Liddell Battery, and Bayswater Ancillary Works

Biodiversity Development Assessment Report

IS334000_BDAR

July 2021

AGL Macquarie Pty Limited

Certification under Section 6.15 of the Biodiversity Conservation Act 2016

I, Matt Consterdine (BAAS20027) certify that this Biodiversity Development Assessment Report and the accompanying finalised credit report dated 30 March 2021 has been prepared in accordance with the requirements of (and information provided under) the Biodiversity Assessment Method.

Matt Consterdine – BAAS20027

30 March 2021

Following recent correspondence with the Hunter Central Coast Branch of Biodiversity and Conservation Division, amendments have been made to this BDAR as well as the BAM-C case (00022769/BAAS20027/ 21/00023909). This report version (Revision 04) was completed on the 8th of July 2021 and contains a new finalised credit report dated 04/06/2021.

Matt Consterdine – BAAS20027

29th July 2021

Contents

Glossary and abbreviations

Abbreviation	Definition
AGLM	AGL Macquarie Pty Limited
ASL	Above sea level
ASS	Acid Sulphate Soil
BAM	Biodiversity Assessment Method
BAM-C	The BAM Calculator
BAW	Bayswater Ancillary Works
BC Act	*Biodiversity Conservation Act 2016*
BCD	NSW Biodiversity Conservation Division now Biodiversity, Conservation & Science (BCS) within the Energy and Science Group (EESG) within the Department of Planning, Industry and Environment (DPIE). Referred throughout this BDAR as BCD
BCT	Biodiversity Conservation Trust
BDAR	Biodiversity Development Assessment Report
BOM	Bureau of Meteorology
BOS	Biodiversity Offsets Scheme
CEEC	Critically Endangered Ecological Communities
CEMP	Construction Environmental Management Plan
Coastal Management SEPP	*State Environmental Planning Policy (Coastal Management) 2018*
CSG	Coal Seam Gas
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DBH	Diameter at breast height
DECC	Department of Environment and Climate Change
DPI	Department of Primary Industries
DPIE	Department of Planning, Industry and Environment
EEC	Endangered Ecological Community
EESG	Environment, Energy and Science Group within the Department of Planning Industry and Environment
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EP&A Act	*Environmental Planning and Assessment Act 1979*
FM Act	*Fisheries Management Act 1994*

Abbreviation	Definition
GGBF	Green and Golden Bell Frog
GIS	Geographic Information System
GWh	Gigawatt hours
IBRA	Interim Biogeographic Regionalisation for Australia
KTP	Key Threatening Process
kV	Kilovolt
LGA	Local government area
LLS Act	*Local Land Services Act 2013*
MNES	Matters of National Environmental Significance
MW	Megawatt
MWh	Megawatt-hour
NEM	National Energy Market
NPWS	National Parks and Wildlife Service
NSW	New South Wales
OEH	Office of Environment and Heritage (now known as the Department of Premier and Cabinet (Heritage) or Heritage NSW)
PCT	Plant Community Type
PMST	EPBC Act Protected Matter Search Tool
SAII	Serious and irreversible impacts
SAT	Spot Assessment Technique
SLL	Striped Legless Lizard
SPRAT	Species Profile and Threats Database
SEARs	Secretary's Environmental Assessment Requirements
SEPP SRD	*State Environmental Planning Policy (State and Regional Development) 2011*
SSD	State Significant Development
TBDC	Threatened Biodiversity Data Collection
TEC	Threatened Ecological Community
TSSC	Threatened Species Scientific Committee
WOAOW	Bayswater Water and Other Associated Operational Works project

Executive Summary

AGL Macquarie Pty Limited (**AGLM**) owns and operates the Bayswater and Liddell power stations, Hunter Valley Gas Turbines and associated ancillary infrastructure. Liddell power station (**Liddell**) is approaching its end of life and is scheduled for closure in 2023. Bayswater power station (**Bayswater**) would continue to be operated through to 2035 to support the transition of the National Electricity Market (**NEM**) toward net-zero emissions and then is intended to be retired.

Jacobs, on behalf of AGLM is currently developing an Environmental Impact Statement (**EIS**) for the assessment of the Liddell Battery, Decoupling and Bayswater Ancillary Works Project (**the Project**) to facilitate the efficient, safe and reliable continuation of electricity generating works, in accordance with Division 4.7 of the *Environmental Planning and Assessment Act 1979 (***EP&A Act***)*. The Project is located within the Bayswater and Liddell power stations and surrounding buffer lands on the New England Highway within the Local Government Areas of Muswellbrook and Singleton.

The features of the Project include:

- **The Battery**: A grid connected Battery Energy Storage System with capacity of up to 500 MW and 2 GWh
- **Decoupling works**: Alternative network connection arrangements for the Liddell 33 kilovolt (**kV**) switching station that provides electricity to infrastructure required for the ongoing operation of Bayswater and associated ancillary infrastructure and potential third-party industrial energy users
- **Bayswater Ancillary Works** (**BAW**): Works associated with Bayswater which may include upgrades to ancillary infrastructure such as pumps, pipelines, conveyor systems, roads and assets to enable maintenance, repairs, replacement, expansion or demolition
- **Consolidated consents:** A modern consolidated consent for the continued operation of Bayswater through the voluntary surrender and consolidation into this application of various existing development approvals required for the ongoing operation of AGLM assets.

Construction works associated with the battery and decoupling works would likely involve as follows:

- Installation and maintenance of environmental controls including temporary and permanent water management infrastructure
- Establishment of access from the existing Liddell access roads
- Demolition or deconstruction of existing equipment as required
- Establishment of a hardstand pad and construction laydown areas
- Cut and fill to battery compound, transformer compounds, footings and construction laydown area
- Trenching and installation of cable from the Battery to 330/33 kV transformer compounds
- Structural works to support battery enclosures, inverters, transformers, buildings and transformer compounds
- Delivery, installation and electrical fit-out of the Battery
- Delivery installation and fit out of transformers and ancillary equipment for decoupling works
- Testing and commissioning activities
- Removal of construction equipment and rehabilitation of construction areas.

Existing environment

The Project is located in the Sydney Basin Interim Biogeographic Regionalisation for Australia (IBRA) Bioregion, and within the Hunter IBRA sub-region. The Project sits within the Central Hunter Foothills landscape as mapped by the NSW National Parks and Wildlife Service (**NPWS**)(NPWS, 2002).

The development site is located within a highly cleared and modified landscape to the north of the Hunter River. A long history of agriculture and coal mining has decreased the extent of native vegetation in this region. The Project has been designed to utilise existing cleared and degraded areas which surround the Liddell and Bayswater power stations.

There is approximately 5,259.1 ha of native vegetation (woody and non-woody vegetation) within a 1,500 m landscape buffer surrounding the development site (10,435.2 ha) equating to a percent native vegetation cover in the landscape of 50%. This estimate is based on State Vegetation Type Map: Upper Hunter v1.0. VIS_ID 4894 (DPIE, 2018), however, this percentage is more likely to be as low as 30% based on findings of the recent Bayswater Power Station Water and Other Associated Operational Works (**WOAOW Project**) (Kleinfelder,2020) and *Vegetation Mapping Report – Bayswater and Liddell Power Stations* (Kleinfelder,2017).

No 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 *Biodiversity Conservation Act 2016* (**BC Act**) would be affected.

Assessment Methods

Ecological surveys were undertaken for this Biodiversity Development Assessment Report (**BDAR**) between August and December 2020 in accordance with the Biodiversity Assessment Method (**BAM**) and included:

- Identification and detailed mapping of plant community types (**PCTs**) involving:
  - Stratification of PCTs in survey units (vegetation zones)
  - Plot based floristic vegetation survey and vegetation integrity assessment
- Threatened species habitat assessment
- Targeted threatened species surveys, including:
  - Parallel transects undertaken across suitable habitats within the study area for threatened flora species
  - Fauna survey methods including spotlighting, call broadcasting, ground and arboreal elliot trapping, remote sensor cameras monitoring, Anabat monitoring, harp trapping and reptile surveys using roof tiles.

Native vegetation and habitats

The following PCTs were recorded within the development site:

- PCT 1691: Narrow-leaved Ironbark – Grey Box grassy woodland of the Central and Upper Hunter
- PCT 1692: Bull Oak grassy woodland of the Central Hunter Valley
- PCT 1731: Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley
- PCT 1071: Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion.

The above listed PCTs correspond with three vegetation classes (Keith 2004) that represent different broad habitat types used to stratify fauna survey, including:

- Coastal valley grassy woodlands
- Coastal swamp forests
- Coastal freshwater lagoons.

Threatened species

One threatened plant species was identified during surveys, *Eucalyptus glaucina* (Slaty Red Gum). Two individuals of this species were recorded next to the western coal conveyor and outside the development site boundary. The species polygon for these two trees does not overlap any PCTs within the development site and no impacts are anticipated.

Given the highly cleared and disturbed nature of the development site, habitat for threatened fauna species is generally of low quality. The lack of structurally complex woodland ecosystems, along with hollow-bearing trees, hollow logs, wood debris and rock outcrops, combined with noise and light disturbance from the power stations and infrastructure means that only disturbance-tolerant fauna species persist within the development site.

The Grey-crowned Babbler (eastern sub-species), (listed as Vulnerable in NSW) was observed multiple times and is likely to frequent the development site regularly, particularly when dispersing between larger woodland areas.

The Southern Myotis (listed as Vulnerable in NSW) is assumed to be present within the site in accordance with paragraph 5.2.4 of the BAM. This species was recorded within 100 metres (**m**) of the development site during the ecological surveys for the WOAOW Project in December 2019 (Kleinfelder 2020) and is likely to forage in suitable habitats occurring within the development site. No hollow-bearing trees are present within the development site. Inspection of man-made structures such as concrete pipes, culverts and other structures did not identify roosting bats. *Miniopterus orianae oceanensis* (Large Bent-winged Bat) and *Scoteanax rueppellii* (Greater broad-nosed bat) were also potentially recorded (both listed as Vulnerable in NSW). The Greater broad-nosed bat (Vulnerable) has a similar call to non-threatened *Scotorepens orion* (Eastern Broad-nosed bat) and differentiation between species call data is difficult. Likewise, the Large Bent-winged Bat has a similar call to non-threatened *Vespadelus regulus* (Southern forest bat). For the purposes of this assessment it is assumed that *Miniopterus orianae oceanensis* and *Scoteanax rueppellii* are occurring in the locality and would utilise the development site during foraging. As above, no roosting habitat is present within the development site.

The Striped Legless Lizard (**SLL**) is also assumed to be present within the development site in accordance with paragraph 5.2.4 of the BAM. This species was not recorded within the development site although due to a condensed timeframe of the assessment the duration of surveys (installation of tile arrays) did not meet the requirements of the Survey Guidelines for Australia's Threatened Reptiles (Department of the Environment Water Heritage and the Arts, 2011b), (relied upon also by NSW DPIE). This species has been recorded during surveys of adjacent lands for the WOAOW project (Kleinfelder, 2020). The location of the record is approximately 800 m from the development site, in a large patch (approximately 40 ha) of PCT 1692 Bull Oak Grassy Woodland – (Moderate-Good), (Kleinfelder, 2020).

Despite targeted surveys, no other threatened species were recorded within the development site.

Biodiversity Impacts

The potential for direct impacts to biodiversity is limited to clearing 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.

Plant community types:

Despite avoidance and minimisation measures, the direct impacts to biodiversity values that may occur as a result of the Project includes up to 42.3 ha of native vegetation (worst case amount), which includes the following PCTs:

- PCT 1691: Narrow-leaved Ironbark – Grey Box grassy woodland of the Central and Upper Hunter -
  - Moderate condition – 2.3 ha (23,000 square meters (**m^2**))
  - Regrowth (poor condition) – 21.6 ha (216,000 m^2)
  - Rehabilitation – 11.4 ha (114,000 m^2)
  - Derived native grassland – 2 ha (20,000 m^2)
- PCT 1692: Bull Oak grassy woodland of the Central Hunter Valley – 1.2 ha (12,000 m^2)
- PCT 1731: Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley – 0.9 ha (9000 m^2)
- PCT 1071: Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion – 3 ha (30,000 m^2)

Threatened Ecological Communities:

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

- Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions (Endangered) – 13.7 ha comprising 'moderate condition' and 'rehabilitation' patches of PCT 1691 noted above.

The areas of PCT 1691 'regrowth' (21.6 ha), PCT 1691 'native grassland' (2 ha) in the development site do not constitute the TEC as they lack a canopy of eucalypts.

Only a small patch of PCT 1691 meets the condition threshold criteria for the EPBC Act listed Central Hunter Eucalypt Forest and Woodland Ecological Community (Critically Endangered) detailed in the listing and conservation advice. This patch is 2.04 ha and is to be retained.

Threatened species:

Direct impacts on species credit threatened species habitat may occur as a result of proposed clearing of native vegetation. Approximately 10 ha of potential habitat for Southern Myotis may be impacted, which represents foraging and connectivity habitat. No hollow-bearing trees are present within the development site, Inspection of man-made structures such as concrete pipes, culverts and other structures did not identify roosting bats. Approximately 38.5 ha of potential habitat for SLL may be impacted which is mostly regrowth vegetation in poor ecological condition.

The vegetation is likely to provide foraging habitat for a range of mobile threatened fauna species including the Grey-headed Flying Fox, and a number of woodland birds and insectivorous bat species. The impact to these species would be limited to foraging habitat only.

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 considered to be minimal and manageable through the implementation of suitable mitigation measures.

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 development. Mitigation measures outlined in this report would be implemented during construction.

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 Biodiversity Assessment Calculator and presented in this BDAR. Areas of the development site that do not possess PCTs have not been assessed and offset credits are not required. Patches of PCTs with vegetation integrity scores below the offset thresholds do not require offsets. Offsets are required for the Southern Myotis which has been assumed present based on recent records adjacent to the development site. Large Bent-winged Bat and Greater broad-nosed bat (foraging) are both ecosystem credit species and offsets are included with the offsets calculated for PCTs. A summary of the biodiversity credit requirements for the development include:

- PCT 1691-Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (TEC) (moderate condition and rehabilitation) – 224 credits
- PCT 1691-Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (NOT TEC) (native grass) – 22 credits
- PCT 1731-Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - 7 credits
- PCT 1692-Bull Oak grassy woodland of the central Hunter Valley – 17 credits
- Southern Myotis (*Myotis macropus*) – 196 credits.
- SLL -279 credits.

The Project impacts and offset obligations have been calculated in the absence of a detailed design, as is normal for a major Project at this stage of the process. Therefore, Project impacts and offset obligations would be revised following detailed design and will include consideration of areas where total clearing and permanent infrastructure is not required.

The Biodiversity Offset Strategy for this Project proposed that the offsetting would be undertaken on a pro-rata basis as different stages of the Project affect different areas of vegetation. The biodiversity offset strategy would be finalised before the commencement of any construction for the Project. Offsetting requirements for impacts to vegetation and habitats will likely involve a range of methods to retire credits such as:

- Payment to the Biodiversity Conservation Fund **(the Fund**) managed by the Biodiversity Conservation Trust (**BCT**)
- Purchase of credits from the open market, with consideration of applying the 'Like for Like' Variation Rules, where required
- Establishment of a Biodiversity Stewardship Site to generate credits to use for offsetting.

More native vegetation is likely to be retained during later design or prior to construction, and to accommodate for this an amount of credits are grouped as 'unlikely' (ie. it is unlikely that these credits will be required to be offset). The BAM (and BAM-C) does not allow for segregation of credits like this and therefore 'unlikely' credits are calculated on a proportionate basis guided by hectares of PCTs to be affected by clearing. Clearing will be undertaken in a staged approach and occur over a longer timeframe. Therefore, it is proposed that credits will likely be retired on a pro-rata basis.

1. Introduction

1.1 Project background

AGL Macquarie Pty Limited **(AGLM**) own and operates the Bayswater Power Station **(Bayswater**) which has a approved generating capacity of 2,640 megawatt (**MW**), the 2,000 MW Liddell Power Station (**Liddell**), and the 50 MW Hunter Valley Gas Turbines and associated ancillary infrastructure systems that operate to produce around 23,000 gigawatt hours (**GWh**) annually, or approximately 35 per cent (**%**) of New South Wales (**NSW**) electricity supply.

AGLM is seeking approval for the Liddell Battery and Bayswater Ancillary Works Project (**the Project**). As a State Significant Development (**SSD**) under the State Environmental Planning Policy (State and Regional Development) 2011 (**SEPP SRD).** The Project is subject to Part 4, Division 4.7 of the E*nvironmental Planning and Assessment Act 1979* (**EP&A Act**) which requires the preparation of Environmental Impact Statement (**EIS**) in accordance with Secretary's Environmental Assessment Requirements (**SEARs)**.

This Biodiversity Development Assessment Report (**BDAR**) assessment has been developed in support of the EIS for the Project.

1.2 Purpose of this technical report

This BDAR has been prepared in accordance with the SEARs issued for the Project on 23 September 2020 by the Planning Secretary of the NSW Department of Planning, Industry and Environment (**DPIE**).

The SEARs relevant to this technical report are presented in Table **1.1.**

Table 1.1 SEARs – Biodiversity

SEARs	Section addressed
▪ An assessment of the biodiversity values and direct and indirect biodiversity impacts of the development throughout its life in accordance with the *Biodiversity Conservation Act* 2016 (NSW), the Biodiversity Assessment Method, and documented in a Biodiversity Development Assessment Report (BDAR), including a strategy to offset any residual impacts, unless a BDAR waiver is granted; ▪ 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; and- ▪ a detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the development over time.	The BDAR has identified the following biodiversity values that may be impacted by the Project: ▪ Terrestrial – **Chapter 5** and **Chapter 6** ▪ Aquatic – **Section 7** ▪ Groundwater dependent ecosystems – **Section 5.8.** The BDAR has identified biodiversity values listed under the *Environment Protection and Biodiversity Conservation Act 1999* **(EPBC Act**) that may be impacted by the Project in **Chapter 8**. An assessment of the biodiversity impacts of the Project are detailed in **Chapter 10** and **12**. A detailed description of the avoidance and mitigation measures are detailed in Chapter 11 assessment of the biodiversity impacts of the Project are detailed in **Chapter 11**.

SEARs	Section addressed
	An assessment of the biodiversity credits requirements and proposed biodiversity offset strategy for the Project are detailed in **Chapter 13 and 14**.

1.3 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
Chris Thomson	Principal Ecologist, technical review of BDAR	Graduate Certificate in Natural Resources Bachelor of Applied Science Accredited under Section 6.10 of the BC Act as a Biodiversity Assessment Method Assessor (No. BAAS18058)
Matt Consterdine	Ecologist - Vegetation Integrity Surveys and targeted plant searches, fauna surveys, report author	Bachelor of Environmental Science and Management Certificate III Conservation and Land Management Accredited under Section 6.10 of the BC Act as a Biodiversity Assessment Method Assessor (No. BAAS20027)
Tim Maher	Ecologist - Vegetation Integrity Surveys and targeted plant searches, fauna surveys, reporting	Master of Research (Plant Ecology) Bachelor of Advanced Science (Biology)
Julia Bayada	Ecologist - Vegetation Integrity Surveys and targeted plant searches, fauna surveys, reporting	Bachelor of Environmental Science and Management

1.4 Project location

Liddell and Bayswater are located approximately 15 kilometres (**km**) south-east of Muswellbrook, 25 km north-west of Singleton and approximately 165 km north-west of Sydney (refer to **Figure 1-1**). The total area of the AGLM landholding is approximately 10,000 hectares (**ha**), including the Ravensworth rehabilitation area, Lake Liddell and surrounding buffer lands.

The Project is located within an area dominated by mining and power generation. The landscape local to Liddell and Bayswater is heavily influenced by industrial activity. Local land use is dominated by large-scale infrastructure associated with Bayswater and Liddell and open cut mining activities at Ravensworth Mine Complex, Mount Arthur Coal, Hunter Valley Operations, Liddell Coal Mine and the former Drayton Mine. Agricultural clearing for the purposes of grazing is also present within and surrounding the AGLM landholding.

The closest residential area is the Antiene subdivision, which is located approximately 4 km north of the Project.

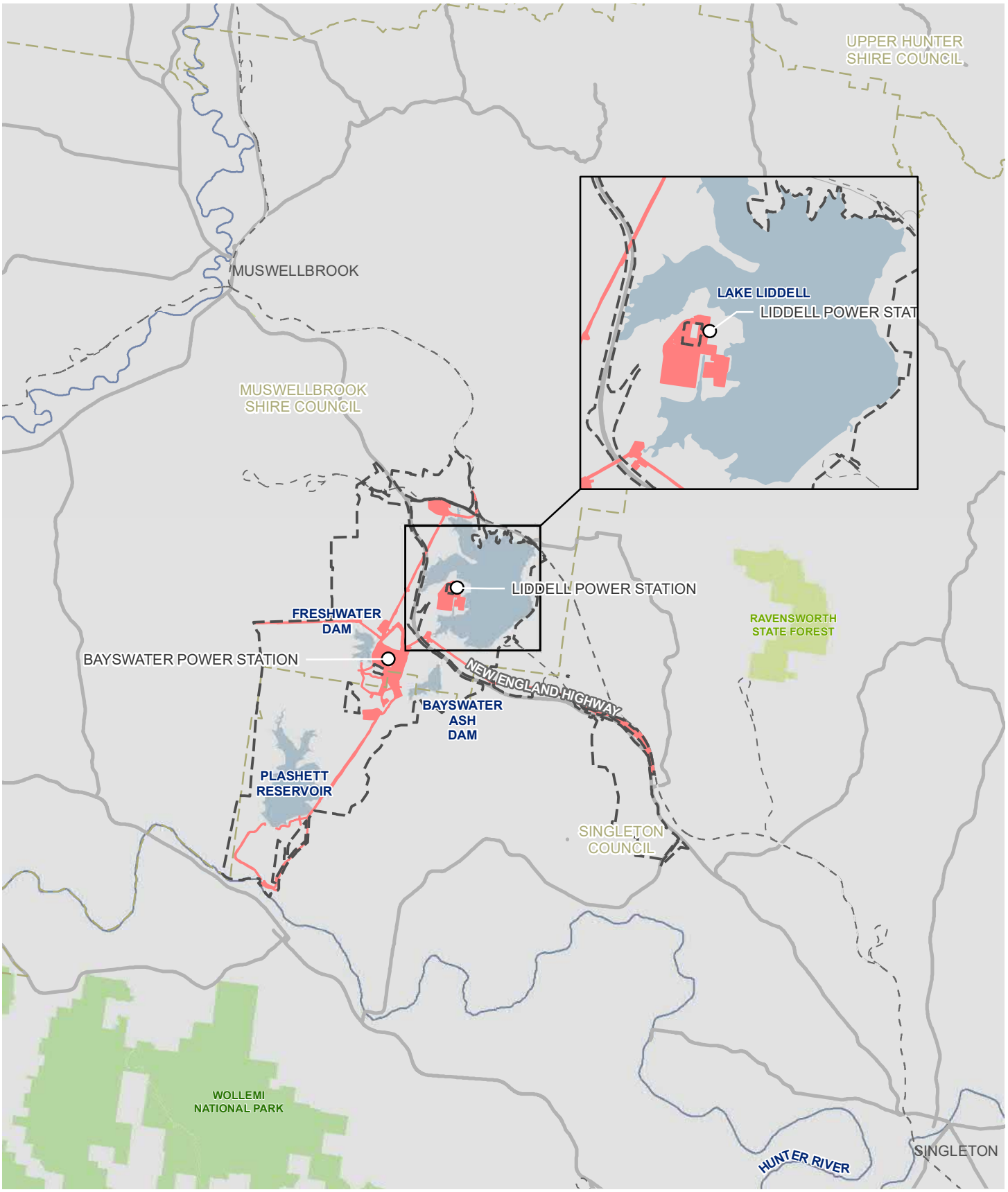
The New England Highway runs between Liddell and Bayswater, with access from the highway provided by means of a dedicated road interchange designed to service the power stations. The Northern Railway Line runs to the east of the AGLM landholding.

The majority of the AGLM landholding has been previously disturbed during the construction and operation of Liddell and Bayswater and historic agricultural practices.

1.5 Key terms used in this report

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

- Development site: this area includes all areas to be directly impacted (see **Figure 1-2**). The development site is also known as the 'subject land' in the BAM. For the purposes of this BDAR, the term *development site* is used
- Assessment area: this area is much larger than the development site and includes the development site and surrounding area within a 50-metre (**m**) buffer (see **Figure 1-2**) and was also surveyed as part of this BDAR
- Locality: this is defined as the area within a 10-km radius surrounding the development site (see **Figure 2-2**)
- Bio-region: this refers to the development site which is located in the Sydney Basin bioregion within the Hunter IBRA sub-region (Thackway and Cresswell, 1995)
- 1,500-m landscape buffer: an area of land within a 1,500-m buffer around the development site. The landscape buffer is an assessment area used to identify landscape features surrounding the development site to provide site context and to inform the likely habitat suitability of the development site (see Figure 1-2).



Legend

- Project area
- AGL owned land
- LGA boundary
- Railway
- Road
- Waterway
- Waterbody
- State forest
- National park

0 5 10 km

1:200,000 at A4

N

Data sources
Jacobs 2021
©Department of Finance, Service and Innovation Aug 2020
AGL 2019

GDA94 MGA56

Figure 2 - 1 Project locality

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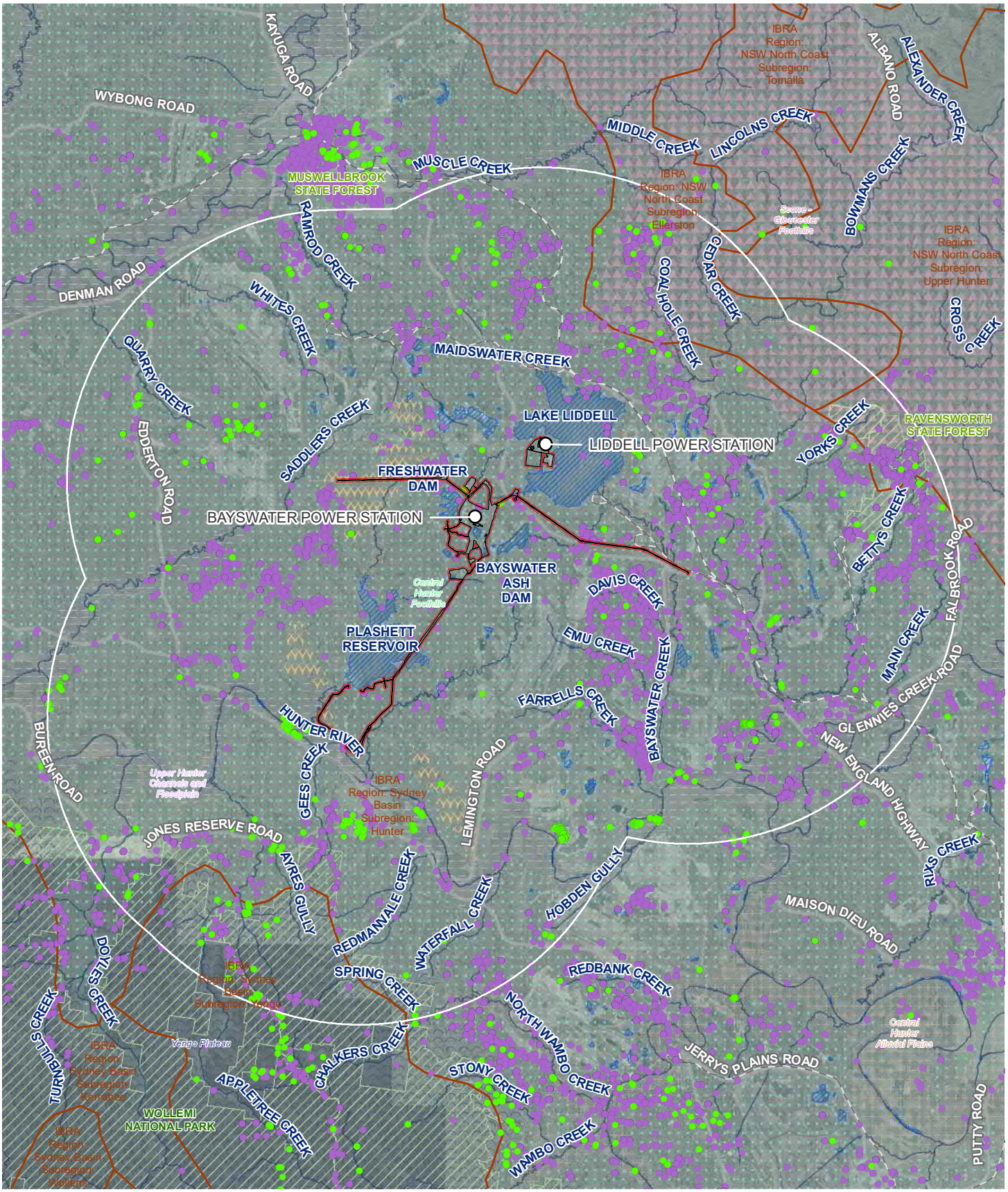

Legend

- Assessment area
- Development site
- 10km locality buffer

Bionet Atlas threatened species sightings
- Flora
- Fauna

- IBRA region/subregion

NSW Landscapes
- Central Hunter Alluvial Plains
- Central Hunter Foothills
- Hunter River Basalts
- Scone - Gloucester Foothills
- Upper Hunter Channels and Floodplain
- Yengo Plateau

- Railway
- Road
- Waterway
- Waterbody
- Wetland
- National park
- State forest

0 5 km

1:195,000 at A4

Data sources

Jacobs 2021
AGL 2020
Department of Planning, Industry and Environment 2016
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Imagery:
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Figure 2 - 2 Location Map

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2. Project description

AGLM are progressing plans to facilitate the efficient, safe and reliable continuation of electricity generating works from Bayswater and Liddell. The Project would consist of the following:

- **The Battery**: A grid connected Battery Energy Storage System (**Battery**) with capacity of up to 500 MW and 2 GWh
- **Decoupling works**: Alternative network connection arrangements for the Liddell 33 kilovolt (**kV**) switching station that provides electricity to infrastructure required for the ongoing operation of Bayswater and associated ancillary infrastructure and potential third-party industrial energy users
- **Bayswater Ancillary Works** (**BAW**): Works associated with Bayswater which may include upgrades to ancillary infrastructure such as pumps, pipelines, conveyor systems, roads and assets to enable maintenance, repairs, replacement or expansion
- **Consolidated consents:** A modern consolidated consent for the continued operation of Bayswater through the voluntary surrender and consolidation into this application of various existing development approvals required for the ongoing operation of AGLM assets.

Construction works associated with the Battery and decoupling works would likely involve as follows:

- Installation and maintenance of environmental controls including temporary and permanent water management infrastructure
- Establishment of a new access from the existing Liddell access roads
- Establishment of a hardstand pad and construction laydown areas
- Cut and fill to battery compound, transformer compounds, footings and construction laydown area
- Trenching and installation of cable from the Battery to 330/33 kV transformer compounds
- Structural works to support battery enclosures, inverters, transformers, buildings and transformer compounds
- Delivery, installation and electrical fit-out of the Battery
- Delivery installation and fit out of transformers and ancillary equipment for decoupling works
- Testing and commissioning activities
- Removal of construction equipment and rehabilitation of construction areas.

The key components of the Project are shown in **Figure 2-1**. A detailed description of the Project and each component is provided in Chapter 2 of the EIS.

2.1 Construction program

The development of the Battery may be staged to respond to market demand. AGLM anticipates the construction occurring over multiple stages. These stages could potentially be:

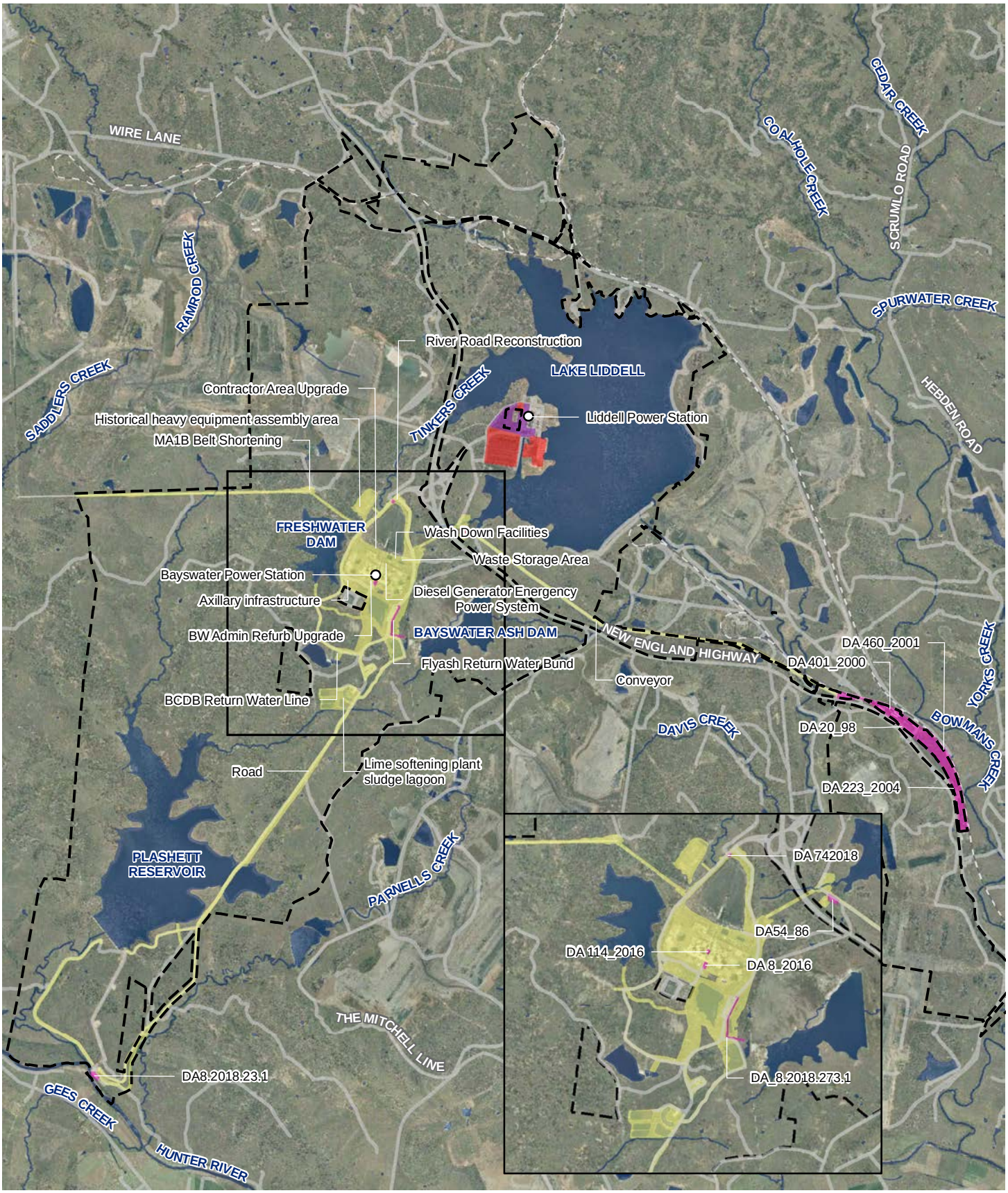
- Stage 1 consisting of 150 MW and 150 MWh
- Stage 2 consisting of an additional 150 MW and 150 MWh
- Stage 3 consisting of 200 MW and up to 1700 MWh with storage capacity being added in response to the needs of the National Energy Market (**NEM**).

The construction of each battery stage is anticipated to take up to 12 months, consisting of the civil works component, mechanical and structural component, electrical works and testing, and commissioning. Stage 3 may be further divided into smaller stages subject to market demand and be delivered on a progressive basis.

The Decoupling works are proposed to be undertaken prior to 2024 to facilitate the planned closure and decommissioning of Liddell. Decoupling works are anticipated to take up to 12 months.

The BAW component would be undertaken at any time up to the planned retirement of Bayswater.

No new disturbance is proposed as part of the approvals to be surrendered and these areas do not require additional assessment in this BDAR.



Legend

Project area
Bayswater Ancillary Works
Battery energy storage system
Decoupling area
Consolidated consent
AGL owned land

Railway
Road
Waterway
Waterbody

0 2 4km

1:90,000 at A4

N

Data sources
Jacobs 2021
AGL 2020
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Imagery:
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Figure 3 - 1 Project overview

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3. Legislation and policy

In accordance with Part 7.9 of the *Biodiversity Conservation Act 2016* (**BC Act**), an application for development consent under Division 4.7 of the EP&A Act to carry out SSD must be accompanied by a BDAR unless the Planning Agency and the Environment Agency Heads determine that the Project is not likely to have any significant impact on biodiversity values. The SEARs issued for the Project (**Section 1.2** of this report) have determined the need for a BDAR in accordance with Section 4.12(8) of the EP&A Act and Schedule 2 of the *Environmental Planning and Assessment Regulations 2000* (EP&A Reg).

The Biodiversity Offsets Scheme (**BOS**) applies to SSD 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 Project as required under the SEARs. This assessment has been undertaken in accordance with the Biodiversity Assessment Method 2020 (**BAM)**. The BDAR documents the results of the biodiversity assessment undertaken for the Project in accordance with relevant State and Commonwealth environmental and threatened species legislation and policy. This BDAR has been prepared by Matt Consterdine (BAAS 20027) who is accredited under Section 6.10 of the BC Act as a BAM Assessor pursuant to Part 6 of the BC Act. Internal technical review of this BDAR was conducted by Chris Thomson (accreditation number BAAS18058).

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 as such is not covered in this BDAR.

The BAM Calculator (**BAM-C**) case number associated with this BDAR is 00022769/BAAS20027/21/00023909.

This BDAR also addresses potential impacts to biodiversity listed under the *Fisheries Management Act 1994* (**FM Act**).

This assessment was undertaken in accordance with and/or in consideration of the following:

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

The EPBC Act is used to assess actions and their likelihood to have a significant impact on matters of national environmental significance (**MNES**). The Project must be referred for a determination as to whether they are a controlled action which requires approval under the EPBC Act. An action includes a project, development, undertaking, activity, or series of activities. The EPBC Act identifies nine MNES:

- World Heritage properties
- National heritage places
- Wetlands of international importance (**Ramsar Convention)**
- Listed threatened species and communities
- Migratory species listed under international agreements

- Great Barrier Reef Marine Park
- Commonwealth marine areas
- Nuclear actions
- Water resources in respect to Coal Seam Gas (**CSG**) and large coal mines.

A Referral has been made under the EPBC Act (EPBC 2020 8844) and identifies that the Project is unlikely to have a significant impact on MNES and is not considered a controlled action. A decision notice under Section 75 of the EPBC Act confirming the Project is not a controlled action was issued by the Commonwealth Department of Agriculture, Water and the Environment (**DAWE**) on 8 January 2021.

This assessment was also undertaken in accordance with and/or in consideration of the following:

- Biodiversity Conservation Regulation 2017 (NSW) (**BC Regulation**)
- *Biosecurity Act 2015* (NSW)
- *Local Land Services Act 2013* (NSW) (**LLS Act**)
- State Environmental Planning Policy (Koala Habitat Protection) 2019 **(Koala SEPP**)
- *Water Management Act 2000* (NSW) (**WM Act**).

4. Landscape features

4.1 IBRA regions and sub-regions

The Project is located in the Sydney Basin IBRA Region (Thackway and Cresswell, 1995), and within the Hunter IBRA sub-region. The site crosses both the Muswellbrook and Singleton Local Government Areas (**LGAs**). The Hunter sub-region is a complex of Permian shales, sandstones, conglomerates, volcanics and coal measures. Bounded on the north by the Hunter Thrust fault and on the south by cliffs of Narrabeen Sandstone, its characteristic landforms are rolling hills, wide valleys, with a meandering river system on a wide flood plain. River terraces are evident, the highest with silicified gravels. Streams can be brackish or saline at low flow. Numerous small swamps in upper catchment, extensive estuarine swamps behind the coastal barrier of beach and dunes. The typical soil is a variety of harsh texture contrast soils on slopes and deep sandy loam alluvium on the valley floors. With a small number of source bordering dunes on southern tributaries of the Hunter. There are deep sands with podsol profiles in the dunes on the barrier with saline, organic muds in the estuary. Soil salinity is common on some bedrocks in the upper catchment.

The BAM uses IBRA regions to identify where alternative species credits can be sourced in accordance with the variation rules under the BOS (Section 6.4 of the BC Regulation 2017). Additionally, the BAM uses IBRA subregions to:

- Filter for threatened species likely to use habitat on the subject land
- Filter for threatened ecological communities that occur on the subject land
- Identify where ecosystem credits can be sourced to offset any impacts of the Project
- Apply the variation rules under the BOS and as identified in Section 6.4 (1) of the BC Act.

4.2 BioNet NSW Landscapes (Mitchell landscapes)

The Project sits within the Central Hunter Foothills 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):

> Undulating lowlands, rounded to steep hills with rock outcrop on ridges on Permian lithic sandstone, conglomerate, shale and coal, general elevation 40 to 300m with a few higher peaks, local relief 30 to 120m. Red-brown to yellow brown harsh texture-contrast soils on slopes, dark coloured clays in valleys and limited accumulations of sand and gravel in streams. The Central Hunter Foothills landscape is defined by typical woodland to open forest communities characteristic of spotted gum (*Corymbia maculata*), forest red gum (*Eucalyptus tereticornis*), narrow-leaved ironbark (*Eucalyptus crebra*), red ironbark (*Eucalyptus sideroxylon*), white box (*Eucalyptus albens*), slaty gum (*Eucalyptus dawsonii*), rough-barked apple (*Angophora floribunda*) with kangaroo grass (*Themeda triandra*) and wallaby grass (*Austrodanthonia* sp).

4.3 Rivers, streams and estuaries

Numerous drainage lines and 1st or 2nd order creeks drain from the Assessment area directly into Lake Liddell or via Tinkers Creek. Other tributaries drain into Pikes Creek and into Bayswater Creek (which ultimately flows into the Hunter River to the south). These creeks, as well as Lake Liddell have been significantly modified to accommodate for the water needs and outputs of Liddell and Bayswater. As such, many waterways are already susceptible to changes in quality and temperatures. Many 1st order and 2nd order streams mapped in the Assessment area (**Figure 7-1**) have been redirected or removed entirely. The creation of man-made canals in (particularly BAW areas) has altered water flows and changed environmental conditions of the naturally

occurring creeks in the areas adjacent to the development site. Saltwater Creek (5th order stream) and a number of other unnamed 1st order streams flow into the Hunter River from below Plashett Reservoir in the south of the BAW area. The flow of these ephemeral creeks is dependent on rainfall and they rarely receive water from Plashett Reservoir or man-made canals of the development site. Parnells Creek (3rd order) occurs to the east of the development site near Plashett Reservoir and is outside the development site. Some small 1st order drainage lines (dry during survey) flow across the road south of Bayswater and into Wisemans Creek, which eventually flows into Plashett Reservoir.

A series of large dams have been constructed in the development site (particularly the BAW areas) for treatment of water and waste from the power stations. These dams range from good-condition freshwater ponds with aquatic vegetation to poor-condition dams containing saline water, sediment or various stages of treated sewage.

All waterways within the development site are modified and contain only small amounts of fringing aquatic vegetation. The natural drainage has been interrupted by constructed dams and/or drainage infrastructure.

4.4 Wetlands

No important wetlands sit within or adjacent to the development site, as according to the BAM definition of important wetlands. The Coastal Wetland, Hunter River – Estuarine, listed under the State Environmental Planning Policy (Coastal Management) 2018 (**Coastal Management SEPP**), is the closest, which occurs 65 km to the south east of the Project area. Local wetlands not identified as important wetlands (according to the BAM) do occur within the Project area.

4.5 Connectivity of habitat

According to the BAM, for development sites, the assessor must identify the connectivity of different areas of habitat that may facilitate the movement of threatened species across their range.

Analysis of Vegetation of the Central Hunter Valley mapping (Peake, 2006) shows that this landscape has been widely cleared in the past and native vegetation remnants are fragmented with limited habitat connectivity remaining.

The development site is generally confined to infrastructure associated with Bayswater and Liddell, and is intersected by internal roads, coal conveyors, transmission lines, water pipelines as well as the New England Highway. Given the development site is mostly cleared and has had a long history of development associated with power generation, as well as grazing, the small vegetation patches remaining within the development site are already isolated from larger woodland areas occurring mainly to the west and north-west. Habitat connectivity within the development site is poor and the existing patches of vegetation are subject to a disturbance from activities associated with routine vegetation management, meaning they would likely be avoided by most native fauna groups. The Project would increase habitat fragmentation to a small degree in the vicinity of the power stations.

Similarly, native vegetation within the wider landscape is also considerably fragmented as a result of decades of land clearing for agriculture and open-cut coal mining. Nonetheless, numerous large remnants still exist, with some quality patches occurring to the west of the development site (and to the south-east of Drayton Mine). A significant north-south vegetation corridor runs from the southern end of Liddell Coal Ash dam to the western edge of Plashett Dam towards Jerrys Plains. This corridor is around 10 km long and up to 2.5 km wide and contains quality patches of Central Hunter Box – Ironbark Woodland and Central Hunter Bulloak Forest (as well as rehabilitation and plantation patches). Much of this vegetation was mapped and described recently in the

Vegetation Mapping Report – Bayswater and Liddell Power Stations (Kleinfelder,2017). Some of the vegetation patches on the development site are within the periphery of this corridor and could also be used by native fauna species during movements between habitats (particularly highly mobile species such as birds and bats). However, these patches are generally separated by small barriers such as roads or clearings. The landscape to the east of the development site is less vegetated and lacks any significant native vegetation corridors. Most woodland areas here are small and relatively isolated. Large barriers to dispersal of flora and fauna exist such as Lake Liddell, New England Highway, Hunter Valley Operations -West Pit mine as well as large areas of cleared grazing land. The riparian corridors of the Hunter River border the southern edge of the development site. The vegetation along this section of the Hunter River is characterized by thin bands of River Oak (*Casuarina cunninghamiana*) and patches of Swamp oak (*Casuarina glauca*). Whilst this riparian strip is mostly continuous (along banks) it is highly disturbed (with dense weeds in understorey and ground layer) and is very thin in some sections (ranging from 5m to 50m wide generally). This corridor is existing outside the development site and will not be affected by the project.

4.6 Areas of geological significance and soil hazard features

The development site contains no areas of geological significance, significant soil hazard features, steep slopes, significant drainage features, or Acid Sulphate Soil (**ASS**) areas.

4.7 Areas of outstanding biodiversity value

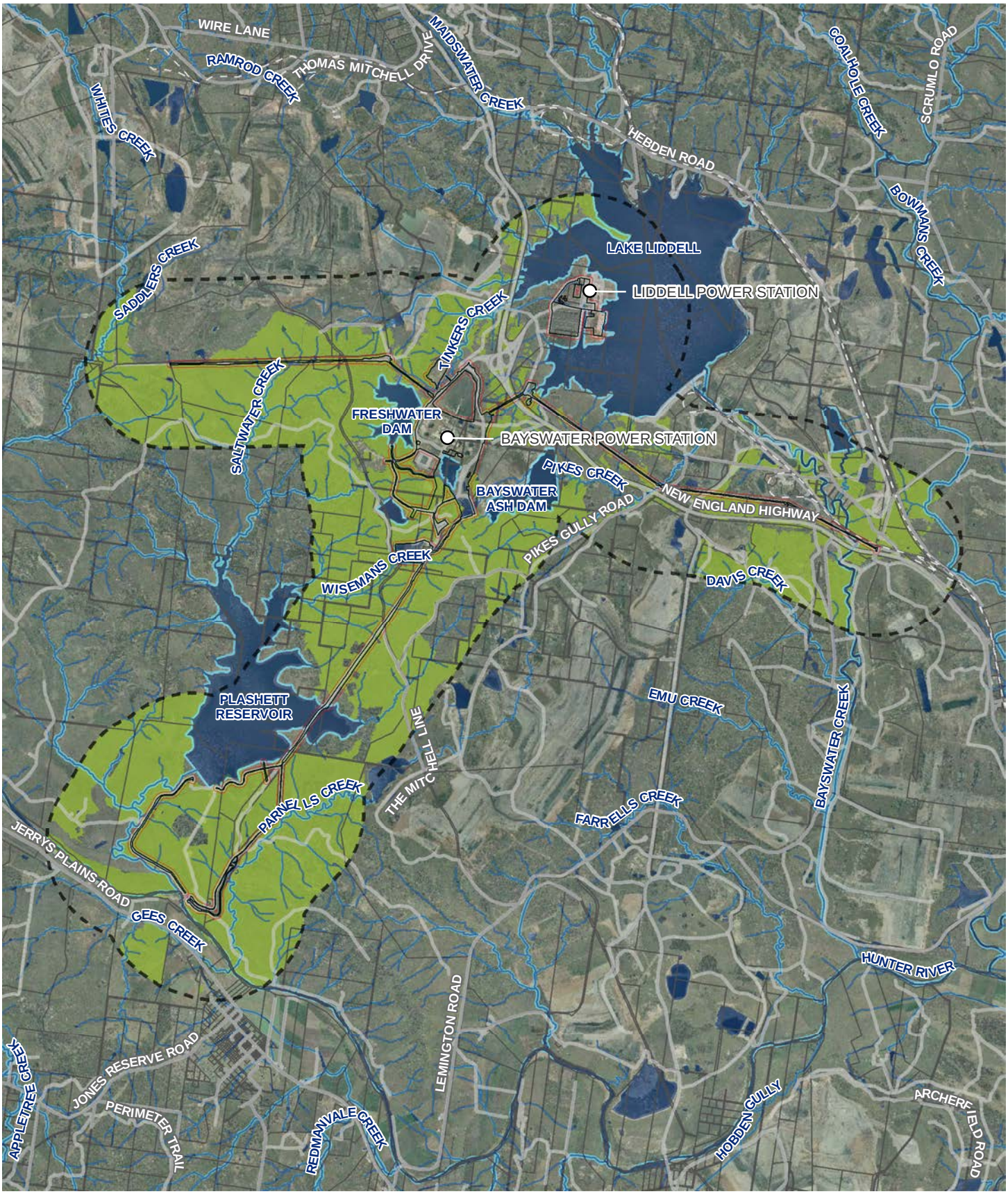
There are no areas of outstanding biodiversity value mapped within the development site.

4.8 Native vegetation extent

To assess the current extent of native vegetation, a buffer of 1,500 m was placed around the boundary of the development site (**Figure 4-1**).

Native vegetation cover is assessed on the development Site and within a 1,500 m buffer area surrounding the outside edge of the boundary of the development Site. This 1,500 m site buffer has an area of 10,435.2 ha which has a native vegetation cover of 5,259.1 ha or 50%. This estimate is based on State Vegetation Type Map: Upper Hunter v1.0. VIS_ID 4894 (DPIE, 2018), however, this percentage is more likely to be as low as 30% based on findings of the Bayswater Power Station Water and Other Associated Operational Works (**WOAOW Project**) (Kleinfelder,2020) and *Vegetation Mapping Report – Bayswater and Liddell Power Stations* (Kleinfelder,2017).

All native woody vegetation within the 1,500 m buffer, including rehabilitation areas, were mapped within the native vegetation cover **(Figure 4-1**). The majority of the woody vegetation occurs to the west of the development Site. Areas of native grasslands were assessed using previous mapping conducted by Kleinfelder (within Bayswater and Liddell), and the Upper Hunter State Vegetation Type Mapping.



Legend

- Assessment area
- Development site
- 1500m landscape assessment boundary
- Native vegetation
- Railway
- Road
- Cadastre
- Waterbody
- Riparian corridor

0 2 4 km

1:97,000 at A4

N

Data sources

Jacobs 2021
AGL 2020
Department of Planning, Industry and Environment 2012
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Figure 4 - 1 Site map

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5. Native vegetation and vegetation integrity

5.1 Background research and data sources

The BDAR completed recently for the WOAOW Project (Kleinfelder, 2020) was reviewed and the results from on-ground vegetation surveys were used to inform the preparation of the vegetation assessment for this BDAR. The vegetation mapping and threatened species observations were gathered and used to inform the field survey program for this Project.

5.2 Mapping extent of native vegetation

The extent of native vegetation in the development site was mapped using aerial imagery. Polygons were digitised in Geographic Information System (**GIS**) (ArcGIS 10.7) at a scale of between 1:1,000 and 1:5,000. The vegetation extent within the development site and a 50 m buffer of this area (**Assessment area**) has been mapped in detail. Some boundary errors may still exist, particularly within the peripheries of the wider Assessment area (beyond the development site). Vegetation mapping was assisted by review of State Vegetation Type Map: Upper Hunter v1.0. VIS_ID 4894 as well as recent vegetation mapping undertaken for the *Vegetation Mapping Report – Bayswater and Liddell Power Stations* (Kleinfelder,2017).

5.2.1 Definition of native 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 LLS Act. Part 5A 60B of the LLS Act defines the meaning of native vegetation as any of the following types of plants native to NSW:

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

A plant is native to NSW if it was established in NSW before European settlement.

Whilst the majority of cleared areas within the development site contain exotic grasslands, some sections contain occasional native trees or shrubs (mostly regrowth *Acacia salicina*). Derived native grasslands also exist in a small part of the development site. While these areas are heavily disturbed, they do contain native vegetation. As such, these areas have been assigned to the most likely PCT as the original PCT can be determined with reasonable confidence based on adjacent PCTs and position in the landscape.

5.2.2 Survey limitations (Vegetation)

The vegetation within the development 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 this 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 will change with time and in response to long-term variation in biophysical conditions on the site such as rainfall and surface drainage patterns.

5.3 Plant community type identification

The types and distributions of PCTs within the development site were identified and mapped progressively during the field surveys. The identification of PCTs presented here is in accordance with the NSW PCT classification as described in the BioNet Vegetation Classification. Each PCT was assigned to the relevant corresponding Threatened Ecological Community (**TEC**) where applicable. A plot-based floristic vegetation survey as described in Section 4.2 of the BAM was undertaken across the development site, supplemented with rapid vegetation assessments of dominant species in accessible areas of the broader Assessment area, to identify the PCTs or most likely PCTs. The plot-based floristic vegetation surveys were undertaken over numerous visits to site in late 2020. (see **Table 5.1** for a summary of survey timing).

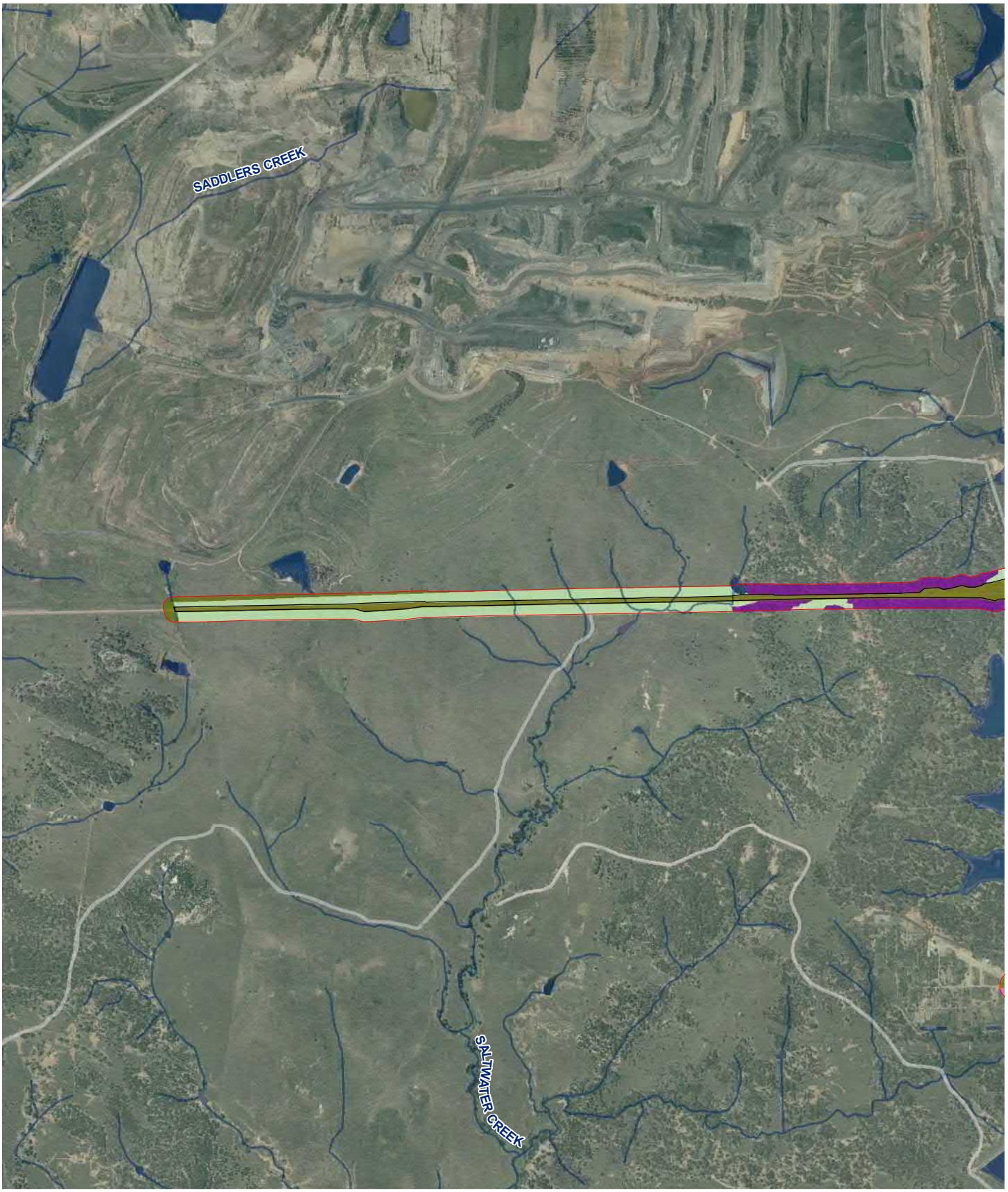
Table 5.1 Survey effort – Vegetation assessment

Survey date	Number days
Preliminary site visit, PCT identification, mapping and scoping surveys	
25 August 2020	1
Main survey period (PCT mapping and VI surveys)	
6-10 October 2020	4
11-12 November 2020	2

5.3.1 Stratification of native vegetation into survey units

Using 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 development site. 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 development site are described in detail in **Section 5.4**.

The vegetation within the development 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 (as illustrated in **Figure 5.1**)



Legend

- Assessment area
- Development site
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

Data sources

Jacobs 2021
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Figure 5 - 1 Map of plant community types

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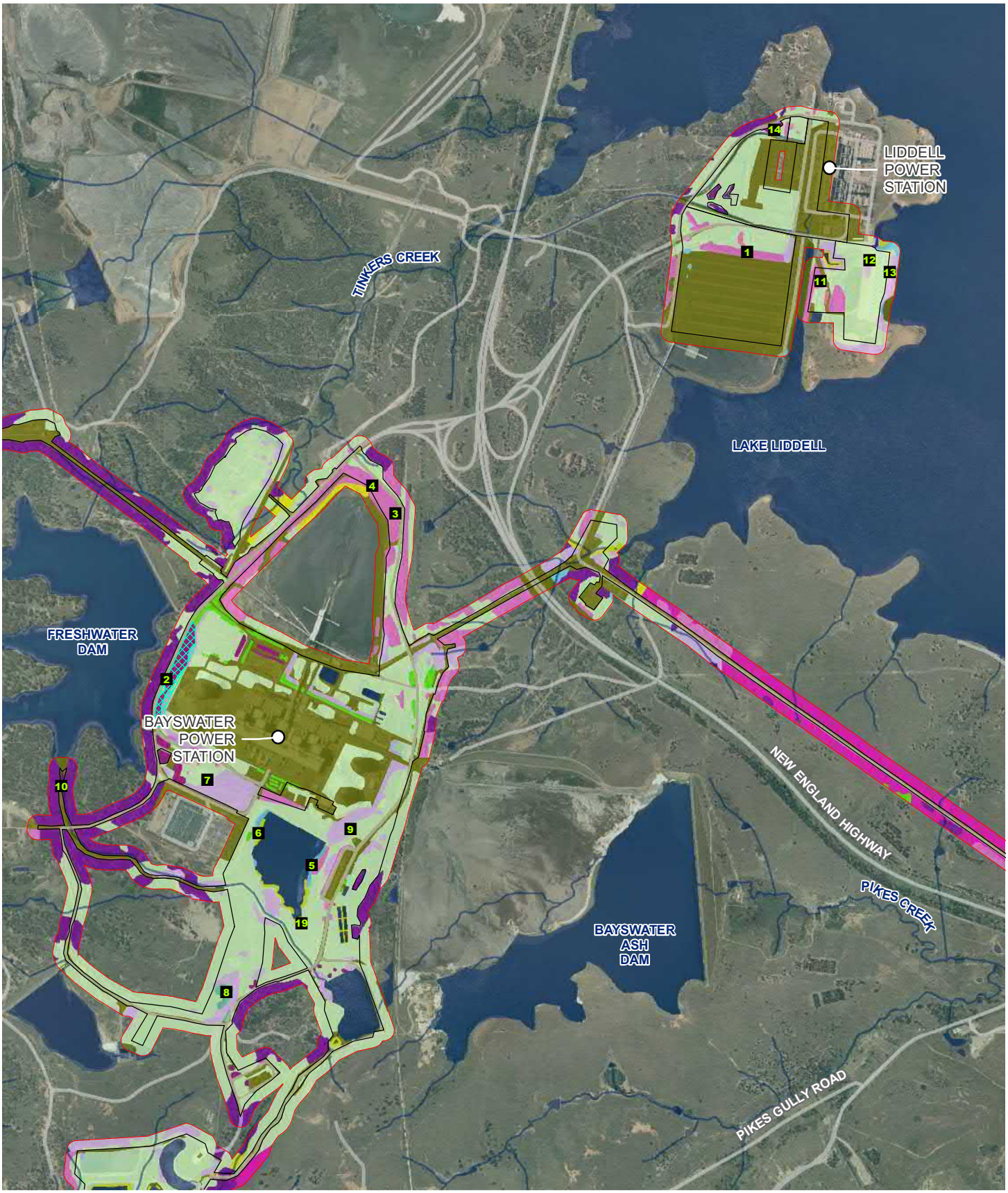

Legend

- Assessment area
- Development site
- Vegetation integrity plot
- Vegetation to be retained
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

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Data sources

Jacobs 2021
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Imagery:
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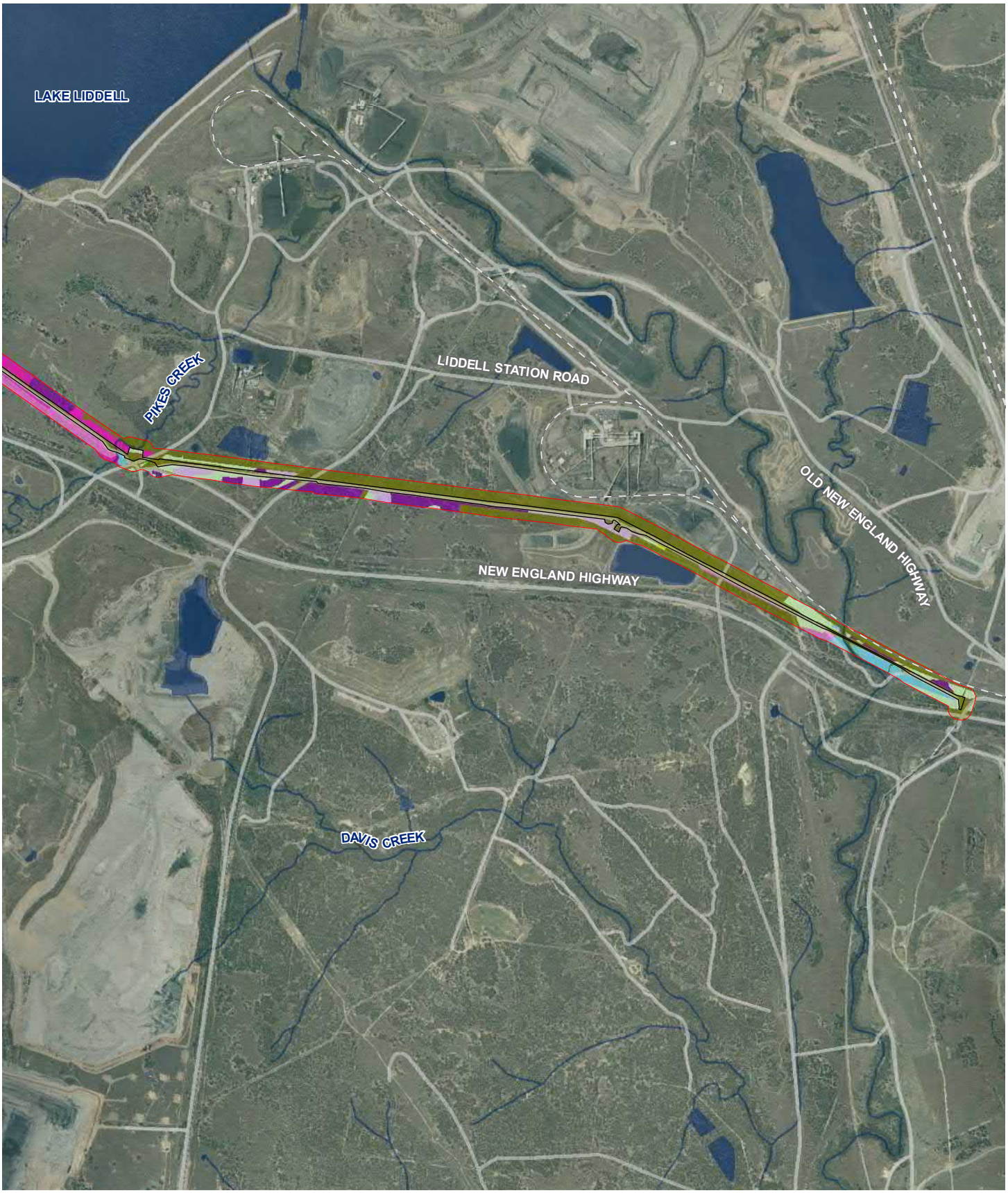

Legend

- Assessment area
- Development site
- Railway
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

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Data sources

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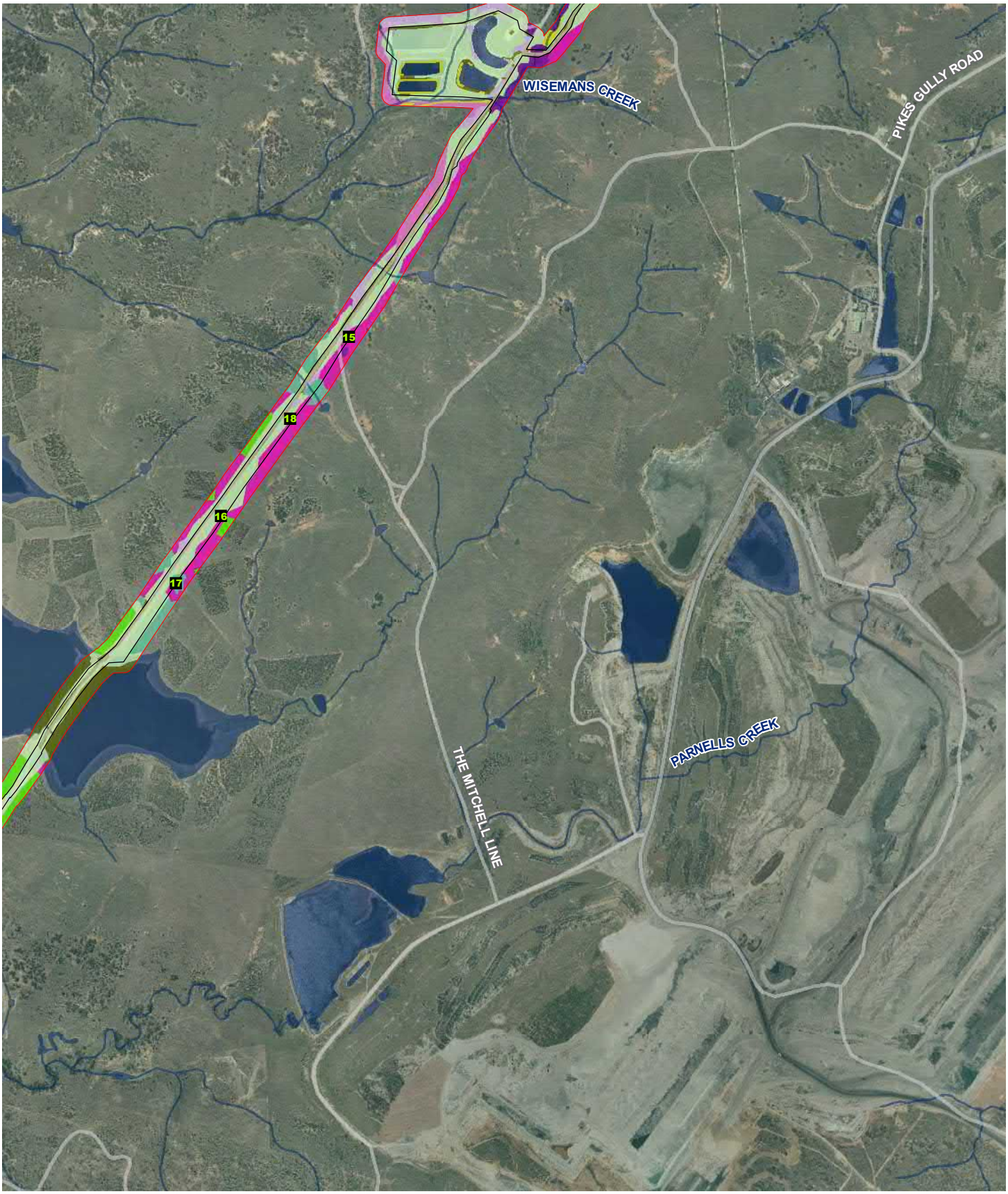

Legend

- Assessment area
- Development site
- Vegetation integrity plot
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

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Data sources

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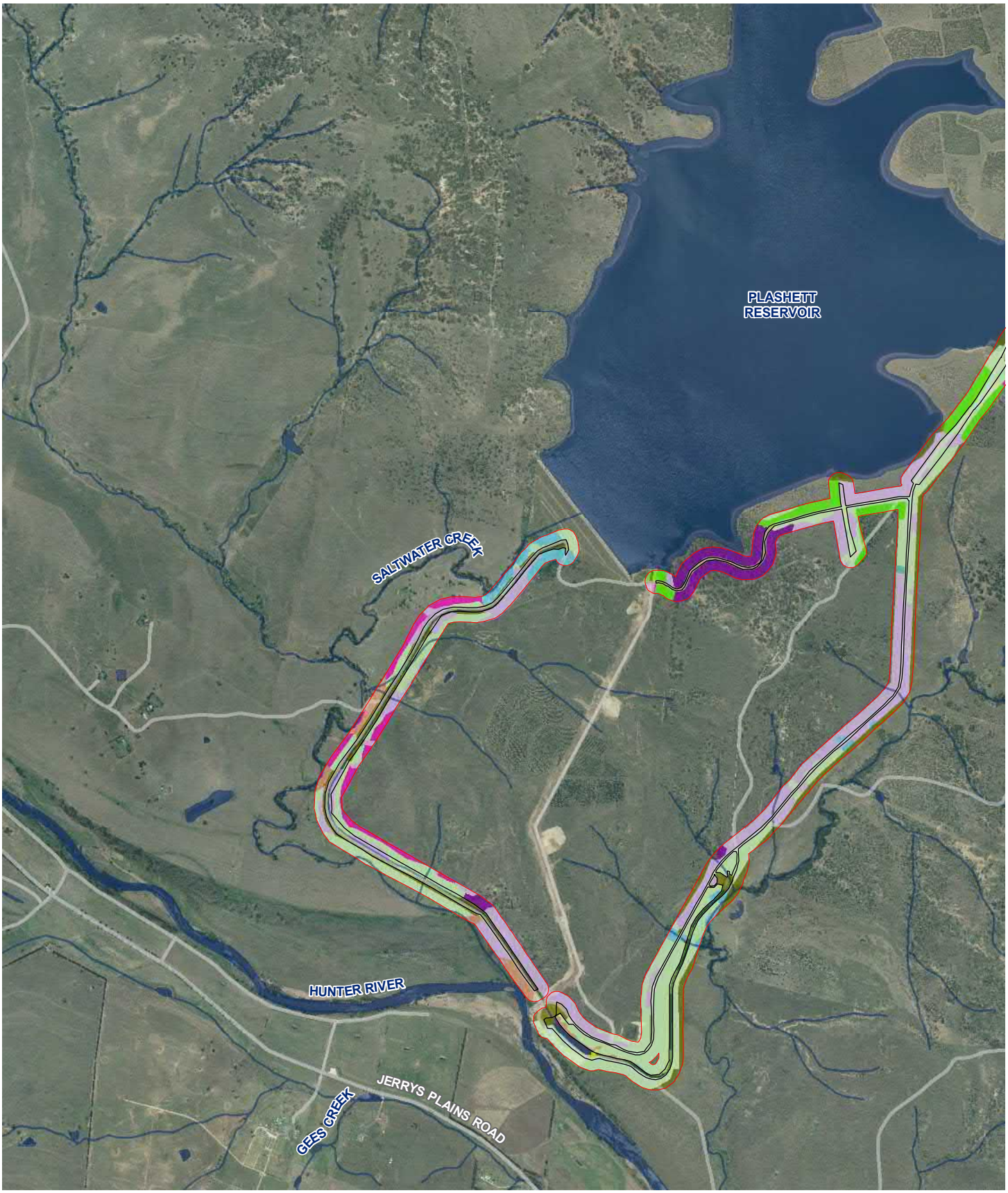

Legend

- Assessment area
- Development site
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 485 River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion)
- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

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Data sources

Jacobs 2021
AGL 2020
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There are 44.3 ha of native vegetation assigned to PCTs within the development site (refer to **Table 5.2**). The remaining vegetated areas (138 ha) of the development site contain exotic grassland (134.1 ha) or planted non-indigenous trees (3.9 ha). Vegetation within the Assessment area (50m buffer of development site) has not been stratified as it is not included in the impact assessment.

5.3.2 Plot-based floristic vegetation survey and vegetation integrity assessment

A plot-based full floristic survey and vegetation integrity assessment was undertaken in accordance with the BAM using a series of 20 x 20 m plots (or 400 square metres (**m²**) (equivalent area), each nested inside a 20 x 50 m plot (or equivalent 1,000 m^2 area).

The location of each plot/mid-line completed during the survey is illustrated in **Figure 5-1.** 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. The emphasis was on identifying broad condition states within each PCT and no attempt was made at fine scale mapping in areas of variable vegetation density.

A summary of the PCTs, vegetation zones and survey effort completed in each vegetation zone is provided in **Table 5.2**.

Nineteen vegetation integrity assessment plots were completed throughout the development site. Due to changes in the development site boundary during the course of the study, the location of one of the PCT 1691 'Regrowth' plots is now outside the development site (although still within the wider Assessment area). The data from this plot was also used to calculate vegetation integrity of PCTs within the development site.

Table 5.2 PCT and vegetation zones identified in the development site

Vegetation Zone	PCT ID No.	PCT name	Broad condition class	Vegetation zone area in development site (ha)	Minimum number of plots/mid-lines required (Table 4 BAM)	Number of plots/mid-lines completed
1	1691	Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	Moderate	4.3	2	3
2			Regrowth	21.6	4	4
3			Rehabilitation	11.4	3	4
4			Native Grassland	2	2	3
5	1731	Swamp Oak – Weeping Grass grassy riparian forest of the Hunter Valley	Moderate-Good	0.9	1	1

Vegetation Zone	PCT ID No.	PCT name	Broad condition class	Vegetation zone area in development site (ha)	Minimum number of plots/mid-lines required (Table 4 BAM)	Number of plots/mid-lines completed
6	1692	Bull Oak grassy woodland of the central Hunter Valley	Moderate-Good	1.2	1	2
7	1071	Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	Moderate	3	2	2

5.4 Plant community types

The PCTs identified within the development site are listed in **Table 5.2** and their distribution is outlined in **Figure 5-1. Figure 5-1** also maps the extent of the PCTs over a 50 m buffer from the development site. The mapping of PCTs has also been extended to the larger Assessment area to provide context. Descriptions of the vegetation that occurs in the development site are provided in the following sections matched to the most likely PCT as described in the BioNet Vegetation Classification database. In most cases the vegetation on site does not perfectly align with any PCT listed in the BioNet Vegetation Classification database so the vegetation has been allocated to the PCT with which it most closely aligns. Vegetation integrity plot data is provided in **Appendix B** and **Appendix C**.

Four PCTs, as defined in the BioNet Vegetation Classification database, were identified within the development site: including:

- PCT 1691: Narrow-leaved Ironbark – Grey Box grassy woodland of the Central and Upper Hunter. PCT 1691 was divided into four zones based on condition, this included areas of 'moderate condition' woodland, regrowth (mostly *Acacia salicina*), rehabilitation (containing some planted Grey Box or Ironbark) and derived native grassland, which were assigned to PCT 1691 as the closest equivalent (this is discussed further in descriptions below)
- PCT 1692: Bull Oak grassy woodland of the Central Hunter Valley. PCT 1692 is present in small patches of the Bayswater site. This PCT is assigned to one vegetation zone
- PCT 1731: Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley. Areas of PCT 1731 constituted one zone. Whilst this PCT is present within the development site (along edges of artificial waterbodies), the proposed future works will generally avoid wetlands, ponds and riparian vegetation
- PCT 1071: Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion. Whilst this PCT is present within the development site (in edges of artificial waterbodies), the proposed future works may avoid wetlands, ponds and aquatic vegetation.

The development site predominantly contains non-native vegetation (134.1 ha), characterised by large expanses of exotic grasslands. Much of the development and disturbance is associated with decommissioning or upgrading of existing facilities and therefore generally impacts existing infrastructure areas such as internal roads, carparks, coal conveyors, pipelines, coal stockpiles and other ancillary infrastructure to support the ongoing operation of the power stations. Such areas do not contain vegetation and have no ecological value, these have been mapped as 'excluded / artificial surface' and make up 148.5 ha within the development site. These areas do not require further assessment under the BAM.

PCT 485 River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion) is present in the far-south of the Assessment area along the edges of the Hunter River. The patches of River Oak which represent this PCT are located beyond the development site and are not affected by the Project, and for this reason have not been assessed.

5.4.1 Narrow-leaved Ironbark - Grey Box grassy woodland of the Central and Upper Hunter – Moderate (PCT 1691)

Vegetation Formation: Grassy woodlands

Vegetation Class: Coastal valley grassy woodlands

PCT % Cleared: 77%

Area within Development Site:

- Vegetation Zone 1 (Moderate) - 4.3 ha (2.04 ha to be retained)
- Vegetation Zone 2 (Regrowth) – 21.6 ha
- Vegetation Zone 3 (Rehabilitation) – 11.4 ha
- Vegetation Zone 4 (Native Grassland) – 2 ha.

Vegetation Zone 1-Moderate Condition 4.3 ha

The canopy of this community is dominated by *Eucalyptus moluccana* (Grey Box) and *Eucalyptus crebra* (Narrow-leaved Ironbark), with *Eucalyptus tereticornis* (Forest Red Gum), locally dominating in areas (discussed further below).

In the less disturbed areas, a scattered mid-storey exists and contains *Allocasuarina luehmannii* (Bulloak), *Acacia salicina* (Native Willow), *Acacia falcata* (Sickle wattle), *Brachychiton populneus* (Kurrajong) and *Notelaea microcarpa* (Narrow-leaved mock-olive), (see **photo 5-1**).

The ground layer within the development site contains dense exotic *Hyparrhenia hirta* (Coolatai grass) with a small assemblage of native grasses with scattered forbs and small shrubs. Commonly occurring native species include *Aristida ramosa* (Purple Wiregrass), *Rytidosperma fulvum* (Wallaby Grass), *Cymbopogon refractus* (Barbed Wire Grass), *Dichondra repens* (Kidney Weed), *Calotis lappulacea* (Yellow burr daisy), *Linum marginale* (Native Flax) *Cheilanthes sieberi* subsp. *sieberi* (Poison Rock Fern) and *Lomandra multiflora* (Many-flowered Mat-rush).

Much of this vegetation zone lacks a mid-storey due to regular grass mowing and vegetation management in areas surrounding the power stations (see **photo 5-2**).

Numerous weed species were recorded within this vegetation zone, typically at lower abundances in areas away from clearings and disturbed areas. Common exotic species include *Sida rhombifolia* (Paddy's Lucerne), *Senecio madagascariensis* (Fireweed), *Opuntia stricta* (Common Prickly Pear), *Chloris gayana* (Rhodes Grass) and *Hyparrhenia hirta* (Coolatai Grass).

This vegetation zone was assigned to PCT 1691 due to the following key species which were consistently present within vegetation: *Eucalyptus moluccana, E. crebra, Brachychiton populneus, Acacia falcata, Eremophila debilis, Aristida ramosa, Cymbopogon refractus, Calotis lappulacea and Dichondra repens* (see **Table 5.3**)

The structure and landscape position of this vegetation within the development site is consistent with the description for PCT 1691, comprising of a Eucalypt Woodland where the ground stratum is the prominent understorey and is typically grassy with scattered forbs. This community occurs across the upper Hunter Valley and low hills between Broke and Merriwa, and north to Scone. It typically occurs on coal-bearing sedimentary geologies (e.g. Wittingham Coal Measures) on flats and mid-slopes at elevations between 70 and 350 m.

Other Grassy Woodlands within the Sydney Basin IBRA region were considered in undertaking the above determination. Two potentially suitable PCTs were identified; PCT 623 and 1603. Both PCT 623 and 1603 have floristic similarities with the vegetation within the development Site.

PCT 623 occurs in the Central to Upper part of the Hunter Valley around Scone in areas with about 1,000 mm of rainfall. The development site does not receive that amount of rainfall (approximately 700 mm annually) and is not that far north. PCT 1603 is an open forest dominated by *Eucalyptus crebra* and while the species occurs, the description of 1691 is more accurate for the vegetation within the development Site.

This vegetation zone is consistent with the Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions Endangered Ecological Community (**EEC**) listed under the BC Act. This TEC is explained in greater detail in **Section 5.7**. Only one patch of this vegetation zone meets the condition thresholds for the Central Hunter Valley eucalypt forest and woodland Critically Endangered Ecological Communities (**CEEC**) listed under the EPBC Act (see **Chapter 8**). This single patch is to be retained.

Table 5.3: Floristic and structural summary of PCT 1691 Vegetation Zone 1 within the development site

Vegetation layer	Dominant species
Tree canopy (upper stratum)	*Eucalyptus moluccana, E. crebra, E tereticornis, Brachychiton populneus*
Midstorey (mid stratum) (Not always present)	*Acacia salicina, A falcata, Notelaea microcarpa*
Groundcovers (ground stratum) (Not always present)	*Aristida ramosa, Rytidosperma fulvum, Cymbopogon refractus, Dichondra repens, Calotis lappulacea, Linum marginale, Cheilanthes sieberi subsp. sieberi and Lomandra multiflora*
Exotic species	*Sida rhombifolia*, *Senecio madagascariensis, Opuntia stricta, Chloris gayana and Hyparrhenia hirta*
High threat weeds	*Hyparrhenia hirta*, *Senecio madagascariensis*, *Chloris gayana*

Photo 5-1: A patch of PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter 'Moderate condition class' (Zone 1) with mid-storey intact (near Bayswater Freshwater lake pipe outfall). Note dense exotic Coolatai Grass in ground layer.

Photo 5-2: A patch of PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter 'Moderate condition class' (Zone 1) with mid-storey absent due to mowing and vegetation management.

Vegetation Zone 2-Regrowth 21.6 ha

This vegetation zone has been assigned to 'regrowth' due to the absence of a canopy. Previous land clearing has left only very sparse eucalypts and occasional *Allocasuarina luehmannii* (Bull Oak). Remaining Eucalypt species include *Eucalyptus moluccana* (Grey Box), Eucalyptus crebra and *Eucalyptus tereticornis* (Forest Redgum) – meaning that these areas likely once existed as PCT 1961. The mid-storey and ground layer are highly modified as a result of previous land clearing and infrequent vegetation management in the areas surrounding the power stations and infrastructure. This vegetation zone is characterized by a monoculture of regrowth and mature *Acacia salicina* (Native Willow) growing amongst dense exotic grasses, particularly *Hyparrhenia hirta* (Coolatai Grass), refer to **Photo 5-3**. It is likely that the dense exotic grass is currently supressing germination of other native plant species. Given the lack of woodland structure, this vegetation zone is in poor condition with low ecological value.

Hyparrhenia hirta (Coolatai Grass) and *Carthamus lanatus* (Saffron Thistle) are highly dominant in most areas. Other exotic species include *Sida rhombifolia* (Paddy's Lucerne), *Senecio madagascariensis* (Fireweed), *Galenia pubescens* (Galenia), *Gomphocarpus fruticosus* (Cotton Bush), *Plantago lanceolata* (Lamb's Tongues), *Chloris gayana* (Rhodes Grass), *Axonopus fissifolius* (Narrow-leafed Carpet Grass), *Rapistrum rugosum* (Wild Mustard) and *Bidens pilosa* (Cobblers Pegs).

This vegetation was determined to be the same PCT as Vegetation Zone 1 and 2 although it has been modified due to land clearing. This was determined through assessment of the dominant species occurring within both vegetation zones (see **Table 5.4**) as well as a comparison landscape setting and surrounding vegetation.

Due to the general absence of canopy species within this zone, it is lacking key diagnostic species and the woodland structure to be classified as the Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions **EEC** listed under the BC Act. Likewise, this vegetation zone was not included in the Central Hunter Valley eucalypt forest and woodland CEEC after assessment against the key diagnostic characteristics and minimum condition criteria outlined in the Conservation Advice (TSSC 2015) (see **Section 5.7** below for full assessment).

Table 5.4: Floristic and structural summary of PCT 1691 Vegetation Zone 2 within the development site

Vegetation layer	Dominant species
Tree canopy (upper stratum)	absent
Mid-storey (mid stratum)	*Acacia salicina*
Groundcovers (ground stratum)	Non-native
Exotic species	*Hyparrhenia hirta, Carthamus lunatus, Gomphocarpus fruticosus Sida rhombifolia, Senecio madagascariensis, Galenia pubescens, Chloris gayana, Bidens pilosa, Rapistrum rugosum, Axonopus fissifolius*
High threat weeds	*Hyparrhenia hirta, Carthamus lunatus, Senecio madagascariensis, Chloris gayana, Rapistrum rugosum, Galenia pubescens, Axonopus fissifolius*

Photo 5-3: A patch of PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter 'Regrowth' (near Bayswater). This vegetation zone is characterised by regrowth *Acacia salicina* with dense exotic Coolatai Grass in ground layer.

Vegetation Zone 3 – Rehabilitation: 11.4 ha

Areas of Rehabilitation consist of mixed stands of native species dominated by mixtures of *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus moluccana* (Grey Box), *Eucalyptus tereticornis* (Forest Redgum), *Eucalyptus punctata* (Grey Gum), *Corymbia maculata* (Spotted Gum), *Eucalyptus melliodora* (Yellow Box) and *Casuarina glauca* (Swamp Oak) in the canopy (see **photo 5-4**).

A scattered mid-storey of *Acacia salicina* (Native Willow), *Acacia spectabilis* (Mudgee Wattle) and *Acacia decora* (Western Silver Wattle) also occurs (see **Table 5.5**).

The groundcover is commonly dominated by exotic grasses *Hyparrhenia hirta* (Coolatai grass), *Chloris gayana* (Rhodes grass), *Megathyrsus maximus* (Guinea grass) although occasional native grasses *Aristida ramosa* (Purple Wiregrass), *Cymbopogon refractus* (Barbed Wire Grass) and *Cynodon dactylon* (Couch) exist. Native herbs are also present including *Enchylaena tomentosa* (Ruby Saltbush), *Einadia nutans* subsp. *nutans*, *Vittadinia cuneata* (Fuzzweed) and *Solanum cinereum* (Narrawa burr). Common weed species within rehabilitation areas include *Galenia pubescens* (Galenia), *Bidens Pilosa* (Cobblers Pegs), *Opuntia stricta* (Common Prickly Pear) and *Sida rhombifolia* (Paddy's Lucerne).

As the canopy species within this vegetation zone have been planted, and the composition only partially aligns with natural vegetation in the area, the landscape position and surrounding vegetation types have been used to assign the closest equivalent PCT to this vegetation zone. As the dominant woodland vegetation type within the development Site, and the surrounds, is PCT 1691, this has been assigned to areas of rehabilitation within the development Site. Noteworthy, most sections of rehabilitation contain mature *Eucalyptus moluccana* (Grey Box)

and *Eucalyptus crebra* (Narrow-leaved Ironbark) which are characteristic species of PCT 1691. As a precautionary approach, areas of rehabilitation which contain planted mature Grey Box and Narrow-leaved Ironbark have also been assigned to Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions EEC listed under the BC Act. However, the same patches do not constitute the Commonwealth EPBC listed Central Hunter Valley eucalypt forest and woodland CEEC after assessment against the key diagnostic characteristics and minimum condition criteria outlined in the Conservation Advice (TSSC 2015) (see **Section 8.3** for full assessment).

A large proportion of rehabilitation areas occur on modified substrates and elevated mounds of soil (particularly in the areas surrounding Bayswater).

Table 5.5: Floristic and structural summary of PCT 1691 Vegetation Zone 3 within the development site

Vegetation layer	Dominant species
Tree canopy (upper stratum)	*Eucalyptus crebra, Eucalyptus moluccana, Eucalyptus tereticornis, Eucalyptus punctata, Corymbia maculata, Eucalyptus melliodora and Casuarina glauca.*
Mid-storey (mid stratum)	*Acacia salicina, Acacia spectabilis and Acacia decora*
Groundcovers (ground stratum)	*Aristida ramosa, Cymbopogon refractus, Cynodon dactylon, Eremophila debilis, Linum marginale, Einadia nutans, Veronica plebeia, Calotis lappulacea, Erodium crinitum, Enchylaena tomentosa, Einadia nutans subsp. nutans*
Exotic species	*Hyparrhenia hirta, Chloris gayana, Megathyrsus maximus, Senecio madagascarensis, Galenia pubescens, Bidens pilosa, Opuntia stricta, Sida rhombifolia*
High threat weeds	*Hyparrhenia hirta, Chloris gayana, Galenia pubescens, Senecio madagascarensis*

Photo 5-4: A patch of PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the Central and Upper Hunter 'Rehabilitation' (near Liddell. This vegetation zone is characterized by mature planted eucalypts with a mostly exotic ground layer.

Vegetation Zone 4 – Native Grassland: 2 ha

This vegetation zone has been historically cleared for grazing and the canopy and mid-storey are typically absent, with only occasional *Eucalyptus moluccana* (Grey Box), *Acacia salicina* (Native Willow) and *Allocasuarina luehmannii* (Bulloak) occurring (see **photo 5-5**). The ground layer is dominated by grasses with scattered forbs and occasional shrubs. Dominant species include *Aristida ramosa* (Purple Wiregrass), *Bothriochloa macra* (Red Grass), *Chloris truncata* (Windmill Grass), *Rytidosperma fulvum* (Wallaby Grass), *Austrostipa verticillata* (Slender Bamboo Grass), *Erodium crinitum* (Blue Storksbill), *Chrysocephalum apiculatum* (Common Everlasting), *Brunoniella australis* (Blue Trumpet), *Enchylaena tomentosa* (Ruby Saltbush), *Vittadinia cuneata* (Fuzzweed), *Solanum cinereum* (Narrawa Burr) and *Cheilanthes distans* (Bristly Cloak Fern), (see **Table 5.6**).

Numerous weed species are also present and tend to dominant in areas of higher disturbance. Common exotic species include *Hyparrhenia hirta* (Coolatai Grass), *Chloris gayana* (Rhodes Grass), *Carthamus lanatus* (Saffron Thistle), *Heliotropium amplexicaule* (Blue heliotrope), *Senecio madagascariensis* (Fireweed), *Galenia pubescens* (Galenia), *Lysimachia arvensis* (Scarlet Pimpernel), *Bidens pilosa* (Cobblers Pegs), *Sonchus oleraceus* (Common Sowthistle), *Sida rhombifolia* (Paddy's Lucerne), *Verbena bonariensis* (Purpletop).

Table 5.6: Floristic and structural summary of PCT 1691 Vegetation Zone 4 within the development site

Vegetation layer	Dominant species
Tree canopy (upper stratum)	absent
Mid-storey (mid stratum)	absent
Groundcovers (ground stratum)	*Aristida ramose, Bothriochloa macra, Chloris truncata, Rytidosperma fulvum, Austrostipa verticillate, Erodium crinitum, Chrysocephalum apiculatum, Brunoniella australis, Enchylaena tomentosa, Vittadinia cuneata, Solanum cinereum, Cheilanthes distans*
Exotic species	*Hyparrhenia hirta, Carthamus lunatus, Heliotropium amplexicaule, Senecio madagascariensis, Galenia pubescens, Lysimachia arvensis, Sonchus oleraceus, Sida rhombifolia, Verbena bonariensis, Chloris gayana, Bidens pilosa*
High threat weeds	*Hyparrhenia hirta, Carthamus lunatus, Galenia pubescens, Heliotropium amplexicaule, Senecio madagascariensis*

Photo 5-5: A patch of PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the Central and Upper Hunter 'Native grassland' (south of Bayswater). This vegetation zone contains predominantly native grass species without a canopy or mid-storey.

5.4.2 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley (PCT 1731)

Vegetation Formation: Forested wetlands

Vegetation Class: Coastal swamp forests

PCT % Cleared: 62%

Area within development site: 0.9 ha (Vegetation Zone 5 – Moderate-Good)

This vegetation zone is characterized by a monoculture of *Casuarina glauca* (Swamp Oak) occurring in small patches on the edges of some man-made dams, the shoreline of Lake Liddell and other low-lying or flood prone areas.

The canopy is dominated by *Casuarina glauca* (Swamp Oak) and the mid-storey is typically sparse and dominated by exotic species in some areas (see **photo 5-6**). Common native species include *Microlaena stipoides var. stipoides* (Weeping Grass), *Austrostipa verticillata* (Slender Bamboo), *Dichondra repens* (Kidney Weed), and *Juncus continuus*, *Typha orientalis* (Cumbungi), (see **Table 5.7**).

The small patches of Swamp Oak Forest contain significant weed infestations. Dominant weeds include, *Juncus acutus* (Sharp Rush), *Megathyrsus maximus* (Guinea Grass), *Pennisetum clandestinum* (Kikuyu), *Galium aparine* (Cleavers) and *Senecio madagascariensis* (Fireweed). *Hyparrhenia hirta* (Coolatai Grass) is highly dominant in most areas. Other exotic species include *Sida rhombifolia* (Paddy's Lucerne), *Senecio madagascariensis* (Fireweed), *Galenia pubescens* (Galenia), and *Bidens pilosa* (Cobblers Pegs).

The Swamp Oak Floodplain Forest within the development Site was not assessed as constituting the Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner EEC. Although the equivalent PCT assigned to the Swamp Oak Forest within the development site is included within the EEC, and while the species composition of the vegetation within the development site broadly conforms with that listed under the NSW Scientific Committee's Determination (2019c), the determination states: "Swamp Oak Floodplain Forest generally occurs below 20 m (rarely above 10 m) elevation in the NSW North Coast, Sydney Basin and South East Corner bioregions". As the Swamp Oak Forest within the development site is well above this elevation (lowest occurrence at 120 m above sea level) (**ASL**), it is not considered to conform with the landscape position of the occurrence of the EEC.

Due to the reasons outlined above (incorrect landscape position) the Swamp Oak Forest within the development site does not meet the diagnostic characteristics of the Coastal Swamp Oak (*Casuarina glauca*) Forest of the NSW and South East Queensland Ecological Community listed under the EPBC Act. Furthermore, given that the patches of PCT 1731 within the Project site are all less than 2 ha in size and do not have a 'predominantly native under-storey', they would not meet the required EPBC Act thresholds detailed in Table 1 of the Conservation advice (incorporating listing advice) for the Coastal Swamp Oak (*Casuarina glauca*) Forest of NSW and South East Queensland ecological community (Department of the Environment and Energy, 2018). According to the EPBC Act Conservation advice for this community "very small or degraded patches that do not meet the minimum condition thresholds will be excluded from national protection". The regrowth Swamp Oak patches within the Project site are generally less than half a hectare in size and have minimal native species in the under-storey or ground layer.

Table 5.7: Floristic and structural summary of PCT 1731 Vegetation Zone 5 within the development site

Vegetation layer	Dominant species
Tree canopy (upper stratum)	*Casuarina glauca*
Midstorey (mid stratum)	*Casuarina glauca*
Groundcovers (ground stratum)	*Microlaena stipoides* var. *stipoides, Austrostipa verticillata, Dichondra repens, Juncus continuus, Typha orientalis*
Exotic species	*Juncus acutus, Megathyrsus maximus, Pennisetum clandestinum, Galium aparine Senecio madagascariensis, Hyparrhenia hirta, Sida rhombifolia, Senecio madagascariensis, Galenia pubescens, Bidens pilosa.*
High threat weeds	*Juncus acutus, Pennisetum clandestinum, Senecio madagascariensis, Hyparrhenia hirta, Galenia pubescens*

Photo 5-6: A patch of PCT 1731: Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley (Moderate_Good condition class) south of Bayswater. This vegetation zone occupies the edges of freshwater dams and contains a monoculture of *Casuarina glauca* (Swamp Oak) trees with a mostly exotic ground layer.

5.4.3 Bull Oak grassy woodland of the central Hunter Valley (PCT 1692)

Vegetation Formation: Grassy woodlands

Vegetation Class: Coastal valley grassy woodlands

PCT % Cleared: 53%

Area within development site: 1.2 ha (Vegetation Zone 6 – Moderate to Good)

The vegetation within this zone is characterised by a monoculture of Bulloak (*Allocasuarina luehmannii*) with a sparse cover of ground layer species. Within the zone there is a low cover of exotic species, however exotics increase in open areas and at the peripheries of the patches (see **photo 5-7**).

The canopy of this community is dominated by *Allocasuarina luehmannii* (Bulloak). *Acacia salicina* (Native Willow) is also present around the edges of the patches.

The ground layer is dominated by grasses with scattered forbs and occasional shrubs (see **Table 5.8**). Native species include *Aristida ramosa* (Purple Wiregrass), *Bothriochloa macra* (Red Grass), *Chloris truncata* (Windmill Grass), *Rytidosperma fulvum* (Wallaby Grass), *Austrostipa verticillata* (Slender Bamboo Grass), *Erodium crinitum* (Blue Storksbill) and *Einadia nutans* subsp. *nutans* (Climbing Saltbush).

Exotic *Hyparrhenia hirta* (Coolatai Grass) is dominant in peripheries of this vegetation zone. Other exotic species include *Carthamus lanatus* (Saffron Thistle), *Sida rhombifolia* (Paddy's Lucerne), *Plantago lanceolata* (Lamb's Tongues), *Senecio madagascariensis* (Fireweed), *Galenia pubescens* (Galenia), *Opuntia stricta* (Common Prickly Pear) and *Bidens pilosa* (Cobblers Pegs).

Within the Sydney Basin IBRA region, there are seven PCTs which contain *A. luehmannii* as a diagnostic species. Of these PCTs only three occur within the correct geographic distribution for the development site, and of these three PCTs, 1692 is the only PCT which is dominated by *A. luehmannii*, with the others being Eucalypt dominated communities containing *A. luehmannii*. Therefore, PCT 1692 was determined to be the best fit for the vegetation present within the development site.

Due to the absence of Eucalypt trees in the canopy, this vegetation zone lacks the key diagnostic species to be classified as the Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions EEC listed under the BC Act. Likewise, this vegetation zone was not included in the Central Hunter Valley eucalypt forest and woodland CEEC after assessment against the key diagnostic characteristics and minimum condition criteria outlined in the Conservation Advice (TSSC 2015) (see **Section 5.7** below for full assessment).

Table 5.8: Floristic and structural summary of PCT 1692 Vegetation Zone 6 within the development site

Vegetation layer	Dominant species
Tree canopy (upper stratum)	*Allocasuarina luehmannii*
Mid-storey (mid stratum)	*Acacia salicina*
Groundcovers (ground stratum)	*Aristida ramosa, Bothriochloa macra, Chloris truncata, Rytidosperma fulvum, Austrostipa verticillate, Erodium crinitum, Einadia nutans* subsp. *nutans*

Vegetation layer	Dominant species
Exotic species	*Hyparrhenia hirta, Carthamus lanatus, Sida rhombifolia, Plantago lanceolata, Senecio madagascariensis, Galenia pubescens, Opuntia stricta, Bidens pilosa*
High threat weeds	*Hyparrhenia hirta, Carthamus lunatus, Senecio madagascariensis, Galenia pubescens*

Photo 5-7: PCT 1692: Bull Oak grassy woodland of the Central Hunter Valley (Moderate condition class) south of Bayswater. This vegetation zone contains a monoculture of *Allocasuarina luehmannii* (BullOak) trees with a sparse ground layer.

5.4.4 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071)

Vegetation Formation: Freshwater wetlands

Vegetation Class: Coastal freshwater wetlands

PCT % Cleared: 75%

Area within development site: 3 ha – Vegetation Zone 7 Moderate

The *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion (PCT1071) is described in the BioNet Vegetation Classification database as man-made water bodies, drainage lines and depressions across a wide variety of environments and includes modified former wetlands. It also

occurs in original form in wide variety of situations associated with coastal plains, valleys, lagoons and other sites of poor drainage.

Vegetation and topography within the development site has been greatly altered as a result of decades of agriculture and power station development. The dams, ponds and canals where this PCT occurs have been constructed or are results of drainage alterations and subsequent water retention. As a result, all patches of this PCT occurring within the Project area exist in artificial watercourses and drainage lines, and are highly altered by years of operation , disturbance and weed invasion. All patches of PCT 1071 are considered to be in only moderate condition given the high levels of exotic species growing amongst the native *Phragmites australis* and *Typha orientalis* (see **photo 5-8**).

This vegetation within and adjacent to the Project site is representative of PCT 1071 as it contains *Phragmites australis* and occasionally *Typha orientalis* occurring around artificial water bodies and drainage lines.

Apart from a dense layer of *Phragmites australis* or *Typha orientalis,* much of this vegetation zone contains exotic species such as *Juncus acutus* (Sharp rush)*, Pennisetum clandestinum* (Kikuyu), *Chloris gayana* (Rhodes Grass), *Verbena bonariensis* (Purpletop), *Plantago lanceolata* (Lambs tongue) *Senecio madagascariensis* (Fireweed). *Typha domingensis* also dominates some waterbodies in the development site and locality. Occasional natives such as *Juncus continuus*, *Carex appressa* (Tall Sedge) or regrowth *Casuarina glauca* (Swamp Oak) also exist (see **Table 5.9**).

The *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion PCT has developed at this location due to human alteration of the drainage line and is not a naturally occurring wetland. As such, this particular occurrence of this PCT is unlikely to be part of the TEC described as 'Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions' TEC and listed under the BC Act. This is because artificial wetlands created on previously dry land specifically for purposes such as water treatment, sewage treatment, stormwater management and farm production, are not regarded as part of this community (see NSW Scientific Committee, 2010). This PCT is not part of a TEC listed under the EPBC Act.

Table 5.9: Floristic and structural summary of PCT 1071 Vegetation Zone 7 within the development site

Vegetation layer	Dominant species
Tree canopy (upper stratum)	absent
Mid-storey (mid stratum)	Occasional juvenile *Casuarina glauca*
Groundcovers (ground stratum)	*Phragmites australis, Typha orientalis, Typha domingensis, Carex appressa, Juncus continuus*
Exotic species	*Juncus acutus, Pennisetum clandestinum, Chloris gayana, Cirsium vulgare, Gomphocarpus fruticosus Plantago lanceolata, Aster subulatus, Senecio madagascariensis, Verbena bonariensis*
High threat weeds	*Juncus acutus, Senecio madagascariensis, Chloris gayana, Pennisetum clandestinum*

Photo 5-8: PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (Moderate condition class) occurs in edges of freshwater dams and ponds. This patch contains *Phragmites australis* growing amongst exotic Coolatai grass.

5.4.5 Exotic grassland

This area is dominated by exotic species (>50% exotic cover at least) and has been classified as non-native vegetation. These areas do not represent any PCT and were not assessed under the BAM. This vegetation type is dominated by exotic grasses *Hyparrhenia hirta* (Coolatai grass), *Chloris gayana* (Rhodes grass), *Paspalum dilatatum* (Paspalum), *Bromus diandrus* (Great Brome), and *Vulpia myuros* (Rat's Tail Fescue), and exotic herbs and shrubs *Galenia pubescens* (Galenia), *Carthamus lanatus* (Saffron Thistle), *Bidens pilosa* (Farmer's friend) *Hypochaeris radicata* (Cat's Ear), *Sida rhombifolia* (Paddy's Lucerne), Plantago lanceolata (Lamb's Tongues), *Senecio madagascariensis* (Fireweed) and *Sisymbrium officinale* (Wild mustard) as shown in **Photo 5-9** and **5-10**.

Native species which also occur sporadically in these areas include, *Aristida ramosa* (Purple Wiregrass), *Acacia salicina* (Native Willow), *Austrostipa verticillata* (Slender Bamboo) and *Dichondra repens* (Kidney Weed).

Exotic grassland covers approximately 134.1 ha of the development site which equates to approximately 73% of the total vegetated areas (or greenfield areas surrounding power station infrastructure and artificial surfaces).

Photo 5-9: Vast areas of exotic grassland to the south of Bayswater. These previously cleared and grazed areas contain dense Coolatai grass (*Hyparrhenia hirta*), (yellow shade areas) and dense herbaceous weeds (light green shade areas). Occasional regrowth *Acacia salicina* are also present (although not at a sufficient density to form a PCT). These areas are of low ecological value.

Photo 5-10: Vast areas of herbaceous weeds dominate previously cleared areas.

5.4.6 Planted Trees

Approximately 3.9 ha of the development site is characterized by garden and landscaped areas adjacent to the power stations and internal access roads (see **photo 5-11**). These patches contain mature planted trees which are non-indigenous species to the area. These vegetation patches do not represent any PCT and were not assessed under the BAM. Planted trees include *Corymbia citriodora* (Lemon-scented Gum), *Corymbia torelliana* (Cadaghi), *Eucalyptus cladocalyx* (Sugar Gum), *Callistemon citrinus* (Crimson bottlebrush), *Melaleuca ericifolia* (Swamp Paperbark), *Lagunaria patersonia* (Norfolk Island Hibiscus) and *Lophostemon confertus* (Brush Box).

Eight planted *Acacia pendula* (Weeping Myall) also occur in a garden bed adjacent to the northern carpark of Bayswater. These individuals occur in an artificial setting alongside Crimson bottlebrush and Swamp Paperbark plantings and do not represent a naturally occurring patch of Hunter Valley Weeping Myall Woodland of the Sydney Basin bioregion (see **Section 6.4.1.2**).

Photo 5-11: Planted *Eucalyptus cladocalyx* (Sugar Gum) near Bayswater. This species is non-indigenous to the Hunter Valley and planted trees do not represent any PCT.

5.4.7 Excluded areas and artificial surfaces

Approximately 148.5 ha of the development site contains existing infrastructure and artificial surfaces characterised by asphalt pads, roads, carparks, gravel tracks, coal stockpiles, coal conveyor belts, pipelines and buildings associated with the power stations as shown in Photo 5-12 to Photo 5-17. Areas which lack vegetation or habitat have not been assessed and are mapped as 'excluded / artificial surface'. The development site is generally concentrated around such features.

Photo 5-12: Cleared corridor containing the eastern coal conveyor and access track. Native trees are situated beyond the edge of the development site.

Photo 5-13: Cleared corridor containing the western coal conveyor and access track. Native trees are situated beyond the edge of the development site.

Photo 5-14: One of many existing internal roads which make up the BAW area. Edges of roads contain exotic grass. Native trees are generally outside the development site.

Photo 5-15: The coal stockpile areas near Liddell. This large area contains concrete and gravel surfaces with regrowth weeds.

Photo 5-16: Numerous ponds contain brine and sediment and lack native vegetation or any habitat.

Photo 5-17: Areas within the power stations and adjacent to buildings (background) contain mown exotic grass and concrete surfaces.

5.5 Vegetation zones and vegetation integrity score

A description of the vegetation zones identified within the development site and the corresponding vegetation integrity **(VI**) score developed from the BAM-C is presented in **Table 5.10**.

Table 5.3 Vegetation zones and vegetation integrity scores

Zone	PCT	Area (ha)	Condition scores (BAM-C)			Vegetation Integrity Score
			Composition	Structure	Function	
1	1691 Moderate	2.3	32.9	24.3	44.2	32.8
2	1691 Regrowth	21.6	2.4	15.8	25.8	10
3	1691 Rehabilitation	11.4	25.5	34.4	39.5	32.6
4	1691 Native Grassland	2	14	40.5	18.4	21.9
5	1731 Mod-good	0.9	5.2	23.2	45	17.6
6	1692 Mod-good	1.2	28.6	31.9	37.7	32.5
7	1071 Moderate	3	34.2	87.5	-	54.7

5.6 Patch size

A patch is defined in the BAM as an area of intact native vegetation that occurs on the development site (disturbance area). The patch may extend onto adjoining land beyond the footprint of the development site, and for woody ecosystems, includes native vegetation separated by ⩽100 m from the next area of intact native

vegetation. For non-woody vegetation, this gap is reduced to ⩽30 m. Patch size for each vegetation zone located on the development site was mapped in accordance with Subsection 4.3.2 of the BAM using the following steps:

1) Identify vegetation zones that will be included in the same patch

2) Identify the boundary of any adjoining intact native vegetation which extends beyond the limit of the development site

3) Digitise each patch in a GIS using separate polygons where multiple patches exist

4) Calculate the area of each patch in ha in a GIS.

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

Patches of vegetation within the development site are generally small and isolated, however, based on aerial imagery and regional vegetation mapping, some of the PCT 1691 and PCT 1692 vegetation zones can be found to be less than 100 m away from the large woodland areas to the east or west of Bayswater, which are over 100 ha in size. As such, the PCT 1691 and PCT 1692 associated vegetation zones entered in the BAM-C are considered to be contiguous with a maximum patch size class of >100 ha. The remaining vegetation zones associated with PCT 1071 and PCT 1731 were found to be isolated from large areas of surrounding native vegetation and were considered to have patch sizes of <5ha.

5.7 Threatened ecological communities (BC Act)

One TEC is present within the development site and occurs as small and degraded patches of vegetation which are generally isolated from any larger, intact areas of the communities (**Figure 5-2**). This community identifies as the Central Hunter Grey Box—Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions which is listed as endangered under the BC Act.

5.7.1 Central Hunter Grey Box—Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions

Vegetation Zones 1 and 3 contain PCT 1691 - Narrow-leaved Ironbark - Grey Box grassy woodland of the Central and Upper Hunter occurring only as a moderate condition class (Zone 1) and as rehabilitation (Zone 3), without any high condition or 'remnant' versions. All patches of PCT 1691 existing within the development site contain some level of previous disturbance, clearing or the presence of invasive weeds.

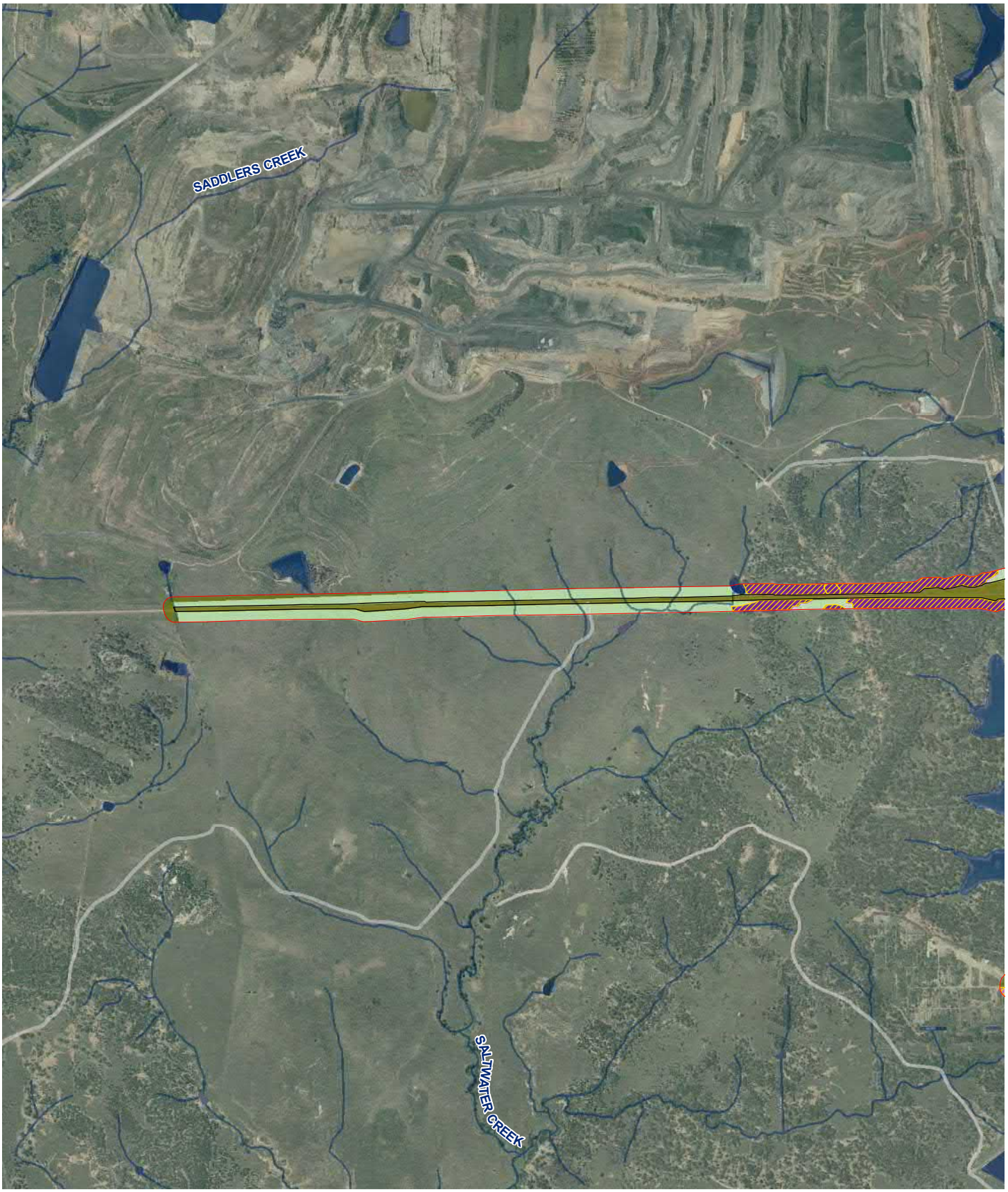
As described in **Section 5.4**, vegetation zones 1 and 3 contain mostly exotic grass in the ground layer or lack an intact ground layer altogether (due to lawn mowing and vegetation management in some instances). The majority of vegetation zone 3– 'PCT 1691 rehabilitation' patches contain planted *Eucalyptus moluccana* (Grey Box) and *Eucalyptus crebra* (Narrow-leaved Ironbark) which are characteristic species of PCT 1691. For this reason the total area of vegetation zone 3 (11.4 ha) was included as this PCT. Despite evidence of disturbance and clearing, both vegetation zones 1 and 3 within the development site are considered to align with the listed 'Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions' EEC. These vegetation zones total 15.7 ha in area within the development site. With the retention of a 2.04 ha patch of vegetation zone 1 to the west of Bayswater, the likely amount of Central Hunter Grey Box—Ironbark Woodland EEC to be impacted is 13.7 ha, and the distribution of this is illustrated on **Figure 5-2**.

Given that vegetation zone 2 – 'PCT 1691 Regrowth' is characterised by only one native species (*Acacia salicina*) growing amongst highly exotic grassland, with no eucalypt species, it is not considered to constitute Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions EEC.

The minor areas of PCT 1691 - Derived native grassland within the development site are also lacking mid-storey and canopy layers and are not classified as the Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions TEC.

Similarly, these derivatives of PCT 1691 were excluded from Central Hunter Valley eucalypt forest and woodland CEEC after assessment against the key diagnostic characteristics and minimum condition criteria outlined in the Conservation Advice (TSSC 2015).

Patches of Bull Oak forest (PCT 1692) are small and isolated and contain no eucalypt species within the canopy. This vegetation zone lacks the key diagnostic species to be classified as the Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions EEC listed under the BC Act. This vegetation zone was not included in the Central Hunter Valley eucalypt forest and woodland CEEC after assessment against the key diagnostic characteristics and minimum condition criteria outlined in the Conservation Advice (TSSC 2015) (see **Section 8.3** below for full assessment).



Legend

- Assessment area
- Development site
- Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

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Data sources

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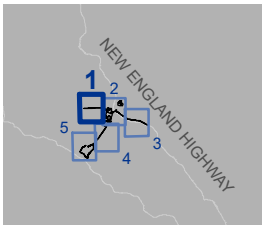

Figure 5 - 2 Map of threatened ecological communities (NSW BC Act)

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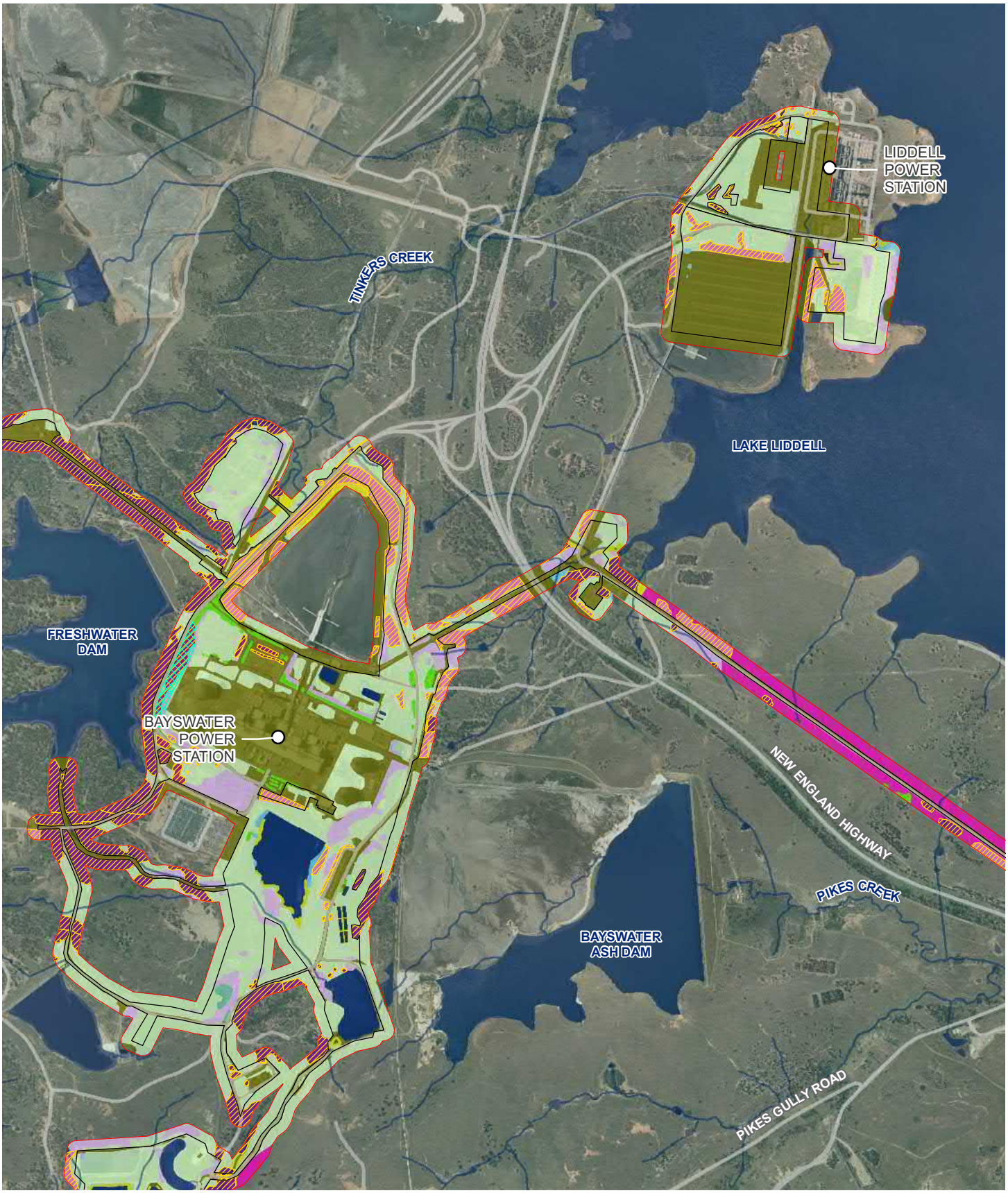

Legend

- Assessment area
- Development site
- Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC
- Vegetation to be retained
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

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Data sources

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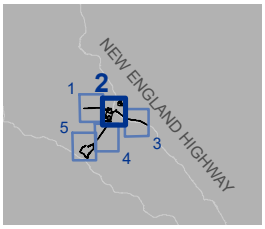

Figure 5 - 2 Map of threatened ecological communities (NSW BC Act)

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Legend

- Assessment area
- Development site
- Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC
- Railway
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

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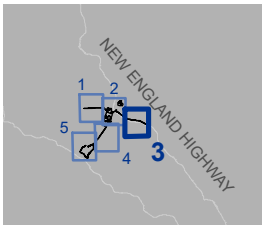

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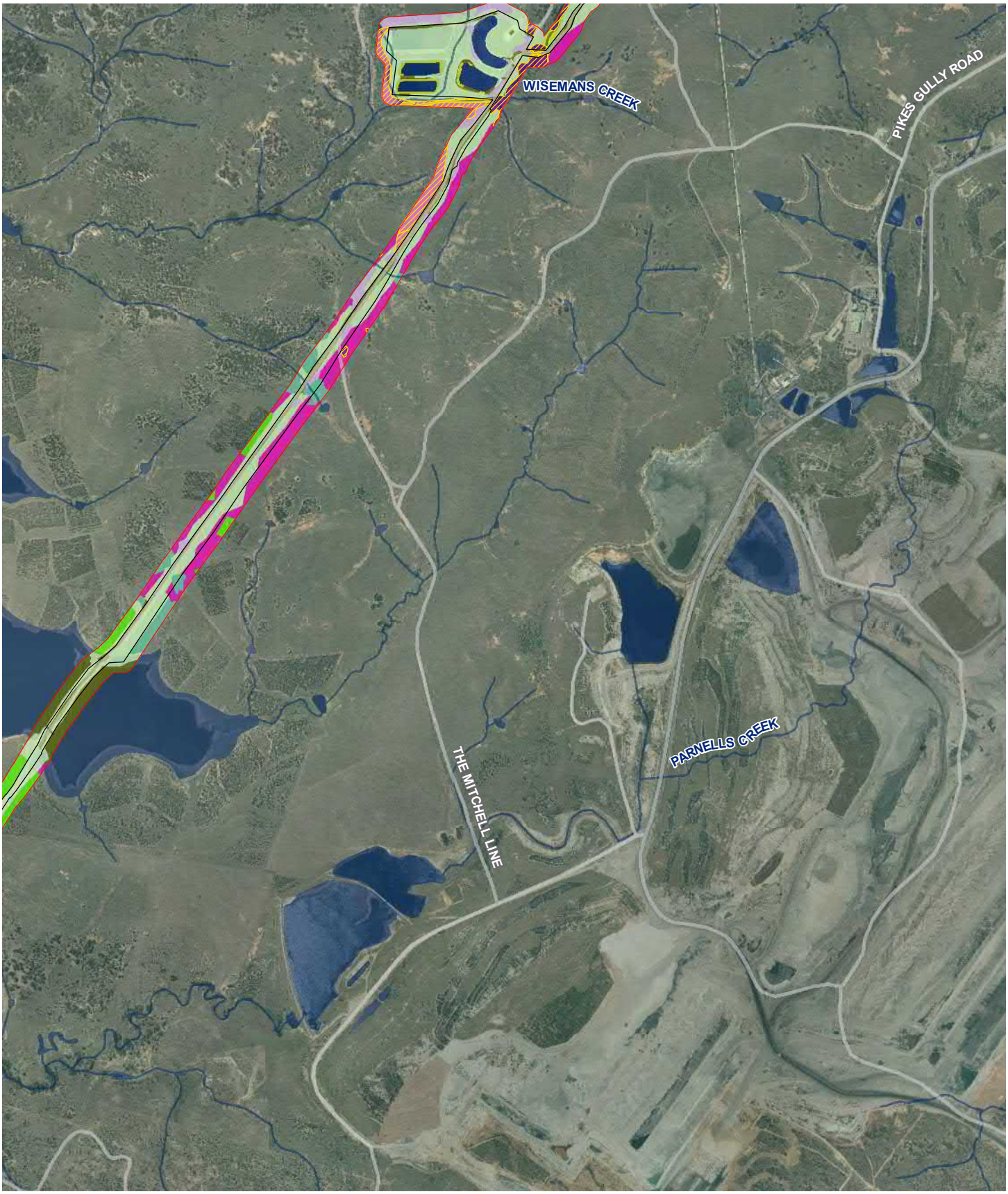

Legend

- Assessment area
- Development site
- Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

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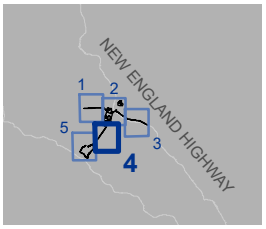

Figure 5 - 2 Map of threatened ecological communities (NSW BC Act)

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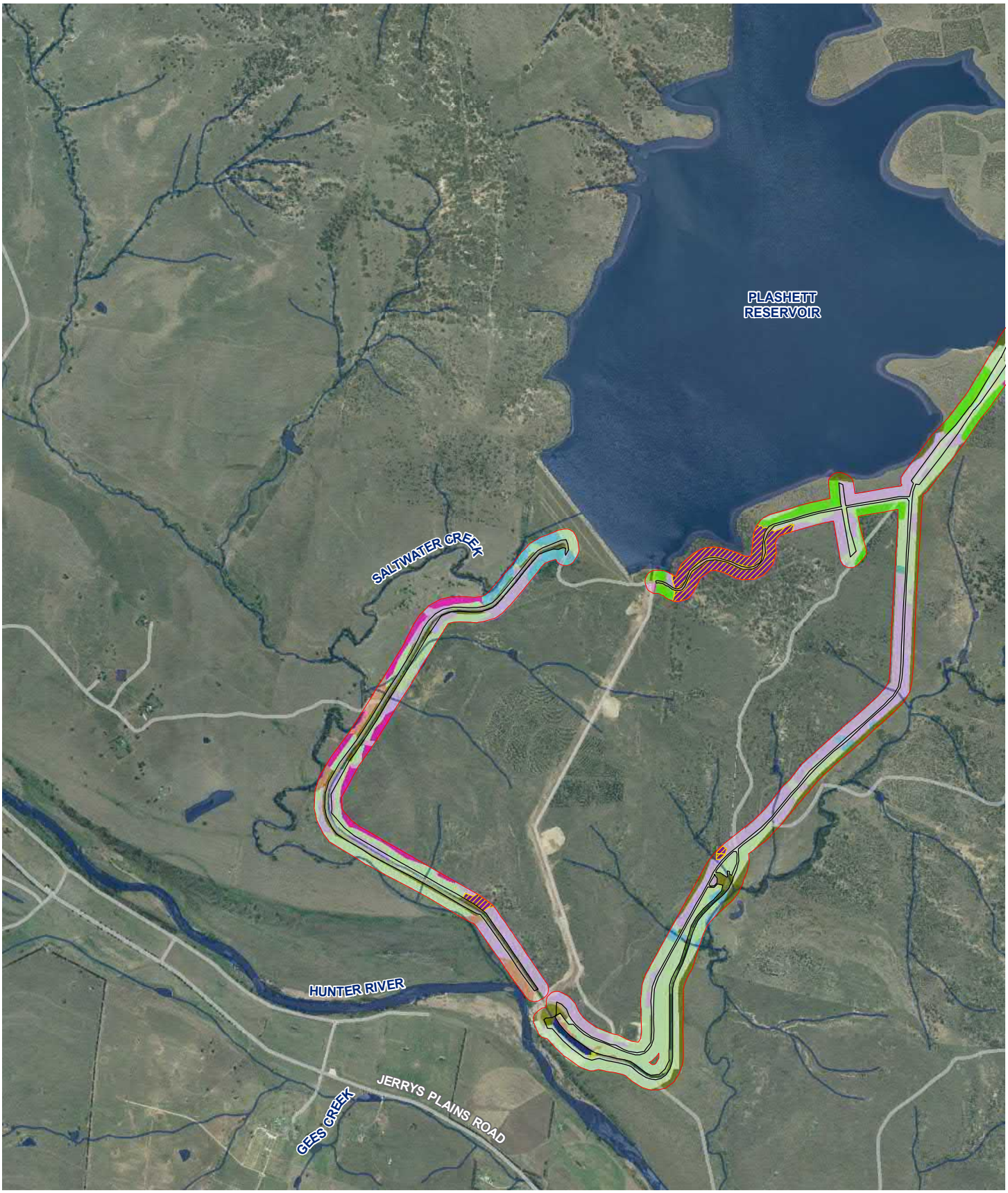

Legend

- Assessment area
- Development site
- Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 485 River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion)
- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

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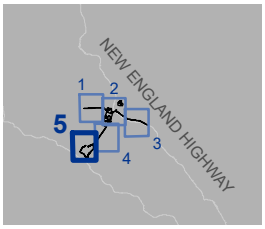

Figure 5 - 2 Map of threatened ecological communities (NSW BC Act)

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5.7.2 Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions

The small patches of Swamp Oak Floodplain Forest within the development site were not assessed as constituting the Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner EEC. Whilst PCT 1731 can be included within the EEC, and while the species composition of the vegetation within the development site broadly conforms with that listed under the NSW Scientific Committee's Determination (2019), the determination states:

'*Swamp Oak Floodplain Forest generally occurs below 20 m (rarely above 10 m) elevation in the NSW North Coast, Sydney Basin and South East Corner bioregions*'. As the Swamp Oak Forest within the development site is well above this elevation (lowest occurrence at 90 m ASL), it is not considered to conform with the landscape position of the occurrence of the EEC.

5.7.3 Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions

Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (Endangered under BC Act and not listed under EPBC Act) only occurs in naturally occurring waterways and flood-prone areas. The patches of *phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071) within the Project site are occurring within artificial drainage lines, in highly modified environments and do not constitute the TEC.

Furthermore, according to the Scientific Committee Final Determination for Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (DPIE,2010) this TEC generally occurs below 20 m elevation in the NSW North Coast, Sydney Basin and South East Corner bioregions. Given the development site is generally over 100 m in elevation, the TEC is considered to be absent from the locality.

This TEC is not assessed further.

5.7.4 Hunter Valley Weeping Myall Woodland in the Sydney Basin Bioregion

The small patch of planted Weeping Myall (*Acacia pendula*) trees within the development site was not classified as the Hunter Valley Weeping Myall Woodland in the Sydney Basin Bioregion CEEC. The absence of the Weeping Myall Woodland within the development site was determined through comparison with the NSW Scientific Committee's Determination (2016). The community conforms to the locality - Sydney Basin Bioregion, and Muswellbrook LGA, as well as the position in the landscape - Permian sediments on the valley floor. It does not however conform to the Floristic Structure and Composition as: mid-high woodland with a dense canopy dominated by Weeping Myall, with diagnostic or positive indicator species dominant/present within the community. The small patch of planted *Acacia pendula* within the development site is not remnant and has been planted as part of historic landscaping around the northern carpark of Bayswater, as shown in **Photo 5-18**. This is evident by obvious changes to the topography in this location (roads, carpark and drainage) as well as a lack of native vegetation. The planted *Acacia pendula* trees display obvious characteristics of the inland form of this species including a strongly pendulous habit (branches), abundance of seed capsules, and absence of suckering stems (unlike the Hunter Valley form which often lacks pendulous habit, has seed generation deficiencies and often suckers from roots). These characteristics are further explained in **Section 6.4.1.2**. *Acacia pendula* have been planted amongst non-indigenous native trees including, *Melaleuca ericifolia*, *Callistemon citrinus*, *Corymbia citriodora* and *Melaleuca styphelioides* (the latter is an indigenous species to the area however its position in the elevated landscape away from waterbodies, creeks and soaks is unnatural).

Of the species assemblage guide for Hunter Valley Weeping Myall Woodland (Section 2 of the Determination) only regrowth *Acacia salicina* is present alongside the planted Acacia pendula patch. No native ground layer plants are present. No further assessment of impacts was conducted for Hunter Valley Weeping Myall Woodland.

Photo 5-18: Planted Weeping Myall (Acacia pendula) trees within a landscaped road verge near Bayswater.

5.8 Groundwater dependent ecosystems

The level of groundwater dependence of vegetation communities in the development site and broader Assessment area has been identified using the *Atlas of Groundwater Dependent Ecosystems* (**GDEs**) (Bureau of Meteorology, 2017) and the *Risk Assessment Guidelines for Groundwater Dependant Ecosystems* released by the NSW DPI (Kuginis *et al.*, 2012). Based on these data, no aquatic GDEs and only low potential terrestrial GDEs occur within the development site and broader surrounds.

6. Threatened species

6.1 Background research and data sources

The BAM-C was used to derive the list of candidate species for this assessment, and the results were also supplemented with database searches, including a review of the Threatened Biodiversity Data Collection (**TBDC**), to identify the threatened species that have been recorded by previous surveys or are considered likely to occur in the broader Assessment area and development site. The results were also supplemented with recent ecological surveys of lands adjacent to the development site by Kleinfelder during 2019 (as updated) for the WOAOW Project.

The BDAR completed for the WOAOW Project (Kleinfelder, 2020) was reviewed and the results were used to inform the preparation of this BDAR. The habitats and threatened species data were gathered and used to inform the field survey program.

A background review of existing information was undertaken to identify the existing environment within a nominal search area of 10 km and the broader locality including relevant bioregion subregions. The review focused on database searches, relevant ecological reports pertaining to the survey area and relevant GIS layers. The review was used to assess the likelihood of occurrence of threatened species, populations and communities as well as important habitat for migratory species in the survey area and locality. The searches were also undertaken to identify any areas of outstanding biodiversity value within or surrounding the development site.

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

- BAM-C – case number 00022769/BAAS20027/21/00023909
- BioNet - the website for the Atlas of NSW Wildlife and Threatened Species Profile Database – searched 15 October 2020
- NSW Department of Primary Industries (DPI) Fisheries NSW Spatial Data Portal – reviewed 15 October 2020
- Department of Agriculture, Water and the Environment (DoAWE) Protected Matters Search Tool – searched 15 October 2020
- NSW Biodiversity Values Map and Threshold Tool - reviewed 12 October 2020
- Important Areas mapping for Regent Honeyeater, Swift Parrot and Migratory bird species.

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 Project. 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.

6.2 Threatened species habitat assessment

This section describes the process of assessing the habitat types within the development site and Assessment area and the habitat suitability assessment for threatened species as outlined in Section 5 of the BAM.

Once the development site (disturbance footprint) had been assessed for landscape context, and the PCTs present and vegetation integrity were known, the list of candidate threatened species for assessment was

developed. As outlined in Section **5.2.1.2** of the BAM, the following criteria (a – f) were used to predict the threatened species that require assessment:

a) The distribution of the species includes the IBRA subregion which the development site is, in the opinion of the assessor, mostly located within, and

b) The development site is within any geographic constraints of the distribution of the species within the IBRA subregion, and

c) The species is associated with any of the PCTs identified by the assessor under Chapter 5 as occurring within the development site, and

d) The native vegetation cover within an assessment area 1,500 m wide surrounding the boundary of the subject site as determined by the assessor in accordance with Section 3 of the BAM is equal to or greater than the minimum class that is required for the species (unless the development is, or is part of, a linear shaped development), and

e) The patch size which the vegetation zone is part of, as identified in Subsection 4.3.2 of the BAM is equal to or greater than the minimum specified for that species, and

f) The species is identified as an ecosystem or species credit species in the TBDC.

A threatened species was predicted as requiring assessment if that species meets all the criteria a) to f) that are relevant to the species. The BAM-C was used to derive the list of candidate species based on criteria a) to f). If any one of the criteria a) to f) relevant to a species was not met, the development site was considered not to be suitable habitat for the threatened species and no further assessment was undertaken for that species.

In addition to the output from the BAM-C, data from the surveys undertaken for the WOAOW Project BDAR (Kleinfelder, 2020) was reviewed and the results were used to inform the candidate species list. The recent surveys undertaken for the WOAOW Project BDAR provides a more up to date view of the species that are known to be present in the disturbance footprint and which species are likely to occur. The results of the BioNet search and the federal Department of Environment's Protected Matters Search Tool search were also used to inform development of the candidate species list to ensure those species that are only listed under the EPBC Act were considered appropriately.

6.2.1 Habitat types

The broad habitat types identified within the development site, along with the corresponding PCT, are outlined in **Table 6-1**. Whilst the majority of the development site is cleared and disturbed, the remaining patches of vegetation have been assigned to three broad habitat types including:

- Coastal valley grassy woodlands (see **Photo 6-1**) – this habitat is typically an open grassy woodland. Woodlands, or rarely forests, that lack an abundance of hard-leaved (sclerophyllous) shrubs in the understorey. 'Box' eucalypts often dominant or present in the tree layer. Grasses prominent in the understorey, except in some semi-arid areas. Widespread across NSW on various soils west of the Great Dividing Ranges, but typically found on relatively fertile loams on the coast, tablelands and western slopes. The small and isolated patches of PCT 1691 and PCT 1692, as well as areas of mature rehabilitation are classified as this habitat type. Areas of PCT 1691 'Regrowth' and PCT 1691 'Native grassland' are excluded from this category as they lack sufficient woodland structure and do not contain any quality habitat features for fauna.
- Coastal swamp forests (see **Photo 6-2**) – whilst this is not occurring in a coastal area, the vegetation structure and composition of PCT 1071 within the development site still matches the description of a

Forested Wetland vegetation formation. This habitat type is characterised by open forests 15-30 m tall with canopies of adjacent trees often touching and an abundance of plants that tolerate periodic inundation or waterlogging. Dominant trees include casuarinas or paperbarks, but not wattles. Under-storey includes a clumped or continuous groundcover of sedges, rushes or grasses and scattered shrubs, but no chenopods. These are confined to the coast and tablelands adjacent to streams, lakes or swamps.

- Coastal freshwater lagoons (see **Photo 6-3**) – this habitat is defined as a Freshwater wetland and contains an abundance of plants that tolerate periodic inundation or waterlogging, dominated by emergent sedges, rushes, reeds, grasses or succulent herbs, or in some cases by submerged or floating aquatic herbs. Soils are deep and often black or dark grey with partly decomposed organic matter. This habitat occurs in low-lying flood prone areas as well as along the edges of numerous man-made dams and ponds throughout the development site. This habitat does not occur in the majority of man-made canals (vegetation in this habitat is regularly removed as part of maintenance) or within the dams / ponds containing saline water.

Table 6.1 Summary of broad habitat types within the development site

PCT IDs	Vegetation formation	Vegetation class / habitat type	Area (ha) in development site
1691 1692	Grassy woodlands	Coastal valley grassy woodlands	16.9 ha
1731	Forested wetlands	Coastal swamp forests	0.9 ha
1071	Freshwater wetlands	Coastal freshwater lagoons	3 ha

Photo 6-1: Patch of Coastal valley grassy woodlands habitat type within the development site.

Photo 6-2: Patch of Coastal swamp forest habitat type within the development site.

Photo 6-3: Patch of Coastal freshwater lagoons habitat type within the development site.

6.2.2 Habitat suitability for species that can be predicted by habitat surrogates (ecosystem credit species)

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 targeted survey has a low probability of detection. Ecosystem credit threatened species have been assessed in conjunction with information about site context **(Section 3.3** and **Subsection 4.3.2** of the BAM), PCTs and vegetation integrity attributes (**Chapter 4** of the BAM), and data from the TBDC (Chapter 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 recent surveys undertaken for the WOAOW Project (Kleinfelder, 2020) provide a more up to date view of the species that are known to be present in the subject site and which species are likely to occur. The results of the BioNet search and the federal Department of Environment's Protected Matters Search Tool search were also used to inform development of the species list.

The initial list of predicted ecosystem credit species is provided in **Table 6.2.** The full threatened species habitat suitability assessment is provided in **Appendix A**.

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 within the development site. Some species do not have any identified habitat constraints, in which case this step was not undertaken. The ecosystem credit species with a habitat constraint applicable to this assessment include:

- Australasian Bittern (*Botaurus poiciloptilus*) - Brackish or freshwater wetlands

- Black Bittern (*Ixobrychus flavicollis*) – Waterbodies / Land within 40 m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation
- Curlew Sandpiper (*Calidris ferruginea*) (Foraging) - As per mapped areas (DPIE)
- Great Knot (*Calidris tenuirostris*) (Foraging) - As per mapped areas (DPIE)
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*) (Foraging) - Presence of Allocasuarina and casuarina species
- Black-necked Stork (*Ephippiorhynchus asiaticus*) (Foraging) - Shallow, open freshwater or saline wetlands or
- Black-tailed Godwit (*Limosa limosa*) (Foraging) - As per mapped areas (DPIE)
- Painted Honeyeater (*Grantiella picta*) - Mistletoes present at a density of greater than five mistletoes per hectare
- Comb-crested Jacana (*Irediparra gallinacean*) – Waterbodies
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*) (Foraging) – Waterbodies / Within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines.

The justification for including or excluding ecosystem credit species from the assessment is provided in **Table 6.2**.

Under the BAM, targeted survey is not required for ecosystem credit species. However, in some circumstances, the TBDC 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 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 6.2** and **Table 6.3** as an ecosystem credit species and a species credit species.

Numerous ecosystem credit species are considered as potentially occurring within the woodland patches, wetland vegetation or Casuarina forest patches within the development site. However, parts of these PCTs are reduced to only regrowth trees (vegetation zone 2) or derived native grassland (Vegetation zone 4) and lack suitable structure and habitat features for many fauna groups. For this reason, numerous ecosystem credit species were excluded from vegetation zone 2 (PCT 1691 regrowth) and vegetation zone 4 (PCT 1691 Native Grassland).

Table 6.2 Summary of predicted ecosystem credit species that were assessed

Species name	Common name	EPBC Act	BC & FM Act	Justification for inclusion / exclusion	Sensitivity to gain class
Anseranas semipalmata	Magpie Goose	-	V	Site is not east of Cessnock	Moderate
Anthochaera phrygia (Foraging)	Regent Honeyeater	CE	CE	Potential habitat within site Excluded from derived native grassland zone Excluded from PCT 1691 regrowth zone	High

Species name	Common name	EPBC Act	BC & FM Act	Justification for inclusion / exclusion	Sensitivity to gain class
Artamus cyanopterus cyanopterus	Dusky Woodswallow	-	V	Potential habitat within site	Moderate
Botaurus poiciloptilus	Australasian Bittern	E	E	Site is not east of Cessnock	Moderate
Calidris ferruginea (Foraging)	Curlew Sandpiper	CE	E	Potential habitat within site	High
Calidris tenuirostris (Foraging)	Great Knot	CE	V	Site is not within 5km of coast or tidal influenced waterbody	High
Callocephalon fimbriatum (Foraging)	Gang-gang Cockatoo	-	V	Potential habitat within site. Excluded from derived native grassland zone Excluded from PCT 1691 regrowth zone	Moderate
Calyptorhynchus lathami (Foraging)	Glossy Black-Cockatoo	-	V	Potential habitat within site. Excluded from derived native grassland zone Excluded from PCT 1691 regrowth zone	High
Chthonicola sagittata	Speckled Warbler	-	V	Potential habitat within site. Excluded from derived native grassland zone Excluded from PCT 1691 regrowth zone	High
Circus assimilis	Spotted Harrier	-	V	Potential habitat within site	Moderate
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	-	V	Potential habitat within site. Excluded from derived native grassland zone Excluded from PCT 1691 regrowth zone	High
Daphoenositta chrysoptera	Varied Sittella	-	V	Potential habitat within site. Excluded from derived native grassland zone Excluded from PCT 1691 regrowth zone	Moderate
Dasyurus maculatus	Spotted-tailed Quoll	E	V	Potential habitat within site. Excluded from derived native grassland zone Excluded from PCT 1691 regrowth zone	High
Ephippiorhynchus asiaticus	Black-necked Stork	-	E	Potential habitat within site	Moderate
Epthianura albifrons	White-fronted Chat	-	V	Potential habitat within site	Moderate
Glossopsitta pusilla	Little Lorikeet	-	V	Potential habitat within site Excluded from derived native grassland zone Excluded from PCT 1691 regrowth zone	High
Grantiella picta	Painted Honeyeater	V	V	Potential habitat within site. Excluded from derived native grassland zone Excluded from PCT 1691 regrowth zone	Moderate

Species name	Common name	EPBC Act	BC & FM Act	Justification for inclusion / exclusion	Sensitivity to gain class
Haliaeetus leucogaster (Foraging)	White-bellied Sea-Eagle	-	V	Potential habitat within site. Excluded from derived native grassland zone Excluded from PCT 1691 regrowth zone	High
Hieraaetus morphnoides (Foraging)	Little Eagle	-	V	Potential habitat within site	Moderate
Irediparra gallinacea	Comb-crested Jacana	-	V	Potential habitat within site	Moderate
Ixobrychus flavicollis	Black Bittern	-	V	Potential habitat within site	Moderate
Lathamus discolor (Foraging)	Swift Parrot	CE	E	Potential habitat within site Excluded from derived native grassland zone Excluded from PCT 1691 regrowth zone	Moderate
Limicola falcinellus (Foraging)	Broad-billed Sandpiper	-	V	Potential habitat within site	High
Lophoictinia isura (Foraging)	Square-tailed Kite	-	V	Potential habitat within site	Moderate
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	-	V	Potential habitat within site	Moderate
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	-	V	Potential habitat within site Excluded from derived native grassland zone Excluded from PCT 1691 regrowth zone	Moderate
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	-	V	Potential habitat within site	High
Miniopterus australis (Foraging)	Little Bent-winged Bat	-	V	Potential habitat within site	High
Miniopterus orianae oceanensis (Foraging)	Large Bent-winged Bat	-	V	Potential habitat within site	High
Neophema pulchella	Turquoise Parrot	-	V	Potential habitat within site	High
Ninox connivens (Foraging)	Barking Owl	-	V	Potential habitat within site	High
Ninox strenua (Foraging)	Powerful Owl	-	V	Potential habitat within site	High
Oxyura australis	Blue-billed Duck	-	V	Potential habitat within site	Moderate
Pandion cristatus (Foraging)	Eastern Osprey	-	V	Potential habitat within site	Moderate
Petroica boodang	Scarlet Robin	-	V	Potential habitat within site	Moderate
Petroica phoenicea	Flame Robin	-	V	Potential habitat within site	Moderate

Species name	Common name	EPBC Act	BC & FM Act	Justification for inclusion / exclusion	Sensitivity to gain class
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	-	V	Recorded on site	Moderate
Pteropus poliocephalus (Foraging)	Grey-headed Flying-fox	V	V	Potential habitat within site Excluded from derived native grassland zone Excluded from PCT 1691 regrowth zone	High
Rostratula australis	Australian Painted Snipe	E	E	Potential habitat within site	Moderate
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	-	V	Potential habitat within site	High
Stictonetta naevosa	Freckled Duck	-	V	Potential habitat within site	Moderate
Tyto novaehollandiae (Foraging)	Masked Owl	-	V	Potential habitat within site	High

6.2.3 Habitat suitability for species that cannot be predicted by habitat surrogates (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 development site (Section 3.3 of the BAM), on PCTs and vegetation integrity attributes in (Section 4 of the BAM), and data obtained from the TBDC(Chapter 5 of the BAM).

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. Based on the assessment of habitat in the development site, and review of databases, published information, and work undertaken for the WOAOW Project (Kleinfelder, 2020), the following species credit species as outlined in **Table 6.3** are considered 'candidate species' for the assessment. The full threatened species habitat suitability assessment is provided in **Appendix A**.

Table 6.3 Summary of candidate species credit species

Species name	Common name	EPBC Act	BC & FM Act	Sensitivity to gain class	Biodiversity Risk Weighting
Plants					
Acacia pendula – Endangered population	Weeping Myall population in the Hunter catchment	-	E2	Very High	3.00
Asperula asthenes	Trailing Woodruff	V	V	High	2.00
Cymbidium canaliculatum - endangered population	Cymbidium canaliculatum population in the Hunter Catchment	-	EP	Moderate	2.00
Diuris tricolor	Pine Donkey Orchid	-	V	Moderate	1.50
Eucalyptus glaucina	Slaty Red Gum	V	V	High	2.00
Maundia triglochinoides	-	-	V	High	2.00
Melaleuca biconvexa	Biconvex Paperbark	V	V	Very High	2.00
Persicaria elatior	Tall Knotweed	V	V	High	2.00
Pterostylis chaetophora	-	-	V	Moderate	2.00
Zannichellia palustris	-	-	E	High	2.00
Birds					
Anthochaera phrygia (Breeding)	Regent Honeyeater	CE	CE	High	3.00
Burhinus grallarius	Bush Stone-curlew	-	E	High	2.00
Calidris ferruginea (Breeding)	Curlew Sandpiper	CE	E	High	3.00
Calidris tenuirostris (Breeding)	Great Knot	CE	V	High	3.00
Callocephalon fimbriatum (Breeding)	Gang-gang Cockatoo	-	V	High	2.00
Calyptorhynchus lathami (Breeding)	Glossy Black-Cockatoo	-	V	High	2.00
Erythrotriorchis radiatus	Red Goshawk	V	CE	High	3.00
Haliaeetus leucogaster (Breeding)	White-bellied Sea-Eagle	-	V	High	2.00
Hieraaetus morphnoides (Breeding)	Little Eagle	-	V	Moderate	1.50
Lathamus discolor (Breeding)	Swift Parrot	CE	E	Moderate	3.00
Limicola falcinellus (Breeding)	Broad-billed Sandpiper	-	V	High	2.00
Limosa limosa (Breeding)	Black-tailed Godwit	-	V	High	2.00
Lophoictinia isura (Breeding)	Square-tailed Kite	-	V	Moderate	1.50
Ninox connivens (Breeding)	Barking Owl	-	V	High	2.00
Ninox strenua (Breeding)	Powerful Owl	-	V	High	2.00
Pandion cristatus (Breeding)	Eastern Osprey	-	V	High	1.50
Tyto novaehollandiae (Breeding)	Masked Owl	-	V	High	2.00
Frogs					
Crinia tinnula	Wallum Froglet	-	V	Moderate	1.50
Litoria aurea	Green and Golden Bell Frog	E	V	High	2.00
Litoria brevipalmata	Green-thighed Frog	-	V	Moderate	1.50
Uperoleia mahonyi	Mahony's Toadlet	-	E	High	2.00

Species name	Common name	EPBC Act	BC & FM Act	Sensitivity to gain class	Biodiversity Risk Weighting
Mammals					
Cercartetus nanus	Eastern Pygmy-possum	-	V	High	2.00
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Very High	3.00
Miniopterus australis (Breeding)	Little Bent-winged Bat	-	V	Very High	3.00
Miniopterus orianae oceanensis (Breeding)	Large Bent-winged Bat	-	V	Very High	3.00
Myotis macropus	Southern Myotis	-	V	High	2.00
Petaurus norfolcensis	Squirrel Glider	-	V	High	2.00
Petrogale penicillata	Brush-tailed Rock-wallaby	V	E	Very High	3.00
Phascogale tapoatafa	Brush-tailed Phascogale	-	V	High	2.00
Planigale maculata	Common Planigale	-	V	High	2.00
Pteropus poliocephalus (Breeding)	Grey-headed Flying-fox	V	V	High	2.00
Reptiles					
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	High	2.00
Delma impar	Striped Legless Lizard	V	V	Moderate	1.50
Hoplocephalus bitorquatus	Pale-headed Snake	-	V	High	2.00

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

6.2.4 Identifying geographic and habitat constraints

Once the initial list of predicted candidate species credit species was generated, the geographic limitations of each species (where applicable) were examined to see if they were met. Where the development 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 development site. The majority of candidate species generated do not have any identified geographic constraints, in which case this step was not undertaken. Only three of the candidate species (two plants and one bird) have a listed geographic constraint, and in each case, the constraint was not sufficient or relevant to the development site, and none were removed from the assessment.

6.2.5 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 development site were present or were substantially degraded to the point that a candidate species is unlikely to utilise the development site (or specific vegetation zones). The habitats within the development site are highly disturbed and are generally isolated from larger areas of habitat. Vegetation patches are small, isolated and habitat quality is generally poor given the dominance of exotic plants in the ground layers and lack of structural complexity in all stratums. Historical vegetation clearing in the locality has been comprehensive and significant soil disturbance has also taken place over decades of power station development and operations. These factors have been considered in the assessment of candidate species credit species.

There were a number of threatened species returned from the calculator that are species credit species if breeding habitat were to be impacted (dual credit species). These species are discussed below in addition to general discussion on the condition of the habitat for species credit species and justification for excluding them from the candidate list.

The Glossy Black-Cockatoo requires hollow bearing trees, living or dead trees with hollows greater than 15 centimetres (**cm**) in diameter and greater than 5 m above the ground. No suitable habitat is present and this species has been excluded. The Gang Gang Cockatoo requires hollow bearing trees, living or dead trees with hollows greater than 9 cm and greater than 5 m above the ground and has also been excluded.

Similarly, the absence of hollow-bearing trees means that the Masked Owl, Powerful Owl and Barking Owl would not breed within the development site and are therefore excluded from the assessment.

Whilst the Square-tailed kite (*Lophoictinia isura*), White-bellied Sea-Eagle (*Haliaeetus leucogaster*), Little Eagle (*Hieraaetus morphnoides*), Red Goshawk (*Erythrotriorchis radiatus*) and Eastern Osprey (*Pandion cristatus*) might frequent the development site and surrounds during foraging activity, the absence of any large stick-nests and large mature eucalypts means that these species are unlikely to breed here and have therefore been excluded as candidate species.

The Red Goshawk has previously been recorded to the north of Singleton and east of Ravensworth (approximately 11 km from the assessment area). This species was not generated by the BAM-C and is not associated with the PCTs present within the assessment area. No stick nests were recorded within the assessment area and breeding habitat for this species is absent. According to the NSW Bionet Atlas, the population in NSW is naturally small (probably only one pair) and lies at extreme of the natural range of species. The development site lacks large - mature trees which are favoured by this species. In NSW, preferred habitats of Red Goshawk include mixed subtropical rainforest, Melaleuca swamp forest and riparian *Eucalyptus* forest of coastal rivers (Debus, 1993), which are absent from the development site. Resident pairs of red goshawks prefer intact, extensive woodlands and forests with a mosaic of vegetation types (Marchant and Higgins 1993). The assessment area does not contain intact or extensive woodlands and consists of only small and isolated patches which are in close proximity to power stations, roads and other high-disturbance areas. Furthermore, evidence of this species was not recorded in the surrounding lands (and higher-quality habitats) during comprehensive avifauna surveys undertaken for the WOAOW project (Kleinfelder, 2020).

The Swift Parrot and Regent Honeyeater are both likely to forage throughout eucalypt forests in the locality, at least on an occasional basis or whilst dispersing between larger areas of habitat. For both species, the species credit component is mapped as important areas. Mapped important areas for these species do not overlap the development site, although surveys were conducted for the Regent Honeyeater.

Breeding habitat constraints for the Little Bent-winged bat and Large Bent-winged bat is highly specific and is restricted to cave systems (including artificial structures). There are only five 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 Lake Liddell locality and would not be affected. The buildings within the development site are currently unlikely to provide roosting opportunities for microchiropteran bats. Buildings were not inspected internally during surveys due to access restrictions. However, external inspection revealed that buildings are mostly enclosed (with limited access for fauna) or are currently in use by people and machinery (with high disturbance regime). Noise and light disturbance (as well as electrical energy) within power station buildings and structures is likely to be overwhelming for locally occurring bat species. Both species have been included, and an inspection was conducted of any artificial structures within the development site.

The Large-eared Pied Bat roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. The development site is not within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops or crevices, or within 2 km of old mines or tunnels. The development site and surrounds do not contain any maternity roosts and this species was removed from the candidate species list.

There are no Grey-headed Flying-fox camps within or adjacent to the development site. According to the National Flying-fox monitoring viewer (Commonwealth Department of Environment), the nearest camp is located to the east of Muscle Creek, approximately 7 km north of the development site. This camp is not recognised as a Nationally Important Flying-fox camp. This camp would not be affected by the Project.

The Curlew Sandpiper, Great Knot, Broad-billed Sandpiper, and Black-tailed Godwit are migratory wading birds that breed in Siberia. The Black-tailed Godwit also breeds in Mongolia. As such, no breeding habitat would be impacted by the Project. For each of these species, the species credit component is mapped as important areas. Mapped important areas for these species do not overlap the development site and therefore these migratory bird species are removed from the species credit assessment.

Numerous other species have been excluded due to the development site lacking preferred habitat types. These include:

- Brush-tailed Rock-wallaby (*Petrogale penicillata*) was excluded as the development site is not within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliff lines
- Habitat for threatened species Wallum Froglet (*Crinia tinnula*), Mahony's Toadlet (*Uperoleia mahonyi*) and Green-thighed Frog (*Litoria brevipalmata*) is not available within the development site or surrounds or is too degraded for these species to be likely to occur (See **Appendix A**). These species were removed from the assessment
- Pink-tailed Worm-lizard (*Aprasia parapulchella*) was removed from the assessment due to the development site (and Assessment area) not containing favourable habitat in the form of rock outcrops or partially buried rocks.

6.2.6 Candidate species added to the assessment

The Squirrel Glider (*Petaurus norfolcensis*) was recently identified (December 2019) within the adjacent WOAOW Project area via remote camera (Kleinfelder, 2020). This record is within a patch of PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Moderate_Good condition class), approximately 1 km to the west of the development site. This species is not associated with PCT 1691 or any of the PCTs within the development site and was not generated by the BAM-C for this assessment. Given potential habitat (albeit poor and disturbed) exists within the development site (within PCT 1691) this species has been added as a candidate species.

No additional threatened species were recorded during comprehensive flora and fauna surveys. No additional Candidate species were added to the assessment. The final list of candidate species (flora and fauna) targeted by site surveys is identified in **Section 6.3**.

6.3 Targeted threatened species surveys

6.3.1 Threatened flora surveys

After the PCTs and finer scale habitats within the development site had been identified, and the threatened species habitat assessment had been undertaken, threatened plant surveys were undertaken targeted to the following candidate species:

Table 6.4 Summary of survey effort for threatened plant species

Species name	Common name	EPBC Act	BC Act	Required survey period (TBDC)	Habitat area (ha) in disturbance footprint	Timing of survey on subject land
Acacia pendula – Endangered Population in the Hunter Catchment	-	-	EP	All year	40.8 ha	Sep
Asperula asthenes	Trailing Woodruff	V	V	Oct-Dec	3.9ha	Oct and Dec
Cymbidium canaliculatum – Endangered Population in the Hunter Catchment	-	-	EP	All year	17.1 ha	Dec
Diuris tricolor	Pine Donkey Orchid	-	V	Sep-Oct	40.8 ha	Sep
Eucalyptus glaucina	Slaty Red Gum	V	V	Jan-Dec	40.8 ha	Sep and Dec
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	Not required under BAM Surveyed to Address EPBC Act requirements (all year)	40.8 ha	Sep and Dec
Maundia triglochinoides	-	-	V	Nov-Mar	7 ha (approx.)	Dec
Melaleuca biconvexa	Biconvex Paperbark	V	V	All year	3.9ha	Sep, Oct , Dec
Ozothamnus tesselatus	-	V	V	Not required under BAM Surveyed to Address EPBC Act requirements (Sep-Oct)	40.8 ha	Sep and Oct
Persicaria elatior	Tall Knotweed	V	V	Dec-May	3.9ha	Dec
Prasophyllum petilum (Synonymous with Prasophyllum sp. Wybong)	-	E	E	Not required under BAM Surveyed to Address EPBC Act requirements. (Flowers Sep-Dec)	40.8 ha	Sep
Pterostylis chaetophora	-	-	V	Sep-Nov	40.8 ha	Sep
Pterostylis gibbosa	Illawarra Greenhood	E	E	Not required under BAM Surveyed to Address EPBC	40.8 ha	Sep

Species name	Common name	EPBC Act	BC Act	Required survey period (TBDC)	Habitat area (ha) in disturbance footprint	Timing of survey on subject land
				Act requirements. (Flowers Sep-Oct)		
Zannichellia palustris	-	-	E	Oct-Jan	7 ha (approx.)	Nov and Dec

The threatened flora surveys were guided by the methodology and effort described in the *Surveying threatened plants and their habitats - NSW survey guide for the Biodiversity Assessment Method* (DPIE, 2020) and the *Draft Survey Guidelines for Australia's Threatened Orchids* (Department of the Environment, 2013). 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 5-10 m spacing between two observers) and with reference to the species prescribed survey timing in the TBDC. This approach was used to adequately cover the areas of potential habitat for the above listed species.

To survey for terrestrial orchids, transects were walked through potentially suitable habitats within the development site, particularly focusing the small patches of PCT 1691, PCT 1692 as well as derived/ modified native grasslands (zone 4) and rehabilitation (where exotic grass was less dense). These zones were considered most likely to provide habitat for *Diuris tricolor* and/or *Prasophyllum petilum*. Patches of regrowth acacia were generally avoided due to dominance of Coolatai Grass (*Hyparrhenia hirta*) in the ground layer.

Targeted surveys for orchids were conducted during September 9-11 to adequately cover the seasonal survey requirements for each of these species. Both *Diuris tricolor* and *Prasophyllum petilum* were recorded to be flowering at another reference population at Mangoola, around 20 km from Lake Liddell, at the time of survey based on comments made by the NSW Biodiversity Conservation Division (**BCD**) (now Biodiversity, Conservation & Science (BCS) within the Energy and Science Group (EESG) within the DPIE and referred throughout this BDAR as BCD) in relation to the WOAOW EIS, subsequent BDAR (Kleinfelder 2020) and updated expert orchid report (2020).Surveys for all other candidate flora species were also undertaken during these same transects. All areas of native vegetation within the development site (including rehabilitation) were adequately checked. Edges of tracks and coal conveyors (adjacent to asphalt) were checked from a vehicle (where dense exotic grass was absent). A summary of the survey timing and area of habitat for each target plant species is provided in **Table 6.4**. The location of tracks walked during the threatened plant surveys and specific search areas for orchids are illustrated in **Figure 6-1**.

Legend

- Assessment area
- Development site
- Threatened flora survey track - Spring
- Waterway
- Waterbody

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 100 200 m

1:10,000 at A4

N

Data sources

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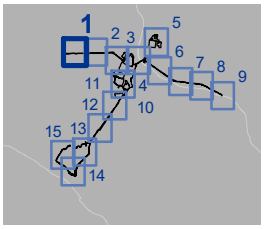

Figure 6 - 1 Threatened flora surveys

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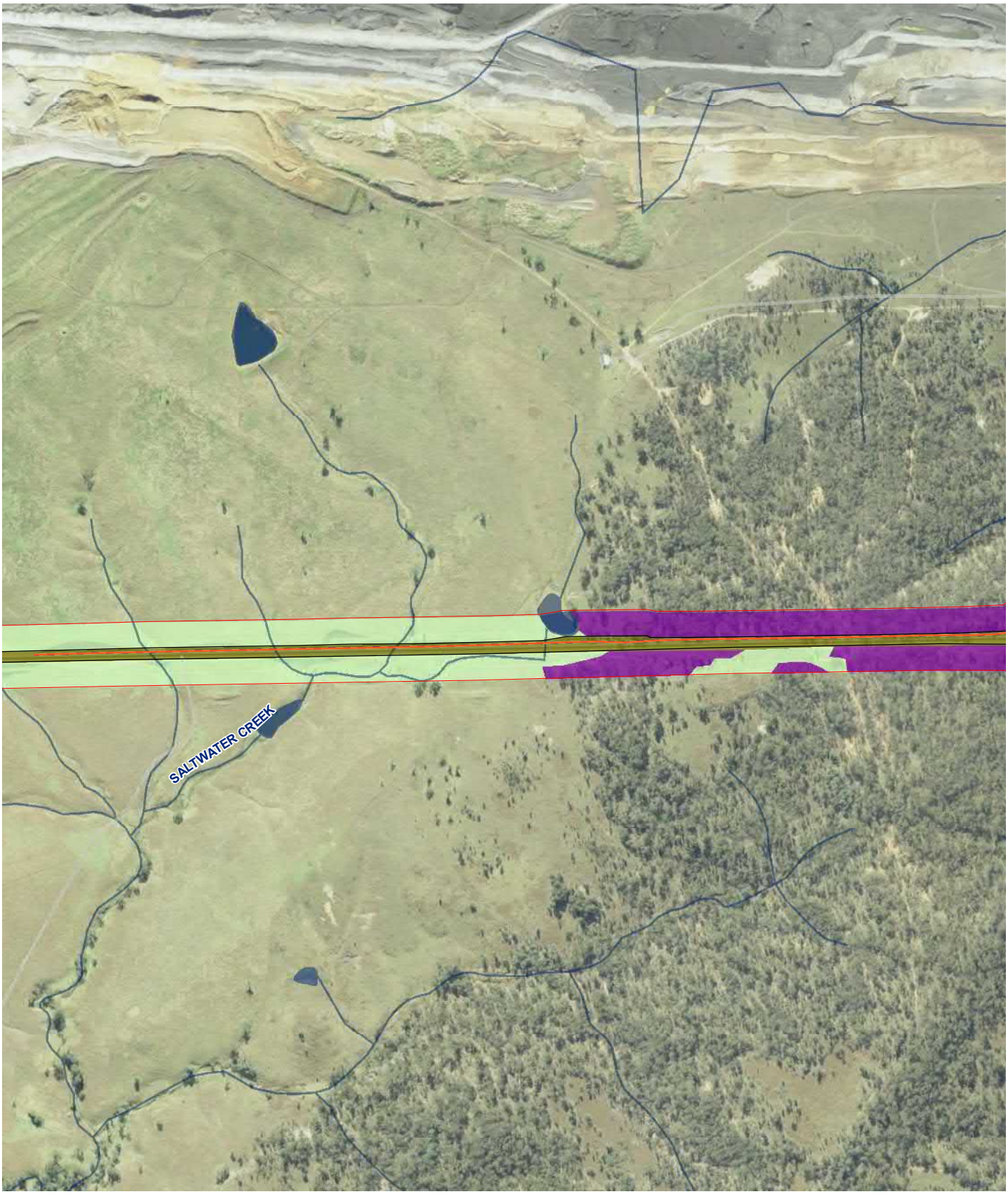

Legend

- Assessment area
- Development site
- Threatened flora survey track - Spring
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 100 200 m

1:10,000 at A4

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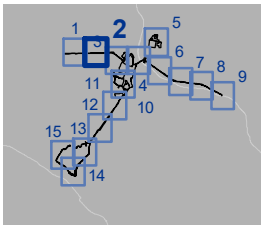

Figure 6 - 1 Threatened flora surveys

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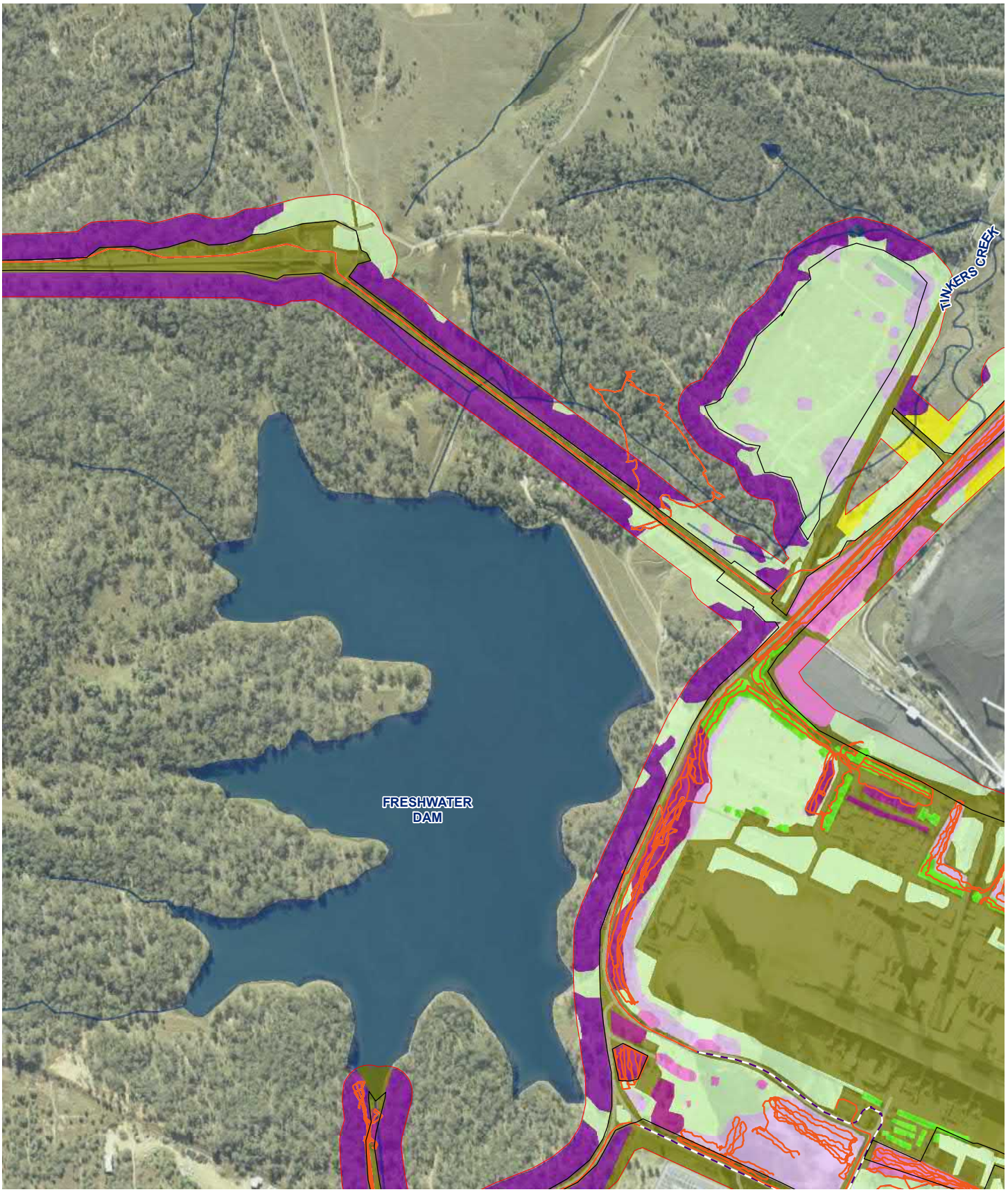

Legend

- Assessment area
- Development site
- Threatened flora survey track - Spring
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 100 200 m

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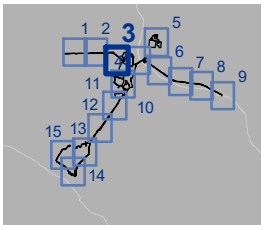

Figure 6 - 1 Threatened flora surveys

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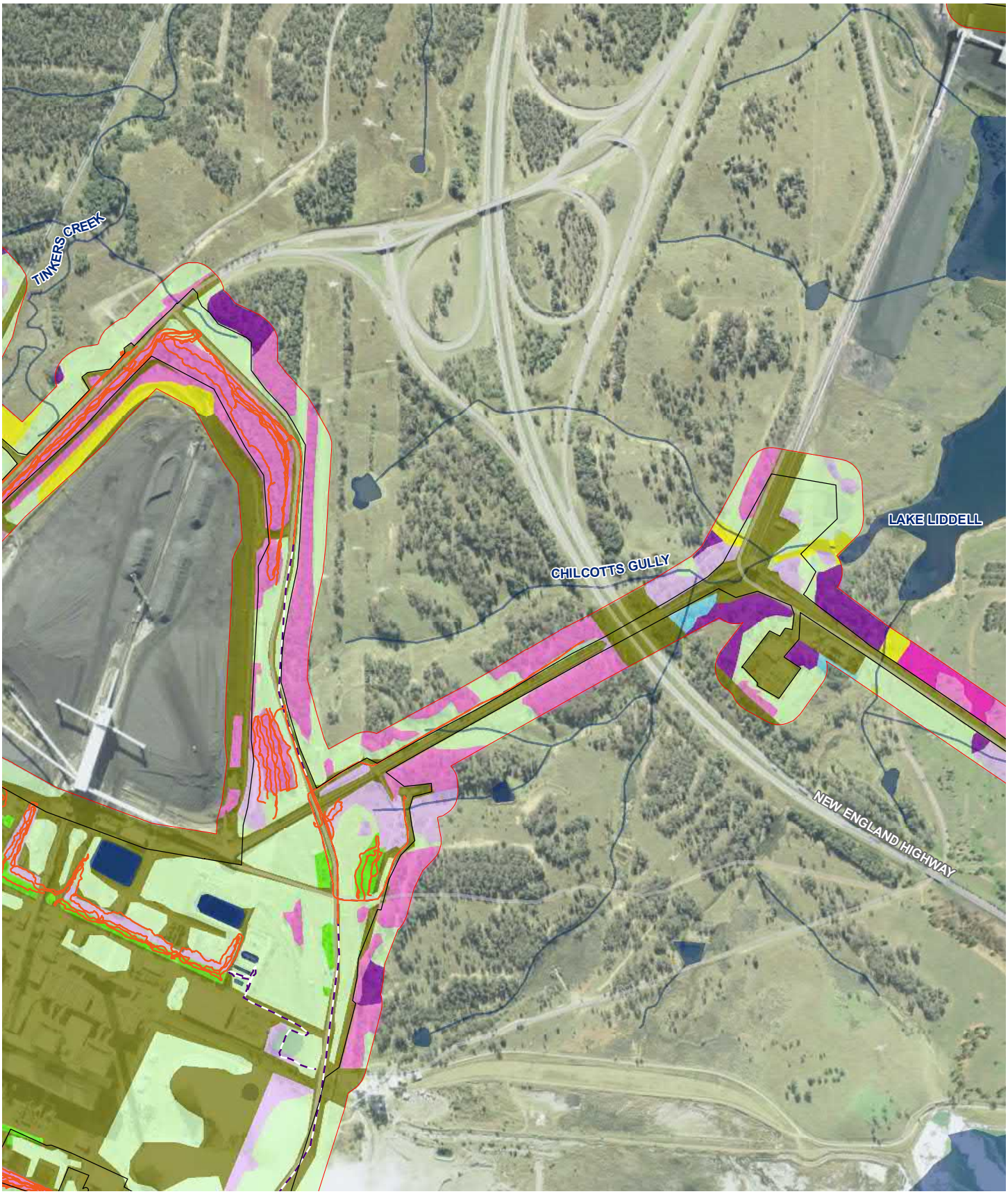

Legend

- Assessment area
- Development site
- Threatened flora survey track - Spring
- Threatened flora survey track - Summer
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 100 200 m

1:10,000 at A4

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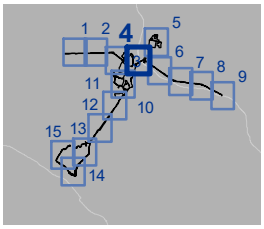

Figure 6 - 1 Threatened flora surveys

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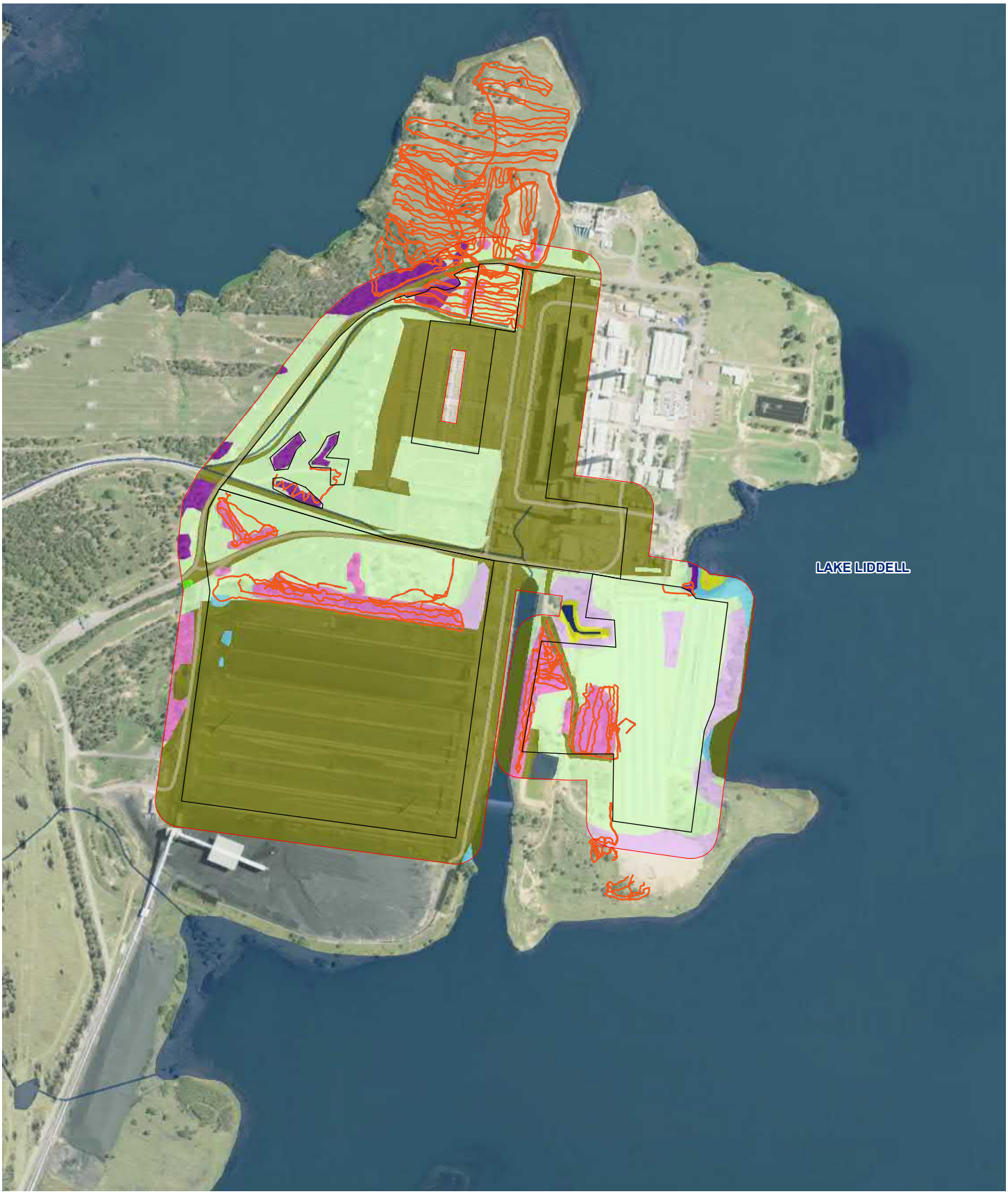

Legend

- Assessment area
- Development site
- Threatened flora survey track - Spring
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 100 200 m

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Data sources

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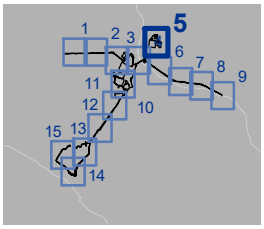

Figure 6 - 1 Threatened flora surveys

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Legend

- Assessment area
- Development site
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 100 200 m

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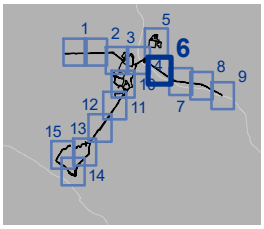

Figure 6 - 1 Threatened flora surveys

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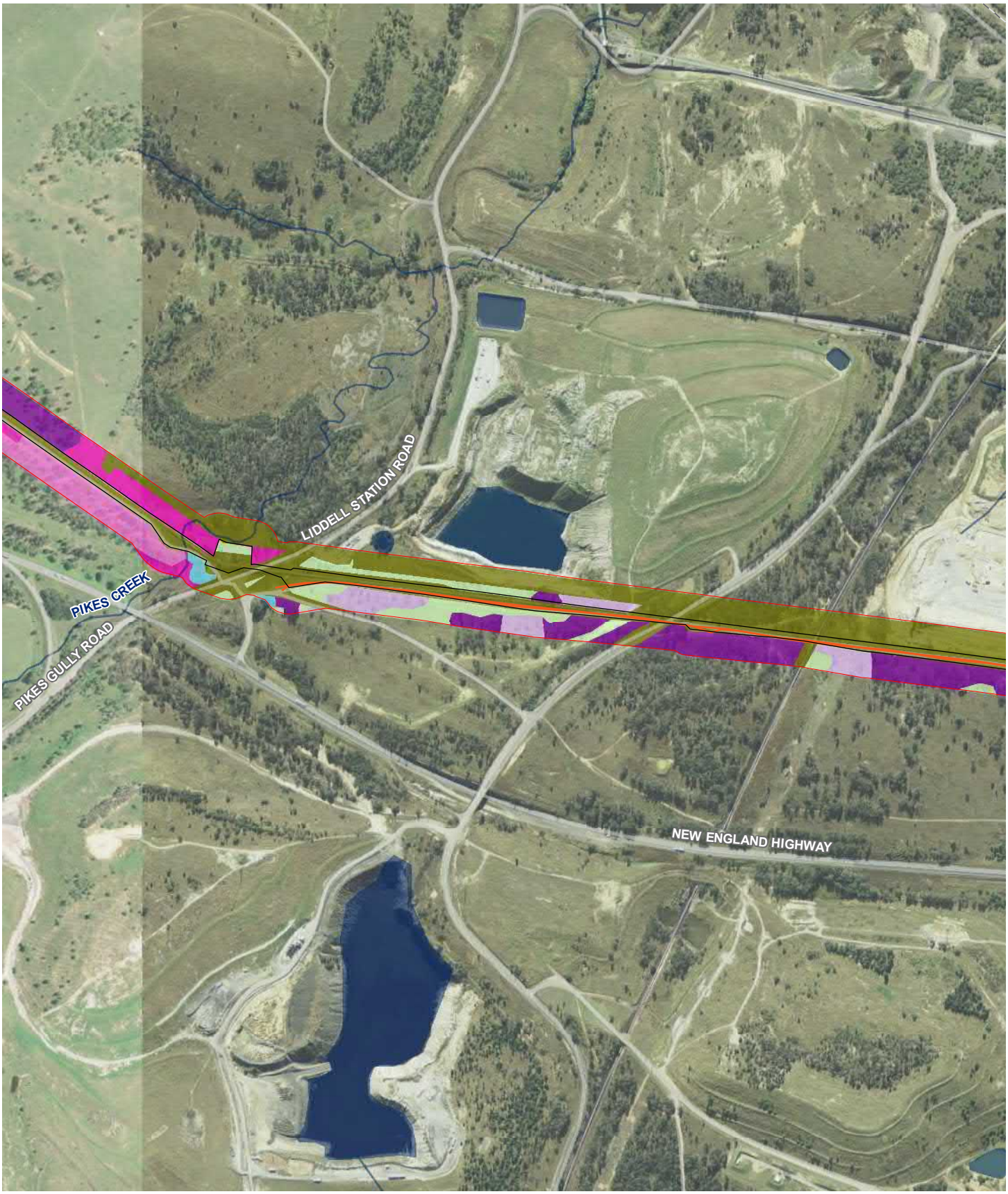

Legend

- Assessment area
- Development site
- Railway
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 100 200 m

1:10,000 at A4

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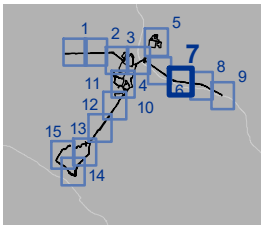

Figure 6 - 1 Threatened flora surveys

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Legend

- Assessment area
- Development site
- Railway
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 100 200 m

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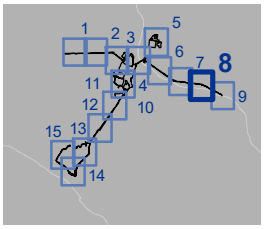

Figure 6 - 1 Threatened flora surveys

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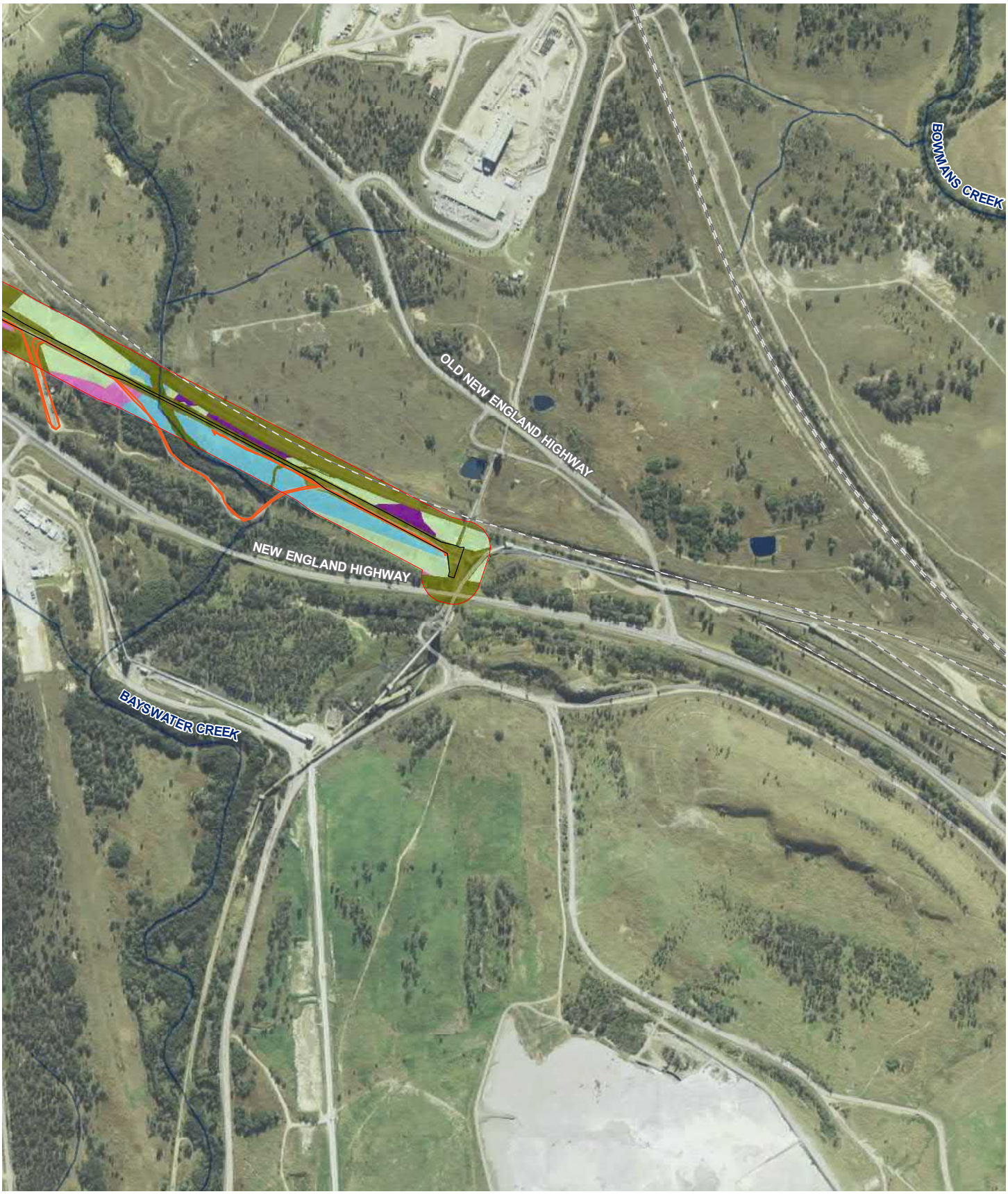

Legend

- Assessment area
- Development site
- Railway
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 100 200 m

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Data sources

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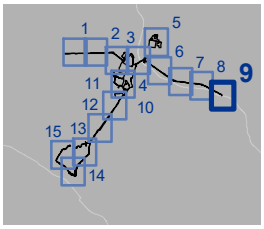

Figure 6 - 1 Threatened flora surveys

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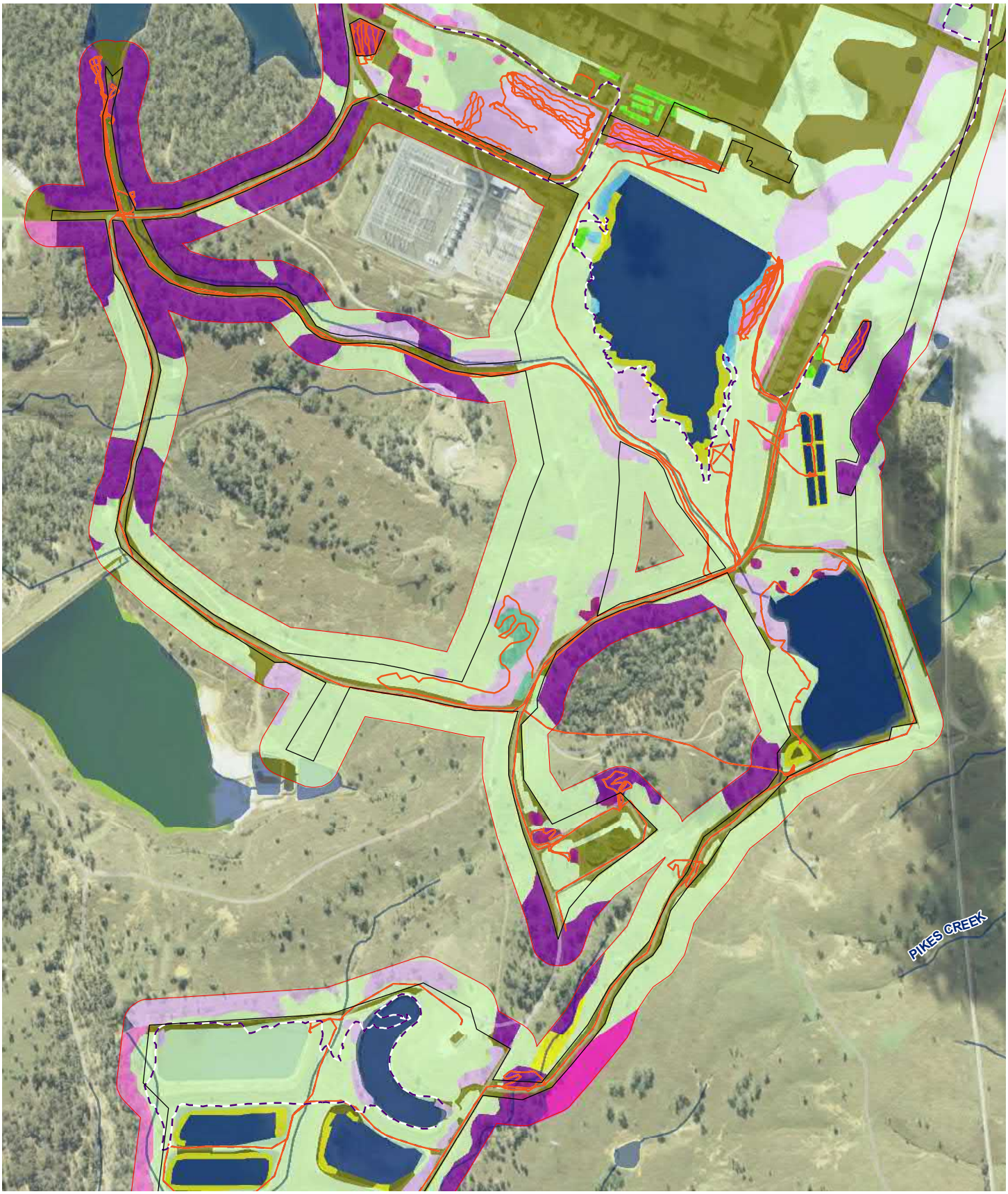

Legend

- Assessment area
- Development site
- Threatened flora survey track - Spring
- Threatened flora survey track - Summer
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 100 200 m

1:10,000 at A4

N

Data sources

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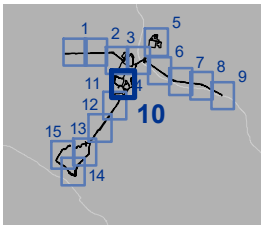

Figure 6 - 1 Threatened flora surveys

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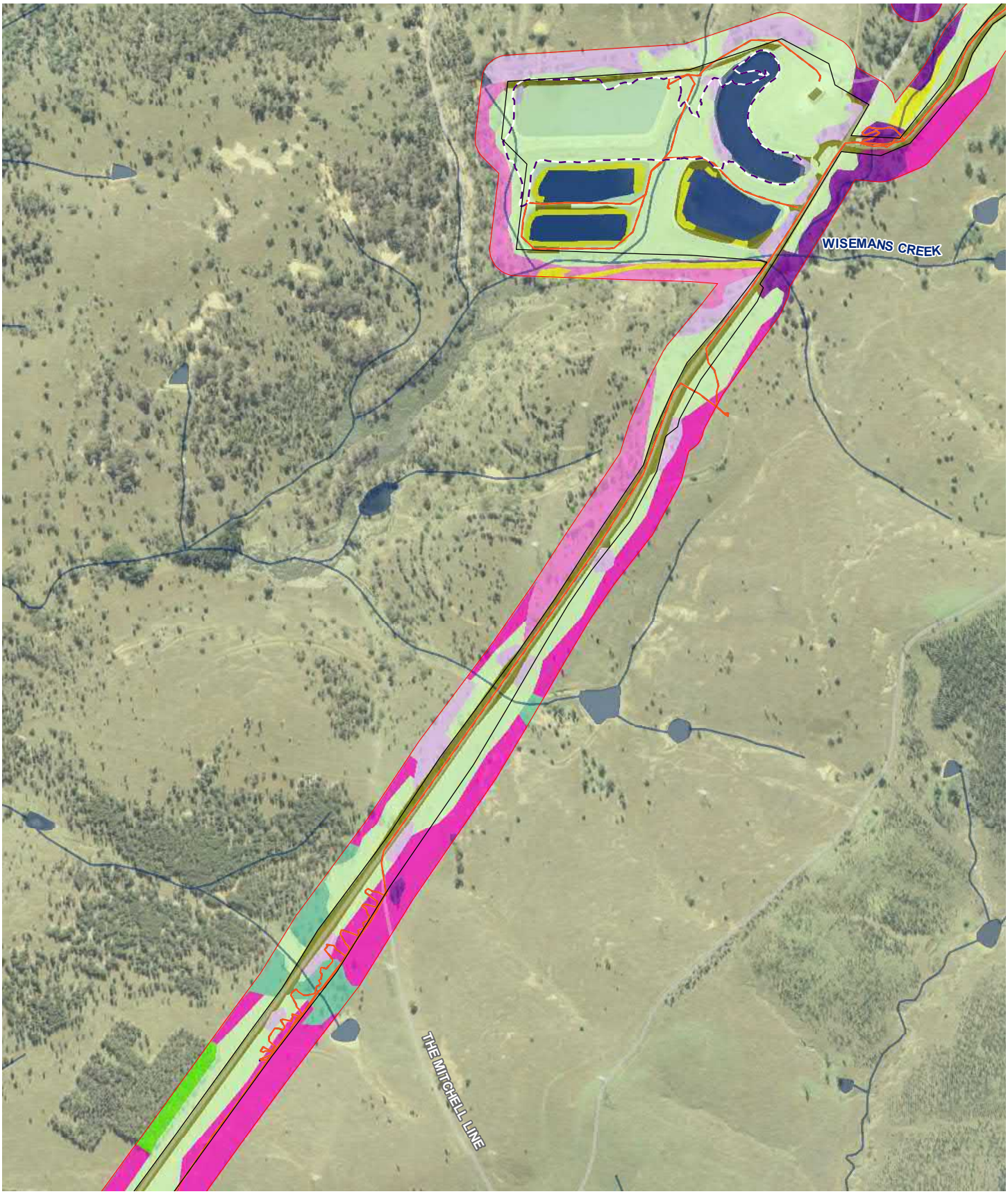

Legend

- Assessment area
- Development site
- Threatened flora survey track - Spring
- Threatened flora survey track - Summer
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 100 200 m

1:10,000 at A4

N

Data sources

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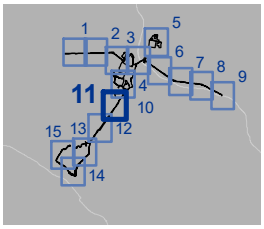

Figure 6 - 1 Threatened flora surveys

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Created by : NT | QA by : SR

Legend

- Assessment area
- Development site
- Threatened flora survey track - Spring
- Threatened flora survey track - Summer
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 100 200 m

1:10,000 at A4

N

Data sources

Jacobs 2021
AGL 2021
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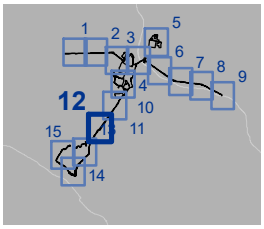

Figure 6 - 1 Threatened flora surveys

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Created by : NT | QA by : SR

Legend

- Assessment area
- Development site
- Threatened flora survey track - Spring
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 100 200 m

1:10,000 at A4

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Data sources

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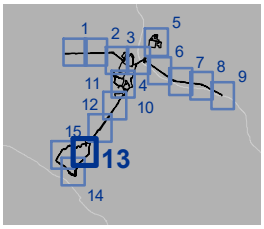

Figure 6 - 1 Threatened flora surveys

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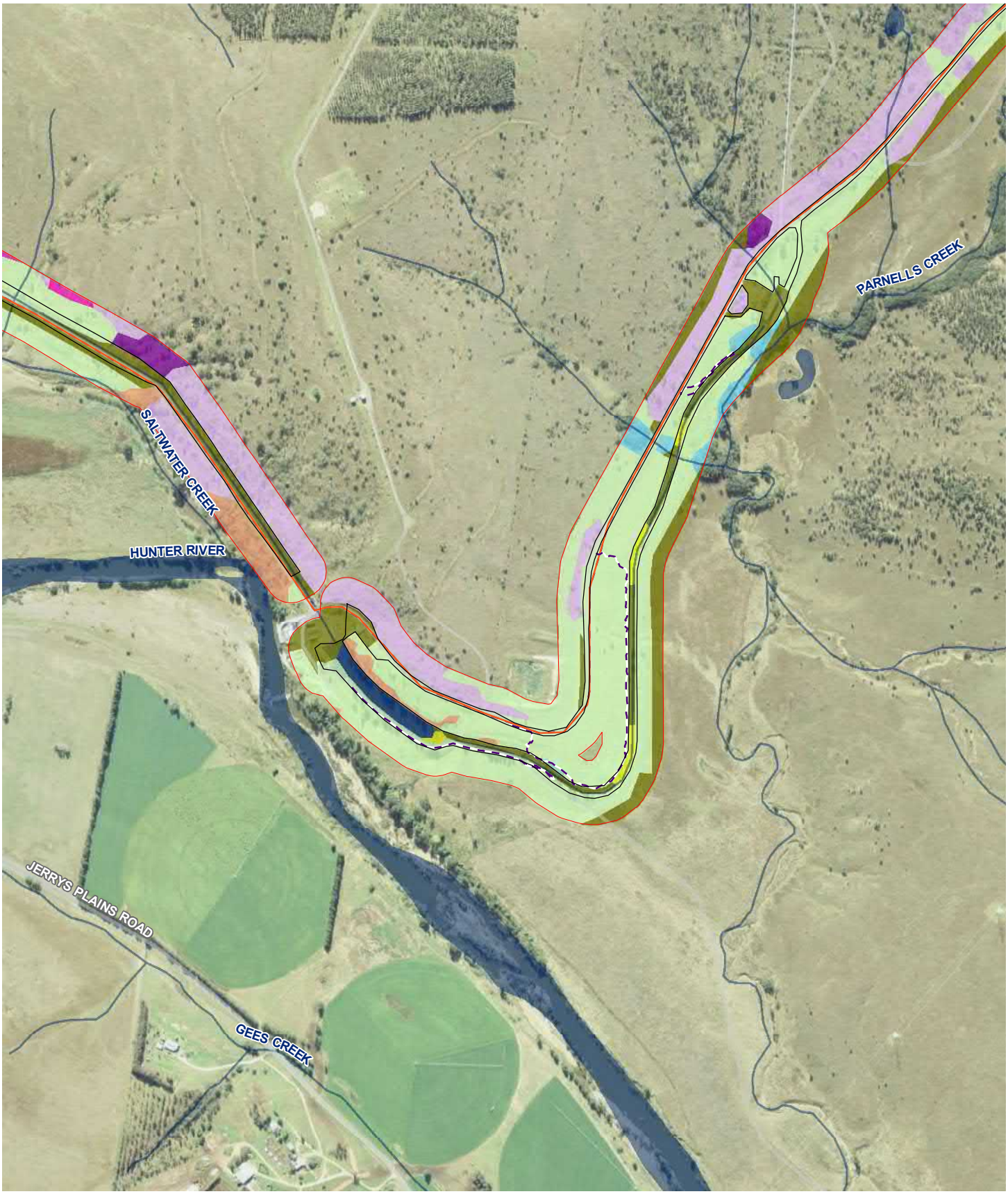

Legend

- Assessment area
- Development site
- Threatened flora survey track - Spring
- Threatened flora survey track - Summer
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 485 River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion)
- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 100 200 m

1:10,000 at A4

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Data sources

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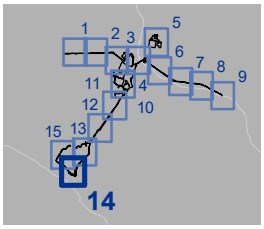

Figure 6 - 1 Threatened flora surveys

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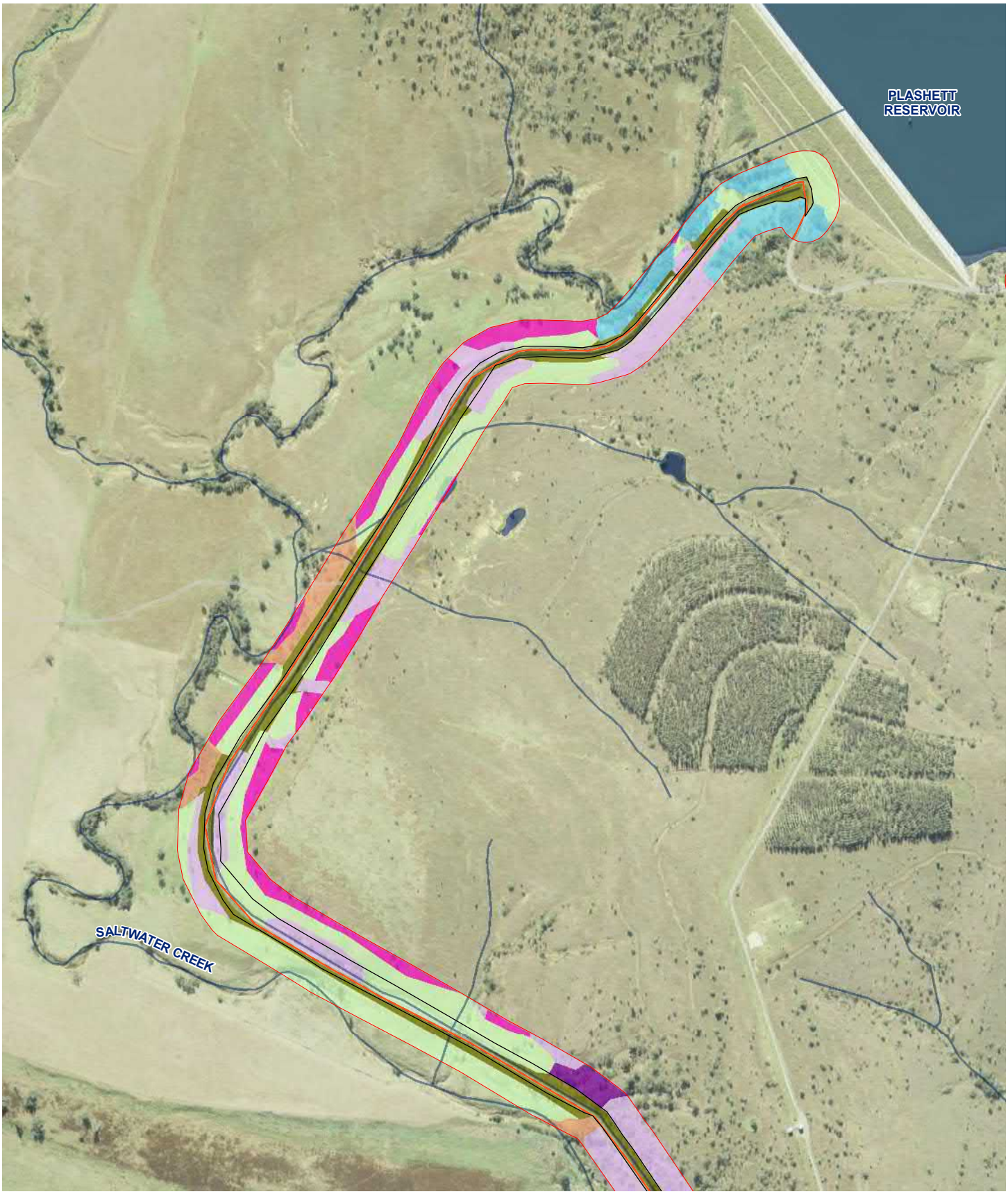

Legend

- Assessment area
- Development site
- Threatened flora survey track - Spring
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 485 River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 100 200 m

1:10,000 at A4

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Data sources

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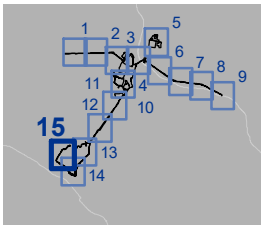

Figure 6 - 1 Threatened flora surveys

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6.3.2 Threatened fauna surveys

The terrestrial fauna surveys included a range of techniques and focussed on all habitat variants within the development site (**Figure 6-2**). Areas of exotic grasslands and existing disturbance (or power station infrastructure) were generally excluded given their lack of ecological value or habitat features. Likewise, much of PCT 1691 – Regrowth does not contain habitat resources suitable for target fauna species, and surveys in these areas were kept minimal. Threatened species identified as candidate species credit species were targeted, however all species recorded were documented. Diurnal and nocturnal surveys were conducted and opportunistic observations of threatened species were also recorded during all other surveys (including vegetation surveys).

Surveys were conducted during spring and summer of 2020 using a combination of sampling techniques based on the 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:

- *NSW Survey Guide for Threatened Frogs* (State of NSW and DPIE, 2020)
- *'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method* (Office of Environment and Heritage (**OEH**), 2018)
- *Survey Guidelines for Australia's Threatened Bats* (Department of the Environment Water Heritage and the Arts, 2010a)
- *Survey Guidelines for Australia's Threatened Birds* (Department of the Environment Water Heritage and the Arts, 2010b)
- *Survey Guidelines for Australia's Threatened Frogs* (Department of the Environment Water Heritage and the Arts, 2010c)
- *Survey Guidelines for Australia's Threatened Mammals* (Department of the Environment Water Heritage and the Arts, 2011a)
- *Survey Guidelines for Australia's Threatened Reptiles* (Department of the Environment Water Heritage and the Arts, 2011b).

Targeted winter surveys for winter-breeding threatened fauna species such as large forest owls, raptors or cockatoos were not conducted due to the lack of suitable breeding habitat features for such species within the development site. Initial habitat assessments in winter 2020 did not record any large stick nests or hollow-bearing trees within or adjacent to the development site. Furthermore, targeted surveys during 2019 for the WOAOW BDAR did not record evidence of breeding by owls, raptors or cockatoos (Kleinfelder,2020). As such, the likelihood of any winter-breeding threatened species occurring on the development site was considered low and target surveys were deemed unnecessary (see S**ection 6.2.5**). Similarly, the lack of large stick nests and large-mature trees across the development site means that suitable breeding habitat for the Red Goshawk was also deemed absent. In NSW, preferred habitats of Red Goshawk include mixed subtropical rainforest, *Melaleuca* swamp forest and riparian *Eucalyptus* forest of coastal rivers (Debus,1993), which are absent from the development site. Resident pairs of red goshawks prefer intact, extensive woodlands and forests with a mosaic of vegetation types (Marchant and Higgins 1993). The assessment area does not contain intact or extensive woodlands and consists of only small - isolated patches which are located next to power stations, roads and other high-disturbance areas.

A summary of the candidate fauna species, survey requirements and timing are detailed in **Table 6.5**. Specific survey details for fauna groups are described in the **Table 6.5**.

Table 6.5 Threatened fauna candidate species, survey requirements and survey period

Species name	Common name	Survey Requirements (TBDC) and guidelines	Survey Timing
Birds			
Anthochaera phrygia	Regent Honeyeater (Breeding)	Site does not occur in important area map, no timing described in TBDC for breeding surveys	December 5 days (plus opportunistic all surveys Sep -Dec)
Botaurus poiciloptilus	Australasian Bittern	Not required under BAM (Ecosystem Credit Species) Surveyed to address EPBC requirements	December 5 days (plus opportunistic all surveys Sep -Dec)
Burhinus grallarius	Bush Stone-curlew	All year	December 4 nights (plus opportunistic all surveys Sep -Dec)
Calidris ferruginea	Curlew Sandpiper	Site does not occur in important area map Surveyed to address EPBC requirements	December 5 days (plus opportunistic all surveys Sep -Dec)
Calidris tenuirostris	Great Knot	Site does not occur in important area map. Surveyed to Address EPBC requirements	December 5 days (plus opportunistic all surveys Sep -Dec)
Grantiella picta	Painted Honeyeater	Not required under BAM (Ecosystem Credit Species) Surveyed to address EPBC requirements	December 5 days (plus opportunistic all surveys Sep -Dec)
Hirundapus caudacutus	White-throated Needletail	Not required under BAM (Ecosystem Credit Species) Surveyed to address EPBC requirements	December 5 days (plus opportunistic all surveys Sep -Dec)
Lathamus discolor (Foraging)	Swift Parrot	Site does not occur in important area map	Survey December 5 days (plus opportunistic all surveys Sep -Dec) was outside of presence in NSW
Rostratula australis	Australian Painted Snipe	Not required under BAM (Ecosystem Credit Species) Surveyed to address EPBC requirements	December 5 days (plus opportunistic all surveys Sep -Dec)
Frogs			
Litoria aurea	Green and Golden Bell Frog	Nov-Mar 4 nights survey following heavy rainfall (>50mm over 7 nights)	December (4 nights spotlight following sufficient rainfall)
Mammals			
Cercartetus nanus	Eastern Pygmy-possum	Oct-Mar	December (4 nights trapping and spotlighting) 23 nights camera monitoring
Chalinolobus dwyeri	Large-eared Pied Bat	Nov-Jan	December (4 nights harp traps and AnaBat)
Dasyurus maculatus	Spotted-tailed Quoll	Not required under BAM (Ecosystem Credit Species) Surveyed to address EPBC requirements (mid Nov-Mar)	December (4 nights trapping and spotlighting) 23 nights camera monitoring
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	N/A	December (4 nights harp traps and AnaBat)

Species name	Common name	Survey Requirements (TBDC) and guidelines	Survey Timing
Myotis macropus	Southern Myotis	Oct-Mar	December (4 nights harp traps and AnaBat)
Phascogale tapoatafa	Brush-tailed Phascogale	Dec-Jun	December (4 nights trapping and spotlighting) 23 nights camera monitoring
Planigale maculata	Common Planigale	Jan-Dec	December (4 nights trapping and spotlighting) 23 nights camera monitoring
Pteropus poliocephalus	Grey-headed Flying-fox	Not required under BAM (Ecosystem Credit Species) Surveyed to address EPBC requirements	December (4 nights spotlighting)
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	N/A	December (4 nights harp traps and AnaBat)
Reptiles			
Delma impar	Striped Legless Lizard	Sep-Dec	November/December roof tiles set for 49 days checked three times.
Hoplocephalus bitorquatus	Pale-headed Snake	Nov-Mar	December 4 nights spotlight

6.3.2.1 Diurnal Birds

Targeted visual and auditory bird surveys were conducted at 18 locations throughout the development site during early December 2020. Surveys targeted waterbodies and the small patches of woodland within the development site (with emphasis given to patches of flowering Eucalypt or Angophora trees). Surveys consisted of twenty-minute listening and visual surveys conducted by two people. Targeted EPBC Act listed species were also targeted including the Regent Honeyeater.

No hollow-bearing trees exist within or immediately adjacent to the development site and targeted surveys for breeding Glossy-black Cockatoos and Gang-gang Cockatoos were not required. Likewise, no large stick nests exist within or adjacent to the development site and surveys for breeding activity of candidate birds of prey was discounted.

Targeted surveys for water birds (threatened and migratory species) were undertaken at each of the larger waterbodies within the development site during December 2020 (total of six surveys). Visual and auditory bird surveys were conducted by two ecologists along the shoreline of large dams and ponds. Approximately 30 minutes was allocated to each survey location.

All observations of birds during other survey activities as well as vegetation surveys (October and November 2020) were noted. Species were identified visually with the aid of binoculars or aurally from call identification.

6.3.2.2 Nocturnal Birds

Given the lack of hollow-bearing trees within and adjacent to the development site as per the findings of the surveys, there is no potential breeding habitat for forest owls. Targeted survey for winter-breeding candidate

species was not required. Likewise, stag-watching and pellet search survey was not required. Call-playback was conducted over four nights (7-11 December 2020) and targeted Bush Stone-curlew. Calls were broadcast through a megaphone to attract individuals or to incite a response. Calls of threatened species were broadcast for five minutes each, followed by ten minutes listening and one to two minutes of stationary spotlighting.

6.3.2.3 Arboreal mammals

Twenty five Elliott B traps were placed in trees at heights of 3 m, along five transects (five traps per transect) for a period of four consecutive nights in December 2020. Traps were baited with a mixture of rolled oats, honey, peanut butter and vanilla essence. The trunks of trees adjacent to traps were sprayed with a mixture of honey and water (this was repeated mid-survey). Traps were checked at dawn each morning for arboreal mammal species.

A total of 12 Reconyx HyperfireTM remote cameras were installed on tree trunks at heights of 3 m or 1 m above ground. A total of seven cameras were installed at 3 m (targeting Brush-tailed Phascogale or Squirrel Glider), and five cameras were installed at 1 m (targeting Eastern Pygmy-possum). Cameras were active onsite for 23 consecutive nights from 7 of December to 30 December 2020. Cameras were baited with a mixture of rolled oats, honey, peanut butter and vanilla essence, and the surrounding area (including the tree trunk) was sprayed with a mixture of honey and water. Images were analysed to identify species captured on camera.

Spotlighting surveys were undertaken over four nights in December 2020 using high powered head torches. Two ecologists walked through suitable habitats with a spacing of 20-30 m between each person. Spotlighting was conducted over two hours after sunset. The combined survey effort equalled 16 person hours.

Surveys for evidence of Koalas were conducted within the development site and adjacent woodland areas. Four Spot Assessment Technique (**SAT**) surveys (Phillips and Callaghan, 2011) were conducted within vegetation dominated by *Eucalyptus tereticornis* (Koala Feed Tree) in December 2020. SAT surveys involved:

The selection of a centre tree (survey point) which is selected according to the following criteria:

- A tree of any species beneath which one or more Koala faecal pellets have been observed; and/or
- A tree in which a Koala is observed; and/or
- Any other tree known or considered to be potentially important for Koalas, or for other assessment purposes.

A minimum of 30 trees (including the centre tree) with a diameter at breast height (**DBH**) of 100 mm or greater are then surveyed. Surveys involve the inspection of the ground surface within 100 cm from the base of the tree. If faecal scats are identified, the survey concludes.

6.3.2.4 Terrestrial mammals

A total of 50 Elliot A traps were set along five transects for a period of four consecutive nights (Dec 7-112020) to target terrestrial mammal species (particularly the Common Planigale). Given suitable habitat patches within the development site are isolated and small in size, only ten Elliott A traps were placed along a transect (compared to the usual 20 per transect). Traps were baited with a mix of rolled oats, honey, peanut butter and vanilla essence and checked at dawn each morning.

In addition to trapping and nocturnal spotlighting, opportunistic daytime observations of the signs of recent terrestrial mammal activity such as diggings, droppings or scratch marks were noted.

6.3.2.5 Bats

Two Harp traps and two Anabat Express Passive Bat Detectors were used to record microchiropteran bats within the development site. Surveys for Microchiropteran bats were targeting the Southern Myotis, and harp traps and Anabats were placed adjacent to suitable waterbodies for four consecutive nights; 7–10 December 2020. Nocturnal searches of blossoming trees were also undertaken during spotlighting to detect Megachiropteran bats. Much of the site contains large waterbodies (dams and ponds) with sparse riparian vegetation (or none), meaning that suitable locations (or fly-ways) for harp trap installation were difficult to find. Harp traps were instead set up in areas directly adjacent to the man-made canals where fly-ways were more defined. Harp traps could not be installed within canals due to unknown flow-regimes and fluctuating water heights (traps could be swept away).

Roost searches were conducted in concrete culverts which exist at intervals along the water canals and pipelines within the development site (**Photo 7-1** and **Photo 7-6**). These were surveyed during the summer period for around 30 minutes during diurnal hours to determine usage by roosting bats. Not all culverts were accessible due to exclusion zones and high-water flows. Most culverts within the development site are unlikely to be utilised by fauna due to highly fluctuating water-levels associated with water discharge from Bayswater and Liddell. Some culverts are regularly inundated or contain fast flowing water.

Other artificial roosts such as empty shipping containers and disused sheds were also surveyed for on an opportunistic basis. The large majority of buildings and structures are still in use as part of power station operation and the noise and light levels around most buildings and operating infrastructure would deter microchiropteran bats (combined with many high voltage powerlines). No hollow-bearing trees are present within the development site.

Suitable habitat for the Southern Myotis is identified as the range of PCTs associated with the species (as per the TBDC) within 200 m of any medium to large permanent creeks, rivers, lakes or other waterways (i.e. with pools/ stretches three metres or wider) (OEH, 2018). The Southern Myotis is assumed to be present within the site in accordance with paragraph 5.2.4 of the BAM. This species was recorded within 100 m of the development site by Kleinfelder in December 2019, and the development site contains native vegetation within 200 m of suitable watercourse (including areas of PCT 1691, PCT 1071 and PCT 1692).

6.3.2.6 Amphibians

General amphibian surveys were undertaken during spotlighting surveys where waterbodies were present. A list of common species was recorded by listening to calls. Targeted surveys were undertaken for Green and Golden Bell Frog (*Litoria aurea*) (**GGBF**) during suitable weather conditions (see below).

~~6.3.2.7.0~~6.3.2.6.1 Green and Golden Bell Frog

Habitat assessments were undertaken for this species in order to identify suitable survey locations. By conducting habitat assessments, some of the aquatic habitats on the Project site can be ruled out as being appropriate for GGBF. Initial habitat assessments were conducted to stratify the habitat available and target survey effort at sites where habitats appeared most suited to GGBF. To determine this, a review of literature on the habitat requirements of GGBF was conducted (in particular; Distribution and conservation status of the GGBF in NSW (Pyke and White, 1996)). These authors document the criteria found most consistently at sites that support breeding and non-breeding populations, including the following:

- Presence of emergent vegetation providing shelter sites
- Moderate to high level disturbance

- Aquatic plant species present (especially *Typha spp.*)
- Still or low flowing water
- Run-off urban / industrial / grazing or parkland
- Substrate sand, or rock
- Shallow water depth <50 cm
- Nearby vegetation low, grassland, or shrubland or woodland
- Unshaded or partial shade
- Areas of grass nearby
- No visible signs of pollution
- *Crinia signifer*a or *Limnodynastes peroni*i present
- *Gambusia holbrooki* absent.

Nocturnal surveys were conducted at seven sites over four nights, between the 22-25 December 2020. Weather conditions are shown in **Table 6.7**. Each site was searched by two ecologists, and the sites deemed as suitable habitat were checked on all four nights during the survey period. The duration of each sampling event extended between twenty and forty minutes per site depending on the size of the site. The survey involved a spotlight search of the perimeter of the ponds/ dams focusing on the upper water column and within emergent vegetation. Call playback was used at each site which involved playing calls through a twenty watt (**w**) loudspeaker for a total of two to five minutes along multiple locations at each site.

~~6.3.2.8~~6.3.2.7 Reptiles

Reptile searches and tile arrays were carried out at different locations within the development site and adjacent woodland areas.

Five tile arrays were set out in a 10 x 5 configuration (total 250 tiles) using standard terracotta roof tiles in potential habitat for the Striped Legless Lizard (*Delma impar*) (**SLL**). These were set on the 11 November 2020 and the final check was conducted on 30 December 2020. Three additional tile arrays which remained from surveys for the WOAOW Project surveys (Kleinfelder 2020) were deemed close enough to the development site to be incorporated into this survey (within 300m of boundary). The three WOAOW Project tile arrays were set up on 25 October 2019 and have remained in-situ for over a year. By incorporating these arrays, the total survey effort is eight tile arrays (or 400 tiles). The *Survey Guidelines for Australia's Threatened Reptiles* (Department of the Environment Water Heritage and the Arts, 2011b) recommend tile arrays are installed three months prior to initiating the surveys (regular checking). Due to the condensed timeframe of the assessment, the five arrays installed on the 11 November 2020 were installed only one month prior to survey. The remaining three WOAOW Project tile arrays were installed over a year prior to survey.

Tiles were checked by flipping each tile over and recording the presence of any reptile species along with evidence of use (diggings and shed skin). Tiles were checked on multiple occasions including 8, 24 and 30 December 2020.

Spotlighting surveys for general reptile species were conducted over four nights in early December 2020 (which also targeted the Pale Headed Snake). Spotlighting was undertaken via random meanders for two hours by two people each night and focused on the small woodland patches within the development site.

Other targeted reptile searches were conducted within the development site between 7-11 December 2020 through random meanders turning over timber, woody debris, rocks and discarded building materials.

~~6.3.2.9~~6.3.2.8 **Timing, season and weather conditions**

Fauna surveys were conducted over a total of fourteen days between November and December 2020. A summary of the field survey times, weather conditions during the survey period and total rainfall conditions experienced during surveys are provided in **Table 6.6** and **Table 6.7**.

Conditions during the general fauna survey (14–18 December 2020) were hot with clear skies and light winds, with only brief rainfall experienced on one of the days.

Target surveys for GGBF were conducted in December 2020 after 74mm of rain was recorded over seven days by the AGLM Liddell rainfall monitoring point (between 15-22 December). Heavy rainfall (40mm) was recorded over 21-22 December. Four separate surveys were undertaken in the evenings of 22-25December. Conditions during the evenings were warm and humid, with mostly clear skies apart from the first evening which was overcast. Conditions were calm with light to moderate winds. Maximum temperatures during the day reached the low thirties dropping to a minimum of 13ºC during the nights.

Table 6.6 Summary of timing, weather and rainfall conditions for general fauna surveys (December 2020)

Date	Temperature (min/max)	Daily rainfall	Sunrise /sunset	Observations (evening)
7/12/20	30ºC max / 15 ºC min	0	05:53 / 20:00	Wind - NNW 5km/hr easing 35 % Relative humidity Moon – Waning gibbous 56% full
8/12/20	26ºC max / 14 ºC min	0	05:52 / 20:00	Wind W 14km/hr easing 28 % Relative humidity Moon – Waning gibbous 50% full
9/12/20	29ºC max / 10 ºC min	0	05:51 / 20:01	Wind ESE 22km/hr easing 60 % Relative humidity Moon – Waning gibbous 34% full
10/12/20	32ºC max / 13 ºC min	0	05:51 / 20:02	Wind NW 15km/hr easing 55 % Relative humidity Moon – Waning gibbous 23% full
11/12/20	22ºC max / 15 ºC min	0.4mm	05:50 / 20:02	N/A

Table 6.7 Summary of timing, weather and rainfall conditions for additional Green and Golden Bell Frog surveys (December 2020)

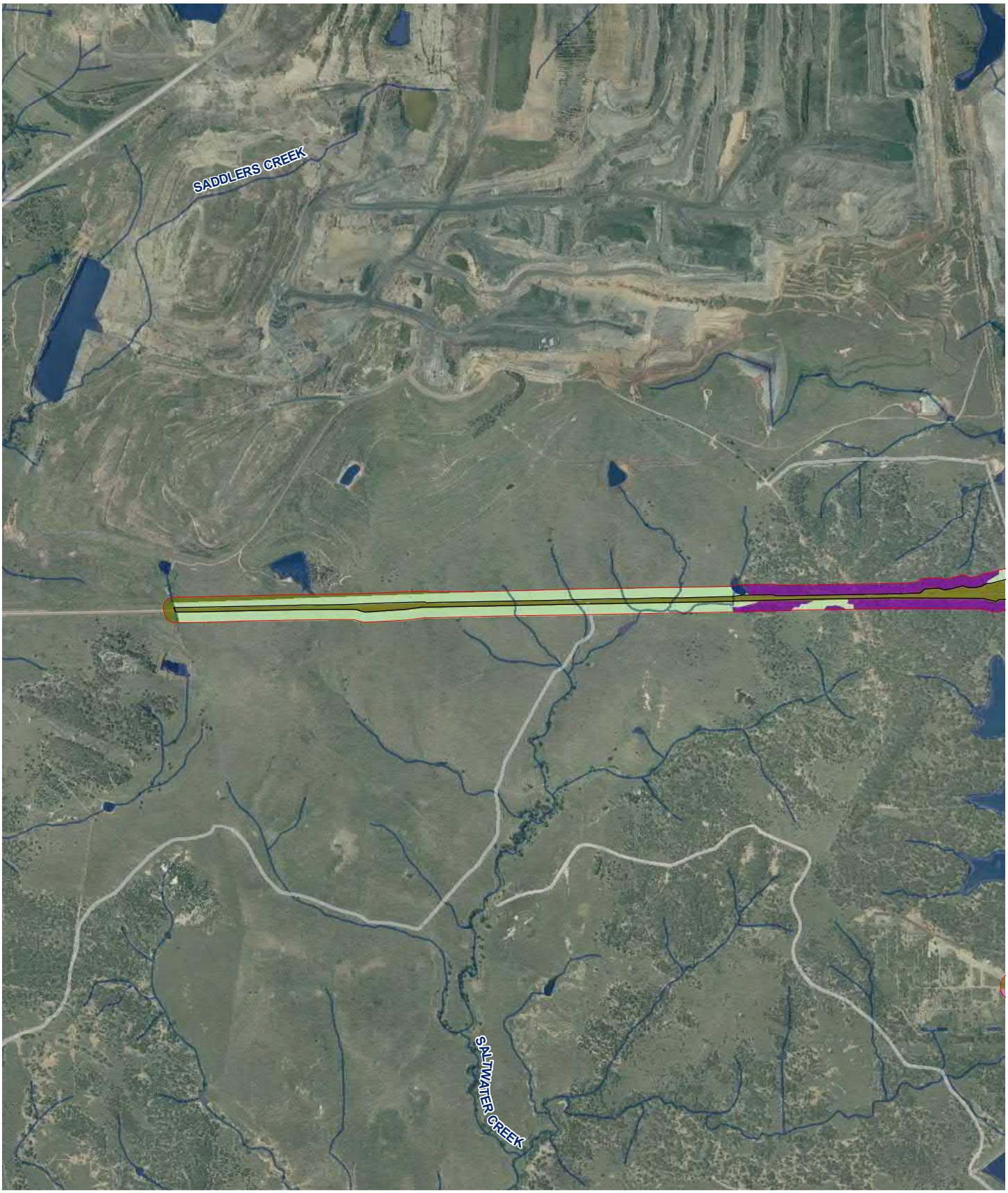
Date	Temperature (min/max)	Daily rainfall	Sunrise /sunset	Observations (evening)
22/12/20	29ºC max / 18 ºC min	11mm	05:47 / 20:03	Wind westerly 13km /hr easing. 50% Relative humidity Moon – waxing gibbous 55% full
23/12/20	27 ºC max / 13 ºC min	0	05:47 / 20:03	Wind westerly 13km /hr easing. 52%Relative humidity Moon – waxing gibbous 64% full
24/12/20	29ºC max / 14ºC min	0	05:48 / 20:04	Wind Northerly 7km /hr 60% Relative humidity

Date	Temperature (min/max)	Daily rainfall	Sunrise /sunset	Observations (evening)
				Moon – waxing gibbous 73% full
25/12/20	27°C max 1/ 3°C min	0	05:48 / 20:04	Wind Southerly 15km/hr 61% Relative humidity Moon – waxing gibbous 81% full

Temperature data and wind data is from Scone Airport weather station (BOM: 061363) and rainfall data is collected from the AGLM Liddell rainfall monitoring point.

6.3.3 Survey Limitations (flora and fauna species)

The desktop assessment and field survey carried out for this BDAR provides a limited view into the ecological values of the development 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 development site has been recorded. The field survey aimed to sample the development 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 development site at the time of the survey. Site conditions, including the presence of threatened species, can change with time. The development site is regularly exposed to high levels of disturbance from operation of the power stations as well as maintenance of the infrastructure, tracks as well as vegetation management in the periphery of infrastructure. Such disturbances may temporarily deter fauna species. To address this limitation, the assessment has aimed to identify the presence and suitability of the habitat for threatened species.



Legend

- Assessment area
- Development site
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

Data sources

Jacobs 2021
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Figure 6 - 2 Threatened fauna surveys

Date: 3/02/2021 Path: \\jacobs.com\ANZ\IE\Projects\04_Eastern\IS334000\22_Spatial\GIS\Directory\Templates\Figures\EIS\Ecology\BDAR\IS334000_BDAR_F008_FaunaSurvey_r2v1.mxd
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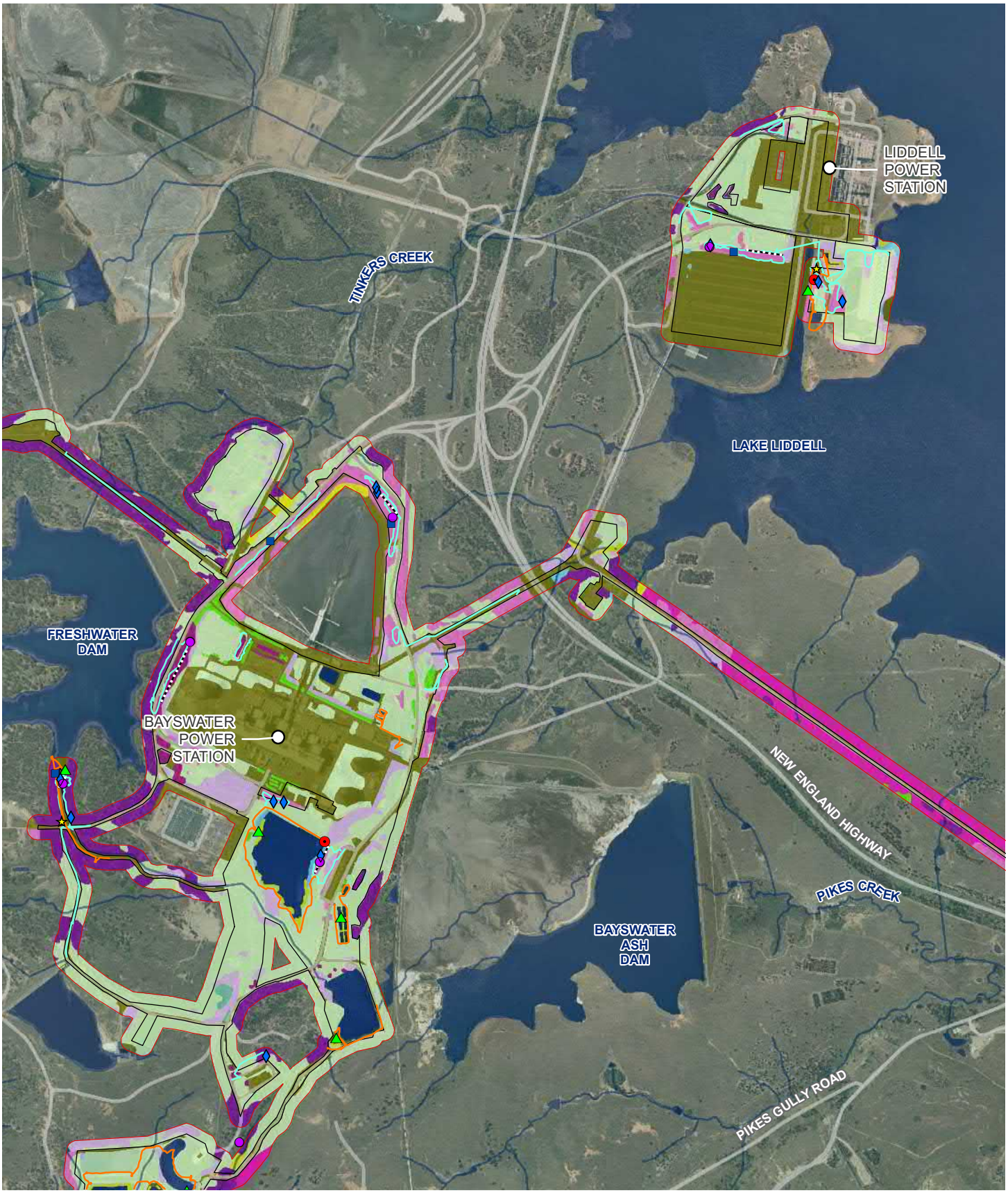

Legend

- Assessment area
- Development site
- Road
- Waterway
- Waterbody

Survey method

- Tile array (reptiles)
- Koala SAT survey
- Infrared camera
- Harp trap
- *Litoria aurea* habitat survey
- Anabat detector
- Elliot trap transect
- Amphibian survey
- Spotlight survey

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

Data sources

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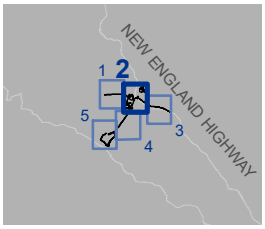

Figure 6 - 2 Threatened fauna surveys

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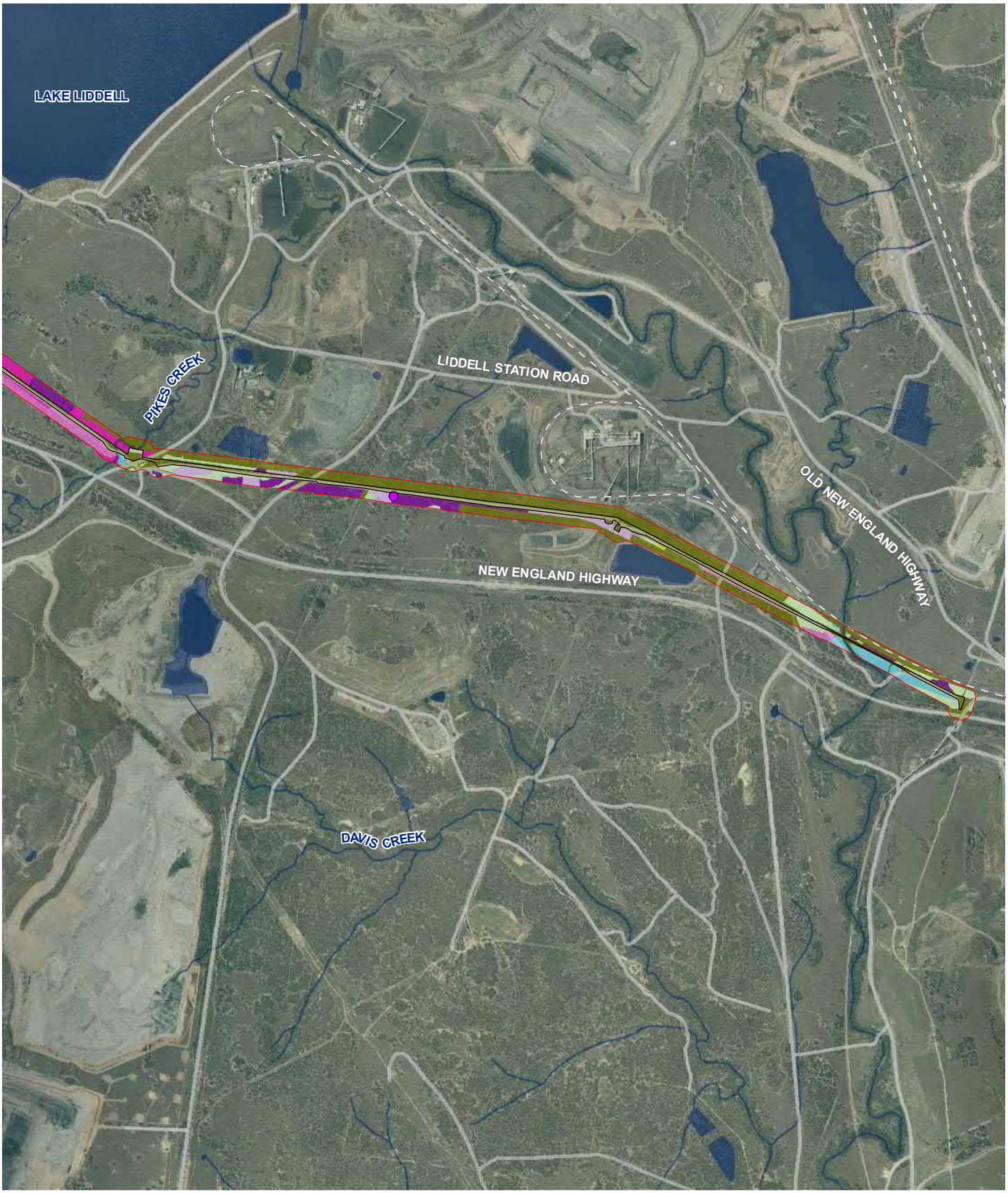

Legend

- Assessment area
- Development site
- Railway
- Road
- Waterway
- Waterbody

Survey method

- Tile array (reptiles)

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

Data sources

Jacobs 2021
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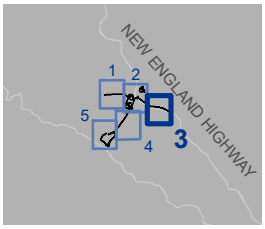

Figure 6 - 2 Threatened fauna surveys

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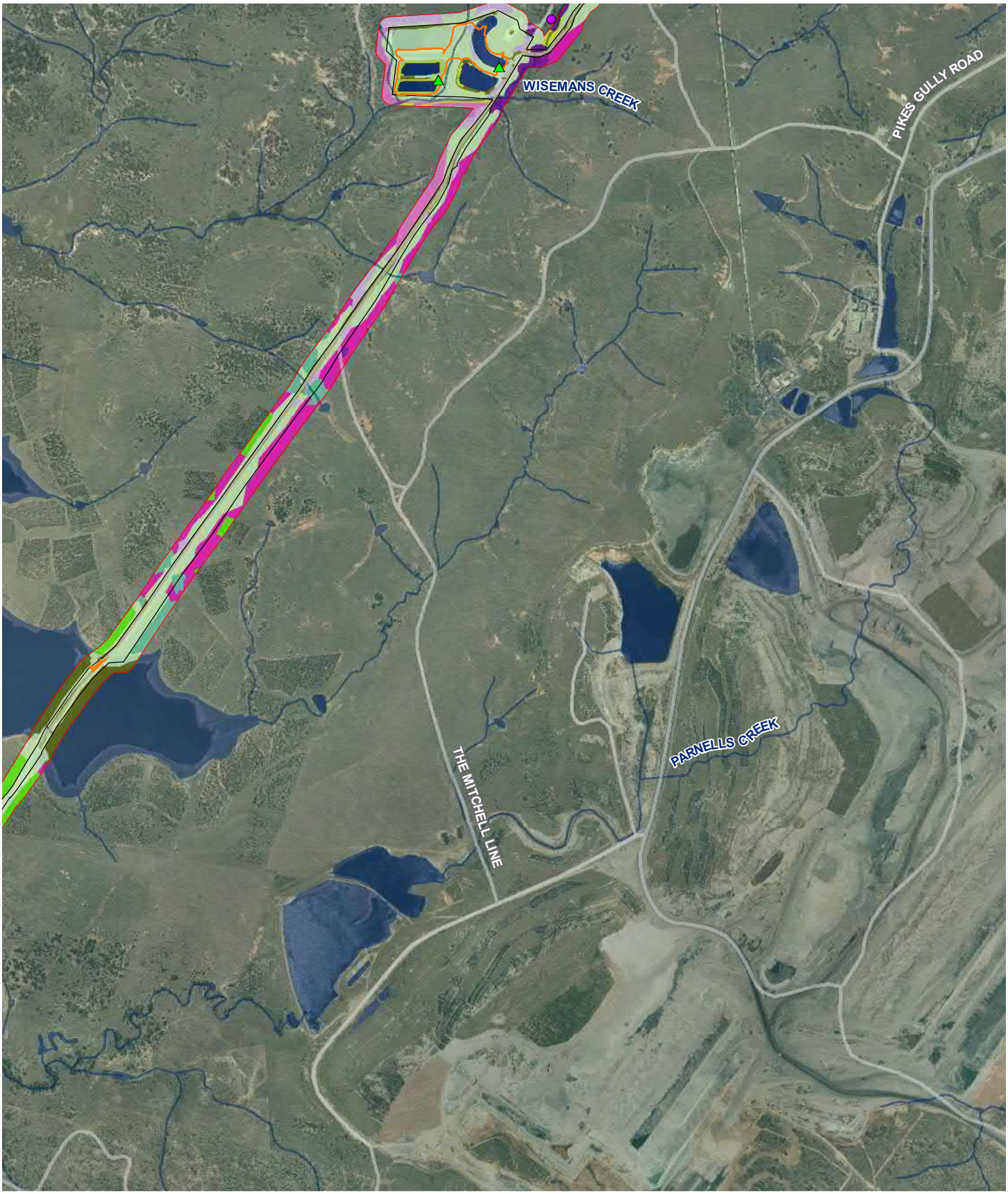

Legend

- Assessment area
- Development site
- Road
- Waterway
- Waterbody

Survey method

- Tile array (reptiles)
- *Litoria aurea* habitat survey
- Amphibian survey

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

Data sources

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Figure 6 - 2 Threatened fauna surveys

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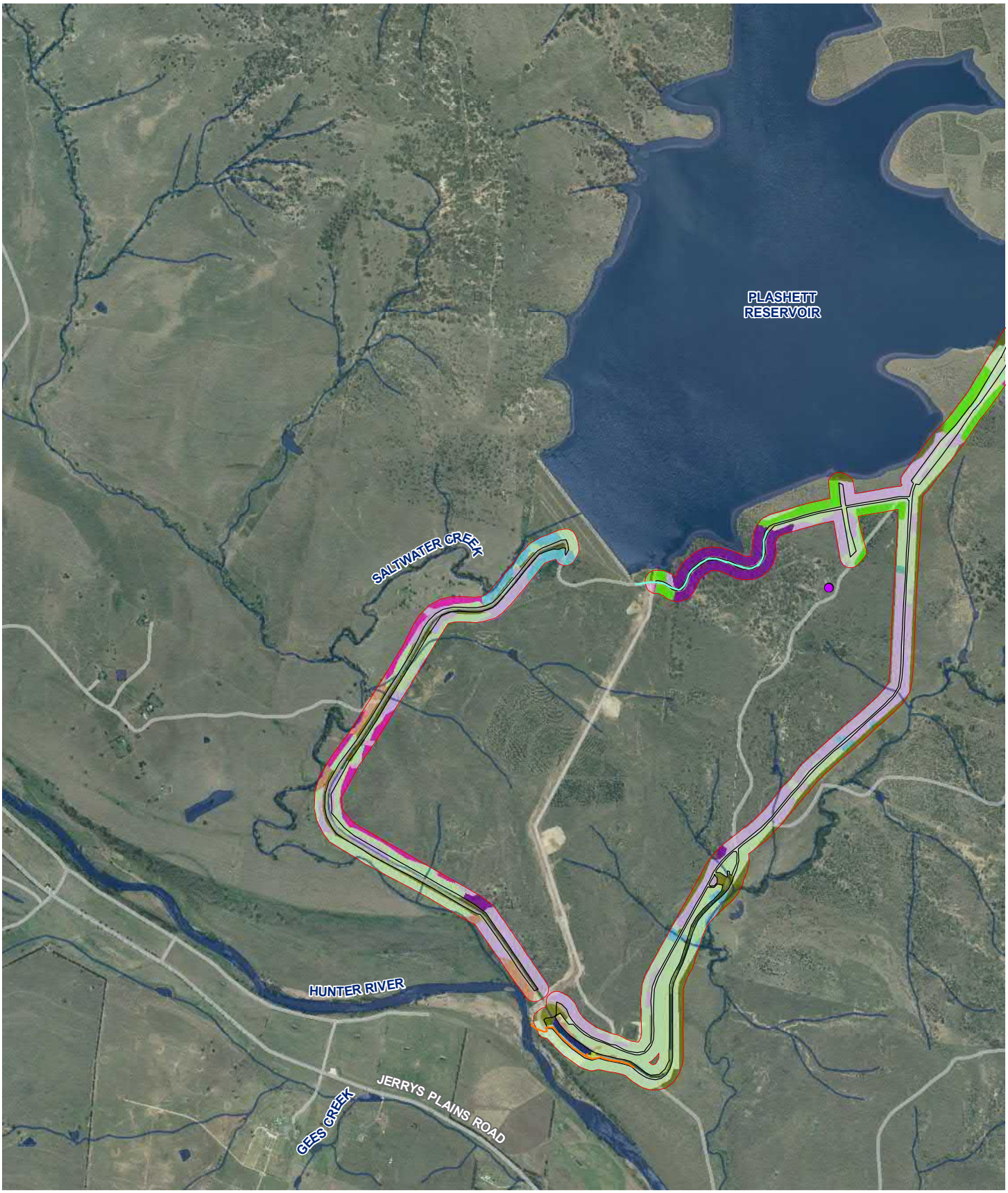

Legend

- Assessment area
- Development site
- Road
- Waterway
- Waterbody

Survey method

- Tile array (reptiles)
- Amphibian survey
- Spotlight survey

Plant community type (PCT) and condition

- PCT 485 River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion)
- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

Data sources

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Figure 6 - 2 Threatened fauna surveys

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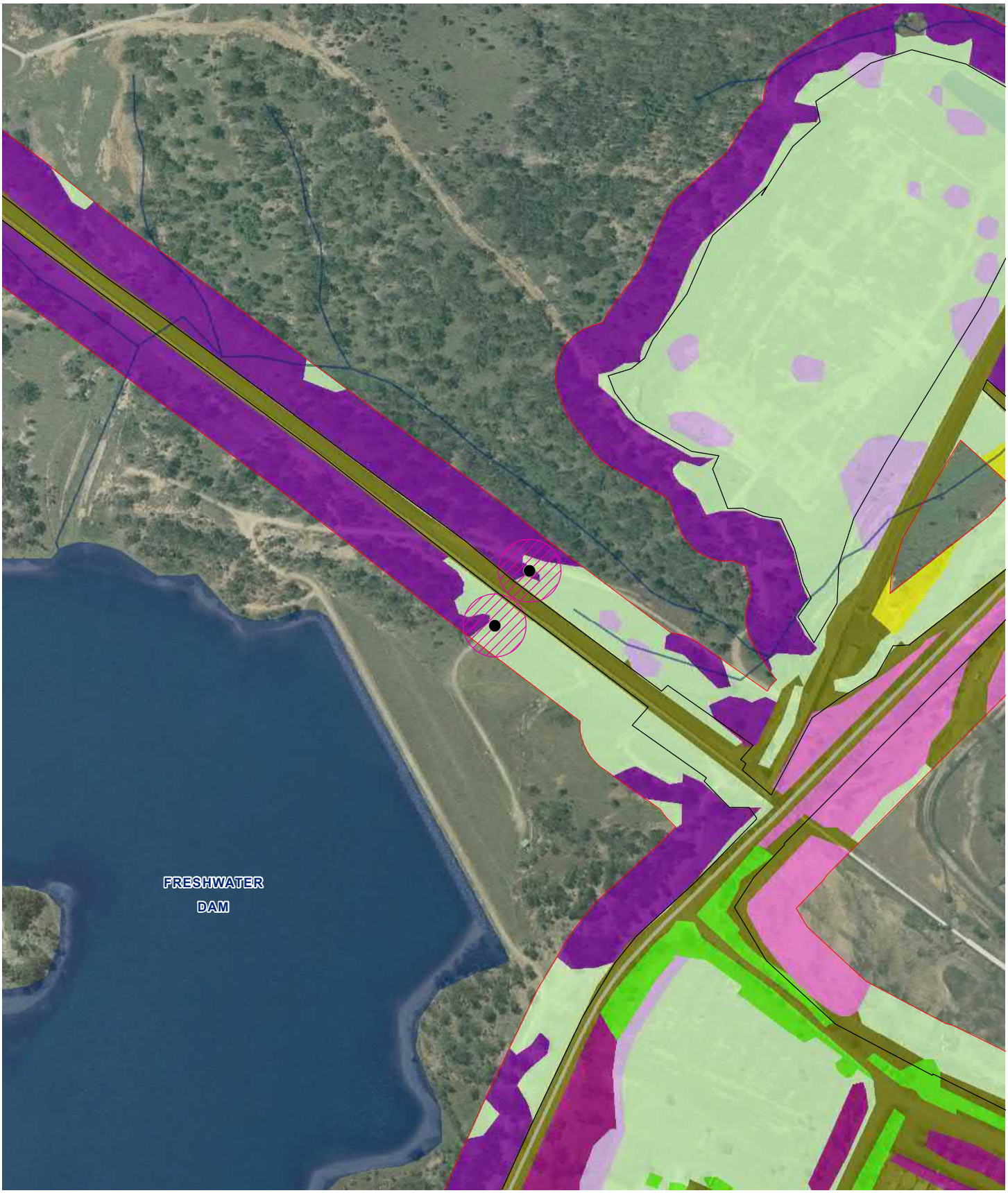
6.4 Threatened species survey results

6.4.1 Threatened flora species

Two *Eucalyptus glaucina* (Slaty Red Gum) were recorded adjacent to the development site near the Bayswater western coal conveyor (and within the assessment area), refer to **Photo 6-4**. Whilst accurate identification of these trees was difficult given the lack of fruit or buds on each tree (buds are required for definite identification), the leaves of each tree were a glaucous colour (known feature of *Eucalyptus glaucina*) and appeared to be visibly different to the surrounding Forest Red Gums (*Eucalyptus tereticornis*), (common species). Due to some uncertainty both trees were recorded as *Eucalyptus glaucina* as a precautionary measure. Two previous records (2003) of *Eucalyptus glaucina* exist within 400m of this section assessment (NSW Bionet Atlas) although these records were not confirmed given lack of fruit or buds. Importantly, no Red Gums (*E.glaucina* or *E.tereticornis*) occur within the development site along this western coal conveyor (**Figure 6-3**). The species polygon for these two trees does not overlap any PCTs within the development site and no impacts are anticipated.

Photo 6-4: Two Eucalyptus glaucina (Slaty Red Gum) trees occur outside the development site near the Bayswater western coal conveyor (See F**igure 6-3)**. Both are within the 50m buffer of the development site (assessment area).



Legend

- Assessment area
- Development site
- Species polygon for *Eucalyptus glaucina*
- *Eucalyptus glaucina*
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 100 200 m

1:5,000 at A4

N

Data sources

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Figure 6 - 3 Threatened species polygon for Slaty Red Gum *(Eucalyptus glaucina)*

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6.4.1.1 Threatened orchids

Surveys for the candidate threatened terrestrial orchid species were undertaken in suitable habitats throughout the 2020 survey period:

- *Diuris tricolor* - Pine Donkey Orchid
- *Pterostylis chaetophora*
- *Cymbidium canaliculatum* - endangered population.

Targeted surveys for orchids were conducted during 9-11 September 2020to adequately cover the seasonal survey requirements for each of the above species. *Diuris tricolor* was recorded to be flowering at a known reference site at Mangoola (approximately 20 km from Lake Liddell) at the time of survey according to advice received from BCD and from Dr Stephen Bell (Bell. The conditions in September 2020 were considered optimum for this species following good rainfall. Rainfall and flowering of *Diuris tricolor* and *Prasophyllum petilum* has been monitored over a ten year translocation project undertaken at Mangoola Coal mine (Bell 2019). Bell describes dry years as being reflective of low rates of flowering detection within recipient translocation plots, while wetter years show an increase in detection, suggesting a clear trend associated with winter rainfall (Bell 2019). Winter rainfall in the central Hunter Valley in 2020 was significantly better than 2019, 2018 and 2017.

These species were not identified within the development site during targeted surveys undertaken for this BDAR (refer to **Section 6.3** for survey details). No orchid species were recorded during surveys (including during all other surveys undertaken across the development site between September and December) during optimum survey periods, and good winter rainfall leading up to the surveys.

Furthermore, no threatened orchid species were recorded during comprehensive surveys of the adjacent WOAOW Project areas by Kleinfelder (also during September 2020). Importantly, the WOAOW Project area (surrounding the development site) contains large expanses of high-quality grassy woodlands and derived native grasslands (which contrasts to the highly exotic and disturbed vegetation of the development site). Additionally, recent expert advice (October 2020) from Bell has been provided to AGLM and Jacobs for the WOAOW Project BDAR. This advice notes that the 2020 season for Spring-flowering terrestrial orchids '*has been one of the best for several years, following at least three years of below-average Winter rainfall in the Hunter Valley*' and '*consequently, the lack of orchids detected within the development site area during their peak flowering period and in a 'good' year strongly suggests that the target species are not present there. Diuris in particular has flowered extensively in and around the Muswellbrook area, while Prasophyllum has been locally abundant in some areas'*. Further details are provided in the expert advice letter (Bell 2020) provided to AGLM for the WOAOW Project BDAR (see **Appendix G**).

6.4.1.2 *Acacia pendula* population in the Hunter catchment - Endangered Population.

As discussed in **Section 5.7**, there are eight individual *Acacia pendula* occurring as planted individuals adjacent to the northern carpark of Bayswater (See **Photo 18** in **Section 5.7**). The patch they are planted in is not remnant and has been planted as part of historic landscaping activities. This is evident by obvious changes to the topography in this location (roads, carpark and drainage) as well as lack of native vegetation. Furthermore, old plastic drip-irrigation pipes run along the base of the planted trees. *Acacia pendula* have been planted amongst non-indigenous native trees including, *Melaleuca ericifolia*, *Callistemon citrinus*, *Corymbia citriodora* and *Melaleuca styphelioides* (the latter is an indigenous species to the area however its position in the elevated landscape away from waterbodies, creeks and soaks is unnatural).

The Hunter population of *Acacia pendula* is fewer than 1000 individuals, from six locations - Jerrys Plains, Edderton, Wybong, Appletree Creek, Warkworth and Appletree Flat. It is not known to occur within any conservation areas - recent surveys on reserves where it could potentially occur have not detected it e.g. Belford

National Park (Bell 2004). A naturally occurring patch of *Acacia pendula* were recorded east of interchange to and from the New England Highway during vegetation surveys conducted for the Vegetation Mapping Report (Kleinfelder, 2017). These plants are 350 m from the assessment area. The naturally occurring patch of *Acacia pendula* will not be affected by the Project.

The *Acacia pendula* within the development site are not a naturally occurring population and would likely be genetically dissimilar to the naturally occurring Hunter Valley populations. As shown in **Photo 6-5**, the planted *Acacia pendula* trees display obvious characteristics of the inland form of this species including a strongly pendulous habit (branches), abundance of seed capsules, and absence of suckering stems (unlike the Hunter Valley form which often lacks pendulous habit, has deficient seed generation and often suckers from roots). The abundance of seed recorded on these trees indicates that they are not of the naturally occurring Hunter Valley form, which is renowned for being unable to generate fruit, and instead reproduces through suckering. Successful fruiting and development of seed has never been observed in *Acacia pendula* in the Hunter Valley, promoting the hypothesis that plants here may be neotonous (retaining juvenile features in the adult phase) or may have lost the capacity for seed production (dispersing instead through vegetative suckers) in response to unfavourable habitat (Bell & Driscoll, 2014). These planted individuals do not constitute the *Acacia pendula* population in the Hunter catchment - Endangered Population.

Photo 6-5: Planted Weeping Myall trees display features associated with the inland form of this species including a strongly pendulous habit (branches), abundance of fruit, and absence of suckering stems. Plastic irrigation pipe at base of trees indicates that this is a patch of planted trees.

After comprehensive surveys of the development site (as well as extensive walked meanders throughout fauna surveys and vegetation surveys), none of the remaining candidate flora species were detected. Habitat for *Melaleuca biconvexa* (Biconvex Paperbark) was considered poor. Low-lying or swampy areas of the development site were typically dominated by dense *Casuarina glauca* or otherwise dense *Typha* spp, *Phragmites australis* or exotic *Juncus acutus* or *Hyparrhenia hirta*.

Aquatic or semi-aquatic threatened plants; *Asperula asthenes, Maundia triglochinoides, Persicaria elatior* and *Zannichellia palustris* were not recorded and the highly disturbed, man-made waterways of the development site are considered to be poor habitat for these species.

Overall, the small patches of native vegetation remaining within the development site are degraded, highly fragmented and are unlikely to constitute habitat for these threatened flora species. The dominance of exotic grasses, as well as regular mowing and vegetation management within the development site would further decrease the likelihood of these species occurring.

The absence of these candidate threatened species from the development site (and assessment area), despite comprehensive survey, means each has been excluded from the impact calculations in the BAM-C associated with this BDAR (in accordance with paragraphs 5.2.3.1 – 5.2.3.4 (Step 3) of the BAM).

6.4.2 Threatened fauna species

Given the highly cleared and disturbed nature of the development site, habitat for threatened fauna species is generally of low quality. The lack of structurally complex woodland ecosystems, along with hollow-bearing trees, hollow logs, wood debris and rock outcrops, combined with noise and light disturbance from the power stations and infrastructure mean that only disturbance-tolerant fauna species persist within the development site. This is evident by assemblage of common fauna species recorded, and by the low number of threatened species recorded during comprehensive surveys.

The recent WOAOW project surveys in areas surrounding the development site (by Kleinfelder in 2019/2020) covered areas of better condition woodland (including approximately 15ha of good condition PCT 1691 and 60 ha of good condition PCT 1692). Given the proximity of these surveys to the development site, it is worth noting that numerous threatened species were recorded by Kleinfelder, including Little Lorikeet, Hooded Robin, Grey-crowned Babbler, Speckled Warbler, Large Bentwing-bat, Southern Myotis, Squirrel Glider and Striped Legless Lizard. Of these species, only the Grey-crowned Babbler was observed during the surveys for this BDAR.

The Grey-crowned Babbler was observed multiple times within the development site and is likely to frequent the development site regularly, particularly when dispersing between larger woodland areas. This species is an ecosystem credit species and, as such, no further assessment is required.

Whilst the Little Lorikeet, Hooded Robin, Speckled Warbler and other threatened woodland birds (such as Regent Honeyeater and Swift Parrot) could utilise patches of native vegetation within the development site during foraging or dispersal, these patches are small, degraded and generally isolated from better quality woodland habitats. These species were not recorded within the Assessment area and are considered unlikely to occur within the developments site, and therefore are not assessed further.

The GGBF has historically been recorded within the Sewage Treatment Ponds within the development site (adjacent to Bayswater). The last confirmed record of the species in the Upper Hunter was from this location, with a small colony of four –five adults, and some dozen juveniles, along with tadpoles being observed in the early 2000's (DECC 2007). These ponds (series of six ponds) as well as other suitable freshwater pond/dam habitats within the development site were surveyed over four nights in December 2020 during suitable weather conditions (see **Section 6.3.2**). The GGBF was not recorded. Likewise, surveys of the Sewage Treatment Ponds by Kleinfelder in November 2019 and January 2020 (as part of the WOAOW Project) did not record this species. Whilst apparently suitable habitat for the GGBF exists within numerous waterbodies across the development site, it is likely that the population of this species no longer persists at this location, and therefore the GGBF is not assessed further.

In 2019 Kleinfelder recorded a single Squirrel Glider (*Petaurus norfolcensis*) within PCT 1691 Narrow-leaved Ironbark – Grey Box grassy woodland – Moderate-Good within the WOAOW Project Area (Kleinfelder 2020). This individual was recorded approximately 1km to the west of the development site. Despite a comprehensive survey involving arboreal traps, motion sensor cameras and spotlighting, this species was not recorded within the development site. Whilst the Squirrel Glider species polygon used for the WOAOW Project BDAR

(Kleinfelder,2020) does include the same PCTs found within the development site, the fact that the vegetation patches within the development site are smaller, highly disturbed and isolated from the surrounding higher quality woodland patches means that the Squirrel Glider is considered unlikely to occur within the development site. Importantly, the development site lacks hollow-bearing trees and suitable shelter habitat for the Squirrel Glider, and this species is not assessed as present.

Surveys for microchiropteran bats using Anabat detectors revealed an assemblage of at least 11, possibly 13 species (See **Appendix D**). Of these *Miniopterus orianae oceanensis* (Large Bent-winged Bat) and *Scoteanax rueppellii* (Greater broad-nosed bat) are threatened species. The Greater broad-nosed bat (Vulnerable) has a similar call to non-threatened *Scotorepens orion* (Eastern Broad-nosed bat) and differentiation between species call data is difficult. Likewise, the Large Bent-winged Bat has a similar call to non-threatened *Vespadelus regulus* (Southern forest bat). For the purposes of this assessment it is assumed that *Miniopterus orianae oceanensis* and *Scoteanax rueppellii* are occurring in the locality and would utilise the Assessment area during foraging. These species are considered ecosystem credit species for foraging. No roosting bats were recorded during inspections of man-made structures (particularly concrete culverts and pipes) and given the lack of hollow-bearing trees, these species are unlikely to breed within the development site.

Six introduced fauna species were recorded including:

- House Mouse (*Mus musculus*)
- Black Rat (*Rattus rattus*)
- Wild Dog (*Canis familiaris*)
- Hare (*Lepus europaeus*)
- Red Fox (*Vulpes vulpes*)
- Mosquito Fish (*Gambusia holbrooki*).

The presence of these species within the development site may decrease likelihood of occurrence of some native species (including threatened species). House Mice and Black Rats were recorded in high numbers during the December 2020 surveys.

6.4.2.1 Striped Legless Lizard

The SLL is assumed to be present within the site in accordance with paragraph 5.2.4 of the BAM. This species was not recorded within the development site although due to a condensed timeframe of the assessment the duration of surveys (installation of tile arrays) did not meet the requirements of the Survey Guidelines for Australia's Threatened Reptiles (Department of the Environment Water Heritage and the Arts, 2011b), (relied upon also by NSW DPIE). These guidelines recommend that tiles are set up 3 months prior to initiating surveys to allow time for the target species to find them useful as shelter (not all tile arrays were in-situ for this duration prior to survey). By assuming presence, the associated PCTs listed as habitat in the NSW Bionet TBDC (and which occur within the development site) have been included in the species polygon **(Figure 6-4)**. The species polygon for SLL includes:

- PCT 1691 Moderate (4.3 ha)
- PCT 1691 Regrowth (21.6 ha)
- PCT 1691 Rehabilitation (11.4 ha)
- PCT 1691 Native Grassland (2 ha)
- PCT 1692 Moderate (1.2 ha).

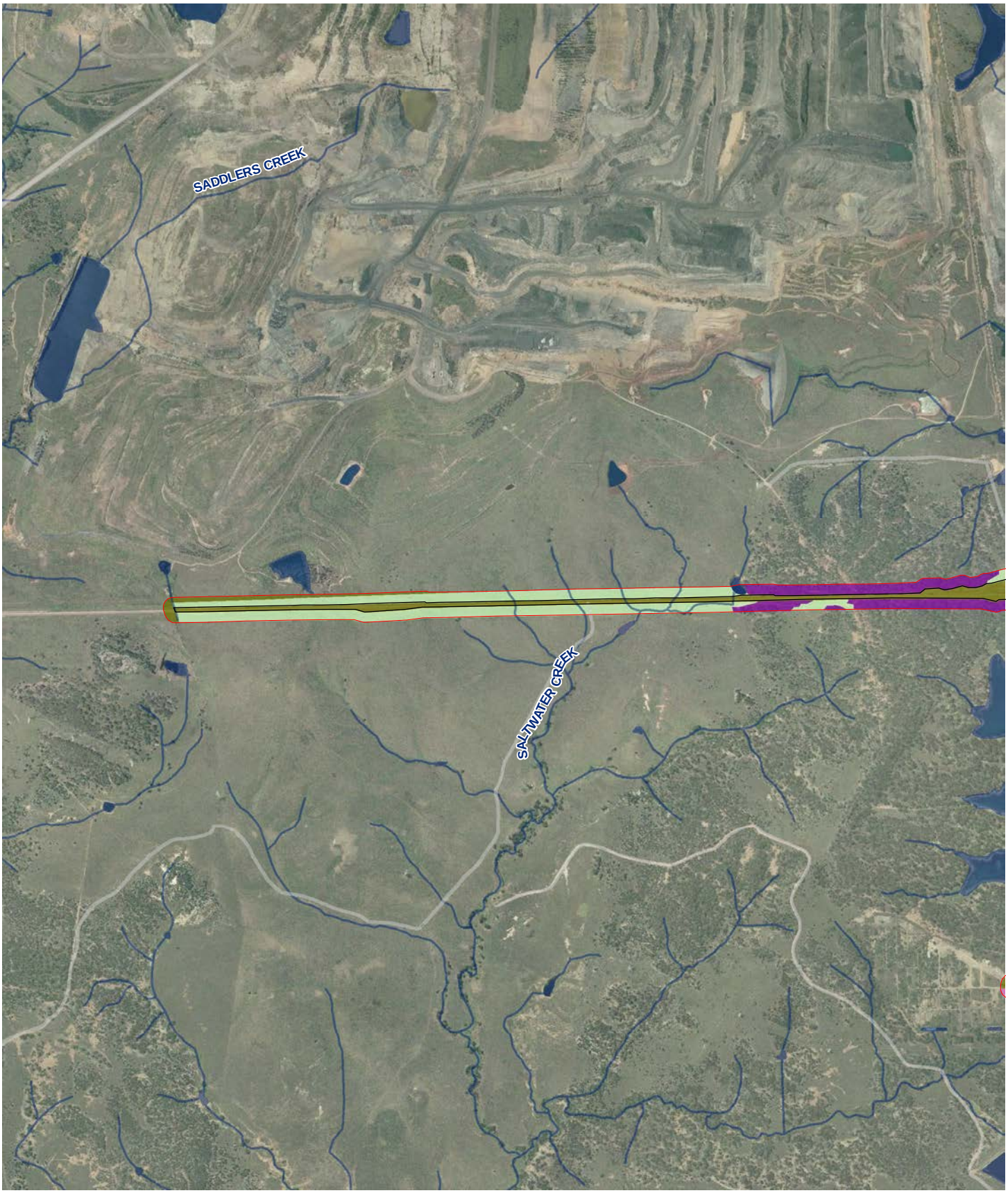
The habitat for this species within the development site is considered to be low-quality given that much of the land was cleared for cattle grazing in the past and has been modified to accommodate power station infrastructure. Areas of native vegetation still exist as small and isolated patches and may provide potential habitat for this species, refer to **Figure 6-4**. The lack of fallen timber, rocks and native grass tussocks on the ground (preferred shelter features) coupled with the dense infestations of exotic grasses and herbaceous weeds would likely deter this species (as well as other cryptic species of reptiles). SLL are mostly reported from areas of relatively undisturbed native grasslands, with a dense cover of perennial tussock grasses, particularly spear grass *Austrostipa bigeniculata* and kangaroo grass *Themeda triandra* (Kukolic 1991; Kukolic & Osborne 1993). Typically, the species is reported from sites where native grass cover is greater than 70% (Kukolic, 1991). The existing records of SLL to the west of the Assessment area (toward Muswellbrook) are located in large areas of quality native woodland (PCT 1692 and 1691 predominantly). The recent 2019 record of this species (WOAOW survey) was located approximately 800 m from the development site in a large patch (approximately 40 ha) of PCT 1692 Bull Oak Grassy Woodland – (Moderate-Good), (Kleinfelder, 2020).

6.4.2.2 Southern Myotis

The Southern Myotis is assumed to be present within the site in accordance with paragraph 5.2.4 of the BAM. This species was recorded within 100 m of the development site during the ecological surveys for the WOAOW Project in December 2019 (Kleinfelder 2020), (**Figure 6-5**). The record was identified via Anabat recordings from the large dam at the western aspect of the Ash Dam (to the east of Bayswater). The Southern Myotis species polygon for the WOAOW Project BDAR intercepts the development site and incorporates some of the waterbodies situated in the eastern portion of the BAW areas (sewage filtration ponds). Given that the nearby record and that the Southern Myotis is highly mobile and capable of dispersing between habitat patches, it is highly likely that this species also uses the various freshwater ponds or dams within the wider development site during foraging activity.

Suitable habitat for the Southern Myotis within the development site is identified as the range of PCTs associated with the species (as per the TBDC) within 200 m of any medium to large permanent creeks, rivers, lakes or other waterways (i.e. with pools/ stretches 3 m or wider) (OEH, 2018). The development site contains native vegetation within 200 m of a suitable watercourse (including areas of PCT 1232, PCT 1071 and patches of planted native trees). Foraging habitat for the Southern Myotis is present within numerous waterbodies which occur within the development site (in freshwater dams, ponds, and potentially the canals when inundated. Human-made structures (bridges and culverts) within the development site were checked (where accessible), and no roosting microchiropteran bats were observed. The total area of the species polygon for the Southern Myotis is 10 ha, including:

- PCT 1691 (6.6 ha)
- PCT 1071 (2.98 ha)
- PCT 1692 (0.38 ha).



Legend

- Assessment area
- Development site
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

N

1:25,000 at A4

Data sources

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Figure 6 - 4 Threatened species polygon for Striped Legless Lizard *(Delma impar)*

Date: 22/06/2021 Path: J:\04_Eastern\IS334000\22_Spatial\GIS\Directory\Templates\Figures\EIS\Ecology\BDAR\IS334000_BDAR_F014_StripedLeglessLizard_r1v2.mxd
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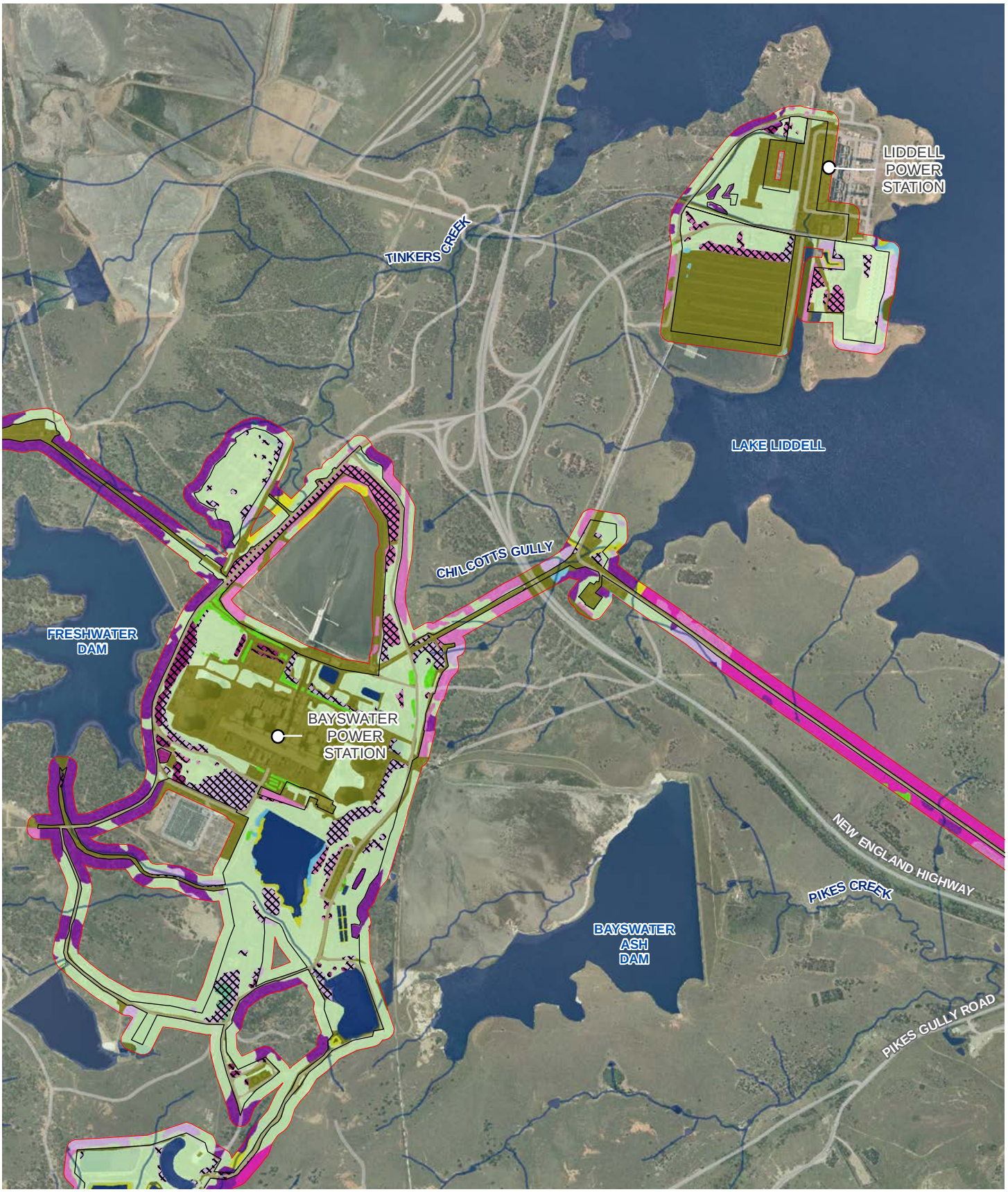

Legend

- Assessment area
- Development site
- Species polygon for Striped Legless Lizard (*Delma impar*)
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

Data sources

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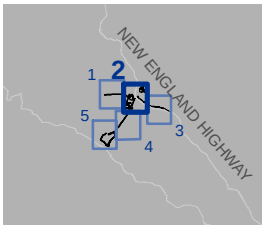

Figure 6 - 4 Threatened species polygon for Striped Legless Lizard *(Delma impar)*

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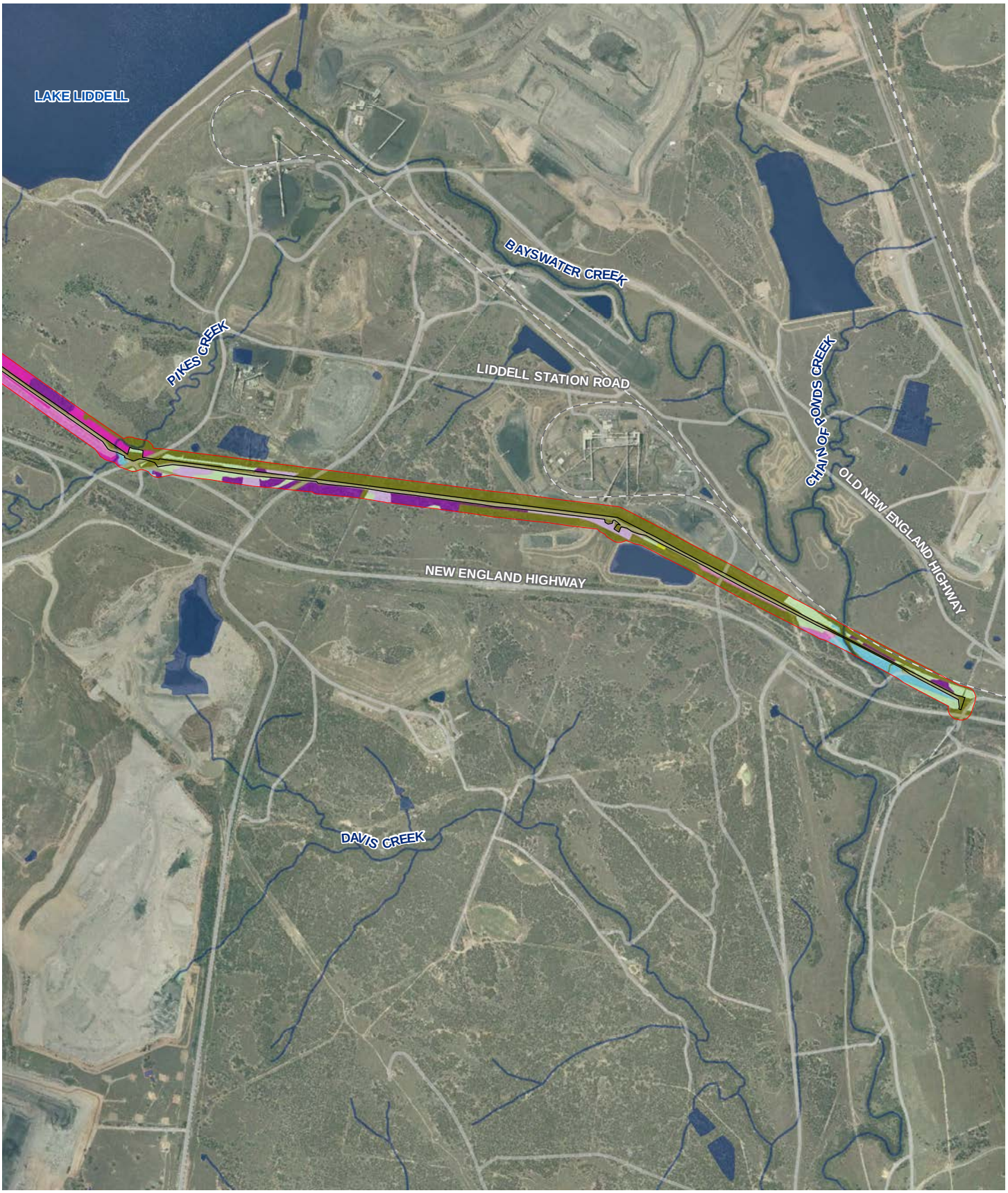

Legend

- Assessment area
- Development site
- Species polygon for Striped Legless Lizard (*Delma impar*)
- Railway
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

Data sources

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Figure 6 - 4 Threatened species polygon for Striped Legless Lizard *(Delma impar)*

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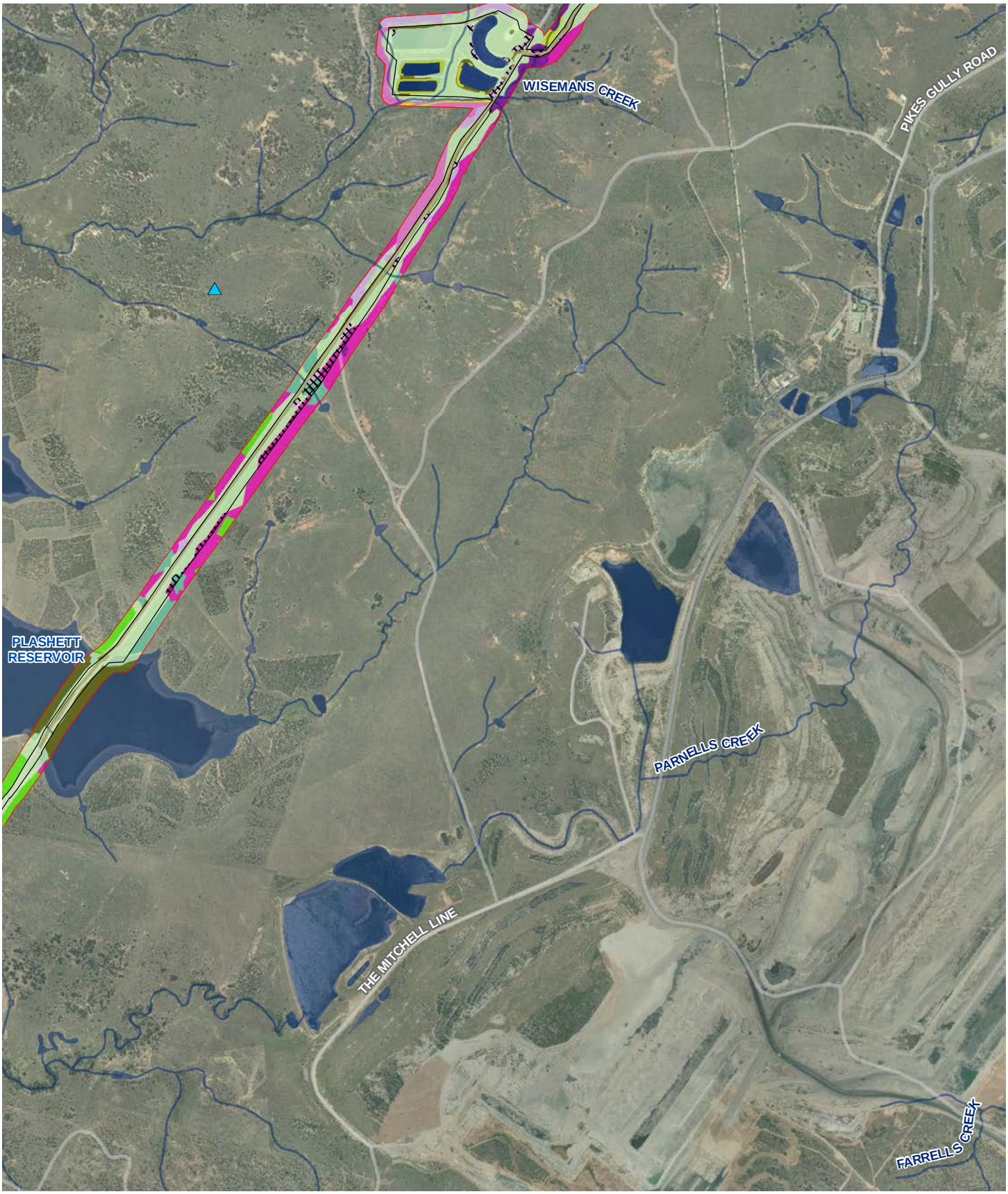

Legend

- Assessment area
- Development site
- Species polygon for Striped Legless Lizard (*Delma impar*)
- Striped Legless Lizard observation (Kleinfelder, 2020)
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

Data sources

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Figure 6 - 4 Threatened species polygon for Striped Legless Lizard *(Delma impar)*

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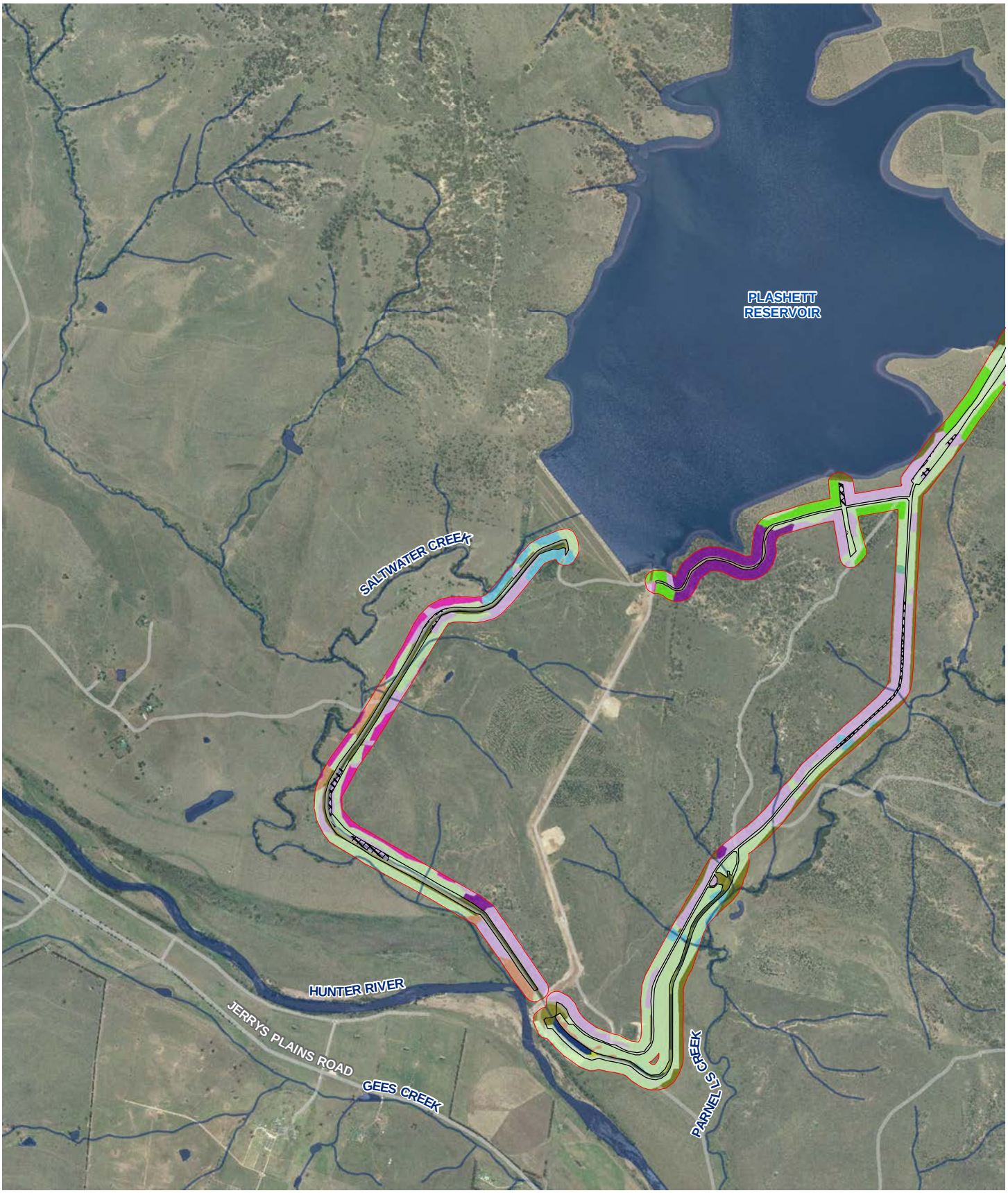

Legend

- Assessment area
- Development site
- Species polygon for Striped Legless Lizard (*Delma impar*)
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 485 River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion)
- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

N

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Data sources

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Figure 6 - 4 Threatened species polygon for Striped Legless Lizard *(Delma impar)*

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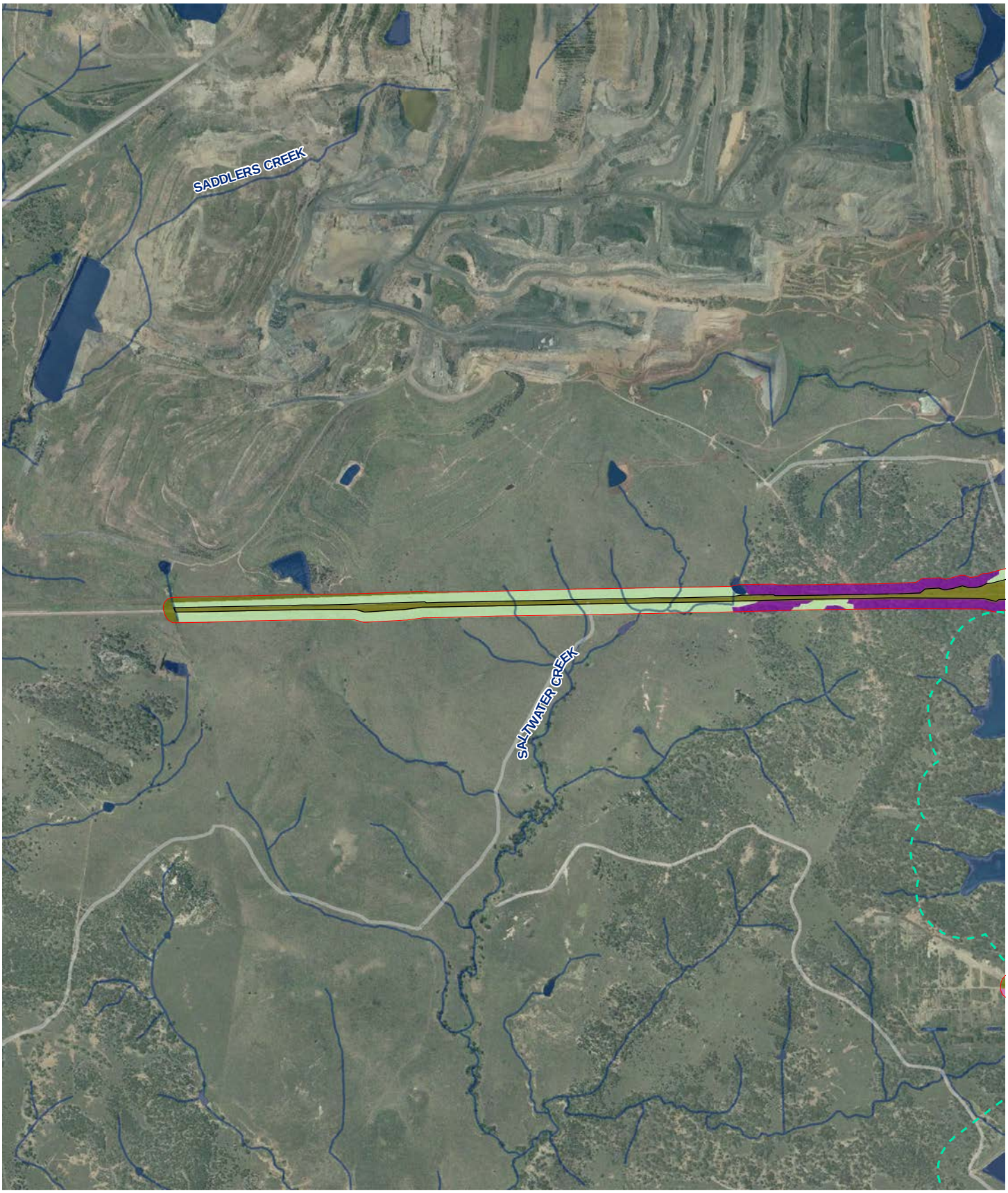

Legend

- Assessment area
- Development site
- 200m waterbody buffer
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

Data sources

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Figure 6 - 5 Threatened species polygon for Southern Myotis *(Myotis macropus)*

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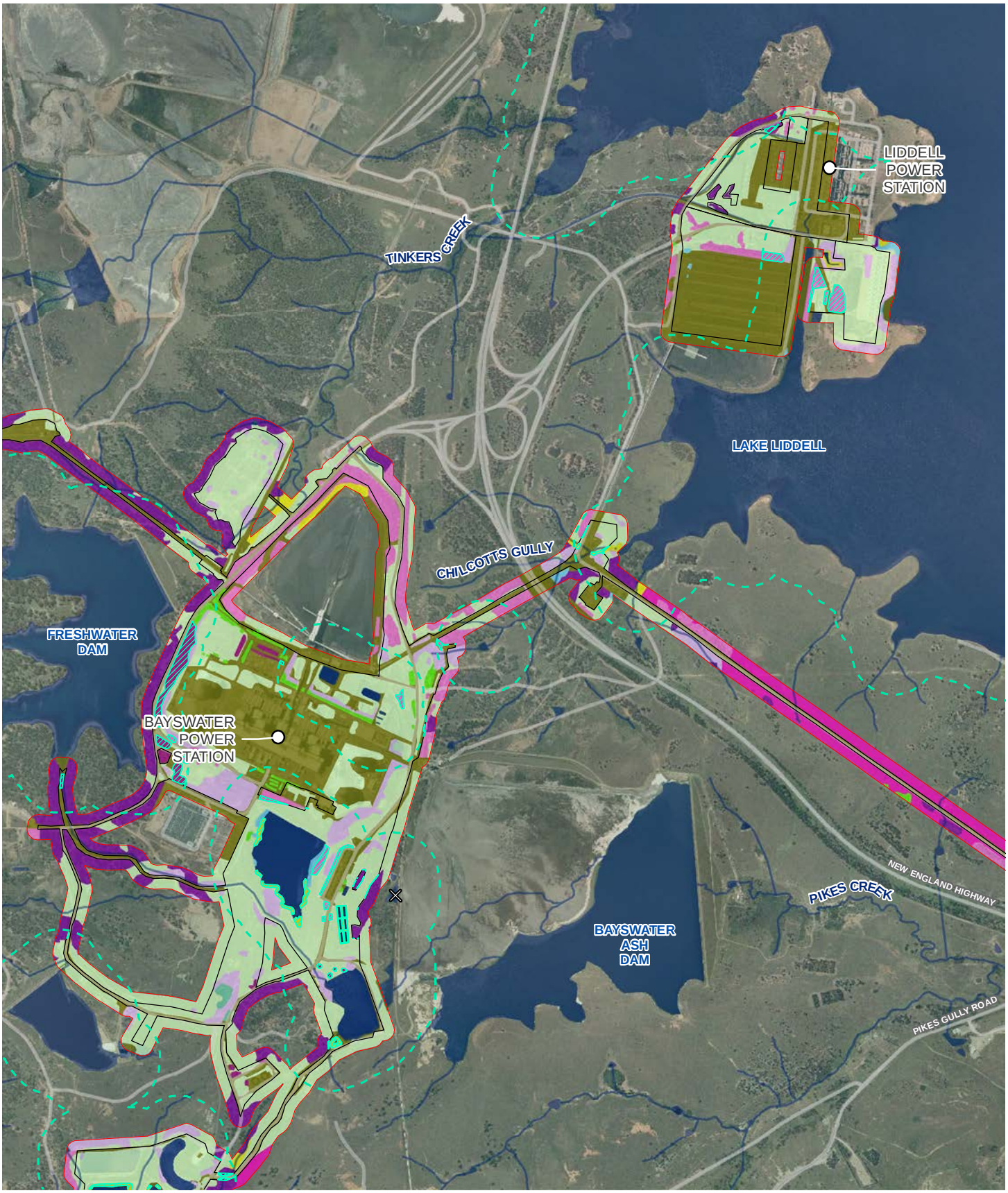

Legend

- Assessment area
- Development site
- Southern Myotis recorded (Kleinfelder, 2019)
- Species polygon for Southern Myotis (*Myotis macropus*)
- 200m waterbody buffer
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

N

1:25,000 at A4

Data sources

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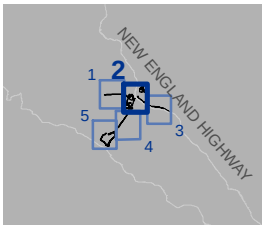
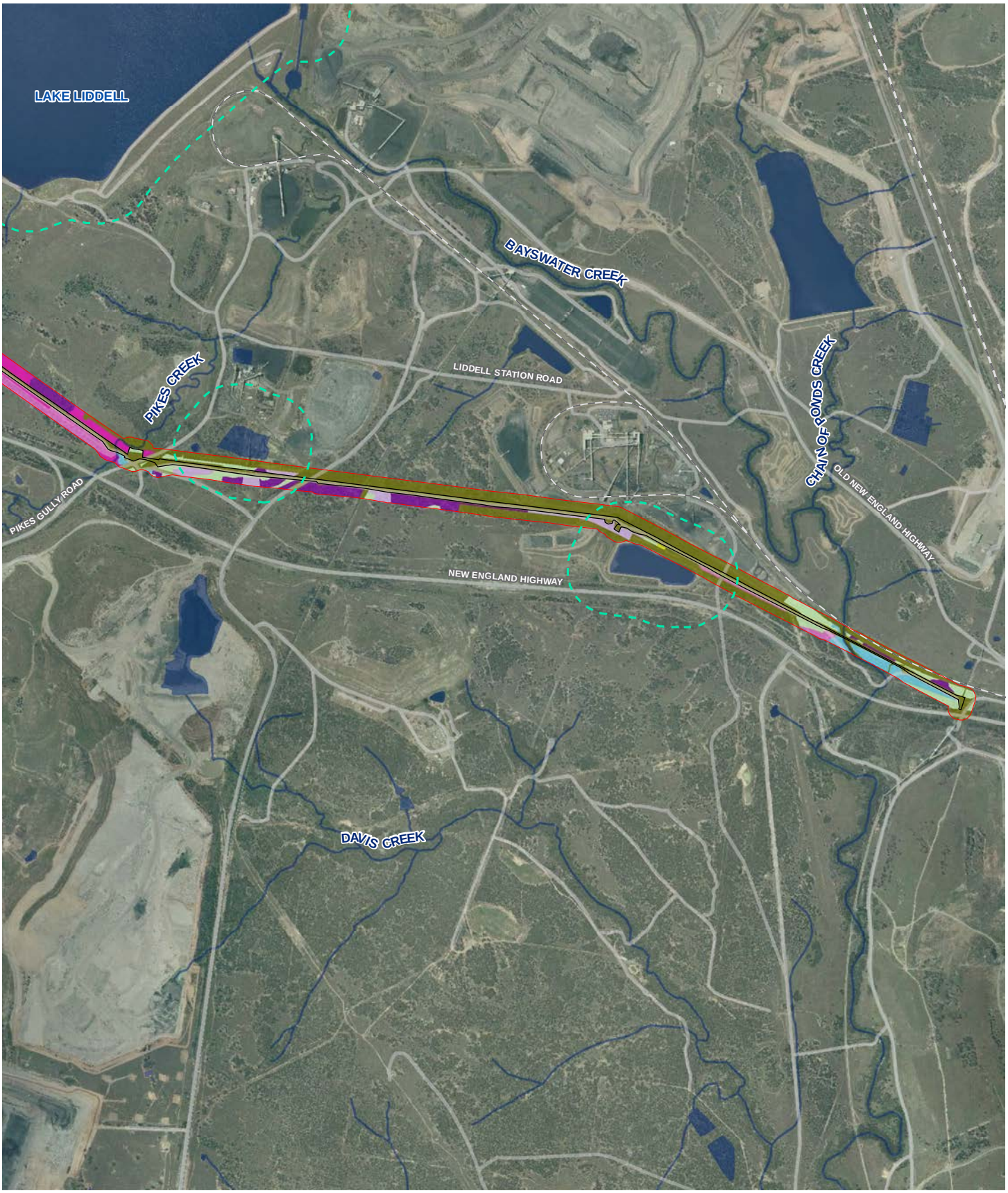


Figure 6 - 5 Threatened species polygon for Southern Myotis *(Myotis macropus)*

Date: 9/06/2021 Path: J:\04_Eastern\IS334000\22_Spatial\GIS\Directory\Templates\Figures\EIS\Ecology\BDAR\IS334000_BDAR_F011_SouthernMyotis_r3v1.mxd
Created by : NT | QA by : KM



Legend

- Assessment area
- Development site
- 200m waterbody buffer
- Railway
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

Data sources

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Figure 6 - 5 Threatened species polygon for Southern Myotis *(Myotis macropus)*

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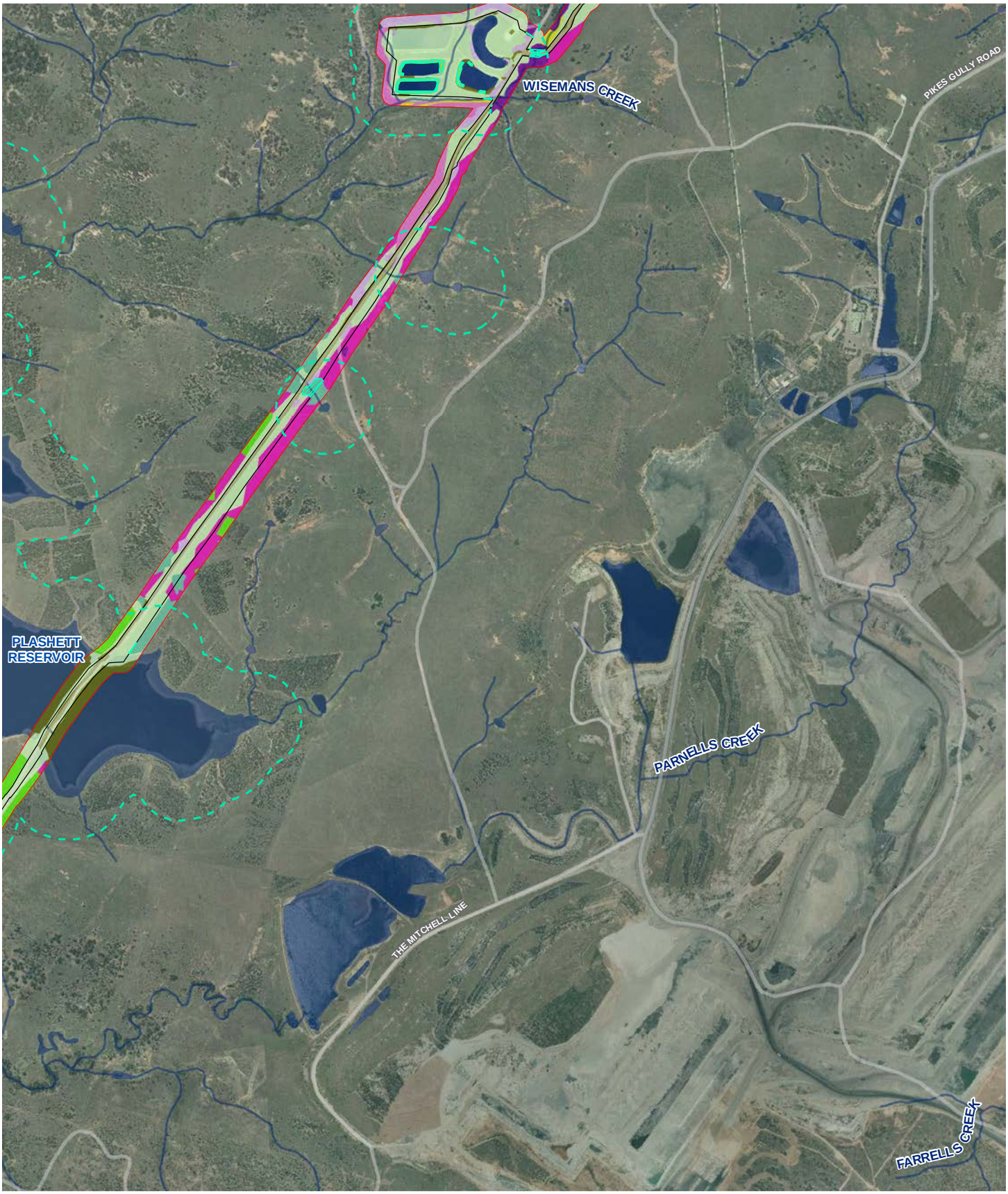

Legend

- Assessment area
- Development site
- Species polygon for Southern Myotis (*Myotis macropus*)
- 200m waterbody buffer
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

N

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Data sources

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Figure 6 - 5 Threatened species polygon for Southern Myotis *(Myotis macropus)*

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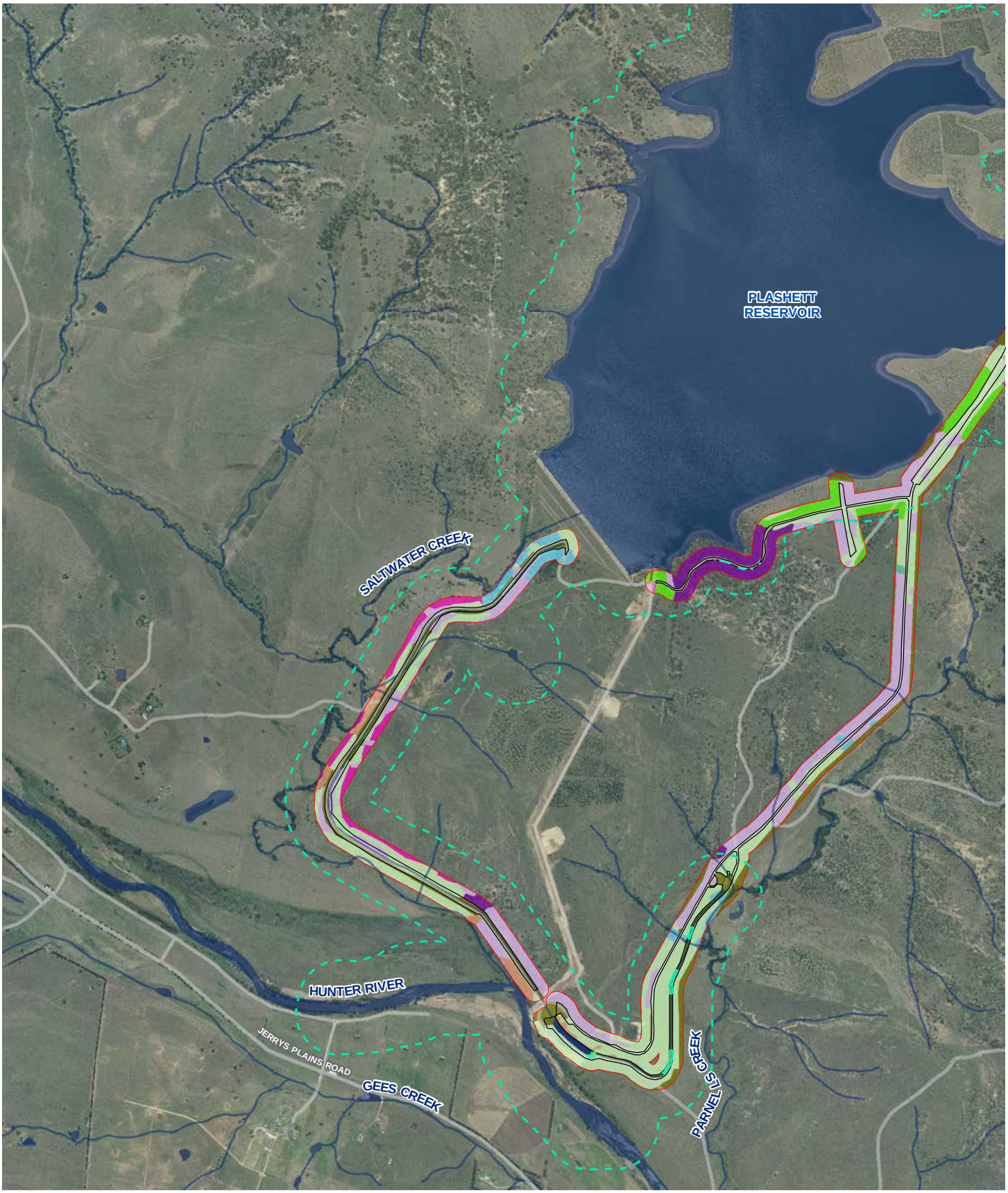

Legend

- Assessment area
- Development site
- Species polygon for Southern Myotis (*Myotis macropus*)
- 200m waterbody buffer
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 485 River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion)
- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

Data sources

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Figure 6 - 5 Threatened species polygon for Southern Myotis *(Myotis macropus)*

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Created by : NT | QA by : KM

6.4.3 Serious and irreversible impact entities

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

Of the threatened species identified and assessed as present within the development site, none are listed in the TBDC or BAM-C as being SAII entities or are considered to meet the SAII principles. On this basis the Project is unlikely to result in serious and irreversible impacts. The Regent Honeyeater is listed as SAII Breeding – which is relevant only to when this species is likely to breed in an area or when important habitat areas have been mapped for this species in NSW. This species is highly unlikely to breed within the Assessment area or surrounds given the woodland patches are small and highly fragmented, with a lack of favourable nesting tree species (See **Appendix F**). The Swift Parrot is also SAII Breeding – however this species returns to Tasmania to breed. The important areas mapping for both these species does not extend across the Project area.

7. Aquatic habitats

Aquatic habitats within the development 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 was sufficient 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 without extensive targeted surveys. 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 Spatial Data Portal
- Protected Matters Search Tool
- Atlas of GDEs (Bureau of Meteorology, 2017)
- SEED - NSW Wetlands mapping
- Australian Wetlands Database (Department of the Environment and Energy, 2019). Comprises an assessment of the habitat within each waterway.

The development site is located entirely within the Hunter River catchment, which includes numerous mapped creeks within the vicinity of Lake Liddell (**Figure7-1**). The catchment area around the development site is highly modified from its original state, having been cleared for agricultural and industrial land use. The development site is currently used for Liddell and Bayswater including their associated ancillary activities, and the landform and drainage has been substantially modified to divert and retain water, pollutants and waste materials. These land uses influence the water quality and quantity/velocity of flows within the catchment. Previously naturally occurring waterways within the development site have long been modified and are subject to irregular water flows as well as pollution and temperature fluctuations (with some having been dammed).

Three waterways have been identified surrounding the development site and are discussed below. No threatened species listed under the FM Act have potential habitat within these watercourses. There are no Coastal wetlands as defined by the Coastal Management SEPP close to the development site.

The 1,500 m landscape buffer includes the Hunter River and numerous natural tributaries. Lake Liddell is situated in areas adjacent to Liddell (see **Figure 1-2**) however will not be affected by the Project providing mitigation measures are implemented during decoupling and construction phases.

Whilst numerous man-made dams, ponds and canals are expected to be affected by the Project, there will be no direct impacts to any naturally occurring aquatic environments.

7.1 Threatened fish

The Project is considered unlikely to significantly affect threatened species, populations or ecological communities listed under the FM Act or EPBC Act (see **Appendix F**). Waterbodies within the development site are man-made (operational) and are isolated from natural creek lines by pipes, concrete culverts, gates, and canals (with constantly fluctuating water levels), refer to **Photo 7-1** to **Photo 7-6**. None of the dams or ponds are

directly connected to the Hunter River and fish passages between the development site and the river do not exist. Whilst the freshwater dam to the west of the Bayswater power station (beyond development site) shows similarity to natural aquatic habitats, the remaining dams in the Bayswater area are degraded and are subject to discharges from the power station and many are highly saline, contain coal ash or are sewage management ponds. Lake Liddell will not be affected by the Project. Mitigation measures will be sufficient to prevent a significant impact to aquatic habitats adjacent to the development site and within the locality (see **Section 11**).

No threatened fish species were returned from desktop searches (**Appendix E**).

Photo 7-1: A flowing man-made canal in the far-south of BAW area. Dense exotic vegetation (mainly grass) dominates banks.

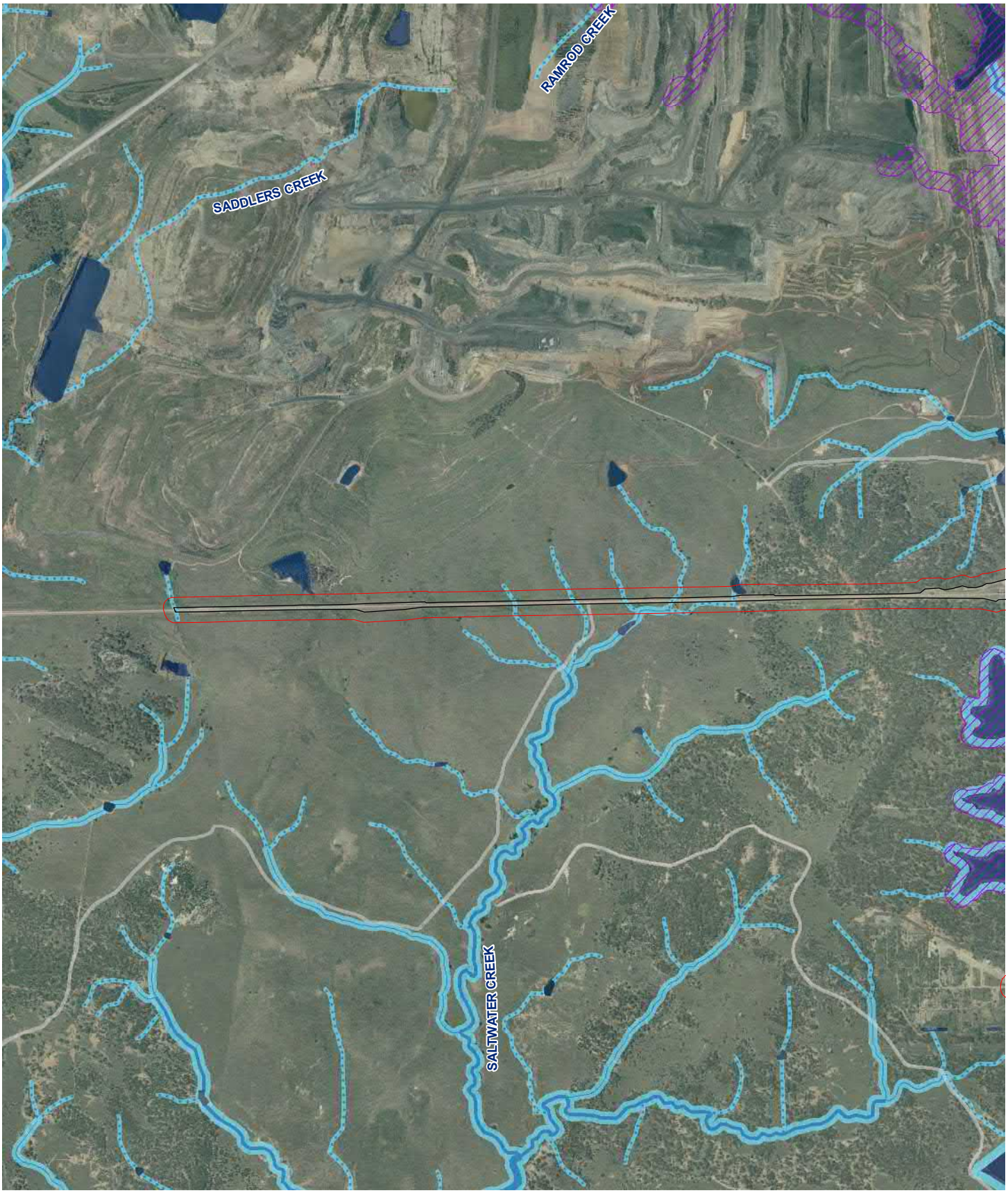
Photo 7-2: A man-made canal and culvert in BAW area. Water level fluctuates greatly, and this canal was dry during most of the surveys.

Photo 7-3: Sewage Treatment Plant Polishing Ponds within the Bayswater Site (where GGBF were recorded in 2003). These ponds are better quality aquatic habitats and lack introduced Gambusia holbrooki.

Photo 7-4: Large dam to the south of Bayswater contains brackish or saline water. No aquatic vegetation present).

Photo 7-5: Canals within BAW area often lack native vegetation and contain regularly fluctuating water-levels.

Photo 7-6: A large dam in the south of the BAW containing thick sediments. No suitable aquatic habitat.



Legend

- Assessment area
- Development site

Strahler stream order

- 1
- 2
- 3
- 4

- Key fish habitat
- Riparian corridor
- Waterbody
- Road

0 0.5 1 km

1:25,000 at A4

Data sources

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Figure 7 - 1 Aquatic habitats

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Legend

- Assessment area
- Development site

Strahler stream order

- 1
- 2
- 3
- 4

- Key fish habitat
- Riparian corridor
- Waterbody
- Road

0 0.5 1 km

1:25,000 at A4

N

Data sources

Jacobs 2021
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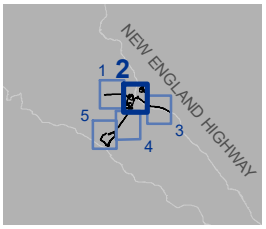

Figure 7 - 1 Aquatic habitats

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Legend

- Assessment area
- Development site

Strahler stream order

- 1
- 2
- 3
- 5

- Key fish habitat
- Riparian corridor
- Waterbody
- Railway
- Road

0 0.5 1 km

1:25,000 at A4

Data sources

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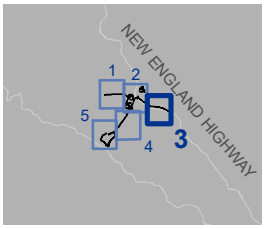

Figure 7 - 1 Aquatic habitats

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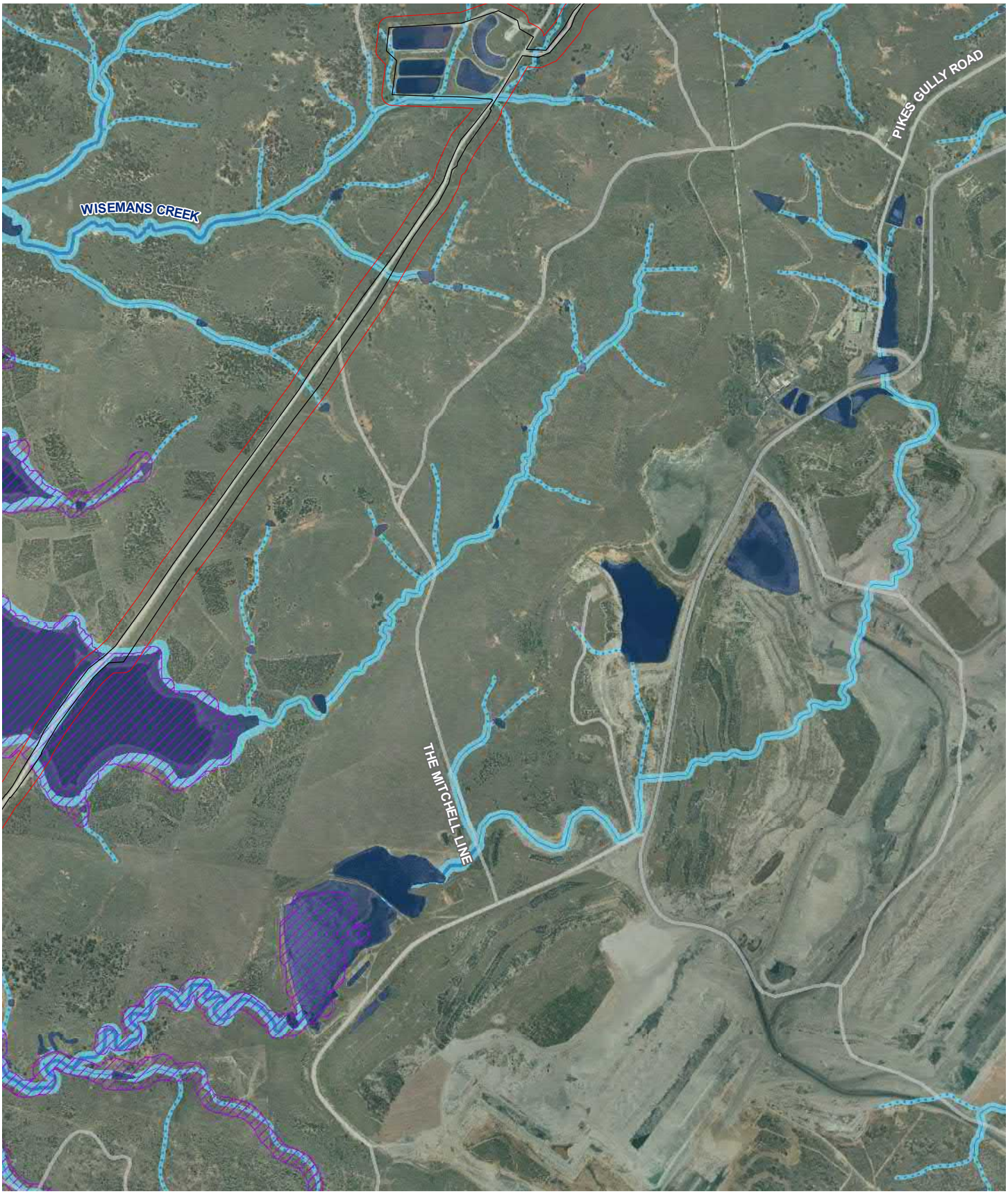

Legend

- Assessment area
- Development site

Strahler stream order

- 1
- 2
- 3

- Key fish habitat
- Riparian corridor
- Waterbody
- Road

0 0.5 1 km

1:25,000 at A4

N

Data sources

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Figure 7 - 1 Aquatic habitats

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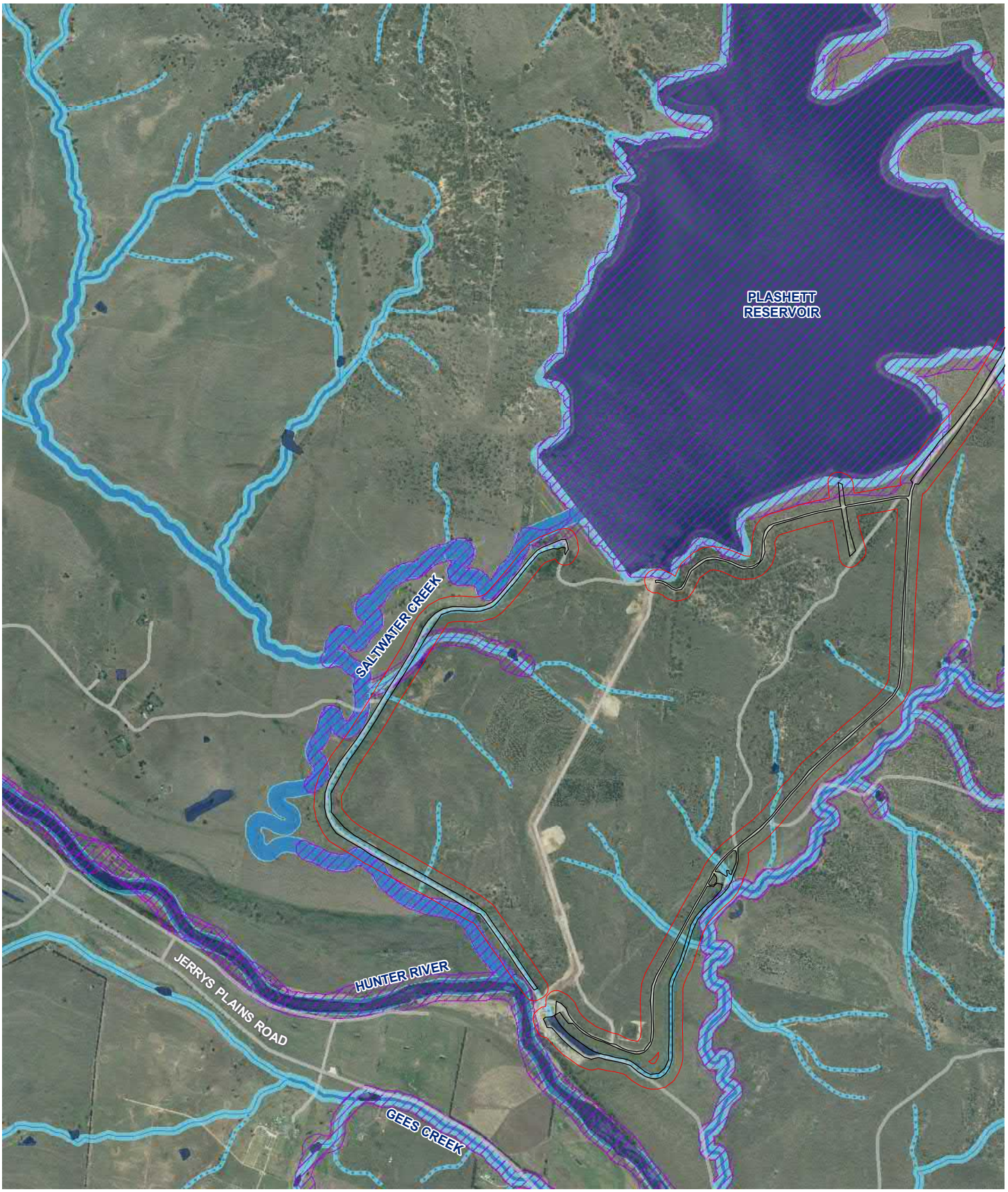

Legend

- Assessment area
- Development site

Strahler stream order

- 0
- 1
- 2
- 3
- 4
- 5
- >6

- Key fish habitat
- Riparian corridor
- Waterbody
- Road

0 0.5 1 km

1:25,000 at A4

N

Data sources

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Figure 7 - 1 Aquatic habitats

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8. 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 (MNES). 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.

The EPBC Act PMST was applied to a 10-km radius of the Project site, and the list of MNES displayed were then assessed for the likelihood to occur in the context of the habitats identified in the Project site. The results of the PMST are shown in **Appendix F**, and the likelihood of occurrence assessment is provided in **Appendix A**.

For threatened biodiversity and migratory species listed under the EPBC Act identified in habitats within the development site 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 F**) where these species have not already been assessed in accordance with the BC Act. 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 % chance of happening; it is sufficient if a significant impact on the environment is a real or not remote chance or possibility (Department of Environment, 2013). This advice has been considered while undertaking the assessments.

8.1 World heritage properties and national heritage places

The development site contains no World Heritage Properties or National Heritage Places according to the PMST.

8.2 Wetlands of international importance

The development site area does not contain any wetlands of international importance (Ramsar). However, the PMST returned one wetland of international importance within 100 km of the Project:

- Hunter Estuary Wetlands located 50 – 100 km upstream.

The distances from the Project are provided in the PMST report. Due to the distance of these wetlands of international importance from the development site they are considered unlikely to be affected.

8.3 Threatened ecological communities

According to the PMST the following EPBC Act listed TECs have been suggested as may occur or likely to occur within the broader development site:

- Central Hunter Valley eucalypt forest and woodland (Critically 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) – likely to occur within area.

Given the presence of PCT 1731: Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley – the potential presence of EPBC Act listed Coastal Swamp Oak Forest of South-east Queensland and NSW Ecological community was also assessed against the diagnostic characteristics of the Commonwealth listing.

Data gathered from the detailed vegetation surveys and general observations on the site were compared with the scientific description for each community listing, as well the size and condition thresholds for listed communities where relevant, this is discussed below.

8.3.1 Central Hunter Valley eucalypt forest and woodland (Critically Endangered)

Central Hunter Eucalypt Forest and Woodland Ecological Community, listed as Critically Endangered under the EPBC Act, is present in the peripheries of the Assessment Area (within a 50m buffer of the development site). The development site (proposed development site) has been designed to follow existing disturbed areas and generally avoids remnant native woodland areas. Vegetation surveys have been conducted across the development site and show that whilst the Project footprint is generally cleared and disturbed, there are small, isolated stands of Narrow-leaved Ironbark – Grey Box grassy woodland of the Central and Upper Hunter (PCT 1691) occurring in various locations. This PCT is present as patches ranging in conditions from moderate condition to highly degraded / regrowth and are generally less than 2ha in area.

The EPBC conservation advice for the Central Hunter Valley eucalypt forest and woodland ecological community (CEEC) states that to be considered a MNES under the EPBC Act, areas of the ecological community must meet the key diagnostic characteristics, and at least the minimum condition thresholds for moderate quality. Further details are in **Table 7.1.**

Table 7.1 Key diagnostic characteristics for the Central Hunter Valley eucalypt forest and woodland ecological community (source: TSSC 2015)

Category and rationale	Thresholds
Class A. High quality condition e.g. A larger patch with good quality native understorey	Patch size is ⩾5 ha; AND ⩾50% of perennial understorey vegetative cover is native; AND the patch contains at least 12 native understorey species.
Class B. High quality condition e.g. A patch with high quality native understorey	Patch size is ⩾0.5 ha AND ⩾70% of perennial vegetative cover in each layer present is native; AND the patch contains at least 12 native understorey species.
Class C. Moderate quality condition e.g. A patch with good quality native understorey	Patch size is ⩾0.5 ha; AND ⩾50% of perennial understorey vegetative cover is native; AND the patch contains at least 12 native understorey species.
Class D. Moderate quality condition e.g. A moderate to	Patch size is ⩾2 ha; AND ⩾50% of perennial understorey vegetative cover is native; AND

Category and rationale	Thresholds		
large sized patch with connectivity to a native vegetation area; or a mature tree; or a tree with hollows.	The patch is contiguous with another patch of native woody vegetation ⩾1 ha in area	OR	The patch has at least one large locally indigenous tree (⩾60 cm dbh), or at least one tree with hollows

Based on the patch definition within the EPBC conservation advice (TSSC 2015), 22 patches of PCT 1691 within the development site were not classified as the CEEC as their patch size is less than 0.5 ha. These patches are isolated from other patches due to gaps of 30 m or more between tree canopies.

Floristic data from BAM plots was used to determine the percentage of perennial native understorey within each plot conducted in areas of the ecological community. Quadrat 7 was the only quadrat conducted within vegetation zone 1 which met the criteria of >50% perennial native understorey cover (with 61 % native groundcover recorded), and as such, this single patch meets the condition criteria for the CEEC. This patch is situated along the eastern edge of the entrance road to Bayswater Power Station. This patch is 2.04 ha in size and is classified as Class C. Moderate quality condition. Despite this patch being located within the development site boundary, it is to be retained as part of the Project **(Figure 8-1**).

No other patches of PCT 1691 (including rehabilitation) were found to have sufficient native groundcover proportion (>50%) or were large enough in area to meet the condition criteria.

The patches of PCT 1692: Bull Oak grassy woodland of the Central Hunter Valley all lacked eucalypt species in the canopy, were smaller than 0.5ha in size and therefore do not meet CEEC condition criteria.

8.3.2 Hunter Valley Weeping Myall (Acacia pendula) Woodland CEEC

The EPBC conservation advice for the Hunter Valley Weeping Myall (Acacia pendula) Woodland CEEC (TSSC 2014) states that to be considered a MNES under the EPBC Act areas of the ecological community must meet the key diagnostic characteristics, and the minimum condition thresholds.

The small patch of planted *Acacia pendula* (eight specimens) within the development site does not meet the two key diagnostic characteristics of the ecological community:

- the patch is a native vegetation remnant with a canopy that is (or was) dominated by *Acacia pendula* (Weeping Myall).

And

- Other native shrubs or herbs are present in the patch, with an indicative plant species list at **Table 1A**, **Appendix A** [of the Conservation Advice]. If a shrub layer is present, it may include one or more of: other species of Acacia, *Geijera* spp. (Wilga), *Dodonaea viscosa* (Hop Bush), *Notelaea microphylla* (Native Olive), *Psydrax odorata* (Stiff Canthium), *Sarcostemma viminale* (Caustic Bush), *Senna artemisioides* (Silver Cassia) or *Spartothamnella juncea* (Red Bead Bush). The ground layer includes a range of native grasses, forbs and chenopod low shrubs.

The small patch of planted *Acacia pendula* within the development site is not remnant and has been planted as part of landscaping efforts around the northern carpark of the Bayswater power station. This is evident by obvious changes to the topography in this location (roads, carpark and drainage) as well as lack of native vegetation. As shown in **Photo 6-5** (**Section 6.4.1**) the planted *Acacia pendula* trees display obvious

characteristics of the inland form of this species including a strongly pendulous habit (branches), abundance of seeds, and absence of suckering stems (unlike the Hunter Valley form which often lacks pendulous habit, has seed generation deficiencies and often suckers from roots). *Acacia pendula* have been planted amongst non-indigenous native trees including, *Melaleuca ericifolia, Callistemon citrinus, Corymbia citriodora* and *Melaleuca styphelioides* (the latter is an indigenous species however its position in the elevated landscape is unnatural). Furthermore none of the associated shrub-layer or ground layer species listed above are present here.

Further, the small patch of planted Acacia pendula does not meet the minimum condition thresholds, as outlined below:

1. The patch of the ecological community must be 0.1 ha or more in size.

And

2. At least 10 native plant species, from the list of native plants at **Table A1**, **Appendix A**, (of the Conservation Advice) are present in a sample plot (see Sampling protocol, below).

And

3. Non-native perennial plants account for no more than 70% of the vegetation cover in each vegetation layer of the patch (including annual plus perennial life histories).

Acacia salicina (regrowth) is the only native plant species from the **Table A1**, **Appendix A** [of the Conservation Advice] occurring alongside the Acacia pendula plantings. Non-native perennial plants do not account for more than 70% of the cover, however, non-indigenous native species do (and the planted non-indigenous native species would not be representative of the ecological community).

8.3.3 Coastal Swamp Oak Forest of South-east Queensland and New South Wales

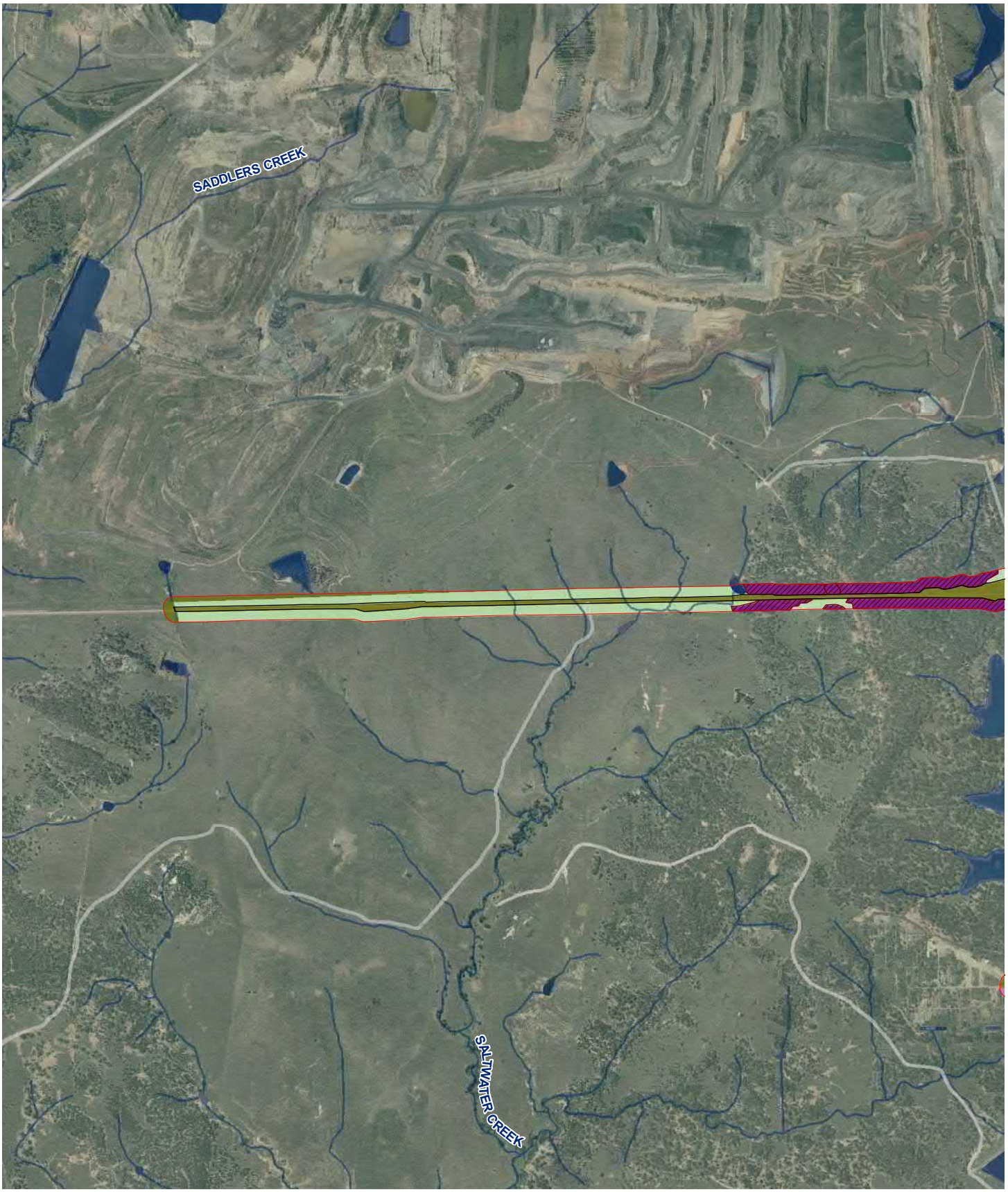
According to the Conservation advice (incorporating listing advice) for the Coastal Swamp Oak (*Casuarina glauca*) Forest of NSW and South East Queensland ecological community (Department of the Environment and Energy, 2018) this ecological community mostly occurs as scattered remnant patches along the coast, up to 50 m ASL but typically less than 20 m ASL. As the Swamp Oak Forest within the development site is well above this elevation (lowest occurrence at 120 m ASL), it is considered to be occurring in an incorrect landscape position and does not meet the diagnostic characteristics of the Coastal Swamp Oak (*Casuarina glauca*) Forest of the NSW and South East Queensland Ecological Community listed under the EPBC Act. Furthermore, given that the patches of PCT 1731 within the development site are all less than 2 ha in size and do not have a 'predominantly native understorey', they would not meet the required EPBC Act thresholds detailed in Table 1 of the Conservation advice (Department of the Environment and Energy, 2018). According to the EPBC Act Conservation advice for this community "very small or degraded patches that do not meet the minimum condition thresholds will be excluded from national protection". The small, regrowth Swamp Oak patches within the Project site are generally less than half a hectare in size and have minimal native species in the understorey or ground layer.

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

Not present within or adjacent to the development site.

Lowland Rainforest of Subtropical Australia

Not present within or adjacent to the development site.



Legend

- Assessment area
- Development site
- Central Hunter Valley eucalypt forest and woodland CEEC
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

Data sources

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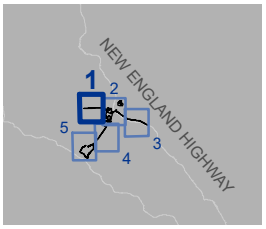

Figure 8 - 1 Map of threatened ecological communities (EPBC Act)

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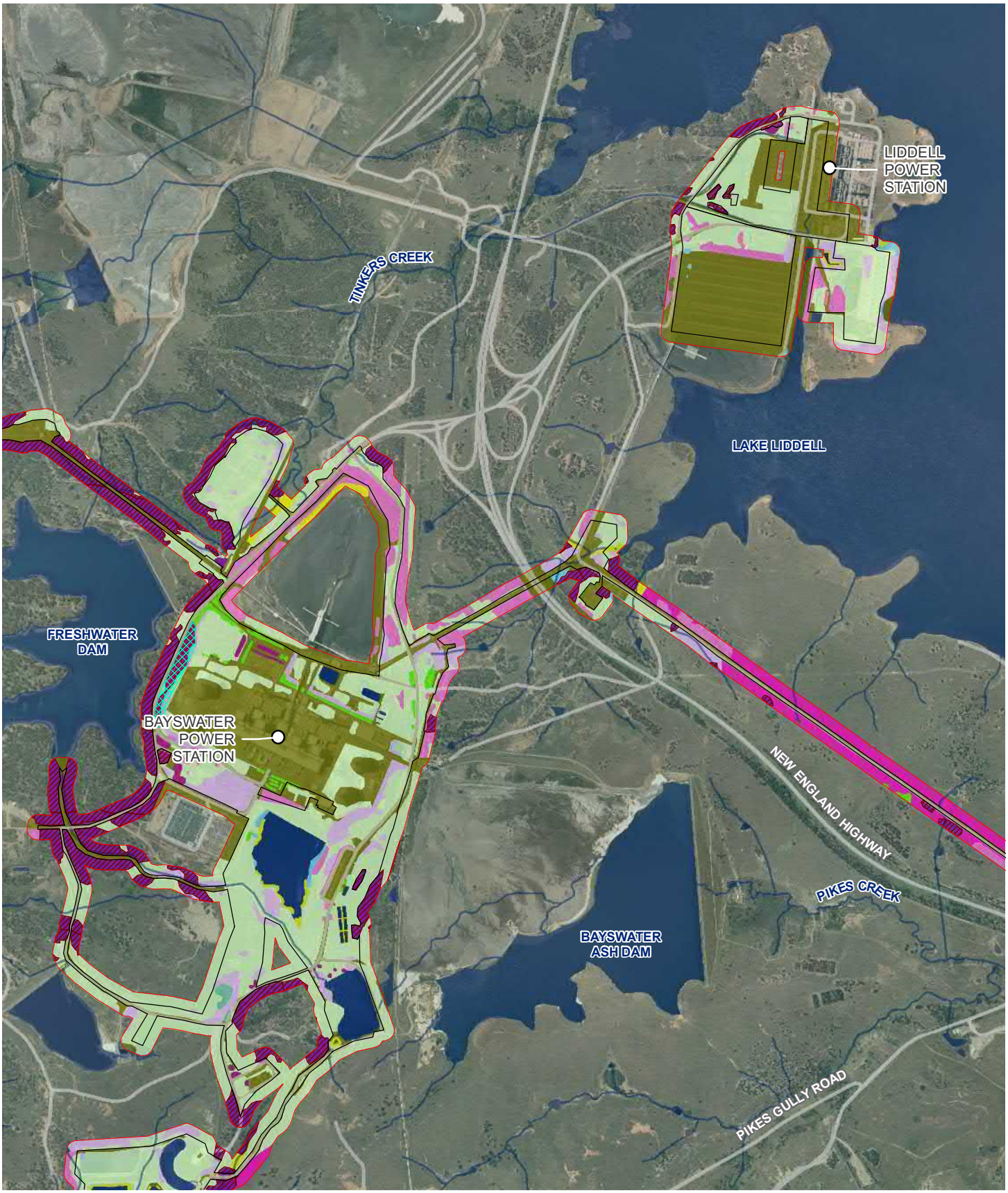

Legend

- Assessment area
- Development site
- Central Hunter Valley eucalypt forest and woodland CEEC
- Vegetation to be retained
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

Data sources

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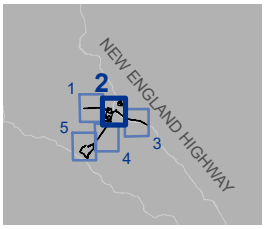

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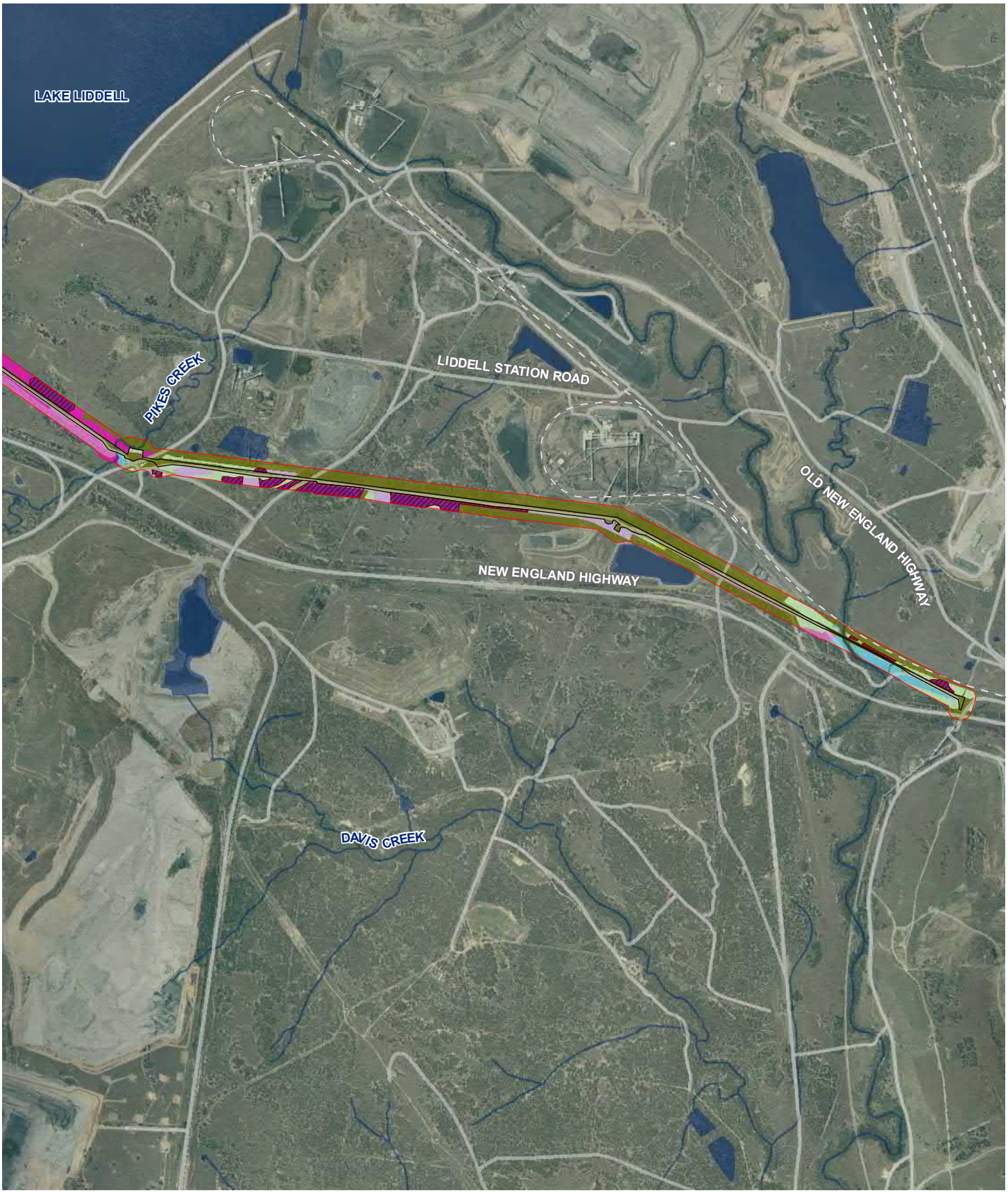

Legend

- Assessment area
- Development site
- Central Hunter Valley eucalypt forest and woodland CEEC
- Railway
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

Data sources

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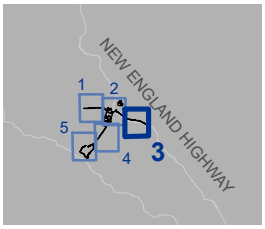

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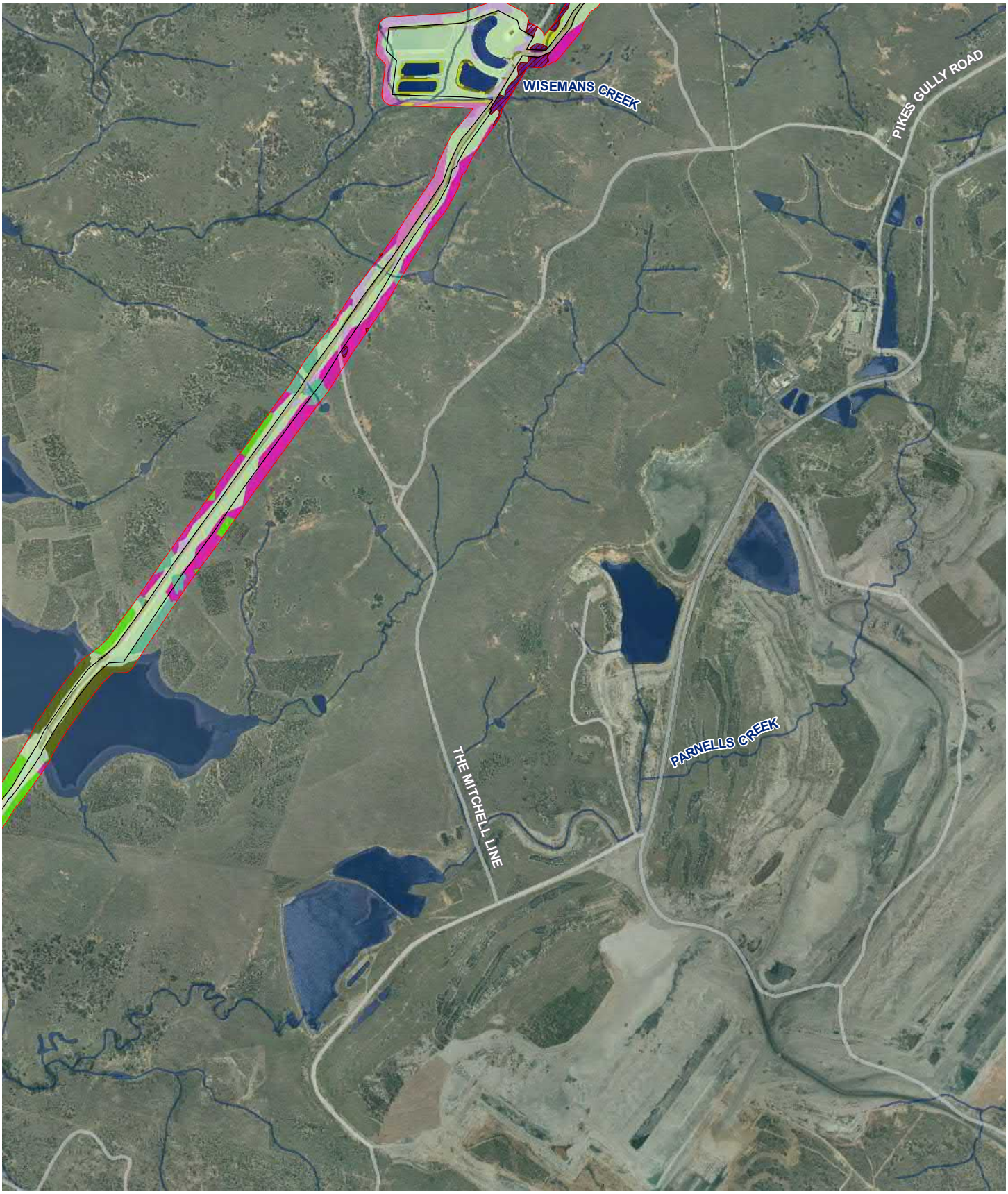

Legend

- Assessment area
- Development site
- Central Hunter Valley eucalypt forest and woodland CEEC
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
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- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

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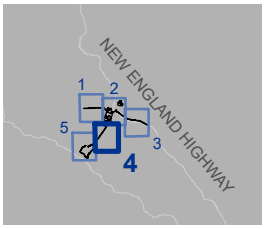

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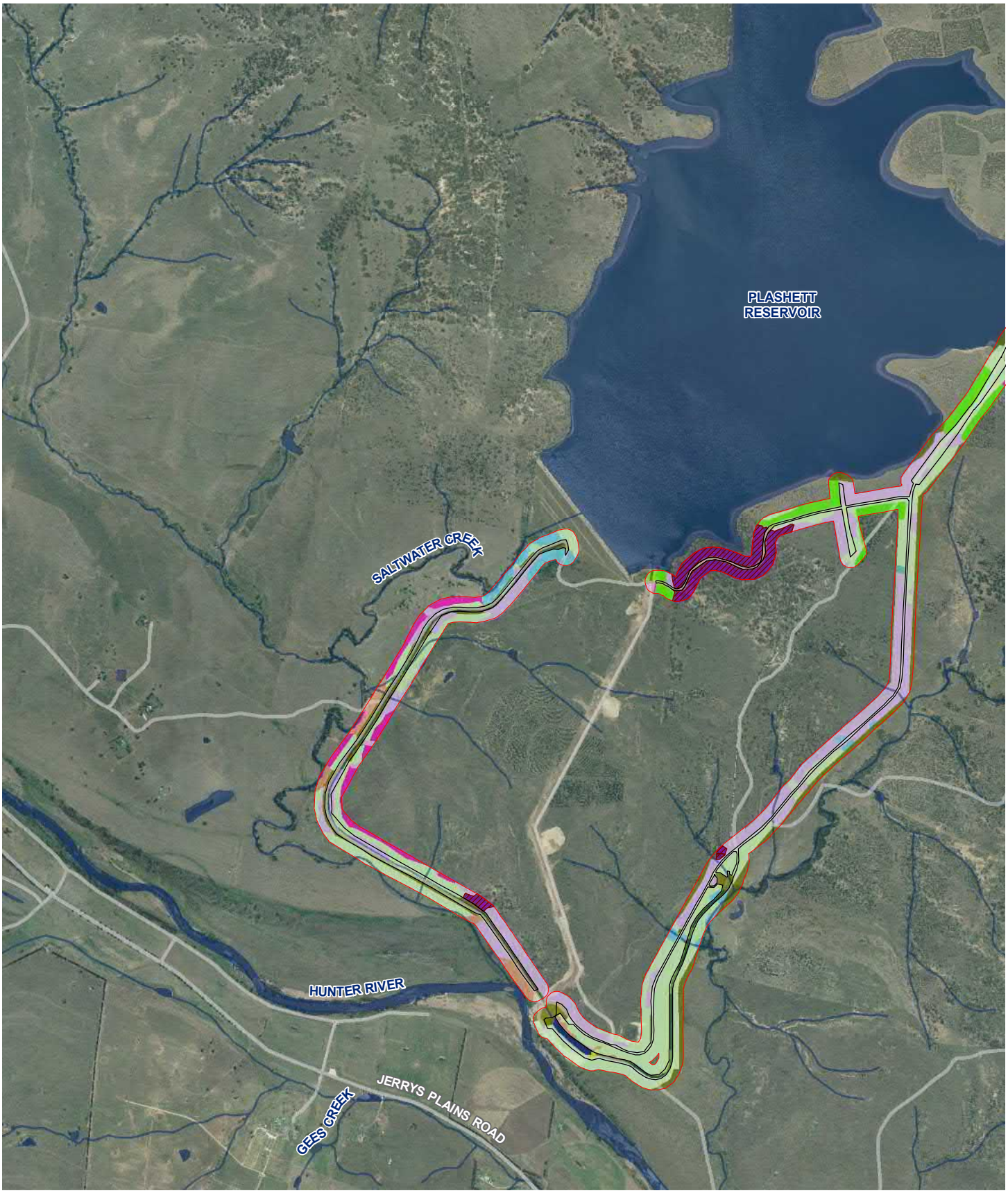

Legend

- Assessment area
- Development site
- Central Hunter Valley eucalypt forest and woodland CEEC
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 485 River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion)
- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

Data sources

Jacobs 2021
AGL 2020
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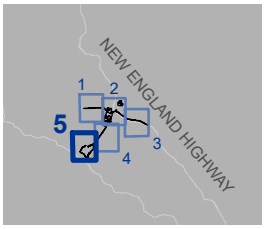

Figure 8 - 1 Map of threatened ecological communities (EPBC Act)

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8.4 Threatened plants

Ten EPBC Act listed threatened plant species were considered potentially likely to occur based on the presence of broadly associated modelled habitat or nearby records: *Androcalva procumbens, Asperula asthenes* (Trailing Woodruff), *Cynanchum elegans* (White-flowered Wax Plant), *Dichanthium setosum* (Bluegrass), *Eucalyptus glaucina* (Slaty Red Gum), *Eucalyptus nicholii* (Narrow-leaved Black Peppermint), *Euphrasia arguta, Prasophyllum sp. Wybong* (a leek-orchid), *Pterostylis gibbosa* (Illawarra Greenhood) and *Thesium australe* (Austral Toadflax).

Two specimens of *Eucalyptus glaucina* (Slaty Red Gum) were recorded adjacent to the development site near the western coal conveyor (and within the assessment area), (see **photo 22** and **23** in **Section 6.4**). Whilst accurate identification of these trees was difficult given the lack of fruit or buds on each tree (buds are required for definite identification), the leaves of each tree were a glaucous colour (known feature of *Eucalyptus glaucina*) and appeared to be different to the surrounding common Forest Red Gums (*Eucalyptus tereticornis*). Due to some uncertainty the precautionary approach was taken, and both trees were recorded as *Eucalyptus glaucina.* Two previous records (2003) of *Eucalyptus glaucina* exist within 400 m of this section assessment (NSW Bionet Atlas) although these records were not confirmed given lack of fruit or buds. Importantly, no Red Gums (*E.glaucina* or *E.tereticornis*) occur within the development site along this western coal conveyor **(Figure 6-3**) and none are to be impacted.

Recent flora surveys as part of the WOAOW Project recorded cultivated specimens of *Eucalyptus nicholii* (Narrow-leaved Black Peppermint) amongst an area of plantation woodland to the south of Borrow Pit 4 (Kleinfelder 2020). These non-naturally occurring specimens are located to the west of the development site and donot occur within the development site or Assessment area.

No other EPBC Act listed threatened plant species were recorded during targeted surveys. Habitats within the development site are either not suitable, or are degraded and highly fragmented, and the likelihood of these threatened plants occurring is low (**Appendix A)**.

Targeted surveys for *Prasophyllum petilum* (Endangered EPBC Act) were conducted during 9-11 September to adequately cover the seasonal survey requirements for this species. This species was observed to be flowering at a known reference site at Mangoola (approximately 20 km from Lake Liddell) at the time of survey.

These species were not identified within the development site during targeted surveys undertaken for this BDAR (refer to **Section 6.3.1** for survey details). No orchid species were recorded during surveys.

Furthermore, no threatened orchid species were recorded during comprehensive surveys of the adjacent WOAOW Project areas by Kleinfelder (also during September 2020). Importantly, the WOAOW Project area (surrounding the development site) contains large expanses of high-quality grassy woodlands and derived native grasslands (which contrasts to the highly exotic and disturbed vegetation of the development site). Additionally, recent expert advice (October 2020) from Dr Stephen Bell has been provided to Kleinfelder for the WOAOW Project BDAR. This advice notes that the 2020 season for Spring-flowering terrestrial orchids '*has been one of the best for several years, following at least three years of below-average Winter rainfall in the Hunter Valley*' and '*consequently, the lack of orchids detected within the Project area during their peak flowering period and in a 'good' year strongly suggests that the target species are not present there. Prasophyllum has been locally abundant in some areas'*. Further details are provided in the expert advice letter (Bell, 2020) provided to Kleinfelder for the WOAOW Project BDAR (see **Appendix G**).

In this advice, a potential reason for the lack of orchid species in the locality is discussed: *"The absence of Spring-flowering orchids across the (WOAOW) Project area is likely indicative of an absence of mycorrhizal fungi in the soil. This is an ongoing research topic, which on current understanding suggests that all terrestrial orchids may be constrained in distribution within the central Hunter Valley because of a lack of fungi. It is unknown if such an*

absence of fungi is due to the prolonged presence of agricultural grazing in this region (which compacts the soil and therefore restricts fungi growth), or if the fungi were never present there" (Bell, 2020). For this reason, as well as surveys for orchids within the development site being unsuccessful, the presence of *Pterostylis gibbosa* (Endangered EPBC Act) within the development site and locality is highly unlikely.

8.5 Threatened animals

The PMST identified 21 threatened fauna species listed under the EPBC Act with potential to occur in the locality based on records and modelled habitat.

The SLL was not recorded within the development site despite being known to occur in the larger woodland patches to the west of the assessment area and toward Drayton Mine. One SLL was recently recorded (2019) within 1km of the development site during surveys for the WAOAW Project (Kleinfelder, 2020). This observation was made in a large area of high quality PCT 1692 woodland. The habitat for this species within the development site is considered to be low-quality given that much of the land was cleared for cattle grazing in the past and has been modified to accommodate power station infrastructure. Areas of native vegetation still exist as small and isolated patches and may provide potential habitat for this species. Importantly, for the purposes of this assessment, SLL has been 'assumed present' in accordance with paragraph 5.2.4 of the BAM. The reason for this finding is due to the survey not meeting the duration specified in the *Survey Guidelines for Australia's Threatened Reptiles* (Department of the Environment Water Heritage and the Arts, 2011b). Under the BAM, where a survey is deemed as insufficient, the target species must be assumed present. The PCTs associated with the SLL include PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the Central and Upper Hunter – Moderate (all conditions) and PCT 1692 Bull Oak grassy woodland of the central Hunter Valley -Moderate. Given this, the area of potential habitat for SLL within the development site totals 38.5 ha.

No other EPBC Act listed fauna species were recorded within the development site during the surveys undertaken for this BDAR. However, the EPBC Act listed threatened fauna species that were considered at least moderately likely to occur in the habitats within the development site are as follows:

- Regent Honeyeater (*Anthochaera phrygia*) - Marginal foraging habitat present within small patches of PCT 1691 within the Assessment area. Has been recorded within the locality. The Tomalpin Woodlands near Cessnock (approximately 60km east of the development site) and the mountainous forest areas to the west of Denman (approximately 33km west of the development site) are the closest mapped 'important areas' for these species
- Swift Parrot (*Lathamus discolour*) - Marginal foraging habitat present within small patches of PCT 1691 within the Assessment area. Has been recorded within the locality. Returns to Tasmania to breed
- Red Goshawk (*Erythrotriorchis radiatus*) - Marginal foraging habitat present within woodland patches. Not associated with any of the PCTs present in assessment area. No stick nests recorded meaning breeding habitat is absent.
- Australasian Bittern (*Botaurus poiciloptilus*)- Marginal foraging or nesting habitat present within small patches of PCT 1071 on edges of numerous ponds and dams
- GGBF (*Litoria aurea*) - Suitable habitat is present within development site. The species has previously been identified within the Sewage Treatment Plant Polishing Ponds within the Bayswater Site (last recorded in early 2000's) and Lake Liddell (last confirmed in late 1970's) (DECC, 2007). Not recorded during targeted surveys by Jacobs 2020 or Kleinfelder 2019
- Large-eared Pied Bat (*Chalinolobus dwyeri*) - Suitable foraging habitat present within the development site. Has been recorded within the locality. Not recorded within development Site

- Corben's Long-eared Bat *(Nyctophilus corbeni)* - Suitable habitat present within the development site. Has been recorded within the locality, however, core areas of distribution are located in larger woodland areas further west
- Grey-headed Flying-fox (*Pteropus poliocephalus*) - Marginal foraging habitat present within the development site (Flowering eucalypts). Has been recorded within the locality. No camps observed within or adjacent to Assessment area during surveys. Similarly, no camps were observed in the surrounding WOAOW Project area (Kleinfelder,2020).

Significance assessments have been completed for these species in accordance with the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of Environment, 2013) (see **Appendix F**).

8.6 Migratory species

Based on the results of the PMST (**Appendix E**), 14 listed migratory species may occur in the broader locality (see **Appendix A and Appendix F**). The following species are considered moderately likely to occur in, or adjacent to, the Project site based on the presence of suitable habitats:

- Migratory marine birds – Fork-tailed Swift (*Apus pacificus*)
- Migratory terrestrial birds – White-throated Needletail (*Hirundapus caudacutus*), Black-faced Monarch (*Monarcha melanopsis*), Yellow Wagtail (*Motacilla flava*), Satin Flycatcher (*Myiagra cyanoleuca*) and Rufous Fantail (*Rhipidura rufifrons*)
- Migratory wetland species – Common Sandpiper (*Actitis hypoleucos*), Sharp-tailed Sandpiper (*Calidris acuminate*), Curlew Sandpiper (*Calidris ferruginea*), Pectoral Sandpiper (*Calidris melanotos*), Latham's Snipe (*Gallinago hardwickii*), Eastern Curlew (*Numenius madagascariensis*), Osprey (*Pandion haliaetus*) and Common Greenshank (*Tringa nebularia*).

'Important habitat' for a migratory species is defined as (Department of Environment, 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 recognized as nationally or internationally important. A wetland habitat should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of water bird, or a total abundance of at least 20,000 water birds. Nationally important wetland habitat includes wetlands that regularly support 0.1% of the flyway population of a single species of migratory shorebird, or 2,000 migratory shorebirds, or fifteen migratory shorebird species. The habitats in the development site are not considered 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 bird species are likely to use the development site and locality, the development site would not be classed as 'important habitat'. A nationally significant proportion of a population would not be supported by the habitats in the development site. The Project 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.

9. 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 Project (which will be outlined in the Project's Construction Environmental Management Plan (**CEMP**), the siting and planning of the Project 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. Due to the location of the development site within a modified and largely cleared environment, there is potential for limiting impacts.

9.1 Avoiding and minimising impacts on native vegetation and habitat during project planning

While the development site is a relatively large area of land, the proposed disturbance will generally apply to areas which contain existing infrastructure or have been previously cleared / disturbed. In this way the development site typically avoids remnant vegetation and significant ecological features in the landscape. Additionally, the proposed development site only requires small amounts of clearing of lower quality fragmented vegetation or rehabilitation and regrowth vegetation, thereby avoiding and minimising impacts on native vegetation.

The numerous patches of planted, rehabilitation and regrowth native vegetation identified along the edges of the development site will most likely be able to be retained once construction footprints and disturbance areas have been determined during detailed design. Peripheral areas of the development site will be used for storage of building materials and machinery, soil stockpiling, and for site offices. There are sufficient areas of cleared land for these activities to be positioned away from native vegetation. However, for the purpose of this assessment, a worst case scenario has been assessed with the majority of this vegetation assumed to be impacted (directly or in-directly). The development site covers a total of 352.9 ha of land, however of this, only 44.3 ha (12.6%) comprises native vegetation. Of this native vegetation mapped, around 21.6 ha (49%) is poor-condition regrowth *Acacia salicina* (growing amongst dense exotic grass) with low ecological value.

A single patch of PCT 1691 along the Bayswater entrance road meets the minimum condition thresholds for moderate quality *Central Hunter Eucalypt Forest and Woodland Ecological Community,* listed as Critically Endangered under the EPBC Act. This patch is 2.04 ha in size and despite being located within the development site boundary, AGLM is committed to avoiding direct impacts to this vegetation as part of the Project, there will be no further interactions with this community.

9.2 Avoiding and minimising prescribed biodiversity impacts during project planning

Some types of projects may have impacts on biodiversity values 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.

The BC Regulation (clause 6.1) identifies actions that are prescribed as impacts to be assessed under the BOS:

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.

The Project 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 impacts of wind turbines are not applicable to this Project. Vehicle movement associated with the operation of Power Stations and management of the surrounding land is already occurring. Increased vehicle movements during proposed construction, decoupling and maintenance of the Project have the potential to result in increased fauna mortality from vehicle strikes and this impact would be managed appropriately.

Further discussion on this is provided in Chapter **10**.

10. Assessment of impacts

10.1 Impacts on native vegetation and habitat

10.1.1 Direct impact of clearing native vegetation, threatened ecological communities and threatened species habitat

Direct impacts have been calculated using the entire development site, apart from the 2.04 ha patch of PCT 1691 to the west of Bayswater which is to be retained (**Figure 5-1**). The large majority of the development site contains existing cleared /disturbed areas with 134 ha of exotic grassland and 148.5 ha of existing infrastructure or artificial surfaces. The development site was designed to avoid the larger, better condition woodland areas existing in the Bayswater and Liddell surrounding areas. Nonetheless, the Project will result in the direct removal of some native vegetation and habitat. The estimated clearing of vegetation is approximately 42.3 ha consisting of the following PCTs:

- Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (PCT 1691)
- Bull Oak grassy woodland of the central Hunter Valley (PCT 1692)
- Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley (PCT 1731)
- *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071).

Table 10.1 provides a summary of the direct impacts to native vegetation that would occur within the disturbance development site, including impacts to one threatened ecological community listed under the NSW BC Act - Central Hunter Grey Box – Ironbark Woodland in the NSW Coast and Sydney Basin Bioregions EEC. These vegetation clearing amounts are a worst case scenario and the likelihood that more vegetation can be retained within the development site during the pre-construction phase is highly possible. AGLM will seek to avoid native vegetation patches during future design and any clearing areas will be carefully selected prior to construction. Furthermore, vegetation clearing would occur on a pro rata basis – and would be carried out gradually during different activities and proportional to the area needed.

The direct impacts on threatened species habitat are outlined in **Table 10.2.**

Table 10.1 Summary of direct impacts to vegetation within the development site

Vegetation Zone	PCT ID No.	PCT name	Broad condition class	Vegetation zone area (ha)	Current VI score	Future VI score	VI loss
1	PCT 1691	Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	Moderate	2.3	32.8	0	-32.8
2	PCT 1691	Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	Regrowth	21.6	10	0	-10
3	PCT 1691	Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	Rehabilitation	11.4	32.6	0	-32.6

Vegetation Zone	PCT ID No.	PCT name	Broad condition class	Vegetation zone area (ha)	Current VI score	Future VI score	VI loss
4	PCT 1691	Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	Native Grassland	2	21.9	0	-21.9
5	PCT 1731	Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley	Moderate_	0.9	17.6	0	-17.6
6	PCT 1692	Bull Oak grassy woodland of the central Hunter Valley	Moderate_	1.2	32.5	0	-32.5
7	PCT 1071	Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	Moderate	3	54.7	0	-54.7

The direct impacts on the Southern Myotis and SSL (species credit threatened species assumed present) habitat associated with the clearing of native vegetation is outlined in **Table 10.2**. The two *Eucalyptus glaucina* recorded were located outside the development site and will not be impacted. 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 10.2**.

Table 10.2 Summary of direct impacts on threatened species habitat (species credit species).

Species name	Common name	EPBC Act	BC & FM Act	Area (ha)	Sensitivity to gain class
Myotis macropus	Southern Myotis	-	V	10 ha of potential foraging / roosting habitat, based on 200 m buffer on waterbodies	High
Delma impar	Striped Legless Lizard	V	V	38.5 ha of potentially suitable habitat. 33 ha of this is regrowth and rehabilitated vegetation.	Moderate

10.1.2 Indirect impact of clearing native vegetation, threatened ecological communities and threatened species habitat

Indirect impacts are negative changes to the structure and function of retained vegetation as a result of factors such as increased light intensity and duration, increased exposure to wind, and weed invasion in edge habitats. These 'edge effects' can have a negative impact on flora and fauna species. Indirect impacts have been assessed in accordance with **Section 2.4.1** of the BAM Stage 2 manual.

The patches of native vegetation within the development site are already isolated from each other as well as larger woodland patches in the surrounding landscape. The woodland patches within the 50 m Assessment area buffer are already separated from the vegetation within the development site (largely by roads, tracks, coal conveyors, transmission lines and exotic pasture). The future clearing or disturbance associated with the Project is unlikely to lead to the creation of new edges in any previously intact vegetation. Edge effects from previous clearing and vegetation management are already existing within the woodland patches adjacent to the

development site. It is unlikely that vegetation within this 50 m buffer would receive increased light amounts or be exposed to more wind.

The development site and surrounding landscape have had a long history of land clearing and modification associated with cattle grazing and Power Station development. Decades of disturbance have resulted in exotic grasses and herbaceous weeds taking over vast areas of land, as well as infiltrating the ground layer of most of the remaining native vegetation patches. Whilst native grass is still persisting in some areas, particularly in the areas beyond the Assessment area, the Project would not affect these outlying areas and would not create opportunity for spread of weeds this far from the development site. Weed introduction associated with edge effects is unlikely to be exacerbated throughout the wider landscape.

Indirect impacts have not been calculated for this assessment given the existing condition of the development site and Assessment area. The future detailed design phase of the Project will further avoid native vegetation patches within the development site and the wider assessment area.

10.1.3 Habitat fragmentation

The majority of the development site is cleared or disturbed, with only small and fragmented patches of native vegetation (including regrowth and rehabilitation). The Project would require clearing of some vegetation, particularly regrowth and rehabilitation patches along road edges or adjacent to existing power station infrastructure (with minimal remnant vegetation present). Likewise, planted trees which are non-indigenous to the locality may also be cleared. The patches of native vegetation are small and are already highly fragmented by existing roads, coal conveyors, pipelines and transmission lines. Fauna movements throughout the locality are already limited by the lack of continuous vegetation corridors and only highly mobile species or disturbance tolerant species are likely to use the development site.

Likewise, seed dispersal and pollination of plants is already limited as a result of extensive clearing throughout the development site over past decades.

Given that the development site is confined mostly to cleared land, and on the basis that any existing vegetation exists as small, isolated fragments, any current fauna movements and ecological processes are likely to remain in the long term. Any vegetation that would be removed during construction would not constitute important habitat for native flora or fauna species. Impacts on the movement corridors for Southern Myotis are unlikely to be altered and this species is capable of crossing small gaps between vegetation patches. A range of mitigation measures are recommended to minimise the risk of impacts on dispersing individuals.

10.1.4 Weed invasion and edge effects

Vegetation patches in the development site are already exposed to weed invasion and edge effects. The small and isolated stands of native vegetation (including regrowth and rehabilitation) are generally characterized by an under-storey and ground layer dominated by exotic species. Given that the development site is situated in a highly modified environment and is centered around two power stations with associated infrastructure, light and noise impacts would already be sufficient to deter most native fauna species. The Project would not exacerbate existing edge effects and weed invasion. Nonetheless, environmental safeguards, including weed control and retention of native vegetation are proposed (See **Section 11**).

10.2 Prescribed biodiversity impacts

This section identifies the potential prescribed biodiversity impacts on threatened species associated with the Project in accordance with **Chapter 6** of the BAM. These are impacts that are in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat.

10.2.1 Impacts on the habitat of threatened species or ecological communities associated with 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 development site or threatened species or ecological communities associated with these features. As such, this prescribed impact has not been considered further.

10.2.2 Impacts on the habitat of threatened species or ecological communities associated with rocks

There are no occurrences of rocks or rocky habitats within the development site or threatened species or ecological communities associated with rocks. As such, this prescribed impact has not been considered further.

10.2.3 Impacts on the habitat of threatened species or ecological communities associated with human made structures

There are three threatened species that can use human made structures as habitat that may be affected by the development which are:

- Large Bent-winged Bat (*Miniopterus orianae oceanensis*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Southern Myotis (*Myotis macropus*).

The Large Bent-winged Bat and Southern Myotis are known to roost in cave-like human made structures including mine shafts, storm water channels, buildings, and under bridges. The Greater Broad-nosed Bat primarily roosts in tree hollows (none within the development site) although has been recorded in buildings.

Searches of concrete culverts, pipes and empty shipping containers showed no evidence of potential roosting habitat for threatened microchiropteran bats. The highly fluctuating water levels of culverts and pipes in the development site would likely deter bats from roosting. The high levels of light pollution, noise and electricity around buildings would also deter bats.

10.2.4 Impacts on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range

Up to 46.2 ha of native vegetation and planted native non-indigenous trees would be impacted by the development (worst case). 21.6 ha of this amount is scattered regrowth *Acacia salicina* growing amongst dense exotic grass. Proposed clearing would occur during different stages and timelines associated with each component of the Project. Nonetheless, if all vegetation within the development site (and non-retained areas) is removed, there will be a minor decrease of habitat connectivity in the locality caused by widening of existing gaps in vegetation. Given vegetation within the development site is already isolated from large areas of intact woodland, the majority of threatened species are unlikely to use these small patches as dispersal routes. Mobile threatened species such as woodland birds and bats may use vegetation during dispersal between larger

woodland areas, and therefore may experience a small loss in habitat connectivity (caused by widening of existing vegetation gaps).

Twelve threatened species may utilise the non-native vegetation, including both native and exotic planted trees and shrubs, that are found within the development sites.

The Grey-crowned Babbler was recorded and is likely to use vegetation within the development site during dispersal between better quality woodland patches. Similarly, other woodland birds such as Brown Treecreeper, Hooded Robin, Flame Robin or Scarlet Robin would potentially fly through the development site on an occasional basis and may perch in the small patches of vegetation.

The Southern Myotis and SLL were both assumed present within the development site (see **section 6.4**). Whilst not recorded on the Development site during surveys, both species have been recently recorded in adjacent lands (Kleinfelder, 2020). The Southern Myotis is highly mobile and is likely move across both vegetated and cleared areas during foraging activities. The development site already contains significant gaps in native vegetation as well as barriers created by power station infrastructure (transmission lines and large buildings). The Project will unlikely exacerbate barriers to dispersal for the Southern Myotis.

The SSL is known to inhabit the higher-quality woodland habitats to the west of the Assessment Area. This species could potentially disperse eastward across the development site on occasion, although habitats within this area are already isolated by significant infestations of exotic grasses, coupled with movement barriers such as roads, water canals and power station infrastructure. The ground surfaces of the development site have historically been modified for cattle grazing and construction of power station infrastructure and generally lack shelter features such as rocks, logs, wood debris and native tussock grasses. Future detailed design will further retain vegetation within the development site and the Project is unlikely exacerbate barriers to dispersal for the SLL.

Due to the marginal conditions of these vegetation patches, their isolation from large tracts of woodland, and high levels of disturbance from Power Stations, vehicles and electricity transmission, it is unlikely the development site is used as breeding habitat by any threatened species. It is unlikely that the development would detrimentally affect the bioregional persistence of these species.

10.2.5 Impacts on movement of threatened species that maintains their life cycle

The life cycle of threatened species known from the locality is unlikely to be dependent on the habitats to be affected by the development site. The habitats to be affected are marginal foraging habitat and no breeding habitat is likely to be impacted. The development site is not part of a recognised movement corridor between breeding grounds, foraging grounds, or other habitats important for the lifecycle of these species such as staging points for migration. The proposed disturbance associated with the BAW will generally be confined to existing disturbance footprints and will not exacerbate habitat fragmentation in the locality to a significant extent. The movement of these species between foraging and breeding grounds would not be affected, and the bioregional persistence of these species would not be detrimentally affected by the development.

The Grey-headed Flying-fox, Swift Parrot and Regent Honeyeater are considered as moderately likely to forage on the flowers and/or fruit of both planted and exotic trees within the development site. The Grey-crowned Babbler uses vegetation for dispersal and may potentially build nests in trees within the development site (particularly in Bulloak trees). No Grey-crowned Babbler nests were identified in the development site, however, are present in the wider Assessment areas in areas of good-condition woodland. The Large Bent-winged Bat and Greater Broad-nosed Bat may forage in the air spaces around areas of non-native vegetation, feeding on the

insects attracted to the vegetation. No hollow-bearing trees were identified on the development site and searches of concrete culverts showed no evidence of potential roosting habitat for threatened microchiropteran bats. The highly fluctuating water levels of culverts and pipes in the development site would likely deter bats from roosting. In the case of the Southern Myotis, only tree hollows within 200 m of water bodies are likely to be utilised, which were not present in the development site.

The SSL was assumed present within the development site however breeding habitat is considered to be poor-condition given that much of the ground surface has been historically modified for cattle grazing and construction of power station infrastructure. The vegetation patches remaining, lack rocks, logs, woody debris and native tussock grasses.

Due to the marginal conditions of these vegetation patches, their isolation from large tracts of woodland, and high levels of disturbance associated with the Power Stations, vehicles and electricity transmission, it is unlikely the development site is used as breeding habitat by any threatened species. It is unlikely that the development would detrimentally affect the bioregional persistence of these species.

10.2.6 Impacts on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities

Given the degraded and operational status of many of the man-made dams and canals within the development site, the condition of aquatic habitats is considered to be poor and the likelihood of threatened species being dependent on these habits is low. These artificial waterways are separated from naturally occurring waterways by pipes and canals with gates. The larger creek lines (and tributaries to Hunter River) within the surrounds of the development site have been avoided and are sufficient distances from proposed disturbance areas.

GGBF (*Litoria aurea*) has previously been identified within the Sewage Treatment Plant Polishing Ponds at Bayswater (last recorded in early 2000's) and Lake Liddell (last confirmed in late 1970's) (DECC, 2007). Recent target surveys by Jacobs 2020 and Kleinfelder 2019 did not record this species and it is highly unlikely that a population persists at this location. The development site does not provide suitable habitat for other threatened amphibian species and no impacts to such species are likely.

Mitigation measures to reduce the pollution during decoupling and construction phases are described in Section 11. Given that the waterbodies within the development site are already isolated from naturally occurring rivers and creeks, no impacts on fish passage are possible, and offsets in accordance with DPI (2013) are not required.

Construction activity in the vicinity of aquatic environments may temporarily increase disturbances such as increased noise, vibration and vehicle movement. Delineation and avoidance of aquatic and riparian areas will prevent direct impacts to these ecosystems. The dams and drainage lines across the development site are already altered with high disturbance regimes associated with operational and maintenance practices.

10.2.7 Impacts of wind turbine strikes on protected animals

This prescribed impact is not applicable to the development.

10.2.8 Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC

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 development site. As explained in **Section 9.2** the risk of an increase in the frequency of vehicle strike due to the development is low.

10.3 Contribution to Key Threatening Processes

A Key Threatening Process (**KTP**) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or an ecological community. KTPs are listed under the BC Act and EPBC Act. At present, there are currently 39 listed KTPs under the BC Act. There are eight KTPs listed under the *FM Act* and there are 21 KTPs listed under the EPBC Act. Of the listed KTPs, the development may directly or indirectly contribute to the following KTPs as outlined in **Table 10.3**. Aside from direct impacts to native vegetation, the potential for contribution to these KTPs can be minimised and avoided through the implementation of mitigation and management measures during construction of the development. These measures would be outlined in a CEMP.

Table 10.3 Summary of KTP that the development will directly or indirectly contribute to

Key Threatening Process	BC Act, FM Act or EPBC Act	Likelihood of the development directly or indirectly contributing to the KTP
Clearing of native vegetation	BC Act	High – clearing of native vegetation would occur however, the vegetation to be cleared is generally low-quality regrowth and rehabilitation A total of 42.3 ha of native vegetation (mostly regrowth and rehabilitation) may be removed based on a worst case conservative assumption.
Land clearance	EPBC Act	High – clearing of native vegetation would occur however, the vegetation to be cleared is generally low-quality regrowth and rehabilitation A total of 42.3 ha of native vegetation (mostly regrowth and rehabilitation) may be removed based on a worst case assumption.
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	BC Act	Low – mitigation measures would be implemented to prevent the spread or introduction of amphibian chytrid fungus
Infection of amphibians with chytrid fungus resulting in chytridiomycosis	EPBC Act	Low – mitigation measures would be implemented to prevent the spread or introduction of amphibian chytrid fungus
Infection of native plants by *Phytophthora cinnamomi*	BC Act	Low – mitigation measures would be implemented to prevent the spread or introduction of *Phytophthora cinnamomi*
Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*)	EPBC Act	Low – mitigation measures would be implemented to prevent the spread or introduction of *Phytophthora cinnamomi*

Key Threatening Process	BC Act, FM Act or EPBC Act	Likelihood of the development directly or indirectly contributing to the KTP
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	BC Act	Low – mitigation measures would be implemented to prevent the spread or introduction of Exotic Rust Fungi
Invasion and establishment of exotic vines and scrambler	BC Act	Low – mitigation measures would be implemented to prevent the spread of weeds
Invasion of native plant communities by African Olive *Olea europaea* subsp. *cuspidata* (Wall. ex G. Don) Cif.	BC Act	Low – mitigation measures would be implemented to prevent the spread of weeds
Invasion of native plant communities by *Chrysanthemoides monilifera*	BC Act	Low – mitigation measures would be implemented to prevent the spread of weeds
Invasion of native plant communities by exotic perennial grasses	BC Act	Low – mitigation measures would be implemented to prevent the spread of weeds. Much of the development site already contains dense exotic grass
Invasion, establishment and spread of Lantana (*Lantana camara* L. sens. Lat)	BC Act	Low – mitigation measures would be implemented to prevent the spread of weeds
Degradation of native riparian vegetation along NSW water courses	FM Act	Low – waterbodies within the development site are man-made. Mitigation measures would be implemented to avoid inadvertent impacts to vegetation outside of the development site associated with the Hunter River

10.4 Noise, vibration, dust, light and contaminants

10.4.1 Noise and vibration impacts

Anthropogenic noise can alter the behaviour of animals or interfere with their normal functioning (Bowles, 1997). During all phases of the Project there would be increased noise and vibration levels in the development site and immediate surrounds due to vegetation clearing, ground disturbance, machinery and vehicle movements, and general human presence.

Based on the information provided above, construction and decoupling activities will likely result in an increase in ambient noise levels (mainly an increase from current noise levels) as well as potentially loud noises and vibration for short periods associated with earth works or demolition during construction only. Even though most fauna occurring within the development site are disturbance tolerant and exposed to regular power station noise, the noise and vibration from activities associated with the Project will potentially disturb fauna and may disrupt foraging, reproductive, or movement behaviours. The impacts from noise emissions are likely to be temporarily localised to the construction / demolition areas and moving as the Project progresses. These emissions are not considered likely to have a significant, long-term, impact on wildlife populations outside the area of impact.

10.4.2 Dust pollution

Elevated levels of dust may be deposited onto the foliage of vegetation adjacent to the Project activities, particularly during construction of battery pads or maintenance of dirt roads. This has the potential to reduce photosynthesis and transpiration and cause abrasion and radioactive heating potentially resulting in reduced growth rates and a decrease in overall health of the vegetation. Consequently, changes in the structure and composition of plant communities and the grazing patterns of fauna may occur near the edges of existing roads or construction areas. Existing dirt roads are already subject to high levels of vehicle movement as part of power station operations and vegetation along these roads is already impacted by dust,

It is likely that some level of dust has been generated consistently throughout the lifecycle of Liddell and Bayswater, and as a result of having coal stockpiles nearby. Dust pollution related to construction (during periods of substantial earthworks) is likely to be highly localised, intermittent, and temporary (particularly during the wetter seasons) and is therefore not considered likely to be a major impact of the Project.

10.4.3 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).

The development site is already significantly affected by light pollution associated with Liddell and Bayswater as well as lighting for roads, coal conveyors, heavy vehicles and pump stations. Construction of the Battery, decoupling of Liddell and the BAW component would be conducted during diurnal hours and should not exacerbate the effects of light pollution from current operations within development site or surrounds.

10.4.4 Contaminant pollution

The Project is unlikely to cause large-scale soil disturbance at depth and is not proposed to interface with groundwater. Where the development may interact with surface water bodies specific construction environmental controls (sediment erosion controls as part of the CEMP) will be implemented. The final layout of the Battery facility is likely to comprise large areas of hardstand that will minimise the potential for any direct contact with subsurface soil during operations. Similar scenarios are envisaged for BAW. Accordingly the Project is unlikely to result in any contamination related impacts to flora and fauna.

Accidental release of contaminants is likely to be localised. Mitigation measures are described further in **Chapter 11** and will be provided within the CEMP.

10.5 Cumulative impacts

The potential biodiversity impacts of the Project must be considered as a consequence of the construction and operation of the Project within the existing environment. The Project will 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 Project within a strategic context.

The Project is proposed in a part of the Hunter Valley that has had a long history of land clearing and disturbance resulting from development of Power Stations, roads, transmission lines, open-cut coal mines as well as widespread cattle grazing. However, the most immediate accumulation of impacts will be the impacts of the Project in addition to those of the WAOAW Project. The cumulative direct vegetation removal impacts of the Project and the WOAOW Project is outlined in **Table 10.3.**

These projects result in a relatively large cumulative impact occurring in a predominately modified and disturbed landscape. The WAOAW project is currently being re-designed and is likely to have lower impacts than what is listed below.

Table 10.4 Cumulative impacts to native vegetation from the Project

PCT ID No.	Plant community type name	Direct impact from the Project (ha)	Direct impact from WOAOW (ha)*	Cumulative impact (ha)
1691	Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (moderate/good)	2.3	14.7	17
1691	Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Regrowth)	21.6	40.36	61.76
1691	Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter – (Rehabilitation)	11.4	3.75	15.15
1691:	Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Native Grassland)	2	147.77	149.7
1692	Bull Oak grassy woodland of the central Hunter Valley	1.2	61.64	62.84
1731	Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley	0.9	2.4	3.3
1071	Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	3	0	3
Total Native vegetation		**42.3**	**270.70**	**313**

11. Mitigating and managing impacts on biodiversity values

While direct impacts are easily quantified and controlled by managing the extent of clearing within the development site, the indirect impacts are subject to the efficacy of implemented environmental controls. As such direct impacts are defined during project design, whereas indirect impacts are mitigated through effective environmental management during construction associated with an adaptive management strategy.

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 Project.

Mitigation and management measures to be carried out prior to, during and following the construction would be outlined in a Flora and Fauna Management Plan (included as part of the CEMP). A summary of mitigation measures is provided in **Table 11.1** below:

Table 11.1 Proposed mitigation measures

Impact	ID	Mitigation action	Outcome	Timing and frequency	Responsibility	Effectiveness of action
Removal of vegetation and habitat for threatened species	N/A	Future detailed design phase will increase retainment of native vegetation.	Avoid and minimise clearing of vegetation and habitat	Pre-construction	AGLM	Retainment of vegetation is highly effective at minimising impacts to habitat
	BIO1	Exclusion zones, or 'No-Go' zones, will be mapped in CEMP and mapping made available to all construction personnel.	Avoid and minimise clearing of vegetation and habitat	Pre-construction	AGLM	Exclusion zones are effective at minimizing impacts to habitat
	BIO2	Woody debris (logs and mulch) produced during vegetation clearing will be re-spread over any cleared areas to protect the soil surface from erosion and to aid habitat restoration where appropriate.	Improve habitat restoration outcomes	During construction	AGLM and contractors	Effective in aiding habitat restoration
Injury or mortality to native fauna during vegetation clearing and construction	BIO3	An inspection of native vegetation to be impacted (within the construction footprint) will be conducted by an ecologist immediately prior to vegetation clearing works (to confirm absence of fauna species). A Spotter/Catcher ecologist must supervise vegetation clearing. In the unlikely event that fauna is present, works will cease until animals can be captured and removed from the construction footprint. Construction crews will be made aware that any native fauna species encountered must be allowed to leave site without being harassed.	Decrease harm to fauna species	Immediately prior to vegetation clearing / During construction	AGLM and contractors to engage Spotter/ Catcher ecologist	Effective in minimizing harm and trauma to fauna species

		Trenches / holes will be inspected each morning and any trapped fauna removed or provide a mechanism for fauna to escape, such as a soil or timber ramp.				
	BIO4	Vehicle movements on newly formed access tracks or construction zones will be limited to 20km/h speed limit implemented to reduce the risk of vehicle strike to fauna.	Decrease harm to fauna species	During construction	AGLM and contractors	Effective in minimizing fauna strikes
Impact to topsoil and soil seed bank.	BIO5	Where native vegetation is removed topsoil is to be retained from excavation areas within construction footprint (where possible). Topsoil stockpiles will be delineated and protected from machinery compaction and contamination during construction. Following construction and infill, topsoil will be re-spread over impacted native vegetation areas (to retain native seedbank and assist with natural revegetation). Avoid stockpiling in the vicinity of drainage lines.	Topsoil and soil seed bank retained for future use	During construction	AGLM and contractors	Effective in aiding rehabilitation and habitat restoration
Impact to surrounding vegetation	BIO6	Accurately and clearly mark out the limits of the construction footprint (only where native vegetation exists). No activities including parking and turning of vehicles and plant/ equipment will occur beyond the construction footprint. The Construction footprint will be demarcated prior to commencement of works in areas where native vegetation exists.	Vegetation outside construction footprint is protected	Pre-construction	AGLM and contractors	Effective in minimizing impacts to surrounding vegetation
	BIO7	Materials, plant, equipment, work vehicles and soil/rock stockpiles to be placed to avoid damage to surrounding vegetation and will be outside tree drip-lines. Construction workers and vehicles will not access areas beyond delineated construction footprints.	Vegetation outside construction footprint is protected	During construction	AGLM and contractors	Effective in minimizing impacts to surrounding vegetation

Impacts from introduction and spread of weeds	BIO8	Where possible, avoid entering areas of significant weed infestations with machinery or personnel. Weed infestations are predominantly located in the Exotic grassland areas, or the PCT 1691 'regrowth' areas mapped within the development site (**Figure 5-2**).	Control spread of weeds from the project	During construction	AGLM and contractors	Known and proven effective
	BIO9	If required, weed control will be undertaken by suitably qualified and/or experienced personnel. This may include: ▪ Manual weed removal in preference to herbicides. ▪ Replacing non-target species removed/killed as a result of weed control activities. ▪ Protecting Non-target species from spray drift. ▪ Using only herbicides registered for use within or near waterways for the specific target weed. ▪ Not applying herbicide if it is raining or if rain is expected. Mixing and loading herbicides and cleaning equipment away from waterways and drains. The CEMP will detail the procedures for management of weeds on the development site (which will be in accordance with the requirements of the Biosecurity Act 2015).	Control spread of weeds from the project	Pre-construction or during construction	AGLM and contractors	Known and proven effective
	BIO10	During the clearing works, weeds will be disposed and managed appropriately to stop the spread of existing weed species.	Control spread of weeds from the project	During construction	AGLM and contractors	Known and proven effective

	BIO11	Ensure vehicle and machinery hygiene measures are applied during construction and operation. Vehicle washdowns may be required for removal of mud and plant materials.	Control spread of weeds from the project	During construction	AGLM and contractors	Known and proven effective
Impacts from introduction and spread of plant or pathogens or animal disease	BIO12	Pathogen management measures will be implemented to prevent introduction and spread of amphibian chytrid fungus, *Phytophthora cinnamomi* and Exotic Rust Fungi. The CEMP will provide a protocol for construction vehicles driving to and from site to prevent the spread or introduction diseases.	Control spread of pathogens from the project	During construction	AGLM and contractors	Known and proven effective
Increase in light, noise and vibration impacts during works	BIO13	Avoid excessive noise and vibration during construction activity. Construction activities to be carried out during diurnal hours.	Decrease disturbance to native fauna	During construction	AGLM and contractors	Known and proven effective
Increased erosion and sedimentation due to the removal of vegetation	BIO14	Erosion and sediment controls will remain in place until all rehabilitation has been completed. Drainage lines will be protected from runoff and stockpiling of spoil.	Limit loss of topsoil and avoid sedimentation impacts to waterways	During construction	AGLM and contractors	Known and proven effective
	BIO15	Revegetation of slopes or exposed soil areas will be undertaken as soon as possible, in accordance with the CEMP. Landscaping of exposed surfaces using native indigenous species only. Soil loss will be prevented by immediate stabilisation of exposed surfaces (e.g. use of Jute mesh and/or soil binder).	Limit loss of topsoil and avoid sedimentation impacts to waterways	During construction / post construction	AGLM and contractors	Known and proven effective
Fragmentation resulting in reduced connectivity	BIO16	Future detailed design phase will enhance retainment of native vegetation. Patches of native vegetation which are located near larger patches	Retain habitat connectivity	Pre-construction	AGLM	Will minimise impacts to habitat connectivity

		of native vegetation would be prioritised for retainment.	in the landscape			

12. Thresholds for the assessment and offsetting of impacts of development

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.

12.1 Impacts on a potential entity that are serious and irreversible impacts

The concept of SAII is fundamentally about protecting threatened entities that are most at risk of extinction from potential development. The BOS recognises that there are some types of serious and irreversible impacts that the community expects will not occur except where the consent authority considers that this type of impact is outweighed by the social and economic benefits that a project will deliver to the State. There are no SAII entities that would be affected by the Project.

12.2 Impacts for which the assessor is required to determine an offset requirement

12.2.1 Impacts on native vegetation (ecosystem credits)

The direct impacts to PCTs which require an offset are summarised in **Table 12.1.**

Table 12.1 Direct impacts to PCTs which require an offset

Veg zone	PCT	TEC	Area (ha)	VI score
1	1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter – Moderate	Yes	2.3	32.8
3	1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter – Rehabilitation	Yes	11.4	32.6
4	1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter – Native Grassland	No	2	21.9
5	1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley – Moderate_Good	No	0.9	17.6
6	1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate	No	1.2	32.5
7	1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin	No	3	54.7

12.2.2 Impacts on threatened species

An offset is required for impacts to SLL as outlined in **Table 12.2**. (The location of this habitat is shown in **Figure 12-1**). PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter and PCT

1692 Bull Oak grassy woodland of the central Hunter Valley are both associated vegetation types for the SLL according to the TBDC. PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley and PCT 1071 *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion are not listed as a vegetation type for SLL under the TBDC and SLL credits are not calculated for these PCTs. Whilst vegetation zone 2 (PCT 1691 Regrowth) only has a VI score of 10 (below the VI score threshold of ⩾15), this zone still contains potentially suitable habitat for SLL (grass tussocks and other shelter features) and is included as requiring an offset (see marked yellow areas of **Figure 12-1**). Two hectares of PCT 1691 – Moderate (vegetation zone 1) will be retained (see **Section 10.1**) and were not included in the final total area requiring offsets.

Table 12.2 Impacts to Striped Legless Lizard

Veg zone	PCT	TEC	Area (ha)	VI score
Striped Legless Lizard (*Delma impar*)				
1,2,3,4	1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	Yes (apart from VZ 2 and 4)	37.3	32.6, 10, 32.8, 21.9
5	1692 Bull Oak grassy woodland of the central Hunter Valley -Moderate	No	1.2	32.5
Total area			**38.5**	

An offset is required for impacts to Southern Myotis as outlined in **Table 12.3**. (The location of this habitat is shown in **Figure 12-1**). PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley – is not listed as a vegetation type for Southern Myotis under the TBDC and Southern Myotis credits are not calculated for this PCT.

Table 12.3 Impacts to Southern Myotis

Veg zone	PCT	TEC	Area (ha)	VI score
Southern Myotis (*Myotis macropus*)				
1 and 3	1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	Yes	6.6	32.6 and 32.8
5	1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate	No	0.38	32.5
7	1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin	No	2.98	54.7
Total area			**10**	

12.3 Impacts for which the assessor is not required to determine an offset requirement

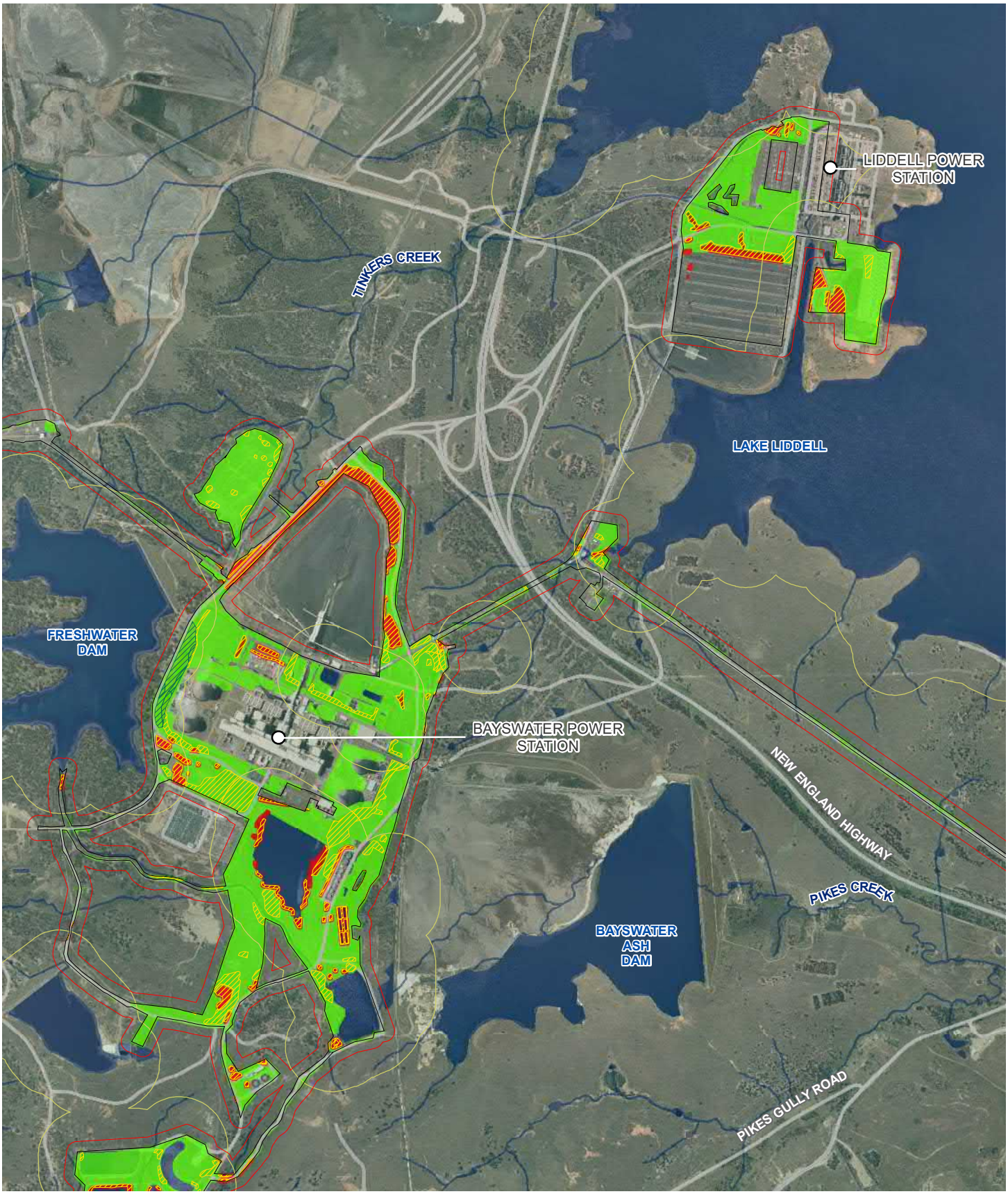
An offset is not required for impacts where the vegetation integrity score is below those set out in subsection 9.2.1 of the BAM for impacts on native vegetation and subsection 9.2.2 of the BAM for impacts on threatened species. Impacts not requiring offset are described in **Table 12.4**. The vegetation integrity score for regrowth patches of PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (vegetation zone 2) is only 10. As the vegetation integrity score for this vegetation zone is below 15, an offset is not required for this impact 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 regrowth form of PCT 1691 does not contain suitable habitat for this species (such as hollow-bearing trees or a canopy of native trees). The location of this vegetation zone is shown in **Figures 5-1** and **12-1**.

Table 12.4 Impacts which do not require an offset

Veg zone	PCT	Area (ha)	VI score	VI score threshold	Offset required
Native vegetation					
2	PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Regrowth)	21.6 ha	10	⩾15	No
Southern Myotis (*Myotis macropus*)					
2	PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Regrowth)	13.1 ha	10	⩾17	No

12.4 Impacts that do not require further assessment by the assessor

Areas of land on the development site without native vegetation do not need to be assessed for credits under chapter 3 or chapter 4 of the BAM. As such, areas of the development site that do not possess PCTs have not been assessed and credits have not been generated (**Figure 12-2**).



Legend

- Assessment area
- Development site
- 200m waterbody buffer
- Vegetation to be retained
- Species impact (Southern Myotis and Striped Legless Lizard)
- PCT impacts
  - Offset required
  - No offset required
- Road
- Waterway
- Waterbody

0 0.5 1 km

1:25,000 at A4

N

Data sources

Jacobs 2021
AGL 2020
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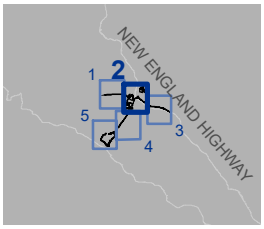

Figure 12 - 1 Impacts requiring offsets and impacts not requiring offsets

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Legend

- Assessment area
- Development site
- 200m waterbody buffer
- Species impact (Southern Myotis and Striped Legless Lizard)
- PCT impacts
  - No offset required
- Road
- Railway
- Waterway
- Waterbody

0 0.5 1 km

1:25,000 at A4

N

Data sources

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Figure 12 - 1 Impacts requiring offsets and impacts not requiring offsets

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Legend

- Assessment area
- Development site
- 200m waterbody buffer
- Species impact (Southern Myotis and Striped Legless Lizard)
- Road
- Waterway
- Waterbody

PCT impacts

- Offset required
- No offset required

0 0.5 1 km

1:25,000 at A4

N

Data sources

Jacobs 2021
AGL 2020
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Figure 12 - 1 Impacts requiring offsets and impacts not requiring offsets

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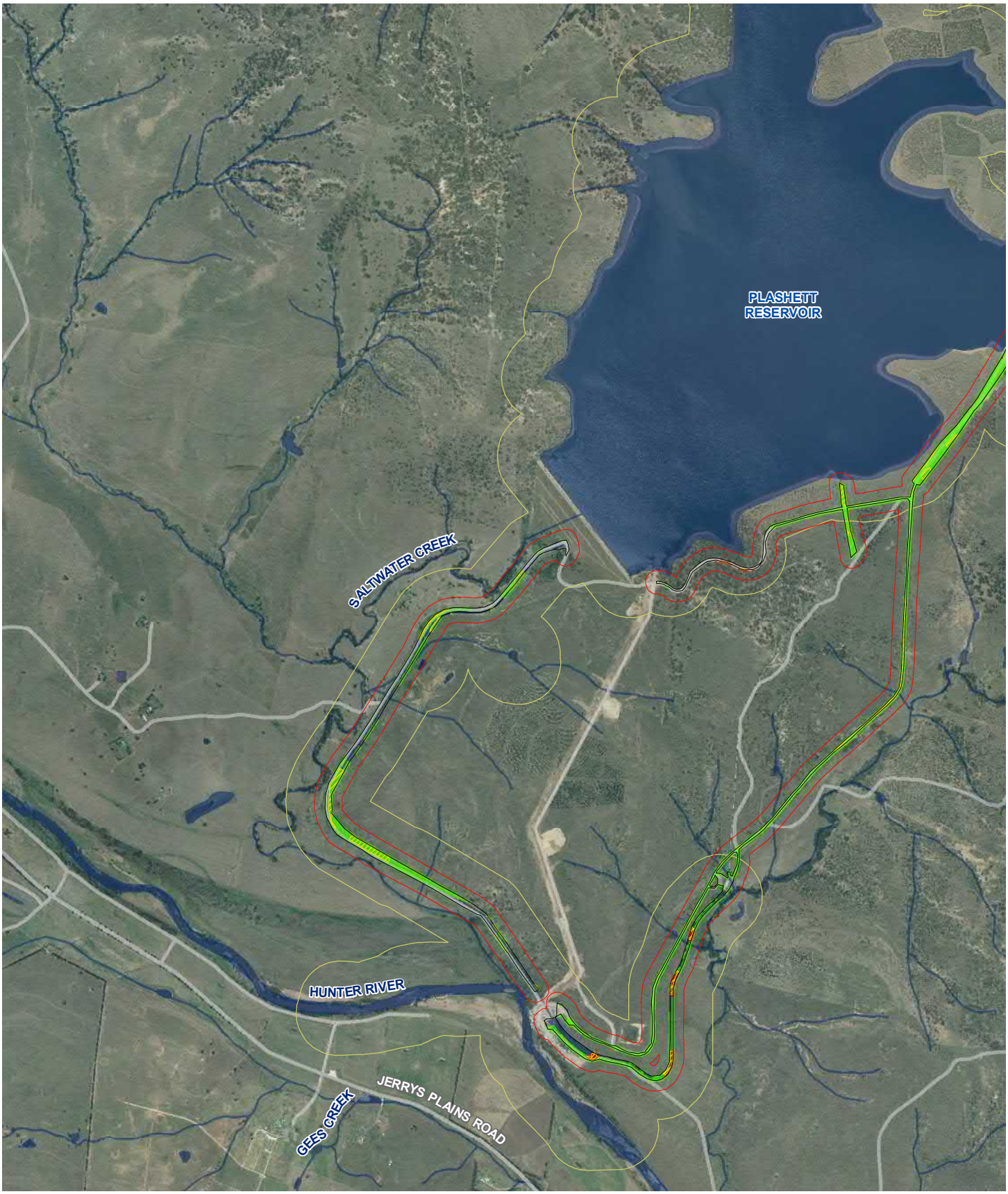

Legend

- Assessment area
- Development site
- 200m waterbody buffer
- Species impact (Southern Myotis and Striped Legless Lizard)
- Road
- Waterway
- Waterbody

PCT impacts

- Offset required
- No offset required

0 0.5 1 km

1:25,000 at A4

N

Data sources

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Figure 12 - 1 Impacts requiring offsets and impacts not requiring offsets

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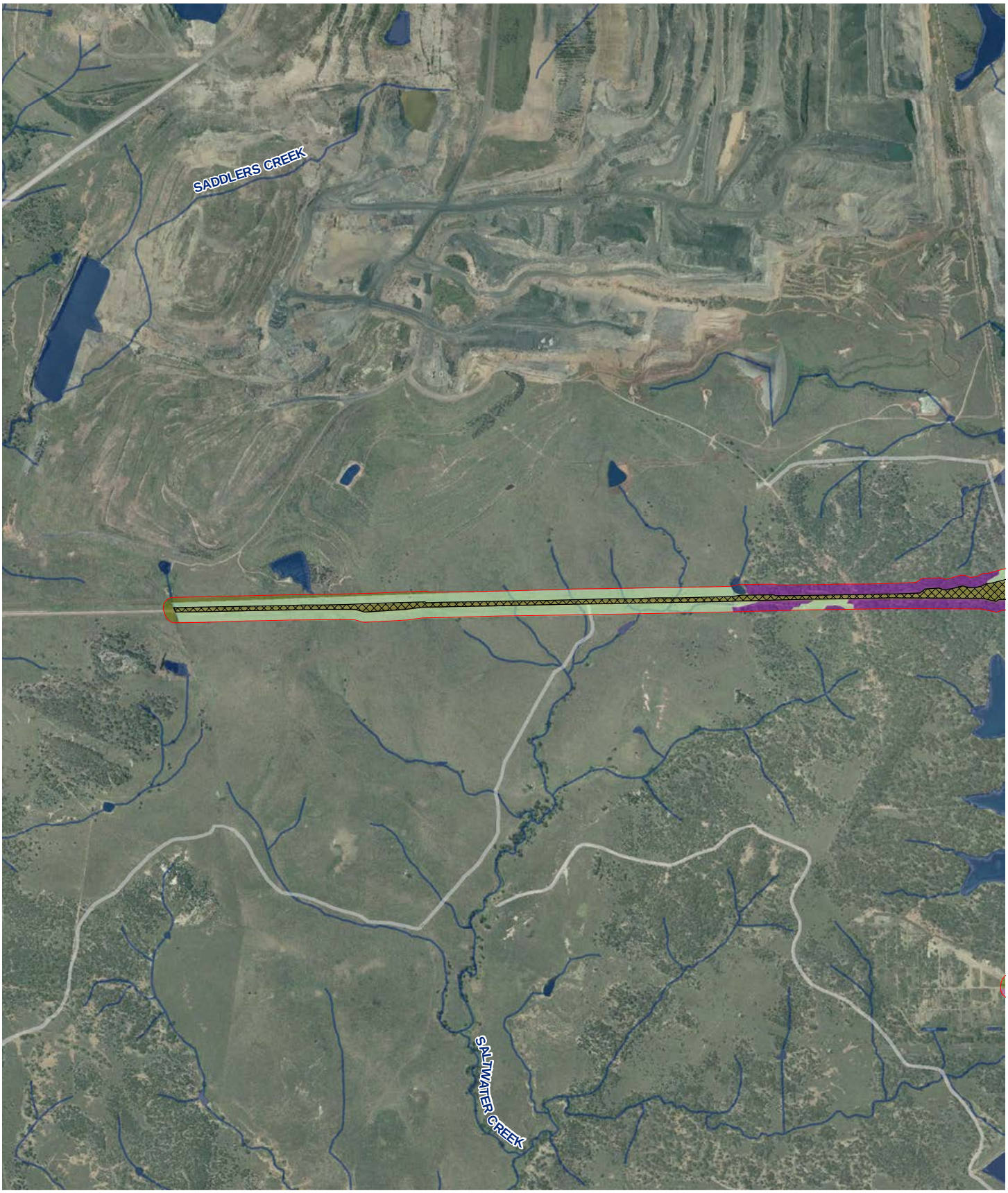

Legend

- Assessment area
- Development site
- Impact areas not requiring assessment
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

Data sources

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GDA94 MGA56

Figure 12 - 2 Impact areas not requiring assessment

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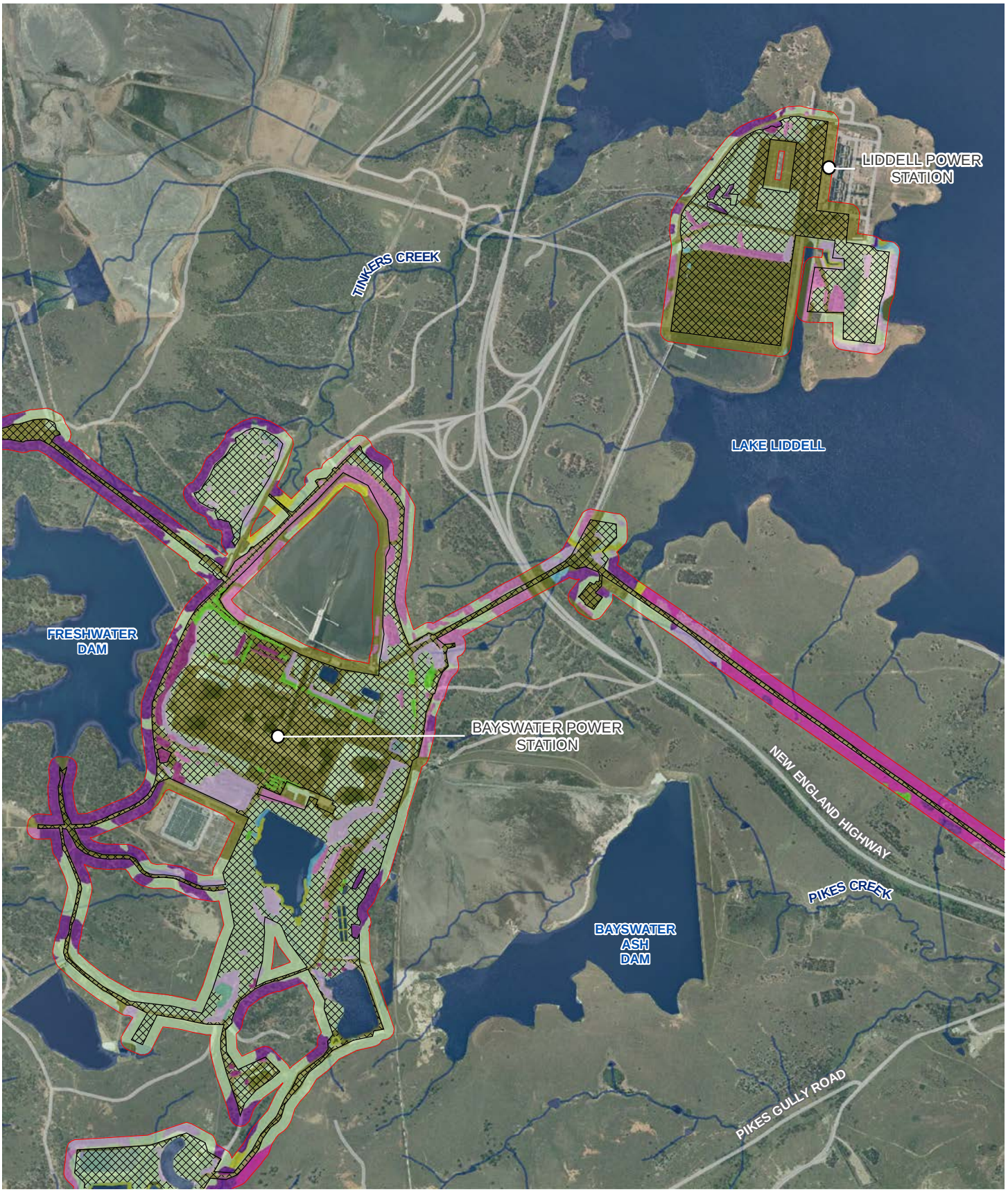

Legend

- Assessment area
- Development site
- Impact areas not requiring assessment
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

Data sources

Jacobs 2021
AGL 2020
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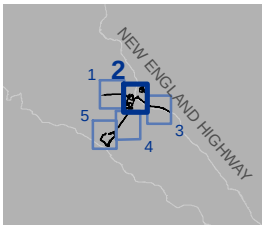

Figure 12 - 2 Impact areas not requiring assessment

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Created by : SR | QA by : NT

Legend

- Assessment area
- Development site
- Impact areas not requiring assessment
- Road
- Railway
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

N

1:25,000 at A4

Data sources

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Figure 12 - 2 Impact areas not requiring assessment

Date: 24/06/2021 Path: J:\04_Eastern\IS334000\22_Spatial\GIS\Directory\Templates\Figures\EIS\Ecology\BDAR\IS334000_BDAR_F015_ImpactAssessment_r1v3.mxd
Created by : SR | QA by : NT

Legend

- Assessment area
- Development site
- Impact areas not requiring assessment
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

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Data sources

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Figure 12 - 2 Impact areas not requiring assessment

Date: 24/06/2021 Path: J:\04_Eastern\IS334000\22_Spatial\GIS\Directory\Templates\Figures\EIS\Ecology\BDAR\IS334000_BDAR_F015_ImpactAssessment_r1v3.mxd
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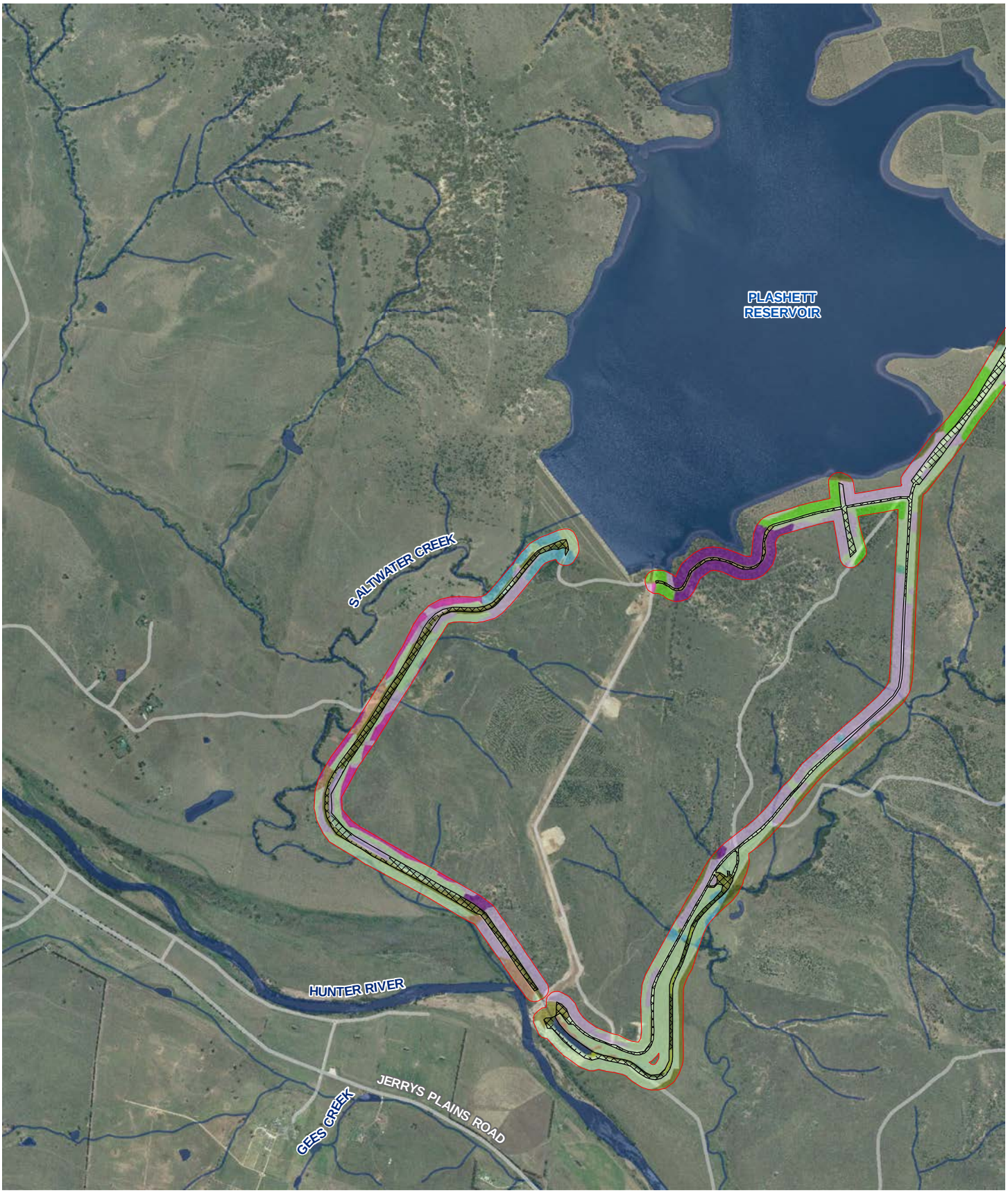

Legend

- Assessment area
- Development site
- Impact areas not requiring assessment
- Road
- Waterway
- Waterbody

Plant community type (PCT) and condition

- PCT 485 River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion)
- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

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Data sources

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Figure 12 - 2 Impact areas not requiring assessment

Date: 24/06/2021 Path: J:\04_Eastern\IS334000\22_Spatial\GIS\Directory\Templates\Figures\EIS\Ecology\BDAR\IS334000_BDAR_F015_ImpactAssessment_r1v3.mxd
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13. Biodiversity credit requirements

A summary of the biodiversity credit requirements for the Project are provided below in **Table 13.1** and **Table 13.2**. The credit report is provided in **Appendix H**.

Table 13.1 Ecosystem credits required by vegetation zone

Veg Zone	PCT	TEC	Credits
1	1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter – Moderate	Yes	38
3	1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter – Rehabilitation	Yes	186
4	1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter – Native Grassland	No	22
5	1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley – Moderate_Good	No	7
6	1692 Bull Oak grassy woodland of the central Hunter Valley -Moderate	No	17
7	1071 *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin - Moderate	No	82
Total			**352**

Table 13.2 Species credits required for Striped Legless Lizard

Species	Credits
Delma impar (Striped Legless Lizard)	
1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter – Moderate	28
1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter – Regrowth	81
1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter – Rehabilitation	139
1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter – Native Grassland	16
1692 Bull Oak grassy woodland of the central Hunter Valley -Moderate	15
Total	**279**

Table 13.3 Species credits required for Southern Myotis

Species	Credits
Myotis macropus (Southern Myotis)	
1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter – Moderate	16
1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter – Rehabilitation	91
1692 Bull Oak grassy woodland of the central Hunter Valley -Moderate	7
1071 *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin - Moderate	82
Total	**196**

14. Biodiversity Offset Strategy

Given the various components of the Project are expected to be undertaken at different times, the credit retirement for biodiversity credits is likely to occur in a staged manner. Vegetation clearing for each part of the Project is not likely to occur immediately, therefore a staged approach is considered favourable. This approach could also allow for vegetation retainment during detailed design of the various Project components and elements.

A Project timeline would be prepared prior to the commencement of works. This would schedule the required biodiversity credits for each stage (based on areas of impacts to each vegetation zone). Retirement of biodiversity credits would occur prior to the commencement of each stage. This plan will be set out in a separate document to this BDAR and would need to be approved by DPIE and any other decision making Agency prior to commencement of any disturbance works.

The Project would be constructed in stages. AGLM are likely to use a combination of options to retire biodiversity credits during each stage of the Project as follows:

- Payment to the Biodiversity Conservation Fund (the Fund) managed by the Biodiversity Conservation Trust (BCT)
- Purchase of credits from the open market, with consideration of applying the 'Like for Like' Variation Rules, where required
- Establishment of a Biodiversity Stewardship Site to generate credits to use for offsetting.

Impacts to biodiversity would be reduced where possible during each stage of the Project.

Total Offsets per credit type have been calculated for the potential clearing of native vegetation and a credit requirement has been calculated using the BAM-C. Offsets were also identified as being required for the Southern Myotis and SSL. The total number of credits to be retired for each stage of the development have been divided on a pro rata basis on a credit / ha (of impact) calculation as shown in **Table 14.1**. AGLM has further confirmed that much of the development site is highly unlikely to be impacted. Areas unlikely to be impacted are identified in **Figure 12-1** and credits within these areas are calculated as presented in brackets in **Table 14.1**. The detailed design would confirm impacts requiring credits to be retired and AGLM would retire these credits prior to commencing each stage.

Table 14.1 Credit requirements for each stage of Project

Stage of Development	PCT 1691 Moderate Credits	PCT 1691 Rehabilitation Credits	PCT 1691 Native Grassland Credits	PCT 1731 Moderate_ Good Credits	PCT 1692 Moderate_ Good Credits	PCT 1071 Moderate Credits	Southern Myotis credits	Striped Legless Lizard credits
Battery	-	57 (57)	-	1 (1)	-	-	37 (37)	32 (32)
Decoupling	2	3 (3)	-	-	-	-	2 (2)	4 (4)
BAW	36 (17.5)	126 (71.5)	24 (0)	6 (0)	17 (1.3)	82(0)	157 (32.9)	243 (61)
Total credits	**38**	**186**	**24**	**7**	**17**	**82**	**196**	**279**

More native vegetation is likely to be retained during later design or prior to construction, and to accommodate for this an amount of credits are grouped as 'unlikely' (ie. it is unlikely that these credits will be required to be

offset). The BAM (and BAM-C) does not allow for segregation of credits like this and therefore 'unlikely' credits are calculated on a proportionate basis guided by ha of PCTs to be affected by clearing.

15. Conclusions

The development site is located within a highly disturbed landscape that does not possess large expanses of intact native vegetation and generally has a low ecological value. As most of the development site is in pre-existing developed areas, or areas which were previously cleared for grazing, direct impacts to terrestrial biodiversity has been largely avoided and/or minimised. The limited amount of native vegetation (mostly rehabilitation or regrowth) that would be disturbed is of poor to moderate quality and threatened species habitats are limited. No 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 would be affected. Importantly, the areas proposed for clearing would be refined during detailed design and reviewed as part of the pre-clearing process.

The worst case total direct impacts to biodiversity values that would occur as a result of the development construction / decoupling and maintenance may include up to 42.3 ha of native vegetation, which includes the following PCTs:

- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Moderate Condition) 2.3 ha
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Regrowth) – 21.6 ha
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Rehabilitation) – 11.4 ha
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Native Grass) – 2 ha
- PCT 1731 Swamp Oak – Weeping Grass grassy riparian forest of the Hunter Valley (Moderate-good condition) – 0.9 ha
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley (Moderate-good condition) – 1.2 ha
- PCT 1071 *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion (Moderate condition) – 3 ha.

One TEC listed under the BC Act will be impacted by the development: Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions (Endangered) – 13.7 ha comprising the combined extent of PCT 1691 (Moderate Condition) and PCT 1691 (Rehabilitation) noted above.

One TEC listed under the EPBC Act was found to occur as a single patch in the western edge of the BAW area. This patch of PCT 1691 is 2.04 ha in area and was found to meet the condition criteria for Central Hunter Eucalypt Forest and Woodland Ecological Community (CE). Despite this patch being located within the development site boundary, it is to be retained as part of the Project. No impacts to EPBC Act listed vegetation communities will occur.

Two species credit species are assumed to be present and may be directly impacted. The Southern Myotis was recorded within 100 m of the development site during the ecological surveys for the WOAOW Project in December 2019 (Kleinfelder 2020). The Southern Myotis species polygon for the WOAOW Project BDAR intercepts the development site and given that the Southern Myotis is highly mobile and capable of dispersing between habitat patches, it is highly likely that this species also uses the various freshwater ponds or dams within the wider development site during foraging activity. The extent of impact to Southern Myotis habitat may be as large as 10 ha consisting of part PCT 1691, PCT 1071 and PCT 1692 that exists within 200 m of man-made

waterbodies. Numerous artificial waterbodies (and the adjacent native vegetation) were excluded as foraging habitat for Southern Myotis due to high levels of contamination or salinity (and lack of aquatic prey animals).

The SLL is also assumed to be present within the development site in accordance with paragraph 5.2.4 of the BAM. This species was not recorded within the development site although due to a condensed timeframe of the assessment the duration of surveys (installation of tile arrays) did not meet the requirements of the Survey Guidelines for Australia's Threatened Reptiles (Department of the Environment Water Heritage and the Arts, 2011b), (relied upon also by NSW DPIE). This species was recorded during surveys of adjacent lands for the WAOAW project (by Kleinfelder, 2020). The location of the record is approximately 800 m from the development site, in a large patch (approximately 40 ha) of PCT 1692 Bull Oak Grassy Woodland – (Moderate-Good), (Kleinfelder, 2020). The extent of impacts to potential SLL habitat within the development site may be up to 38.5 ha of native vegetation including PCT 1691 and PCT 1692 (mostly regrowth and rehabilitation).

Targeted surveys for the GGBF did not identify this species around the Bayswater Sewage treatment ponds (previous recorder location of GGBF) or in any other freshwater dams. Despite numerous areas of suitable habitat for the existence of this species, their absence from the survey, very old local records, and there being no known populations close to the development site, the GGBF is unlikely to be impacted and species offsets are not required.

No significant impacts to threatened species listed under the EPBC Act will occur. A Referral has been made under the EPBC Act (EPBC 2020 8844) and identifies that the Project is unlikely to have a significant impact on MNES and is not considered a controlled action. A decision notice under Section 75 of the EPBC Act confirming the Project is not a controlled action was issued by the Commonwealth Department of Agriculture, Water and the Environment (**DAWE**) on 8 January 2021.

Considering the highly disturbed nature of the landscape within the development site, there are not expected to be any indirect impacts that will adversely affect areas of vegetation that will be retained. It is unlikely that indirect impacts to surrounding aquatic habitats from erosion and contaminated run-off would be exacerbated during the Project construction and operation (given the existing contamination from the Power Stations already). However, the implementation of standard mitigation measures (i.e. sediment control, spill control) would be implemented to control sediment and pollutants during the proposed works.

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 development. Mitigation and management measures that would be implemented during the development would be outlined in a Flora and Fauna Management Plan (refer to **Appendix E** (Construction Environmental Management Framework) of the Environmental Impact Statement).

Offsets have been calculated for the potential clearing of native vegetation and a credit requirement has been calculated using the BAM-C. Offsets were also identified as being required for the loss of potential habitat for Southern Myotis and SLL.

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Appendix A. Habitat assessment and likelihood of occurrence assessment for threatened species

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

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
Acacia pendula – Endangered Population	Acacia pendula population in the Hunter catchment	-	EP	The species occurs on the western slopes, western plains and far western plains of NSW, and south into Victoria and north into Queensland. This Hunter population is known to occur naturally as far east as Warkworth and extends northwest to Muswellbrook and to the west of Muswellbrook at Wybong. Only recorded to date at 6 locations: Jerrys Plains, Edderton, Wybong, Appletree Creek, Warkworth and Appletree Flat. These locations occur within the Muswellbrook and Singleton Local Government Areas, with the population potentially also occurring within the Mid-Western Regional and Upper Hunter LGA's. The stand at Jerrys Plains is part of the community known as "Weeping Myall - Coobah - Scrub Wilga Shrubland of the Hunter Valley". This is listed under Commonwealth legislation as a "Critically Endangered Ecological Community". Within the Hunter catchment the species typically occurs on heavy soils, sometimes on the margins of small floodplains, but also in more undulating locations.	BioNet – 462, BAM-C	No habitat constraints. Only occurs within Hunter River Catchment.	Low (Not recorded in development site and Assessment area)
Allocasuarina glareicola	-	E	E	Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool. Grows in Castlereagh woodland on lateritic soil. Found in open woodland with *Eucalyptus parramattensis, Eucalyptus fibrosa, Angophora bakeri, Eucalyptus sclerophylla* and *Melaleuca decora*. Common associated understorey species include *Melaleuca nodosa, Hakea dactyloides, Hakea sericea, Dillwynia tenuifolia, Micromyrtus minutiflora, Acacia elongata, Acacia brownei, Themeda australis* and *Xanthorrhoea minor*.	Kleinfelder (2020)	None	Low (Not recorded in development site and Assessment area)

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
Asperula asthenes	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 / Forster (including Myall Lakes NP, New England NP, Wallingat NP and Darawnk NR). Occurs in damp sites, often along riverbanks.	BioNet – 1, PMST, BAM-C, Kleinfelder (2020)	None	Low (Not recorded in development site and Assessment area)
Commersonia procumbens	-	V	V	Endemic to NSW, mainly confined to the Dubbo-Mendooran-Gilgandra region, but also in the Pilliga and Nymagee areas. Recent collections made from the Upper Hunter region, and additional populations found in Goonoo SCA in response to the 2007 fires. The species is often found as a pioneer species of disturbed habitats. It has been recorded colonising disturbed areas such as roadsides, the edges of quarries and gravel stockpiles and a recently cleared easement under power lines.	PMST, Kleinfelder (2020)	None	Low (Not recorded in development site and Assessment area)
Cryptostylis hunteriana	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. It is known historically from a number of localities on the NSW south coast and has been observed in recent years at many sites between Batemans Bay and Nowra (although it is uncommon at all sites). Also recorded at Munmorah State Conservation Area, Nelson Bay, Wyee, Washpool National Park, Nowendoc State Forest, Ku-Ring-Gai Chase National Park and Ben Boyd National Park. 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 (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*).	Kleinfelder (2020)	None	Low (Not recorded in development site and Assessment area)
Cymbidium canaliculatum –	Cymbidium canaliculatum	-	EP	In NSW the species is restricted to the north-eastern quarter of the State, occurring chiefly in inland districts west to New Angledool	BioNet – 36, BAM-	Epiphytes - no	Low

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
Endangered Population	population in the Hunter Catchment			and Walgett on the north western plains and north of the Hunter River, through the north western slopes, northern tablelands and north coast into south-eastern Queensland. The Hunter population is known to occur naturally as far south as Weston and Pokolbin in the Lower Hunter, which represents its south-eastern geographic limit, but appears to be more centred in the Upper Hunter, predominantly north of Singleton. In this area it is chiefly known from an area bounded by Ravensworth, Muswellbrook, Denman and Sandy Hollow, but extends northwards to the Aberdeen – Scone – Wingen districts. 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. It usually occurs singly or as a single clump, which can form large colonies on trees, between 2 and 6 m from the ground.	C, Kleinfelder (2020)	Epiphytic in a range of eucalypts and Angophora|Fallen/standing dead timber including logs - yes Cut stumps or logs on ground – no Only occurs within Hunter catchment as defined by Australia's River Basins (Geoscience Australia 1997)).	(Not recorded in development site and Assessment area)
Cynanchum elegans	White-flowered Wax Plant	E	E	Restricted to eastern NSW where it is distributed from Brunswick Heads on the north coast to Gerroa in the Illawarra region. The species has been recorded as far west as Merriwa in the upper Hunter River valley. The White-flowered Wax Plant usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree *Leptospermum laevigatum* – Coastal Banksia *Banksia integrifolia* subsp. *integrifolia* coastal scrub; Forest Red Gum *Eucalyptus tereticornis* aligned open forest and woodland; Spotted Gum *Corymbia maculata* aligned open forest and woodland; and Bracelet Honeymyrtle *Melaleuca armillaris* scrub to open scrub.	PMST, Kleinfelder (2020)	None	Unlikely Suitable habitat absent from development site (Not recorded in development site and Assessment area)
Dichanthium setosum	Bluegrass	V	V	Bluegrass occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW, extending to northern Queensland. It occurs widely on private property, including in the Inverell, Guyra, Armidale and Glen Innes	PMST, Kleinfelder (2020)	None	Unlikely

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				areas. Associated with heavy basaltic black soils and red-brown loams with clay subsoil. Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. (Often collected from disturbed open grassy woodlands on the northern tablelands, where the habitat has been variously grazed, nutrient-enriched and water-enriched). It is open to question whether the species tolerates or is promoted by a certain amount of disturbance, or whether this is indicative of the threatening processes behind its depleted habitat.			Suitable habitat absent from development site (Not recorded in the development site and Assessment area)
Diuris tricolor	Pine Donkey Orchid	-	V	Sporadically distributed on the western slopes of NSW, extending from south of Narrandera all the way to the north of NSW. Localities in the south include Red Hill north of Narrandera, Coolamon, and several sites west of Wagga Wagga. Condobolin-Nymagee road, Wattamondara towards Cowra, Eugowra, Girilambone, Dubbo and Cooyal, in the Central West. Pilliga SCA, Pilliga National Park and Bibblewindi State Forest in the north (and extending into Queensland) and Muswellbrook in the east. Disturbance regimes are not known, although the species is usually recorded from disturbed habitats. The Pine Donkey Orchid grows in sclerophyll forest among grass, often with native Cypress Pine (*Callitris* spp.). It is found in sandy soils, either on flats or small rises. Also recorded from a red earth soil in a Bimble Box community in western NSW.	BioNet – 353, BAM-C, Kleinfelder (2020)	None	Unlikely Suitable habitat absent from development site (Not recorded in development site and Assessment area)
Diuris tricolor – Endangered Population	Pine Donkey Orchid population in the Muswellbrook local government area	-	EP	The population of *Diuris tricolor* in the Muswellbrook LGA, in the upper Hunter Valley, comprises a number of occurrences, ranging from a few scattered individuals to a few thousand plants. The area of occupancy of the population is less than 50 km^2. Therefore, the geographic distribution of the population is estimated to be highly restricted. The population of *Diuris tricolor* in the Muswellbrook LGA is at the eastern limit of the geographic range of the species	BioNet – 353	None	Unlikely Suitable habitat absent from development site

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				and all other populations of the species are located west of the Great Dividing Range. The distance of the Muswellbrook LGA population to the nearest population of the species to the west is about 100 km. Therefore, the population in the Muswellbrook LGA is disjunct and at the limit of its geographic range. Found in sclerophyll woodland and derived grassland on flats or small rises, on a range of substrates including sandy or loamy soils.			(Not recorded in development site and Assessment area)
Eucalyptus camaldulensis – Endangered Population	Eucalyptus camaldulensis population in the Hunter catchment	-	EP	The Hunter population occurs from the west at Bylong, south of Merriwa, to the east at Hinton, on the bank of the Hunter River, in the Port Stephens local government area. It has been recorded in the local government areas of Lithgow, Maitland, Mid-Western Regional, Muswellbrook, Port Stephens, Singleton and Upper Hunter. May occur with *Eucalyptus tereticornis, Eucalyptus melliodora, Casuarina cunninghamiana* subsp. *cunninghamiana* and *Angophora floribunda.* Most of the occurrences are on private land and there are no known occurrences in conservation reserves.	BioNet – 773, Kleinfelder (2020)	None	Unlikely Suitable habitat absent from development site (Not recorded in development site and Assessment area)
Eucalyptus glaucina	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.	BioNet – 16, PMST, BAM-C, Kleinfelder (2020)	None	Two trees are present within 50 m buffer of development site. Not recorded within development site.
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range. Found largely on private property and roadsides, and occasionally in conservation reserves. Planted as urban trees, windbreaks and corridors. Typically grows in dry grassy woodland, on shallow soils of slopes	BioNet – 2, Kleinfelder (2020)	None	Unlikely Planted specimens recorded approx1 km west of development site.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock.			Not recorded in development site and Assessment area.
Euphrasia arguta	-	CE	CE	Euphrasia arguta was rediscovered in the Nundle area of the NSW north western slopes and tablelands in 2008. Prior to this, it had not been collected for 100 years. Historically, Euphrasia arguta has only been recorded from relatively few places within an area extending from Sydney to Bathurst and north to Walcha. The Royal Botanic Gardens Specimen Register records an additional location reported and vouchered in 2002 from near the Hastings River; and Euphrasia arguta was also recorded from the Barrington Tops in 2012. 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, Kleinfelder (2020)	None	Unlikely Suitable habitat absent from development site (Not recorded in development site and Assessment area)
Homoranthus darwinioides	-	V	V	Rare in the central tablelands and western slopes of NSW, occurring from Putty to the Dubbo district. It is found west of Muswellbrook between Merriwa and Bylong, and north of Muswellbrook to Goonoo SCA. The species has been collected from Lee's Pinch, but not relocated at its original locality north of Mt Coricudgy above the headwaters of Widden Brook. Grows in in various woodland habitats with shrubby understoreys, usually in gravely sandy soils. Landforms the species has been recorded growing on include flat sunny ridge tops with scrubby woodland, sloping ridges, gentle south-facing slopes, and a slight depression on a roadside with loamy sand.	Kleinfelder (2020)	None	Unlikely Suitable habitat absent from development site (Not recorded in development site and Assessment area)

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
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. Associated with wetland species e.g. *Triglochin procerum*.	BAM-C	Riparian areas/drainage lines, water ponding, man-made dams and drainage channels up to 1 m deep - yes Semi-permanent/ephemeral wet areas - yes Swamps - shallow swamps up to 1 m deep - yes Waterbodies - shallow waterbodies up to 1 m deep - yes No geographic limitations.	Low Potential habitat exists in development site. Not recorded in development site and Assessment area.
Melaleuca biconvexa	Biconvex Paperbark	V	V	Biconvex Paperbark is only found in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. Biconvex Paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	BAM-C	None	Low Potential habitat largely absent from development site. Not recorded in development site and Assessment area.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
Olearia cordata	-	V	V	A NSW endemic with a scattered distribution generally restricted to the south-western Hunter Plateau, eastern Colo Plateau, and the far north-west of the Hornsby Plateau near Wisemans Ferry east of Maroota. Most known populations occur within conservation reserves (Wollemi National Park, Yengo National Park and Wisemans Ferry Historic Site). Grows in dry open sclerophyll forest and open shrubland, on sandstone ridges.	Kleinfelder (2020)	None	Unlikely Suitable habitat absent from development site (Not recorded in development site and Assessment area)
Ozothamnus tesselatus	-	V	V	Restricted to a few locations in an east-west zone south of Bunnan and between west Bylong and east Ravensworth. Grows in eucalypt woodland.	BioNet – 1, Kleinfelder (2020)	None	Low Potential habitat exists in development site. Not recorded in development site and Assessment area.
Persicaria elatior	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). The species also occurs in Queensland. This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	BAM-C	Semi-permanent/ephemeral wet areas or within 50 m - yes Swamps or within 50 m - yes Waterbodies - including Wetlands, or within 50 m – yes	Low Potential habitat exists in development site. Not recorded in development site and Assessment area.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
						No geographic limitations.	
Pomaderris brunnea	Brown Pomaderris	V	E	Brown Pomaderris is found in a very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It also occurs near Walcha on the New England tablelands and in far eastern Gippsland in Victoria. Brown Pomaderris grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines.	Kleinfelder (2020)	None	Low Potential habitat exists in development site. Not recorded in development site and Assessment area.
Prasophyllum petilum	Tarengo Leek Orchid	E	E	Natural populations are known from a total of five sites in NSW. These are near Boorowa, Queanbeyan area, Ilford, Delegate and a newly recognised population c.10 km west of Muswellbrook. It also occurs at Hall in the Australian Capital Territory. This species has also been recorded at Bowning Cemetery where it was experimentally introduced, though it is not known whether this population has persisted. Highly colonial, with very large numbers present and very conspicuous at the Boorowa site, but cryptic at the Queanbeyan, Ilford and Delegate sites where low numbers are recorded. The population near Muswellbrook is also small.	BioNet – 1	None	Low development site lacks suitable habitat. Not recorded in development site and Assessment area.
Prasophyllum sp. Wybong (C.Phelps ORG 5269)	-	CE	-	Endemic to NSW, it is known from near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell, Tenterfield, Currabubula and the Pilliga area. Most populations are small, although the Wybong population contains by far the largest number of individuals. Known to occur in open eucalypt woodland and grassland.	PMST, Kleinfelder (2020)	None	Low development site lacks suitable habitat. Not recorded in development site and Assessment area.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
Prostanthera cineolifera	Singleton Mint Bush	V	V	Restricted to only a few localities near Scone, Cessnock and St Albans. Grows in open woodlands on exposed sandstone ridges. Usually found in association with shallow or skeletal sands.	Kleinfelder (2020)	None	Low development site lacks suitable habitat. Not recorded in development site and Assessment area.
Prostanthera cryptandroides subsp. cryptandroides	Wollemi Mint-bush	V	V	Distributed between Lithgow and Sandy Hollow on the NSW central west slopes, central tablelands and western parts of the central coast botanical regions. Populations occur in Wollemi National Park and Gardens of Stone National Park. A voucher specimen exists for the far northern tablelands near Tenterfield; however, this may represent subsp. euphrasioides. At Glen Davis, occurs in open forest dominated by *Eucalyptus fibrosa*. Other eucalypt species may be present as sub-dominants. In the Denman-Gungal and Widden-Baerami Valley areas, occurs on rocky ridgelines on Narrabeen Group Sandstones in association with a range of communities. Associated communities include: Narrabeen Rocky Heath, Narrabeen Acacia Woodland, Narrabeen Exposed Woodland; Open Heath of *Calytrix tetragona, Leptospermum parviflorum* and *Isopogon dawsonii*; and Open Scrubland of *Eucalyptus dwyeri, Baeckea densifolia, Dillwynia floribunda, Aotus ericoides* and *Hemigenia cunefolia*.	Kleinfelder (2020)	None	Low development site lacks suitable habitat. Not recorded in development site and Assessment area.
Pterostylis chaetophora	-	-	V	Recorded in Queensland and NSW. In NSW it is currently known from 18 scattered locations in a relatively small area between Taree and Kurri Kurri, extending to the south-east towards Tea Gardens and west into the Upper Hunter, with additional records near Denman and Wingen. There are also isolated records from the Sydney region. The species occurs in two conservation reserves, Columbey National Park and Wingen Maid Nature Reserve. The preferred habitat is seasonally moist, dry sclerophyll forest with a grass and shrub understorey. The most commonly observed	BAM-C	None	Low Potentially suitable habitat. Not recorded in development site and Assessment area.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				habitat is vegetation characterised by grassy open forests or derived native grasslands of *Eucalyptus amplifolia* and *Eucalyptus moluccana* on gentle flats, or that are dominated by *Corymbia maculata* with any of *Eucalyptus fibrosa, Eucalyptus sideroploia* or *Eucalyptus crebra*.			
Pterostylis gibbosa	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). All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. In the Hunter region, the species grows in open woodland dominated by Narrow-leaved Ironbark *E. crebra*, Forest Red Gum *E. tereticornis* and Black Cypress Pine *Callitris endlicheri*.	PMST, Kleinfelder (2020)	None	Low Potentially suitable habitat. Not recorded in development site and Assessment area.
Rhodamnia rubescens	Scrub Turpentine	-	CE	Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of *R. rubescens* typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000-1,600 mm. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	BioNet – 1, Kleinfelder (2020)	None	Low development site lacks suitable habitat. Not recorded in development site and Assessment area.
Thesium australe	Austral Toadflax	V	V	Austral Toadflax is 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. Although originally described from material collected in the SW Sydney area, populations have not been seen in a long time. It may persist in some areas in the broader region. Occurs in grassland on coastal headlands or grassland and grassy	PMST, Kleinfelder (2020)	None	Low Marginal suitable habitat.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				woodland away from the coast. Often found in association with Kangaroo Grass (*Themeda australis*).			Not recorded in development site and Assessment area.
Wollemia nobilis	Wollemi Pine	CE	CE	Restricted to remote canyons in the Wollemi National Park, north-west of Sydney. Occurs in warm temperate rainforest and rain forest margins in remote sandstone canyons.	Kleinfelder (2020)	None	None
Zannichellia palustris	-	-	E	In NSW, known from the lower Hunter and in Sydney Olympic Park. Grows in fresh or slightly saline stationary or slowly flowing water.	BAM-C	Waterbodies - yes Freshwater or slightly brackish estuarine areas (10%) – yes No geographic limitations.	Low Marginal suitable habitat. Not recorded in development site and Assessment area.

Table A.2: Habitat assessment for threatened animal species

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
Birds							
Anseranas semipalmata	Magpie Goose	-	V	The Magpie Goose is still relatively common in the Australian northern tropics, though had disappeared from south-east Australia by 1920 due to drainage and overgrazing of reed swamps used for breeding. Since the 1980s there have been an increasing number of records in central and northern NSW. Vagrants can follow food sources to south-eastern NSW. 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.	BioNet – 1, BAM-C, Kleinfelder (2020)	No habitat constraints. Only occurs east of Cessnock.	Low Marginal habitat present in ponds and dams.
Anthochaera Phrygia	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 (*Casuarina* spp.) 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.	BioNet – 3, PMST, BAM-C, Kleinfelder (2020)	As per mapped areas. No geographic limitations.	Moderate Marginal foraging habitat present. Has been recorded within the locality.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
Artamus cyanopterus cyanopterus	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.	BioNet – 49, BAM-C, Kleinfelder (2020)	None	Moderate Marginal foraging habitat present.
Botaurus poiciloptilus	Australasian Bittern	E	E	Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.).	BAM-C, Kleinfelder (2020)	Waterbodies - yes Brackish or freshwater wetlands - yes Only occurs east of Cessnock.	Moderate Marginal habitat present in larger freshwater dams where tall aquatic vegetation is present.
Burhinus grallarius	Bush Stone-curlew	-	E	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber.	BAM-C	Fallen/standing dead timber including logs – no No geographic limitations.	Low Low-quality habitat present. Lack of fallen timber in development site.
Calidris ferruginea	Curlew Sandpiper	CE, M	E	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	PMST, BAM-C, Kleinfelder (2020)	As per mapped areas (contact DPIE for maps)). No geographic limitations.	Low Low-quality habitat present in waterbodies of the development site.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				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.			
Calyptorhynchus lathami	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. Inland populations feed on a wide range of sheoaks, including *Allocasuarina verticillata, A. diminuta,* and *A. gymnathera*. *Casuarina cristata* is also utilised and may be a critical food source for some populations.	BioNet – 8, BAM-C, Kleinfelder (2020)	Presence of Allocasuarina and casuarina species – yes Hollow bearing trees - no Living or dead tree with hollows greater than 15cm diameter and greater than 5m above ground - no No geographic limitations.	Low Low-quality foraging habitat only.
Callocephalon fimbriatum	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	BAM-C	Hollow bearing trees - no Eucalypt tree species with hollows greater than 9 cm diameter – no No geographic limitations.	Low Low-quality foraging habitat only.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				Summer with nests located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts.			
Calidris tenuirostris	Great Knot	CE, M	V	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 sandflats, including inlets, bays, harbours, estuaries and lagoons.	BAM-C	As per mapped areas (contact DPIE for maps)). Only occurs within 5 km of coast or tidal influenced water bodies.	Low Low-quality foraging habitat only. Site not within 5vkm of intertidal waterbodies.
Chthonicola sagittata	Speckled Warbler	-	V	The Speckled Warbler has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. There has been a decline in population density throughout its range, with the decline exceeding 40% where no vegetation remnants larger than 100ha survive. The Speckled Warbler lives in a wide range of *Eucalyptus* dominated communities that have a grassy understorey, often on rocky ridges or in gullies.	BioNet – 327, BAM-C, Kleinfelder (2020)	None	Moderate Marginal habitat present. Recorded in WAOAW study area.
Circus assimilis	Spotted Harrier	-	V	The Spotted Harrier occurs throughout the Australian mainland, except in densly 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.	BioNet – 35, BAM-C, Kleinfelder (2020)	None	Moderate Marginal foraging habitat present.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
Climacteris picumnus victoriae	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 (*Eucalyptus camaldulensis*) 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.	BioNet – 83, BAM-C, Kleinfelder (2020)	None	Moderate Marginal foraging habitat present.
Daphoenositta chrysoptera	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 decorticating 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.	BioNet – 43, BAM-C, Kleinfelder (2020)	None	Moderate Marginal foraging habitat present.
Ephippiorhynchus asiaticus	Black-necked Stork	-	E	The species *Ephippiorhynchus asiaticus* comprises two subspecies, *E. a. asiaticus* in India and south-east Asia, and *E. a. australis* in Australia and New Guinea. In Australia, Black-necked Storks are widespread in coastal and subcoastal northern and eastern	BioNet – 2, BAM-C, Kleinfelder (2020)	Swamps -shallow, open freshwater or saline wetlands or shallow edges of deeper	Moderate Marginal foraging habitat present.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				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.		wetlands within 300m of these swamps - yes Waterbodies - shallow lakes, lake margins and estuaries within 300m of these waterbodies – yes No geographic limitations.	
Epthianura albifrons	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.	BAM-C	None	Moderate Marginal foraging habitat present. No known records within locality.
Erythrotriorchis radiatus	Red Goshawk	V	CE	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	BioNet – 2, PMST, Kleinfelder (2020)	None	Low No breeding habitat (stick nests) observed. Marginal foraging habitat present. A

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				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.			small number of records exist to the north of Singleton and to the East of Ravensworth.
Falco subniger	Black Falcon	-	V	The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be referable to the Brown Falcon. In New South Wales there is assumed to be a single population that is continuous with a broader continental population, given that falcons are highly mobile, commonly travelling hundreds of kilometres. The Black Falcon is found along tree-lined watercourses and in isolated woodlands, mainly in arid and semi-arid areas.	BioNet – 4.	None	Moderate Marginal foraging habitat present.
Glossopsitta pusilla	Little Lorikeet	-	V	The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year and 'locally nomadic' movements are suspected of breeding pairs. Forages primarily in the canopy of open *Eucalyptus* forest and woodland, yet also finds food in *Angophora*, *Melaleuca* and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity.	BioNet – 56, BAM-C, Kleinfelder (2020)	None	Moderate Marginal foraging habitat present.
Grantiella picta	Painted Honeyeater	V	V	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of birds, and	BioNet – 1, PMST, BAM-C,	Mistletoes present at a density of greater than	Low

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				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 *Amyema*.	Kleinfelder (2020)	five mistletoes per hectare – no No geographic limitations.	Marginal habitat present. Minimal Mistletoe plants in development site. No known records within the locality.
Haliaeetus leucogaster	White-bellied Sea-Eagle	M	V	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. The habitats occupied by the sea-eagle are characterised by the presence of large areas of open water (larger rivers, swamps, lakes, and the sea).	BioNet – 34, PMST, BAM-C, Kleinfelder (2020)	Waterbodies - within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines – yes Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines - no No geographic limitations.	Low Marginal foraging habitat present. May use air space above site when flying along Hunter River.
Hieraaetus morphnoides	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.	BioNet – 20, BAM-C, Kleinfelder (2020)	Nest trees - live (occasionally dead) large old trees within vegetation) – no No geographic limitations.	Moderate Marginal foraging habitat present.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
Hirundapus caudacutus	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.	BioNet – 13, PMST, Kleinfelder (2020)	None	Unlikely Almost exclusively aerial, development site generally lacks suitable habitat. Disturbance from Power Stations likely to deter this species.
Irediparra gallinacea	Comb-crested Jacana	-	V	The Comb-crested Jacana 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	Waterbodies - yes Freshwater wetlands with a good surface cover of floating aquatic vegetation – no No geographic limitations.	Low Low quality foraging habitat present. Floating vegetation scarce.
Ixobrychus flavicollis	Black Bittern	-	V	The Black Bittern has a wide distribution, from southern NSW north to Cape York and along the north coast to the Kimberley region. The species also occurs in the south-west of Western Australia. In NSW, records of the species are scattered along the east coast, with individuals rarely being recorded south of Sydney or inland. Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	BAM-C	Waterbodies - yes Land within 40 m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation – yes	Low Low quality foraging habitat present.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
						No geographic limitations.	
Lathamus discolor	Swift Parrot	CE	E	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. Migrates to the Australian south-east mainland between February and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there is abundant lerp (from sap-sucking bugs) infestations.	BioNet – 9, PMST, BAM-C, Kleinfelder (2020)	As per mapped areas. No geographic limitations.	Moderate Marginal foraging habitat present.
Limicola falcinellus	Broad-billed Sandpiper	-	V, M	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 sandflats and mudflats, harbours, embayments, lagoons, saltmarshes and reefs as feeding and roosting habitat. Occasionally, individuals may be recorded in sewage farms or within shallow freshwater lagoons.	BAM-C	As per mapped areas (contact DPIE for maps)). No geographic limitations.	Low Low quality foraging habitat present.
Limosa limosa	Black-tailed Godwit	-	V, M	The Black-tailed Godwit is 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 recorded at Kooragang Island (Hunter River estuary), with occasional records elsewhere along the coast, and inland. Records in western NSW indicate that a regular inland passage is used by the species, as it may occur around any of the large lakes in the western areas during summer, when the muddy shores are	BAM-C	As per mapped areas (contact DPIE for maps)). No geographic limitations.	Low Low quality foraging habitat present.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				exposed. The species has been recorded within the Murray-Darling Basin, on the western slopes of the Northern Tablelands and in the far north-western corner of the state. Primarily a coastal species. Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. Further inland, it can also be found on mudflats and in water less than 10 cm deep, around muddy lakes and swamps.			
Lophoictinia isura	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 *Eucalyptus longifolia, Corymbia maculata, E. elata,* or *E. smithii*. Individuals appear to occupy large hunting ranges of more than 100 km^2. 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.	BioNet – 2, BAM-C, Kleinfelder (2020)	Nest trees – no No geographic limitations.	Moderate Marginal foraging habitat present in development site. No breeding habitat.
Melanodryas cucullata cucullata	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.	BioNet – 19, BAM-C, Kleinfelder (2020)	None	Moderate Marginal habitat present in development site. Recorded in WAOAW Project area in 2019 (Kleinfelder, 2020)
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	-	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	BioNet – 7, BAM-C,	None	Moderate

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				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 (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis*). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.	Kleinfelder (2020)		Marginal habitat present in development site.
Neophema pulchella	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.	BioNet – 3, BAM-C, Kleinfelder (2020)	None	Moderate Marginal habitat present in development site in edges of Eucalypt patches.
Ninox connivens	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.	BioNet – 2, BAM-C, Kleinfelder (2020)	Hollow bearing trees - no Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground – no No geographic limitations.	Low Marginal foraging habitat present in development site. No breeding habitat.
Ninox strenua	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,	BioNet – 3, BAM-C, Kleinfelder (2020)	Hollow bearing trees - no	Low Marginal foraging habitat present in development site.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				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 comprising species such as Turpentine (*Syncarpia glomulifera)*, Black Sheoak (*Allocasuarina littoralis)*, Blackwood (*Acacia melanoxylon)*, Rough-barked Apple (*Angophora floribunda)*, Cherry Ballart (*Exocarpus cupressiformis*) and a number of Eucalypt species.		Living or dead trees with hollow greater than 20cm diameter – no No geographic limitations.	No breeding habitat.
Numenius madagascariensis	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, Kleinfelder (2020)	None	Low Only low-quality foraging habitat present in development site.
Oxyura australis	Blue-billed Duck	-	V	The Blue-billed Duck is 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. The Blue-billed Duck 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, although prefers to dive if approached.	BioNet – 4, BAM-C, Kleinfelder (2020)	None	Moderate Suitable habitat in large dams in development site.
Pandion cristatus	Eastern Osprey	-	V	The Osprey has a global distribution with four subspecies previously recognised throughout its range. However, recent studies have	BioNet – 1, BAM-C,	Presence of stick-nests in living and dead trees	Low

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				identified that there are two species of Osprey - the Western Osprey (*P. halietus*) with three susbpecies occurring in Europe, Asia and the Americas and the Eastern Osprey (*P. cristatus*) occurring between Sulawesi (in Indonesia), Australia and New Caledonia. Eastern Ospreys are found right around the Australian coastline, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. There are a handful of records from inland areas. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes.	Kleinfelder (2020)	(>15m) or artificial structures within 100m of a floodplain for nesting) – no No geographic limitations.	Only low-quality foraging habitat present in development site.
Petroica boodang	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.	BioNet – 20, BAM-C, Kleinfelder (2020)	None	Moderate Marginal foraging habitat present in development site.
Petroica phoenicea	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 sedgelands at high altitudes.	BioNet – 7, BAM-C, Kleinfelder (2020)	None	Moderate Marginal foraging habitat present in development site.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	-	V	The Grey-crowned Babbler has two distinctive subspecies that intergrade to the south of the Gulf of Carpentaria. West of here the subspecies *rubeculus*, formerly considered a separate species (Red-breasted Babbler) is still widespread and common. The eastern subspecies (temporalis occurs from Cape York south through Queensland, NSW and Victoria and formerly to the south east of South Australia. This subspecies also occurs in the Trans-Fly Region in southern New Guinea. 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 south 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. Woodlands on fertile soils in coastal regions.	BioNet – 524, BAM-C, Kleinfelder (2020)	None	Present – observed on site
Ptilinopus magnificus	Wompoo Fruit-Dove	-	V	Occurs along the coast and coastal ranges from the Hunter River in NSW to Cape York Peninsula. It is rare south of Coffs Harbour. Three subspecies are recognised, with the most southerly in NSW and south-eastern Queensland. It used to occur in the Illawarra, though there are no recent records. Occurs in, or near rainforest, low elevation moist eucalypt forest and brush box forests.	BioNet – 1	None	Low No suitable habitat
Rostratula australis	Australian Painted Snipe	E, M	E	Most records are from the south east, particularly the Murray Darling Basin, with scattered records across northern Australia and historical records from around the Perth region in Western Australia. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds.	PMST, BAM-C, Kleinfelder (2020)	None	Unlikely Suitable habitat along edges of larger freshwater dams in development site. No known records within locality.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
Stagonopleura guttata	Diamond Firetail	-	V	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum (*Eucalyptus pauciflora*) Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Nests are globular structures built either in the shrubby understorey, or higher up, especially under hawk's or raven's nests. Birds roost in dense shrubs or in smaller nests built especially for roosting.	BioNet – 28, Kleinfelder (2020)	None	Moderate Marginal foraging habitat present in development site.
Stictonetta naevosa	Freckled Duck	-	V	The Freckled Duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. It breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. The duck is forced to disperse during extensive inland droughts when wetlands in the Murray River basin provide important habitat. The species may also occur as far as coastal NSW and Victoria during such times. 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.	BioNet – 1, BAM-C, Kleinfelder (2020)	None	Moderate Suitable habitat in larger freshwater dams in development site.
Turnix maculosus	Red-backed Button-quail	-	V	In Australia, the Red-backed Button-quail extends discontinuously from the Kimberley region of Western Australia, through the Top End of the Northern Territory and the southern Gulf of Carpentaria, to Cape York Peninsula and eastern Queensland and central-eastern and north-eastern NSW. It is mainly a species of coastal and subcoastal regions. The Red-backed Button-quail is recorded only infrequently in NSW, with most records from the North Coast Bioregion; there are historical records south as far as Sydney and three outlying records from western NSW (a breeding record from	BioNet – 1	None	Low Marginal foraging habitat. Scarce records within locality.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				Finley in 1954; the Macquarie Marshes in 1955; and Coolabah in 2000). Over their Australian range, Red-backed Button-quail inhabit grasslands, open and savannah woodlands with grassy ground layer, pastures and crops of warm temperate areas, typically only in regions subject to annual summer rainfall greater than 400 mm. In NSW, said to occur in grasslands, heath and crops. Said to prefer sites close to water, especially when breeding. The species has been observed associated with the following grasses (in various vegetation formations): speargrass *Heteropogon*, Blady Grass *Imperata cylindrica*, *Triodia, Sorghum*, and Buffel Grass *Cenchrus ciliaris*.			
Tyto longimembris	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.	BioNet – 1, Kleinfelder (2020)	None	Moderate Potential foraging habitat in grass areas. Abundant prey recorded during survey (House mouse & Black Rat). Scarce records within locality.
Tyto novaehollandiae	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. Lives in dry eucalypt forests and woodlands from sea level to 1100 m. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	BioNet – 16, BAM-C, Kleinfelder (2020)	Hollow bearing trees - no Living or dead trees with hollows greater than 20cm diameter – no No geographic limitations.	Low Only low-quality foraging habitat present. No breeding habitat.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
Tyto tenebricosa	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 in very large tree-hollows.	BioNet – 1	None	Low Only low-quality foraging habitat present. No breeding habitat.
Frogs							
Crinia tinnula	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 sedgelands and wet heathlands. They can also be found along drainage lines within other vegetation communities and disturbed areas, and occasionally in swamp sclerophyll forests.	BAM-C	None	Unlikely No suitable habitat present within or adjacent to site.
Heleioporus australiacus	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.	PMST, Kleinfelder (2020)	None	Unlikely No suitable habitat present within or adjacent to site.
Litoria aurea	Green and Golden Bell Frog	V	E	Formerly distributed from the NSW north coast near Brunswick Heads, southwards along the NSW coast to Victoria where it extends into east Gippsland. Records from west to Bathurst, Tumut and the ACT region. 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	BioNet – 8, PMST, BAM-C, Kleinfelder (2020)	Semi-permanent/ephemeral wet areas - yes Within 1km of wet areas - yes	Low Previously recorded within the Bayswater Sewage Treatment Ponds (2003).

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				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. Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas.		Swamps - within 1km of swamp – yes Waterbodies - within 1km of waterbody – yes No geographic limitations.	Not recorded here during recent surveys (Kleinfelder 2019 & 2020 or Jacobs 2020)
Litoria booroolongensis	Booroolong Frog	E	E	Restricted to tablelands and slopes in NSW and north-east Victoria at 200–1300 m above sea level. Occurs along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses.	PMST, Kleinfelder (2020)	None	Unlikely No suitable habitat present within or adjacent to site.
Litoria brevipalmata	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	None	Unlikely Habitat too degraded within site.
Litoria littlejohni	Littlejohn's Tree Frog	V	V	Littlejohn's Tree Frog has a distribution that includes the plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest (90 km north of Sydney) south to Buchan in Victoria. The majority of records are from within the Sydney Basin Bioregion with only scattered records south to the Victorian border and this species has not been recorded in southern NSW within the last decade. Records are isolated and tend to be at high altitude. This species breeds in the upper reaches of permanent streams and in	Kleinfelder (2020)	None	Unlikely No suitable habitat present within or adjacent to site.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				perched swamps. Non-breeding habitat is heath based forests and woodlands where it shelters under leaf litter and low vegetation, and hunts for invertebrate prey either in shrubs or on the ground.			
Uperoleia mahonyi	Mahony's Toadlet	-	E	Mahony's Toadlet is endemic to the mid-north coast of New South Wales (NSW) and to date has been found between Kangy Angy and Seal Rocks. Current observations indicate Mahony's Toadlet 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. Commonly associated with acid paperbark swamps, Mahony's Toadlet also is known to occur in wallum heath, swamp mahogany-paperbark swamp forest, heath shrubland and Sydney red gum woodland. Recent studies suggest intact vegetation adjacent to and within water bodies is an important habitat feature for this species.	BAM-C	None	Unlikely No suitable habitat present within or adjacent to site.
Mamals							
Cercartetus nanus	Eastern Pygmy-possum	-	V	The Eastern Pygmy-possum is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extends from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes. 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.	BAM-C	None	Unlikely Small patches of marginal habitat. Patches are degraded and isolated and lack tree hollows.
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes. Roosts in caves (near	BioNet – 64, PMST, BAM-C, Kleinfelder (2020)	Cliffs - no Within two kilometres of rocky areas containing caves, overhangs,	Unlikely

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. They remain loyal to the same cave over many years. Also, found in well-timbered areas containing gullies.		escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels – no No geographic limitations.	No caves, cliffs or crevices nearby or in locality.
Dasyurus maculatus	Spotted-tailed Quoll	E	V	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.	BioNet – 102, PMST, BAM-C, Kleinfelder (2020)	None	Unlikely Small patches of marginal habitat. Patches are degraded and isolated and lack structure and suitable habitat features (hollow logs, rocks).
Falsistrellus tasmaniensis	Eastern False Pipistrelle	-	V	Prefers moist habitats, with trees taller than 20 m. Generally, this species roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	BioNet – 13, Kleinfelder (2020)	None	Unlikely Small patches of marginal habitat. Patches of Eucalypts are degraded and isolated and lack tree hollows.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	-	V	The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW. Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures.	BioNet – 191, BAM-C, Kleinfelder (2020)	None	Unlikely Small patches of marginal habitat. Patches of Eucalypts are degraded and isolated and lack tree hollows. Man-made structures are in use with high levels of disturbance.
Miniopterus australis	Little Bent-winged Bat	-	V	East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	BioNet – 23, BAM-C, Kleinfelder (2020)	Caves - no 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' - no observation type code 'E nest-roost' - no with numbers of individuals >500 - no	Unlikely Small patches of marginal habitat. Patches of Eucalypts are degraded and isolated and lack tree hollows. Man-made structures are in use with high levels of disturbance.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
						or from the scientific literature – no No geographic limitations.	
Miniopterus orianae oceanensis	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.	BioNet – 183, BAM-C, Kleinfelder (2020)	Caves - no Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records with microhabitat code "IC - in cave" – no observation type code "E nest-roost" – no with numbers of individuals >500 – no No geographic limitations.	Present (foraging). No evidence of roosting or breeding. Small patches of marginal habitat. Patches of Eucalypts are degraded and isolated and lack tree hollows. Man-made structures are in use with high levels of disturbance.
Myotis macropus	Southern Myotis	-	V	Generally, this species 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. Recorded near Bayswater Ash Dam within 100m of development site in December 2019 (Kleinfelder,2020). Suitable habitats exist in	BioNet – 56, BAM-C, Kleinfelder (2020)	Hollow bearing trees - no Within 200 m of riparian zone - yes	Assumed Present Recorded within 100 m of development site.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				development site (including vegetation within 200m of waterbodies)		Bridges, caves or artificial structures within 200 m of riparian zone - yes Waterbodies - this include rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200 m of the site – yes No geographic limitations.	Foraging habitat present.
Nyctophilus corbeni	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 *Allocasuarina leuhmanni* 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.	BioNet – 3, PMST, Kleinfelder (2020)	None	Unlikely Small patches of marginal habitat. Patches of Eucalypts are degraded and isolated and lack tree hollows.
Petauroides volans	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 leaves, 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	PMST, Kleinfelder (2020)	None	Low Small patches of Eucalypts are isolated and lack structural complexity (mostly

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				abundance of tree hollows (at least 4-8 suitable hollows per ha) 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^2 may be required to maintain viable populations.			rehabilitation). No large eucalypts present. No hollow-bearing trees present.
Petaurus norfolcensis	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.	BioNet – 91, Kleinfelder (2020)	None	Moderate Recorded during WAOAW surveys approximately 1 km from development site in good condition forest. Marginal foraging habitat present. No tree hollows within development site. Species not detected during field surveys.
Petrogale penicillata	Brush-tailed Rock-wallaby	V	E	The range of the Brush-tailed Rock-wallaby extends from south-east Queensland to the Grampians in western Victoria, roughly following the line of the Great Dividing Range. However, the distribution of the species across its original range has declined significantly in the west and south and has become more fragmented. In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the	BioNet – 7, PMST, BAM-C, Kleinfelder (2020)	Land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or clifflines – no	Low No suitable rocky habitat present within or adjacent to development site.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				Warrumbungle Ranges being the western limit. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north.		No geographic limitations.	
Phascogale tapoatafa	Brush-tailed Phascogale	-	V	The Brush-tailed Phascogale has a patchy distribution around the coast of Australia. In NSW it is mainly found east of the Great Dividing Range although there are occasional records west of the divide. Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest. Agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater.	BioNet – 110, BAM-C, Kleinfelder (2020)	None	Low Small patches of Eucalypts are isolated and lack structural complexity (mostly rehabilitation). No large eucalypts present. No hollow-bearing trees present. Species not detected during field surveys.
Phascolarctos cinereus	Koala	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.	BioNet – 20, PMST, Kleinfelder (2020)	None	Low Marginal habitat present in isolated Eucalypt patches (with numerous food tree species). No nearby records. Species not detected during field surveys.

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
Planigale maculata	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.	BAM-C	None	Low Small patches of Eucalypts are isolated and lack structural complexity (mostly rehabilitation). No large eucalypts present. No hollow-bearing trees present. Species not detected during field surveys.
Pseudomys novaehollandiae	New Holland Mouse	V	-	The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Genetic evidence indicates that the New Holland Mouse once formed a single continuous population on mainland Australia and the distribution of recent subfossils further suggest that the species has undergone a large range contraction since European settlement. Total population size of mature individuals is now estimated to be less than 10,000 individuals although, given the number of sites from which the species is known to have disappeared between 1999 and 2009, it is likely that the species' distribution is actually smaller than current estimates. Known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes.	PMST, Kleinfelder (2020)	None	Low Small patches of Eucalypts are isolated and lack structural complexity (mostly rehabilitation). Under storey typically dominated by dense exotic grass. Species not

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
							detected during field surveys.
Pteropus poliocephalus	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.	BioNet – 897, PMST, BAM-C, Kleinfelder (2020)	no breeding camps No geographic limitations.	Moderate Suitable foraging habitat present within the site. Has been recorded within the locality. No camps observed onsite or nearby during surveys.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	-	V	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.	BioNet – 26, BAM-C, Kleinfelder (2020)	None	Low Marginal foraging habitat. Patches of Eucalypts are degraded and isolated and lack tree hollows. Likely to be deterred by light, noise and electricity near Power Stations.
Scoteanax rueppellii	Greater Broad-nosed Bat	-	V	The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England	BioNet – 23	None	Present (foraging). No evidence of

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				Tablelands, however, does not occur at altitudes above 500 m. 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.			roosting or breeding. Marginal foraging habitat. Patches of Eucalypts are degraded and isolated and lack tree hollows. Likely to be deterred by light, noise and electricity near Power Stations.
Vespadelus troughtoni	Eastern Cave Bat	-	V	The Eastern Cave Bat is 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. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT. 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. Occasionally found along cliff-lines in wet eucalypt forest and rainforest.	BioNet – 45, Kleinfelder (2020)	None	Low Marginal foraging habitat. No cliffs nearby.
Reptiles							
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	The Pink-tailed Legless Lizard is only known from the Central and Southern Tablelands, and the South Western Slopes. There is a concentration of populations in the Canberra/Queanbeyan Region. Other populations have been recorded near Cooma, Yass, Bathurst, Albury and West Wyalong. This species is also found in the ACT. Inhabits sloping, open woodland areas with predominantly native	BioNet – 2, PMST, BAM-C	Rocky areas or within 50m of rocky areas – no No geographic limitations.	Low Marginal foraging habitat. No rocky habitat within or

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
				grassy ground layers, particularly those dominated by Kangaroo Grass (*Themeda australis*). Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks. Commonly found beneath small, partially-embedded rocks and appear to spend considerable time in burrows below these rocks; the burrows have been constructed by and are often still inhabited by small black ants and termites.			adjacent to development site.
Delma impar	Striped Legless Lizard	V	V	The Striped Legless Lizard occurs in the Southern Tablelands, the South West Slopes, the Upper Hunter and possibly on the Riverina. Populations are known in the Goulburn, Yass, Queanbeyan, Cooma, Muswellbrook and Tumut areas. Also occurs in the ACT, Victoria and south-eastern South Australia. 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 *Themeda australis*, spear-grasses *Austrostipa* spp. and poa tussocks *Poa* spp., and occasionally wallaby grasses *Austrodanthonia* spp. Sometimes present in modified grasslands with a significant content of exotic grasses, grasslands with significant amounts of surface rocks, which are used for shelter and may utilise dried cowpats for shelter.	BioNet – 35, PMST, BAM-C, Kleinfelder (2020)	None	Assumed present due to duration of survey not meeting recommended duration in survey guidelines (as a result of condensed assessment timeline). Marginal habitat exists. Recorded in 2019 in good condition woodland patches to west of Bayswater (Kleinfelder 2020).

Species name	Common name	EPBC Act	BC Act	Distribution and habitat	Data source	Habitat constraints and Geographic limitations (BAM-C)	Likelihood of occurrence
							Not recorded on site during target surveys.
Hoplocephalus bitorquatus	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. A small number of historical records are known for the New England Tablelands from Glenn Innes and Tenterfield; however, the majority of records appear to be from sites of relatively lower elevation. Although the Pale-headed snake distribution is very cryptic, it now appears to have contracted to a patchy and fragmented distribution. Found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest. In drier environments, it appears to favour habitats close to riparian areas.	BAM-C	None	Low Low-quality habit exists in fragmented patches of woodland (mostly rehabilitation). Not recorded on site during target surveys.

* Distribution and habitat requirement information adapted from: Australian Government Department of the Environment http://www.environment.gov.au/biodiversity/threatened/index.html, EESG http://www.environment.nsw.gov.au/threatenedspecies/

Key:

CE = critically endangered

E = endangered

EP = endangered population

V = vulnerable

M = migratory

Appendix B. Floristic survey composition and structure data

Species	GF code	Cover (%)																		
		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19
Acacia amblygona	SG											0.2		0.1						
Acacia baileyana	SG											0.5								
Acacia decora	SG			0.4							0.3									
Acacia decurrens	TG											0.5								
Acacia doratoxylon	TG	0.3										0.4								
Acacia falcata	SG										4	0.2								
Acacia implexa	SG	3																		
Acacia salicina	TG		0.3	0.2	0.2			15	0.3	20	5		20	10	0.4	1		3	0.2	3
Acacia saligna	EX												2	0.3						
Acacia spectabilis	SG	0.2																		
Allocasuarina luehmannii	TG								20		1							10		
Anagallis arvensis	EX		0.1	0.1				0.4		2		0.4	2	2		1	1	0.2		
Aristida ramosa	GG			0.1					0.5		0.1					20	20	5	20	
Arthropodium milleflorum	FG			0.2																
Asperula conferta	FG								0.1											
Asphodelus fistulosus	EX															0.1	2	1	2	
Aster subulatus	EX	0.1					0.2													
Atriplex spp.	SG														0.1					
Austrostipa scabra	GG		3	3																
Austrostipa verticillata	GG																	2	5	
Axonopus fissifolius	HT												3							
Bidens pilosa	EX	0.5				1		0.4		3	1			0.3			2			
Bothriochloa macra	GG											0.5				5	15	10	20	
Brachychiton populneus	TG										2									

Species	GF code	Cover (%)																		
		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19
Brachyscome dentata	FG								0.1											
Brunonia australis	FG								0.1											
Brunoniella australis	FG			0.2																
Calotis cuneifolia	FG		0.1																	
Calotis lappulacea	FG			0.1	0.8						0.5	0.2			4					
Carex appressa	GG																			0.1
Carthamus lanatus	HT							0.1								8	20	5	12	
Casuarina cunninghamiana	TG					40														
Casuarina glauca	TG	12			15															2
Centaurea melitensis	EX												0.1							
Centaurium erythraea	EX															1			1	
Cheilanthes distans	EG															1	0.5			
Cheilanthes sieberi	EG										0.1									
Chloris gayana	HT									1						0.1				0.1
Chloris truncata	GG							1									0.2		10	
Chrysocephalum apiculatum	FG								0.2	0.1										
Chrysocephalum semipapposum	FG																		4	
Cirsium vulgare	EX						0.4													
Convolvulus erubescens	OG										0.1									
Conyza bonariensis	EX													0.3						
Corymbia citriodora	EX					1														
Corymbia maculata	TG			2																
Cotula coronopifolia	EX															2				
Cymbopogon refractus	GG																	10	0.2	
Cynodon dactylon	GG	2					2	2												

Species	GF code	Cover (%)																		
		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19
Desmodium brachypodum	FG										0.1				0.1					
Dianella revoluta	FG		0.8																	
Dichelachne micrantha	GG								2						3		0.1	10		
Dichondra repens	FG	0.1	0.2								0.2						2	2		
Einadia hastata	FG	0.1							0.4			0.2			0.2					
Einadia nutans	FG		0.2	0.1	0.3				0.2											
Einadia polygonoides	FG														0.1					
Enchylaena tomentosa	SG	0.2	0.2	0.1	0.4			0.1	0.1			0.5			0.1	1		0.5		
Eragrostis leptostachya	GG															1				
Eremophila debilis	SG		0.5	0.8							0.2	0.4								
Erodium crinitum	FG			0.5	0.1			30		5					0.2		1	2		
Eucalyptus crebra	TG	5	5	5	4						1	5			10					
Eucalyptus melliodora	TG			5								10								
Eucalyptus moluccana	TG	10	30	10	2			2			5									
Eucalyptus punctata	TG	4																		
Eucalyptus tereticornis	TG	2			4						15	8								
Galenia pubescens	HT	0.5	0.1	2	15			3	3	10		1	3	1	30		2	4		
Galium aparine	EX	0.2				5														
Glycine clandestina	OG	0.2	0.5	0.2							0.1									
Glycine tabacina	OG																0.1		0.1	
Glycine tomentella	OG														0.4					
Gomphocarpus fruticosus	EX						0.5			0.6				0.2		0.1	0.5		0.1	
Hardenbergia violacea	OG	0.2																		
Heliotropium amplexicaule	HT															0.5	5	0.1		
Hyparrhenia hirta	HT	20	8	10	8			20	2	70	50			0.3	10	2	5	1	0.1	10

Species	GF code	Cover (%)																		
		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19
Hypochaeris radicata	EX							0.1						0.1						
Isolepis cernua	GG				0.1															
Juncus acutus	HT						10													
Juncus continuus	GG					0.5	2													
Lepidium africanum	EX														5					
Lepidium campestre	EX									0.1										
Linum marginale	FG			0.1				0.5		0.1	0.1		1							
Linum trigynum	EX							2					0.2	0.2		0.2				
Lomandra confertifolia subsp. pallida	GG	0.5																		
Lomandra filiformis	GG								10							0.1				
Lomandra multiflora subsp. multiflora	GG		3	0.2					2		2									
Malva neglecta	EX												4							
Medicago minima	EX										0.5				0.2			0.1		
Medicago truncatula	EX				0.1			5		2										
Melilotus indicus	EX							4			0.1		4	0.3						
Melinis repens	EX							0.1												
Notelaea microcarpa	TG										4									
Onopordum acanthium	EX	0.3											0.1	0.2						
Opuntia stricta	EX	0.2			0.2					0.2								0.2	0.1	
Panicum maximum	EX			8	2															
Passiflora caerulea	EX					1														
Pennisetum clandestinum	HT					0.1														
Petrorhagia dubia	EX							0.5										2		
Phragmites australis	GG																			80
Phyllanthus virgatus	FG														0.1					

Species	GF code	Cover (%)																		
		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19
Phytolacca octandra	EX											0.1								
Pimelea latifolia	SG		0.1						0.1											
Plantago lanceolata	EX	0.3	0.1	0.1						1			5	5	0.1	6	5	3	3	0.1
Plantago myosuros	EX												5	2						
Rapistrum rugosum	EX								0.1	0.2										
Rumex crispus	EX						0.5													
Rytidosperma fulvum	GG								0.5		0.2					20		4	2	
Rytidosperma tenuius	GG		5																	
Senecio madagascariensis	HT	0.1	0.1		0.2	0.1		0.1	0.2	0.1		0.2	0.5	0.2		0.1	8	3	0.1	0.1
Sida corrugata	FG		1		0.1				1											
Sida rhombifolia	EX			0.1		4		10		0.5	1		1				2	2	5	
Solanum cinereum	SG										0.1						8	0.1	0.5	
Solanum nigrum	EX	0.3		0.2		0.5			0.2			0.1	1							
Sonchus oleraceus	EX	0.1			0.1	0.1		0.2	0.1	0.1					0.2					0.1
Sporobolus africanus	EX												8							
Stenotaphrum secundatum	HT	2																		
Templetonia stenophylla	FG								0.1		0.1									
Typha domingensis	GG																			
Typha orientalis	GG	80				5	80													10
Verbena bonariensis	EX						0.5							5		5		0.2		
Veronica plebeia	FG			0.4	0.1															
Vicia sativa	EX																0.1			
Vittadinia cuneata	FG														3	0.1			0.5	
Vulpia myuros	EX													1						
Wahlenbergia communis	FG											0.1								

Species	GF code	Cover (%)																	
		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19
Wahlenbergia gracilis	FG							0.2				0.2			0.2					
*GF code: TG = Tree, SG = Shrub, GG = Grass and grass-like, FG = Forb, EG = Fern, OG = Other, HT = High Threat weed, EX = Exotic [P=Plot]																				

Appendix C. Vegetation integrity assessment plot data

plot	PCT	Area	Patch size	Condition	zone	easting	northing	bearing	compTree	compShrub	compGrass	compForbs	compFerns	compOther	strucTree	strucShrub	strucGrass	strucForbs	strucFerns	strucOther	funLargeTre	funHollowtr	funLitterCov	funLenFalle	funTreeSte	funTreeSte	funTreeSte	funTreeSte	funTreeSte	funTreeRege	funHighThre
1	1691	11.4	100	R	56	309334.78	6416214.76	95	6	3	3	2	0	2	33.3	3.4	82.5	0.2	0	0.4	1	0	43	8	1	1	1	1	1	1	22.6
2	1691	2.3	100	M	56	306568.26	6414178.33	35	3	3	3	5	0	1	35.3	0.8	11	2.3	0	0.5	1	0	23	1	0	1	1	1	1	0	8.2
3	1691	11.4	100	R	56	307658.54	6414967.64	310	5	3	3	7	0	1	22.2	1.3	3.3	1.6	0	0.2	0	0	80	4	1	1	1	1	0	0	12
4	1691	11.4	100	R	56	307548.27	6415100.93	305	5	1	1	5	0	0	25.2	0.4	0.1	1.4	0	0	0	0	43	2	1	1	1	0	0	0	23.2
5	1731	0.9	4	MG	56	307260.35	6413291.2	170	1	0	2	0	0	0	40	0	5.5	0	0	0	0	0	90	2	1	1	1	1	0	1	0.2
6	1071	3	3	M	56	307007.06	6413446.47	40	0	0	3	0	0	0	0	0	84	0	0	0	0	0	85	0	0	0	0	0	0	0	10
7	1691	21.6	100	RE	56	306764.72	6413698.05	210	2	1	2	3	0	0	17	0.1	3	30.7	0	0	0	0	10	0	1	0	0	0	0	0	23.2
8	1692	1.2	100	MG	56	306854.13	6412687.64	290	2	2	5	8	0	0	20.3	0.2	15	2.2	0	0	0	0	48	0	1	1	1	1	0	1	5.2
9	1691	21.6	100	RE	56	307444.64	6413465.23	288	1	0	0	3	0	0	20	0	0	5.2	0	0	0	0	15	0	1	1	0	0	0	1	81.1
10	1691	2.3	100	M	56	306066.51	6413671.06	320	7	4	3	5	1	2	33	4.6	2.3	1	0.1	0.2	0	0	76	4	1	1	1	1	0	1	50
11	1691	11.4	100	R	56	309684.56	6416075.83	315	5	5	1	4	0	0	23.9	1.8	0.5	0.7	0	0	0	0	81	4	1	1	1	1	0	1	1.2
12	1691	21.6	100	RE	56	309917.5	6416175.01	185	1	0	0	1	0	0	20	0	0	1	0	0	0	0	8	0	1	1	0	0	0	1	6.5

plot	PCT	Area	Patch size	Condition	zone	easting	northing	bearing	compTree	compShrub	compGrass	compForbs	compFerns	compOther	strucTree	strucShrub	strucGrass	strucForbs	strucFerns	strucOther	funLargeTre	funHollowtr	funLitterCov	funLenFalle	funTreeSte	funTreeSte	funTreeSte	funTreeSte	funTreeSte	funTreeRege	funHighThre
13	1691	216	100	RE	56	310013.15	6416119.27	178	1	1	0	0	0	0	10	0.1	0	0	0	0	0	0	18	0	1	1	0	0	0	1	1.5
14	1691	2.3	100	M	56	309464.15	6416797.01	35	2	2	1	8	0	1	10.4	0.2	3	7.9	0	0.4	1	0	20	0	0	0	1	0	1	1	40
15	1691	2	100	NG	56	305952.31	6410459.97	40	1	1	5	1	1	0	1	1	46.1	0.1	1	0	0	0	3	0	0	0	0	0	0	1	10.7
16	1691	2	100	NG	56	305341.96	6409604.15	240	0	1	4	2	1	1	0	8	35.3	3	0.5	0.1	0	0	3	0	0	0	0	0	0	0	40
17	1692	1.2	100	MG	56	305129.15	6409287.22	280	2	2	6	2	0	0	13	0.6	41	4	0	0	0	0	5	0	1	1	1	1	0	0	13.1
18	1691	2	100	NG	56	305673.04	6410071.08	205	1	1	6	2	0	1	0.2	0.5	57.2	4.5	0	0.1	0	0	78	0	0	0	0	0	0	0	12.2
19	1071	3	3	M	56	307212.08	6413015.22	240	2	0	3	0	0	0	5	0	90.1	0	0	0	0	0	52	0	0	0	0	0	0	1	10.2

KEY: Condition- R=Rehabilitation, RE= Regrowth, M = Moderate, MG = Moderate-good, NG = Native grassland

Appendix D. Echolocation call analysis

Microbat Call Identification Report

Prepared for ("Client"):	Jacobs
Survey location/project name:	Hunter Valley, NSW
Survey dates:	7th & 10th December 2020
Client project reference:	
Job no.:	JAC-2002
Report date:	20 January 2021

Methods

Data received and post-processing

Balance! Environmental received eight raw ZCA files recorded over four consecutive nights (7th - 10th December 2020) using two Anabat Express detectors (Titley Scientific, Brisbane).

The ZCA files were converted to zero-crossing analysis bat-call sequence files (ZC files) using *Anabat Insight* (Version 1.9.7; Titley Scientific, Brisbane), which had been downloaded and converted by the client from two Anabat Express detectors.

GPS metadata included in the ZC files indicates that the detectors were deployed in the Hunter Valley, near the Bayswater Power Station ("Anabat 1") and Liddell Power Station ("Anabat 2").

Call analysis and species identification

All ZC files were processed manually in *Anabat Insight*, with calls identified by reviewing call spectrograms and derived metrics and comparing them with regionally relevant reference calls and published call descriptions (Pennay *et al.* 2004). Consideration was also given to the probability of species' occurrence, with reference to published distribution information (e.g. Churchill 2008; van Dyck et al. 2013) and on-line database records (e.g. http://www.ala.org.au).

Reporting standard

The format and content of this report follows Australasian Bat Society standards for the interpretation and reporting of bat call data (Reardon 2003), available on-line at http://www.ausbats.org.au/.

Species nomenclature follows Armstrong *et al.* (2020).

Results & Discussion

The ZCA conversion process yielded 279 ZC files; however, 35 of those files contained only non-bat background noise. The other 244 ZC files contained 245 bat calls, of which 223 were positively identified. The other 22 "unresolved" calls had characteristics potentially attributable to two species.

At least 11, possibly 13 species were detected during the survey (see **Table** 1). Ten call types were positively attributed to nine unique species plus the *Nyctophilus* genus. Calls of the latter group cannot be reliably differentiated to species; and two species probably occur in the study area (*N. geoffroyi* and *N. gouldi*).

Fifteen of the "unresolved" calls were allocated to two pairs of species, the members of which were also positively identified from more definitive calls: *Chalinolobus gouldii/Ozimops ridei*; and *Vespadelus regulus/Miniopterus orianae*. The other six "unresolved" calls represented at least one and possibly two additional species records for the survey. These calls belonged to one or both of *Scotorepens orion* and *Scoteanax rueppellii*.

Sample call spectrograms of each species/group are shown in **Appendix 1**.

Table 1 Bats recorded during the Bayswater-Liddell survey, 7-10 December 2020. Number of calls identified per species per detector-night

Detector:	ANABAT 1 (SN440628)				ANABAT 2 (SN440564)				Species total
Night:	7/12	8/12	9/12	10/12	7/12	8/12	9/12	10/12	
Positively identified calls									
Chalinolobus gouldii	3	6	6	1	10	3		2	31
Chalinolobus morio		3	1						4
Nyctophilus sp.		4	2	1					7
Scotorepens balstoni			1		1				2
Vespadelus regulus	2			1	2	1			5
Vespadelus vulturnus	6			2					8
Miniopterus orianae	7	35	20	17	9	6	1		96
Austronomus australis	1	1	1	1	1		1		6
Ozimops planiceps	6	10	18	15	9			1	59
Ozimops ridei	1	2	1		1				5
Unresolved calls									
C. gouldii / O. ridei		3	2	1	1				7
Scotorepens orion / Scoteanax rueppellii			1	1	4				6
V. regulus / M. orianae				2	4	2		1	9
Detector-night total	26	64	53	42	42	12	2	4	245

References

Churchill, S. (2008). Australian Bats. Jacana Books, Allen & Unwin; Sydney.

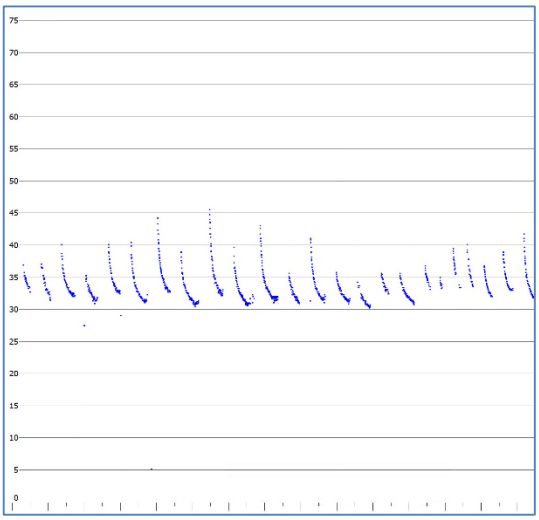
Pennay, M., Law, B., and Reinhold, L. (2004). Bat calls of New South Wales: Region based guide to echolocation calls of Microchiropteran bats. NSW Department of Environment and Conservation, Hurstville.

Reardon, T. (2003). Standards in bat detector based surveys. Australasian Bat Society Newsletter 20, 41-43.

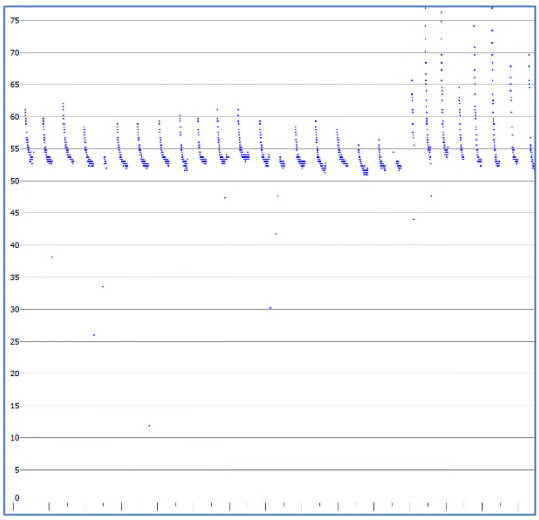
Reardon, T.B., Armstrong, K.N. and Jackson, S.M. (2020). A current taxonomic list of Australian Chiroptera; Version 2020-06-09. Available from Australasian Bat Society. URL: http://ausbats.org.au/species-list/4593775065

van Dyck, S., Gynther, I. and Baker, A. (ed.) (2013). Field Companion to the Mammals of Australia. New Holland; Sydney.

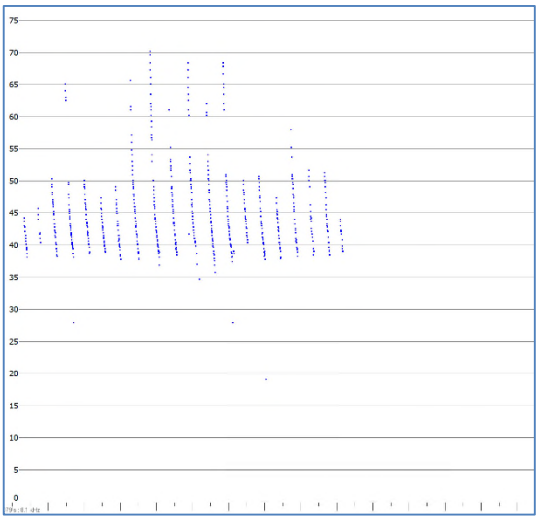
Appendix 1 Representative sonograms from the Bayswater-Liddell dataset.
X-axis (time)=10 msec per tick; time between pulses removed



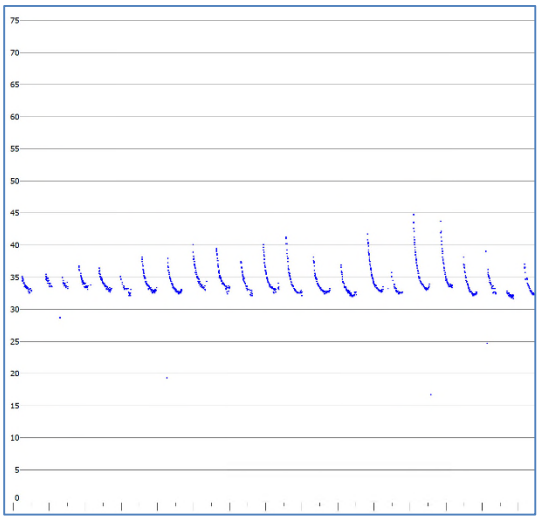
Chalinolobus gouldii



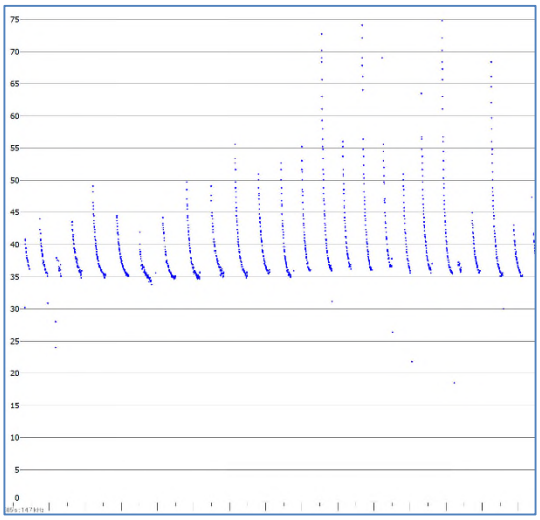
Chalinolobus morio



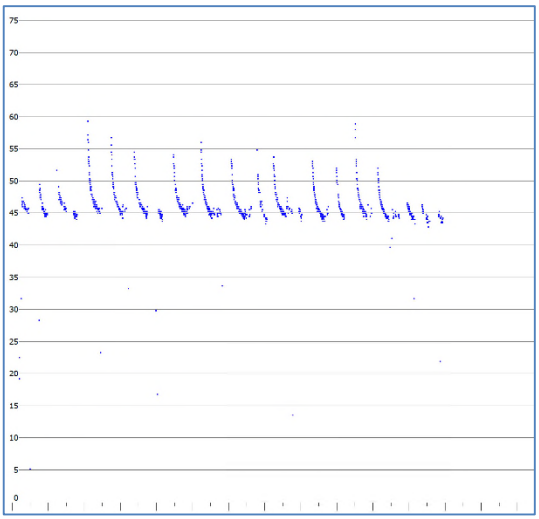
Nyctophilus sp.



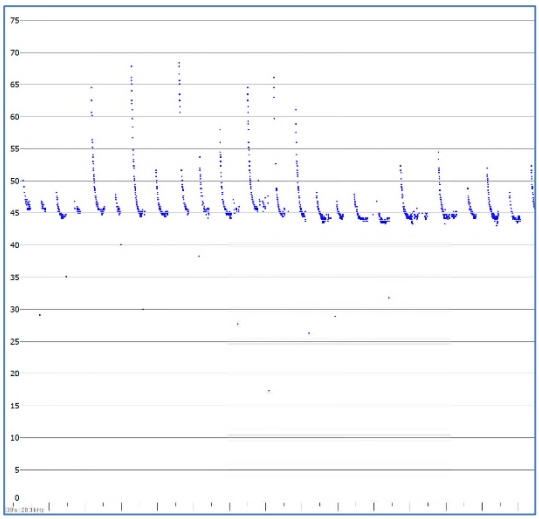
Scotorepens balstoni



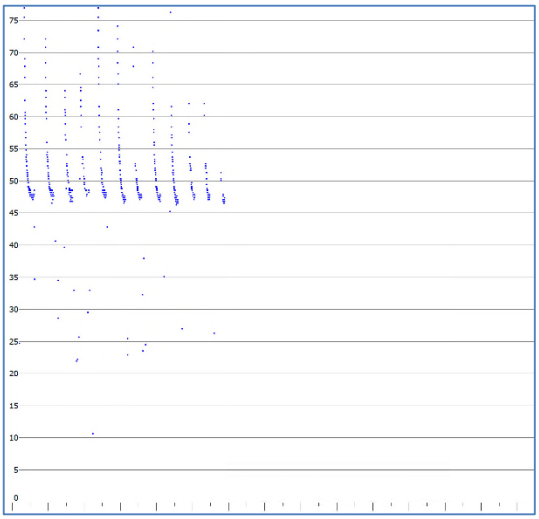
Scotorepens orion / Scoteanax rueppellii



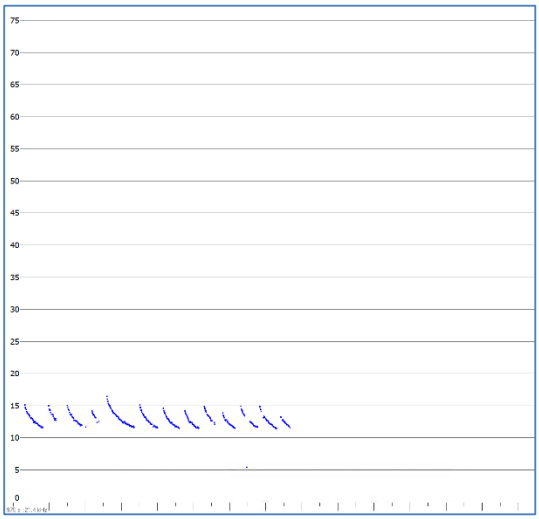
Miniopterus orianae



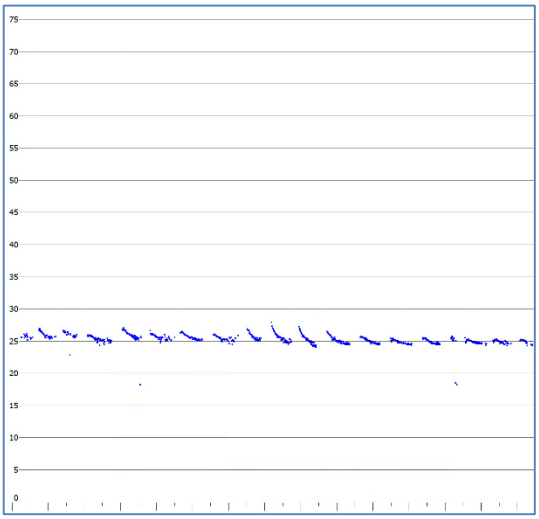
Vespadelus regulus



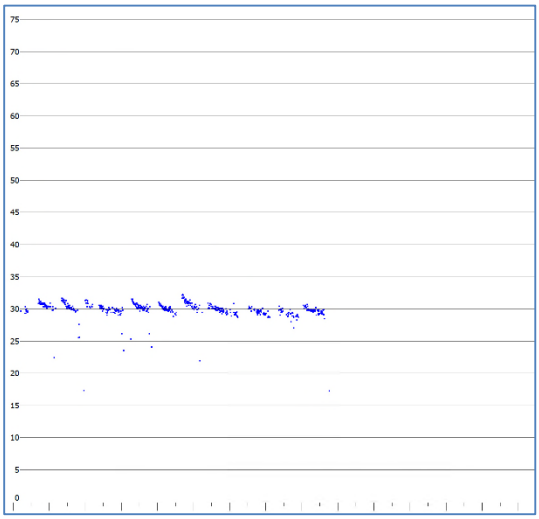
Vespadelus vulturnus



Austronomus australis



Ozimops planiceps



Ozimops ridei

Appendix E. EPBC Act Protected Matters Search Tool report

Appendix F. EPBC Act significance assessments

Assessments of significance have been conducted for threatened species, populations and communities that have been recorded in the Project area during field surveys or were identified as having a moderate or higher potential to occur in the Project area based on the presence of habitat, or have been recorded in adjacent lands during the comprehensive surveys for the WOAOW Project (Kleinfelder,2020). It is noted that the development site contains a much more cleared and disturbed environment than the WOAOW Project area, and the proportion of native vegetation is lower within the development site.

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 % chance of happening; it is sufficient if a significant impact on the environment is a real or not remote chance or possibility (Department of Environment, 2013). This advice has been considered while undertaking the assessments.

The EPBC Act listed threatened communities and species subject to this assessment include:

- Central Hunter Valley eucalypt forest and woodland ecological community
- Green and Golden Bell Frog (*Litoria aurea*) (**GGBF**)
- Striped legless lizard (*Delma impar*) (**SLL**)
- Swift Parrot (*Lathamus discolor*)
- Regent Honeyeater (*Anthochaera phrygia*)
- Australasian Bittern (*Botaurus poiciloptilus*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*).

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.

The direct impact of the Project relates to the clearing of native vegetation which may provide potential habitat for the Striped legless lizard, GGBF Grey-headed Flying-fox, Regent Honeyeater, Swift Parrot or Australasian Bittern. The direct impacts to the species habitat (native vegetation) within the development site is summarised in **Table F1**.

Table F1 Summary of direct impact to EPBC Act listed threatened species habitat (native vegetation) within the development site

Species	Plant community type	Area (ha) of likely impact within the development site
▪ Central Hunter Valley eucalypt forest and woodland ecological community	Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (PCT 1691)	0
▪ Green and Golden Bell Frog (*Litoria aurea*)	*Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071) and Swamp Oak – Weeping Grass grassy riparian forest of the Hunter Valley (PCT 1731)	3
▪ Striped Legless Lizard (*Delma impar*)	Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (PCT 1691) and Bull Oak grassy woodland of the central Hunter Valley (PCT 1692)	38.5
▪ Swift Parrot (*Lathamus discolor*) ▪ Regent Honeyeater (*Anthochaera phrygia*) ▪ Grey-headed Flying-fox (*Pteropus poliocephalus*)	Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (PCT 1691) and Bull Oak grassy woodland of the central Hunter Valley (PCT 1692)	17
▪ Australasian Bittern (*Botaurus poiciloptilus*)	*Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071)	3

Of the total areas of PCT 1691 to be potentially impacted, 21.6 ha is 'regrowth' vegetation. This regrowth vegetation is in poor ecological condition and is characterized by regrowth *Acacia salicina* (Native Willow) growing amongst dense exotic grasses, particularly *Hyparrhenia hirta* (Coolatai Grass). This vegetation lacks a native canopy layer and the mid-storey is sparse and consists of only the aforementioned Acacia species. Given a lack of flowering Eucalypts and other canopy trees in this vegetation, these areas would not provide suitable foraging habitats for Swift Parrot, Regent Honeyeater or Grey-headed Flying-fox. For this reason, the potential loss of PCT 1691 regrowth is not included as an impact to these species. While the SLL is sometimes recorded in modified grasslands (NSW Bionet,2021), the PCT 1691 regrowth areas within the development site lacked native grass tussocks, rocks, woody debris and other shelter features. The ground layer of these areas was often close to 100% cover exotic grass. Striped Legless Lizards are mostly reported from areas of relatively undisturbed native grasslands, with a dense cover of perennial tussock grasses, particularly spear grass *Austrostipa bigeniculata* and kangaroo grass *Themeda triandra* (Kukolic 1991; Kukolic & Osborne 1993). Typically, the species is reported from sites where native grass cover is greater than 70% (Kukolic, 1991). PCT 1691 regrowth has been included as habitat for the SLL however the likelihood of this species occurring in such areas is considered to be low given a lack of preferred shelter features. Therefore, whilst the total area of habitat for SLL is shown to be 38.5 ha, the area of preferred habitat (with prescribed shelter features) is likely to only be 16.9 ha (made up of better condition forms of PCT 1691 and PCT 1692).

The GGBF has previously been recorded within the Sewage Treatment Ponds within the development site (adjacent to Bayswater). The last confirmed record of the species in the Upper Hunter was from this location, with a small colony of four to five adults, and some dozen juveniles, along with tadpoles being observed in the early 2000's (DECC 2007). These ponds (series of six ponds) as well as other suitable freshwater pond/dam habitats within the development site were surveyed over four nights in December 2020 during suitable weather conditions. The GGBF was not recorded. Likewise, surveys of the Sewage Treatment Ponds by Kleinfelder in

December 2019 and January 2020 (as part of the WOAOW Project) did not record this species. Whilst apparently suitable habitat for the GGBF exists within numerous waterbodies across the development site, it is likely that the population of this species no longer persists at this location. Habitat is associated with PCT 1071- *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion, occurring as fringing vegetation of numerous dams and ponds. The Sewage Treatment Plant Polishing Ponds within Bayswater did not contain predatory *Gambusia holbrooki* (Mosquito Fish). The majority of other waterbodies across the development site were found to contain this pest and are therefore less likely to contain suitable habitat for the GGBF.

F.1.1 Central Hunter Valley eucalypt forest and woodland ecological community

The EPBC conservation advice for the Central Hunter Valley eucalypt forest and woodland ecological community, which is a CEEC states that to be considered a MNES under the EPBC Act, areas of the ecological community must meet the key diagnostic characteristics, and at least the minimum condition thresholds for moderate quality. It was determined that a single patch of PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter existing within the development site does meet the minimum condition thresholds for moderate quality. This patch exists within the western edge of the Bayswater site and is 2.04 ha in size. The basis for inclusion as CEEC was that this patch of woodland contains a ground layer consisting of greater than 50% native species cover. This patch is isolated from nearby larger patches of CEEC by the Bayswater entrance road as well as mown areas of exotic grass. Importantly, the entirety of this 2.04 ha CEEC patch is to be retained and will not be impacted by the Project.

No other patches of PCT 1691 within the development site contained sufficient native cover in their ground layer or were large enough in size to meet the thresholds for CEEC.

An action is likely to have a significant impact on a Critically Endangered or Endangered ecological community if there is a real chance or possibility that it will:

1) reduce the extent of an ecological community

A single patch of 2.04 ha of Central Hunter Valley eucalypt forest and woodland CEEC was identified within the development site. This CEEC is also present in large areas to the west of Bayswater beyond the development site. This single patch within the development site is to be retained and therefore the Project will not reduce the extent of this CEEC.

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

The majority of the development site is cleared or disturbed, with only small and fragmented patches of native vegetation (including regrowth and rehabilitation). Importantly, the Project will not result in the breaking apart of large blocks of high-quality examples of threatened ecological communities. No further habitat fragmentation on a landscape scale will occur as a result of the Project. Isolation of habitats is also unlikely to increase substantially, given the development site contains existing areas of isolated habitats. The patch of CEEC existing within the development site is already separated from larger areas of CEEC by the Bayswater entrance road as well as areas of mown exotic grass.

Overall, habitat connectivity will remain in a similar state after construction of the Project. There is unlikely to be declines in population density or species richness within vegetation patches as a result of the Project. There is also unlikely to be a significant alteration to community composition, species interactions or ecosystem functioning in the locality due to the Project. These factors are already highly impacted by historic land use. Therefore, habitat fragmentation is considered a minor impact of the Project in regard to its context and intensity.

3) adversely affect habitat critical to the survival of an ecological community

The single patch of Central Hunter Valley eucalypt forest and woodland CEEC is to be retained within the study area. As such, the Project will not impact or adversely affect habitat critical to the survival of this ecological community.

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

The single patch of Central Hunter Valley eucalypt forest and woodland CEEC is to be retained within the study area. As such, no abiotic factors (i.e. water, nutrients, or soil) necessary for this CEEC will be modified or destroyed as a result of the Project. This patch of CEEC exists in a modified setting and is already surrounded by roads and power station infrastructure.

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

The single patch of Central Hunter Valley eucalypt forest and woodland CEEC is to be retained within the study area. As such, the Project will not result in a substantial change in the species composition of this CEEC. This patch of CEEC exists in a modified setting and is already surrounded by roads and power station infrastructure.

6) cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

i) assisting invasive species, that are harmful to the listed ecological community, to become established, or

ii) causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or

The future clearing or disturbance associated with the Project is unlikely to lead to the creation of new edges in any previously intact vegetation. Edge effects from previous clearing and vegetation management are already existing within the woodland patches adjacent to the development site. Furthermore, the development site and surrounding landscape have had a long history of land clearing and modification associated with cattle grazing and power generation. Decades of disturbance have resulted in exotic grasses and herbaceous weeds taking over vast areas of land, as well as infiltrating the ground layer of most of the remaining native vegetation patches. As such, weed introduction associated with edge effects is unlikely to be exacerbated throughout the wider landscape.

The single patch of Central Hunter Valley eucalypt forest and woodland CEEC to be retained within the study area will not be directly affected by the Project. In addition to, the Project mitigation strategy and environmental management procedures would include guidance for preventing the introduction and/or spread of weeds and disease-causing agents such as bacteria and fungi.

No regular mobilisation of fertilisers, herbicides or other chemicals will occur as a result of the Project.

7) interfere with the recovery of an ecological community.

No recovery plan is currently in place, or recommended, for this CEEC (DoEE, 2019). The Project would not interfere substantially with the recovery of this community given larger areas of the CEEC would remain outside of the study area, such that the community is likely to persist in the landscape after the Project is built.

Conclusion

The 2.04 ha of Central Hunter Valley eucalypt forest and woodland CEEC present in the pdevelopment site will not be reduced or modified as a result of the Project. No large change in composition will occur. No further habitat fragmentation or isolation on a landscape scale will occur. The local occurrence of this TEC will persist after the Project is built. After consideration of the factors above, an overall conclusion has been made that the Project is unlikely to result in a significant impact to this TEC.

F.1.2 Green and Golden Bell Frog (*Litoria aurea*)

The GGBF has previously been recorded within the Sewage Treatment Ponds within the development site (adjacent to Bayswater Power Station). The last confirmed record of the species in the Upper Hunter was from this location, with a small colony of four to five adults, and some dozen juveniles, along with tadpoles being observed in the early 2000's (DECC 2007). These ponds (series of six ponds) as well as other suitable freshwater pond/dam habitats within the development site were surveyed over four nights in December 2020 during suitable weather conditions. The GGBF was not recorded. Likewise, surveys of the Sewage Treatment Ponds by Kleinfelder in December 2019 (as part of the WOAOW Project) did not record this species. Whilst apparently suitable habitat for the GGBF exists within numerous waterbodies across the development site, it is likely that the population of this species no longer persists at this location. Habitat is associated with PCT 1071- Phragmites australis and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion, occurring as fringing vegetation of numerous dams and ponds. The Sewage Treatment Plant Polishing Ponds within Bayswater did not contain predatory *Gambusia holbrooki* (Mosquito Fish). The majority of other waterbodies across the development site were found to contain this pest and are therefore less likely to contain suitable habitat for the GGBF.

Based on the availability of habitat and the occurrence of previous records, this species was given a moderate likelihood of occurrence within the development site.

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

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

The development site contains small patches of suitable habitat for the GGBF (predominantly in PCT 1071 and PCT 1731 areas) and consists of constructed dams which contain permanent water and suitable wetland vegetation (primarily *Typha orientalis* and *Juncus acutus*). The canals within the development site are generally poor habitat due to fluctuating flows of water. The action will remove or modify 3.9 ha of potential habitat for the GGBF. The surrounding landscape contains many other suitable waterbodies for this species, particularly Lake Liddell.

The GGBF has previously been recorded within the Sewage Treatment Ponds within the development site (adjacent to Bayswater). The last confirmed record of the species in the Upper Hunter was from this location, with a small colony of four to five adults, and some dozen juveniles, along with tadpoles being observed in the early 2000's (DECC 2007). These ponds (series of six ponds) as well as other suitable freshwater pond/dam habitats within the development site were surveyed over four nights in December 2020 during suitable weather conditions. The GGBF was not detected during these targeted field surveys. Likewise, surveys of the Sewage Treatment Ponds by Kleinfelder in December 2019 (as part of the WOAOW Project) did not record this species.

Whilst apparently suitable habitat for the GGBF exists within numerous waterbodies across the development site, it is likely that the population of this species no longer persists at this location, and therefore the Project is unlikely to lead to a long-term decrease in the size of an important population for this species.

2) reduce the area of occupancy of an important population

As the GGBF was not detected during targeted field surveys, it is unlikely that the action will reduce the area of occupancy of an important population.

3) fragment an existing important population into two or more populations

As the species was not detected during recent field surveys by Kleinfelder and Jacobs (December 2020), and the closest known population occurs approximately 80 km to the south-east of the study area, it is unlikely that the Project will fragment an existing important population. Potential habitats for this species within the development site and locality are already isolated and connectivity between artificial dams and ponds is already low. The Project will not impact any larger areas of potential habitat existing in the locality (such as Lake Liddell).

4) adversely affect habitat critical to the survival of a species

No habitat critical to the survival of the GGBF is mapped at this point in time (DAWE, 2020). However, it can be assumed that due to the decline of the species and restricted nature of the known populations in NSW, any occupied habitat would be critical to the survival of the species.

As the species was not detected during recent surveys within the WOAOW project area (2019), as well as the six sewage treatment ponds where this species was recorded in 2003 (within the development site) and targeted field surveys conducted by Jacobs in December 2020, it is unlikely that the Project will adversely affect habitat critical to the survival of the species.

5) disrupt the breeding cycle of an important population

As the species was not detected during the recent surveys (or the 2019 field surveys by Kleinfelder), it is unlikely that the Project will disrupt the breeding cycle of an important population.

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

The various artificial waterbodies within the development site (totalling 22 ha) provide potentially suitable habitat for the GGBF. The large majority of these waterbodies are surrounded by dense exotic grass. Many are also considered as unsuitable due to contaminated water (increased salinity, pollutants and sediments) and temperature fluctuations. The action will remove or modify 3.9 ha of fringing aquatic vegetation and riparian vegetation. Whilst the aquatic habitats within the development site may be removed or modified, the wider extents of habitat in the locality would not be affected, and the GGBF can be expected to use the disturbed areas during construction and post construction if suitable conditions are present.

The impact to non-native vegetation and existing disturbed areas may also reduce availability of lower grade habitat, but the GGBF can be expected to continue to use the disturbed areas during and after the action. The impact is not to the core wetland habitat (Lake Liddell), so the Project is considered unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

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

The existing weed and feral animal threat levels are unlikely to change significantly due to the action given the current uses of the surrounding area. Introduced *Gambusia holbrooki* (Mosquito Fish), which are known to prey on the tadpoles of the GGBF, are already established in almost all of the habitats in the development site. Only the Bayswater Sewage Ponds were found to not contain Mosquito Fish. Therefore, the Project is unlikely to result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat. A site-specific CEMP will be prepared and implemented prior to the commencement of any clearing or construction works to ensure that impacts are minimised.

8) introduce disease that may cause the species to decline, or

The presence and spread of the Chytrid Fungus resulting in Chytridiomycosis is acknowledged as a KTP in Australia and is widely regarded as playing an important role in the decline of the GGBF. Chytrid Fungus is already widespread in NSW; however, some populations of this species are free from or resistant to it. It has been suggested that such populations are in areas inhospitable to the growth of the disease, such as fluctuating levels of salinity. There is a chance that activities associated with the Project may introduce Chytrid fungus into the habitat. However, a site-specific CEMP will detail pathogen control measures that will be implemented to ensure that Chytrid fungus is not introduced or spread during the construction phase.

9) interfere substantially with the recovery of the species.

There is no adopted or made recovery plan for this species. However, the following actions taken from the draft recovery plan have been identified to aid in the recovery of the GGBF:

- Liaising with public authorities and private landholders
- Implementing strategic planning instruments
- Implementing environmental impact assessment guidelines
- Identifying and assessing threats
- Preparing guidelines for the construction, improvement and maintenance of GGBF
- Undertaking habitat improvement activities
- Preparing GGBF plans of management for key populations
- Implementing a frog disease management strategy
- Integrating the recovery plan with relevant threat abatement plans and other threat reduction initiatives
- Creating a database of population localities
- Implementing a systematic monitoring program on public lands
- Promoting and coordinating research programs for the GGBF.

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 GGBF has previously been recorded within the Sewage Treatment Plant Polishing Ponds within Bayswater (the development site), approximately 20 years ago (NSW Bionet Atlas). Recent surveys conducted by Kleinfelder within these ponds and the adjacent WOAOW Project area did not identify this species (Kleinfelder, 2020). Additionally, the GGBF was not detected during targeted field surveys conducted by Jacobs in December 2020 (during ideal survey conditions). The action will remove or modify 3.9 ha of potential habitat for the GGBF. However, the action would not directly impact on a known breeding site or any habitat critical to the survival of this species. The habitats are likely to represent foraging and shelter for individuals dispersing across the landscape and are a small proportion of the availability of similar quality habitat in the locality (such as Lake Liddell).

After consideration of the factors above, an overall conclusion has been made that the proposed development is unlikely to result in a significant impact to the GGBF.

F.1.3 Striped Legless Lizard (*Delma impar*)

The SLL is listed as vulnerable under the EPBC Act. The SLL was not recorded within the development site during targeted field surveys involving the installation and regular checking of eight tile arrays (400 tiles). However, the SLL was recently recorded in woodland areas adjacent to the development site (within one kilometre) during 2019 surveys for the WOAOW Project (Kleinfelder, 2020). Whilst the WOAOW Project area contains larger and better-quality areas of woodland and derived native grasslands, as well as lower levels of disturbance, the development site also contains small patches of potential habitat for this species.

The SLL is associated with the areas of PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter and 1692 Bull Oak grassy woodland of the central Hunter Valley occurring within the development site. While the SLL is sometimes recorded in modified grasslands (NSW Bionet,2021), the PCT 1691 'regrowth' areas within the development site lacked native grass tussocks, rocks, woody debris and other shelter features. The ground layer of these areas was often close to a 100% cover of exotic grass. Striped Legless Lizards are mostly reported from areas of relatively undisturbed native grasslands, with a dense cover of perennial tussock grasses, particularly spear grass *Austrostipa bigeniculata* and kangaroo grass *Themeda triandra* (Kukolic 1991; Kukolic & Osborne 1993). Typically, the species is reported from sites where native grass cover is greater than 70% (Kukolic, 1991). PCT 1691 'regrowth' areas have been included as habitat for the SLL however the likelihood of this species occurring in such areas is considered to be low given a lack of preferred shelter features. Therefore, whilst the total area of habitat for SLL is shown to be 38.5 ha, the area of preferred habitat (with prescribed shelter features) is likely to only be 16.9 ha (made up of better condition forms of PCT 1691 and PCT 1692). Native vegetation patches within the development site exist as small and isolated patches which generally lack the structural complexity found in the larger woodland patches surrounding the development site.

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

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

The SLL occurs in the Southern Tablelands, the South West Slopes, the Upper Hunter and possibly on the Riverina. Populations are known in the Goulburn, Yass, Queanbeyan, Cooma, Muswellbrook and Tumut areas. Occurrence of the species in the Muswellbrook area is a range extension for the species, with the first being recorded at the Muswellbrook Common in 2013 (approximately 15 km north-west of the development site). Additionally, the species was recorded approximately 5 km to the west of the site in 2018, as part of surveys for the Maxwell Coal Project (Kleinfelder, 2020).

The SLL was not recorded within the development site during targeted field surveys. However, recent surveys by Kleinfelder on adjacent land (WOAOW Project) identified evidence of a population. The species was detected twice at the same location within a woodland area within 1 km of the development site.

The following information regarding 'important populations' is taken from the EPBC Act - Referral guidelines for the vulnerable Striped Legless Lizard, *Delma impar* (Department of Sustainability, Environment, Water, Population and Communities 2011):

> *An 'important population' is defined as 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.*
>
> *An important population of the striped legless lizard is one that meets at least one of the criteria outlined above, and is likely to be viable over the long-term. To be viable, a striped legless lizard population must*

occur in suitable habitat with the ability for population dynamics (for example breeding, recruitment and dispersal) to occur over time.

The habitat for an 'important population' of striped legless lizard typically comprises native temperate grassland or grassy woodland, where the species is either known (including similar habitat connected / immediately adjacent to the site), or has the potential to occur. The minimum patch size threshold for medium to long-term habitat and population viability is greater than or equal to 0.5 hectares, which supports predominantly tussock-forming grass species (native or non-native).

Given the cryptic nature of the species, and the inherent difficulty in determining the species' population size, habitat proxies may be used to infer whether an important population is likely to occur at a given site. Although the species largely prefers sites supporting key habitat characteristics outlined in the SPRAT profile, it is also known to occupy habitats which superficially appear unsuitable (such as degraded sites dominated by introduced understorey species which are not connected to areas of higher quality habitat). Therefore, the use of habitat characteristics alone in assessing whether a site is likely to support an important population needs to be treated with caution.

A population could also be considered important if it is well-studied, and hence provides opportunity for greater understanding of the species through a long-term dataset.

The following factors need to be considered in determining whether a site is not likely to support an important population under the provisions of the EPBC Act:

- *Sites less than 0.5 hectares*
- *Small isolated areas of habitat which are currently under pressure, or are likely to experience long-term pressures (for example sites located within urban settings, such as adjacent to factories or in residential subdivisions).*
- *Small sites which support marginal or low-quality habitat (for example dominated by high threat weeds).*

Based on the distribution of the species in NSW, this population is near the northern limit of the species range. Only one individual was identified during Kleinfelder's targeted surveys in 2019 (tile arrays and active searches) and it was concluded that an assessment of the viability of the population was difficult to assess, while the species can be cryptic and hard to detect, it would be anticipated that if a viable population of the species occurs within the Study Area additional individuals would have been recorded. Surveys conducted for the Maxwell Coal Project to the west of the Study Area identified a total of 26 specimens (16 living individuals and ten sloughs (shed skins)) (Kleinfelder, 2020).

It is estimated that the action will remove or modify up to 38.5 ha of low-quality habitat for this species. The current development site is a worst case scenario and future detailed design of the project will aim to avoid the majority of native vegetation. All areas of native woodland vegetation were assessed as suitable habitat for the species. Remaining areas were excluded due to the lack of tussock grass cover, and/or other refugia (i.e. logs, fence posts, rocky area) within these areas. Whilst the distribution of the species in the locality is unknown, the development site is highly disturbed and generally lacks suitable habitat for the SLL.

The areas surrounding the development site contain large areas of woodland vegetation and higher quality habitat. The loss of small and isolated patches of poor-quality habitat within the development site would unlikely lead to long-term impacts on the species. As such, any impacts are unlikely to be significant.

2) reduce the area of occupancy of an important population

It is estimated that 38.5 of low-quality potential habitat for the SLL will be removed for the Action. While there is a large area of surrounding potentially suitable habitat in the area, the Project has the potential to reduce the area of occupancy of the population. The current development site is a worst case scenario and future detailed design of the project will aim to avoid the majority of native vegetation. The SLL was not detected during targeted field surveys of the power station surrounds, it is unlikely that the action will reduce the area of occupancy of an important population.

3) fragment an existing important population into two or more populations

The habitat onsite primarily comprises small, isolated patches with a low-level of connectivity to surrounding habitat. The Project was designed to follow existing disturbed areas and power station infrastructure, thus avoiding good-condition native woodlands. Vegetation patches are separated from nearby woodland areas by roads, coal conveyors, vast exotic grass areas and power station infrastructure. The land surrounding the power stations has long been cleared and modified and acts as a barrier to dispersal for most fauna groups. The loss of any potential habitat for SLL within the development site would not isolate remaining habitat from other patches and it is unlikely that the Action would fragment an existing population into two or more populations.

4) adversely affect habitat critical to the survival of a species

According to the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of the Environment, 2013), 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 SLL is known to inhabit lowland native grasslands and grassy woodlands, typically dominated by native tussock-forming grass species such as kangaroo grass (*Themeda triandra*), spear grasses (*Austrostipa* sp.), and Poa tussocks (*Poa* sp.). The species also inhabits a range of temperate grasslands, including areas dominated by introduced grass species and at sites with a history of grazing and pasture improvement (DSEWPC, 2011).

The development site is unlikely to meet the majority of the above criteria; however, breeding habitat cannot be ruled out.

Habitat assessment of the development site for the species identified that the site contains marginal habitat due to historical land clearing for cattle grazing and more recent mofifications for power station infrastructure. The overwhelming majority of groundcover of the site is exotic and disturbed although there are some grassy areas which contain native groundcover and increased sheltering opportunities for the species. The site also contains some scattered debris (building materials).

This species was not recorded despite targeted surveys using artificial habitat (400 roof tiles) and additional searches beneath building materials and waste near the power stations (conducted during peak activity period November – December 2020). Due to the habitat not being assessed as optimal for the species, and that recent surveys for the WOAOW Project (November – December 2019) only identified one individual it is unlikely that the development site contains habitat critical to the survival of the species. There are large areas of woodland habitat in the areas surrounding the action area that will be retained. The current development site is a worst case scenario and future detailed design of the project will aim to avoid the majority of native vegetation. Therefore, the action is unlikely to adversely affect habitat critical to the survival of this species.

5) disrupt the breeding cycle of an important population

Given the small extent of low-quality habitat within the development site, as well as poor habitat connectivity it is unlikely a breeding population is present. Future clearing activities of the Project within habitat for the species will be avoided, where possible, during breeding and through to egg hatching periods for the species, November to February (November to December mating, December to January egg laying, and January to February hatching). As such, impacts on the breeding cycle of the species will be minimised.

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

The patches of potential habitat are small, isolated, and are occurring in an already highly fragmented landscape. The Project was designed to follow existing disturbed areas and power station infrastructure, thus avoiding good-condition native woodlands. The loss of 38.5 ha of low-quality habitat for this species within the impact area would not isolate remaining habitat from other patches and it is unlikely that the Action would significantly reduce the area of available habitat such that it would lead to the decline of these species. The current development site is a worst case scenario and future detailed design of the project will aim to avoid the majority of native vegetation.

7) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The biggest threat of an invasive species to *Delma impar* is the "Modification and degradation of native grassland habitat through incompatible and inadequate land management practices, weed invasion" (ACT Government 2017). The clearing of habitat is recognised as a major factor contributing to the threatened status of the SLL. The associated indirect impacts of this KTP are well documented and include increased potential for the proliferation of invasive species.

The development site is largely cleared and contains high levels of exotic vegetation (particularly vast areas of dense exotic grasses). Fauna surveys (December,2020) revealed that large populations of introduced House mice (*Mus musculus*) and Black Rats (*Rattus rattus*) were present within the development site. These species were found to occupy similar habitat features to what is suitable for the SLL. Given a long history of disturbance on the site, the existing weed and feral animal threat levels are unlikely to change significantly due to the Action. A site-specific CEMP will be prepared and implemented prior to the commencement of any clearing or construction works to ensure that impacts are minimised. With these measures in place, this Project is not considered likely to result in a significant increase in the impact of invasive species on the SLL or its habitat.

8) introduce disease that may cause the species to decline, or

There are no known diseases affecting SLL. The action would be unlikely to increase feral animal abundance or the potential for significant disease vectors to affect local populations.

9) interfere substantially with the recovery of the species.

Ten specific conservation objectives were outlined in the *National Recovery Plan for the Striped Legless Lizard (Delma impar)* prepared by Smith and Robertson (1999):

- Establish and maintain national forums for the discussion and organization of the conservation of the SLL across its natural distribution.
- Determine the distribution of potential SLL habitat.
- Determine the current distribution and abundance of SLLs in Victoria, NSW, the ACT and SA
- Establish a series of reserves and other managed areas such that viable populations are maintained across the known distribution of the species
- Determine the habitat use and ecological requirements of SLLs

- Identify the nature and extent of the threatening processes affecting SLLs
- Undertake a program of research and monitoring to provide a basis for adaptive management of SLLs
- Increase community awareness and involve the community in aspects of the recovery program.
- Assess the need for salvage and translocation, determine their feasibilities, develop protocols and undertake a trial translocation if appropriate
- Ensure that captive population(s) are used to support education and research elements of the recovery plan.

Locally, and more recently, the SLL *Delma impar* Action Plan (ACT Government 2017) identifies five actions to assist in the recovery of this species:

- Conserve all large populations in the ACT. Protect other ACT populations from unintended impacts (unintended impacts are those not already considered through an environmental assessment or other statutory process)
- Manage the species and its habitat to maintain the potential for evolutionary development in the wild
- Enhance the long-term viability of populations through management of adjacent grassland to increase habitat area and connect populations, or to establish new populations
- Improved understanding of the species' ecology, habitat and threats
- Promote a greater awareness of and strengthen stakeholder and community engagement in the conservation of the species.

The ten conservation actions listed in the national recovery plan are largely not applicable to the Project l and actions for the government to complete. Therefore, the Project is unlikely to interfere substantially with the recovery of the SLL given habitat resources for these species would remain outside of the development site, such that the species are likely to persist in the landscape.

Conclusion

Approximately 38.5 ha of marginal habitat for the SLL will be removed for the Action. Of this area only 16.9 ha is considered to be preferred habitat (with components of native grass tussocks, wood debris or other shelter features). The current development site is a worst case scenario and future detailed design of the project will aim to avoid the majority of native vegetation. Twenty-three records of SLL occur within the locality (OEH, 2019). Targeted surveys for this species within the WOAOW Project area in 2019 identified one individual within Borrow Pit 4 (Kleinfelder, 2020). This record is within 1 km of the development site. No SLL were recorded during targeted surveys of the development site in December 2020. The Project was designed to follow existing disturbed areas and power station infrastructure, thus avoiding good-condition native woodlands. The Project is unlikely to exacerbate habitat fragmentation in the landscape and the potential for the Project to have a significant impact on the species is unlikely. The amount of suitable habitat within the development site is limited and the Project avoids areas of good condition native vegetation.

After consideration of the factors above, an overall conclusion has been made that the development is unlikely to result in a significant impact to the SLL and a referral is not required.

F.1.4 Swift Parrot (*Lathamus discolor*) and Regent Honeyeater (*Anthochaera phrygia*)

The Swift Parrot and Regent Honeyeater are considered moderately likely to occur based on the presence of marginal foraging habitat, particularly winter flowering species such as *Eucalyptus tereticornis*. These species are known to sporadically occur within and move through the Hunter Valley region, particularly the Swift Parrot while on mainland Australia during winter. The Tomalpin Woodlands near Cessnock (approximately 60 km east of the

development site) and the mountainous forest areas to the west of Denman (approximately 33 km west of the development site) are the closest mapped 'important areas' for these species. Both species are considered likely to only occur intermittently in the locality of Liddell and Bayswater, and the likelihood of birds using the small and isolated woodland patches within the development site as a continual source of habitat is low.

The Swift Parrot occurs as a single, migratory population. It is thought that the Regent Honeyeater also comprises a single Australian population.

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

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

The area impacted by the Project contains a minor amount of potential foraging habitat for the Swift Parrot and Regent Honeyeater. A total of 13.7 ha of suitable woodland habitat for these species occurs within the impact area. A further 3.9 ha of planted vegetation (non-indigenous tree species) may also provide foraging resources and is likely to be impacted. These areas combine to make a total of 17.6 ha likely to be impacted. While the habitat in the area impacted by the development is not optimal, the loss of potential feed trees would affect the opportunity for these species to feed in the area. However, the area impacted by the Project is not considered a critical area for the Swift Parrot or Regent Honeyeater and has not been mapped as an area of important habitat for the Regent Honeyeater.

These species may utilise trees in the area impacted by the Project for foraging intermittently when suitable inland (i.e. box ironbark woodlands) resources are scarce or opportunistically while moving through the Hunter Valley region. The development would remove 176ha of potential foraging habitat for these species, but the impact will be negligible considering that no high-quality foraging habitat will be impacted and the large extent of resources in the adjacent environment will remain.

The Swift Parrot does not breed in mainland Australia. There are only four known key breeding regions remaining for the Regent Honeyeater: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley, Hunter Valley and the Bundarra-Barraba region. The mountainous forest areas to the west of Denman (approximately 33 km west of the development site) is the closest known area in the Hunter Valley occupied by the Regent Honeyeater and would not be impacted by the Project. Furthermore, the extent of habitat remaining in the area after the Project would provide sufficient foraging resources to sustain future visitation, such that the Project is unlikely to lead to a long-term decrease in the size of the Swift Parrot or the Regent Honeyeater populations.

2) 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 development site for foraging intermittently when no other suitable resources are available.

The development would contribute to the loss of a small amount of marginal potential foraging habitat which would result in a negligible reduction in foraging habitat available. However, it would not reduce the area of occupancy of the Swift Parrot, which is estimated at 4,000 km^2or the Regent Honeyeater, which is estimated at 300 km^2.

3) Fragment an existing population into two or more populations

Importantly, the development would not result in fragmentation of habitat for the Swift Parrot and Regent Honeyeater. These species are highly mobile and as a regular behavior fly long distances over open areas to move between suitable foraging habitats. The Project was designed to follow existing disturbed areas and power station infrastructure, thus avoiding good-condition native woodlands. Woodland patches within the site are

small and isolated (generally less than 2 ha). The Project would not affect the movement of the Swift Parrot or Regent Honeyeater between habitat patches or fragment the populations.

4) Adversely affect habitat critical to the survival of a species

Habitat critical to the survival of the Swift Parrot includes; those areas of priority habitat for which the Swift Parrot has a level of site fidelity or possess phenological characteristics likely to be of importance to the Swift Parrot. Box-ironbark and Swamp Mahogany habitats are considered to be the two major forest types for the Swift Parrot in the Hunter Valley.

Habitat critical to the survival of the Regent Honeyeater includes:

- Any breeding or foraging habitat in areas where the species is likely to occur (as defined by the distribution map provided in Figure 2 of the National Recovery Plan – this includes the Sydney Region); and
- Any newly discovered breeding or foraging locations.

The area impacted by the development contains 17.6ha of potential foraging habitat for these species. The development site is within an area where the Regent Honeyeater and Swift Parrot could potentially occur, therefore the foraging habitat that will be impacted is considered to be critical to survival. However, the habitat within the area impacted by the Project is not a primary habitat and unlikely to be of critical importance to the survival of these species.

The habitats are likely to only be visited on rare occasion by birds passing through on route to larger higher quality habitats in the locality. The Project is unlikely to adversely affect habitat critical to the survival of the Swift Parrot and Regent Honeyeater.

5) Disrupt the breeding cycle of a population

The Swift Parrot is endemic to south-eastern Australia and breeds only in Tasmania. This species migrates to mainland Australia in autumn. As such, the development would not impact on breeding habitat for this species. Important winter foraging grounds will not be impacted so there would be negligible impact on the life cycle of the Swift Parrot.

There are only four known key breeding regions remaining for the Regent Honeyeater: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley, Hunter Valley and the Bundarra-Barraba region. It is likely that this species also breeds in other locations, breeding mostly corresponds with the flowering of key eucalypt and mistletoe species. Nests are usually placed in the canopy of mature trees with rough bark, e.g. ironbarks, sheoaks (*Casuarina*) and rough-barked Apple (*Angophora*). Given that breeding of the Regent Honeyeater is not known from the locality, it is unlikely that the development site would constitute breeding habitat for this species. As such, the Project would not impact on breeding habitat for the Regent Honeyeater.

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

As a large-scale migrant (Swift Parrot) and a 'rich-patch nomad' (Regent Honeyeater), these species can cover vast areas of their winter range, seeking suitable flowering eucalypt habitat. These species occur in the region and may utilise trees in the area impacted by the development site for foraging intermittently when no other suitable resources are available. The impact to foraging habitat from the development would be negligible and the development is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

7) 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 in NSW is weeds. Additionally, Noisy Miners and Bell Miners may make the habitat less suitable for the Swift Parrot and Regent Honeyeater due to competitive exclusion. The site already contains extensive weed infestation and Project is unlikely to exacerbate weed invasion. The site is already characterized by small isolated vegetation patches occurring in a disturbed setting and is already well suited to Noisy Miners. The removal of habitat may increase competition for food resources, however a site-specific CEMP will be prepared and implemented prior to the commencement of any clearing or construction works to ensure that impacts are minimised and/or controlled. These management measures will prevent construction activities from introducing or spreading new or existing environmental and noxious weeds or plant and animal pathogens. Consequently, the Project is unlikely to result in any further invasive species becoming established in the habitat for these species.

8) 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 mould infects the roots of plants and has the potential to cause dieback. It is the intention to use current best practice hygiene protocols as part of a CEMP to prevent the introduction or spread of pathogens. Mitigation and environmental management procedures for the development would include guidance for preventing the introduction and/or spread of disease-causing agents such as bacteria and fungi.

9) Interfere with the recovery of the species.

The *National Recovery Plan for the Swift Parrot* (Commonwealth of Australia 2011) identifies the following actions for recovery of this species:

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

The *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia)* (Commonwealth of Australia 2011) identifies four strategies for recovery of this species:

- Improve the extent and quality of Regent Honeyeater habitat.
- Bolster the wild population with captive-bred birds until the wild population becomes self-sustaining.
- Increase understanding of the size, structure, trajectory and viability of the wild population.
- Maintain and increase community awareness, understanding and involvement in the recovery program.

The recovery actions listed above to help recover the Swift Parrot and Regent Honeyeater are largely not applicable to the Project. The removal of suitable foraging habitat conflicts with the first strategy of the Regent Honeyeater recovery plan, though this impact is not considered likely to interfere with the recovery of this species. The Project would not interfere with the recovery of the Swift Parrot.

Conclusion

There would be 17.6ha of reduction in extent of potential foraging habitat for the Swift Parrot and Regent Honeyeater from the Project. The Project would not break apart large blocks or habitat or restrict movement patterns of these species. There would be no impact to breeding habitat for either of these species. It is unlikely to reduce the size of the Swift Parrot population or the Regent Honeyeater population or decrease the reproductive success of these species. The Project is unlikely to interfere with the recovery of the Swift Parrot or Regent Honeyeater. After consideration of the factors above, an overall conclusion has been made that the

Project is unlikely to result in a significant impact to the Swift Parrot or Regent Honeyeater and a referral is not required.

F.1.5 Australasian Bittern (*Botaurus poiciloptilus*)

The Australasian Bittern is considered moderately likely to occur within the study area based on the presence of potential marginal foraging or nesting habitat present on edges of numerous ponds and dams where tall aquatic vegetation is present, primarily in small patches of PCT 1071- *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion. This species was not recorded within the development site despite target surveys of man-made dams and ponds (over four days in December 2020).

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

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

In Australia, the Australasian Bittern occurs from south-east Queensland to south-east South Australia as far as the Adelaide Region, southern Eyre Peninsula, Tasmania and in the southwest of Western Australia (Jaensch et al. 1988; Marchant and Higgins 1990; Garnett et al. 2011). The man-made dams and ponds to be impacted by the Project contain a minor amount of potential foraging or nesting habitat for the Australasian Bittern. A total of 3 ha of low-quality foraging or nesting habitat for this species occurs as fringing aquatic vegetation which may be removed during future maintenance works within BAW areas. However, the impact will be negligible considering that no high-quality foraging or nesting habitat will be impacted and the extent of resources in the adjacent environment (Lake Liddell) will remain.

2) Reduce the area of occupancy of the species

A total of 3 ha of marginal potential foraging or nesting habitat fringing aquatic vegetation will be removed during future maintenance of BAW areas for this species. However, the Project would not reduce the area of occupancy of the Australasian Bittern. This species is widespread in small numbers throughout south western and south-eastern Australia, including Tasmania. Habitat where this species may occur within the development site includes man-made ponds and dams, which are degraded and disturbed due to their proximity to Liddell and Bayswater Power Stations. As such, the Project is unlikely to reduce the area of occupancy of this species.

3) Fragment an existing population into two or more populations

The development site is largely cleared, with high levels of disturbance associated with Bayswater and Liddell power stations. The site does not offer important habitat connectivity and the man-made waterbodies are unlikely to be important for dispersal of the Australasian Bittern throughout its range. The Project would not fragment the existing Australasian Bittern population into two or more populations. Numerous adjacent large waterbodies (such as Lake Liddell) will remain unimpacted by the Project.

4) Adversely affect habitat critical to the survival of a species

Habitat critical to the survival of the Australasian Bittern includes:

- Any wetland habitat where the species is known or likely to occur (breeding or foraging habitat) within the indicative distribution map; and
- Any location with suitable habitat outside the above area that may be periodically occupied by Australasian Bittern.

The area likely to be impacted by the Project contains approximately 3 ha of potential foraging or nesting habitat for this species (within small patches of PCT 1071). The development site is within an area where the

Australasian Bittern could potentially occur, therefore potential foraging or nesting habitat that will be impacted is considered to be critical to survival. However, the habitat within the area impacted by the Project is not a primary habitat and unlikely to be of critical importance to the survival of these species.

The habitats are likely to only be visited on rare occasion by birds passing through on route to larger higher quality habitats throughout the Hunter region. The high disturbance levels of the man-made dams and ponds (associated with the power stations) is likely to deter most fauna groups. Furthermore, given the abundance of better quality waterways in the locality such as Lake Liddell, the Project is unlikely to adversely affect habitat critical to the survival of the Australasian Bittern.

5) Disrupt the breeding cycle of a population

The Australasian Bittern breeds from October to February in single solitary pairs, or polygamously with up to three nesting females per booming male (Bitterns in Rice Project 2016). The species nests in densely vegetated freshwater wetlands, building its nests within dense cover over shallow water placed about 30 cm above the water level (Marchant and Higgins 1990). In rushland, it may avoid breeding in the densest areas (Marchant and Higgins 1990), and in reedbeds may prefer smaller patches, rather than continuous stands (M. Herring, pers. comm. 2019). If population densities are high, it may resort to more open wetlands for nesting, such as in stunted Acacia swamps (Marchant and Higgins 1990).

Given that breeding of the Australasian Bittern is not known from the locality and the aquatic vegetation within man-made dams and ponds is degraded and highly disturbed, it is unlikely that the development site would constitute breeding habitat for this species. As such, the development would not impact on breeding habitat for the Australasian Bittern.

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

The area impacted by the Project contains a minor amount of potential foraging or nesting habitat for the Australasian Bittern. A total of 3 ha of fringing aquatic vegetation (small patches of PCT 1071) may be removed during future maintenance of the BAW areas for this species. However, the impact to foraging or nesting habitat will be negligible considering that no high-quality foraging or nesting habitat will be impacted and the extent of resources in the adjacent environment will remain. As such, the development is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

7) 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 Australasian Bittern in NSW is weeds, particularly Lippia (*Phyla canescens*). Known terrestrial species that are potentially harmful or detrimental to the species (such as Red Fox, Feral Pig, Black Rat) are already present within the development site. Given the site is largely cleared and dominated by exotic vegetation, the Project is unlikely to exacerbate weed invasion. The removal of small patches of habitat could theoretically increase competition for food resources, however a site-specific CEMP will be prepared and implemented prior to the commencement of any clearing or construction works to ensure that impacts are minimised and/or controlled. These management measures will prevent construction activities from introducing or spreading new or existing environmental and noxious weeds or plant and animal pathogens. Consequently, the Project is unlikely to result in any further invasive species becoming established in the habitat for these species.

8) 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 mould infects the roots of plants and has the potential to cause dieback. It is the intention to use current best practice hygiene protocols as part of a CEMP to prevent the introduction or spread

of pathogens. Mitigation and environmental management procedures for the development would include guidance for preventing the introduction and/or spread of disease-causing agents such as bacteria and fungi.

9) Interfere with the recovery of the species.

The *National Draft Recovery Plan for the Australasian Bittern* (Commonwealth of Australia 2019) identifies the following objectives for recovery of this species:

- Implement management strategies to reduce threats to Australasian Bittern and their habitat
- Enhance protection, improve the quality and increase the extent of suitable habitat for the Australasian Bittern
- Improve knowledge of the biology and ecology of Australasian Bittern and implement a monitoring strategy to identify population trends
- Increase stakeholder participation in Australasian Bittern conservation and management
- Coordinate, review and report on recovery process

The Projectt would not conflict with the recovery objectives for the Australasian Bittern listed above. The Project 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 Project boundary. Consequently, the Project would not interfere with the recovery of the Australasian Bittern.

Conclusion

Despite no record of this species during recent surveys, the man-made ponds and dams within the development site could potentially be used by Australasian Bitterns. There would be a 3 ha reduction in extent of potential foraging or nesting habitat for the Australasian Bittern from the Project. Potential habitat is comprised of small and isolated patches of fringing aquatic vegetation existing in man-made waterways in close proximity to Power Stations and associated infrastructure. The Project would not break apart large blocks of habitat or restrict movement patterns of this species. It is unlikely to reduce the size of the Australasian Bittern population or the or decrease the reproductive success of this species. The Project is unlikely to interfere with the recovery of the Australasian Bittern. After consideration of the factors above, an overall conclusion has been made that the Project is unlikely to result in a significant impact to the Australasian Bittern and a referral is not required.

F.1.6 Grey-headed Flying-fox (*Pteropus poliocephalus*)

The Grey-headed Flying-fox are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. No Grey-headed Flying-fox camps are located in the vicinity of the development site, with the nearest camp situated approximately 30 km north-west adjacent to Lower William Street, Muswellbrook along the Hunter River. This species was not recorded during recent fauna surveys however could potentially occur within the development site when trees are flowering. The Grey-headed Flying-fox exists as a single interconnected population in Australia. As such, it is considered an important population.

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

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

There are no roost camps in the development site and the Project would not affect any known permanent roosting, breeding / maternity site. Therefore, it is likely that the impacts of construction and operation of the Project would be confined to minor loss of foraging habitat caused by direct clearing or damage to 17ha of native

and exotic vegetation during the construction phase. However, this loss of foraging habitat would be negligible and unlikely to affect breeding success given the widespread nature of similar native vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of local individuals. Additionally, the movements of the Grey-headed Flying-fox are wide-ranging, particularly throughout the Lower Hunter Valley. Therefore, the development is considered unlikely to lead to a long-term decrease in the size of an important population of the Grey-headed Flying-fox.

2) reduce the area of occupancy of an important population

The area of occupancy of the Grey-headed Flying-fox is not known but the species exists as one interconnected population along the eastern Australian coastal belt from Rockhampton in central Queensland to Melbourne in Victoria. The area occupied by this species would remain the same after construction. No impact to area of occupancy is expected.

3) fragment an existing important population into two or more populations

Highly mobile species such as bats are expected to be less impacted by fragmentation. The Grey-headed Flying-fox is particularly well adapted to accessing widely spaced habitat resources given its mobility and preference for seasonal fruits and blossom in differing parts of the landscape. The Project was designed to follow existing disturbed areas and power station infrastructure, thus avoiding good-condition native woodlands. The Project would not fragment an important population of the Grey-headed Flying-fox. Individuals would still be able to disperse between roosts along the east Australian coast. Genetic exchange within the population and dispersal would not be disrupted by the Project.

4) adversely affect habitat critical to the survival of a species

This species typically exhibits very large home range and Grey-headed Flying-fox 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 development site and the site does not provide typical or likely roosting habitat. However, the nearest camp within the locality exists approximately 30 km north-west adjacent to Lower William Street, Muswellbrook along the Hunter River. 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-kilometre 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.

The 17.8 ha of potential foraging habitat in the development site is unlikely to constitute critical foraging habitat. The majority of this vegetation consists of rehabilitation areas and planted non-indigenous trees. Furthermore, the development is located at a sufficient distance from the nearest camp and would not result in disturbance to this camp or any known camps within the locality. Given the extensive nature of high-quality foraging habitats within the range of local bats, the Project is not expected to adversely affect foraging habitat critical to the survival of this species in this region.

5) disrupt the breeding cycle of an important population

The Project would not directly impact on a known or likely roost camp / breeding or maternity site. Extensive foraging resources are available in the locality that would provide suitable resources during the maternity season. The habitats in the development site are not limiting for this species.

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

The Grey-headed Flying-fox can cover large areas of its range seeking suitable flowering eucalypts and fruits for foraging. The species could potentially utilise vegetation in the study area and surrounds for foraging when the trees are in flower. The impact to foraging habitat from the development would be negligible and the Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of foraging habitat to the extent that the species is likely to decline.

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

The Project 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 with a Project of this nature is minimal given weeds are already well established in the habitat. The management of invasive species would be managed under the CEMP using best practice methods.

8) introduce disease that may cause the species to decline, or

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

9) 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 Project and the development is not expected to interfere substantially with the recovery of the species.

Conclusion

The Grey-headed Flying-fox would be subject to a 17ha reduction in extent of potential foraging habitat from the Project. No breeding camps or other important habitat would be directly impacted. The impact is unlikely to reduce the population size of the Grey-headed Flying-fox or decrease the reproductive success of this species. The Project would not interfere with the recovery of the Grey-headed Flying-fox. After consideration of the factors above, an overall conclusion has been made that the development is unlikely to result in a significant impact to the Grey-headed Flying-fox and a referral for biodiversity matters is not necessary.

Appendix G. Terrestrial Orchid Survey – Expert Advice

EASTCOAST FLORA SURVEY
VEGETATION ASSESSMENT & MAPPING

PO Box 216 KOTARA NSW 2289
Ph. 02 4953 6523

26 October 2020

Kleinfelder
95 Mitchell Road
Cardiff, NSW 2285

Attention: Gilbert Whyte

Re: Threatened orchid surveys for the Bayswater Water and Other Associated Operational Works Project

Dear Gilbert

During May this year, I completed an Expert Report to accompany a Biodiversity Development Assessment Report (BDAR) being prepared by Kleinfelder for the proposed *Bayswater Power Station Water and Other Associated Operational Works* (the Project), as required and in accordance with s. 6.3.1.3 of the NSW Governments Biodiversity Assessment Method (OEH 2017). That Expert Report specifically addressed the likelihood of occurrence of two threatened terrestrial orchids, *Diuris tricolor* and *Prasophyllum petilum,* which were predicted to potentially occur within the area. I concluded in that report that one or both of these species may be present within 142 ha of the four proposed borrow pits, but that if they were it was unlikely that extensive populations would be present. This view was based on the differing habitat traits within the proposed Project area when compared to other parts of the Hunter Valley where I have studied these species.

In response, Kleinfelder have now undertaken targeted surveys across these four borrow pits where I suggested orchid habitat may occur, seeking to determine whether *Diuris tricolor* or *Prasophyllum petilum* are present there. These surveys were completed over 15-18 September 2020, which corresponds with my own observation of flowering in these species elsewhere in the Hunter Valley. Parallel survey transects approximately 10 m apart were surveyed, following the DPIE (2020) guidelines for terrestrial orchids in open vegetation. During these surveys, no individuals of *Diuris tricolor* or *Prasophyllum petilum* were detected, and only the common *Pterostylis bicolor* was observed (and these only in Borrow Pit 4). I have viewed maps showing survey effort prepared using the GPS track lines (also appended to this letter) and am satisfied that sufficient survey has now been completed.

It is worth noting that the 2020 season for Spring-flowering terrestrial orchids has been one of the best for several years, following at least three years of below-average Winter rainfall in the Hunter Valley. Consequently, the lack of orchids detected within the Project area during their peak flowering period and in a 'good' year strongly suggests that the target species are not present there. *Diuris* in particular has flowered extensively in and around the Muswellbrook area, while *Prasophyllum* has been locally abundant in some areas. It is also of interest to note that few other orchid species were observed during surveys, despite the good season.

With the exception of *Pterostylis bicolor* in Borrow Pit 4, the absence of any Spring-flowering orchids across the Project area is likely indicative of an absence of mycorrhizal fungi in the soil. This is an ongoing research topic, which on current understanding suggests that all terrestrial orchids may be constrained in distribution within the central Hunter Valley because of a lack of fungi. It is unknown if such an absence of fungi is due to the prolonged presence of agricultural grazing in this region (which compacts the soil and therefore restricts fungi growth), or if the fungi were never present there. Mycorrhizal fungi are required to provide nutrient to freshly dispersed orchid seed so that they do not desiccate and perish and are also necessary throughout other life stages of these plants. Orchid seed dispersing into these areas will not successfully germinate if there are no fungi there in support.

Given the available evidence, it is highly likely that *Diuris tricolor* and/or *Prasophyllum petilum* do not occur within the Project area, based on:

- inconsistencies in fine-scale habitat attributes between the Project area and other locations supporting the target species, as outlined in my Expert Report;
- the lack of target orchids detected within the Project area during mid-September 2020, the best Spring- flowering orchid season there has been for several years;
- the extent of targeted survey conducted by Kleinfelder along transects 10 m apart across the 142 ha of potential orchid habitat within the Project area;
- the absence or low abundance of any other terrestrial orchid species within the Project area, suggestive of an absence of mycorrhizal fungi (and/or insect pollinators) for all terrestrial species.

Please do not hesitate to get in touch if you require further information.

Yours sincerely

Dr Stephen Bell
M: 0407 284 240

Map frame A(i)
HP Pipe Clearing (south)

Map Frame A(ii)
Coal Handling Plant Water and Wastewater Infrastructure Upgrades

Map Frame A(iii)
Salt Cake Landfill

Legend

- Targeted Threatened Flora Survey Tracks (15-18 September 2020)
- Study Area
- Development Site
- Watercourse

Plant Community Type and Vegetation Zone

- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Moderate_Good_CEEC) - **Zone 1**
- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Regrowth) - **Zone 3**
- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Grassland) - **Zone 4**
- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Rehabilitation) - **Zone 5**
- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Plantation) - **Zone 6**
- Non-Native: Exotic Grasslands
- Excluded

0 50 100 200 300 400 500 Metres

N

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PROJECT REFERENCE: 20200509
DATE DRAWN: 2020/09/29 13:36 Version 1
DRAWN BY: GJoyce

DATA SOURCE:
NSW DFSI - 2018
AGL - 2019
Nearmap - 2020

Flora Survey Effort
15-18 September 2020

Jacobs Group
Biodiversity Development Assessment Report
Bayswater Water and Other Associated
Operational Works (WAOAW) Project

FIGURE:
11A

L:\GIS FOLDER\00 CLIENT FILES\129265_AGL_MacquarieLtd\20211878_BayswaterOrchidSurvey_Sep2020\Mapping\20200509_BDAR_Fig11A_ThreatenedFlora_Round4.mxd

Map Frame B
Borrow Pits 3 and 4

Legend

- Targeted Threatened Flora Survey Tracks (15-18 September 2020)
- Study Area
- Development Site

Plant Community Type and Vegetation Zone

- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Moderate_Good_CEEC) - **Zone 1**
- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Moderate_Good) - **Zone 2**
- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Regrowth) - **Zone 3**
- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Grassland) - **Zone 4**
- PCT 1692: Bull Oak grassy woodland of the central Hunter Valley (Moderate_Good) - **Zone 7**
- PCT 1692: Bull Oak grassy woodland of the central Hunter Valley (Moderate_Good_CEEC) - **Zone 8**
- PCT 1731: Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley (Moderate_Good) - **Zone 9**
- Non-Native: Wetland/Dam (with Wetland Vegetation)
- Non-Native: Exotic Grasslands
- Dam
- Excluded
- Watercourse

0 50 100 200 300 400 500 Metres

N

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PROJECT REFERENCE: 20200509
DATE DRAWN: 2020/09/29 13:39 Version 1
DRAWN BY: GJoyce

DATA SOURCE:
NSW DFSI - 2018
AGL - 2019
Nearmap - 2020

Flora Survey Effort
15-18 September 2020

Jacobs Group
Biodiversity Development Assessment Report
Bayswater Water and Other Associated
Operational Works (WAOAW) Project

FIGURE:
11B

L:\GIS FOLDER\00 CLIENT FILES\129265_AGL_MacquarieLtd\20211878_BayswaterOrchidSurvey_Sep2020\Mapping\20200509_BDAR_Fig11B_ThreatenedFlora_Round4.mxd

Map Frame C
Borrow Pits 1 and 2, Ash Dam Augmentation, Ash Harvesting and Water Management Works, HP Pipe Clearing (north) and LSP Sludge Line

Legend

- Targeted Threatened Flora Survey Tracks (15-18 September 2020)
- Study Area
- Development Site
- Watercourse

Plant Community Type and Vegetation Zone

- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Moderate_Good_CEEC) - **Zone 1**
- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Moderate_Good) - **Zone 2**
- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Regrowth) - **Zone 3**
- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Grassland) - **Zone 4**
- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Rehabilitation) - **Zone 5**
- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Plantation) - **Zone 6**
- PCT 1692: Bull Oak grassy woodland of the central Hunter Valley (Moderate_Good) - **Zone 7**
- PCT 1731: Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley (Moderate_Good) - Zone 9
- Non-Native: Wetland/Dam (with Wetland Vegetation)
- Non-Native: Exotic Grasslands
- Dam
- Excluded

0 50 100 200 300 400 500 Metres

N

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PROJECT REFERENCE: 20200509
DATE DRAWN: 2020/09/29 13:48 Version 1
DRAWN BY: GJoyce
DATA SOURCE:
NSW DFSI - 2018
AGL - 2019
Nearmap - 2020

Flora Survey Effort
15-18 September 2020

Jacobs Group
Biodiversity Development Assessment Report
Bayswater Water and Other Associated Operational Works (WAOAW) Project

FIGURE:
11C

L:\GIS FOLDER\00 CLIENT FILES\129265_AGL_MacquarieLtd\20211878_BayswaterOrchidSurvey_Sep2020\Mapping\20200509_BDAR_Fig11C_ThreatenedFlora_Round4.mxd

Map Frame D(i)
Ravensworth Ash Line - West

Map Frame D(ii)
Ravensworth Ash Line - Central

Map Frame D(iii)
Ravensworth Ash Line - East

Legend

- Targeted Threatened Flora Survey Tracks (15-18 September 2020)
- Study
- Development Site
- Watercourse

Plant Community Type and Vegetation

- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Moderate_Good_CEEC) - **Zone 1**
- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Moderate_Good) - **Zone 2**
- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Regrowth) - **Zone 3**
- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Grassland) - **Zone 4**
- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Rehabilitation) - **Zone 5**
- PCT 1731: Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley (Moderate_Good) - Zone 9
- Non-Native: Wetland/Dam (with Wetland
- Non-Native: Exotic Grasslands
- Dam
- Excluded

0 50 100 200 300 400 500 Metres

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PROJECT REFERENCE: 20200509
DATE DRAWN: 2020/09/29 13:56 Version 1
DRAWN BY: GJoyce
DATA SOURCE:
NSW DFSI - 2018
AGL - 2019
Nearmap - 2020

Flora Survey Effort
15-18 September 2020

Jacobs Group
Biodiversity Development Assessment Report
Bayswater Water and Other Associated
Operational Works (WAOAW) Project

FIGURE:
11D

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Appendix H. Biodiversity credit report

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00022769/BAAS20027/21/00023909

Proposal Name
AGL Liddell Battery and Bayswater Ancillary Work

BAM data last updated *
31/05/2021

Assessor Name
Matt Consterdine

Assessor Number
BAAS20027

BAM Data version *
40

Proponent Names

Report Created
23/06/2021

BAM Case Status
Finalised

Assessment Revision
1

Assessment Type
Major Projects

Date Finalised
04/06/2021

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

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		

Species
Nil

Additional Information for Approval

PCTs With Customized Benchmarks

BAM Biodiversity Credit Report (Like for like)

PCT
No Changes

Predicted Threatened Species Not On Site

Name
Anseranas semipalmata / Magpie Goose
Calidris tenuirostris / Great Knot
Limicola falcinellus / Broad-billed Sandpiper

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1691-Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions	13.7	0	224	224
1691-Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	Not a TEC	23.6	0	22	22
1731-Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley	Not a TEC	0.9	0	7	7
1692-Bull Oak grassy woodland of the central Hunter Valley	Not a TEC	1.2	0	17	17
1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	Not a TEC	3.0	0	82	82

1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Coastal Freshwater Lagoons This includes PCT's: 781, 783, 1071, 1735, 1736, 1737, 1740, 1741, 1742	Coastal Freshwater Lagoons >=70% and <90%	1071_Moderate	No	82	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1691-Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions This includes PCT's: 1603, 1605, 1691, 1692	-	1691_Moderate01	No	38	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions This includes PCT's: 1603, 1605, 1691, 1692	-	1691_Rehabilitation	No	186	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1691-Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Coastal Valley Grassy Woodlands This includes PCT's: 116, 618, 760, 761, 762, 830, 834, 838, 849, 850, 1326, 1395, 1603, 1604, 1691	Coastal Valley Grassy Woodlands >=70% and <90%	1691_Regrowth	No	0	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Coastal Valley Grassy Woodlands This includes PCT's: 116, 618, 760, 761, 762, 830, 834, 838, 849, 850, 1326, 1395, 1603, 1604, 1691	Coastal Valley Grassy Woodlands >=70% and <90%	1691_Native_grassland	No	22	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1692-Bull Oak grassy woodland of the central Hunter Valley	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Coastal Valley Grassy Woodlands This includes PCT's: 116, 618, 622, 623, 760, 761, 762, 829, 830, 834, 837, 838, 849, 850, 1326, 1395, 1603, 1604, 1691, 1692	Coastal Valley Grassy Woodlands >=50% and <70%	1692_Moderate-good	No	17	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1692-Bull Oak grassy woodland of the central Hunter Valley

1731-Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Coastal Swamp Forests This includes PCT's: 839, 1064, 1227, 1230, 1231, 1232, 1716, 1717, 1718, 1719, 1723, 1730, 1731, 1795, 1798	Coastal Swamp Forests >=50% and <70%	1731_Moderate-good	No	7	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Delma impar / Striped Legless Lizard	**1691_Moderate01, 1691_Regrowth, 1691_Rehabilitation, 1691_Native_grassland, 1692_Moderate-good**	38.5	279.00

Myotis macropus / Southern Myotis	**1691_Moderate01, 1691_Rehabilitation, 1692_Moderate-good, 1071_Moderate**	10.0	196.00

Credit Retirement Options

Like-for-like credit retirement options

Delma impar / Striped Legless Lizard	Spp	IBRA subregion
	Delma impar / Striped Legless Lizard	Any in NSW
Myotis macropus / Southern Myotis	Spp	IBRA subregion
	Myotis macropus / Southern Myotis	Any in NSW

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id
00022769/BAAS20027/21/00023909

Proposal Name
AGL Liddell Battery and Bayswater Ancillary Work

BAM data last updated *
31/05/2021

Assessor Name
Matt Consterdine

Assessor Number
BAAS20027

BAM Data version *
40

Proponent Name(s)

Report Created
23/06/2021

BAM Case Status
Finalised

Assessment Revision
1

Assessment Type
Major Projects

Date Finalised
04/06/2021

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

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		

Species
Nil

Additional Information for Approval

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

BAM Biodiversity Credit Report (Variations)

Name
Anseranas semipalmata / Magpie Goose
Calidris tenuirostris / Great Knot
Limicola falcinellus / Broad-billed Sandpiper

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1691-Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions	13.7	0	224	224.00
1691-Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	Not a TEC	23.6	0	22	22.00
1731-Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley	Not a TEC	0.9	0	7	7.00
1692-Bull Oak grassy woodland of the central Hunter Valley	Not a TEC	1.2	0	17	17.00
1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	Not a TEC	3.0	0	82	82.00

1071-Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region

	Coastal Freshwater Lagoons This includes PCT's: 781, 783, 1071, 1735, 1736, 1737, 1740, 1741, 1742	Coastal Freshwater Lagoons >=70% and <90%	1071_Moderate	No	82	Hunter,Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Freshwater Wetlands	Tier 2 or higher threat status	1071_Moderate	No	82	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1691-Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions This includes PCT's: 1603, 1605, 1691, 1692	-	1691_Moderate01	No	38	Hunter,Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions This includes PCT's: 1603, 1605, 1691, 1692	-	1691_Rehabilitation	No	186	Hunter,Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Grassy Woodlands	Tier 3 or higher threat status	1691_Moderate01	No	38	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Grassy Woodlands	Tier 3 or higher threat status	1691_Rehabilitation	No	186	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1691-Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Coastal Valley Grassy Woodlands This includes PCT's: 116, 618, 760, 761, 762, 830, 834, 838, 849, 850, 1326, 1395, 1603, 1604, 1691	Coastal Valley Grassy Woodlands >=70% and <90%	1691_Regrowth	No	0	Hunter,Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Coastal Valley Grassy Woodlands This includes PCT's: 116, 618, 760, 761, 762, 830, 834, 838, 849, 850, 1326, 1395, 1603, 1604, 1691	Coastal Valley Grassy Woodlands >=70% and <90%	1691_Native_grassland	No	22	Hunter,Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Grassy Woodlands	Tier 2 or higher threat status	1691_Regrowth	No	0	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Grassy Woodlands	Tier 2 or higher threat status	1691_Native_grassland	No	22	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1692-Bull Oak grassy woodland of the central Hunter Valley	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Coastal Valley Grassy Woodlands This includes PCT's: 116, 618, 622, 623, 760, 761, 762, 829, 830, 834, 837, 838, 849, 850, 1326, 1395, 1603, 1604, 1691, 1692	Coastal Valley Grassy Woodlands >=50% and <70%	1692_Moderate-good	No	17	Hunter,Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1692-Bull Oak grassy woodland of the central Hunter Valley	**Variation options**					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Grassy Woodlands	Tier 3 or higher threat status	1692_Moderate-good	No	17	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1731-Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Coastal Swamp Forests This includes PCT's: 839, 1064, 1227, 1230, 1231, 1232, 1716, 1717, 1718, 1719, 1723, 1730, 1731, 1795, 1798	Coastal Swamp Forests >=50% and <70%	1731_Moderate-good	No	7	Hunter,Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Forested Wetlands	Tier 3 or higher threat status	1731_Moderate-good	No	7	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Delma impar / Striped Legless Lizard	**1691_Moderate01, 1691_Regrowth, 1691_Rehabilitation, 1691_Native_grassland, 1692_Moderate-good**	38.5	279.00
Myotis macropus / Southern Myotis	**1691_Moderate01, 1691_Rehabilitation, 1692_Moderate-good, 1071_Moderate**	10.0	196.00

Credit Retirement Options

Like-for-like options

Delma impar/ Striped Legless Lizard	Spp	IBRA region	
	Delma impar/Striped Legless Lizard	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Myotis macropus/ Southern Myotis	Spp		IBRA region
	Myotis macropus/Southern Myotis		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Appendix I. Staff Experience

Staff	Qualifications	Experience
Chris Thomson (report review)	Graduate Certificate in Natural Resources Bachelor of Applied Science Accredited under Section 6.10 of the BC Act as a Biodiversity Assessment Method Assessor (No. BAAS18058)	24 years as an ecological consultant.
Matt Consterdine (lead ecologist, report author, flora and fauna survey, BAM-C calculations)	Bachelor of Environmental Science and Management Certificate III Conservation and Land Management Accredited under Section 6.10 of the BC Act as a Biodiversity Assessment Method Assessor (No. BAAS20027)	Eight years as an ecological consultant. One year in bush regeneration.
Tim Maher (reporting, flora and fauna survey)	Master of Research (Plant Ecology) Bachelor of Advanced Science (Biology)	Two years as an ecological consultant. Two years in bush regeneration.
Julia Bayada (Graduate), (reporting, flora and fauna survey)	Bachelor of Environmental Science and Management	One year as an ecological consultant. One year in NSW Government environmental department.

Appendix J. Guide to revised BDAR (and BCD response)

Jacobs was commissioned by AGL Macquarie Pty Ltd (AGLM) to deliver an Environmental Impact Statement (**EIS**) for the proposed Liddell Battery and Bayswater Ancillary Works Project (SSD-8889679) (**the Project**). The EIS was supported by various technical assessments including a Biodiversity Development Assessment Report (**BDAR**) and placed on public exhibition from 15 April to 12 May 2021.

Hunter Central Coast Branch of the **BCD** has provided a submission which includes a list of recommendations for addressing information gaps or improvements to the BDAR (in a letter titled *Liddell Battery and Bayswater Ancillary Works Project (SSD-8889679) - Review of Environmental Impact Statement - 7 May 2021*). The recommendations received from BCD were accepted and adjustments to this revised BDAR (IS334000_BDAR_Rev03 20210604_Certification copy) have been made (including adjustments to the BAM Calculator - (00022769/ BAAS20027/21/00023909).

The purpose of this appendix is to provide a guide for identifying which sections of the revised BDAR have been edited or re-worked in response to BCD recommendations. Changes to the revised BDAR are listed below the relevant recommendation.

Recommendation 1

BCD recommends the BAM accredited assessor certifies that the BDAR was finalised within 14 days of the exhibition of the EIS.

The BDAR that was placed on public exhibition was updated to include the certification statement (within 14 days) prior to going on public display. No further action was required.

Recommendation 2

BCD recommends that the proponent describes how the survey effort for the striped legless lizard meets the Survey Guidelines for Australia's Threatened Reptiles (Department of Agriculture, Water and the Environment, 2011).

Given that the survey duration was insufficient to meet Survey Guidelines for Australia's Threatened Reptiles (Department of Agriculture, Water and the Environment, 2011), this species has been assumed present in in accordance with paragraph 5.2.4 of the BAM.

Changes to revised BDAR include:

- **Section 6.3.2.8** Targeted surveys for threatened reptiles adjusted to explain issues with survey duration for SLL.
- **Section 6.4.2** NSW BC Act listed threatened fauna adjusted to assume presence of SLL and discuss habitats within development site (discussed in new **Section 6.4.2.1**)
- Species polygon for SLL **Figure 6-4** added
- **Section 8.5** Commonwealth listed threatened animals adjusted to assume presence of SLL and discuss habitats within development site
- SLL added to **Section 12.2.2** Impacts on threatened species, including discussion text and **Table 12.2**
- Species impact area for SLL added to **Figure 12-1**
- Column for SLL added to **Table 14.1** Credit requirements for each stage of the Project
- **Chapter 15** Conclusion text adjusted to include SLL

- SLL text added to Executive summary
- **Appendix A** - likelihood of occurrence text adjusted for SLL
- **Appendix F** – EPBC Act Significance Assessments – text adjusted for SLL.

The SLL is assumed present in the updated version of the BAM-C (00022769/ BAAS20027/21/00023909).

Recommendation 3

Further justification should be provided for the exclusion of the red goshawk from further assessment.

This species was not generated by the BAM-C and is not associated with any of the PCTs of the assessment area, however, has been added to the Assessment due to the presence of a small number of records occurring to the north of Singleton and east of Ravensworth.

This species was added to **Section 6.2.5** of the Revised BDAR and its likelihood of occurrence discussed. Lack of suitable habitat for this species was further explained in **Section 6.3.2**. This species was also added to **Section 8.5** (commonwealth listed threatened animals). The Red Goshawk likelihood of occurrence text has also been updated **Appendix A**.

Recommendation 4

BCD recommends a new version of Figure 6-1 'Threatened flora surveys' is prepared, at 1:1,000 scale, that clearly shows the location of targeted flora surveys, and the vegetation zones in which they were conducted.

Figure 6-1 of the BDAR has been revised to show more detail of threatened flora surveys, and is presented at 1:10,000 scale. Flora survey tracks are clear at this scale. The BAM recommends 1:1,000 scale is used for this figure, however, due to the size of the Assessment area it is not feasible to produce maps at this scale (this would add over 100 figures to the BDAR).

Recommendation 5

BCD recommends that the proponent describes the habit, and the ability to develop seeds and suckers of the planted Weeping Myall plants and states whether they are of the indigenous Hunter Valley form or the inland form of the species.

Further information has been provided as to why the planted *Acacia Pendula* trees near the Bayswater carpark are not considered to be the Hunter Valley form of this species.

Changes to revised BDAR include:

- Text updates in **Section 5.7** Threatened ecological communities (BC Act)
- Text updates in **Section 6.4.1** Threatened flora species, with photos added of key identifying features (**Photo 6-5**).
- Text updates in **Section 8.3** Threatened ecological communities (EPBC Act).

Recommendation 6

BCD recommends that text currently obscured by the photo on page 53 of the BDAR, and a figure caption for the photo on the same page are provided in the Response to Submissions Report.

This formatting issue is resolved in the revised BDAR.

Recommendation 7

BCD recommends that details are provided that meet the requirements of Table 25 of the BAM:

Required Detail: Discussion of connectivity of the native vegetation as per Paragraphs 4.2.1.8–4.2.1.11 of the BAM
Text added to **Chapter 4.5** which better describes existing habitat connectivity in the surrounding landscape and Central Hunter Valley.
Required Detail: Candidate species list, with the Biodiversity Risk Weighting for each species (as per Table 25 of the BAM)
Biodiversity Risk weighting scores added to each of the Candidate species in **Table 6.3**.
Required Detail: A table that describes the measures to be implemented before, during and after construction to avoid and minimise the impacts of the project, including action, outcome, timing and responsibility (as per Table 25 of the BAM).
Chapter 11 text updated, and **Table 11.1** updated to describe staging, outcomes and responsibility of impact mitigation measures.
Required Detail: Maps demonstrating indirect impact zones (where applicable) (as per Table 25 of the BAM)
There is no detailed design for the Project. The current development site is a worst-case scenario and incorporates all direct and indirect impact areas. The future impact areas will likely be much more confined than what is accounted for in this BDAR. A smaller final disturbance footprint is likely, and avoidance of native vegetation will be prioritized. The mapped 'assessment area' already provides a 50m buffer of the development site in which indirect impacts have been discussed in the BDAR. No amendments have been made to BDAR.
Required Detail: Map(s) of impact areas not requiring offset (as per Section 10.3 of the BAM)
This information is mapped in **Figures 12-1** of the BDAR.
Required Detail: Maps(s) of impact areas not requiring assessment (as per Section 10.4 of the BAM)
Revised BDAR contains new **Figures 12-2** which show areas not requiring assessment – including the 'Excluded/ Artificial surface' and 'Exotic grassland' areas currently mapped.
Required Detail: The Biodiversity credit report that includes the table of credit class and matching credit profiles (as per Table 25 of the BAM)
Revised BDAR contains the requested credit report as an appendix.
Required Detail: Conformation on the identification of Utricularia subulata in BAM Plot 15 for the project (Appendix B of the BDAR). This would be an important new record for the NSW Central Western Slopes Botanic Subdivision.
This is an incorrect ID of French Flax (*Linum trigynum*) which is a common weed throughout grassy woodlands of the Hunter Valley. The location of BAM plot 15 is on an elevated site containing native and exotic grasses with no water retaining features or temporarily inundated soaks, meaning that there is no suitable habitat for *Utricularia subulata.* Given that both these species are exotic and the cover and abundance does not change in the BAM plot data, there is no change to the VI score of the PCT. This means no alterations to the BAM-C are required. Appendix B Floristic survey composition and structure data has been updated to fix this error (see plot 15 column).