</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Frogs		
<a href="#">Heleioporus australiacus</a> Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat may occur within area
<a href="#">Litoria aurea</a> Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Mixophyes balbus</a> Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat may occur within area
<a href="#">Mixophyes iteratus</a> Giant Barred Frog, Southern Barred Frog [1944]	Endangered	Species or species habitat likely to occur within area
Mammals		
<a href="#">Chalinolobus dwyeri</a> Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Dasyurus maculatus maculatus (SE mainland population)</a> Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
<a href="#">Petauroides volans</a> Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Petrogale penicillata</a> Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)</a> Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Potorous tridactylus tridactylus</a> Long-nosed Potoroo (SE Mainland) [66645]	Vulnerable	Species or species habitat may occur within area
<a href="#">Pseudomys novaehollandiae</a> New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Pteropus poliocephalus</a> Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
<a href="#">Acacia bynoeana</a> Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Cryptostylis hunteriana</a> Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
<a href="#">Cynanchum elegans</a> White-flowered Wax Plant [12533]	Endangered	Species or species habitat likely to occur within area
<a href="#">Dichanthium setosum</a> bluegrass [14159]	Vulnerable	Species or species habitat likely to occur



Name	Status	Type of Presence
within area		
<a href="#">Eucalyptus glaucina</a> Slaty Red Gum [5670]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Eucalyptus parramattensis subsp. decadens</a> Earp's Gum, Earp's Dirty Gum [56148]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Euphrasia arguta</a> [4325]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Grevillea parviflora subsp. parviflora</a> Small-flower Grevillea [64910]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Persicaria elatior</a> Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Persoonia hirsuta</a> Hairy Geebung, Hairy Persoonia [19006]	Endangered	Species or species habitat may occur within area
<a href="#">Prasophyllum sp. Wybong (C.Phelps ORG 5269)</a> a leek-orchid [81964]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Prostanthera cineolifera</a> [11233]	Vulnerable	Species or species habitat may occur within area
<a href="#">Pterostylis gibbosa</a> Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat known to occur within area
<a href="#">Rhizanthella slateri</a> Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area
<a href="#">Rutidosis heterogama</a> Heath Wrinklewort [13132]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Syzygium paniculatum</a> Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Tetratheca juncea</a> Black-eyed Susan [21407]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Thesium australe</a> Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Reptiles		
<a href="#">Delma impar</a> Striped Legless Lizard, Striped Snake-lizard [1649]	Vulnerable	Species or species habitat may occur within area
Listed Migratory Species		[ <a href="#">Resource Information</a> ]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		



Name	Threatened	Type of Presence
<a href="#">Cuculus optatus</a> Oriental Cuckoo, Horsfield's Cuckoo [86651]	Vulnerable	Species or species habitat may occur within area
<a href="#">Hirundapus caudacutus</a> White-throated Needletail [682]		Species or species habitat known to occur within area
<a href="#">Monarcha melanopsis</a> Black-faced Monarch [609]		Species or species habitat known to occur within area
<a href="#">Monarcha trivirgatus</a> Spectacled Monarch [610]		Species or species habitat may occur within area
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat likely to occur within area
<a href="#">Myiagra cyanoleuca</a> Satin Flycatcher [612]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Rhipidura rufifrons</a> Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
<a href="#">Gallinago hardwickii</a> Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]		Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat known to occur within area
<a href="#">Tringa nebularia</a> 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
Defence - SCOBIE BARRACKS ; 2/17 RNSWR RUTHERFORD ; RUTHERFORD GRES DEPOT

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		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardea alba</a> Great Egret, White Egret [59541]		Breeding known to occur within area
<a href="#">Ardea ibis</a> Cattle Egret [59542]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
<a href="#">Chrysococcyx osculans</a> Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
<a href="#">Gallinago hardwickii</a> Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
<a href="#">Hirundapus caudacutus</a> White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Lathamus discolor</a> Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
<a href="#">Monarcha melanopsis</a> Black-faced Monarch [609]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Monarcha trivirgatus</a> Spectacled Monarch [610]		Species or species habitat may occur within area
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat likely to occur within area
<a href="#">Myiagra cyanoleuca</a> Satin Flycatcher [612]		Species or species habitat known to occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]		Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]	Endangered*	Species or species habitat known to occur within area
<a href="#">Rhipidura rufifrons</a> Rufous Fantail [592]		Species or species habitat known to occur within area
<a href="#">Rostratula benghalensis (sensu lato)</a> Painted Snipe [889]		Species or species habitat known to occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[ Resource Information ]
Name	State
Werakata	NSW
Werakata	NSW

Regional Forest Agreements	[ Resource Information ]
Note that all areas with completed RFAs have been included.	
Name	State
<a href="#">North East NSW RFA</a>	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 Resouces Audit, 2001.	

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
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 known 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 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

Name	Status	Type of Presence
Oryctolagus cuniculus Rabbit, European Rabbit [128]		within area  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 within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		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		Species or species habitat likely to occur



Name	Status	Type of Presence
[20126] Genista sp. X Genista monspessulana Broom [67538]		within area  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] Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area  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
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.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

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

-32.787545 151.481012,-32.787022 151.477557,-32.784983 151.477965,-32.785146 151.479359,-32.784334 151.47951,-32.784514 151.481033,-32.785326 151.480883,-32.78538 151.481355,-32.787545 151.481012

# 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](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-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, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
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- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- 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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## Appendix G. Assessment of serious and irreversible impacts (SAII)

### G.1 SAII Assessment – Regent Honeyeater

Criteria	Discussion
1) The action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII	<p>The majority of the Proposal Site has been subject to extensive prior disturbance with its former use as an aluminium smelter. The proposed action would have a footprint considerably smaller than the former aluminium smelter. The design of the Proposed action incorporates development within the already existing disturbed area and would impact on approximately 0.40 ha of intact mapped Regent Honeyeater vegetation.</p> <p>Important ecological features of the Regent Honeyeater, such as large habitat trees and high-quality nectar foraging resources, would be avoided during the proposed impacts. Furthermore, no known breeding birds have been identified within the Proposal Site.</p>
<p>2) The assessor must consult the TBDC and/or other sources to report on the current population of the species including:</p> <p>a. evidence of rapid decline (Principle 1, clause 6.7(2)(a) BC Regulation) presented by an estimate of the:</p> <p>i. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or</p> <p>ii. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer) as indicated by: an index of abundance appropriate to the species; decline in geographic distribution and/or habitat quality; exploitation; effect of introduced species, hybridisation, pathogens, pollutants, competitors or parasites</p> <p>b. evidence of small population size (Principle 2, clause 6.7(2)(b) BC Regulation) presented by:</p> <p>i. an estimate of the species' current population size in NSW, and</p>	<p>a) i. The species is classified as Critically Endangered because its population is inferred to have undergone extremely rapid declines over the past three generations (24 years).</p> <p>The breeding population was previously estimated at 1,500 mature individuals, roughly equivalent to 2,200-2,300 individuals in total, but following very rapid declines there were thought to be just 350-400 mature individuals remaining in 2010.</p> <p>ii. This species is suspected to have declined by &gt;80% over the past three generations (24 years), with declines driven primarily by drought, compounded by habitat loss caused by historic clearance for agriculture, and possibly competition with other native species, particularly Noisy Miner.</p> <p>b) i. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW, the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some year's flocks converge on flowering coastal woodlands and forests. In 2011, the</p>

Criteria	Discussion
<p>ii. an estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer), and</p> <p>iii. where such data is available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations</p> <p>c. evidence of limited geographic range for the threatened species (Principle 3, clause 6.7(2)(c) BC Regulation) presented by:</p> <p>i. extent of occurrence</p> <p>ii. area of occupancy</p> <p>iii. number of threat-defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences), and</p> <p>iv. whether the species' population is likely to undergo extreme fluctuations</p> <p>d. evidence that the species is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation) because:</p> <p>i. known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g. species is clonal) on, a biodiversity stewardship site</p> <p>ii. the species is reliant on abiotic habitats which cannot be restored or replaced (e.g. karst systems) on a biodiversity stewardship site, or</p> <p>iii. life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g. frogs severely impacted by chytrid fungus).</p>	<p>Regent Honeyeater's population was estimated with medium reliability at 350–400 mature birds.</p> <p>ii. In 1997 the population in New South Wales was estimated at a maximum of 1,000 birds but far fewer birds have been recorded since, with maximum of just 40 there in 2009 and 80+ in the Hunter Valley in 2012 (Birdlife Australia 2012).</p> <p>This species is suspected to have declined by &gt;80% over the past three generations (24 years).</p> <p>iii. While the species has regional variation in calls (Powys 2010), banded birds have been recorded moving between all main sites, so the species is considered to have a single subpopulation (Garnett et al. 2011).</p> <p>The estimated number of mature individuals within the one subpopulation of the Regent Honeyeater is 350.</p> <p>Birds concentrate at a small number of sites when breeding, but numbers fluctuate greatly between years and sites.</p> <p>c) i. Formerly abundant and ranging from Adelaide to south-east Queensland, the species now has a patchy distribution which extends from south east Queensland, through New South Wales (NSW) and the Australian Capital Territory (ACT), to central Victoria.</p> <p>The extent of occurrence, including breeding and resident areas, is approximately 129,000 km<sup>2</sup>.</p> <p>ii. There is difficulty in defining the range, area of occupancy, population size and population trends for this highly mobile and thinly spread species. Regent Honeyeaters occur mainly in dry box ironbark open-forest and woodland areas inland of the Great Dividing Range. The Regent Honeyeater's area of occupancy is estimated at 300 km<sup>2</sup> but in NSW, the Regent Honeyeater has an area of occupancy of less than 200 km<sup>2</sup>.</p> <p>iii. The Lower Hunter Valley Important Bird Area, a critical site for this species, has been under threat from the proposed development of an industrial park in the area – the Hunter Economic Zone (HEZ). The Proposal Site contains the most important area of foraging habitat for the species in the Lower Hunter</p>



Criteria	Discussion
	<p>Region (Roderick <i>et al.</i> 2013) and a significant breeding event in 2007-2008, where a total of 19 nests were located (additional nests may have been missed), demonstrates the Proposal Site contains significant breeding habitat as well. There are no records of nesting in the Proposal Site.</p> <p>iv. Birds concentrate at a small number of sites when breeding, but numbers fluctuate greatly between years and sites, and movements outside the breeding season are poorly understood.</p> <p>d) i. The Regent honeyeater is a poor reproducer and the population size is low. With small population sizes, individual pairs must spend more time and energy defending a breeding territory or nectar source, possible resulting in lower reproductive outputs. In poor years, it is not clear whether birds fail to nest or shift elsewhere to breed.</p> <p>ii. Habitat critical to the survival of the regent honeyeater occurs in a wide range of land ownership arrangements, including on private land, travelling stock routes and reserves, state forests and state reserves, and National Parks.</p> <p>Nests are usually built in the crowns of tall trees, mostly eucalypts and sometimes among mistletoe. There are no tall trees in the Proposal Site. The dominant PCT 1633 at the Proposal Site is characterised by low trees ranging from 5 to 8 m tall</p> <p>iii. Many remnant vegetation patches are degraded and likely missing important ecological features, such as large trees and/or high-quality nectar flows. Nectar availability is reduced through clearing, drought, fire, or presence/absence of competing species such as the Noisy Miner.</p> <p>Infection of native plants by <i>Phytophthora cinnamomi</i> has been identified as being spread by construction machinery. This water-borne mould infects the roots of plants and has the potential to cause dieback. Machinery associated with vegetation clearance and subsequent construction has the potential to transmit the fungus to remaining native vegetation remnants of the species. This is a potential indirect impact to the species through the transmission of pathogens into retained habitat near the facility.</p>

Criteria	Discussion
3) Where the TBDC indicates data is 'unknown' or 'data deficient' for a species for a criterion listed in Subsection 9.1.2(2.), the assessor must record this in the BDAR or BCAR.	The TBDC does not indicate data is 'unknown' or 'data deficient' for this species
<p>4) In relation to the impacts from the proposal on the species at risk of an SAIL, the assessor must include data and information on:</p> <p>a. the impact on the species' population (Principles 1 and 2) presented by:</p> <ul style="list-style-type: none"> <li>i. an estimate of the number of individuals (mature and immature) present in the subpopulation on the subject land (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population, and</li> <li>ii. an estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or</li> <li>iii. if the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that will be impacted, along with the area of habitat to be impacted by the proposal</li> </ul> <p>b. impact on geographic range (Principles 1 and 3) presented by:</p> <ul style="list-style-type: none"> <li>i. the area of the species' geographic range to be impacted by the proposal in hectares, and a percentage of the total AOO, or EOO within NSW</li> <li>ii. the impact on the subpopulation as either: all individuals will be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species will be directly impacted</li> <li>iii. to determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which</li> </ul>	<p>a) i. There were approximately 80 individuals recorded in the Hunter Valley in 2012 (Birdlife Australia 2012), resulting in approximately 20% of the total subpopulation.</p> <p>ii. The Recovery Plan for the Regent Honeyeater identifies 9 key foraging species, none of which are found in PCT 1633 confirmed in the Proposal Site.</p> <p>iii. The impacts to a small area of lower quality potential foraging habitat in the study area is considered unlikely to lead to a long-term decrease in the size of the Regent Honeyeater population as the work would not impact on the critical remaining strongholds of the species.</p> <p>The Regent Honeyeater would suffer a small reduction in extent of marginal (not preferred) habitat from the action. However, impacts are predicted to be minimal as this species is unlikely to use the study area consistently and the impact is very minor in the context of the extent of habitat available to this species in the locality.</p> <p>b) i. The total area of mapped important habitat in the Cessnock-Kurri area is around 415 ha, and the Proposal would directly impact around 0.40 ha of intact woodland.</p> <p>ii. The proposed impact would affect some habitat, but no individuals of the species would be directly impacted. Movement corridors within the locality would remain intact, where the Proposal would not contribute further to fragmentation.</p> <p>iii. The total area of mapped important habitat in the Cessnock-Kurri area is around 415 ha. This species is highly mobile and capable of long-distance flight. However, movements between breeding populations are not frequent and most birds appear to remain in the breeding areas of Bundarra-Barraba area and the Capertee Valley in NSW, and north-eastern Victoria. The proposed impacts are</p>

Criteria	Discussion
<p>genetic exchange can occur (e.g. seed dispersal) and pollination distance for the species</p> <p>iv. to determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR.</p>	<p>on the edge of the mapped habitat and would not be significant to the breeding and dispersal or the genetic diversity of this species.</p> <p>The impacts to foraging and breeding habitat are minimal. The impact to habitat from the Proposal is not expected to lead to a decline in the species in this region considering the large amount of higher quality foraging habitat available to local animals around the Kurri Kurri region.</p> <p>iv. There are no reported nesting sites from the Proposal Site, and there is a low likelihood that the small area within the Proposal Site boundary would be preferred for nesting, although can't be ruled out entirely. The chance of disrupting the breeding cycle is very low, and activities should be timed to avoid the breeding activities.</p> <p>The main invasive species harmful to habitat for the Regent Honeyeater is weeds. Noisy Miners are abundant in the habitat which may make the habitat less suitable for the Regent Honeyeater due to competitive exclusion. The action may result in weed invasion and the removal of habitat may concentrate local miner populations increasing competition, however the vegetation removal would be minor.</p> <p>There are no known disease issues affecting this species in relation to the action. The action would be unlikely to increase the potential for significant disease vectors to affect local populations.</p>
<p>5) The assessor may also provide new information that can be used to demonstrate that the principle identifying the species as at risk of an SAI, is inaccurate.</p>	<p>The Regent Honeyeater would suffer a small reduction in extent of marginal (not preferred) habitat from the action. However, impacts are predicted to be minimal as this species is unlikely to use the study area consistently and the impact is very minor in the context of the extent of habitat available to this species in the locality. The action is unlikely to reduce the population size of the Regent Honeyeater or decrease the reproductive success of this species. After consideration of the factors above, an overall conclusion has been made that the action is unlikely to result in a significant impact to the Regent Honeyeater.</p>

## G.2 SAI Assessment – Swift Parrot

Criteria	Discussion
<p>1) The action and measures taken to avoid the direct and indirect impact on the potential entity for an SAI</p>	<p>The majority of the Proposal Site has been subject to extensive prior disturbance with its former use as an aluminium smelter. The proposed action would have a footprint considerably smaller than the former aluminium smelter. The design of the Proposed action incorporates development within the already existing disturbed area and would not impact on any mapped Swift Parrot vegetation.</p>
<p>2) The assessor must consult the TBDC and/or other sources to report on the current population of the species including:</p> <p>a. evidence of rapid decline (Principle 1, clause 6.7(2)(a) BC Regulation) presented by an estimate of the:</p> <p>i. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or</p> <p>ii. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer) as indicated by: an index of abundance appropriate to the species; decline in geographic distribution and/or habitat quality; exploitation; effect of introduced species, hybridisation, pathogens, pollutants, competitors or parasites</p> <p>b. evidence of small population size (Principle 2, clause 6.7(2)(b) BC Regulation) presented by:</p> <p>i. an estimate of the species' current population size in NSW, and</p> <p>ii. an estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer), and</p> <p>iii. where such data is available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations</p> <p>c. evidence of limited geographic range for the threatened species (Principle 3, clause 6.7(2)(c) BC Regulation) presented by:</p> <p>i. extent of occurrence</p>	<p>a) i. The Swift Parrot is considered a migratory species, where it breeds in Tasmania during the Australian summer and the entire population then migrates north to mainland Australia for the winter.</p> <p>It is estimated that the population approximately contains around 2,000 mature individuals and is declining, however a population viability analysis model predicted that the population would decline by an average of 87% (79-95%) over three generations (12-18 years).</p> <p>ii. Nest predation by Sugar Gliders (<i>Petaurus breviceps</i>) introduced to Tasmania poses a severe threat (Stojanovic <i>et al.</i> 2014) and is estimated to cause severe declines over the next three generations (Heinsohn <i>et al.</i> 2015). On mainland Tasmania almost 79% Swift Parrot nests were predated and 65% of adult females were killed by Sugar Gliders.</p> <p>Habitat loss and alteration within breeding and drought refuge habitats remains a key threat. Furthermore, Climate Change threatens to alter habitat phenology and climatic conditions such that habitat availability may be significantly reduced.</p> <p>b) i. The Swift Parrot occurs as a single, migratory population. Significant declines were observed in the late 1980s to mid-1990s. It is estimated that the population approximately contains around 2,000 mature individuals and is declining. The estimated population size of the Swift Parrot ranges from 1000 – 2499 individuals.</p> <p>ii. Population Viability Analysis (Heinsohn <i>et al.</i> 2015) projected that Swift Parrots would undergo substantial declines within three generations (based on modelled scenarios that considered impacts of sugar glider predation).</p> <p>iii. The Swift Parrot comprises of one subpopulation, where the number of mature individuals in the wild is approximately 2000.</p>

Criteria	Discussion
<p>ii. area of occupancy</p> <p>iii. number of threat-defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences), and</p> <p>iv. whether the species' population is likely to undergo extreme fluctuations</p> <p>d. evidence that the species is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation) because:</p> <ul style="list-style-type: none"> <li>i. known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g. species is clonal) on, a biodiversity stewardship site</li> <li>ii. the species is reliant on abiotic habitats which cannot be restored or replaced (e.g. karst systems) on a biodiversity stewardship site, or</li> <li>iii. life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g. frogs severely impacted by chytrid fungus).</li> </ul>	<p>Fluctuations of the Swift Parrot is subject to impacts from the major threats which could cause the species to undergo extreme fluctuations.</p> <p>c) i. The estimated Swift Parrot Extent of Occurrence including breeding and resident areas is 21,500 km<sup>2</sup>.</p> <p>On the mainland of Australia, the Swift Parrot occurs in eucalypt forest and woodlands, mainly box-ironbark habitats on the inland slopes of the Great Dividing Range and in coastal forests. Critical food resources occur within this habitat, principally nectar from prolific flowering species</p> <p>ii. The estimated area of occupancy for the Swift Parrot is 1,400 km<sup>2</sup>.</p> <p>iii. Sugar gliders, which in Tasmania are introduced from mainland Australia, take eggs and young from the nest sites of the Swift Parrot and commonly kill the female.</p> <p>Furthermore, models predict warmer drier conditions in south-east Tasmania which will increase the frequency of fire in the breeding habitat.</p> <p>Over 50% of the original grassy <i>E. globulus</i> forest in Tasmania has been cleared (Brereton et al. 2004). Selective logging has resulted in the removal of larger trees from the remaining forest patches.</p> <p>iv. The major threats facing the Swift Parrot, including the introduction of Sugar Gliders, habitat loss, changed fire regime and climate change have caused and could potentially cause a magnitude of fluctuations ranging from 50-100% severity.</p> <p>d) i. When breeding, it is almost always associated with its main food source, flowering Tasmanian blue gum (<i>Eucalyptus globulus</i>). Overall, the availability and flowering of the feed trees can severely affect the availability of breeding habitat (Tzaros et al. 2009). Most breeding birds are found in remnant forest patches of less than 0.01 km<sup>2</sup>. Recovery efforts have focused on habitat improvement and attempts to reduce the impacts of Sugar Gliders, these are beneficial but will need to be amplified to reverse negative population trends.</p> <p>Furthermore, the species appeared to be very susceptible to Allee effects, where survival and reproductive success decline with decreasing population density.</p>



Criteria	Discussion
	<p>ii. The Swift Parrot nests in hollows of both live and dead eucalypt trees.</p> <p>iii. The Swift Parrot is threatened by disturbance, Psittacine beak and feather disease and also illegal bird capture and trade (D. Saunders in litt. 2007).</p>
3) Where the TBDC indicates data is 'unknown' or 'data deficient' for a species for a criterion listed in Subsection 9.1.2(2.), the assessor must record this in the BDAR or BCAR.	The TBDC does not indicate data is 'unknown' or 'data deficient' for this species
<p>4) In relation to the impacts from the proposal on the species at risk of an SAIL, the assessor must include data and information on:</p> <p>a. the impact on the species' population (Principles 1 and 2) presented by:</p> <p>i. an estimate of the number of individuals (mature and immature) present in the subpopulation on the subject land (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population, and</p> <p>ii. an estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or</p> <p>iii. if the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that will be impacted, along with the area of habitat to be impacted by the proposal</p> <p>b. impact on geographic range (Principles 1 and 3) presented by:</p> <p>i. the area of the species' geographic range to be impacted by the proposal in hectares, and a percentage of the total AOO, or EOO within NSW</p> <p>ii. the impact on the subpopulation as either: all individuals will be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species will be directly impacted</p>	<p>a) i. There is one subpopulation of the migratory Swift Parrot which breeds in Tasmania, then migrated to mainland Australia during the winter months. The estimated individuals of the Swift parrot are 1000-2499. The number of individuals known to forage in NSW is unknown. However, the Swift Parrot does not breed in the study area and the extent of habitat remaining in the study area would provide sufficient resources to sustain future visitation, such that the action is unlikely to lead to a long-term decrease in the size of the population.</p> <p>ii. As the Swift Parrot breeds in Tasmania, there are no identified breeding pairs within the Proposal Site, therefore would not be impacted upon.</p> <p>iii. The impacts to a small area of lower quality potential foraging habitat in the study area (includes 0.34 ha of intact woodland direct and indirect impact) is considered unlikely to lead to a long-term decrease in the size of the Swift Parrot population as the work would not impact on the critical remaining strongholds of the species.</p> <p>The Proposal would involve direct removal of around 0.40 ha of intact woodland. <b>However, the Swift Parrot important areas map does not cover the Proposal Site.</b></p> <p>b) i. The Extent of Occurrence for the Swift Parrot is 21,500 km<sup>2</sup> where the estimated impacts to the Swift Parrot habitat within the Proposal Site is 76 ha. Therefore, the Proposal is estimated to impact on 0.00003 % of the Swift Parrots Extent of Occupancy.</p> <p>ii. The proposed impacts would affect some Swift Parrot habitat; however, no individuals would be directly impacted. The direct impact on habitat is estimated to</p>

Criteria	Discussion
<p>iii. to determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g. seed dispersal) and pollination distance for the species</p> <p>iv. to determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR.</p>	<p>be 0.40 ha. <b>However, the Swift Parrot important areas map does not cover the Proposal Site.</b></p> <p>iii. The Swift Parrot does not breed in the study area and the extent of habitat remaining in the study area would provide sufficient resources to sustain future visitation, such that the action is unlikely to lead to a long-term decrease in the size of the population. The proposed impacts are on the edge of the mapped habitat and would not be significant to the breeding and dispersal or the genetic diversity of this species.</p> <p>iv. Throughout the species' range high quality feeding habitat has been cleared for agriculture and urban development, with the threat of critical habitat loss continuing despite some gains. The extent and quality of Swift Parrot wintering and breeding habitat continues to be greatly reduced by timber harvesting, despite numerous attempts to develop and integrate policies to reduce the impact.</p> <p>Predation rates, particularly pertaining to the introduced Sugar Glider in Tasmania, are highest when the parrot's nest in more fragmented and degraded areas.</p> <p>Wildfire impacts Swift Parrot habitat by altering tree flowering phenology and tree cavity availability.</p> <p>Furthermore, models predict warmer drier conditions in south-east Tasmania which will increase the frequency of fire in the breeding habitat.</p>
<p>5) The assessor may also provide new information that can be used to demonstrate that the principle identifying the species as at risk of an SAIL, is inaccurate.</p>	<p>The local population may suffer a small reduction in extent of suitable (low quality and not preferred) foraging habitat from the action, but no critical important habitat of the Swift Parrot would be impacted by the Proposal. The action is unlikely to reduce the population size of the Swift Parrot or decrease the reproductive success of this species. The action would not interfere with the recovery of the Swift Parrot. After consideration of the factors above, an overall conclusion has been made that the action is unlikely to result in a significant impact to the Swift Parrot.</p>