

APPENDIX E

Biodiversity Development Assessment Report

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niche Environment and Heritage

Appin Mine Ventilation and Access Project

Biodiversity Development Assessment Report

Prepared for Illawarra Metallurgical Coal | 29 June 2021



niche-eh.com

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Project number	Client	Project manager	LGA
6418	Illawarra Metallurgical Coal	Stephen Bloomfield	Wollondilly

Declaration

This Biodiversity Development Assessment Report has been prepared on the basis of the requirements of (and information provided under) the Biodiversity Assessment Method as certified by Stephen Bloomfield (BAAS 18054)



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Executive summary

Context

Niche Environment and Heritage Pty Ltd (Niche) was engaged by Illawarra Metallurgical Coal (IMC) to prepare a Biodiversity Development Assessment Report (BDAR) for the establishment of two ventilation shafts (Ventilation Shaft 7 and Ventilation Shaft 8) and associated ventilation and mine access infrastructure and facilities (the Project) located at 345 Menangle Road, Menangle, NSW (the property). The subject land covers the area that would be impacted by the Project.

This report describes the ecological values within the subject land as per the Biodiversity Assessment Methodology (BAM) (DPIE 2020a), and determines whether the Project is likely to have an impact on threatened biodiversity listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The ecological assessment, undertaken in accordance with the BAM (DPIE 2020a), included the following:

- Site walkover to map type and extent of native vegetation and determine habitat for threatened biodiversity.
- Collection of floristic and habitat data from seven BAM plots and six Rapid Data Points (RDPs).
- Targeted surveys for flora species.

Targeted flora survey for Spiked Rice-flower (*Pimelea spicata*) and Downy Wattle (*Acacia pubescens*) was undertaken as part of the assessment.

Targeted fauna survey was not undertaken due to lack of potential habitat in the subject land.

Results

Two plant community types (PCT) were mapped within the subject land:

- PCT 835 *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*.
- PCT 849 *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*.

PCT 835 aligns with *River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* (RFEF) Threatened Ecological Community (TEC). RFEF is listed as Endangered under the BC Act and Critically Endangered under the EPBC Act[1]. However, with reference to the NSW Scientific Committee's definition of RFEF, PCT 835 within the subject land would not meet the BC Act definition of the TEC. Similarly, it would not satisfy the condition thresholds provided in the Commonwealth conservation advice for RFEF to make it eligible for Commonwealth listing. The Project will not impact on the RFEF TEC.

PCT 849 aligns with *Cumberland Plain Woodland in the Sydney Basin Bioregion* (CPW) TEC. CPW is listed as Critically Endangered under both the BC Act and EPBC Act[2]. However, with reference to the Commonwealth conservation advice for CPW, PCT 849 within the subject land would not satisfy the condition thresholds provided to make it eligible for Commonwealth listing. The Project will therefore only impact the CPW TEC

[1] Listed as River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria.
[2] Listed as Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest.

protected at a State level (BC Act). Therefore, the Project would not have an impact on any TECs listed on the EPBC Act.

No threatened flora were recorded within the subject land. No threatened flora are considered to have a moderate or higher likelihood of occurrence in the subject land.

No threatened fauna species were recorded within the subject land. No threatened fauna are considered to have a moderate or higher likelihood of occurrence in the subject land.

Impact assessment

The Project will result in the following:

- Direct removal of 18.78 ha of native vegetation (highly modified and invaded by introduced species).
- Removal of fauna habitat (native vegetation and ephemeral drainage lines).
- Impact on a Serious and Irreversible Impacts (SAII) entity: CPW TEC.

Avoid/mitigate impacts

The Project has been designed to avoid stands of CPW TEC that are present within the property. The development footprint has been situated within the poorest quality vegetation and fauna habitat on the property.

Measures to reduce the impact of the Project on biodiversity values are detailed in this report.

Credit calculations and offsetting

A total of two ecosystem credits are required to offset impacts to native vegetation as a result of the Project:

- PCT 849 *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion* – two (2) ecosystem credits.

Glossary and list of abbreviations

Term or abbreviation	Definition
BAM	Biodiversity Assessment Method
BAM-C	Biodiversity Assessment Method Credit Calculator
BC Act	NSW *Biodiversity Conservation Act 2016*
BC Reg	NSW *Biodiversity Conservation Regulation 2017*
BDAR	Biodiversity Development Assessment Report
BMP	Biodiversity Management Plan
BOS	NSW Biodiversity Offsets Scheme
CEEC	Critically Endangered Ecological Community
cm	Centimetre/s
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DCP	Development Control Plan
DPIE	NSW Department of Planning, Industry and Environment (formerly DECCW, DECC, DEC, OEH)
EEC	Endangered Ecological Community
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
ha	Hectare/s
IBRA	Interim Biogeographic Regionalisation for Australia
km	Kilometre/s
LEP	Local Environment Plan
LGA	Local Government Area
Locality	The subject land and surrounds, nominally a 10 km radius from the subject land
m	Metre/s
MNES	Matters of National Environmental Significance (from the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*).
PCT	Plant Community Type
RDP	Rapid Data Point
SAII	Serious and Irreversible Impacts
SEPP	State Environmental Planning Policy
SSD	State Significant Development
TBDC	Threatened Biodiversity Data Collection
TEC	Threatened Ecological Community
VI	Vegetation Integrity as calculated by the BAM-C

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1. Introduction

1.1 Context

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by Illawarra Metallurgical Coal (IMC) to assess the ecological values and impacts associated with the establishment of two ventilation shafts and associated ventilation and mine access infrastructure and facilities (the Project) located at 345 Menangle Road, Menangle, NSW (the property) (Figure 1). The subject land (in accordance with the requirements of the NSW Biodiversity Assessment Methodology [BAM] [DPIE 2020a]), or Project Area as described in the Modification Report, covers the area that would be impacted by the Project (Figure 2, Figure 3).

The Appin Mine is an existing underground coal mine situated in the Southern Coalfield of NSW, approximately 35 kilometres north-west of Wollongong. This mine extracts coal from the Bulli Coal Seam under the Bulli Seam Operations (BSO) Project (Project Approval 08_0150). The Project is a modification to the BSO and is being assessed as State Significant Development (SSD) under Part 4, Division 4.7 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Appin Mine operations are progressing further away from the existing ventilation and mine access infrastructure. As such, the purpose for the Project is to provide adequate ventilation and mine access to ensure a safe and efficient underground working environment.

The primary objective of this Biodiversity Development Assessment Report (BDAR) is to use the BAM (DPIE 2020a) to describe and assess the ecological values within the subject land and surrounds within NSW, determine whether the Project is likely to have an impact on threatened biodiversity listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and identify and quantify any associated biodiversity offsetting requirements.

1.2 The Project

The Project would include the construction and operation of the following key infrastructure (Figure 3):

- One downcast ventilation shaft (to be known as Ventilation Shaft 7).
- One upcast ventilation shaft (to be known as Ventilation Shaft 8) and associated extraction fans.
- Mine access facilities (including a winder and headframe) within Ventilation Shaft 7.
- Associated ventilation and mine access infrastructure and facilities.
- Sedimentation ponds.

Clean water from the site water management system will be discharged into Foot Onslow Creek. The water to be discharged will be in accordance with water quality standards prescribed by the Environmental Protection Authority (EPA). An aquatic ecology assessment has been conducted by Niche and is provided in Annex 1.

It is expected that the shafts would be constructed from the surface down to the underground workings via a combination of mechanical excavation and conventional shaft sinking (drill and controlled blasting).

Excavation of the shafts would occur 24 hours per day, seven days per week, while the remainder of construction activities associated with the facility (e.g. installation of surface infrastructure) would generally be limited to daytime hours. The facility would be required to operate 24 hours per day, seven days per week, consistent with other similar facilities within the locality.

The facility would operate concurrently as a ventilation facility (one upcast and one downcast shaft, associated fans and equipment) and as a mine access site (including equipment such as a winder, headframe, bathhouse, materials storage, offices). The construction and operation of the ventilation infrastructure is critical to the mine and will therefore be constructed first as a matter of priority.

The construction footprint (used interchangeably with subject land throughout this report) associated with the Project is expected to be 21.44 ha, while the operational footprint will be 14.01 ha (Figure 3, Figure 4).

For the purpose of this BDAR all vegetation within the construction footprint has been assessed as being removed. Therefore, the Project will require the removal of 18.78 hectares (ha) of native vegetation, albeit highly modified and invaded by introduced species.

1.3 The subject land

The subject land is located at 345 Menangle Road, Menangle, NSW (Figure 1). The subject land encompasses 21.44 ha of land and is zoned RU2 Rural Landscape in the Wollondilly Local Environment Plan (LEP) 2011.

The subject land has been previously cleared and historically grazed. As such, it is dominated by grassland, the composition of which is predominantly exotic. The introduced African Boxthorn (*Lycium ferocissimum*) is common in the subject land.

The woody native vegetation present in the subject land is restricted to small isolated patches of weed infested Blackthorn (*Bursaria spinosa*) shrubland that have naturally regenerated over time and isolated Forest Red Gum (*Eucalyptus tereticornis*) individuals.

Foot Onslow Creek traverses the south-eastern and northern portions of the subject land, while two unnamed ephemeral drainage lines feed into this creek (refer to Figure 4). Foot Onslow Creek is a 3rd order (Strahler) stream and flows in a northerly direction. The two unnamed drainage lines are 1st order (Strahler) streams. One of these traverses the western portion of the subject land through a series of dams before meeting Foot Onslow Creek, while the other flows under Menangle Road in the west and feeds into Foot Onslow Creek in the north of the subject land. Neither of these ephemeral drainage lines contained water at the time of the field surveys.

A linear strip of riparian forest lines Foot Onslow Creek and is dominated by the introduced Peppercorn Tree (*Schinus molle*).

One currently occupied dwelling is present in the north of the subject land and a shed is present near the largest of the dams in the centre of the subject land (Figure 4). Construction waste, discarded car bodies, sawn and felled timber, and disused tyres are common.

As shown on Figure 2, the subject land occurs within the:

- Sydney Interim Biogeographic Regionalisation of Australia (IBRA) Bioregion.
- Cumberland IBRA Subregion.
- Cumberland Plain Mitchell Landscape.

1.4 Approval and assessment process

The following legislation or planning instruments are relevant to the works associated with the Project within the subject land.

1.4.1 State approval and assessment process – application of the BAM

The EP&A Act provides an assessment framework (in concert with the BC Act) for the consideration of impacts to threatened biodiversity. Under section 7.2 of the BC Act, development is likely to significantly affect threatened species if:

a) it is likely to significantly affect threatened species or ecological communities, or their habitats, according to the test in section 7.3 of the BC Act, or
b) the development exceeds the Biodiversity Offsets Scheme (BOS) threshold if the biodiversity offsets scheme applies to the impacts of the development on biodiversity values, or
c) it is carried out in a declared area of outstanding biodiversity value.

The Project is to be assessed as SSD under Part 4, Division 4.7 of the EP&A Act, which requires proponents to use the BOS and BAM (DPIE 2020a) to prepare a BDAR under the BC Act (section 3.9). The BDAR is to outline avoidance and mitigation measures as well as offset requirements for all vegetation clearing regardless of whether significant impacts on threatened biodiversity are likely to occur. Project approval will require offsetting as per the requirements of the BDAR or, to a lesser degree, as agreed upon after consultation with the Minister administering the BC Act.

The BAM (DPIE 2020a) is a framework for assessment of biodiversity impacts and determination of offsetting requirements under the BOS. The BOS and implementation of the BAM (DPIE 2020a) is triggered when certain thresholds are exceeded, as prescribed in the *Biodiversity Conservation Regulation 2017* (BC Reg), namely:

- The area of native vegetation to be cleared exceeds the clearing threshold associated with the minimum lot size applicable to the property.
- The land to be cleared occurs in the shaded area of the Biodiversity Values Map.
- The development is likely to significantly affect threatened species or ecological communities, in accordance with the five-part test.

While the Project requires a BDAR under section 3.9 of the BC Act, it triggers consideration of the project under the BOS as:

- The area of native vegetation likely to be cleared exceeds the clearing threshold (i.e. 1 ha as the minimum lot size is 40 ha).
- The area in which clearing is proposed occurs on the shaded area of the Biodiversity Values Map.

This BDAR describes the biodiversity values present within the subject land and identifies impacts from the Project on these values. This assessment has used the BAM Calculator (BAM-C) (version 1.3.0.00) (DPIE 2021a).

1.4.2 Commonwealth approval and assessment process

Matters of National Environmental Significance (MNES) are protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The BAM (DPIE 2020a) requires proponents to identify and assess the impacts on all nationally listed threatened species and threatened ecological communities that may be present on or near the development site. Where threatened biodiversity listed under the EPBC Act may be potentially impacted by the Project, an assessment of impacts will be undertaken via the Significance Impact Criteria provided under the EPBC Act.

Under the EPBC Act, activities that have potential to result in significant impacts on MNES must be referred to the Commonwealth Minister for the Environment and Energy for assessment.

This report considers the impact of the Project on MNES.

1.4.3 NSW Biosecurity Act 2015

The broad objectives for biosecurity in NSW under the *Biosecurity Act 2015* are to manage biosecurity risks from animal and plant pests and diseases, weeds and contaminants by:

- Preventing their entry into NSW.
- Quickly finding, containing and eradicating any new entries.
- Effectively minimising the impacts of those pests, diseases, weeds and contaminants that cannot be eradicated through robust management arrangements.

Under the *Biosecurity Act 2015*, priority weeds are defined in the following categories:

- Weeds of National Significance.
- National Environmental Alert List Weeds.
- Water weeds.
- Native plants considered weeds.

In NSW all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Weeds identified under the *Biosecurity Act 2015* have been identified in section 2.2.5.

1.4.4 Water Management Act 2000

The objects of the *Water Management Act 2000* (WM Act) are to provide for the sustainable and integrated management of the water sources of the state for the benefit of both present and future generations and, in particular:

- Ecologically sustainable development.
- Protect, enhance and restore water recourses.
- Recognise and foster social and economic benefits.
- Recognise the role of the community.
- Provide efficient and equitable sharing of water.
- Management of water sources with other aspects of the environment including native vegetation and native fauna.
- Encourage the sharing of responsibility and efficient use of water.
- Encourage best practice management and use of water.

The Office of Water is the regulator and policy maker for water resource management in NSW and administers the WM Act. The department develops natural resource management policy frameworks, strategies and plans related to water management.

Controlled activities carried out in, on or under waterfront land are regulated by the WM Act. The NSW Office of Water is required to assess the impact of any proposed controlled activity to ensure that no more than minimal harm will be done to waterfront land as a consequence of carrying out the controlled activity. Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 metres of the highest bank of the river, lake or estuary.

While the Project will impact waterfront land, thus constituting a controlled activity, in accordance with 4.41(1)(g) of the EP&A Act approval from the Office of Water is not required.

1.4.5 State Environmental Planning Policy (Koala Habitat Protection) 2021

The State Environmental Planning Policy (SEPP) (Koala Habitat Protection) 2021 (the Koala Habitat Protection SEPP 2021) came into force on 17 March 2021 to replace and repeal the Koala Habitat protection SEPP 2020 (which replaced the Koala Habitat protection SEPP 2019 on 30 November 2020, and was in force from November 2020 until March 2021) for specific areas of NSW.

The Koala Habitat Protection SEPP 2021 does not apply to SSD.

1.4.6 Wollondilly Local Environmental Plan 2011

Local Environment Plans (LEP) are created by Councils in consultation with their community and guide planning decisions for LGAs. They apply either to the whole or part of an LGA and make provision for the protection or utilisation of the environment through zoning of land and development controls.

The subject land is subject to the Wollondilly LEP 2011 and is zoned RU2 Rural Landscape. The activities proposed to occur on the subject land are as defined under 'underground mining' in clause 3 of the Mining SEPP being "*shafts, drill holes, gas and water drainage works, surface rehabilitation works and access pits associated with that mining (whether carried out on or beneath the earth's surface)"*. Therefore, activities proposed to occur on the subject land are considered to be permissible with consent, pursuant to clause 7(1)(a) of the Mining SEPP, which permits 'underground mining' to be carried out on any land.

Clause 5(3) of the Mining SEPP gives it primacy where there is any inconsistency between the provisions in the Mining SEPP and the provisions in any other environmental planning instrument (subject to limited exceptions under clause 4). The practical effect of clause 5(3) for the Project is that, if there is any inconsistency between the provisions of the Mining SEPP and those contained in the Wollondilly LEP, the provisions of the Mining SEPP will prevail.

1.4.7 Wollondilly Development Control Plan 2016

The *Wollondilly Development Control Plan 2016* (DCP) (Wollondilly Shire Council 2016) has been prepared in accordance with Division 6 of the EP&A Act and with Part 3 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). Clause 11 of the State and Regional Development SEPP indicates that DCPs (whether made before or after the commencement of the SEPP) do not apply to SSD, and hence do not apply to the Project.

Notwithstanding, it is noted that landscaping would preferentially consist of native plants that are endemic (locally occurring) to the locality using those recommended species provided under part 11 of the Wollondilly DCP 2016.

1.5 Assessment objectives and format

The primary objective of this assessment is to use the guidelines and methodology provided in the BAM (DPIE 2020a) to determine the impact the Project would have on biodiversity, avoid and mitigate these impacts and then calculate the Project's biodiversity offset requirement.

This BDAR consist of two broad stages consistent with the BAM (DPIE 2020a):

Stage 1 – Biodiversity Assessment

- Assessment of landscape features.
- Assessment of native vegetation.

- Assessment of threatened species and populations.

Stage 2 – Impact Assessment

- Avoid and minimise impacts on biodiversity values.
- Consider impact and offset thresholds.
- Determine and calculate offset requirements.

1.6 Assessment resources and assessor qualifications

This BDAR has been prepared by the accredited personnel and support staff identified in Table 1. Resources and survey guidelines used in the development of this BDAR are detailed in Table 2.

Table 1: Assessor qualifications and resources

Personnel	Qualifications	Tasks carried out
Stephen Bloomfield	Senior Ecologist (Botanist) Accredited Biodiversity Assessor (BAAS 18054)	BAM plots and targeted threatened flora searches; data management, data entry, credit calculations, review of credit calculations, report preparation.
Matthew Russell	Senior Aquatic Ecologist	Report preparation.
David Wilkinson	Ecologist	BAM plots and targeted threatened flora searches; data management, data entry, report preparation.
Sian Griffiths	Senior Ecologist Accredited Biodiversity Assessor (BAAS 17066)	Peer review.
Loren Laughlin	GIS Specialist	Mapping.
Yin Hua	GIS Specialist	Mapping.

Table 2: Assessment resources and guidelines used

Assessment resources/guideline	
Resources	• BAM (DPIE 2020a) • BAM 2020 Operational Manual – Stage 1 (DPIE 2020b) • BAM Operational Manual – Stage 2 (DPIE 2019a) • BAM 2020 Operational Manual – Stage 3 (DPIE 2020c) • BAM Calculator User Guide (OEH 2018) • Biodiversity Assessment Method Calculator (BAM-C), app version 1.3.0.00, data version 37 (DPIE 2021a) • The BioNet Atlas of NSW Wildlife (DPIE 2021b) • EPBC Act Protected Matters Search Tool (PMST) (Commonwealth Department of the Agriculture, Water and Environment (DAWE) 2021a) • BioNet Threatened Species Database (DPIE 2021c) • The NSW Bionet Vegetation Information System database, access via the Bionet Vegetation Classification database (DPIE 2021d) • Species Profile and Threats Database (SPRAT) with information on threatened species profiles, recovery plans and final determinations (DAWE 2021b).
Survey guidelines	• Surveying threatened plants and their habitats, NSW survey guide for the Biodiversity Assessment Method (DPIE 2020d).

2. Landscape Assessment

2.1 Landscape assessment - methods

As detailed in section 4 of the BAM (DPIE 2020a), a landscape assessment for the Project is required, which was conducted within the BAM-C. Landscape value is an assessment of a number of factors including:

- Native vegetation cover.
- Rivers, streams and estuaries.
- Areas of geological significance.
- Habitat connectivity.

For each factor the current state of the landscape is assessed then compared with the state of the landscape if the Project were to proceed.

2.1.1 Landscape features and scoring

Table 3 provides details of the landscape settings and native vegetation cover estimate for the Project.

Table 3: Landscape features and native vegetation cover estimate under the NSW BAM

Landscape features	Description	Figure reference
Subject land size	21.44 ha	
IBRA bioregion/subregion	Sydney/Cumberland	Figure 2
NSW (Mitchell) Landscapes	Cumberland Plain Mitchell Landscape	Figure 2
Rivers, streams and estuaries and Strahler stream order	Foot Onslow Creek is the primary water body in the subject land and meanders in and out of the subject land's eastern boundary in a northerly direction. Foot Onslow Creek is a 3rd order (Strahler) stream. This creek contained stagnant pools of water at the time of the field surveys and was not flowing. In accordance with Table 14, Appendix E of the BAM (DPIE 2020a) 3rd order streams require a riparian buffer of 30 m on each side to protect the drainage line. Two unnamed ephemeral drainage lines occur within the subject land and feed into Foot Onslow Creek. One follows the contour of the subject land from the south-western corner through a series of dams before meeting Foot Onslow Creek, while the other flows under Menangle Road in the west and feeds into Foot Onslow Creek in the north of the subject land. Both of these drainage lines are 1st order (Strahler) streams. Neither contained any water during the field surveys. In accordance with Table 14, Appendix E of the BAM (DPIE 2020a) 1st order streams require a riparian buffer of 10 m on each side to protect the drainage line.	Figure 4
Wetlands within and adjacent to development	There are no wetlands present within, or in close proximity to, the subject land.	Figure 4
Connectivity features	Given the lack of native vegetation in the subject land connectivity is little to non-existent. The subject land and general locality has been predominantly cleared in the past for agricultural purposes. A very narrow riparian corridor along Foot Onslow Creek connects the subject land with some other stands of native and exotic vegetation to the south. This extends no more than approximately 1 km beyond the limits of the subject land. Limited roadside vegetation generally occurs as a single line of native/exotic trees and/or shrubs and is considered to be of little value in terms of fauna dispersal.	Figure 2 and Figure 4

Landscape features	Description	Figure reference
Buffer area (percent native vegetation cover)	A 1,500 m buffer was applied to the subject land resulting in an overall buffer area of 1088.87 ha. Existing vegetation mapping (OEH 2013) identified limited areas of native vegetation within the buffer area. ***Native vegetation cover*** The native vegetation extent and cover of woody vegetation was determined via aerial photography interpretation based on canopy cover, local vegetation mapping (OEH 2013) and knowledge of the subject land. For **woody vegetation** 4.5 per cent (%) of the buffer area was determined to support native woody vegetation with benchmark cover (49.5 ha). For **non-woody vegetation (grassland)** none of the buffer area was determined to support native grassland with benchmark cover (0 ha). Given the landscape and history of the locality, the grasslands present are unlikely to reach benchmark cover. ***Total native vegetation cover*** Combining the estimated woody and non-woody vegetation cover resulted in <5% of the buffer area supporting native vegetation. This falls into the 0-10% category within the BAM-C.	Figure 2
Site context	Site-based assessment.	-
Geological significance and soils	No areas of geological significance (i.e. karst, caves, crevices, cliffs) are present within the subject land. The subject land is not considered to consist of any soil hazard features.	-

2.2 Native vegetation and flora assessment

2.2.1 Methods - assessment of threatened species and populations

2.2.1.1 Data review

A review of relevant literature, databases and existing vegetation mapping was undertaken to identify likely vegetation communities and threatened biodiversity with the potential to occur in the subject land. This information was reviewed prior to field surveys to inform initial survey effort and design and identify species for consideration.

Database searches within the locality (a 10 km radius around the subject land) were conducted to identify threatened flora and TECs with known occurrences or with the potential to occur on the subject land. A likelihood of occurrence analysis (Annex 3) was then undertaken prior to field surveys for each species/TEC, based on preliminary information regarding habitat present within the subject land. The following resources were used for this purpose:

- Database searches:
  - NSW BioNet Atlas Database (DPIE 2021b) for spatial records of threatened flora listed under the BC Act within a 10 km radius of the subject land.
  - EPBC Act (PMST) (DAWE 2021a) for flora and ecological communities identified as MNES known from or with potential habitat within a 10 km radius of the subject land.
  - Preliminary run of the BAM-C tool (using benchmark condition for previously mapped Plant Community Types [PCTs]) to identify candidate species credit species and predicted ecosystem credit species known or predicated to occur within the IBRA subregion.
- Vegetation mapping: existing vegetation mapping (OEH 2013) was examined prior to the field survey to determine the vegetation communities likely to be present in the subject land.
- A flora and fauna constraints assessment prepared for the subject land (Niche 2020a).
- A flora and fauna assessment for the Appin Area Surface to In Seam (STIS) Exploration (Niche 2020b).

Five categories for likelihood of occurrence were attributed to threatened biodiversity after considering the number and proximity of known records, presence or absence of preferred habitat types (e.g. native vegetation types) and professional judgement. The categories are outlined in Table 4. Species considered further for impact assessment included:

- Those in the 'Known', 'High' or 'Moderate' categories and where impacts for the species could reasonably occur from the Project.
- Candidate species as identified by the BAM-C.

Table 4: Likelihood of occurrence criteria

Likelihood rating	Threatened flora criteria	Threatened and migratory fauna criteria
Known	The species was observed within the subject land.	The species was observed within the subject land.
High	It is likely that a species inhabits or utilises habitat within the subject land.	It is likely that a species inhabits or utilises habitat within the subject land.
Moderate	Potential habitat for a species occurs within the subject land. Adequate field survey would determine if there is a 'high' or 'low' likelihood of occurrence for the species within the subject land.	Potential habitat for a species occurs within the subject land and the species may occasionally utilise that habitat. Species unlikely to be wholly dependent on the habitat present within the subject land.
Low	It is unlikely that the species inhabits the subject land.	It is unlikely that the species inhabits the subject land. If present at the site, the species would likely be a transient visitor. The subject land contains only very common habitat for this species which the species would not rely on for its on-going local existence.
None	The habitat within the subject land is unsuitable for the species.	The habitat within the subject land is unsuitable for the species.

Species listed with a 'Low' or 'None' likelihood of occurrence are those for which there is limited, or no habitat present within the subject land.

The likelihood of occurrence analysis (Annex 3) was then updated for each species, based on the PCTs mapped within the subject land, following the onsite habitat assessment.

Threatened flora identified as candidate species in the BAM-C and those considered likely to occur are listed in Table 5. Chapter 5 of the BAM (DPIE 2020a) was referred to when assessing whether further assessment, including targeted survey, was required.

2.2.1.2 Threatened flora requiring survey

A total of 22 threatened flora were identified by the BAM-C as species credit species and/or having a moderate to high likelihood of occurring in the subject land (Table 5 and Annex 3). The requirement for targeted survey for each of these species to determine presence/absence from the subject land (and the subsequent requirement for credits to be generated) was determined by consideration of the following:

- For each candidate species, review of PCTs associated with each species (as per the Threatened Biodiversity Data Collection [TBDC]) and presence of those PCTs within each subregion for which the species was identified as a candidate species.
- Presence of habitat constraints (as identified in the TBDC) within the impact area.
- Quality/suitability of habitat present as determined during the initial field survey.

Table 5 details the list of candidate and threatened flora species identified as requiring further assessment. Table 5 includes associated PCT for each species within the subject land (as identified in the TBDC) and identifies whether targeted surveys were required/undertaken. Where species presence could not be ruled out based on lack of associated PCTs or quality of habitat, a conservative approach was taken and targeted surveys conducted.

2.2.2 Methods – field survey

Field surveys were undertaken on three occasions and included the following:

1. BAM plots, vegetation mapping and incidental threatened flora survey and habitat assessment – 18 August 2020, 13 January 2021 and 23 January 2021.
2. Targeted threatened flora survey and habitat assessment – 13 January 2021 and 23 January 2021.

Plot/transect surveys and targeted threatened species surveys were conducted throughout the subject land with results used within the BAM-C to generate credit requirements. PCTs across the subject land were recorded and mapped using a combination of vegetation quadrats, transects and walking meanders. Vegetation mapped as occurring within the subject land and flora survey effort is shown on Figure 5. Table 6 lists the PCTs present, including their vegetation formation, class and status. Alignment of the vegetation communities to a PCT is discussed in section 2.2.3.

The following survey tasks were completed for the flora survey:

- Plant community delineation and mapping, using a combination of floristic assessments within BAM plots (seven plots as per the BAM requirements [DPIE 2020a]) and six Rapid Data Points (RDPs).
- Targeted flora surveys, including quadrats and random meander (see details below).
- Opportunistic observations of threatened flora, Threatened Ecological Communities (TECs), habitat quality and high threat and priority weeds.

Ecological values of the subject land (including potential threatened species habitat) were appraised via survey and assessment of vegetation communities and their condition.

2.2.2.1 BAM plots

The BAM plot requirement was determined using the BAM (DPIE 2020a) and was based on the area of each PCT condition type to be impacted. Existing vegetation mapping was used to estimate the number of plots required prior to survey, which was then refined once on-site to account for variation in condition/community type not apparent from the mapping. The quality and type of PCTs present varied markedly from that identified in the existing mapping, which resulted in significant time identifying and re-mapping the vegetation communities.

The number of plots conducted for each PCT and vegetation zone is provided in Table 6 and the location of the completed plots is shown on Figure 5. Details regarding PCT delineation and mapping are provided in section 2.2.3.

Table 5: Candidate flora species and habitat suitability assessment

Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	**Scientific name**	**Credit class**	**Site within species geographic constraints?**	**Species associated with site PCT?**	**Vegetation cover required**	**Required patch size**	**Requires further assessment?**	**Habitat constraints**	**Site habitat condition suitability**	
Acacia bynoeana	Bynoe's Wattle	Species	n/a	Yes. PCT 849	n/a	n/a	Yes	None listed	The subject land is considered too degraded to support suitable habitat for this plant.	Not required
Acacia pubescens	Downy Wattle	Species	n/a	Yes. PCT 849	n/a	n/a	Yes	None listed	Given its ability to colonise disturbed sites the subject land is considered to contain potential habitat for this plant.	Targeted survey required
Caladenia tessellata	Thick Lip Spider Orchid	Species	n/a	Yes. PCT 849	n/a	n/a	Yes	None listed	The subject land is considered too degraded to support suitable habitat for this plant.	Not required
Callistemon linearifolius	Netted Bottle Brush	Species	n/a	Yes. PCT 835	n/a	n/a	Yes	None listed	The subject land is considered too degraded to support suitable habitat for this plant.	Not required

Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	**Scientific name**	**Credit class**	**Site within species geographic constraints?**	**Species associated with site PCT?**	**Vegetation cover required**	**Required patch size**	**Requires further assessment?**	**Habitat constraints**	**Site habitat condition suitability**	
Cynanchum elegans	White-flowered Wax Plant	Species	n/a	Yes. PCT 835 PCT 849	n/a	n/a	Yes	None listed	The subject land is considered too degraded to support suitable habitat for this plant.	Not required
Dillwynia tenuifolia		Species	n/a	Yes. PCT 849	n/a	n/a	Yes	None listed	The subject land is considered too degraded to support suitable habitat for this plant.	Not required
Dillwynia tenuifolia - endangered population	Dillwynia tenuifolia, Kemps Creek	Species	No	Yes. PCT 849	n/a	n/a	No	None listed	The subject land is considered too degraded to support suitable habitat for this plant.	Not required
Eucalyptus benthamii	Camden White Gum	Species	n/a	Yes. PCT 835 PCT 849	n/a	n/a	Yes	None listed	The subject land is considered too degraded to support suitable habitat for this plant.	Not required
Grevillea juniperina	Juniper-leaved Grevillea	Species	n/a	Yes PCT 849	n/a	n/a	Yes	None listed	The subject land is considered to be outside of this	Not required

Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	**Scientific name**	**Credit class**	**Site within species geographic constraints?**	**Species associated with site PCT?**	**Vegetation cover required**	**Required patch size**	**Requires further assessment?**	**Habitat constraints**	**Site habitat condition suitability**	
subsp. juniperina									species known distribution. In addition, the subject land is considered too degraded to support suitable habitat for this plant.	
Hibbertia sp. Bankstown	Hibbertia sp. Bankstown	Species	n/a	Yes. PCT 835	n/a	n/a	Yes	None listed	The subject land is considered too degraded to support suitable habitat for this plant.	Not required
Marsdenia viridiflora subsp. viridiflora - endangered population	Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith LGA's	Species	No	Yes. PCT 835 PCT 849	n/a	n/a	No	None listed	The subject land is considered too degraded to support suitable habitat for this plant.	Not required
Persicaria elatior	Tall Knotweed	Species	n/a	Yes. PCT 835	n/a	n/a	Yes	None listed	The subject land is considered too degraded to support suitable habitat for this plant.	Not required

Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	**Scientific name**	**Credit class**	**Site within species geographic constraints?**	**Species associated with site PCT?**	**Vegetation cover required**	**Required patch size**	**Requires further assessment?**	**Habitat constraints**	**Site habitat condition suitability**	
Persoonia bargoensis	Bargo Geebung	Species	n/a	Yes. PCT 849	n/a	n/a	Yes	None listed	The subject land is considered too degraded to support suitable habitat for this plant.	Not required
Persoonia hirsuta	Hairy Geebung	Species	n/a	Yes. PCT 835	n/a	n/a	Yes	None listed	The subject land is considered too degraded to support suitable habitat for this plant.	Not required
Pilularia novae-hollandiae	Austral Pillwort	Species	n/a	Yes. PCT 835	n/a	n/a	Yes	None listed	The subject land is considered too degraded to support suitable habitat for this plant.	Not required
Pimelea curviflora var. curviflora		Species	n/a	Yes. PCT 849	n/a	n/a	Yes	None listed	The subject land is considered too degraded to support suitable habitat for this plant.	Not required
Pimelea spicata	Spiked Rice-flower	Species	n/a	Yes. PCT 849	n/a	n/a	Yes	None listed	There is potential habitat within PCT849 shrubland.	Targeted survey required

Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	**Scientific name**	**Credit class**	**Site within species geographic constraints?**	**Species associated with site PCT?**	**Vegetation cover required**	**Required patch size**	**Requires further assessment?**	**Habitat constraints**	**Site habitat condition suitability**	
Pomaderris brunnea	Brown Pomaderris	Species	n/a	Yes. PCT 835	n/a	n/a	Yes	None listed	The subject land is considered too degraded to support suitable habitat for this plant.	Not required
Pterostylis saxicola	Sydney Plains Greenhood	Species	n/a	Yes. PCT 849	n/a	n/a	Yes	None listed	The subject land is considered too degraded to support suitable habitat for this plant.	Not required
Pultenaea pedunculata	Matted Bush-pea	Species	n/a	Yes. PCT 849	n/a	n/a	Yes	None listed	The subject land is considered too degraded to support suitable habitat for this plant.	Not required
Thesium australe	Austral Toadflax	Species	n/a	Yes. PCT 849	n/a	n/a	Yes	None listed	The subject land is considered too degraded to support suitable habitat for this plant.	Not required
Wahlenbergia multicaulis -	Tadgell's Bluebell - Auburn, Bankstown,	Species	No	Yes. PCT 835	n/a	n/a	No	None listed	The subject land is considered too degraded to	Not required

Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	**Scientific name**	**Credit class**	**Site within species geographic constraints?**	**Species associated with site PCT?**	**Vegetation cover required**	**Required patch size**	**Requires further assessment?**	**Habitat constraints**	**Site habitat condition suitability**	
endangered population	Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield LGA's								support suitable habitat for this plant.	

2.2.2.2 Threatened flora survey effort

Targeted threatened flora surveys were undertaken for two species, Spiked Rice-flower (*Pimelea spicata*) and Downy Wattle (*Acacia pubescens*), within areas of suitable habitat (Table 5).

The survey guidelines for threatened plants (DPIE 2020d) was consulted. While parallel transects are recommended for targeting these plants, given the only area of suitable habitat for Spiked Rice-flower was a small patch of PCT 849 shrubland (0.04 ha), the floristic component of the BAM plot (also 0.04 ha in size) conducted within this area of vegetation is considered an appropriate amount of survey effort when endeavouring to determine the presence of this plant. In regard to Downy Wattle, given its conspicuous habit and cleared nature of the subject land, the undertaking of BAM plots and traversing the site in undertaking these is considered appropriate.

2.2.3 Plant community delineation and mapping

All vegetation within the subject land was validated via field survey with mapping updated to reflect vegetation observed and surveyed during field assessment. As mentioned previously, the quality and type of PCTs present varied markedly from that identified in the existing vegetation mapping. Vegetation occurring across the subject land aligned to two PCTs (Table 6). Different condition classes were applied to vegetation where differences in structure and quality occurred. Vegetation zones were established for each combination of vegetation type and condition as follows (Table 6):

- PCT 835 – *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*. This PCT occurs in association with Foot Onlsow Creek and is of a poor and degraded condition.
- PCT 849 - *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*. This PCT occupies the majority of the subject land. It occurs as three diminished vegetation zones, woodland (a single isolated tree), shrubland and grassland, all of which consist of a groundcover dominated by introduced species.

More detailed vegetation community descriptions including species used to aid in determining PCTs and justification for alignment to each of the nominated PCTs are provided in Annex 4.

2.2.4 Site values

Flora

A total of 73 flora species were recorded across the seven plots; including 30 native species and 43 exotic species. Floristic plot data including cover and abundance of all species recorded is provided in Annex 5.

Plot and transect values

Results of the floristic composition, structure and function data obtained during the field assessment is provided in Annex 6.

Site value scores

The site value assessment was carried out by entering plot data into the BAM-C. The data provides quantitative measures of composition, structure and function for each vegetation zone (Annex 5). The BAM-C compares the values recorded at the site with the benchmark for the vegetation class to provide the site value score. This score represents the overall condition of the vegetation compared to the benchmark value (out of 100).

The score from these inputs was used to determine the number of ecosystem credits that are required for Project to proceed.

Table 6: PCTs present across the subject land

PCT ID	PCT name	Zone (Condition)	TEC status per BioNet Vegetation Classification (BC Act/EPBC act)	Vegetation Formation (Keith 2004)	Vegetation Class (Keith 2004)	PCT % cleared (DPIE 2021d)	Total area in subject land (ha)	Area to be cleared /impacted for development (ha)	BAM Plots required for the impact area	BAM Plots completed
PCT 835	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Forest (low)	Endangered (BC Act)[3] Critically Endangered (EPBC Act)[4]	Forested Wetlands	Coastal Floodplain Wetlands	93	0.44	0.44	1	1
PCT 849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Grassland (low)	Critically Endangered (BC Act)[5] Critically Endangered (EPBC Act)	Grassy Woodlands	Coastal Valley Grassy Woodlands	93	18.21	18.21	3	4
		Shrubland (low)					0.10	0.10	1	1
		Woodland (low)^					0.06	0.03	1	1
Total							**18.81**	**18.78**	**6**	**7**

^ Given this zone consists of two separate patches, one an isolated tree and the other being three trees, that are not representative of the PCT in the locality and that its size makes it difficult to undertake a BAM plot, a larger stand of woodland that occurs beyond the limit of, and adjacent to, the construction footprint to the south, was surveyed in order to obtain BAM plot data.

[3] With reference to the NSW Scientific Committee's definition of RFEF, PCT 835 within the subject land would not meet this definition.
[4] With reference to the Commonwealth conservation advice for RFEF, PCT 835 would not satisfy the relevant condition thresholds to make it eligible for Commonwealth listing.
[5] With reference to the Commonwealth conservation advice for CPW, PCT 849 would not satisfy the relevant condition thresholds to make it eligible for Commonwealth listing.

Patch size for PCT 849 grassland was given the highest score in the BAM-C (>100 ha) as this vegetation zone is directly connected to other large areas of grassland considered to be in the same or better condition than that present in the subject land (as can be seen on Figure 2 and Figure 4). The other vegetation zones were given the lowest score in the BAM-C (<5 ha) as these zones are small isolated patches connected to only other small isolated patches (within 100 m of each other) in a fragmented landscape.

The current and future vegetation integrity (VI) scores from the BAM-C are detailed in Table 7. The future integrity scores for the direct impact zones were reduced to zero as all vegetation and habitats within this zone would be removed. Given the mitigation measures to reduce the impact of indirect impacts, only the direct impact areas are required to be entered into the BAM-C for the purpose of calculating the ecosystem credits, as shown in Table 7.

Table 7: Vegetation zones with current and future VI scores

Vegetation zone	Vegetation zone ID	Impacted area (ha)	Patch size (ha)	Current VI score	Future VI score	Change in VI score
PCT 835 forest (low)	VZ1	0.44	2	6.5	0	-6.5
PCT 849 grassland (low)	VZ2	18.21	101	5.9	0	-5.9
PCT 849 shrubland (low)	VZ3	0.1	1	16.5	0	-16.5
PCT 849 woodland (low)	VZ4	0.03	2	26.3	0	-26.3

2.2.5 High threat and priority weeds

During the field surveys 13 High Threat Weed (HTW) species were recorded: Narrow-leafed Carpet Grass (*Axonopus fissifolius*), *Briza subaristata*, Saffron Thistle (*Carthamus lanatus*), Rhodes Grass (*Chloris gayana*), Umbrella Sedge (*Cyperus eragrostis*), Panic Veldtgrass (*Ehrharta erecta*), St. John's Wort (*Hypericum perforatum*), Lantana (*Lantana camara*), African Boxthorn (*Lycium ferocissimum*), African Olive (*Olea europaea subsp. cuspidata*), Paspalum (*Paspalum dilatatum*), *Polygala virgata*, Fireweed (*Senecio madagascariensis*) and Buffalo Grass (*Stenotaphrum secundatum*).

Fireweed, Saffron Thistle and Paspalum are the most common across the subject land, with *Briza subaristata* to a lesser degree and African Boxthorn occurring in patches. The other HTW species are present at a low frequency.

Of the 43 exotic species recorded, four are listed as priority weeds for the Greater Sydney region: African Boxthorn, African Olive, Fireweed and Lantana.

2.2.6 Threatened ecological communities

PCT 849 in the subject land conforms to *Cumberland Plain Woodland in the Sydney Basin Bioregion* (CPW), a TEC (Critically Endangered) under the BC Act. With reference to the NSW Scientific Committee's determination on CPW, native grasslands derived from clearing of the woodland and forest are also part of this community if they contain characteristic non-woody species of the ecological community (DPIE 2021e).

It is acknowledged that PCT 849 aligns with *Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest*, a TEC (Critically Endangered) under the EPBC Act; however, with reference to the Commonwealth conservation advice for this TEC (DAWE 2020c), PCT 849 within the subject land would not satisfy the condition thresholds provided to make it eligible for Commonwealth listing: the key diagnostic features and condition thresholds require the patch of the TEC to consist of native trees with a minimum projected foliage cover of 10% and be at least 0.5 ha in size (DAWE 2021c), among other criteria.

The Project will therefore only impact the CPW TEC protected at a State level (BC Act).

It is acknowledged that PCT 835 aligns with *River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* (RFEF) TEC, listed as Endangered under the BC Act and Critically Endangered under the EPBC Act[6]. However, as no native tree layer is present, PCT 835 within the subject land would not meet the definition for RFEF as provided by the NSW Scientific Committee (DPIE 2021f) and Commonwealth conservation advice (DAWE 2021d).

While PCT 849 and PCT 835 are listed as TECs on the EPBC Act, given the condition of these vegetation types present in the subject land they do not conform to the definition of their associated TEC under the EPBC Act. The Project would not impact on any Commonwealth listed TEC.

2.2.7 Threatened flora

As detailed in section 2.2.2.2, surveys were undertaken for two threatened flora species predicted to occur within the subject land: Spiked Rice-flower (Table 8).

No threatened flora were identified in the subject land. As such, no flora species credits are required for the Project.

Table 8: Candidate flora species and assessment of credit requirement

Common name	Scientific name	Status
Candidate species (species credit species)		
Spiked Rice-flower	*Pimelea spicata*	Surveyed. Not present. No suitable habitat present in the subject land.
Downy Wattle	*Acacia pubescens*	Surveyed. Not present. No records occur within the locality (DPIE 2021b).

2.3 Fauna assessment

2.3.1 Methods - assessment of threatened species and populations

2.3.1.1 Data review

For the native vegetation and flora assessment, a review of relevant literature, databases and existing vegetation mapping was undertaken to identify vegetation (fauna habitat) and threatened fauna with the potential to occur on the subject land. Methodology is as detailed in section 2.2.1, including database searches and literature reviews and assessment of the likelihood of occurrence of each species. Results of the searches and reviews were undertaken prior to field survey to inform field survey requirements.

A likelihood of occurrence analysis was undertaken for each species, prior to field surveys, based on the PCTs/vegetation mapped within the subject land. This was updated within the current report (Annex 3) to reflect the suitability of habitat present within the subject land, as identified following the onsite habitat assessment. Threatened species identified as subject species requiring further assessment included:

- Species with a moderate or higher likelihood of occurrence.
- Candidate species as identified in the BAM-C.

Subject species requiring further assessment and/or survey are detailed below.

[6] Listed as River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria.

2.3.1.2 Threatened fauna requiring survey

Targeted threatened fauna surveys are required for those species identified as having a moderate to high likelihood of occurrence (based on presence of suitable habitat/required habitat constraints) (Annex 3) and those identified as candidate species by the BAM-C once the BAM plot data was entered.

All ecosystem (predicted) credit species were assumed present within the subject land for which they were predicted to occur. Ecosystem credit species are listed in Table 9.

Table 9. Predicted (ecosystem credit) threatened species

Common Name	Scientific Name	BC Act*	Vegetation Types
Australasian Bittern	*Botaurus poiciloptilus*	E	**PCT 835** *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*.
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V	**PCT 835** *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*. **PCT 849** *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*.
Diamond Firetail	*Stagonopleura guttata*	V	**PCT 835** *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*. **PCT 849** *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*.
Dusky Woodswallow	*Artamus cyanopterus*	V	**PCT 835** *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*. **PCT 849** *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*.
Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	V	**PCT 835** *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*. **PCT 849** *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*.
Eastern Osprey	*Pandion cristatus*	V	**PCT 835** *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*.
Flame Robin	*Petroica phoenicea*	V	**PCT 835** *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*. **PCT 849** *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*.
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	**PCT 835** *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*. **PCT 849** *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*.
Hooded Robin (south-eastern form)	*Melanodryas cucullata*	V	**PCT 835** *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*. **PCT 849** *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*.

Common Name	Scientific Name	BC Act*	Vegetation Types
Koala	*Phascolarctos cinereus*	V	**PCT 835** *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*. **PCT 849** *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*.
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	V	**PCT 835** *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*. **PCT 849** *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*.
Little Bent-winged Bat	*Miniopterus australis*	V	**PCT 835** *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*. **PCT 849** *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*.
Little Lorikeet	*Glossopsitta pusilla*	V	**PCT 835** *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*. **PCT 849** *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*.
Regent Honeyeater	*Anthochaera phrygia*	CE	**PCT 835** *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*. **PCT 849** *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*.
Scarlet Robin	*Petroica boodang*	V	**PCT 835** *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*. **PCT 849** *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*.
Speckled Warbler	*Chthonicola sagittata*	V	**PCT 835** *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*. **PCT 849** *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*.
Spotted-tailed Quoll	*Dasyurus maculatus*	V	**PCT 835** *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*. **PCT 849** *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*.
Swift Parrot	*Lathamus discolor*	E	**PCT 835** *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*. **PCT 849** *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*.
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	V	**PCT 835** *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*. **PCT 849** *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*.

* E – Endangered; V – Vulnerable; CE – Critically Endangered

Where species with a high likelihood of occurrence were not identified by the BAM-C as candidate species, they were added to vegetation zones within IBRA subregions where suitable habitat was identified during the habitat assessment.

A total of 26 threatened fauna species were identified by the BAM-C as species credit species and/or having a moderate to high likelihood of occurring in the impact area (Table 10 and Annex 3). This included 22 species identified as candidate species by the BAM-C, an additional four species identified in the EPBC Act PMST search; one was identified as having a moderate likelihood of occurrence (Annex 3). Of the candidate species identified, six are species subject to serious and irreversible impacts (SAII).

The requirement for targeted survey for each of these species to determine presence/absence from the subject land (and the subsequent requirement for credits to be generated) was determined following the process detailed in section 5.2 of the BAM (DPIE 2020a) with consideration of the following:

- For each candidate species, review of PCTs associated with each species (as per the TBDC) and presence of those PCTs within each subregion for which the species was identified as a candidate species.
- Presence of habitat constraints (as identified in the TBDC) within the impact area.
- Quality/suitability of habitat present as determined during the initial field survey.
- Survey effort undertaken during the initial BAM site assessment/survey.

Species were excluded from candidacy in the BAM-C for the following reasons:

- Excluded due to absence of required habitat (habitat constraints) regardless of the presence of the species associated PCTs.
- Excluded due to the heavily degraded vegetation zones present, which lack suitable habitat for all candidate species.
- Excluded based on the absence of mapped important areas (i.e. Swift Parrot, Regent Honeyeater).
- Excluded as having been surveyed, based on the absence of large stick nests suitable for large raptors within the impact area, which indicates no suitable breeding habitat within the impact area (i.e. White-bellied Sea Eagle, Eastern Osprey).

Due to the following factors, the subject land is unlikely to provide significant habitat for any listed threatened fauna species:

- The small size of the impact area.
- High level of disturbance within a highly developed rural area.
- Lack of habitat features providing roost sites and shelter.
- The lack of habitat constraints for candidate species for which constraints are listed in the TBDC.
- The presence of a small range of seasonally flowering and fruiting flora species.

No targeted surveys for threatened fauna were considered necessary.

Table 10: Candidate fauna species and habitat suitability assessment

Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	**Scientific name**	**Credit class**	**Site within species geographic constraints?**	**Species associated with site PCT?**	**Vegetation cover required**	**Required patch size**	**Requires further assessment?**	**Habitat constraints**	**Site habitat condition suitability**	
Birds										
Eastern Osprey	*Pandion cristatus*	Species/ Ecosystem	None	Yes. PCT 835	≤10%	<5 ha	Yes	Presence of stick-nests in living and dead trees (>15m) or artificial structures within 100m of a floodplain for nesting.	No stick nests are present within the subject land.	Not required.
Regent Honeyeater	*Anthochaera phrygia*	Species/ Ecosystem	None	Yes. PCT 835/PCT 849	≤10%	<5 ha	Yes	As per mapped areas.	Subject land not within mapped area.	Not required.
Swift Parrot	*Lathamus discolor*	Species/ Ecosystem	None	Yes. PCT 835	≤10%	<5 ha	Yes	As per mapped areas.	Subject land not within mapped area.	Not required.
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Species/ Ecosystem	n/a	Yes. PCT 835/PCT 849	≤10%	<5 ha	Yes	Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large	No stick nests are present within the subject land.	Not required.

Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	**Scientific name**	**Credit class**	**Site within species geographic constraints?**	**Species associated with site PCT?**	**Vegetation cover required**	**Required patch size**	**Requires further assessment?**	**Habitat constraints**	**Site habitat condition suitability**	
								dams or creeks, wetlands and coastlines. Notes also state that the presence of a large stick nest within tree canopy; ; or an adult with nest material; or adults observed duetting within breeding period.		
Mammals										
Grey-headed Flying-fox	*Pteropus poliocephalus*	Species/ Ecosystem	None	Yes. PCT 835/PCT 849	≤10%	<5 ha	Yes	Breeding Camps	No breeding camps are present within the subject land. Limited foraging habitat available.	Not required.

Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	**Scientific name**	**Credit class**	**Site within species geographic constraints?**	**Species associated with site PCT?**	**Vegetation cover required**	**Required patch size**	**Requires further assessment?**	**Habitat constraints**	**Site habitat condition suitability**	
Koala	*Phascolarctos cinereus*	Species/ Ecosystem	None	Yes. PCT 835/PCT 849	≤10%	<5 ha	Yes	Site contains 'important' habitat.	The habitat present in the subject land is not considered important to the Koala. The subject land is isolated and distant from known populations of Koala, and primarily cleared, with one isolated mature Forest Red Gum expected to be removed.	Not required.
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	Species/ Ecosystem	None	Yes. PCT 835/PCT 849	≤10%	<5 ha	Yes	Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records with microhabitat	No suitable breeding habitat was identified on site. Limited foraging habitat available.	Not required

Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	**Scientific name**	**Credit class**	**Site within species geographic constraints?**	**Species associated with site PCT?**	**Vegetation cover required**	**Required patch size**	**Requires further assessment?**	**Habitat constraints**	**Site habitat condition suitability**	
								code "IC - in cave;" observation type code "E nest-roost;" with numbers of individuals >500.		
Little Bent-winged Bat	*Miniopterus australis*	Species/ Ecosystem	None	Yes. PCT 835/PCT 849	≤10%	<5 ha	Yes	Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with	No suitable breeding habitat was identified within the subject land. Limited foraging habitat available.	Not required

Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	**Scientific name**	**Credit class**	**Site within species geographic constraints?**	**Species associated with site PCT?**	**Vegetation cover required**	**Required patch size**	**Requires further assessment?**	**Habitat constraints**	**Site habitat condition suitability**	
								numbers of individuals >500; or from the scientific literature.		
Southern Myotis	*Myotis macropus*	Species	None	Yes. PCT 835/PCT 849	≤10%	<5 ha	Yes	Hollow-bearing trees, bridges, caves or artificial structures: Within 200 m of riparian zone.	No hollow-bearing trees are present within the subject land.	Not required.
Squirrel Glider	*Petaurus norfolcensis*	Species	None	Yes. PCT 835/PCT 849	≤10%	<5 ha	Yes	None listed, however the TBDC record notes that large old trees with hollows are essential for breeding, nesting and movement.	No hollow-bearing trees are present within the subject land.	Not required.

Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	**Scientific name**	**Credit class**	**Site within species geographic constraints?**	**Species associated with site PCT?**	**Vegetation cover required**	**Required patch size**	**Requires further assessment?**	**Habitat constraints**	**Site habitat condition suitability**	
Amphibians										
Green and Golden Bell Frog	*Litoria aurea*	Species	None	Yes. PCT 835/PCT 849	≤10%	<5 ha	Yes	Within 1 km of wet areas, swamps, waterbodies.	The subject land is considered too degraded to support suitable habitat for this frog. In addition, no records occur within 10 km of the subject land.	Not required.
Invertebrates										
Cumberland Plain Land Snail	*Meridolum corneovirens*	Species	None	Yes. PCT 835/PCT 849	≤10%	<5 ha	Yes	None listed	The subject land is considered too degraded to support suitable habitat for this snail. In addition no suitable or significant cover of course woody debris is present.	Not required.
Dural Land Snail	*Pommerhelix duralensis*	Species	None	Yes. PCT 849	≤10%	<5 ha	Yes	None listed	No suitable habitat is present within the subject land. Occurrence in Wollondilly Shire is considered	Not required.

Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Vegetation cover required	Required patch size	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
									unlikely (DPIE 2021c).	

2.3.2 Methods – field survey

Field surveys were undertaken on 18 August 2020, 13 January 2021 and 23 January 2021. The following tasks were completed:

1. Habitat assessment – identification of important habitat features.
2. Evaluation of habitat quality of native vegetation present.

2.3.2.1 Habitat assessment

The key habitat features recorded were used to determine the likely presence of threatened species. These features included:

- Type, condition and diversity of vegetation communities present.
- Presence of roosting/breeding/shelter resources such as:
  - large stick nests suitable for raptors
  - hollow-bearing trees and stags
  - rock ledges, shelters, caves, outcrops, gibber plains
  - logs and leaf litter.
- Permanent and ephemeral aquatic habitat (described further in Annex 1).

2.3.2.2 Threatened fauna survey effort

No candidate species were confirmed as being present or utilising the subject land through the assessment process under section 5.2 of the BAM (Table 10) (DPIE 2020a). No other threatened fauna were considered to have more than a 'Low' likelihood of occurrence. As such, no targeted surveys for threatened fauna were conducted.

2.3.3 Fauna and fauna habitats

Fauna species recorded in the subject land are listed in Annex 7. A total of 14 species were recorded during field surveys, comprising 12 birds, one mammal and one frog species (Annex 7). No threatened fauna species were recorded during the field survey.

Native vegetation

The native vegetation present consists of grassland, however a large mix of exotic species are also present. A small area of Blackthorn (*Bursaria spinosa*) occurs in the western portion of the subject land, while an isolated Forest Red Gum is present in the centre of the subject land.

None of the native vegetation present is considered to provide quality fauna habitat. Common to abundant animals that reside in the groundcover and that are tolerant of disturbance and exposure are expected to be the only species that would utilise such habitats (i.e. skinks).

No hollow-bearing trees or fallen timber was present. Minimal leaf litter is present.

Hollow-bearing trees

One hollow-bearing tree was recorded on the property (Easting 290162, Northing 3781031) (Annex 8) (Figure 5). This tree, however, is not within the subject land and would not be directly or indirectly impacted by the Project.

Aquatic habitat

The aquatic habitat is restricted to a stretch of Foot Onslow Creek that is present adjacent to the northern boundary of the subject land and two farm dams. An aquatic ecology assessment has been undertaken and is provided in Annex 1.

Foot Onslow Creek, an intermittent 3rd order stream, was restricted to a chain of isolated shallow pools while water flow was limited. This creek is intermittent and likely only flows during periods of extended, moderate or high rainfall. The pools of water were generally shallow and clear. The creek exhibited signs of channel erosion in places, however, the channel and banks were mostly stable. The channel was reasonably well vegetated by the exotic Peppercorn Tree (*Schinus molle*) and a mixed native/exotic groundcover. The native emergent macrophyte Cumbungi (*Typha orientalis*) was also present within the creek. While flood borne debris and rubbish was observed snagged on the adjacent fence line, Foot Onslow Creek was generally free of debris.

While Foot Onslow Creek is likely to provide some aquatic habitat (including some macrophytes) for tolerant aquatic fauna it is unlikely to support sensitive species protected under the NSW *Fisheries Management Act 1994* and/or EPBC Act. Additionally, Foot Onslow Creek is not mapped as being Key Fish Habitat (DPI 2021).

The two farm dams present are around 1200 m^2 (35 m by 35 m) and 200 m^2 (20 m by 10 m) in size. Neither dam contains significant amounts of aquatic vegetation nor are they likely to provide habitat for threatened aquatic fauna.

2.3.4 Threatened fauna

As discussed in section 2.3.1.2, no threatened fauna were considered to have more than a 'Low' likelihood of occurring on the subject land and no species were confirmed as candidate species. As a result, no targeted threatened fauna surveys were conducted. It is very unlikely that any threatened fauna species utilises the site for more than occasional foraging.

The Project is not required to provide biodiversity offsets for any threatened fauna. As such, no species credits are required for fauna.

3. Impact Assessment

The Impact Assessment forms Stage 2 of the BDAR as detailed in section 8 of the BAM (DPIE 2020a).

3.1 Avoid and minimise impacts

In accordance with the BAM (DPIE 2020a), proponents must demonstrate the measures employed to avoid, mitigate and offset impacts of a Project on biodiversity values. This section outlines the avoidance, management and mitigation measures that IMC have incorporated into the Project design or will employ during construction, operation or completion of the Project to reduce impacts on biodiversity values.

A summary of the avoidance and mitigation measures including action, outcome, timing and responsibility are provided in section 3.2.5.

3.1.1 Avoidance measures (pre-construction)

Efforts to avoid and minimise impacts through siting and design of the Project are detailed below.

Location and design

Niche conducted a flora and fauna constraints assessment at 345 Menangle Road, Menangle in 2019. That assessment identified the ecological constraints present to assist with the planning of the Project. The subject land was subsequently selected to avoid stands of CPW that are present in the south (this stand also contains a hollow-bearing tree) (Figure 5), south-east and north-east of the property. The three mature trees present in the road reserve of Menangle Road in the north of the subject land are to be retained (Figure 6). The location of the Project impacts on those areas of the property that are in the poorest condition. The primary habitat to be impacted is CPW grassland which has a VI score of 6.8[7].

The CPW CEEC is an entity at risk of a SAII, the impact on the grassland zone of this TEC being unavoidable regardless of where the Project is located within the property.

Revegetation for screening purposes has been proposed along the fence line and on top the bunds. Under the BC Act, according to BAM 2020, biodiversity offsets are not required for the removal of vegetation planted on a site. This information was confirmed in correspondence with the NSW Biodiversity Conservation Division (BCD) via bam.support@environment.nsw.gov.au (email dated 24 November 2020).

Prescribed impacts

Prescribed impacts relevant to the Project and relevant avoidance and mitigation measures are detailed in section 3.2.3.

3.2 Impact summary

An assessment of the potential impact of the Project on biodiversity is provided below. It considers direct and indirect impacts as defined in the BAM (DPIE 2020a).

The Project would affect biodiversity, including threatened biodiversity, through both direct and indirect impacts. The areas subject to direct and indirect impact are discussed below.

[7] A VI score less than 15 signifies the PCT is in very poor condition and does not require to be offset.

3.2.1 Direct impacts

As discussed in section 1.2, the area of direct impact has been defined as the area that will need to be cleared to accommodate the Project. The area of direct impacts is presented in Figure 6.

The primary direct impacts are the removal of 0.44 ha of PCT 835 and 18.34 ha of PCT 849 vegetation. This vegetation provides potential foraging resources for insectivorous, frugivorous and nectivorous fauna. Assessment of direct impacts is presented in Table 11.

These direct impacts cannot be further avoided or mitigated. As per the BAM (DPIE 2020a), section 4 details the biodiversity credits required to offset the unavoidable impacts of the Project.

3.2.2 Indirect impacts

The area of indirect impact is limited to patches of CPW present to the south and south-east of the subject land and Foot Onslow Creek to the north-east. It should be noted that the patches of CPW patches are isolated and are of a low to moderate condition, while the patch in the south has the potential to provide habitat for threatened microbats (i.e. presence of hollow-bearing tree). Assessment of potential indirect impacts is presented in Table 11.

Table 11. Assessment of direct and indirect impacts

Impact]	Extent of impact as a result of the Project
Direct impacts	
Removal or modification of native vegetation	Known: Approximately 0.44 ha of PCT 835 and 18.34 ha of PCT 849 vegetation would be removed.
Loss of individuals of a threatened species	None: No threatened flora or fauna habitat was identified within the area of direct impact. No threatened species are likely to be harmed as part of the Project.
Removal or modification of threatened species habitat other than native vegetation (micro-habitat features)	None: No threatened species habitat (excluding native vegetation) was identified on the subject land.
Death through trampling or vehicle strike	Low: The Project is unlikely to cause death through trampling or vehicle strike.
Death through poisoning	Low: No poisons are proposed to be used as part of the Project. Harmful substances used in construction would all be controlled as per required Australian Standards.
Fragmentation	Low: Approximately 18.78 ha of highly modified native vegetation would be permanently removed. Given the majority (18.21 ha) of this is grassland and a small portion isolated shrubland (0.1 ha), it is not considered to contribute to fragmentation of remnant native vegetation in the locality.
Indirect impacts	
Predation by domestic and/or feral animals	Low: The Project is not likely to increase the presence of domestic or feral animals in the local area.
Loss of shade/shelter	Known: The removal of vegetation in the subject land would result in a loss of shade and shelter for local ground-dwelling fauna. This impact is considered low in magnitude as the area to be impacted is small and in poor condition, providing minimal habitat.

Impact]	Extent of impact as a result of the Project
Loss of individuals through starvation	Low: Removal of the habitat on the subject land is not considered likely to cause loss of individuals through starvation. It is likely to be used seasonally as a foraging resource by insectivorous, frugivorous and nectivorous species occupying a much larger territory and relying on other resources throughout the rest of the year.
Loss of individuals through exposure	Low: Habitat to be removed in the subject land is dominated by grassland with very small isolated patches of shrubland and an isolated tree. Therefore, the Project is not considered likely to cause a loss of individuals through exposure.
Edge effects (noise, light, traffic)	Low: The hollow-bearing tree immediately adjacent to the south of the construction footprint has the potential to be utilised by threatened hollow-dependent bats. These species can be sensitive to noise and light. The subject land currently experiences impacts from noise and light due to the high volume of traffic using Menangle Road. No works will take place immediately adjacent to this tree. The Project is not considered likely to adversely affect any threatened microbats through noise or light.
Traffic impacts	Low: Increased traffic within the subject land and also using Menangle Road has the potential to impact on locally occurring fauna that may be traversing the locality. Traffic on site will be confined to new internal roads and hardstand areas with very low speed restrictions. Threatened species are unlikely to be subject to this impact.
Deleterious hydrological changes	Low: The Project will alter runoff flows throughout the subject land. Any impacts beyond the subject land during or after construction are expected to be marginal and would be managed by standard sediment and erosion controls during construction and the incorporation of stormwater drainage into the Project design.
Contamination of groundwater, surface water and Foot Onslow Creek	None: Runoff and wastewater from site processes would be retained within the Project's sedimentation ponds and discharged into Foot Onslow Creek. The discharge will be in accordance with water quality standards prescribed by the EPA. No transport of contaminants into the wider hydrological system of the area is likely.
Weed invasion	Low: Area is already highly weed-infested.
Increased human activity within or directly adjacent to sensitive habitat areas	High: The CPW present beyond the construction footprint is a sensitive habitat area.

3.2.3 Prescribed impacts

The potential for the prescribed impacts identified in Chapter 6 of the BAM (DPIE 2020a) has been considered in Table 12. The following prescribed impacts are relevant to the Project:

- Hydrological process sustaining/interacting with rivers, streams or wetlands.
- Vehicle strikes on threatened species.

Table 12: Prescribed impacts

Feature	Present	Description of feature characteristics and location	Potential impact	Threatened species orcommunity using or dependent on feature
Karst, caves, crevices, cliffs or other geologically significant feature	☐Yes / ☒No	N/A	None	N/A
Rocks	☐Yes / ☒No	N/A	None	N/A
Human-made structure	☒Yes / ☐No	Small building and shed	None	Building not considered suitable habitat for roosting microbats.
Non-native vegetation	☒Yes / ☐No	Stands of Peppercorn Tree.	None	No threatened species are considered to utilise the Peppercorn Trees present.
Corridors	☐Yes / ☒No	N/A	None	N/A
Hydrological process sustaining/interacting with rivers, streams or wetlands	☒Yes / ☐No	Ephemeral drainage lines flow through the subject land meeting with Foot Onslow Creek via farm dams.	Disturbance of overland and underground flows may affect flow of creek.	None identified.
Wind farm development	☐Yes / ☒No	N/A	N/A	N/A
Vehicle strikes on threatened species	☒Yes / ☐No	Menangle Road and internal machinery/vehicle movements.	Mortality or injury as a result of vehicle strike.	Ground-dwelling threatened species are unlikely to be using any of the adjacent habitats.
Other	☐Yes / ☒No	N/A	No additional prescribed impacts identified.	N/A

Prescribed impacts will be managed and mitigated via the measures detailed in Table 13.

3.2.4 Potential serious and irreversible impacts (SAII)

The BC Act and the *Local Land Services Act 2013* (LLS Act) imposes various obligations on decision-makers in relation to impacts on biodiversity values that are at risk of SAII. These obligations generally require a decision-maker to determine whether the residual impacts of a proposed development on biodiversity values (that is, the impacts that would remain after any proposed avoid or mitigate measures have been taken) are serious and irreversible (DPIE 2020b).

CPW is identified on the list of threatened entities for which the potential for SAII must be considered (OEH (2017b). The location of CPW at risk of SAII in the subject land is shown on Figure 7.

No threatened species at risk of SAII are known or considered likely to occur in the subject land.

The BC Act and the BC Reg provide a framework to guide the consent authority in making a determination in relation to SAII. The framework consists of a series of principles defined in the BC Reg and supporting guidance, provided for under section 6.5 of the BC Act, to interpret these principles (DPIE 2019b). Criteria to interpret the principles is included in Table 1 of *Guidance to assist a decision-maker to determine a serious and irreversible impact* (DPIE 2019b). Namely, an impact is considered serious and irreversible under Part 6.7 of the BC Reg if it:

1. Will cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline.
2. Will further reduce the population size of the species that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or will further degrade or disrupt an ecological community that is already observed, inferred or reasonably suspected to be severely degraded or disturbed.
3. Impacts on the habitat of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution.
4. Impacts on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

Under the BAM (DPIE 2020a), an assessor must provide information on a range of factors affecting the vulnerability of the species to SAII. These criteria are addressed in detail for CPW in Annex 9 and summarised below.

Summary of SAII on CPW

- The Project has been designed to avoid the better quality stands of treed CPW that are present in the south (this stand also contains a hollow-bearing tree), south-east and north-east of the property. Those areas of the property that are to be impacted are of poor quality.
- The Project is expected to impact 18.34 ha of CPW (consisting of a grassland zone, shrubland zone and woodland zone). This is approximately 0.2% of the remaining CPW in NSW. It is noted that this 0.2% estimate includes a grassland variant of CPW within the site but compares it to a vegetation mapping project that does not generally include such variants. As such, a true comparison to the vegetation mapping undertaken would take in only the wooded variants of CPW present on the subject land, and thus result in an even smaller reduction of CPW in NSW.
- The area of CPW to be impacted is predominantly grassland with high proportion of weeds present throughout. It has little to no structural integrity, has low floristic diversity and its ecological processes have been substantially disrupted such that the community's functioning is dramatically reduced.
- The grassland, shrubland and woodland zones have a VI of 5.9, 16.5 and 26.3, respectively.

- Patches of intact[8] CPW in the surrounding locality are scarce, with those small isolated stands present being of low quality and impacted by weeds. No good quality CPW remnants are present within a 500 m buffer of the subject land.

The Project is considered unlikely to cause SAII to CPW.

3.2.5 Mitigation measures (construction and post construction)

Management and mitigation measures to be implemented during the construction and operational phases of the Project are detailed in Table 13. These will be documented within the Biodiversity Management Plan (BMP) or relevant management plans to be developed for the Project. It is noted that a BMP has been developed for the BSO and will be reviewed/updated accordingly to include the subject land (IMC 2019).

Table 13: Mitigation measures

Mitigation measure	Responsibility
Pre-construction	
Establishment of fencing between woodland areas (i.e. in the south and south-east) and the construction area to demarcate the subject land boundary. Fencing to be maintained throughout the construction phase.	Project manager
Review/updating of the BSO BMP (IMC 2019) (refer to section 3.2.7).	Project manager
Construction	
Implementation of erosion and sediment controls for the duration of construction works. Regular maintenance of erosion and sediment controls during construction and until excavated areas are vegetated. This will be detailed in the relevant project management plan.	Project manager
Implementation of the BSOBMP.	Project manager
Pest and weed prevention measures for construction activities and management of any priority pests or weeds within the subject land.	Project manager
Post construction	
Landscape planting focusing on naturally occurring endemic tree and shrub species.	Project manager
Management and removal of all waste from the subject land.	Project manager
During operation	
Monitoring of water quality within the Sediment Pond and treating the water to ensure the quality of the discharged water meets IMC's EPL requirements.	Project manager
Monitoring and maintenance of all erosion and sedimentation controls.	Project manager

[8] i.e. containing all structural layers.

3.2.6 Adaptive management strategy (for major Projects only)

The mitigation measures provided in Table 13, section 3.2.5 are considered adequate to protect the terrestrial and aquatic environment against any potential impacts. Therefore, it is considered that an adaptive management strategy is not required.

While water from the retention basin will be discharged into Foot Onslow Creek, this will be as per EPA standards. As such, no significant impacts are considered likely. In addition, no threatened species are considered to be reliant on the aquatic environment for their life-cycle requirements.

3.2.7 Biodiversity Management Plan/s and Construction Environmental Management Plans

The BMP prepared for the BSO (IMC 2019) would be reviewed/updated to include the subject land prior to the commencement of construction to inform and manage various activities throughout the life of the Project in order to protect and manage important biodiversity values.

4. Quantifying Offset Requirements

The BAM (DPIE 2020a) identifies the BAM-C as the appropriate tool for quantifying the offsets required in both ecosystem credit and species credit terms. A calculation of the nature and extent of biodiversity credits required due to ecological impacts associated with the Project has been undertaken using the BAM-C.

The case has been finalised and submitted via the online BAM-C.

No threatened biodiversity listed on the EPBC Act are required to be offset for the Project, as the Project does not result in a significant impact on any threatened biodiversity listed on the EPBC Act.

4.1 Summary of ecosystem credits required

The results of the BAM-C ecosystem offset credit requirements, including current, future and change in VI scores are shown in Table 14.

Table 14: Ecosystem credit requirement

PCT (best fit)_zone	Impact area (ha)	Current VI score	Future VI score	Change in VI Score	Biodiversity risk weighting	Required credits
PCT 849 woodland	0.03	26.3	0	-26.3	2.5	1
PCT 849 shrubland	0.1	16.5	0	-16.5	2.5	1
PCT 849 grassland	18.21	5.9	0	-5.9	2.5	0
PCT 835 forest	0.44	6.5	0	-6.5	2	0
Total	**18.78**					**2**

Impacts to native vegetation communities within the subject land generate a requirement for two ecosystem credits. These two ecosystem credits also cover the credit requirement for ecosystem credit species. The full BAM-C biodiversity credit report is provided in Annex 10.

Figure 6 identifies the impacts of the Project and those areas requiring to be offset. In accordance with the BAM (DPIE 2020a), areas to be offset are PCT's with a VI score:

- ≥ 15 where the PCT is an Endangered Ecological Community (EEC) or CEEC.
- ≥ 17 where the PCT is associated with threatened species habitat or is a Vulnerable Ecological Community.
- ≥ 20 where the PCT is not represented with a TEC or associated with threatened species habitat.

Areas not requiring to be offset include any other areas where the VI scores are less than those detailed above.

4.2 Summary of species credits required

The Project will not impact any species credit species. As such, no species credits are required to offset the Project.

5. Summary

Impacts of the Project on ecological values are summarised as follows:

- Direct removal of 18.78 ha of highly modified native vegetation containing one TEC. The majority (18.21 ha) of this is modified grassland.
- Removal of highly modified non-threatened fauna habitat (native vegetation).
- Removal of highly modified flora habitat.
- Removal of two farm dams.

As no threatened biodiversity listed under the EPBC Act were recorded or considered likely to occur in the subject land, no assessment/s of significance under the EPBC Act were required. As such, there is no requirement for an EPBC Act Referral regarding Commonwealth threatened species, communities or populations.

IMC have aimed to avoid and minimise environmental impacts from the Project through detailed design and siting of the Project and implementation of actions aimed at mitigating and managing potential indirect impacts of the Project as detailed in section 3.1.1.

Biodiversity offsets required for unavoidable impacts of the Project have been calculated as follows:

- Ecosystem credits: a total of two (2) ecosystem credits for PCT 849 *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*. These ecosystem credits also cover the credit requirement for ecosystem credit species.

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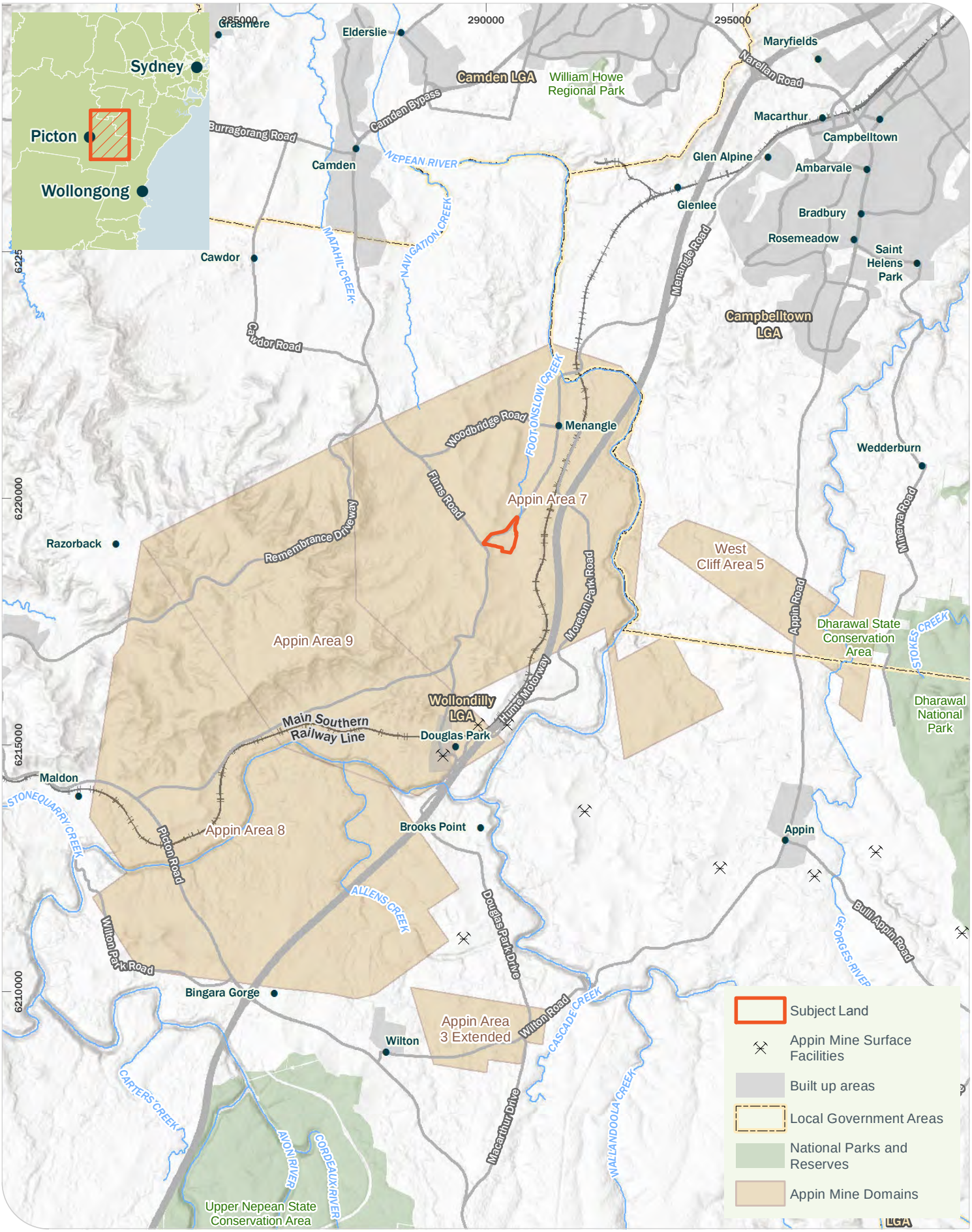
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0 2
km
GDA 1994 MGA Zone 56

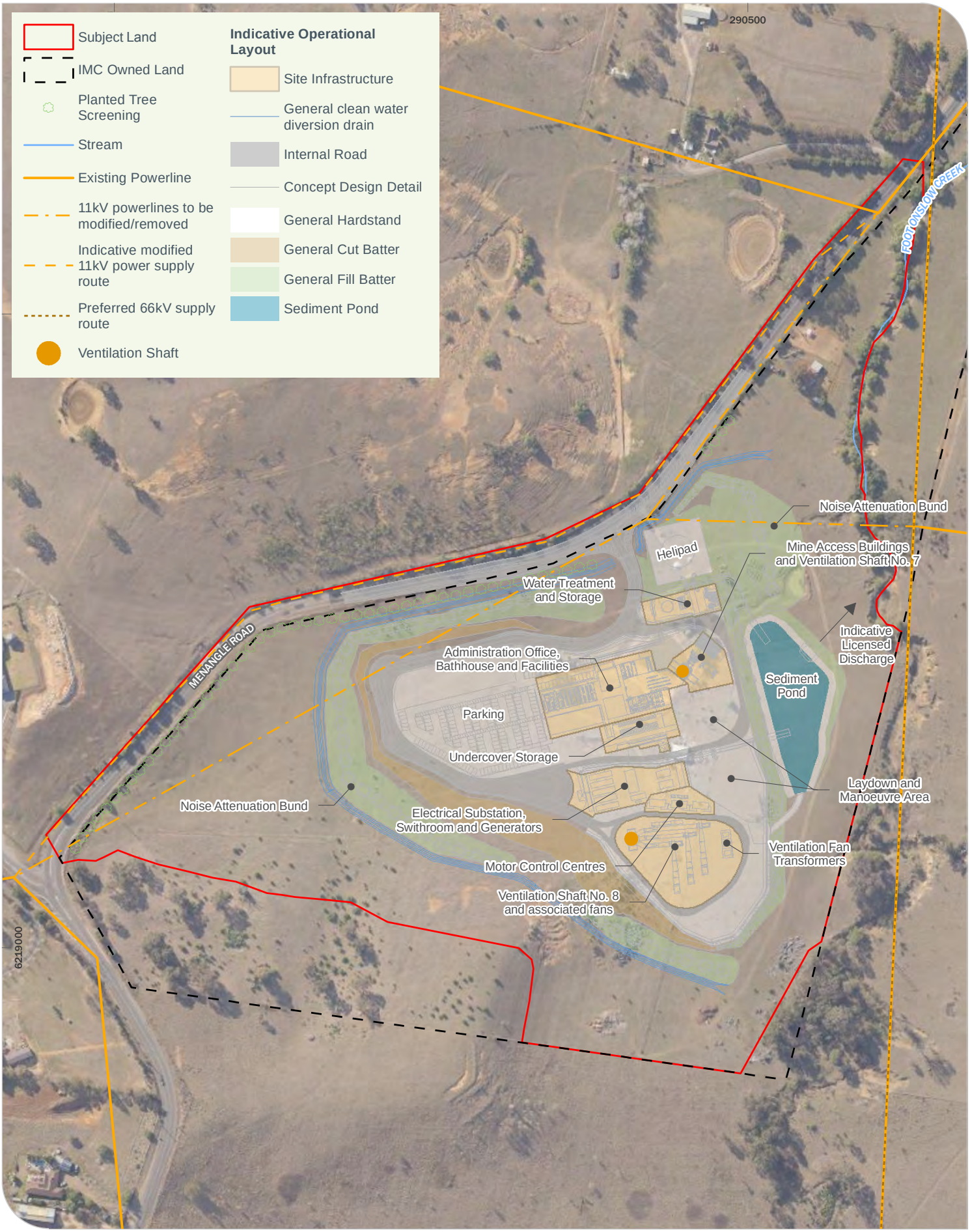
Regional Location
Appin Mine Ventilation and Access Project

Niche PM: Stephen Bloomfield
Niche Proj. #: 6418
Client: South32

Figure 1

Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

289000
290000
291000
6221000
6220000
6219000
6218000
6217000
NAVIGATION CREEK
FOOTONSLOW CREEK
HARRIS CREEK
Hawkesbury - Nepean Channels and Floodplains
Upper Nepean Gorges
Cumberland Plain
IBRA Region: Sydney Basin
Sub-region: Cumberland
LGA: Wollondilly Shire Council
Construction Footprint
Operational Boundary
1500m buffer
Non Perennial Stream
Perennial Stream
Mitchell Landscape
Vegetation Type
Woody
DNG
Not native
0
300
m
GDA 1994 MGA Zone 56
niche Environment and Heritage
Niche PM: Stephen Bloomfield
Niche Proj. #: 6418
Client: South32
Location Map
Appin Mine Ventilation and Access Project
Figure 2
Australia latest: Imagery @ Metromap /Australia latest
Drawn by: YH File: T:\spatial\projects\6400\6418_AppinMineAccessandVentilation_BDAR_NSW\Maps\report\BDAR\Updated\BDAR_20210429\6418_Fig2_LocationMap.mxd Last updated: 4/30/2021 1:12:38 PM
v2.0



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0 75
m
GDA 1994 MGA Zone 56

Niche PM: Stephen Bloomfield
Niche Proj. #: 6418
Client: South32

Subject Land
Appin Mine Ventilation and Access Project
Operational Site Layout

Figure 3

public/NSW_Imagery: © Department of Customer Service 2020

290000
290200
290400
290600
6219600
6219400
6219200
6219000
6218800
1242/DP1121129
1241/DP1121129
3/DP242606
20A/DP4450
412/DP1044196
40/DP717358
50/DP711829
19/DP4450
FOOTONSLOW CREEK

Construction Footprint
Operational Boundary
Non Perennial Stream
Perennial Stream
Waterbody
Lot

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0 60
m
GDA 1994 MGA Zone 56

Niche PM: Stephen Bloomfield
Niche Proj. #: 6418
Client: South32

Site Map
Appin Mine Ventilation and Access Project

Figure 4

Australia latest: Imagery @ Metromap /Australia latest

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290000
290200
290400
290600
6219600
6219400
6219200
6219000
6218800
1
2
3
4
5
6
7
BAM Plot
RDP
Hollow-bearing tree
Vegetation zone (PCT, name)
849, Grassland
849, Woodland
849, Shrubland
835, Exotic Forest
0, non-vegetative
0, exotic vegetation
Construction Footprint
Operational Boundary
0
60
m
N
GDA 1994 MGA Zone 56
niche Environment and Heritage
Niche PM: Stephen Bloomfield
Niche Proj. #: 6418
Client: South32
Vegetation zones and plot locations
Appin Mine Ventilation and Access Project
Figure 5
Australia latest: Imagery @ Metromap /Australia latest
Drawn by: YH File: T:\spatial\projects\a6400\a6418_AppinMineAccessandVentilation_BDAR_NSW\Maps\report\BDAR\UpdatedBDAR_20210429\6418_Fig5_VegZone.mxd LastUpdated: 4/30/2021 1:10:41 PM
v2.0

290000
290200
290400
290600
6219600
6219400
6219200
6219000
6218800

Construction Footprint
Operational Boundary
Area to be offset (VI>=15)
Area to be retained

0 60
m
GDA 1994 MGA Zone 56

Niche PM: Stephen Bloomfield
Niche Proj. #: 6418
Client: South32

Impacts and offsetting
Appin Mine Ventilation and Access Project

Figure 6

Australia latest: Imagery @ Metromap /Australia latest

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v2.0

290000
290200
290400
290600
6219600
6219400
6219200
6219000
6218800

Construction Footprint
Operational Boundary
SAII
Area to be retained

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0 60
m
GDA 1994 MGA Zone 56

Niche PM: Stephen Bloomfield
Niche Proj. #: 6418
Client: South32

Location of CPW at risk of SAII
Appin Mine Ventilation and Access Project

Figure 7

Australia latest: Imagery @ Metromap /Australia latest

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v2.0

Annex 1. Aquatic Ecology Report

Excellence in your environment

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Appin Mine Ventilation and Access Project Menangle NSW

Aquatic Ecology

Prepared for Illawarra Metallurgical Coal | 28 June 2021



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Excellence in your environment

Document control

Project number	Client	Project manager	LGA
6418	Illawarra Metallurgical Coal	Stephen Bloomfield	Wollondilly Shire

Version	Author	Review	Status	Date
D1	David Wilkinson, Stephen Bloomfield	Sian Griffiths	Draft	23 March 2021
D2	David Wilkinson, Stephen Bloomfield	Sian Griffiths	Draft	24 March 2021
Rev1	David Wilkinson, Stephen Bloomfield	Matt Russell	Draft	12 April 2021
Rev2	David Wilkinson, Stephen Bloomfield, Matthew Russell		Draft	10 May 2021
Rev3	David Wilkinson, Stephen Bloomfield, Matthew Russell		Final	2 June 2021
Rev4	David Wilkinson, Stephen Bloomfield, Matthew Russell		Final	28 June 2021

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1. Introduction

1.1 Background

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by Illawarra Metallurgical Coal (IMC) to undertake an aquatic ecology assessment of the proposed Appin Mine Ventilation and Access Project (the Project).

The Project description is provided in Section 1.2 of the Biodiversity Development Assessment Report (BDAR) and not repeated here. Insofar as this aquatic ecology assessment is concerned, the project will result in the discharge of water into Foot Onslow Creek which bounds the northern side of 345 Menangle Road, Menangle, NSW (the subject land).

1.1.1 Water management

The Project requires the construction of a range of surface water management measures, which would be installed during site establishment. These measures have been designed to mitigate possible water quality impacts to Foot Onslow Creek and the Nepean River from the construction phase of the Project and would continue to be utilised during the operational phase where required.

During construction of the access road and other site infrastructure, standard clean and dirty water diversion drainage, careful staging and minimisation of disturbed areas and sediment and erosion control measures (Landcom 2004) will be used to minimise the generation and discharge of dirty water from construction activities (IMC 2021). Other surface water management measures that would be installed as part of the construction phase include:

- Sedimentation pond/s, located downstream of the bulk earthworks pad, which would receive dirty water runoff from the general construction site.
- Clean water diversion swales and culverts that divert clean water runoff around the construction site towards Foot Onslow Creek.
- Dirty water swales that capture and direct dirty water runoff from the construction site areas into the sedimentation pond.
- Clean water diversion swales and culverts that divert clean water runoff from the vegetated bunds around the construction site towards Foot Onslow Creek.
- Mobile flocculant dosing plants for the sedimentation ponds, if required.
- Oil/water separation sumps would be installed in areas likely to be in contact with hydrocarbons.
- Additional construction phase water management structures or diversions, sediment ponds or tanks to temporarily manage surface water or construction process water for various activities (IMC 2021).

A licenced discharge point would be required to manage controlled releases from the sedimentation pond. Releases would only occur when there is excess runoff collected in sedimentation ponds, which cannot be reused on site (IMC 2021).

It is anticipated that all surface water management infrastructure would be decommissioned and removed upon project completion (IMC 2021).

1.1.2 Aim

This document reports on the results of the visual stream health assessment of Foot Onslow Creek within the subject land, the aim of the inspection being to determine if there is any sensitive aquatic habitat (i.e. Key Fish Habitat) or suitable habitat for threatened aquatic species listed under the NSW *Fisheries Management 1994 Act* (FM Act), NSW *Biodiversity Conservation Act 2016* (BC Act) and/or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), that could be impacted by the Project. Additionally, water quality collected in Foot Onslow Creek and onsite farm dams by South32 was considered in the assessment.

2. Methods

2.1 Location of subject land

The section of Foot Onslow Creek that was inspected is located adjacent to the northern boundary of the subject land (Figure 2 of the BDAR).

Table 1: Survey area

Subject land	Location	Latitude	Longitude
Foot Onslow Creek, Menangle	Foot Onslow Creek	-34.145346	150.728676

2.2 Methods

2.2.1 Desktop review

A background desktop review was undertaken to examine existing ecological mapping, past surveys and threatened species records from the local area and, if available, of the subject land. The following databases were accessed:

- NSW BioNet (NSW Department of Planning, Industry and Environment [DPIE] 2021a).
- Commonwealth Department of Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (DAWE 2021).
- Department of Primary Industries (DPI) Fisheries NSW Spatial Data Portal (DPI 2021a).
- The Central Resource for Sharing and Enabling Environmental Data in NSW (SEED) portal (DPIE 2021b).
- DPI Key Fish Habitat mapping (DPI 2021b).

2.2.2 Field methods

The site inspection was undertaken on 13 January 2021 by Niche Ecologist David Wilkinson and Niche Senior Ecologist Stephen Bloomfield. The field methods were consistent with standardised AUSRIVAS habitat assessment techniques for aquatic habitat visual assessment.

2.2.3 Visual assessment

A description of aquatic habitat was produced using a modified AUSRIVAS proforma. The survey is a rapid visual assessment used to describe the habitat based on the following parameters:

- geomorphology
- channel diversity
- bank stability
- riparian vegetation and adjacent land use
- macrophytes
- local impacts and land use practices.

3. Aquatic habitat impact assessment

3.1 Rainfall

The inspection was conducted on 13 January 2021. Antecedent rainfall since the start of the month was 24 millimetres (mm) (Figure 1) which fell between 2 and 5 January 2021. No rain fell in the eight days prior to inspection. The water level at the time of sampling was low with no visible flow.

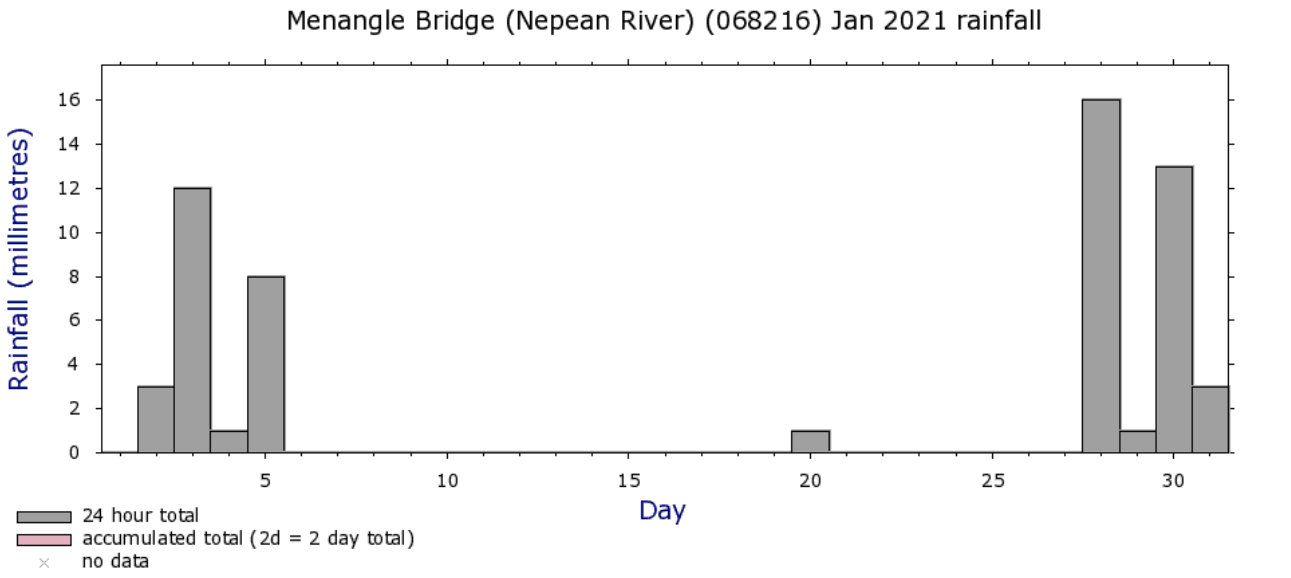


Figure 1: Rainfall for January 2021

3.2 Aquatic habitat

3.2.1 Foot Onslow Creek

Results of the visual survey, including photographs of the habitat within Foot Onslow Creek, are provided in Annex 1. Foot Onslow Creek is intermittent and likely only flows during periods of extended, moderate or high rainfall. Within the subject land the watercourse resides chiefly within agricultural land. Foot Onslow Creek is predominantly highly disturbed and in poor condition. Within the subject land the creek was restricted to a chain of isolated pools. The pools were generally shallow and clear. The creek bed was dominated by fine sediment and exhibited signs of minor channel/bank erosion; however, the channel and banks were mostly stable. The channel was reasonably well vegetated by mostly exotic trees and a mixed native/exotic groundcover, with the riparian vegetation being in good health. Native emergent macrophyte, Cumbungi (*Typha orientalis*) was also present. Flood borne debris and rubbish were observed snagged on the fence line crossing the creek, however Foot Onslow Creek was generally free of debris and submerged organic matter.

In summary, Foot Onslow Creek is a rural stream and currently impacted by farmland runoff, habitat degradation, stream modification and land use. Impacts observed include:

- rubbish and debris
- farm dams located upstream
- localised bank and channel erosion and sedimentation
- exotic vegetation
- disturbance from cattle.

3.2.2 Dams

Other aquatic habitat in the subject land includes two farm dams. The furthest up-slope (Dam 1) was approximately 1200 m^2 (35 m by 35 m). The smaller dam closer to Foot Onslow Creek (Dam 2) was 200 m^2 (20 m by 10 m) in size. Neither dam contains significant amounts of aquatic vegetation nor are they likely to provide habitat for threatened aquatic fauna. However, there is potential habitat for native eels, turtles, and small native and exotic fish e.g., Mosquito Fish (*Gambusia holbrooki*).

3.3 Key fish habitat

Foot Onslow Creek is as an intermittent 3rd order stream with several farm dams upstream. While it is likely to provide some aquatic habitat (including some macrophytes) for disturbance tolerant aquatic fauna, it is unlikely to support sensitive species protected under State and Federal legislation. Additionally, Foot Onslow Creek is not mapped as being Key Fish Habitat (DPI 2021b, DPIE 2021b).

3.4 Water quality

Water quality data has been collected by South 32 since 2008 in Foot Onslow Creek and onsite dam water quality was collected in December 2021. A summary of the water quality for Foot Onslow Creek is provided in Table 2 and for two onsite dams in Table 3. Water quality in Foot Onslow creek was typical for a disturbed intermittent waterway with elevated electrical conductivity, Total Dissolved Solids (TDS), and low dissolved oxygen (DO). The pH on average was more alkaline (pH- 8) in Foot Onslow Creek. The dams at the time of sampling had low electrical conductivity, and mostly low concentration of metals, with highest concentration being aluminium and iron. Nutrients (Total Nitrogen and Total Phosphorus) were slightly elevated above ANZECC default guidelines for upland streams.

Table 2 Water quality Foot Onslow Creek

Parameter	Average	Standard deviation
Electrical Conductivity	1616	901
pH	8	0.4
Dissolved oxygen (%)	73.5	22.3
Total dissolved solids TDS (mg/L)	909	525
Iron (mg/L)	1.5	2
Manganese (mg/L)	0.3	0.4

3.5 Threatened aquatic species

Two species of threatened fish were identified by the Protected Matters Search Tool (PMST) (DAWE 2021) as having potential habitat within a 10 kilometre radius of the subject land; Macquarie Perch (*Macquaria australasica)* and Australian Grayling (*Prototroctes maraena).* Historically, Macquarie Perch has been found in lakes and rivers. Macquarie Perch can form significant populations in impoundments but are truly a riverine fish that require flowing water to breed. The preferred habitat of Macquarie perch is cool, shaded, upland streams with deep rocky pools and substantial instream cover (Lintermans 2013). This habitat as well as riffle breeding habitat was not available at the subject land. Australian Grayling are diadromous (migrate between fresh and salt water). During the freshwater phase of the life cycle, Australian Grayling inhabit lower altitude reaches of both large rivers and smaller streams. Very little is known about the specific environmental requirements or habitats, however Australian Grayling are not known to occur in intermittent streams (DPI 2015). Further, there are no known records of either the Macquarie Perch or the Australian Grayling occurring within Foot Onslow Creek.

Neither the Macquarie Perch, Australian Grayling nor any other threatened aquatic species are expected to be present within, or utilise, Foot Onslow Creek.

Table 3: Water quality of onsite dams

Parameter	Dam 1	Dam 2
Aluminium (mg/L)	1.18	0.09
Ammonia (mg/L)	0	0
Arsenic (mg/L)	0.002	0.001
Bicarbonate Alkalinity as CaCO3 (mg/L)	93	74
Carbonate Alkalinity as CaCO3 (mg/L)	0	0
Dissolved Oxygen - (%)	67.4	91.2
Electrical Conductivity – (uS/cm)	189	155
Iron (mg/L)	3.17	1.05
Nickel (mg/L)	0.002	0.002
Nitrate as N (mg/L)	0.02	0.06
Nitrite (mg/L)	0	0
Nitrite + Nitrate as N (mg/L)	0.02	0.06
pH (pH units)	7.01	6.84
pH – Field (pH units)	7.35	7.99
Phosphate as P (mg/L)	0	0
Suspended Solids (SS) (mg/L)	198	48
Temperature – (◦C)	21.06	21.37
Total Alkalinity as CaCO3 (mg/L)	93	74
Total Kjeldahl Nitrogen as N (mg/L)	0.9	1.8
Total Nitrogen as N (mg/L)	0.9	1.9
Total Phosphorus as P (mg/L)	0.03	0.08
Turbidity – (NTU)	43.3	26.2
Zinc (mg/L)	0.008	0

ANZECC guidelines: Total Phosphorus 0.02mg/L, Total Nitrogen - 0.25 mg/L, Electrical conductivity 20-350 uS/cm, pH -6.5-8, Dissolved oxygen -90-100%, Turbidity 2-25 NTU. Australia and New Zealand guidelines for freshwater and marine ecology: (mg/L)– Al- 0.055, Mn -1.9, As 0.024, Ni – 0.011, Zn – 0.008.

3.6 Impact assessment

The water management of the subject land will be designed to be consistent with best practice management (Landcom 2004), to have negligible or beneficial impact to the environment, and discharges from the site will be managed through an Environment Protection Licence (EPL). As such the Project is expected to have no impact on the ecology of the downstream waterway.

There is the potential for water quality impacts to arise from the controlled blasting residue (ammonium nitrate) which, if not managed, may dissolve and transmit to the downstream environment. A variety of

factors influence the potential to harm the aquatic environment, such as type and quantity of residue as well as the environmental condition of the site (e.g. presence of surface waterways, precipitation rate and vegetation). Ammonium nitrate is of low toxicity to aquatic life however concentrated volumes of nitrates may cause algal blooms in static waters (CSBP Limited 2017). This can affect food webs, aquatic habitat, and macroinvertebrate assemblages if a significant concentration is released into the waterway. Foot Onslow Creek is not mapped as Key Fish Habitat and is unlikely to provide habitat or refuge to any threatened aquatic species and therefore they will not be impacted by the project. Notwithstanding this, the sediment pond will be subject to an EPL and management of the discharge water quality will be required to adhere to the EPL conditions.

Potential impacts are considered in the assessment matrix in Table 4.

Table 4: Impact assessment matrix

Potential impact	Risk	Mitigation	Assessment of impact to aquatic ecology
Erosion and sedimentation impact to water quality	High	Erosion and sedimentation controls in accordance with Blue Book (Landcom 2004) and best practice. Use of sedimentation pond and regulated through licenced discharge point.	Low
Threatened aquatic species	Low - none occur in waterways	Specific mitigation not required.	Nil
Key fish habitat	Low - Foot Onslow not considered KFH.	Specific mitigation not required.	Nil
Blasting residue entering downstream environment – Ammonium nitrate	Low - Moderate –Low toxicity to aquatic life.	Monitoring and management of explosives and spill prevention and containment measures.	Low
Modification of existing farm dams	Moderate- potential loss of dam habitat. Management of aquatic fauna may be required.	Relocation of aquatic fauna if required in accordance with a Fauna Relocation Management Plan.	Low – aquatic fauna relocated to appropriate nearby aquatic habitat.
Water quality impacts	Moderate – potential for runoff onsite to affect water quality – pH, turbidity, nutrients and metals, oil/grease.	Water management system to be managed in accordance with best practice. Separation of clean water and site water. Regulation of surface water through licenced discharge point. Routine surface water monitoring. Treatment/management of any contaminants of concern to within background levels or licence conditions.	Low

4. Conclusion and recommendations

Foot Onslow Creek is a rural stream and currently impacted by farmland runoff, habitat degradation, stream modification and land use. Impacts to the creek include:

- upstream farm dams
- rubbish and debris
- localised bank and channel erosion and sedimentation
- exotic vegetation
- disturbance from cattle.

The catchment of Foot Onslow Creek is highly modified with several farm dams which can reduce runoff, sediment transport to river systems, water quality and change stream flow characteristics. Two small existing farm dams on the subject land may contribute to the cumulative impacts of Foot Onlsow Creek. Historical disturbance to the riparian vegetation and access to the creek by livestock has led to localised erosion both within the subject land and along the extent of the creek line beyond the subject area. Despite this, the channel and bank are relatively stable and is typical of a disturbed rural low-mid order waterway.

The aquatic habitat assessment for Foot Onslow Creek within the subject land concluded that the creek does not contain suitable habitat for the threatened aquatic fauna. Further, the Project is not likely to have any impact on threatened aquatic species or Key Fish Habitat or other important aquatic habitat within Foot Onslow Creek.

Modification to existing dams may require relocation of aquatic fauna (eels and turtles). If this is required, aquatic fauna must be relocated in accordance with a Fauna Relocation Plan.

Potential downstream impacts from the indicative discharge point on the subject land are expected to be negligible, with any water discharged being conducted in accordance with relevant licence requirements and standard practices for storm water management. The risk of harm from controlled blasting residue and other water quality contaminants are low with mitigation measures in place to manage surface water runoff, accidental spills and implementation of treatment measures for any containment that significantly exceed background conditions or water quality guidelines. It is recommended that an assessment and modelling of water quality be undertaken for the detail design to determine appropriate water quality limits to ensure the proposed project water management and treatment measures will have a negligible or beneficial influence on the downstream environment. Water treatment of the sediment pond must ensure discharged water meet ANZECC guidelines or limits prescribed by the EPL.

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Foot Onslow Creek



A: Upstream



B: Downstream

	Attribute	Foot Onslow Creek
Riparian	Vegetation	The dominant tree species comprised Peppercorn tree (*Schinus molle)*, while isolated *Acacia implexa* was also present. Groundcover was dominated by Couch (*Cynodon dactylon*) and Umbrella Sedge (*Cyperus eragrostis*).
	Stream shading	Moderate shading
	Exotic vegetation	Present
Stream characteristics	Modal width	3 metres (m)
	Bank condition	Exposed and vegetated banks; stable.
	Substrate	Fine sediments; silt, sand, clay and some gravel
	Flow/depth	No flow/ <1 m
	Macrophytes/algae	No algae/Typha (*Typha orientalis*)
	Water quality observations	Slight tannin discolouration/clear water
Comments		Some flood borne debris and rubbish present on fence line

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Environmental management and approvals
Impact assessments
Development and activity approvals
Rehabilitation
Stakeholder consultation and facilitation
Project management

Environmental offsetting
Offset strategy and assessment (NSW, QLD, Commonwealth)
Accredited BAM assessors (NSW)
Biodiversity Stewardship Site Agreements (NSW)
Offset site establishment and management
Offset brokerage
Advanced Offset establishment (QLD)

Annex 2. Digital files created for the BDAR

6418_ConstructionFootprint

6418_OperationalBoundary

6418_1500m_buffer

6418_VegetationType

6418_BAMPlot

6418_RDP

6418_HollowbearingTree

6418_VegetationZone

6418_Area_tobeOffset

6418_Area_tobeRetained

6418_SAII

Annex 3. Threatened species status and likelihood of occurrence

E = Endangered; V = Vulnerable, CE = Critically Endangered.

Unless otherwise stated, habitat information obtained from the BioNet Threatened Species Database (DPIE 2021c) and SPRAT Profiles (DAWE 2021c).

Scientific name (Data source)	Common name	BC Act	EPBC Act	Class of credit	Habitat	Likelihood of occurrence
BIRDS						
Actitis hypoleucos	Common Sandpiper		M, MA	n/a	Utilises a wide range of coastal wetlands and some inland wetlands, mostly found around muddy margins or rocky shores. Forages in shallow water and on soft mud, roosts on rocks or vegetation such as mangroves. Northern hemisphere breeding.	None
Anthochaera phrygia	Regent Honeyeater	CE	E,M	Species/Ecosystem	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. The distribution of the species has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some years flocks converge on flowering coastal woodlands and forests.	Low
Apus pacificus	Fork tailed Swift		M	n/a	The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher.	Low - overfly habitat only
Artamus cyanopterus	Dusky Woodswallow	V	-	Ecosystem	Dusky woodswallows are widespread in eastern, southern and south western Australia. The species occurs throughout most of New South Wales, but is sparsely scattered in, or largely absent from, much of the upper western region. Most breeding activity occurs on the western slopes of the Great Dividing Range. Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or	Low

Scientific name (Data source)	Common name	BC Act	EPBC Act	Class of credit	Habitat	Likelihood of occurrence
					sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris.	
Botaurus poiciloptilus	Australasian Bittern	E	E	Ecosystem	The Australasian Bitterns is widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (Typha spp.) and spikerushes (*Eleoacharis spp.*).	None
Burhinus grallarius	Bush Stone-curlew	E	-	Species	Inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber.	Low
Calidris acuminata	Sharp-tailed Sandpiper	-	M	n/a	Prefers muddy edges of shallow or brackish wetlands, with inundated or emergent sedges, saltmarsh or other low vegetation. Also found foraging in sewage ponds and flooded paddocks. Northern hemisphere breeding.	None
Calidris ferruginea	Curlew Sandpiper	E	CE, M	Species/Ecosystem	It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes the inland. Northern hemisphere breeding.	None
Calidris melanotos	Pectoral Sandpiper	-	M	n/a	Prefers shallow fresh to saline wetlands, found at coastal lagoons, estuaries, bays, swamps, inundated grasslands, saltmarshes and artificial wetlands. Northern hemisphere breeding.	None
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	Species/Ecosystem	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. 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. It requires tree hollows in which to breed.	None

Scientific name (Data source)	Common name	BC Act	EPBC Act	Class of credit	Habitat	Likelihood of occurrence
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Species/Ecosystem	Inhabits forest with low nutrients, characteristically with key *Allocasuarina spp*. Tends to prefer drier forest types with a middle stratum of Allocasuarina below Eucalyptus or Angophora. Often confined to remnant patches in hills and gullies. Breed in hollows stumps or limbs, either living or dead. Endangered population in the Riverina.	None
Chthonicola sagittata	Speckled Warbler	V	-	Ecosystem	The Speckled Warbler lives in a wide range of eucalypt dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy.	Low
Circus assimilis	Spotted Harrier	V	-	Ecosystem	The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. Occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	Low
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	Ecosystem	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 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.	Low
Cuculus optatus	Oriental Cuckoo	-	M, MA	n/a	Mainly inhabits coniferous, deciduous and mixed forests. Breeds in northern hemisphere. Brood parasite, laying eggs in nests of other birds.	None

Scientific name (Data source)	Common name	BC Act	EPBC Act	Class of credit	Habitat	Likelihood of occurrence
Daphoenositta chrysoptera	Varied Sittella	V	-	Ecosystem	Inhabits wide variety of dry eucalypt forests and woodlands, usually with either shrubby under storey or grassy ground cover or both, in all climatic zones of Australia. Usually in areas with rough-barked trees, such as stringybarks or ironbarks, but also in paperbarks or mature Eucalypts with hollows.	Low
Dasyornis brachypterus	Eastern Bristlebird			n/a	The distribution of the Eastern Bristlebird has contracted to three disjunct areas of south-eastern Australia. There are three main populations: Northern - southern Queensland/northern NSW, Central - Barren Ground NR, Budderoo NR, Woronora Plateau, Jervis Bay NP, Booderee NP and Beecroft Peninsula and Southern - Nadgee NR and Croajingalong NP in the vicinity of the NSW/Victorian border. Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. In northern NSW the habitat occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone.	None
Ephippiorhynchus asiaticus	Black-necked Stork	E	-	Ecosystem	Mainly found on shallow, permanent, freshwater terrestrial wetlands, and surrounding marginal vegetation, including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters, as well as extending into adjacent grasslands, paddocks and open savannah woodlands. They also forage within or around estuaries and along intertidal shorelines, such as saltmarshes, mudflats and sandflats, and mangrove vegetation.	None
Falco hypoleucos	Grey Falcon	E	-	Ecosystem	Chiefly distributed in throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast.	None
Gallinago hardwickii	Latham's Snipe	-	M	n/a	Latham's Snipe is a non-breeding migrant to the south east of Australia including Tasmania, passing through the north and New Guinea on passage. Latham's Snipe breed in Japan and on the east Asian mainland.	Low

Scientific name (Data source)	Common name	BC Act	EPBC Act	Class of credit	Habitat	Likelihood of occurrence
					Seen in small groups or singly in freshwater wetlands on or near the coast, generally among dense cover. They are found in any vegetation around wetlands, in sedges, grasses, lignum, reeds and rushes and also in saltmarsh and creek edges on migration.	
Glossopsitta pusilla	Little Lorikeet	V	-	Ecosystem	Distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range in NSW, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Mostly occur in dry, open eucalypt forests and woodlands. They feed primarily on nectar and pollen in the tree canopy. Nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts. Most breeding records come from the western slopes.	Low
Grantiella picta	Painted Honeyeater	V	V	Ecosystem	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs 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.	None
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	M	Species/Ecosystem	Inhabits coastal and near coastal areas, building large stick nests, and feeding mostly on marine and estuarine fish and aquatic fauna.	Low
Hieraaetus morphnoides	Little Eagle	V	-	Species/Ecosystem	Most abundant in lightly timbered areas with open areas nearby. Often recorded foraging in grasslands, crops, treeless dune fields, and recently logged areas. May nest in farmland, woodland and forest in tall trees.	Low - overfly habitat only
Hirundapus caudacutus	White-throated Needletail	-	M	Species	An aerial species found in feeding concentrations over cities, hilltops and timbered ranges.	Low - overfly habitat only
Lathamus discolor	Swift Parrot	E	E	Species/Ecosystem	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW . This species is	Low

Scientific name (Data source)	Common name	BC Act	EPBC Act	Class of credit	Habitat	Likelihood of occurrence
					migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability.	
Lophoictinia isura	Square-tailed Kite	V	-	Species/Ecosystem	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 100km2. 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.	Low - overfly habitat only
Melanodryas cucullata	Hooded Robin (south-eastern form)	V	-	Ecosystem	Occupy a wide range of eucalypt woodlands, Acacia shrublands and open forests.	Low
Monarcha melanopsis	Black-faced Monarch	-	M	n/a	Found along the coast of eastern Australia, becoming less common further south. Inhabits rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating.	None
Motacilla flava	Yellow Wagtail	-	M	n/a	Breeds in temperate Europe and Asia. The Yellow Wagtail is a regular wet season visitor to northern Australia. Increasing records in NSW suggest this species is an occasional but regular summer visitor to the Hunter River region. The species is considered a vagrant to Victoria, South Australia and southern Western Australia. Habitat requirements for the Yellow Wagtail are highly variable, but typically include open grassy flats near water. Habitats include open areas with low vegetation such as grasslands, airstrips, pastures, sports fields; damp open areas such as muddy or grassy edges of wetlands, rivers, irrigated farmland, dams, waterholes; sewage farms, sometimes utilise tidal mudflats and edges of mangroves.	None
Myiagra cyanoleuca	Satin Flycatcher	-	M	n/a	The Satin Flycatcher is found along the east coast of Australia from far northern Queensland to Tasmania, including south-eastern South	None

Scientific name (Data source)	Common name	BC Act	EPBC Act	Class of credit	Habitat	Likelihood of occurrence
					Australia. Found in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests.	
Neophema pulchella	Turquoise Parrot	V	-	Ecosystem	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland.	Low
Ninox connivens	Barking Owl	V	-	Species/Ecosystem	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. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey found on these fertile riparian soils.;1|Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species.	Low
Ninox strenua	Powerful Owl	V	-	Species/Ecosystem	Occupies wet and dry eucalypt forests and rainforests. Can occupy both un-logged and lightly logged forests as well as undisturbed forests where it usually roosts on the limbs of dense trees in gully areas. It is most commonly recorded within red turpentine in tall open forests and black she-oak within open forests. Large mature trees with hollows at least 0.5 m deep are required for nesting. Tree hollows are particularly important for the Powerful Owl because a large proportion of the diet is made up of hollow-dependent arboreal marsupials. Nest trees for this species are usually emergent with a diameter at breast height of at least 100 cm.	None
Numenius madagascariensis	Eastern Curlew	-	CE, MA, M	n/a	A primarily coastal distribution. Found in all states, particularly the north, east, and south-east regions including Tasmania. Rarely recorded inland. Mainly forages on soft sheltered intertidal sand flats or mudflats, open and without vegetation or cover. Breeds in the northern hemisphere.	None
Pandion cristatus	Osprey	V	-	Species/Ecosystem	Found right around the Australian coast line, 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. Favour	None

Scientific name (Data source)	Common name	BC Act	EPBC Act	Class of credit	Habitat	Likelihood of occurrence
					coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water.	
Petroica boodang	Scarlet Robin	V	-	Ecosystem	The Scarlet Robin is found from SE Queensland to SE South Australia and also in Tasmania and SW Western Australia. In NSW, it occurs from the coast to the inland slopes. The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs.	Low
Petroica phoenicea	Flame Robin	V	-	Ecosystem	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. The groundlayer 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. In winter, birds migrate to drier more open habitats in the lowlands (i.e. valleys below the ranges, and to the western slopes and plains). Often occurs in recently burnt areas; however, habitat becomes unsuitable as vegetation closes up following regeneration. In winter lives in dry forests, open woodlands and in pastures and native grasslands, with or without scattered trees. In winter, occasionally seen in heathland or other shrublands in coastal areas.	Low
Rhipidura rufifrons	Rufous Fantail	-	M	n/a	Found along the east coast of Australia from far northern Queensland to Tasmania, including south-eastern South Australia. Inhabits tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests.	None
Rostratula australis	Australian Painted Snipe	E	E, MA	Ecosystem	In NSW, this species has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp. Most common in the Murray-Darling Basin. 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.	None

Scientific name (Data source)	Common name	BC Act	EPBC Act	Class of credit	Habitat	Likelihood of occurrence
Stagonopleura guttata	Diamond Firetail	V	-	Ecosystem	Feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season). Found in grassy eucalypt woodlands, including box-gum woodlands and snow gum woodlands. Also occurs in open forest, mallee, natural temperate grassland, and in secondary grassland derived from other communities.	Low
Thinornis cucullatus	Hooded Plover	-	V	n/a	It mainly occurs on wide beaches backed by dunes with large amounts of seaweed and jetsam, creek mouths and inlet entrances. Nests are found above the high water mark on flat beaches, on stony terraces, or on sparsely vegetated dunes.	None
Tringa nebularia	Common Greenshank	-	M	n/a	Variety of inland wetlands and sheltered coastal habitats of varying salinity. Found on mudflats, saltmarsh, mangroves in embayments, harbours, deltas and lagoons. Breeds in northern hemisphere.	None
Tyto novaehollandiae	Masked Owl	V	-	Species/Ecosystem	Lives in dry eucalypt forests and woodlands from sea level to 1100 m.	Low
MAMMALS						
Cercartetus nanus	Eastern Pygmy-possum	V	-	Species	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.	None
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Species	Located in a variety of drier habitats, including the dry sclerophyll forests and woodlands to the east and west of the Great Dividing Range. Can also be found on the edges of rainforests and in wet sclerophyll forests. This species roosts in caves and mines in groups of between 3 and 37 individuals.	Low – potential foraging habitat only
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Ecosystem	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing	None

Scientific name (Data source)	Common name	BC Act	EPBC Act	Class of credit	Habitat	Likelihood of occurrence
					trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites.	
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Ecosystem	Inhabit sclerophyll forests, preferring wet habitats where trees are more than 20 m high. Two observations have been made of roosts in stem holes of living eucalypts. There is debate about whether or not this species moves to lower altitudes during winter, or whether they remain sedentary but enter torpor . This species also appears to be highly mobile and records showing movements of up to 12 km between roosting and foraging sites .	Low – potential foraging habitat only
Isoodon obesulus	Southern Brown Bandicoot	E	E	Species	Prefers sandy soils with scrubby vegetation and-or areas with low ground cover that are burn from time to time. A mosaic of post fire vegetation is important for this species.	None
Micronomus norfolkensis	Eastern Freetail-bat	V	-	Ecosystem	Most records are from dry eucalypt forests and woodlands to the east of the Great Dividing Range. Appears to roost in trees, but little is known of this species' habits.	Low – potential foraging habitat only
Miniopterus australis	Little Bentwing-bat	V	-	Species/Ecosystem	Coastal north-eastern NSW and eastern Queensland. Little Bent-wing Bat is an insectivorous bat that roost in caves, in old mines, in tunnels, under bridges, or in similar structures. They breed in large aggregations in a small number of known caves and may travel 100s km from feeding home ranges to breeding sites. Little Bent-wing Bat has a preference for moist eucalypt forest, rainforest or dense coastal banksia scrub where it forages below the canopy for insects.	Low – potential foraging habitat only
Miniopterus orianae oceanensis	Eastern Bentwing-bat	V	-	Species/Ecosystem	Eastern Bent-wing Bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young.	Low – potential foraging habitat only
Myotis macropus	Southern Myotis	V	-	Species	The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. Generally roost in groups of 10 - 15 close to water in caves, mine shafts,	Low – potential foraging habitat only

Scientific name (Data source)	Common name	BC Act	EPBC Act	Class of credit	Habitat	Likelihood of occurrence
					hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage.	
Petauroides volans	Greater Glider	-	V	n/a	The Greater Glider is restricted to eastern Australia, occurring from the Windsor Tableland in north Queensland through to central Victoria. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows.	None
Petaurus norfolcensis	Squirrel Glider	V	-	Species	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.	None
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Species	Found in rocky areas in a wide variety of habitats including rainforest gullies, wet and dry sclerophyll forest, open woodland and rocky outcrops in semi-arid country. Commonly sites have a northerly aspect with numerous ledges, caves and crevices (Eldridge 1995).	None
Phascolarctos cinereus	Koala	V	V	Species/Eco system	Inhabits eucalypt forests and woodlands. The suitability of these forests for habitation depends on the size and species of trees present, soil nutrients, climate and rainfall .	Low
Pseudomys novaehollandiae	New Holland Mouse	-	V	n/a	The New Holland Mouse currently has a disjunct, fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes.	None
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Species/Eco system	This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Bats commute daily to foraging areas, usually within 15 km of the day roost although some individuals may travel up to 70 km.	Low
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Ecosystem	Prefer moist gullies in mature coastal forests and rainforests, between the Great Dividing Range and the coast. They are only found at low altitudes below 500 m. In dense environments they utilise natural and human-made opening in the forest for flight paths. Creeks and small	Low

Scientific name (Data source)	Common name	BC Act	EPBC Act	Class of credit	Habitat	Likelihood of occurrence
					rivers are favoured foraging habitat. This species roosts in hollow tree trunks and branches.	
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Ecosystem	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	Low
INVERTEBRATES						
Meridolum corneovirens	Cumberland Plain Land Snail	E	-	Species	Primarily inhabits CPW (a CEEC). This community is a grassy, open woodland with occasional dense patches of shrubs. Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish.	Low
Pommerhelix duralensis	Dural Land Snail	E	E	Species	The species has a strong affinity for communities in the interface region between shale-derived and sandstone-derived soils, with forested habitats that have good native cover and woody debris. It favours sheltering under rocks or inside curled-up bark. It does not burrow nor climb. The species has also been observed resting in exposed areas, such as on exposed rock or leaf litter, however it will also shelter beneath leaves, rocks and light woody debris. Pommerhelix duralensis in the strict sense is found in an area of north-western Sydney between Rouse Hill - Cattai and Wiseman's Ferry, west from Berowra Creek. Occurrence in Wollondilly Shire is considered unlikely in light of current knowledge.	None
REPTILES						
Hoplocephalus bungaroides	Broad-headed Snake	E	V	Species/Ecosystem	Occurs almost exclusively in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they spend most of the year sheltering in and under rock crevices and exfoliating rock. However,	None

Scientific name (Data source)	Common name	BC Act	EPBC Act	Class of credit	Habitat	Likelihood of occurrence
					some individuals will migrate to tree hollows to find shelter during hotter parts of summer.	
FROGS						
Heleioporus australiacus	Giant Burrowing Frog	V	V	Species	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based.	None
Litoria aurea	Green and Golden Bell Frog	E	V	Species	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.	Low
Litoria littlejohni	Littlejohn's Tree Frog	V	V	Species	This species breeds in the upper reaches of permanent streams and in perched swamps. Non-breeding habitat is heath based forests and woodlands where it shelters under leaf litter and low vegetation.	None
Litoria raniformis	Growling Grass Frog	E	V	Species	Usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat.	None
Mixophyes balbus	Stuttering Frog	E	V	Species	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range.	None
PLANTS						
Acacia bynoeana	Bynoe's Wattle	E	V	Species	Grows mainly in heath and dry sclerophyll forest in sandy soils. Mainly south of Dora Creek-Morisset area to Berrima and the Illawarra region, west to the Blue Mountains, also recorded from near Kurri Kurri in the Hunter Valley and from Morton National Park.	None
Acacia pubescens	Downy Wattle	V	V	Species	Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravely soils, often with ironstone. Occurs in open woodland and forest, in a variety of plant	Low

Scientific name (Data source)	Common name	BC Act	EPBC Act	Class of credit	Habitat	Likelihood of occurrence
					communities, including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and CPW.	
Allocasuarina glareicola		E	E	Species	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 Parramatta Red Gum, Broad-leaved Ironbark, Narrow-leaved Apple, Scribbly Gum and Paperbarks.	None
Caladenia tessellata	Thick Lip Spider Orchid	E	V	Species	Found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil. Known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Populations in Kiama and Queanbeyan are presumed extinct.	None
Callistemon linearifolius	Netted Bottle Brush	V	-	Species	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Recorded in 2000 at Coalcliff in the northern Illawarra. For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. Grows in dry sclerophyll forest on the coast and adjacent ranges.	None
Commersonia prostrata	Dwarf Kerrawang	E	E	Species	From the Tomago sandbeds north-east of Newcastle (NSW) to Gippsland Lakes hinterland (Vic). On sandy or peaty soils in eucalypt woodland, open forest or ecotonal forest. Recorded as responding to disturbance.	None
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	Species	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 gummifer*a) 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*).	None

Scientific name (Data source)	Common name	BC Act	EPBC Act	Class of credit	Habitat	Likelihood of occurrence
Cynanchum elegans	White-flowered Wax Plant	E	E	Species	Recorded from rainforest gullies scrub and scree slopes from the Gloucester district to the Wollongong area and inland to Mt Dangar.	None
Dillwynia tenuifolia		V	-	Species	In western Sydney, may be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland.	Low
Dillwynia tenuifolia	*Dillwynia tenuifolia, Kemps Creek*	EP	-	Species	The endangered population occurs in the area bounded by Western Road, Elizabeth Drive, Devonshire Road and Cross Street, Kemps Creek in the Liverpool Local Government Area. It occurs on a small outlier of the Berkshire Park Soil Landscape. The site supports a transition from Castlereagh Ironbark Forest to Castlereagh Scribbly Gum Woodland. Portions of the site contain a form of Shale Gravel Transition Forest.	None
Eucalyptus benthamii	Camden White Gum	V	V	Species	Restricted but locally abundant, in wet forest on sandy alluvial soils along valley floors; confined to the lower Nepean R. area.	Low
Genoplesium baueri	Bauer's Midge Orchid	E	E	Species	Grows in dry sclerophyll forest and moss gardens over sandstone. Flowers February to March. Has been recorded between Ulladulla and Port Stephens. Currently the species is known from just over 200 plants across 13 sites. The species has been recorded in Berowra Valley Regional Park, Royal National Park and Lane Cove National Park and may also occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments.	None
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea	V	-	Species	Endemic to Western Sydney, centred on an area bounded by Blacktown, Erskine Park, Londonderry and Windsor with outlier populations at Kemps Creek and Pitt Town. Recorded from CPW, Castlereagh Ironbark woodland, Castlereagh Scribbly Gum woodland and Shale-Gravel Transition forest. Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium (often with shale influence), typically containing lateritic gravels.	Low

Scientific name (Data source)	Common name	BC Act	EPBC Act	Class of credit	Habitat	Likelihood of occurrence
Grevillea parviflora subsp. parviflora	Small-flowered Grevillea	V	V	Species	Grows in sandy or light clay soils usually over thin shales. Occurs in a range of vegetation types from heath and shrubby woodland to open forest. Found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests. Often occurs in open, slightly disturbed sites such as along tracks.	None
Gyrostemon thesioides		E	-	Species	Grows on hillsides and riverbanks and may be restricted to fine sandy soils. Within NSW, has only ever been recorded at three sites, to the west of Sydney, near the Colo, Georges and Nepean Rivers. The most recent sighting was of a single male plant near the Colo River within Wollemi National Park. The species has not been recorded from the Nepean and Georges Rivers for 90 and 30 years respectively, despite searches. Also occurs in Western Australia, South Australia, Victoria and Tasmania.	None
Haloragis exalata subsp. exalata		V	V	Species	Occurs in four widely scattered localities in eastern NSW. It is distributed in the central coast, south coast and north-western slopes botanical subdivisions of NSW. The species appears to require protected and shaded damp situations in riparian habitats.	Low
Hibbertia sp. Bankstown	Hibbertia sp. Bankstown	CE	CE	Species	The airport site is very heavily modified from the natural state, lacks canopy species and is currently a low grass-shrub association with many pasture grasses and other introduced herbaceous weeds. Soil at the site is a sandy (Tertiary) alluvium with a high silt content. The remnant vegetation at the site and soil type are consistent with an inferred pre-settlement cover of Castlereagh Ironbark forest.	None
Leucopogon exolasius	Woronora Beard-heath	V	V	Species	Grows in woodland on sandstone. Restricted to the Woronora and Grose Rivers and Stokes Creek, Royal National Park.	None
Marsdenia viridiflora R. Br. subsp. viridiflora	Bankstown, Blacktown, Camden, Campbelltown, Fairfield,	EP	-	Species	Grows in vine thickets and open shale woodland.	Low

Scientific name (Data source)	Common name	BC Act	EPBC Act	Class of credit	Habitat	Likelihood of occurrence
	Holroyd, Liverpool and PenrithLGA's					
Melaleuca deanei	Dean's Low Melaleuca	V	V	Species	Grows in wet heath on sandstone in coastal districts from Berowra to Nowra.	None
Persicaria elatior	Tall Knotweed	V	V	Species	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	Low
Persoonia bargoensis	Bargo Geebung	E	V	Species	The Bargo Geebung occurs in woodland or dry sclerophyll forest on sandstone and on heavier, well drained, loamy, gravely soils.	None
Persoonia hirsuta	Hairy Geebung	E	E	Species	The Hairy Geebung is found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	None
Persoonia nutans	Nodding Geebung	E	E	Species	In woodland to dry sclerophyll forest on laterite and alluvial sand; confined to the Cumberland Plain.	Low
Pilularia novae-hollandiae	Austral Pillwort	E	-	Species	Grows in shallow swamps and waterways, often among grasses and sedges. It is most often recorded in drying mud as this is when it is most conspicuous.	Low
Pimelea curviflora var. curviflora		V	V	Species	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands.	Low
Pimelea spicata	Spiked Rice-flower	E	E	Species	Once widespread on the Cumberland Plain, the Spiked Rice-flower occurs in two disjunct areas; the Cumberland Plain (Narellan, Marayong, Prospect Reservoir areas) and the Illawarra (Lansdowne to Shellharbour to northern Kiama). In both the Cumberland Plain and Illawarra environments this species is found on well-structured clay soils. On the inland Cumberland Plain sites it is associated with grey box and Ironbark. In the coastal Illawarra it occurs commonly in Coast Banksia open woodland with a better developed shrub and grass understorey.	Moderate

Scientific name (Data source)	Common name	BC Act	EPBC Act	Class of credit	Habitat	Likelihood of occurrence
Pomaderris brunnea	Brown Pomaderris	V	V	Species	The species is expected to live for 10 - 20 years, while the minimum time to produce seed is estimated to be 4 - 6 years. Found in a very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area. It also occurs at Walcha on the New England Tableland and in far eastern Gippsland in Victoria.	Low
Pomaderris cotoneaster	Cotoneaster Pomaderris	E	E	Species	In dry sclerophyll forest, often on skeletal soil.	Low
Pterostylis saxicola	Sydney Plains Greenhood	E	E	Species	Restricted to western Sydney between Freemans Reach in the north and Picton in the south. Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where Pterostylis saxicola occurs are sclerophyll forest or woodland on shale-sandstone transition soils or shale soils.	None
Pultenaea pedunculata	Matted Bush-pea	E	-	Species	Pultenaea pedunculata occurs in a range of habitats. NSW populations are generally among woodland vegetation but plants have also been found on road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies in populations in the Windellama area.	Low
Pultenaea aristata	Prickly Bush-pea	V	V	Species	Grows in moist, dry sclerophyll woodland to heath on sandstone, specifically the drier areas of Upland Swamps. Restricted to the Woronora Plateau, a small area between Helensburgh, south of Sydney, and Mt Keira above Wollongong.	None
Rhizanthella slateri	Eastern Australian Underground Orchid	V	E	Species	Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest. Highly cryptic given that it grows almost completely below the soil surface, with flowers being the only part of the plant that can occur above ground. Therefore usually located only when the soil is disturbed. In NSW, currently known from fewer than 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra.	Low

Scientific name (Data source)	Common name	BC Act	EPBC Act	Class of credit	Habitat	Likelihood of occurrence
Rhodamnia rubescens	Scrub Turpentine	CE	-	Species	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 above sea level 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.	None
Syzygium paniculatum	Magenta Lilly Pilly	E	V	Species	Found only in NSW, in a narrow, linear coastal strip from Bulahdelah to Conjola State forest. On the south coast the species occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral rainforest. On the central coast it occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities	None
Thelymitra kangaloonica	Kangaloon Sun-orchid	CE	CE	Species	Recorded from shallow black peaty soil in coastal heath on sandstone. *Thelymitra sp. Kangaloon* is a terrestrial orchid endemic to New South Wales, and is known from three locations near Robertson in the Southern Highlands.	None
Thesium australe	Austral Toadflax	V	V	Species	Grows in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. Occurs in grassland or grassy woodland. Grows on kangaroo grass tussocks but has also been recorded within the exotic coolatai grass.	Low
Wahlenbergia multicaulis - endangered population	Tadgell's Bluebell - Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield LGA's	EP	-	Species	Found in disturbed sites and grows in a variety of habitats including forest, woodland, scrub, grassland and the edges of watercourses and wetlands. Typically occurs in damp, disturbed sites (with natural or human disturbance of various forms), typically amongst other herbs rather than in the open.	None

Annex 4. Plant community descriptions

PCT 835: Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion

Extent:

This PCT is restricted to a small area (0.44 ha) in association with Foot Onslow Creek in the north of the subject land.

Condition and presence of weeds:

The area of PCT 835 in the subject land is in a low condition. It is heavily disturbed, with diminished structural integrity. A native canopy and mid-storey is generally absent, with the exotic Peppercorn Tree (*Schinus molle*) dominating the overstorey. The groundcover is comprised of a mixture of native and exotic species. Typical native species consist of *Austrostipa sp.*, Couch (*Cynodon dactylon*) and Native Raspberry (*Rubus parvifolius*), while exotic species such as Paddy's Lucerne (*Sida rhombifolia*), Umbrella Sedge (*Cyperus Eragrostis*), Panic Veldt Grass (*Ehrharta erecta*) and Paspalum (*Paspalum dilatatum*) are common.

Conservation status:

PCT 835 in the subject land does not conform to the definition or condition thresholds provided by DPIE (2021d) or DAWE (2021b) necessary for it to align to the RFEF TEC listed under the BC Act or EPBC Act (refer to section 2.2.6).

Characteristic species used for identification of PCT:

Given the degraded nature and poor quality of the vegetation floristic composition did not assist in aligning the vegetation to this PCT.

Justification of evidence used to identify the PCT:

PCT 835 as described within the BioNet VIS (DPIE 2021d) is highly consistent with the geographic location and habitat of this PCT within the subject land. Key matching characteristics include:

- Its position in the landscape being on stream banks
- Existing vegetation mapping (OEH 2013) mapped this PCT as occurring in association with Foot Onslow Creek.

Given the degraded nature and poor quality of the vegetation, floristic composition did not assist in aligning the vegetation to this PCT.

Photograph:



Plate 1. PCT 835_low

PCT 849: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion

Extent:

A total of 18.37 ha of this community occurs in the subject land. The subject land would have originally been dominated by this PCT with all vegetation strata layers present. As a result of historical clearing and past and current land use practices, this PCT now occurs as three vegetation zones: grassland (18.21 ha), shrubland (0.1 ha) and woodland (0.06).

Condition and presence of weeds:

PCT 849 grassland in the subject land is in a low condition. It is heavily disturbed and contains only a ground layer with a mixture of native and exotic species. *Austrostipa spp.* is the dominant native species in this vegetation zone, however, Kangaroo Grass (*Themeda triandra*) occurs in dense patches in the central and north of the subject land. Other semi-common natives include Star Cudweed (*Euchiton sphaericus*) and Slender Tick-trefoil (*Desmodium varians*). *Setaria sp.*, *Briza subaristata*, Saffron Thistle (*Carthamus lanatus*), Fireweed (*Senecio madagascariensis*), Paddy's Lucerne (*Sida rhombifolia*) and Paspalum (*Paspalum dilatatum*) are common exotic species. The exotic shrub African Boxthorn (*Lycium ferocissimum*) occurs in patches throughout this vegetation zone.

PCT 849 shrubland is in a low to moderate condition and consists of a shrub layer dominated by Blackthorn (*Buraria spinosa*) and groundcover comprised of a mixture of native and exotic grasses. Typical native species consist of *Austrostipa sp.*, Slender Tick-trefoil, Variable Glycine (*Glycine tabacina*) and Weeping Grass (*Microlaena stipoides*) while exotic species such as Fireweed, *Setaria sp.*, *Briza subaristata* are common.

PCT 849 woodland is in a low condition in the subject land and consists of an isolated Forest Red Gum tree. African Boxthorn is present around its base, while the groundcover is comprised of a similar mixture of native and exotic grasses found in the other two zones.

Conservation status:

PCT 849 aligns with CPW, a TEC listed as Critically Endangered under the BC Act.

PCT 849 in the subject land does not conform to the definition or condition thresholds provided by DAWE (2021b) necessary for it to align to the *Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest* TEC listed as Critically Endangered under the EPBC Act (refer to section 2.2.6).

Characteristic species used for identification of PCT:

The key diagnostic species used to identify this PCT in the subject land was Forest Red Gum and Blackthorn. Associated groundcover species listed in the BioNet VIS (DPIE 2021d) also present within this vegetation zone in the subject land included: Weeping Grass, Kangaroo Grass and Star Cudweed.

Justification of evidence used to identify the PCT:

The description of PCT 849, as provided in the BioNet VIS (DPIE 2021d), is highly consistent with the geographic location, habitat and floristics of this PCT as identified in the subject land. Key matching characteristics include:

- Its geological and geographical occurrence on clay/loam soils derived from Wianamatta Shales on the Cumberland Plain at low altitudes (mainly below 150m).
- Its species composition which matches that described in the BioNet VIS (DPIE 2021d), namely the presence of key dominant diagnostic species Blackthorn along with associated groundcover species as listed above.

Photographs:



Plate 2. PCT 849 grassland



Plate 3. PCT 849 shrubland



Plate 4. PCT 849 woodland

Note: Plate 4 is of the woodland patch where the surrogate BAM plot was conducted to obtain BAM plot values for the small area PCT 849 woodland present within the subject land. It occurs beyond the limits of the subject land and would not be impacted. This area has a more developed structure than that within the subject land.

Exotic vegetation

Extent:

This vegetation type is restricted to a small area (0.33 ha) and occurs in the road reserve of Menangle Road and adjacent to the largest of the dams in the centre of the subject land.

Condition and presence of weeds:

The exotic vegetation is dominated by weeds. African Olive is the predominant species present, while Large-leaved Privet (*Ligustrum lucidum*) and Peppercorn Tree also occur. The groundcover is comprised of exotic species such as Rhodes Grass.

Conservation status:

Given the dominance of exotic species an all structural layers, or the absence of structural layers, the exotic vegetation present in the subject land does not align to any PCT in the BioNet VIS (DPIE 2021d). Therefore, it does not conform to any TEC listed under the BC Act or EPBC Act.

Characteristic species used for identification of PCT:

Given the dominance of exotic species an all structural layers, or the absence of structural layers, the exotic vegetation present in the subject land does not align to any PCT in the BioNet VIS (DPIE 2021d).

Justification of evidence used to identify the PCT:

Given the dominance of exotic species an all structural layers, or the absence of structural layers, the exotic vegetation present in the subject land does not align to any PCT in the BioNet VIS (DPIE 2021d).

Photographs:



Plate 5. Exotic vegetation

Vegetation pictured is that in the road reserve of Menangle Road.

Annex 5. Floristic plot data

Family	Species	Common Name	Plot 1 Cover	Plot 1 Abundance	Plot 2 Cover	Plot 2 Abundance	Plot 3 Cover	Plot 3 Abundance	Plot 4 Cover	Plot 4 Abundance
Anacardiaceae	Schinus molle*						25			
Apiaceae	Daucus carota*	Wild Carrot			0.1	3	0.1	3	0.1	1
Apocynaceae	Gomphocarpus fruticosus*	Narrow-leaved Cotton Bush	0.1	1						
Asteraceae	Calotis lappulacea	Yellow Burr-daisy								
Asteraceae	Carthamus lanatus*	Saffron Thistle	5		0.2	10	0.1	1	1	30
Asteraceae	Cirsium vulgare*	Spear Thistle	0.1	1			0.5	10	0.5	10
Asteraceae	Conyza bonariensis*	Flaxleaf Fleabane	0.2	2	0.1	2	0.2	10		
Asteraceae	Conyza parva*	Fleabane	0.5	5						
Asteraceae	Euchiton sphaericus	Star Cudweed	0.1	5	0.3	30				
Asteraceae	Gamochaeta calviceps*	Cudweed			0.1	1				
Asteraceae	Gnaphalium purpureum*									
Asteraceae	Hypochaeris radicata*	Catsear	0.1	2	0.5	20	0.1	3		
Asteraceae	Lactuca serriola*	Prickly Lettuce							0.1	1
Asteraceae	Senecio madagascariensis*	Fireweed	2	30	1	50	0.1	5	0.3	20
Asteraceae	Vittadinia cuneata	A Fuzzweed							0.1	1
Brassicaceae	Lepidium bonariense*	Argentine Peppercress					0.1	2	0.1	2
Campanulaceae	Wahlenbergia spp.	Bluebell							0.1	1
Caryophyllaceae	Paronychia brasiliana*	Chilean Whitlow Wort								
Chenopodiaceae	Einadia hastata	Berry Saltbush					0.1	3	0.1	3
Chenopodiaceae	Einadia nutans	Climbing Saltbush					0.1	3	0.1	1
Clusiaceae	Hypericum perforatum*	St. Johns Wort								
Convolvulaceae	Convolvulus erubescens	Pink Bindweed					0.1	1		

Family	Species	Common Name	Plot 1 Cover	Plot 1 Abundance	Plot 2 Cover	Plot 2 Abundance	Plot 3 Cover	Plot 3 Abundance	Plot 4 Cover	Plot 4 Abundance
Cyperaceae	Cyperus brevifolius*									
Cyperaceae	Cyperus eragrostis*	Umbrella Sedge					1	50		
Cyperaceae	Cyperus spp.									
Fabaceae (Faboideae)	Desmodium varians	Slender Tick-trefoil	0.1	5					0.1	30
Fabaceae (Faboideae)	Glycine tabacina	Variable Glycine								
Fabaceae (Faboideae)	Lotus subbiflorus*	Hairy Birds-foot Trefoil	0.1	5						
Fabaceae (Faboideae)	Trifolium glomeratum*	Clustered Clover								
Gentianaceae	Centaurium erythraea*	Common Centaury	0.1	10	0.1	10	0.1	3	0.1	3
Geraniaceae	Erodium crinitum	Blue Crowfoot								
Geraniaceae	Geranium sp. 2						0.1	1		
Linaceae	Linum trigynum*	French Flax	0.1	3						
Lythraceae	Lythrum hyssopifolia	Hyssop Loosestrife					0.2	5		
Malvaceae	Modiola caroliniana*	Red-flowered Mallow					0.1	2	0.1	2
Malvaceae	Sida rhombifolia*	Paddy's Lucerne	3	50			2	100	2	50
Myrsinaceae	Anagallis arvensis*	Scarlet Pimpernel	0.1	1	0.1	1	0.1	1	0.1	3
Myrtaceae	Eucalyptus crebra	Narrow-leaved Ironbark								
Oleaceae	Olea europaea subsp. cuspidata*	African Olive								
Oxalidaceae	Oxalis spp.		0.1	5			0.1	3	0.1	5
Pittosporaceae	Bursaria spinosa	Native Blackthorn	0.1	1						
Plantaginaceae	Plantago lanceolata*	Lamb's Tongues	0.5	30	0.2	10	0.3	30	1	50
Poaceae	Austrostipa spp.	A Speargrass	60		5		5		50	
Poaceae	Axonopus fissifolius*	Narrow-leafed Carpet Grass								

Family	Species	Common Name	Plot 1 Cover	Plot 1 Abundance	Plot 2 Cover	Plot 2 Abundance	Plot 3 Cover	Plot 3 Abundance	Plot 4 Cover	Plot 4 Abundance
Poaceae	Bothriochloa macra	Red Grass			0.1	1	0.1	1		
Poaceae	Briza subaristata*		5		0.3	20	0.1	5		
Poaceae	Chloris gayana*	Rhodes Grass								
Poaceae	Chloris ventricosa	Tall Chloris								
Poaceae	Cynodon dactylon	Common Couch			0.3	30	5			
Poaceae	Ehrharta erecta*	Panic Veldtgrass					1	50		
Poaceae	Elymus scaber	Common Wheatgrass			0.1	3	0.1	1		
Poaceae	Eragrostis leptostachya	Paddock Lovegrass								
Poaceae	Microlaena stipoides	Weeping Grass					0.1	5		
Poaceae	Paspalidium distans								0.1	1
Poaceae	Paspalum dilatatum*	Paspalum	2	50	0.2	10	1	50	0.5	30
Poaceae	Rytidosperma spp.									
Poaceae	Setaria spp.*		10		0.2	20	0.2	20	0.3	20
Poaceae	Sporobolus creber	Slender Rat's Tail Grass								
Poaceae	Stenotaphrum secundatum*	Buffalo Grass					0.1	1		
Poaceae	Themeda triandra		0.2	5	50					
Polygalaceae	Polygala virgata*									
Polygonaceae	Rumex brownii	Swamp Dock								
Polygonaceae	Rumex spp.*	Dock					0.3	10		
Rosaceae	Rosa canina*	Dog Rose	0.2	2			0.1	1	0.1	2
Rosaceae	Rubus parvifolius	Native Raspberry					0.5	20		
Scrophulariaceae	Misopates orontium*	Lesser Snapdragon								
Solanaceae	Lycium ferocissimum*	African Boxthorn					0.2	1		

Family	Species	Common Name	Plot 1 Cover	Plot 1 Abundance	Plot 2 Cover	Plot 2 Abundance	Plot 3 Cover	Plot 3 Abundance	Plot 4 Cover	Plot 4 Abundance
Solanaceae	Solanum sisymbriifolium*				0.1	1				
Solanaceae	Solanum spp.*		0.1	2					0.2	3
Typhaceae	Typha orientalis	Broad-leaved Cumbungi					0.3	5		
Verbenaceae	Lantana camara*	Lantana								
Verbenaceae	Verbena bonariensis*	Purpletop	0.3	10	0.1	3	0.5	30	0.3	20
Verbenaceae	Verbena spp.*									

Family	Species	Common Name	Plot 5 Cover	Plot 5 Abundance	Plot 6 Cover	Plot 6 Abundance	Plot 7 Cover	Plot 7 Abundance
Anacardiaceae	Schinus molle*							
Apiaceae	Daucus carota*	Wild Carrot	0.1	2	0.2	5	0.1	5
Apocynaceae	Gomphocarpus fruticosus*	Narrow-leaved Cotton Bush						
Asteraceae	Calotis lappulacea	Yellow Burr-daisy	0.1	1				
Asteraceae	Carthamus lanatus*	Saffron Thistle	0.1	2	5			
Asteraceae	Cirsium vulgare*	Spear Thistle					0.1	1
Asteraceae	Conyza bonariensis*	Flaxleaf Fleabane	0.3	30	0.2	10	0.1	3
Asteraceae	Conyza parva*	Fleabane						
Asteraceae	Euchiton sphaericus	Star Cudweed					0.1	2
Asteraceae	Gamochaeta calviceps*	Cudweed					0.1	1
Asteraceae	Gnaphalium purpureum*							
Asteraceae	Hypochaeris radicata*	Catsear					0.5	30
Asteraceae	Lactuca serriola*	Prickly Lettuce					0.1	2

Family	Species	Common Name	Plot 5 Cover	Plot 5 Abundance	Plot 6 Cover	Plot 6 Abundance	Plot 7 Cover	Plot 7 Abundance
Asteraceae	Senecio madagascariensis*	Fireweed	0.1	20	10		10	
Asteraceae	Vittadinia cuneata	A Fuzzweed	0.1	1				
Brassicaceae	Lepidium bonariense*	Argentine Peppercress	0.3	30				
Campanulaceae	Wahlenbergia spp.	Bluebell					0.1	1
Caryophyllaceae	Paronychia brasiliana*	Chilean Whitlow Wort, Brazilian Whitlow	0.1	2				
Chenopodiaceae	Einadia hastata	Berry Saltbush	0.5	50				
Chenopodiaceae	Einadia nutans	Climbing Saltbush	0.1	10				
Clusiaceae	Hypericum perforatum*	St. Johns Wort					0.2	5
Convolvulaceae	Convolvulus erubescens	Pink Bindweed					0.1	1
Cyperaceae	Cyperus brevifolius*		0.2	20				
Cyperaceae	Cyperus eragrostis*	Umbrella Sedge						
Cyperaceae	Cyperus spp.						0.1	3
Fabaceae (Faboideae)	Desmodium varians	Slender Tick-trefoil					1	50
Fabaceae (Faboideae)	Glycine tabacina	Variable Glycine	0.1	10			0.5	30
Fabaceae (Faboideae)	Lotus subbiflorus*	Hairy Birds-foot Trefoil					0.1	2
Fabaceae (Faboideae)	Trifolium glomeratum*	Clustered Clover					0.1	1
Gentianaceae	Centaurium erythraea*	Common Centaury			0.1	2	0.1	10
Geraniaceae	Erodium crinitum	Blue Crowfoot			0.1	1		
Geraniaceae	Geranium sp. 2							
Linaceae	Linum trigynum*	French Flax						
Lythraceae	Lythrum hyssopifolia	Hyssop Loosestrife						
Malvaceae	Modiola caroliniana*	Red-flowered Mallow	0.1	3	0.1	3		

Family	Species	Common Name	Plot 5 Cover	Plot 5 Abundance	Plot 6 Cover	Plot 6 Abundance	Plot 7 Cover	Plot 7 Abundance
Malvaceae	Sida rhombifolia*	Paddy's Lucerne	5		3	80	0.5	50
Myrsinaceae	Anagallis arvensis*	Scarlet Pimpernel					0.1	1
Myrtaceae	Eucalyptus crebra	Narrow-leaved Ironbark	10					
Oleaceae	Olea europaea subsp. cuspidata*	African Olive	0.1	1				
Oxalidaceae	Oxalis spp.		0.1	3	0.1	2	0.1	10
Pittosporaceae	Bursaria spinosa	Native Blackthorn					10	
Plantaginaceae	Plantago lanceolata*	Lamb's Tongues	0.1	3	0.1	1	0.3	30
Poaceae	Austrostipa spp.	A Speargrass	5.1	2	0.5	30	5	
Poaceae	Axonopus fissifolius*	Narrow-leafed Carpet Grass					0.1	2
Poaceae	Bothriochloa macra	Red Grass	2	100	1	50	0.1	3
Poaceae	Briza subaristata*						5	
Poaceae	Chloris gayana*	Rhodes Grass			0.1	1		
Poaceae	Chloris ventricosa	Tall Chloris	0.1	10	0.2	10		
Poaceae	Cynodon dactylon	Common Couch	40		0.1	3	0.1	5
Poaceae	Ehrharta erecta*	Panic Veldtgrass						
Poaceae	Elymus scaber	Common Wheatgrass			0.1	3		
Poaceae	Eragrostis leptostachya	Paddock Lovegrass	0.1	1				
Poaceae	Microlaena stipoides	Weeping Grass	5		0.1	2	0.5	50
Poaceae	Paspalidium distans		0.3	50	0.1	3		
Poaceae	Paspalum dilatatum*	Paspalum			3	100	1	30
Poaceae	Rytidosperma spp.		0.1	1				
Poaceae	Setaria spp.*		0.1	5	50		10	

Family	Species	Common Name	Plot 5 Cover	Plot 5 Abundance	Plot 6 Cover	Plot 6 Abundance	Plot 7 Cover	Plot 7 Abundance
Poaceae	Sporobolus creber	Slender Rat's Tail Grass	0.2	20	1	50		
Poaceae	Stenotaphrum secundatum*	Buffalo Grass						
Poaceae	Themeda triandra				0.1	1	0.1	2
Polygalaceae	Polygala virgata*						0.1	3
Polygonaceae	Rumex brownii	Swamp Dock			0.1	1		
Polygonaceae	Rumex spp.*	Dock						
Rosaceae	Rosa canina*	Dog Rose						
Rosaceae	Rubus parvifolius	Native Raspberry						
Scrophulariaceae	Misopates orontium*	Lesser Snapdragon			0.1	1		
Solanaceae	Lycium ferocissimum*	African Boxthorn	15		0.2	1		
Solanaceae	Solanum sisymbriifolium*							
Solanaceae	Solanum spp.*		0.1	2	0.3	5	0.1	2
Typhaceae	Typha orientalis	Broad-leaved Cumbungi						
Verbenaceae	Lantana camara*	Lantana	0.1	1				
Verbenaceae	Verbena bonariensis*	Purpletop	0.2	20	0.1	5		
Verbenaceae	Verbena spp.*						0.1	10

Annex 6. BAM plot transect scores

Plot no.	PCT code	PCT abbreviated name and condition	Zone	Easting	Northing	Bearing
6418sb01	849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain_grassland (low)	56	290453	6219342	46
6418sb02	849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain_grassland (low)	56	290507	6219257	100
6418sb03	835	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain_forest (low)	56	290579	6219410	183
6418sb04	849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain_grassland (low)	56	290465	6219042	30
6418sb05	849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain_grassland (low)	56	290188	6219014	233
6418sb06	849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain_grassland (low)	56	290233	6219078	192
6418sb07	849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain_shrubland (low)	56	290233	6219267	247

Plot no.	PCT code	Species richness						Cover (%)						
		Tree species	Shrub species	Grass species	Forb species	Fern species	Other species	Tree	Shrub	Grass	Forb	Fern	Other	High threat weed
6418sb01	849	0	1	3	2	0	1	0.0	0.1	60.3	0.2	0.0	0.1	14.0
6418sb02	849	0	0	5	1	0	0	0.0	0.0	55.5	0.3	0.0	0.0	1.7
6418sb03	835	0	1	6	5	0	1	0.0	0.5	10.6	0.6	0.0	0.1	3.6
6418sb04	849	0	0	4	5	0	1	0.0	0.0	55.2	0.5	0.0	0.1	1.8
6418sb05	849	1	0	10	5	0	1	10.0	0.0	52.9	0.9	0.0	0.1	15.4
6418sb06	849	0	0	9	3	0	0	0.0	0.0	3.2	0.5	0.0	0.0	18.3
6418sb07	849	0	1	6	3	0	3	0.0	10.0	5.9	0.3	0.0	1.6	16.4

Plot no.	Tree regeneration	Large trees (count)	Trees with hollows (count)	Litter cover (%)	Fallen logs (m)	Tree composition				
						Stems 5 to 10 cm	Stems 10 to 20cm	Stems 20 to 30 cm	Stems 30 to 50 cm	Stems 50 to 80 cm
6418sb01	Absent	0	0	7.0	0	Absent	Absent	Absent	Absent	Absent
6418sb02	Absent	0	0	5.0	0	Absent	Absent	Absent	Absent	Absent
6418sb03	Absent	0	0	3.0	0	Present	Absent	Absent	Absent	Absent
6418sb04	Absent	0	0	5.0	0	Absent	Absent	Absent	Absent	Absent
6418sb05	Absent	1	0	1.2	0	Absent	Absent	Absent	Present	Present
6418sb06	Absent	0	0	0.0	0	Absent	Absent	Absent	Absent	Absent
6418sb07	Present	0	0	0.8	0	Present	Absent	Absent	Absent	Absent

Note: field data was collected in electronic format, therefore raw data sheets have not been provided.

Annex 7. Fauna species list

Scientific name	Common name	Observation type
Birds		
Acridotheres tristis *	Common Myna	O
Cacatua sp.	Corella	O
Chenonetta jubata	Australian Wood duck	O
Coracina novaehollandiae	Black-faced Cuckoo-shrike	W
Corvus coronoides	Australian Raven	W
Cracticus tibicen	Australian Magpie	O
Egretta novaehollandiae	White-faced Heron	O
Elanus axillaris	Black-shouldered kite	O
Malurus cyaneus	Superb Fairy-wren	W
Manorina melanocephala	Noisy Miner	W
Platycercus eximius	Eastern Rosella	O
*Pycnonotus jocosus**	Red-whiskered Bulbul	W
Rhipidura leucophrys	Willie Wagtail	W
Taeniopygia bichenovii	Double-barred Finch	O
Mammals		
Macropus giganteus	Eastern Grey Kangaroo	O
*Rattus *	Black Rat	O
Amphibians		
Litoria dentata	Bleating Tree Frog	W
Invertebrate		
*Cornu aspersum**	Garden snail	O

Key: W – heard; O – observed.

Note: field data was collected in electronic format, therefore raw data sheets have not been provided.

Annex 8. Hollow-bearing tree register

Tree number	Scientific name	Common name	No. of hollows	Hollow size class (cm)	Height above ground (m)
1	*Eucalyptus moluccana*	Grey Box	2	5-10,10-15	4

Note: field data was collected in electronic format, therefore raw data sheets have not been provided.

Annex 9. Consideration of serious and irreversible impacts

Additional impact assessment provisions	Cumberland Plain Woodland
1. *the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII*	Refer to section 3.1.1 of the BDAR. The Project has been designed to avoid the better quality stands of treed CPW that are present in the south (this stand also contains a hollow-bearing tree), south-east and north-east of the property. Those areas of the property that are to be impacted are of poor quality. The Project also involves revegetation along the fence line and on top the bunds. This will increase floristic and structural diversity of the CPW CEEC in these areas.
2. *report on the current status of the TEC including:* a. *evidence of reduction in geographic distribution as the current total geographic extent of the TEC in NSW AND the estimated reduction in geographic extent of the TEC since 1970 (not including impacts of the proposal)* b. *extent of reduction in ecological function for the TEC using evidence that describes the degree of environmental degradation or disruption to biotic processes indicated by:* *i. change in community structure* *ii. change in species composition* *iii. disruption of ecological processes* *iv. invasion and establishment of exotic species* *v. degradation of habitat, and* *vi. fragmentation of habitat*	The pre-European area of occupancy of CPW was 71,200 ha[9] while the current extent is estimated at 11,200 ha (DPIE 2021d). This is a reduction of around 84%. However, the 'PCT percent cleared estimate' tab of the PCT 849 profile in the Bionet Vegetation Classification database is 93% (DPIE 2021d). Tozer (2003) and Benson & Howell (1990b) (in DPIE 2021e) estimate the total extent of CPW to be 8.8% and 6%, respectively, of the pre-European distribution of the community. Almost all remaining CPW CEEC across its distribution is regrowth forest and woodland from past clearing activities (Benson & Howell 1990a in DPIE 2021e). The CPW in the subject land is highly degraded and has been subject to past clearing resulting in diminished to no structural integrity of the CPW present and habitat loss, and cattle grazing resulting in soil degradation. These past activities and land uses are not unique to the subject land and have occurred, and continue to do so, across the entire Cumberland Plain. These activities have resulted in a highly degraded, weed infested, low quality fragmented landscape, of which intact CPW stands are uncommon, and better quality ones are rare. The area of CPW to be impacted has little to no structural integrity, is impacted by weeds, has low floristic diversity and its ecological processes have been substantially disrupted such that the community's functioning is dramatically reduced.

[9] This is a combination of PCT 849 and PCT 850 that both constitute the CPW TEC.

Additional impact assessment provisions	Cumberland Plain Woodland
c. *evidence of restricted geographic distribution, based on the TEC's geographic range in NSW according to the:* *i. extent of occurrence* *ii. area of occupancy, and* *iii. number of threat-defined locations*	PCT 849 is largely confined to the Cumberland IBRA subregion, but also occurs in margins of the Burragorang, Sydney Cataract and Yengo IBRA subregions (DPIE 2021d), while CPW was estimated to occur within an extent of occurrence of 2,810 km^2, and an area of occupancy of just under 2,100 km^2. While no specific data is provided in regard to threat defined locations, given the restricted area of occupancy and surrounding threats, it could be argued all areas of CPW are under threat.
d. *evidence that the TEC is unlikely to respond to management.*	The TBDC does not provide any data regarding this item.
3. *the impact on the geographic extent of the TEC by estimating the total area of the TEC to be impacted by the proposal:* a. *in hectares, and* b. *as a percentage of the current geographic extent of the TEC in NSW.*	The Project is expected to impact 18.78 ha of CPW. This is approximately 0.2% of the remaining CPW in NSW.
4. *the extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes of the TEC by:* a. *estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500 m of the development footprint or equivalent area for other types of proposals*	With reference to the vegetation mapping undertaken for the locality (OEH 2013), no areas of CPW have been mapped within 500 m of the subject land. However, based on the field surveys undertaken by Niche (2020a, 2020b) small isolated stands of CPW have been mapped as occurring within the south and east of 345 Menangle Road. These areas total approximately 1.77 ha. Diminished CPW in the form of grassland and exotic pasture grasslands dominate the 500 m buffer area. No good quality, intact CPW remnants are present within the 500 m buffer.
b. *describing the impacts on connectivity and fragmentation of the remaining areas of TEC measured by:* *i. distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed, and* *ii. estimated maximum dispersal distance for native flora species characteristic of the TEC, and*	If the grassland form of CPW is not impacted, a contiguous link is provided throughout the locality. Subsequent to the Project, grassland areas may be fragmented by a distance of up to 500 m. However, grassland areas will remain adjacent to those fragmented patches permitting the movement of pollinator vectors and enabling other dispersal mechanisms.

<table>
<tr><th>Additional impact assessment provisions</th><th>Cumberland Plain Woodland</th></tr>
<tr><td>iii. other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development

c. describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone(s). The assessor must also include the relevant composition, structure and function condition scores for each vegetation zone.</td><td>The grassland zone has a VI of 5.9 which, in accordance with the BAM (DPIE 2020a), does not need to be offset. The shrubland and woodland have a VI of 16.5 and 26.3, respectively, and must be offset in accordance with the BAM (DPIE 2020a) (see section 4.1 of the BDAR).

The floristic composition, structure and function data obtained during the field assessment is provided in Annex 6, while the composition structure and function condition scores are provided below:

<table>
<tr><th>PCT/zone</th><th>Current VI score</th><th>composition</th><th>structure</th><th>function</th></tr>
<tr><td>849 grassland</td><td>5.9</td><td>14.5</td><td>36.9</td><td>0.4</td></tr>
<tr><td>849 shrubland</td><td>16.5</td><td>26.4</td><td>9.9</td><td>17.2</td></tr>
<tr><td>849 woodland</td><td>26.3</td><td>35.3</td><td>43.4</td><td>11.9</td></tr>
</table>
</td></tr>
<tr><td>5. Provision of new information that demonstrates that the principle identifying that the TEC is at risk of an SAII is not accurate.</td><td>N/A</td></tr>
</table>

Annex 10. Ecosystem and species credits required (BAM-C Credit report)

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00023280/BAAS18054/20/00023281	Appin Mine Ventilation and Access Project	10/06/2021
Assessor Name	Report Created	BAM Data version *
Stephen M Bloomfield	28/06/2021	45
Assessor Number	BAM Case Status	Date Finalised
BAAS18054	Finalised	28/06/2021
Assessment Revision	Assessment Type	BOS entry trigger
0	Part 4 Developments (General)	BOS Threshold: Biodiversity Values Map

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

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

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	BC Act Listing status	EPBC Act listing status	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits

Cumberland riverflat forest											
2	835_forest_low	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	6.5	6.5	0.44	Endangered Ecological Community	Not Listed	High Sensitivity to Potential Gain	2.00		0
										Subtotal	**0**
Cumberland shale plains woodland											
1	849_grassland_low	Cumberland Plain Woodland in the Sydney Basin Bioregion	5.9	5.9	18.2	Critically Endangered Ecological Community	Critically Endangered	High Sensitivity to Potential Gain	2.50	TRUE	0
3	849_shrubland_low	Cumberland Plain Woodland in the Sydney Basin Bioregion	16.5	16.5	0.1	Critically Endangered Ecological Community	Critically Endangered	High Sensitivity to Potential Gain	2.50	TRUE	1
4	849_Woodland_moderate	Cumberland Plain Woodland in the Sydney Basin Bioregion	26.3	26.3	0.03	Critically Endangered Ecological Community	Critically Endangered	High Sensitivity to Potential Gain	2.50	TRUE	1
										Subtotal	**2**
										Total	**2**

Species credits for threatened species

BAM Credit Summary Report

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Species credits

BAM Candidate Species Report

Proposal Details

Assessment Id 00023280/BAAS18054/20/00023281	Proposal Name Appin Mine Ventilation and Access Project	BAM data last updated * 10/06/2021
Assessor Name Stephen M Bloomfield	Report Created 28/06/2021	BAM Data version * 45
Assessor Number BAAS18054	Assessment Type Part 4 Developments (General)	BAM Case Status Finalised
Assessment Revision 0	Date Finalised 28/06/2021	BOS entry trigger BOS Threshold: Biodiversity Values Map

* 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.

List of Species Requiring Survey

Name	Presence	Survey Months
Acacia pubescens Downy Wattle	No (surveyed)	☑ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Pimelea spicata Spiked Rice-flower	No (surveyed)	☑ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Threatened species assessed as not on site

Refer to BAR for detailed justification

Common name	Scientific name	Justification in the BAM-C
Austral Pillwort	Pilularia novae-hollandiae	Refer to BAR
Austral Toadflax	Thesium australe	Refer to BAR

Bargo Geebung	Persoonia bargoensis	Refer to BAR
Brown Pomaderris	Pomaderris brunnea	Refer to BAR
Bynoe's Wattle	Acacia bynoeana	Refer to BAR
Camden White Gum	Eucalyptus benthamii	Refer to BAR
Cumberland Plain Land Snail	Meridolum corneovirens	Refer to BAR
Dillwynia tenuifolia	Dillwynia tenuifolia	Refer to BAR
Dillwynia tenuifolia, Kemps Creek	Dillwynia tenuifolia - endangered population	Refer to BAR
Dural Land Snail	Pommerhelix duralensis	Refer to BAR
Eastern Osprey	Pandion cristatus	Refer to BAR
Green and Golden Bell Frog	Litoria aurea	Habitat degraded
Grey-headed Flying-fox	Pteropus poliocephalus	Refer to BAR
Hairy Geebung	Persoonia hirsuta	Refer to BAR
Hibbertia sp. Bankstown	Hibbertia sp. Bankstown	Refer to BAR
Juniper-leaved Grevillea	Grevillea juniperina subsp. juniperina	Refer to BAR
Koala	Phascolarctos cinereus	Refer to BAR
Large Bent-winged Bat	Miniopterus orianae oceanensis	Habitat constraints
Little Bent-winged Bat	Miniopterus australis	Habitat constraints
Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	Marsdenia viridiflora subsp. viridiflora - endangered population	Refer to BAR
Matted Bush-pea	Pultenaea pedunculata	Refer to BAR
Netted Bottle Brush	Callistemon linearifolius	Refer to BAR
Pimelea curviflora var. curviflora	Pimelea curviflora var. curviflora	Refer to BAR
Regent Honeyeater	Anthochaera phrygia	Habitat constraints
Southern Myotis	Myotis macropus	Refer to BAR
Squirrel Glider	Petaurus norfolcensis	Refer to BAR

Swift Parrot	Lathamus discolor	Refer to BAR
Sydney Plains Greenhood	Pterostylis saxicola	Refer to BAR
Tadgell's Bluebell in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield	Wahlenbergia multicaulis - endangered population	Geographic limitations
Tall Knotweed	Persicaria elatior	Refer to BAR
Thick Lip Spider Orchid	Caladenia tessellata	Refer to BAR
White-bellied Sea-Eagle	Haliaeetus leucogaster	Habitat constraints
White-flowered Wax Plant	Cynanchum elegans	Refer to BAR

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00023280/BAAS18054/20/00023281	Appin Mine Ventilation and Access Project	10/06/2021
Assessor Name	**Report Created**	**BAM Data version ***
Stephen M Bloomfield	28/06/2021	45
Assessor Number	**Assessment Type**	**BAM Case Status**
BAAS18054	Part 4 Developments (General)	Finalised
Assessment Revision	**BOS entry trigger**	**Date Finalised**
0	BOS Threshold: Biodiversity Values Map	28/06/2021

* 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.

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name	Vegetation Types(s)
Australasian Bittern	Botaurus poiciloptilus	835-Cumberland riverflat forest
Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae	849-Cumberland shale plains woodland
		835-Cumberland riverflat forest
Diamond Firetail	Stagonopleura guttata	849-Cumberland shale plains woodland
		835-Cumberland riverflat forest
Dusky Woodswallow	Artamus cyanopterus cyanopterus	849-Cumberland shale plains woodland
		835-Cumberland riverflat forest
Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	849-Cumberland shale plains woodland
		835-Cumberland riverflat forest
Eastern Osprey	Pandion cristatus	835-Cumberland riverflat forest
Flame Robin	Petroica phoenicea	849-Cumberland shale plains woodland
		835-Cumberland riverflat forest
Grey-headed Flying-fox	Pteropus poliocephalus	849-Cumberland shale plains woodland
		835-Cumberland riverflat forest
Hooded Robin (south-eastern form)	Melanodryas cucullata cucullata	849-Cumberland shale plains woodland

Hooded Robin (south-eastern form)	Melanodryas cucullata cucullata	835-Cumberland riverflat forest
Koala	Phascolarctos cinereus	849-Cumberland shale plains woodland
		835-Cumberland riverflat forest
Large Bent-winged Bat	Miniopterus orianae oceanensis	849-Cumberland shale plains woodland
		835-Cumberland riverflat forest
Little Bent-winged Bat	Miniopterus australis	849-Cumberland shale plains woodland
		835-Cumberland riverflat forest
Little Lorikeet	Glossopsitta pusilla	849-Cumberland shale plains woodland
		835-Cumberland riverflat forest
Regent Honeyeater	Anthochaera phrygia	849-Cumberland shale plains woodland
		835-Cumberland riverflat forest
Scarlet Robin	Petroica boodang	849-Cumberland shale plains woodland
		835-Cumberland riverflat forest
Speckled Warbler	Chthonicola sagittata	849-Cumberland shale plains woodland
		835-Cumberland riverflat forest
Spotted-tailed Quoll	Dasyurus maculatus	849-Cumberland shale plains woodland
		835-Cumberland riverflat forest
Swift Parrot	Lathamus discolor	849-Cumberland shale plains woodland
		835-Cumberland riverflat forest
White-bellied Sea-Eagle	Haliaeetus leucogaster	849-Cumberland shale plains woodland
		835-Cumberland riverflat forest
White-throated Needletail	Hirundapus caudacutus	849-Cumberland shale plains woodland
		835-Cumberland riverflat forest

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Refer to BAR for detailed justification

Common Name	Scientific Name	Justification in the BAM-C

BAM Vegetation Zones Report

Proposal Details

Assessment Id	Assessment name	BAM data last updated *
00023280/BAAS18054/20/00023281	Appin Mine Ventilation and Access Project	10/06/2021
Assessor Name	**Report Created**	**BAM Data version ***
Stephen M Bloomfield	28/06/2021	45
Assessor Number	**Assessment Type**	**BAM Case Status**
BAAS18054	Part 4 Developments (General)	Finalised
Assessment Revision	**Date Finalised**	**BOS entry trigger**
0	28/06/2021	BOS Threshold: Biodiversity Values Map

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Vegetation Zones

#	Name	PCT	Condition	Area	Minimum number of plots	Management zones
1	849_grassland_low	849-Cumberland shale plains woodland	grassland_low	18.21	3	

2	835_forest_low	835-Cumberland riverflat forest	forest_low	0.44	1	
3	849_shrubland_low	849-Cumberland shale plains woodland	shrubland_low	0.1	1	
4	849_Woodland_moderate	849-Cumberland shale plains woodland	Woodland_moderate	0.03	1	

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00023280/BAAS18054/20/00023281

Proposal Name
Appin Mine Ventilation and Access Project

BAM data last updated *
10/06/2021

Assessor Name
Stephen M Bloomfield

Assessor Number
BAAS18054

BAM Data version *
45

Proponent Names

Report Created
28/06/2021

BAM Case Status
Finalised

Assessment Revision
0

Assessment Type
Part 4 Developments (General)

Date Finalised
28/06/2021

BOS entry trigger
BOS Threshold: Biodiversity Values Map

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Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Cumberland Plain Woodland in the Sydney Basin Bioregion	Critically Endangered Ecological Community	849-Cumberland shale plains woodland

Species
Nil

Additional Information for Approval

BAM Biodiversity Credit Report (Like for like)

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

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
849-Cumberland shale plains woodland	Cumberland Plain Woodland in the Sydney Basin Bioregion	18.3	0	2	2
835-Cumberland riverflat forest	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	0.4	0	0	0

835-Cumberland riverflat forest

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region

	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 686, 828, 835, 941, 1108, 1109, 1212, 1228, 1293, 1318, 1326, 1386, 1504, 1556, 1594, 1618, 1720, 1794	-	835_forest_low	No	0	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

849-Cumberland shale plains woodland	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_grassland_low	No	0	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_shrubland_low	No	1	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_Woodland_moderate	No	1	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

No Species Credit Data

Credit Retirement Options

Like-for-like credit retirement options

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id

00023280/BAAS18054/20/00023281

Proposal Name

Appin Mine Ventilation and Access Project

BAM data last updated *

10/06/2021

Assessor Name

Stephen M Bloomfield

Assessor Number

BAAS18054

BAM Data version *

45

Proponent Name(s)

Report Created

28/06/2021

BAM Case Status

Finalised

Assessment Revision

0

Assessment Type

Part 4 Developments (General)

Date Finalised

28/06/2021

BOS entry trigger

BOS Threshold: Biodiversity Values Map

* 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
Cumberland Plain Woodland in the Sydney Basin Bioregion	Critically Endangered Ecological Community	849-Cumberland shale plains woodland

Species
Nil

Additional Information for Approval

PCTs With Customized Benchmarks

PCT
No Changes

BAM Biodiversity Credit Report (Variations)

Predicted Threatened Species Not On Site

Name
No Changes

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
849-Cumberland shale plains woodland	Cumberland Plain Woodland in the Sydney Basin Bioregion	18.3	0	2	2.00
835-Cumberland riverflat forest	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	0.4	0	0	0.00

835-Cumberland riverflat forest

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 686, 828, 835, 941, 1108, 1109, 1212, 1228, 1293, 1318, 1326, 1386, 1504, 1556, 1594, 1618, 1720, 1794	-	835_forest_low	No	0	Cumberland,Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

835-Cumberland riverflat forest	**Variation options**					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Forested Wetlands	Tier 1	835_forest_low	No	0	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
849-Cumberland shale plains woodland	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_grassland_low	No	0	Cumberland,Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_shrubland_low	No	1	Cumberland,Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_Woodland_moderate	No	1	Cumberland,Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

No Species Credit Data

Credit Retirement Options

Like-for-like options

Biodiversity payment summary report

Assessment Id	Payment data version	Assessment Revision	Report created
00023280/BAAS18054/20/00023281		0	28/06/2021

Assessor Name	Assessor Number	Proposal Name	BAM Case Status
Stephen M Bloomfield	BAAS18054	Appin Mine Ventilation and Access Project	Finalised

Assessment Type	Date Finalised	BOS entry trigger
Part 4 Developments (General)	28/06/2021	BOS Threshold: Biodiversity Values Map

PCT list

Price calculated	PCT common name	Credits
Yes	**849 -** Cumberland shale plains woodland	2
Yes	**835 -** Cumberland riverflat forest	0

Species list

Price calculated	Species	Credits

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

Biodiversity payment summary report

IBRA sub region	PCT common name	Threat status	Offset trading group	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Cumberland	**849 -** Cumberland shale plains woodland	Yes	Cumberland Plain Woodland in the Sydney Basin Bioregion	18.83%	$ 1,097.37	1.6350	$ 33,697.42	2	$67,394.84
Cumberland	**835 -** Cumberland riverflat forest	Yes	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	15.82%	$737.69	2.3979	$ 22,097.40	0	$0.00

Subtotal (excl. GST)	**$67,394.84**
GST	**$6,739.48**
Total ecosystem credits (incl. GST)	**$74,134.32**

Species credits for threatened species

Biodiversity payment summary report

Species profile ID	Species	Threat status	Price per credit	Risk premium	Administrative cost	No. of species credits	Final credits price

No species available

Grand total **$74,134.32**

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Our services

Ecology and biodiversity
Terrestrial
Freshwater
Marine and coastal
Research and monitoring
Wildlife Schools and training

Heritage management
Aboriginal heritage
Historical heritage
Conservation management
Community consultation
Archaeological, built and landscape values

Environmental management and approvals
Impact assessments
Development and activity approvals
Rehabilitation
Stakeholder consultation and facilitation
Project management

Environmental offsetting
Offset strategy and assessment (NSW, QLD, Commonwealth)
Accredited BAM assessors (NSW)
Biodiversity Stewardship Site Agreements (NSW)
Offset site establishment and management
Offset brokerage
Advanced Offset establishment (QLD)