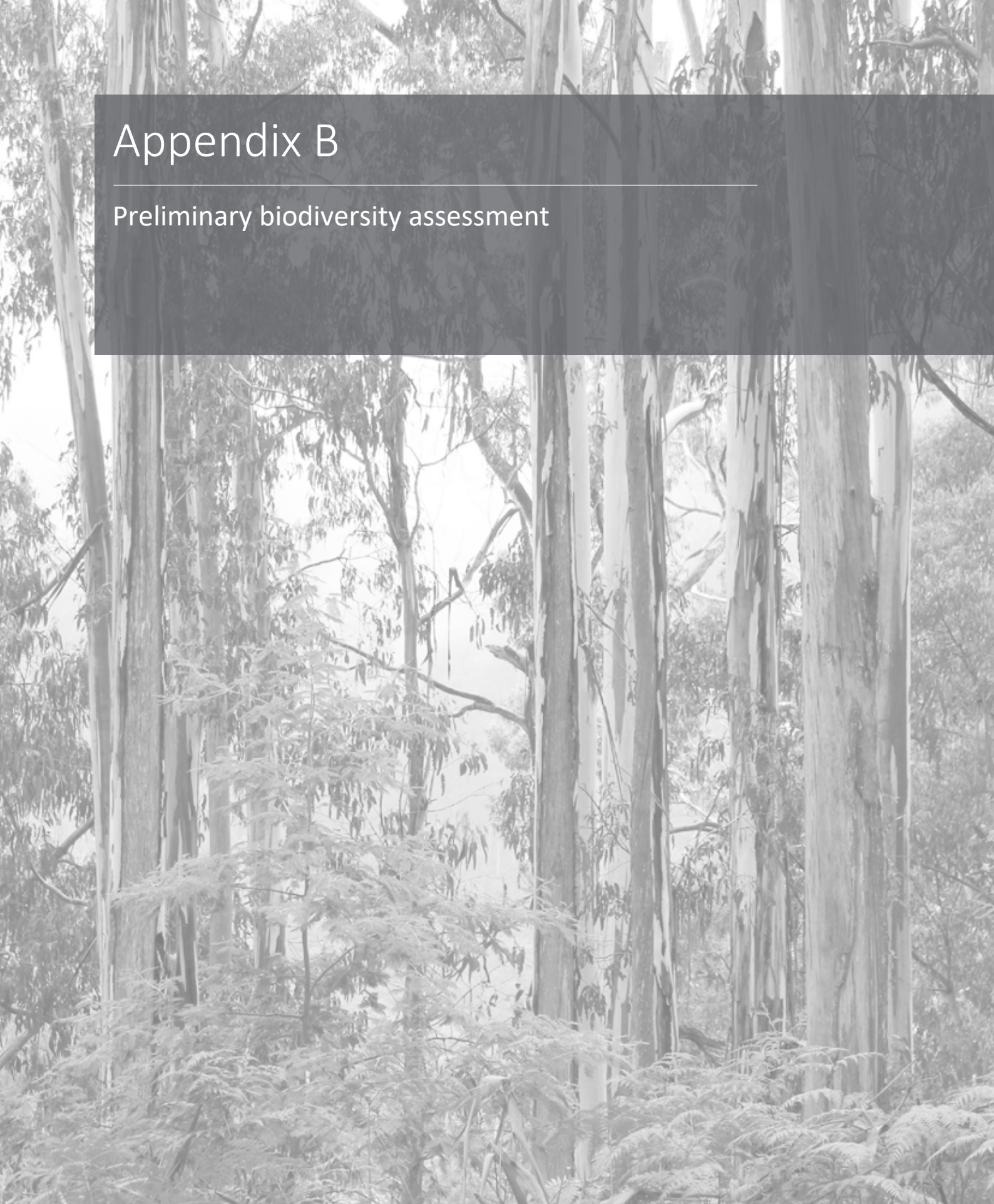


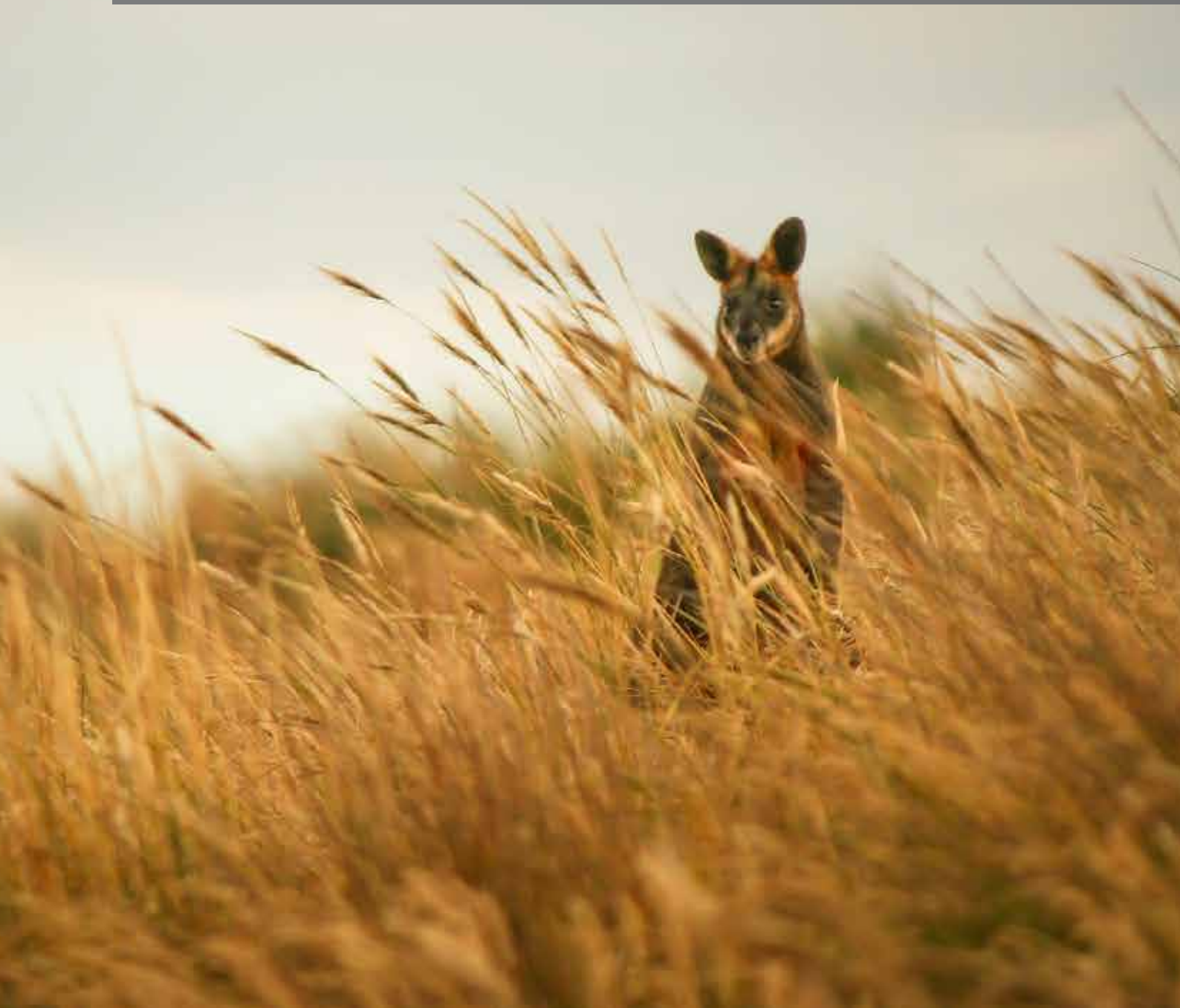
Appendix B

Preliminary biodiversity assessment



Three Dams Project – Mole River Dam Project Terrestrial and Aquatic Biodiversity Ecological Constraints Assessment

Prepared for Water NSW
March 2020





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Three Dams Project – Mole River Dam Project

Terrestrial and Aquatic Biodiversity Ecological Constraints Assessment

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6 March 2020

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6 March 2020

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

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Executive Summary

ES1 Project description

Three Dams, namely Wyangala, Dungowan and Mole River, have been declared as critical State Significant Infrastructure (CSSI) projects under the NSW *Environmental Planning and Assessment Act 1979*. These CSSI projects require approval from the NSW Minister for Planning and Public Spaces and are likely to require approval by the Commonwealth Minister for the Environment. An Environmental Impact Statement is required for each project application. If Commonwealth approval is required, it is likely that it would occur via an accredited process.

The need to deliver the dams is critical to the State's drought recovery process and needs to be completed to the highest standard in relation to the assessment and delivery. Each dam is to be constructed rapidly to create security for the various town water supplies and associated industries reliant on the delivery of water for viability.

This Ecological Constraints Assessment has been prepared by EMM Consulting Pty Limited (EMM) specifically for the Mole River Dam project (the Project). Mole River Dam is located approximately 20 km south west of Tenterfield at the northern end of the New England region of NSW. The Project includes:

- construction of a rockfill dam and associated embankment to provide 100 GL of storage;
- construction of a spillway, including approach channel, ogee spill crest and downstream chute and terminal structure;
- construction of intake tower and associated access bridge;
- installation of appropriate fish passage;
- upgrade or construction of new access roads suitable for construction and ongoing maintenance requirements;
- installation of construction compounds and laydown areas as required;
- establishing a construction camp and associated services as required; and
- installation of ancillary facilities, including utilities and services, or relocation of existing infrastructure and services as required.

The purpose of this preliminary assessment is to establish existing environment of the project using desktop review and preliminary field survey, undertake a preliminary assessment of project design elements, likely impacts requiring consideration, and provide recommendations for future assessment and design of the project.

ES2 Existing environment

ES2.1 Landscape features

The Mole River Dam project is located in the Nandewar Interim Biogeographic Regionalisation of Australia (IBRA) region and Nandewar Northern Complex IBRA subregion and Mole Valley, Ashford Mole Valleys and Inverell Plateau Granites BioNet NSW Landscape (formerly Mitchell landscapes).

The Mole River is in the Border Rivers catchment. The study area includes 18 major waterways (3rd or higher stream order), which feed into the catchment of the proposed Dam. No important wetlands, coastal wetlands, Ramsar wetlands or local wetlands are located within or immediately adjacent to the project footprint.

ES2.2 Native vegetation

Regional vegetation mapping predicts that seven native plant community types (PCT's) occur within the project footprint.

Regional mapping predicts that seven native plant community types (PCTs) and one potential PCT occur within the project footprint. One Plant Community Type (PCT; PCT 599) may be equivalent to *White Box Yellow Box Blakely's Red Gum Woodland*, listed as endangered under the *Biodiversity Conservation Act 2016* (BC Act), and *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland*, listed as critically endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Box Gum Woodland). There is currently a preliminary determination for this community to be listed as critically endangered under the BC Act.

Approximately fifteen hectares of potential Box Gum Woodland occur in the project footprint. Only very limited access for preliminary survey has been carried out and more detailed field surveys will be required to confirm if the vegetation within the terrestrial study area does or does not align with regional mapping. Impacts on this threatened ecological community will be a key consideration for assessment.

ES2.3 Threatened species

From database searches and a preliminary Biodiversity Assessment Method (BAM; OEH 2017) assessment a total of 41 threatened native flora species and 35 threatened native fauna species listed as species credit species, and thus requiring offsets under the NSW Biodiversity Offset Scheme (BOS), were predicted to occur within 10 km of the project footprint. A preliminary assessment was made of the likelihood of these species occurring, with a precautionary approach utilised if there was uncertainty as to whether habitat or the species may occur on site. After this process was conducted a total of 24 threatened flora species, and 27 threatened fauna species were identified as candidate species requiring targeted survey, expert reports, or assumption of presence under the BAM.

Six of these flora species credit species and eight fauna species credit species are identified as being candidate entities for 'serious and irreversible impact', where impacts may contribute significantly to the risk of extinction of the species.

From preliminary review of future assessment requirements, the bulk of survey could be satisfied if targeted surveys were performed for threatened flora and fauna in November (with remaining surveys for flora required in September and fauna in June/July).

ES2.4 Migratory species

A total of six migratory species listed under the EPBC Act were assessed as having a moderate to high likelihood of occurrence within, or adjacent to, the terrestrial study area.

ES2.5 Aquatic species and habitats

The downstream environment may be affected by greater capture of flows. Background research identified one threatened ecological aquatic community downstream of Mole River Dam which may be affected: Lowland Darling River aquatic ecological community, listed as an Endangered Ecological Community (EEC) under the *Fisheries Management Act 1995* (FM Act). This EEC commences approximately 50 km downstream of the proposed Mole River Dam at the confluence with the Dumaresq River, and then flows into the Macintyre River. Future assessments will need to determine if there is potential for any changes in water availability that may impact on this EEC.

A total of 18 major and 62 minor streams (3rd order or less) were identified as likely to be impacted by the inundation area.

A total of six threatened aquatic species listed under the FM Act and/or the EPBC Act were identified through background research, with four considered to be moderate to high potential to occur.

ES2.6 Groundwater-dependent ecosystems (GDEs)

The Groundwater Dependent Ecosystems Atlas predicted that three PCTs may be present in the downstream aquatic study area that could represent terrestrial GDEs. Of the predicted terrestrial GDEs, PCT 1307 may represent Box Gum Woodland. One aquatic GDE, the Border Rivers, was predicted.

No databases are available in NSW which catalogue the presence of subterranean fauna; however, based on a brief literature review, it is possible that stygofauna may occur within the aquatic study area, with a number of stygobitic groups recorded from six sub-catchments of the Border Rivers catchment and from varying geologies and salinities.

Further assessment of groundwater availability and changes to groundwater following construction will need to be undertaken to inform a more detailed GDE assessment. Further assessment of whether the aquatic study area supports aquatic and/or subterranean GDEs will also be required as part of the EIS stage.

ES3 Summary

A number of potential impacts and biodiversity constraints have been identified in this report. While the key components of the project are largely fixed, the final design solution and operation will be based on an iterative design and assessment process that will be carried out as part of the EIS. Where feasible, design should consider biodiversity values present and seek to minimise impacts to these values.

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Abbreviations and acronyms

Abbreviation/acronym	Definition
BAM	Biodiversity Assessment Method
BC Act	<i>Biodiversity Conservation Act 2016</i>
BC Regulation	Biodiversity Conservation Regulation 2017
BCF	Biodiversity Conservation Fund
BOM	Bureau of Meteorology
BOS	Biodiversity Offsets Scheme
CSSI	Critical State significant infrastructure
DAWE	Department of Agriculture, Water and the Environment
DIWA	Directory of Important Wetlands in Australia
DoEE	Department of the Environment and Energy (now DAWE)
DPI	Department of Primary Industries
DPIE	Department of Planning, Industry and Environment
EIS	Environmental impact statement
EMM	EMM Consulting Pty Limited
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPBC Act	<i>Environment Protection Biodiversity Conservation Act 1999</i>
FM Act	<i>Fisheries Management Act 1994</i>
IBRA	Interim Biogeographic Regionalisation of Australia
GDEs	Groundwater-dependant ecosystems
KTP	Key threatening processes
LGA	Local Government Area
MNES	Matters of national environmental significance
OEH	Office of Environment and Heritage
PCT	Plant community type
PMST	Protected Matters Search Tool
SEARs	Secretary's Environmental Assessment Requirements
SAII	Serious and irreversible impacts
TEC	Threatened Ecological Community
VIS	Vegetation Information System
EPI	Environmental planning instruments

1 Introduction

1.1 Project overview

The passing of the NSW *Water Supply (Critical Needs) Act 2019* on 14 November 2019 has declared '3 Dams' to be critical State significant infrastructure (CSSI) under the provisions of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The '3 Dams' are Wyangala, Dungowan and Mole River dams. These CSSI projects require approval from the NSW Minister for Planning and Public Spaces, and applications for the projects are required to be accompanied by an environmental impact statement (EIS) that has been prepared in accordance with environmental assessment requirements issued by the Secretary of the NSW Department of Planning, Industry and Environment (DPIE); referred to as Secretary's Environmental Assessment Requirements (SEARs).

It is possible that the 3 Dams will also require approval by the Commonwealth Minister for the Environment under the provisions of the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act). If so, it is likely that the Commonwealth would accredit the assessment process of the EP&A Act, meaning that the EIS prepared under the EP&A Act would be used to form the basis of the assessment under the EPBC Act.

The need to deliver the dams is critical to the State's drought recovery process and needs to be completed to the highest standard in relation to the assessment and delivery. Each dam is to be constructed rapidly to create security for the various town water supplies and associated industries reliant on the delivery of water for viability.

This Ecological Constraints Assessment has been prepared by EMM Consulting Pty Limited (EMM) specifically for the Mole River Dam project. Mole River Dam is located approximately 20 kilometres (km) south-west of Tenterfield in NSW. The project includes:

- construction of a rockfill dam and associated embankment to provide 100 GL of storage;
- construction of a spillway, including approach channel, ogee spill crest and downstream chute and terminal structure;
- construction of intake tower and associated access bridge;
- installation of appropriate fish passage;
- upgrade or construction of new access roads suitable for construction and ongoing maintenance requirements;
- installation of construction compounds and laydown areas as required;
- establishing a construction camp and associated services as required;
- installation of ancillary facilities, including utilities and services, or relocation of existing infrastructure and services as required

1.2 Purpose of this preliminary assessment report

The purpose of this preliminary assessment report is to:

- establish existing environment of the project using desktop review;
- undertake a preliminary assessment of project design elements and likely impacts requiring consideration; and
- provide recommendations for future assessment and design of the project.

1.3 Study area

The terminology outlined in Table 1.1 is used throughout this report.

Table 1.1 Project terminology

Term	Definition / description
Inundation area	Full supply level (FSL).
Project footprint	Inundation area plus operational and construction footprints (if known).
Terrestrial study area	Project footprint plus a nominal 50 m buffer.
Aquatic study area	Project footprint plus areas subject to potential downstream impacts.
Project area	A nominal 10 km buffer surrounding the project footprint.

The probable maximum flood (PMF) level will involve additional temporary flooding when these events occur. This may occur within the defined study area where slopes are steep but may occur outside of the study area in areas with gentler gradients.

2 Legislative context

2.1 NSW Environmental Planning and Assessment Act 1979

The NSW EP&A Act and Environmental Planning and Assessment Regulation 2000 (EP&A Regulation) form the statutory framework for environmental assessment and planning approval in NSW. Implementation of the EP&A Act is the responsibility of the Minister for Planning and Public Spaces, statutory authorities and local councils.

Mole River Dam project has been declared CSSI in accordance with the provisions of Schedule 3 of the *Water Supply (Critical Needs) Act 2019*. As a result, the Mole River Dam project may be carried out without obtaining development consent under Part 4 of the EP&A Act. However, the project is subject to Division 5.2 of the EP&A Act, which requires the preparation of an EIS and the approval of the NSW Minister for Planning and Public Spaces.

SEARs will be issued by DPIE for the project following submission of the scoping report. The SEARs identify matters which must be addressed in the EIS and essentially form its terms of reference.

Under section 5.22(2) of the EP&A Act, environmental planning instruments (EPIs), including SEPPs, do not apply to CSSI. In addition, under sections 5.23 and 5.24 of the EP&A Act, certain approvals under separate NSW legislation are not be required for CSSI projects (section 5.23) or would be required to be issued consistent with the planning approval, if granted, (section 5.24).

For SSI projects, including CSSI projects, use of the Biodiversity Assessment Method (BAM, OEH 2017) is mandatory unless a waiver is sought. Full assessment of impacts to biodiversity is likely to be required in accordance with the BAM, with a biodiversity development assessment report (BDAR) required at the EIS stage. This assessment identifies potential ecological values that may require consideration during preparation of the BDAR and the EIS.

2.1.1 State Environmental Planning Policy No 44 – Koala Habitat Protection

State Environmental Planning Policy No 44 – Koala Habitat Protection (SEPP 44) aims to encourage the conservation and management of natural vegetation areas that provide habitat for Koalas (*Phascolarctos cinereus*) to ensure permanent free-living populations will be maintained over their present range and to reverse the current trend of population decline.

As the Mole River Dam Project is CSSI, all environmental planning instruments (including SEPP44) do not apply. Nonetheless, the BDAR will need to consider whether Koalas will be impacted by the project.

2.2 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, heritage places and water resources which are defined as matters of national environmental significance (MNES) under the EPBC Act. These are:

- world heritage properties;
- places listed on the National Heritage Register;
- Ramsar wetlands of international significance;
- threatened flora and fauna species and ecological communities;
- migratory species;

- Commonwealth marine areas;
- the Great Barrier Reef Marine Park;
- nuclear actions (including uranium mining); and
- water resources, in relation to coal seam gas or large coal mining development.

Under the EPBC Act, a person proposing to take an action that may or will have a significant impact on MNES is to refer the action to the Commonwealth Department of Agriculture, Water and Environment (DAWE) for determination as to whether or not it is a controlled action. The *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* (DoE 2013), outline a 'self-assessment' process including detailed criteria to assist persons in deciding whether or not a referral may be required, and if the proposed action may have a significant impact on MNES. If deemed a controlled action the project is assessed under the EPBC Act and a decision made by the Commonwealth Minister for the Environment as to whether or not to grant approval.

At this stage, it is assumed referral of the Mole River Dam project will be undertaken under the EPBC Act, due to the potential presence of threatened species and ecological communities.

Assessment via a bilateral agreement or under an accredited process is likely to provide assessment efficiencies for WaterNSW. Currently, there is no bilateral agreement between the Commonwealth of Australia and the State of NSW accrediting the Biodiversity Offsets Scheme (BOS) or the BAM (OEH 2017). A bilateral agreement has been drafted, but the date for gazettal of the agreement is unknown at this stage; though, on 20 November 2019 the NSW Executive Council passed the amending regulation that will allow for the Commonwealth to endorse the BOS and BAM, and it is understood that the bilateral will thus be enacted once there signoff from the Commonwealth Minister for the Environment.

If available, WaterNSW will seek assessment under the bilateral agreement. If the bilateral agreement is not available, WaterNSW will seek accreditation of the BAM (OEH 2017) during the referral process.

2.3 NSW Biodiversity Conservation Act 2016

The NSW *Biodiversity Conservation Act 2016* (BC Act) details mechanisms for the conservation of biodiversity in NSW through the protection of threatened flora and fauna species, populations and ecological communities. The BC Act, together with the NSW Biodiversity Conservation Regulation 2017 (BC Regulation), established the BAM and Biodiversity Offsets Scheme (BOS), for use by accredited persons in biodiversity assessment under the scheme. The purpose of the BAM is to assess the impact of actions on threatened species and threatened ecological communities (TECs) and their habitats and determine offset requirements.

The BAM sets out the requirements for a repeatable and transparent assessment of terrestrial biodiversity values in order to:

- identify the biodiversity values on land subject to proposed development area;
- determine the residual impacts of a proposed development following all measures to avoid, minimise and mitigate impacts; and
- quantify and describe the biodiversity credits required to offset the residual impacts of proposed development on biodiversity values.

For CSSI projects, use of the BAM is mandatory unless a waiver is sought. Given the presence of substantial native vegetation and threatened species in the terrestrial study area, assessment of impacts to biodiversity will be required in accordance with the BAM for the Mole River Dam project.

2.4 NSW Fisheries Management Act 1994

The NSW *Fisheries Management Act 1994* (FM Act) contains provisions for the conservation of fish stocks, key fish habitat, biodiversity, and threatened species, populations and ecological communities. It regulates the conservation of fish, aquatic vegetation and some aquatic macroinvertebrates, and the development and sharing of the fishery resources of NSW for present and future generations. The FM Act lists threatened species, populations and ecological communities, key threatening processes (KTPs) and declared critical habitat. Assessment guidelines to determine whether a significant impact is expected are detailed in section 220ZZ and 220ZZA of the FM Act.

Another objective of the FM Act is to conserve key fish habitat. These are defined as aquatic habitats that are important to the sustainability of recreational and commercial fishing industries, the maintenance of fish populations generally, and the survival and recovery of threatened aquatic species. Key fish habitat is defined in sections 3.2.1 and 3.2.2 of the *Policy and Guidelines for Fish Conservation and Management* (DPI 2013a).

Assessment under the FM Act will be required for the Mole River Dam project due to the potential for impacts to aquatic species and habitats within, and downstream of, the project footprint.

2.5 NSW Water Management Act 2000

The *Water Management Act 2000* (WM Act) provides physical definition of a waterway, and other waterbodies, pertinent to this assessment:

‘watercourse means a river, creek or other natural stream of water (whether modified or not) flowing in a defined channel, or between banks, notwithstanding that the flow may be intermittent or seasonal or the banks not clearly or sharply defined, and includes –

- (a) a dam that collects water flowing in any such stream; and
- (b) a lake through which water flows; and
- (c) a channel into which the water of any such stream has been diverted; and
- (d) part of any such stream; and
- (e) the floodplain of any such stream –...’

Specific guidance relating to the assessment of groundwater-dependant ecosystems (GDEs) are provided within The *NSW State Groundwater Dependent Ecosystems Policy* (DLWC 2002) and *Risk assessment guidelines for groundwater dependent ecosystems: Volume 1 – The conceptual framework* (Serov et al. 2012).

3 Methods

3.1 Background research

3.1.1 Database searches

In order to inform project context, information regarding vegetation communities, flora and fauna species was obtained from publicly available databases.

Background research included a review of the *State Vegetation Type Map: Border Rivers Gwydir / Namoi Region Version 2.0. VIS_ID 4467* (OEH 2016). Plant community types (PCTs) mapped within the terrestrial study area were reviewed to determine potential alignment with TECs listed under the EPBC Act, BC Act or FM Act.

Ecological database searches were undertaken to compile background information and assess ecological records, allowing us to determine the likelihood of occurrence of threatened species and communities within 10 km of the project footprint. Databases included:

- BioNet Atlas of NSW Wildlife (Bionet);
- DAWE Protected Matters Search Tool (PMST) for MNES;
- Vegetation Information System (VIS) Classification 2.1 database;
- Freshwater threatened species distribution maps (DPI Fisheries);
- Key Fish Habitat maps (DPI Fisheries);
- Preliminary determinations for threatened species and communities listed under the BC Act and EPBC Act;
- Groundwater Dependant Ecosystems Atlas (Bureau of Meteorology (BOM));
- Australian Ramsar Wetlands: Internationally Important Wetlands (DAWE); and
- Directory of Important Wetlands: Nationally Important Wetlands (DAWE).

Database searches were completed for the locality, defined as an area within a 10 km buffer of the project footprint; however, with regard to the aquatic assessment, more extensive buffers (up to 50 km) were considered if threatened aquatic species were considered likely to move throughout the catchment.

A preliminary BAM assessment was also undertaken to generate a list of candidate species and entities required to be considered for further assessment during development of a BDAR.

3.1.2 Literature review

The following reports were also reviewed during the background research component:

- PrimeFact 173: Lower Darling River aquatic ecological community (DPI 2007);
- PrimeFact 176: Olive Perchlet (western population) – *Ambassis agassizii* (DPI 2013b);
- PrimeFact 1321: Eel-Tailed Catfish population in the Murray-Darling Basin, *Tandanus tandanus* (DPI 2015);

- PrimeFact 1275: Southern Purple Spotted Gudgeon – *Mogurnda adspersa* (DPI 2017);
- Fish and Flows in the Northern Basin: responses of fish to changes in flow in the Northern Murray–Darling Basin – Valley Scale Report (DPI 2015); and
- Stygofauna Presence Within Fresh and Highly Saline Aquifers of The Border Rivers Region in Southern Queensland (Schulz *et al.* 2013).

3.2 Field survey

A preliminary field survey of the study area was undertaken on 13 February 2020. The preliminary field survey included:

- rapid verification of regional vegetation mapping (in particular for communities that may meet BC Act or EPBC Act TEC definitions);
- an initial habitat assessment for terrestrial threatened species, focusing on threatened species which can be readily excluded based on geographic or habitat constraints; and
- where relevant, an assessment of potential aquatic habitat (including key fish habitat).

The field survey was rapid in nature and did not involve detailed assessment of native vegetation, threatened species habitat or aquatic environments. The results detailed in this report provide an overview of the biodiversity values in the study area and project footprint and the potential impacts arising from the Mole River Dam project. No ancillary sites such as laydown areas, construction compounds or camps, if required, were investigated. This assessment should not be relied upon for the purposes of detailed impact assessment.

3.3 Groundwater-dependent ecosystems

A search was performed on the Groundwater Dependent Ecosystems Atlas (BOM 2020) for potential GDEs occurring downstream of the proposed dam. The search area comprised a 50 m buffer on the downstream aquatic study area (ie 1 km downstream of the proposed dam). A literature review was also conducted, specific to sub-surface aquatic GDEs.

GDEs considered in this assessment included:

- aquatic ecosystems that rely on the surface expression of groundwater. This includes surface water ecosystems which may have a groundwater component, such as rivers, wetlands and springs;
- terrestrial ecosystems that rely on the subsurface presence of groundwater. This includes all vegetation ecosystems; and
- subterranean ecosystems. This includes cave and aquifer ecosystems.

GDEs within the inundation area were not included as these would be removed by the proposed dam. Upstream GDEs were also not included as impacts are not expected to occur in this area.

4 Existing environment

4.1 Landscape features

The Mole River Dam project is located in the Nandewar Interim Biogeographic Regionalisation of Australia (IBRA) region and Nandewar Northern Complex IBRA subregion and Mole Valley, Ashford Mole Valleys and Inverell Plateau Granites BioNet NSW Landscape (formerly Mitchell landscapes; Figure 4.1).

The Mole River Dam project is located in the Border Rivers catchment and on the Mole River. The project footprint intersects buffers of 80 waterways, including 18 major waterways (3rd order or above) and 62 minor waterways (Figure 4.1). No important wetlands (wetlands listed on the Directory of Important Wetlands in Australia (DIWA)), coastal wetlands listed under the State Environmental Planning Policy (Coastal Management) 2018, Ramsar wetlands or local wetlands (any wetland that is not identified as an important wetland) are located within or immediately adjacent to the project footprint.

4.2 Native vegetation

Plant community types (PCTs), and their alignment with TECs listed under the EPBC Act, BC Act and/or FM Act are outlined below.

OEH (2016) predicts that seven native plant community types (PCTs) and one potential PCT (Candidate Native Grasslands) occur within the project footprint (Figure 4.2). These PCTs, and their alignment with threatened ecological communities TECs listed under the EPBC Act or BC Act, are listed in Table 4.1. Field surveys will confirm if the vegetation within the terrestrial study area does or does not align with regional mapping.

Table 4.1 Plant Community Types mapped within the project footprint (OEH 2016)

Plant Community Type (PCT)	Conservation status		Extent within project footprint (ha)	Candidate SAIL
	EPBC Act	BC Act		
Cleared or Non-native	-	-	47.4	-
Candidate Native Grasslands	-	-	390.6	-
84 - River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South and Nandewar Bioregions	-	-	259.4	-
516 - Grey Box grassy woodland or open forest of the Nandewar Bioregion and New England Tableland Bioregion	-	-	0.97	-
549 - Silver-leaved Ironbark - Black Cypress Pine +/- White Box shrubby open forest mainly in the northern Nandewar Bioregion	-	-	32.1	-
564 - White Cypress Pine - Silver-leaved Ironbark - Caley's Ironbark open forest of the central Nandewar Bioregion and western New England Tableland Bioregion	-	-	11.5	-
594 - Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion	-	-	43.7	-
596 - Tumbledown Red Gum - White Cypress Pine - Silver-leaved Ironbark shrubby woodland mainly in the northern Nandewar Bioregion	-	-	24.6	-

Table 4.1 Plant Community Types mapped within the project footprint (OEH 2016)

Plant Community Type (PCT)	Conservation status		Extent within project footprint (ha)	Candidate SAI
	EPBC Act	BC Act		
599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	CE	E	15.5	Yes
Total native vegetation			778.4	
Total for project footprint			825.8	

Notes: V = Vulnerable, E = Endangered, CE = Critically Endangered

One of the PCTs mapped within the terrestrial study area may form part of one TEC. PCT 599 may be equivalent to *White Box Yellow Box Blakely's Red Gum Woodland*, listed as endangered under the BC Act, and 3.1.2, listed as critically endangered under the EPBC Act (Box Gum Woodland). Box Gum Woodland is currently being considered for listing as critically endangered under the BC Act, with a preliminary determination in place. Box Gum Woodland is also listed as a candidate entity for SAI, meaning that impacts on these communities will need to be considered in more detail.

OEH (2016) maps 15.5 ha of potential Box Gum Woodland in the project footprint. Initial review of aerial photography indicates that many of these areas are highly degraded. Whilst degraded areas may still meet the definition of the community under the BC Act, these degraded areas are unlikely to meet the condition thresholds under the EPBC Act. This will need to be assessed during more detailed field assessments.

There is no approved conservation advice for the EPBC Act listed community. *EPBC Act Policy Statement 3.5 White Box Yellow Box Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands* (DEH 2006) provides a flowchart to determine if patches meet the condition thresholds for inclusion as a TEC. Broadly, an area in which an overstorey exists without a substantially native understorey is deemed to be degraded and no longer a viable part of the ecological community. In order for an area to be included as a TEC, a patch must have a predominantly native understorey.

In addition, a small area of PCT 547 is located just outside the terrestrial study area. This PCT may be equivalent to the *Semievergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions* listed as endangered under the EPBC Act, and *Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions* listed as endangered under the BC Act (hereafter known as Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions). This PCT will also be the focus of further field assessments.

4.3 Threatened species

4.3.1 Ecosystem credit species

Ecosystem credit species are threatened species that can be reliably predicted to use an area of land based on habitat surrogates. For the purposes of the BAM (OEH 2017), ecosystem credit species are deemed to be offset through the habitat surrogates (PCTs) in which they occur.

A list of ecosystem credit species predicted to occur within the terrestrial study area, based on the PCTs present, is provided in Table 4.2.

Table 4.2 Ecosystem credit species predicted to occur within 10 km of the project footprint

Scientific name	Common name	Conservation status	
		EPBC Act	BC Act
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	CE
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow		V
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo		V, EP
<i>Chthonicola sagittata</i>	Speckled Warbler		V
<i>Circus assimilis</i>	Spotted Harrier		V
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)		V
<i>Daphoenositta chrysoptera</i>	Varied Sittella		V
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork		E
<i>Glossopsitta pusilla</i>	Little Lorikeet		V
<i>Grantiella picta</i>	Painted Honeyeater	V	V
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle		V
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard		V
<i>Hieraaetus morphnoides</i>	Little Eagle		V
<i>Lathamus discolor</i>	Swift Parrot	CE	E
<i>Lophoictinia isura</i>	Square-tailed Kite		V
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)		V
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)		V
<i>Neophema pulchella</i>	Turquoise Parrot		V
<i>Ninox connivens</i>	Barking Owl		V
<i>Ninox strenua</i>	Powerful Owl		V
<i>Petroica boodang</i>	Scarlet Robin		V
<i>Petroica phoenicea</i>	Flame Robin		V
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)		V
<i>Rostratula australis</i>	Australian Painted Snipe	E	E
<i>Stagonopleura guttata</i>	Diamond Firetail		V
<i>Tyto novaehollandiae</i>	Masked Owl		V
<i>Chalinolobus picatus</i>	Little Pied Bat		V
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	E	V
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle		V
<i>Macropus dorsalis</i>	Black-striped Wallaby		E
<i>Miniopterus orianae oceanensis</i>	Eastern Bentwing-bat		V
<i>Nyctophilus corbeni</i>	Corben's Long-eared Bat	V	V
<i>Phascolarctos cinereus</i>	Koala	V	V, EP

Table 4.2 Ecosystem credit species predicted to occur within 10 km of the project footprint

Scientific name	Common name	Conservation status	
		EPBC Act	BC Act
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	V	
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat		V
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat		V
<i>Anomalopus mackayi</i>	Five-clawed Worm-skink	V	E

Notes: V = Vulnerable, E = Endangered, EP = Endangered Population, CE = Critically Endangered, P = Preliminary Determination

At this stage, it has been assumed that all ecosystem credit species are likely to occur within the project footprint. This will be refined once fieldwork has taken place during the EIS phase.

4.3.2 Species credit species

Species credit species are threatened species that cannot be reliably predicted to occur based on habitat surrogates. For the purposes of the BAM (OEH 2017), species credit species require detailed assessment and, if present, additional offsets to ecosystem credits.

An assessment of habitat suitability for threatened species credit species was undertaken in accordance with Step 2 of Section 6.4 of the BAM (OEH 2017). For those threatened species credit species predicted to occur, for which habitat constraints are listed, an initial desktop assessment was undertaken of the presence of the habitat features within the terrestrial study area. The species generated by the calculator with habitat constraints, as well as the results of the habitat constraints assessment, are provided below.

i Flora species

Background research identified 41 threatened flora species credit species have been previously recorded and/or are predicted to occur within 10 km of the project footprint. To develop a list of flora species credit species requiring further assessment, an assessment was undertaken in accordance with Step 2 and Step 3 of Section 6.4 of the BAM (OEH 2017), as shown in Appendix A.1. This assessment identified 24 flora species credit species requiring further assessment (Table 4.3). This includes 12 species for which there are Bionet records within 10 km of the project footprint.

Table 4.3 Candidate flora species credit species requiring further assessment

Scientific name	Common name	Conservation status		Candidate SAI
		EPBC Act	BC Act	
<i>Acacia macnuttiana</i>	MacNutt's Wattle	V	V	-
<i>Acacia pubifolia</i>	Velvet Wattle	V	E	-
<i>Acacia pycnostachya</i>	Bolivia Wattle	V	V	Yes
<i>Almaleea cambagei</i>	Torrington Pea	V	E	-
<i>Angophora exul</i>	Gibraltar Rock Apple		E	Yes
<i>Astrotricha roddii</i>	Rod's Star Hair	E	E	-

<i>Boronia granitica</i>	Granite Boronia	E	V	-
<i>Cadellia pentastylis</i>	Ooline	V	V	-
<i>Callistemon pungens</i>		V		-
<i>Capparis canescens</i>	Wild Orange		E	Yes
<i>Dichanthium setosum</i>	Bluegrass	V	V	-
<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	V	V	-
<i>Grevillea beadleana</i>	Beadle's Grevillea	E	E	-
<i>Haloragis exalata</i> subsp. <i>velutina</i>	Tall Velvet Sea-berry	V	V	-
<i>Indigofera baileyi</i>	Bailey's Indigo		E	-
<i>Lepidium peregrinum</i>	Wandering Pepper Cress	E	E	Yes
<i>Leucopogon confertus</i>	Torrington Beard-heath	E	E	Yes
<i>Monotaxis macrophylla</i>	Large-leaved Monotaxis		E	-
<i>Phebalium glandulosum</i> subsp. <i>eglandulosum</i>	Rusty Desert Phebalium	V	E	Yes
<i>Picris evae</i>	Hawkweed	V	V	-
<i>Polygala linariifolia</i>	Native Milkwort		E	-
<i>Pomaderris queenslandica</i>	Scant Pomaderris		E	-
<i>Rutidosia heterogama</i>	Heath Wrinklewort	V	V	-
<i>Swainsona sericea</i>	Silky Swainson-pea		V	-

Notes: V = Vulnerable, E = Endangered, EP = Endangered Population, CE = Critically Endangered, P = Preliminary Determination

Further targeted surveys will be required for these species.

Six species considered to have a moderate to high likelihood of occurrence in the terrestrial study area are listed as candidate SAI entities meaning that impacts to these species have the potential to be serious and irreversible. Of note, Bolivia Wattle and Gibraltar Rock Apple, Wandering Pepper Cress, Torrington Beard-heath and Rusty Desert Phebalium all have been previously recorded within 10 km of the project footprint.

In addition, *Boronia inflexa* subsp. *torringtonensis* (a shrub) has been proposed for listing as critically endangered under the BC Act. The species has been recorded north of Torrington, within Torrington State Forest within 10 km of the project footprint.

ii Fauna species

Background research identified 35 threatened fauna species credit species have been previously recorded and/or are predicted to occur within 10 km of the project footprint. To develop a list of fauna species credit species requiring further assessment, an assessment was undertaken in accordance with Step 2 and Step 3 of Section 6.4 of the BAM (OEH 2017), as shown in Appendix A.2. This assessment identified 27 fauna species credit species requiring further assessment (Table 4.4). This includes seven species for which there are Bionet records within 10 km of the project footprint.

Table 4.4 **Candidate fauna species credit species requiring further assessment**

Scientific name	Common name	Conservation status		Candidate SAIL
		EPBC Act	BC Act	
Amphibians				
<i>Litoria booroolongensis</i>	Booroolong Frog	E	E	-
Birds				
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	CE	Yes
<i>Burhinus grallarius</i>	Bush Stone-curlew		E	-
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo		V, EP	-
<i>Erythrotriorchis radiatus</i>	Red Goshawk	V	CE	Yes
<i>Geophaps scripta</i>	Squatter Pigeon	V	E	Yes
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle		V	-
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard		V	-
<i>Hieraaetus morphnoides</i>	Little Eagle		V	-
<i>Lathamus discolor</i>	Swift Parrot	CE	E	Yes
<i>Lophoictinia isura</i>	Square-tailed Kite		V	-
<i>Ninox connivens</i>	Barking Owl		V	-
<i>Ninox strenua</i>	Powerful Owl		V	-
<i>Tyto novaehollandiae</i>	Masked Owl		V	-
Mammals				
<i>Aepyprymnus rufescens</i>	Rufous Bettong		V	-
<i>Cercartetus nanus</i>	Eastern Pygmy-possum		V	-
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Yes
<i>Miniopterus orianae oceanensis</i>	Eastern Bentwing-bat		V	Yes
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	-
<i>Petauroides volans</i>	Greater Glider	V	EP	-
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	V	E	Yes
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale		V	-
<i>Phascolarctos cinereus</i>	Koala	V	V, EP	-
<i>Vespadelus trougtoni</i>	Eastern Cave Bat		V	Yes
Reptiles				
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake		V	-
<i>Amalosia rhombifer</i>	Zigzag Velvet Gecko	-	E	-
<i>Underwoodisaurus sphyrurus</i>	Border Thick-tailed Gecko	V	V	-

Notes: V = Vulnerable, E = Endangered, EP = Endangered Population, CE = Critically Endangered, P = Preliminary Determination

Further targeted surveys will be required for these species.

Eight species considered to have a moderate to high likelihood of occurrence in the terrestrial study area are listed as candidate SAIL entities meaning that impacts to these species have the potential to be serious and irreversible. Of note, the Eastern Cave Bat and the Eastern Bentwing-bat have been previously recorded within 10 km of the project footprint. The potential for roosting habitat for these species will be determined during the EIS.

4.4 Migratory species

Background research identified 11 migratory species listed under the EPBC Act have been previously recorded and/or are predicted to occur within 10 km of the project footprint. A likelihood of occurrence assessment was undertaken to evaluate the likelihood of each of these migratory species occurring in the terrestrial study area based on the PCTs and associated habitats likely to be present (Appendix A.3). A total of six migratory species were assessed as moderate to high likelihood of occurrence in the terrestrial study area (Table 4.5).

Table 4.5 Migratory species considered a moderate to high likelihood of occurrence in the terrestrial study area

Scientific name	Common name	Conservation status
		EPBC Act
<i>Apus pacificus</i>	Fork-tailed Swift	Mi
<i>Hirundapus caudacutus</i>	White-throated Needletail	Mi
<i>Monarcha melanopsis</i>	Black-faced Monarch	Mi
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	Mi
<i>Rhipidura rufifrons</i>	Rufous Fantail	Mi
<i>Gallinago hardwickii</i>	Latham's Snipe	Mi

Note: Mi = migratory

4.5 Aquatic species and habitats

Background research identified the presence of one aquatic community of ecological significance listed under the FM Act, located downstream of the project footprint). The Lowland Darling River aquatic ecological community, listed as an endangered ecological community (EEC) under the FM Act, commences approximately 50 km downstream of the proposed Mole River Dam at the confluence with the Dumaresq River, which then flows into the Macintyre River (DPI 2007). The EEC is considered a lowland riverine environment and is characterised by meandering channels consisting of a variety of habitats, including deep channels, pools, runs or riffles, billabongs, in-stream woody habitats, aquatic plants, wetlands, gravel beds and flood plains (DPI 2007). These habitats support an abundance of native fish and invertebrate species, of which many have not been comprehensively studied (DPI 2007).

With regard to key fish habitat, and in alignment with the FM Act objective to 'conserve key fish habitats', permanent and semi-permanent freshwater habitats must be considered for assessment if they intersect areas of impact. These habitats include rivers, creeks, lakes, lagoons, billabongs, weir pools and impoundments up to the top of the bank, but do not include small ephemeral headwater creeks and gullies (i.e. 1st and 2nd order streams; Strahler 1952) or farm dams constructed on these systems. In addition, waterways need to be assessed for "sensitivity", and "suitability for fish passage" (DPI 2013a). The key fish habitat map for the Tenterfield Local Government Authority (LGA) indicates that the majority of the waterways within, and adjacent to, the aquatic study area are considered to contain key fish habitat (DPI 2020), as defined under the FM Act and in accordance with DPI (2013a) (Figure 4.3).

Background research identified six threatened aquatic species listed under the FM Act and/or the EPBC Act that have been previously recorded and/or are predicted to occur within, or adjacent to, the locality. A likelihood of occurrence assessment was undertaken to evaluate the likelihood of each of these threatened aquatic species occurring in the aquatic study area based on the aquatic habitats likely to be present (Appendix A.4). A total of four threatened aquatic species were assessed as having a moderate to high likelihood of occurrence within, or adjacent to, the aquatic study area (Figure 4.3). The remaining two threatened aquatic species were assessed as being of low potential to occur. A summary of threatened aquatic species with a moderate to high likelihood of occurrence within, or adjacent to, the aquatic study area is provided in Table 4.6.

Only the Murray-Darling Basin population of the Eel tailed Catfish (*Tandanus tandanus*), the western population of the Southern Purple-spotted Gudgeon (*Mogurnda adspersa*), and the western population of Olive Perchlet (*Ambassis agassizii*) are considered to be threatened; with these species being relatively widespread throughout other areas of NSW (DPI 2013b, DPI 2015, DPI 2017). With regard to the Murray Cod (*Maccullochella peelii*), there is currently limited publicly available data on the distribution of this species and therefore Figure 4.3 does not present any distribution data, relative to the aquatic study area.

In addition to listed species, it is considered that the Platypus (*Ornithorhynchus anatinus*) may also occur and could potentially be impacted upon. Whilst this species is not currently listed, there are indications that this species may be in decline, and thus it may warrant consideration of potential impacts.

Table 4.6 **Threatened aquatic species considered a moderate to high likelihood of occurrence in the aquatic study area**

Scientific name	Common name	Conservation status	
		EPBC Act	FM Act
<i>Ambassis agassizii</i>	Western population of Olive Perchlet	-	EP
<i>Maccullochella peelii</i>	Murray Cod	V	-
<i>Mogurnda adspersa</i>	Southern Purple-spotted Gudgeon	-	E
<i>Tandanus tandanus</i>	Murray-Darling Basin population of Eel-tailed Catfish	-	EP

Note: V = Vulnerable, E = Endangered, EP = Endangered Population, CE = Critically Endangered

In addition to listed species, it is considered that the Platypus (*Ornithorhynchus anatinus*) may also occur and could potentially be impacted upon. The species has been recorded in the upper reaches of the Mole River, including recent records from 2015, with numerous records from Tenterfield Creek. Whilst this species is not currently listed under the EPBC Act, BC Act or FM Act, there are indications that this species may be in decline, and thus it may warrant consideration of potential impacts.

4.6 Groundwater-dependent ecosystems

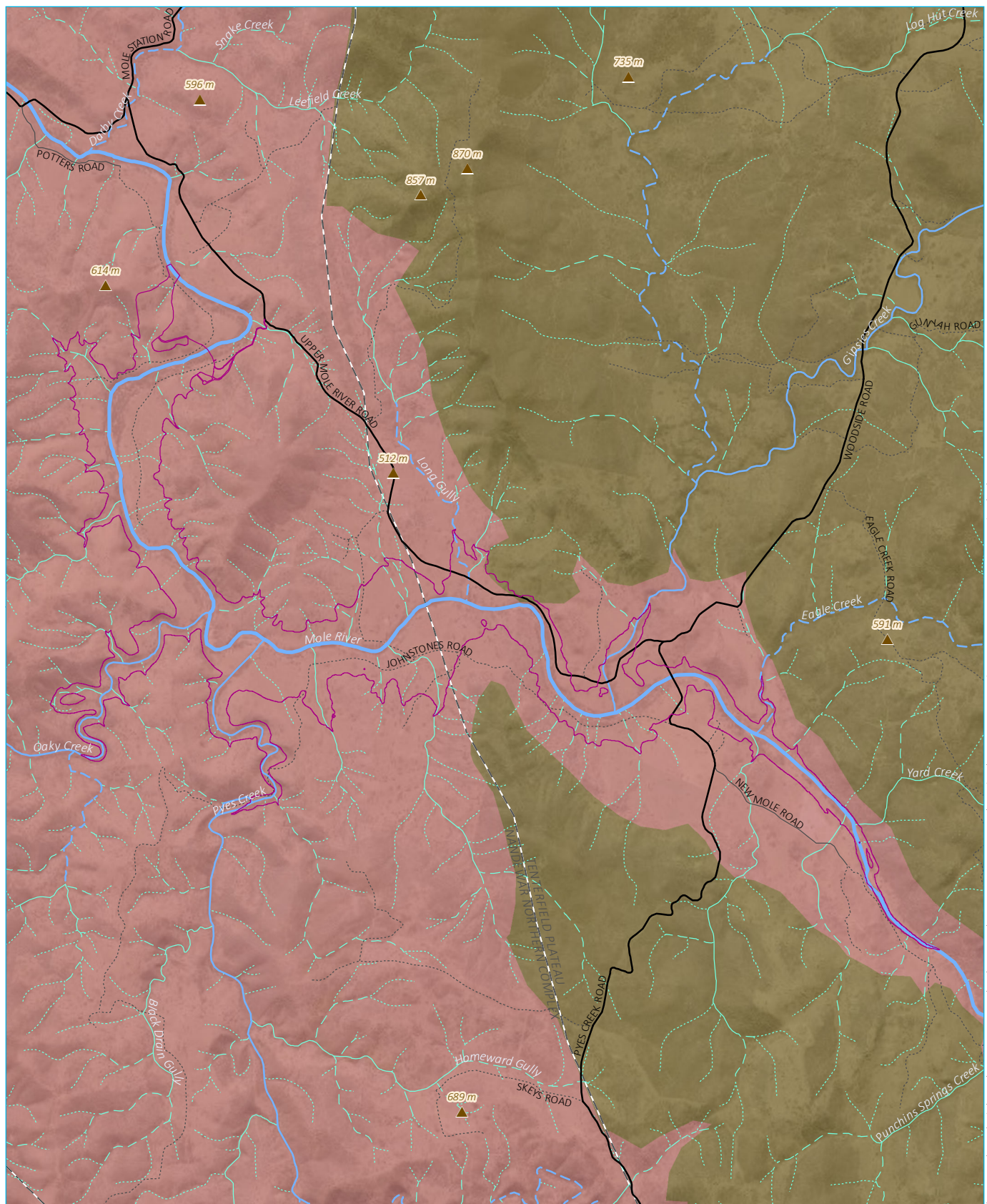
The Groundwater Dependent Ecosystems Atlas (BOM 2020) predicted that three PCTs may be present in the downstream aquatic study area that could represent terrestrial GDEs. Of the predicted terrestrial GDEs, PCT 1307 may represent Box Gum Woodland. One aquatic GDE was predicted.

Table 4.7 Potential GDEs in the downstream aquatic study area

GDE type	Potential GDE
Aquatic	The Border Rivers are predicted to be an aquatic GDE.
Terrestrial PCTs	84 - River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion 594 - Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion 1307 - White Cypress Pine - Silver-leaved Ironbark - Caley's Ironbark open forest of the central Nandewar Bioregion and western New England Tableland Bioregion
Subterranean	Data not available in NSW.

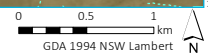
No databases are available in NSW which catalogue the presence of subterranean fauna; however, based on a brief literature review, it is possible that stygofauna may occur within the aquatic study area, with a number of stygobitic groups recorded from six sub-catchments of the Border Rivers catchment and from varying geologies and salinities (Schulz *et al.* 2013). While the geology of the project footprint study area predominantly comprises fine-grained, dark-grey mudstone and siltstones, which are not generally prospective for subterranean fauna, the discontinuous unconsolidated sediments occurring along the valley, consisting of fine to medium-grained quartz-rich to quartz-lithic sands and polymictic pebble to cobble gravel, may provide sufficient pore space for stygofauna to inhabit where groundwater aquifers are intersected.

Further assessment of groundwater availability and changes to groundwater following construction will need to be undertaken to inform a more detailed GDE assessment. Further assessment of whether the aquatic study area supports aquatic and/or subterranean GDEs will also be required as part of the EIS stage.



Source: EMM (2020); WaterNSW (2020); DFSI (2017); ELVIS (2017); DPI (2013)

*Inundation area should be considered approximate only. It is based on current limited available spatial data and is subject to future verification.



KEY

- Project footprint
- IBRA7 sub-regions
- ▲ Spot height
- Arterial and sub arterial road
- Local road
- Vehicular track

Strahler stream order

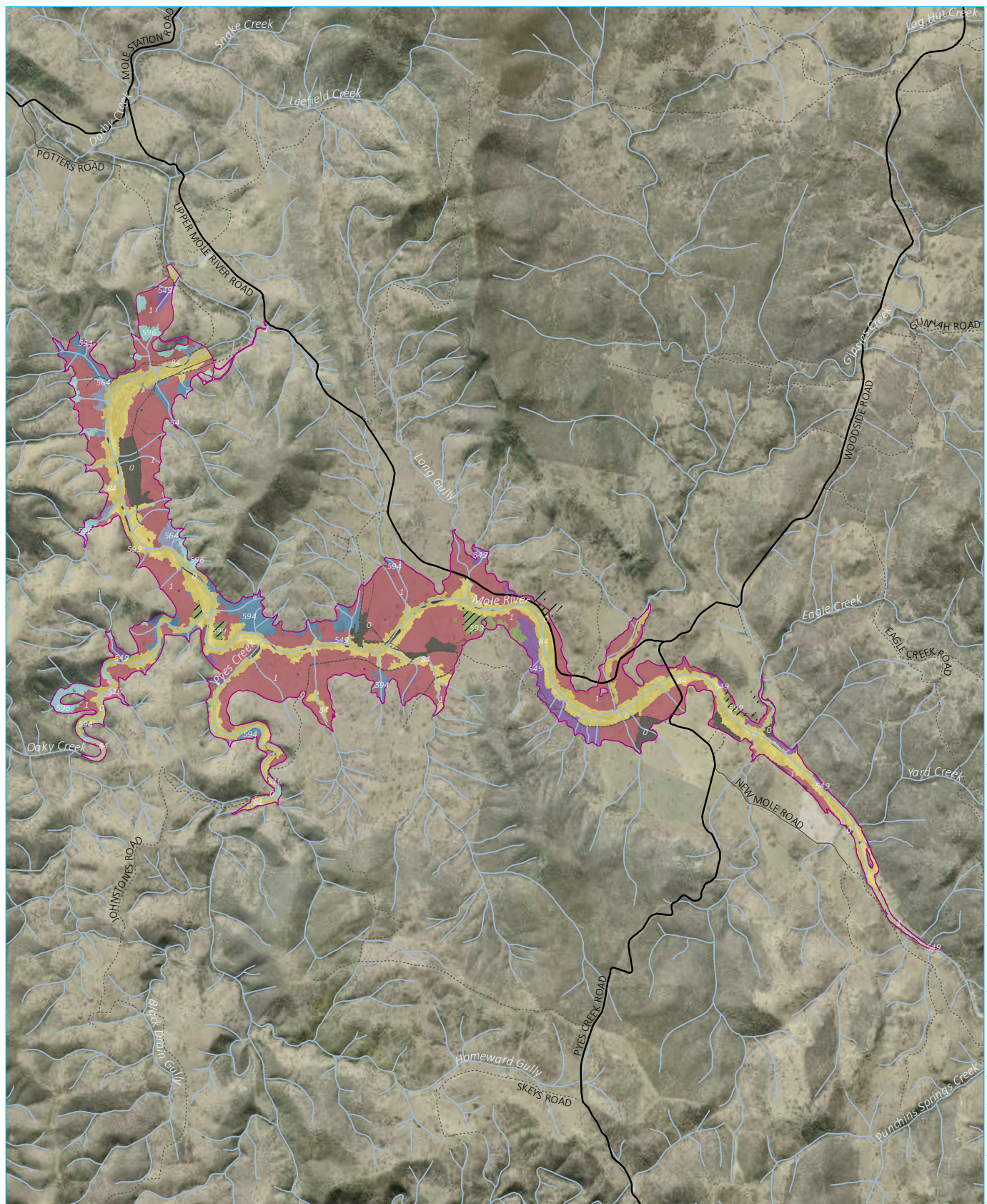
- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 7th order

Mitchell landscape

- NAN Ashford
- NET Granites

Landscape features

Mole River Dam Project
Environmental constraints assessment
Figure 4.1



Source: EMM (2020); WaterNSW (2020); DFSI (2017); ELVIS (2017); OEH (2015); DPI (2013)

*Inundation area should be considered approximate only. It is based on current limited available spatial data and is subject to future verification.

KEY

- Project footprint
- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- Potential threatened ecological community
- PCT | Not Native
- PCT1 | Candidate Native Grasslands
- PCT516 | Grey Box grassy woodland or open forest of the Nandewar Bioregion and New England Tableland Bioregion

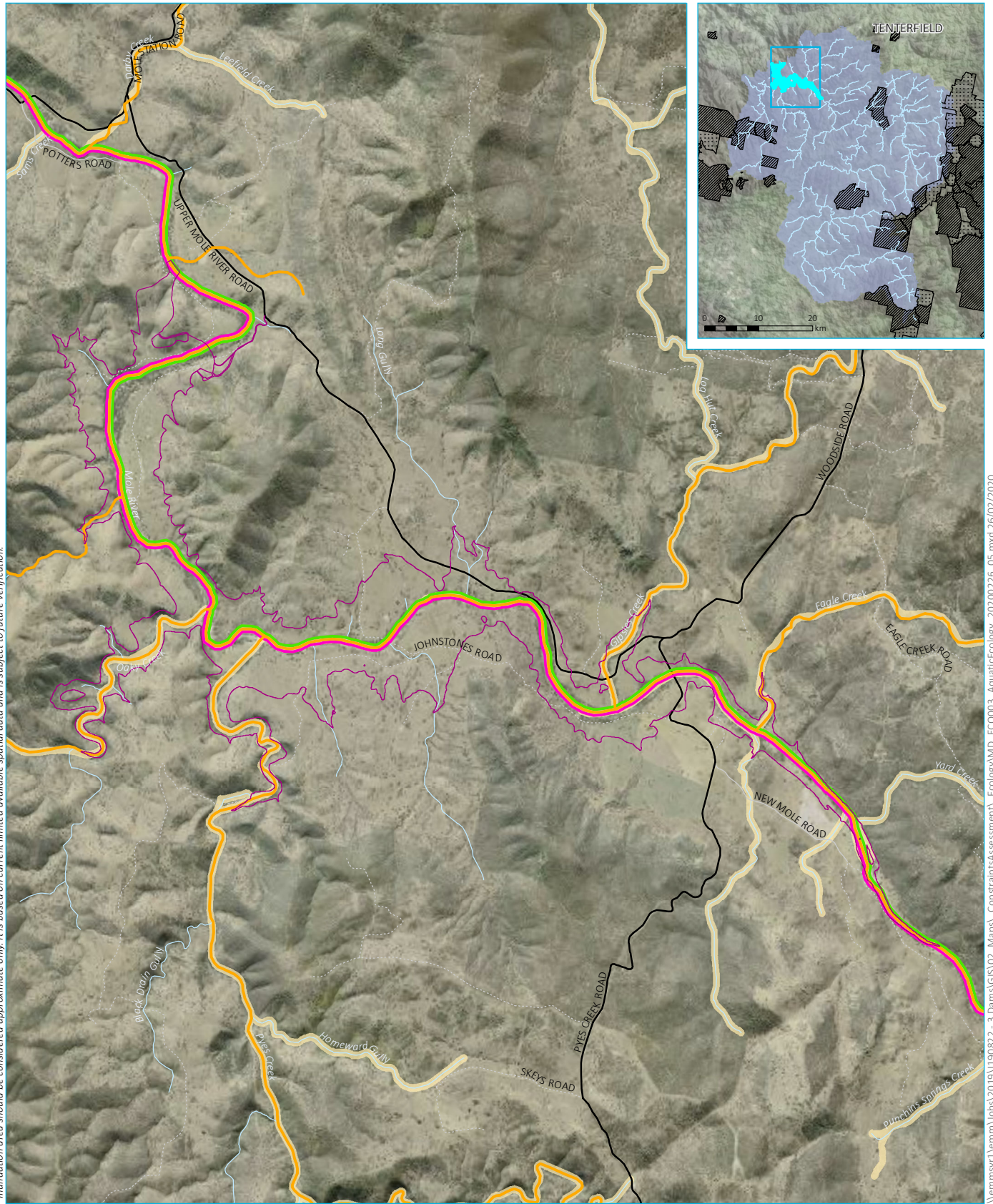
- PCT549 | Silver-leaved Ironbark - Black Cypress Pine +/- White Box shrubby open forest mainly in the northern Nandewar Bioregion
- PCT564 | White Cypress Pine - Silver-leaved Ironbark - Caley's Ironbark open forest of the central Nandewar Bioregion and western New England Tableland Bioregion
- PCT594 | Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar

- PCT596 | Tumbledown Red Gum - White Cypress Pine - Silver-leaved Ironbark shrubby woodland mainly in the northern Nandewar Bioregion
- PCT599 | Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion
- PCT84 | River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South and Nandewar Bioregions

Plant community type mapping

Mole River Dam Project
Environmental constraints assessment
Figure 4.2

Source: EMM (2020); WaterNSW (2020); DFSI (2017); ELVIS (2013); DPI (2009, 2013); BoM (2011)
 *Inundation area should be considered approximate only. It is based on current limited available spatial data and is subject to future verification.



KEY

- | | |
|---|--|
| Project footprint | Mole River Dam catchment (refer to inset) |
| Main road | Key fish habitat |
| Local road | Aquatic species |
| Vehicular track | Eel Tailed Catfish |
| Watercourse (Strahler stream order 3 and above) | Macquarie Perch |
| State forest (refer to inset) | Purple Spotted Gudgeon |
| NPWS reserve (refer to inset) | |

Aquatic habitat and species

Mole River Dam Project
 Environmental constraints assessment
 Figure 4.3

5 Discussion

This ecological constraints assessment report provides a summary of the biodiversity values present within the terrestrial and aquatic study areas of the Mole River Dam project. Data has been collated based solely on background research and very limited preliminary field survey to date.

5.1 Potential impacts

The main impacts of the Mole River Dam project will be associated with direct impacts arising from the clearing works for construction of the project, including inundation of upstream environments. Potential direct impacts arising from the project include:

- clearing of an estimated 778.4 ha of native vegetation, including communities which may meet the criteria of a TEC (Box Gum woodland);
- clearing of threatened species habitat; and
- disturbance/inundation of waterways.

In addition to the direct impacts arising from the project, a number of indirect, prescribed and uncertain impacts, as described in the BAM (OEH 2017), may also result, including:

- increased noise, vibration and dust levels during construction, resulting in disturbance of fauna species, and potential consequent abandonment of habitat, or changes in behaviour (including breeding behaviour);
- erosion and sedimentation from construction works;
- lighting for night works during construction, resulting in potential disturbance to fauna species and changes in occupancy or behaviour;
- increase in weeds and pathogens, resulting in degradation of retained native vegetation and habitat;
- increase in predatory and pest animal species, resulting in increased predation and competition and a consequent reduction in populations;
- impediment to fish passage;
- changes in flow regimes downstream of the Dam, resulting in impacts to aquatic systems, species and habitats; and
- potential for alteration in hydrogeology for any GDEs present.

Measures to avoid, minimise and mitigate impacts will need to be considered during design and further environmental assessment undertaken as a part of the EIS. Any residual impacts will need to be offset.

5.2 Offsets

5.2.1 Terrestrial ecology

Any residual impacts arising from the project, after all measures to avoid, minimise and mitigate impacts have been considered, will need to be offset. Under the NSW BOS proponents have several options for meeting an offset liability (Plate 5.1). Offset requirements for the project would be determined in consultation with relevant agencies is recommended including DAWE, NSW Biodiversity and Conservation Division (BCD) and DPI Fisheries.

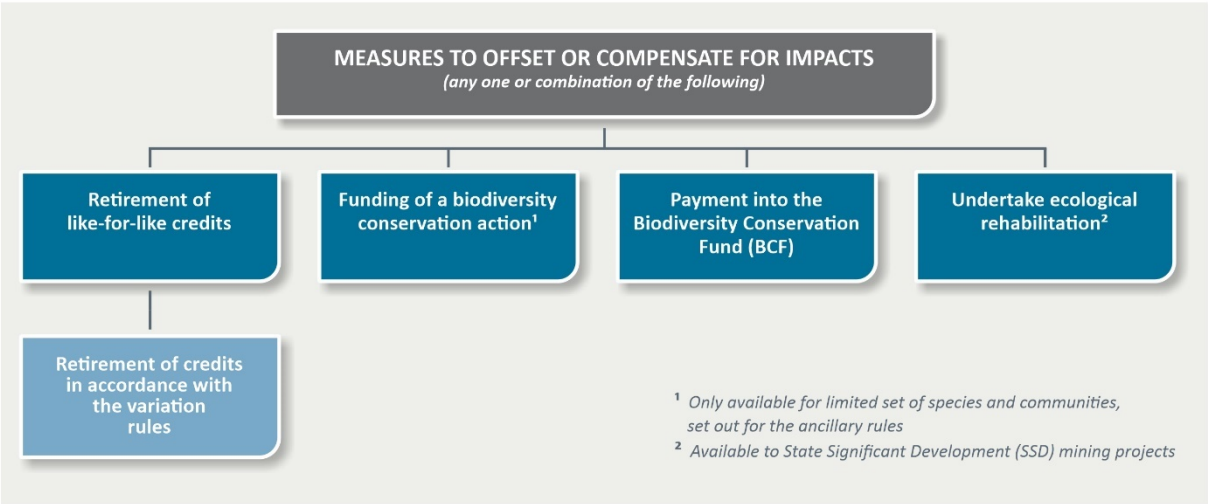


Plate 5.1 Options for meeting an offset liability

5.3 Constraints and opportunities

Using the information outlined above EMM has identified and summarised constraints and opportunities for the project requiring consideration in future design and assessment (Table 5.1).

Table 5.1 Key biodiversity constraints and opportunities

Item	Discussion
TECs listed under the BC and EPBC Act	<p>The presence of areas of Box Gum Woodland (Section 4.2) within the project footprint (about 15 ha) will require consideration during design to avoid and minimise impacts.</p> <p>Detailed vegetation mapping, including assessment against EPBC Act and BC Act condition thresholds, will be required at EIS phase.</p> <p>Presence of TECs will be considered during detailed design and in discussions with approval agencies. There are not opportunities to avoid impacts for the inundation but will seek to avoid impacts for other components of the project, such as ancillary infrastructure.</p>

Table 5.1 Key biodiversity constraints and opportunities

Item	Discussion
Threatened species including SAIL candidate entities	<p>Background research indicates that the project footprint and surrounds may support various potential candidate SAIL entities (see Table 4.3 and Table 4.4). The Minister must be satisfied that all measures to avoid and minimise impacts to SAIL entities have been considered.</p> <p>The SAIL entity concept is about protecting threatened species and threatened ecological communities that are most at risk of extinction from potential development impacts or activities. For SSI projects, the Minister is required to take impacts to SAIL entities into consideration and must determine whether there are any additional and appropriate measures that will minimise SAIL.</p> <p>Target threatened flora and fauna surveys will be performed, where possible, as part of the EIS for candidate SAIL entities. Early discussion with relevant agencies is recommended.</p>
Preliminary determination for Box Gum woodland	<p>White Box Yellow Box Blakely's Red Gum Woodland, currently listed under the BC Act as endangered, has been nominated for listing as critically endangered with a preliminary determination made. This is likely to result in an increased offset requirement and project costs.</p> <p>Regular checking new listings under the BC Act and EPBC Act is recommended. Re-assessment of impacts and offsets would be required if the ecological community is uplisted.</p>
Threatened aquatic ecological communities (FM Act)	<p>The Lowland Darling River endangered ecological community is located 35 km downstream of the Mole River Dam. Construction of the dam and holding back of flows may reduce the amount of water that is available for environmental flow release and ecosystem maintenance.</p> <p>Surface and groundwater modelling and a water balance assessment should be undertaken as well as, at a minimum, a desktop assessment of the likelihood of occurrence of and impact to this EEC. Field surveys may be required.</p>
Aquatic ecosystem impacts	<p>Background research (Section 3.1) indicates that aquatic species listed under the EPBC Act and/or FM Act have the potential to occur within, or adjacent to, the project footprint. Further survey and assessment of direct and indirect negative (and positive) impacts for these species is likely to be required.</p> <p>Reduction in surface water flow downstream has the potential to impact any surface waterbodies and/or subterranean fauna if there is a degree of ground-surface water interaction. Further assessment to understand GDEs, and quantify these impacts, is likely to be required.</p> <p>In-field survey, and discussion with DAWE and DPI Fisheries, will need to be undertaken to investigate the presence of threatened aquatic species.</p> <p>Surface and groundwater modelling and a water balance assessment should be undertaken as well as, at a minimum, a desktop assessment of the likelihood of occurrence of, and impact to, aquatic GDEs. The desktop assessment may provide recommendations that further field survey is undertaken.</p> <p>If proposed infrastructure interrupts the flow, and thus fish passage, of a waterway (3rd order or higher), management measures and /or installation of fish passageways are likely to be required.</p>
Impact of drought on ability to conduct ecological assessments	<p>There is a risk that due to the ongoing drought, vegetation within the terrestrial study area will be drought affected and the ability to conduct BAM plots impacted, with the quality of vegetation reduced.</p> <p>In addition, detectability of some threatened species may be reduced or may be minimal (eg frog species not vocalising, nomadic bird species not currently present in the survey area, or flora species not detectable due to lack of reproductive material).</p> <p>It may be necessary to assume presence for some threatened species credit species, which will need to be determined through the EIS assessment process and in consultation with BCD.</p>
Project design, including ancillary facilities and sites for sourcing construction materials	<p>At this stage, the full design of the project is yet to be determined including the location and area for any ancillary facilities within the study area.</p> <p>Where feasible, design should consider biodiversity values present and seek to minimise impacts to these values. It is recommended that the placement of ancillary facilities occur in already cleared areas wherever feasible.</p> <p>It is recommended to prioritise sourcing materials from existing quarries (which have approvals in place). If this is not possible, look to minimise biodiversity impacts as much as possible when siting quarry or borrow pits.</p>

6 Future assessment

To adequately assess the biodiversity impacts arising from the project a number of assessments will be required as a part of the EIS for the Mole River Dam. Based on the current understanding of project areas to be impacted, the anticipated assessment requirements are outlined in Table 6.1.

Table 6.1 Future assessment requirements

Assessment requirement	Potential scope of works
Detailed vegetation mapping	<ul style="list-style-type: none"> Detailed vegetation mapping, including mapped of PCTs and vegetation zones (based on condition) will be required.
Vegetation plot survey	<ul style="list-style-type: none"> Completion of vegetation plots, as per the BAM. As no plot data was collected during the constraints report, accurate descriptions of the conditions of vegetation within the project footprint and surrounds cannot generated. As a result, the estimates of the impacts and offsets to be provided in the ECA report may change. Completion of vegetation plots as per the BAM during the EIS phase will enable impacts to be quantified and required offsets identified. At this stage it is unknown how many plots will be required as it will depend on both the number and extent of vegetation zone, which are a combination of PCT and condition.
Threatened species surveys – flora	<ul style="list-style-type: none"> Targeted flora surveys, undertaken in accordance with the <i>NSW Guide to Surveying Threatened Plants</i> (OEH 2016), will be required for the 24 candidate flora species credit species outlined in Section 4.3.2i. Surveys should be undertaken in accordance with seasonal surveys requirements (Appendix B.1). A preliminary assessment indicates that November is an optimal time to for undertaking these surveys, with 21 out of 24 species able to be surveyed during this period (including five of the six candidate SAI entities). Additional surveys may be required for three species in September (including the remaining candidate SAI entity). Some species may not be able to be surveyed within the required project timeframes due to seasonality or other constraints. In accordance with the NSW Biodiversity Assessment Method (BAM) in instances where a species cannot be surveyed within the required timeframes during BDAR and EIS preparation, these species must be assumed present for the BDAR. Further surveys can be undertaken during the response to submissions or post-approval (as a part of the management plan process), and prior to construction, and addressed in a revised BDAR. If prepared post-approval, modification to the Project Approval is likely to be required.
Threatened species surveys – fauna	<ul style="list-style-type: none"> Targeted fauna surveys, undertaken in accordance with NSW and Commonwealth survey guidelines, will be required for the 27 candidate fauna species credit species outlined in Section 4.3.2ii. This will include: <ul style="list-style-type: none"> diurnal bird surveys for Red Goshawk, Regent Honeyeater, Swift Parrot, Glossy Black-cockatoo, Squatter Pigeon and Square-tailed Kite; targeted nest searches for Red Goshawk, White-bellied Sea Eagle, Little Eagle and Square-tailed Kite; hollow bearing trees surveys for Glossy Black-cockatoo, Powerful Owl, Barking Owl, Masked Owl and Greater Glider; call playback and spotlighting for nocturnal birds and mammals including Bush Stone Curlew, Powerful Owl, Barking Owl, Masked Owl, Greater Glider, Rufous Bettong, Koala, Brush-tailed Phascogale, Eastern Pygmy Possum and Grey-headed Flying-fox; small mammal trapping and arboreal mammal trapping for Eastern Pygmy Possum; remote camera surveys for Squatter Pigeon, Rufous Bettong, Black-striped Wallaby, Brush-tailed Rock-wallaby and Brush-tailed Phascogale;

Table 6.1 **Future assessment requirements**

Assessment requirement	Potential scope of works
	<ul style="list-style-type: none"> – targeted Koala surveys, using a combination of the Regularized Grid Based (RGB) Spot Assessment Technique (SAT), acoustic recording devices (for calling males) or Koala detection dogs; – acoustic surveys for microbats for Large-eared Pied-bat, Eastern Cave Bat and Eastern Bentwing-bat; – habitat assessment and nocturnal searches (visual encounter surveys (VES)) for reptiles and amphibians for Boorolong Frog, Pale-headed Snake, Zigzag Velvet Gecko and Border Thick-tailed Gecko; • Surveys should be undertaken in accordance with seasonal surveys requirements (Appendix B.1). A preliminary assessment indicates that November are an optimal time to for undertaking these surveys, with 20 out of 27 species able to be surveyed during this period (including six of the eight candidate SAI entities). Additional surveys may be required for four species in June (including one of the two remaining candidate SAI entities). The remaining species (Eastern Bentwing Bat) is most reliably surveyed in December- February, but only requires survey if breeding habitat (caves or tunnels) is present. This can be scoped in earlier surveys. • It is recommended that any species unable to be surveyed due to timeframe limitations are assumed present for the BDAR, and/or that further surveys are undertaken for any species which cannot be surveyed in accordance with NSW and Commonwealth survey guidelines during response to submissions or post-approval (as a part of the management plan process), and prior to construction.
Key fish habitat assessments	<ul style="list-style-type: none"> • Key fish habitat assessments will be required and should be undertaken as part of a comprehensive “aquatic ecology assessment”. Key fish habitat is currently mapped conservatively and does not account for variation within a waterway that would be available from field assessments. As such, there is potential for estimates of impacts on key fish habitat to be overestimated, and thus aquatic ecology offsets to be overestimated. In-field characterisation, in combination with examination of existing stream order data, will be required to be undertaken (in accordance with DPI policy) by assessing “waterway type” and “waterway class”.
Threatened species surveys – aquatic fauna	<ul style="list-style-type: none"> • Aquatic surveys will need to be undertaken as part of a comprehensive “aquatic ecology assessment” to document the aquatic values within the aquatic study area. Targeted surveys, undertaken in accordance with NSW and Commonwealth guidelines, will be required for up to four threatened aquatic species and potentially for the Platypus, as outlined in Section 4.5. This may include a combination of the following methods, or alternative accepted methods; gill netting, fyke netting, electrofishing, angling, eDNA sample analysis, etc. • It should be noted that consultation with DPI Fisheries should be undertaken as soon as practicable to discuss appropriate sampling techniques and expectations.
GDE assessment	<ul style="list-style-type: none"> • Reduction in surface water base flow downstream has the potential to impact any surface waterbodies and/or subterranean fauna if there is a degree of ground-surface water interaction. Further assessment to understand GDEs, and quantify these impacts, is likely to be required. Surface and groundwater modelling and a water balance assessment should be undertaken as well as, at a minimum, a desktop assessment of the likelihood of occurrence of, and impact to, aquatic GDEs. The desktop assessment may provide recommendations that further field survey is undertaken.

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					https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10783			
OEH	2020j,	<i>Bush Stone-curlew</i>	–	<i>profile,</i>	viewed	5	February	2020,
					https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10113			
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Appendix A

Species credit species habitat suitability assessment



A.1 Flora species credit species

Table A.1 Flora species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
<i>Acacia atrox</i>	Myall Creek Wattle		E	-	No. Dense shrub growing in two populations near Delungra and Gurley in north-west NSW. Grows on the upper slope and crests of hills in partly cleared paddocks adjacent to dry sclerophyll forest primarily in North-west Slopes Dry Sclerophyll Woodlands and Western Slopes Dry Sclerophyll Forests. Grows on basalt in deep clay soils. The project footprint is over 100 km from the two populations near Delungra and Gurley (ALA, 2020), therefore the likelihood of species occurring in the terrestrial study area is low.
<i>Acacia macnuttiana</i>	MacNutt's Wattle	V	V	-	Yes. The species has been recorded within 10 km of the project footprint previously and the area meets the geographic, geological and habitat requirements of the species. Upright or spreading shrub confined to the New England Tablelands and North West Slopes in widely scattered sites from the Tenterfield area and west towards Torrington. Grows near streams in Northern Montane Heaths, Northern Tableland Dry Sclerophyll Forests, McKies Stringybark/Blackbutt Open Forest and New England Peppermint Grassy Woodlands. Grows on granite or metasediments (DEWHA, 2008a).
<i>Acacia pubifolia</i>	Velvet Wattle	V	E	Yes. Rocky areas occur within the project footprint or within 50 m of the project footprint.	-

Table A.1 Flora species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
<i>Acacia pycnostachya</i>	Bolivia Wattle	V	V		Yes. The species grows amongst granite outcrops on hillsides at altitudes of 700-900 m in New England Dry Sclerophyll Forests, Northern Tableland Dry Sclerophyll Forests and Northern Montane Heaths (DoE, 2014a). The species has been recorded within 10 km of the project footprint previously and the terrestrial study area meets the geographic, geological and habitat requirements of the species.
<i>Acacia ruppii</i>	Rupp's Wattle	E	E		No. An erect, open shrub growing at elevations of 50-150 metres in the Banyabba-Coaldale area north-west of Grafton. Grows in dry open forest and shrublands near creeks and roadsides in association with Needlebark Stringybark Eucalyptus planchoniana, Red Bloodwood Corymbia gummifera and Smudgy Apple Angophora woodsiana. Grows in sandy soils. The project footprint is over 100 km from recorded population in the Banyabba-Coaldale area north-west of Grafton (ALA, 2020).
<i>Almaleea cambagei</i>	Torrington Pea	V	E	Yes. Periodically inundated swamps are likely to occur within the project footprint or within 50 m of the project footprint.	This species has previously been recorded within 10 km of the project footprint.
<i>Angophora exul</i>	Gibraltar Rock Apple		E	Yes. Shallow soils in dry open woodland and rocky slopes occur in the project footprint.	This species has previously been recorded within 10 km of the project footprint.
<i>Asterolasia beckersii</i>	Dungowan Starbush		E	-	No. The Dungowan Starbush is a newly discovered shrub 1.5 - 3.5 m high with branches and leaves covered by

Table A.1 Flora species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
					fawn-coloured star-shaped hairs. Dungowan Starbush is only known from eleven locations in the local region around Dungowan Dam near Tamworth. The project footprint is over 250 km from these recorded populations (ALA, 2020).
<i>Astrotricha roddii</i>	Rod's Star Hair	E	E	-	Yes. The species grows on granite and acid volcanic outcrops including rock crevices in North-west Slopes Dry Sclerophyll Woodlands, Northern Tableland Dry Sclerophyll Forests and Western Slopes Dry Sclerophyll Forest (DEWHA, 2008b). Although the project footprint is over 70 km from recorded populations growing in Kwiambal, Kings Plains National Park, Severn River Nature Reserve and Severn River State Forest, habitat and geological requirements of the species exist within the terrestrial study area.
<i>Bertya opposens</i>		V	V	-.	No. Slender shrub recorded from four scattered sites in NSW, one at Coolabah, two south of Narrabri and the fourth near Cobar. Grows on ridges with mallee in a wide variety of communities including North-west Slopes Dry Sclerophyll Woodlands, Pilliga Outwash Dry Sclerophyll Forests, Western Slopes Dry Sclerophyll Forests and Inland Rocky Hill Woodlands. Grows in shallow, red soils. The project footprint is over 300 - 500 km from recorded populations in western NSW (ALA, 2020).
<i>Boronia granitica</i>	Granite Boronia	E	V	Yes.	This species has previously been recorded within 10 km of the project footprint.

Table A.1 **Flora species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)**

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
				Rocky areas within 50m of granite outcrops or slabs do not occur in the terrestrial study area.	
<i>Cadellia pentastylis</i>	Ooline	V	V	-	Yes. The species grows in low to medium nutrient soils ranging from surface layers of sandy loam grading to light-medium clay soils deeper in the soil profile (DEWHA, 2008c). The species has been recorded within 10 km of the project footprint previously and the area meets the geographic, geological and habitat requirements of the species.
<i>Callistemon pungens</i>		V		-	Yes. The species is distributed throughout the north-east region of NSW. The species has been recorded within 10 km of the project footprint previously and the area meets the geographic and habitat requirements of the species.
<i>Capparis canescens</i>	Wild Orange		E	-	Yes. The species grows in a variety of communities including North-west Slopes Dry Sclerophyll Woodlands, Western Slopes Dry Sclerophyll Forests, Yetman Dry Sclerophyll Forests and Floodplain Transition Woodlands (OEH, 2020a). Although previously recorded populations of the species near Bonshaw and Ashford are 40 - 60 km from the project footprint, habitat requirements of the species are present within the terrestrial study area.
<i>Commersonia procumbens</i>		V	V	No.	-

Table A.1 Flora species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
				Piliga sandstone does not occur in the project footprint.	
<i>Dichanthium setosum</i>	Bluegrass	V	V	-	Yes. The species Grows in moderately disturbed areas including cleared woodlands, roadside remnants and agricultural pasturelands in a variety of communities including Inland Riverine Forests, Northern Tableland Dry Sclerophyll Forests, Western Slopes Grassy Woodlands and Coastal Valley Grassy Woodlands (OEH, 2020b). Although this species has not been previously recorded within 10 km of the project footprint, geographic, geological and habitat requirements of the species are present within the terrestrial study area.
<i>Digitaria porrecta</i>	Finger Panic Grass		E		No. Loosely tufted grass growing on the North West Slopes and Plains spanning from Moree to Tambar Springs in the south, and Coonabarabran to Tamworth. Grows in grasslands, woodlands, travelling stock routes and along roadsides in a variety of communities including Western Slopes Grassy Woodlands, Riverine Plain Woodlands, Western Slopes Grasslands and Semi-arid Floodplain Grasslands. Grows on fertile soils. The study area is over 200 km from recorded populations in western NSW (ALA, 2020). Habitat requirements of the species are unlikely to occur within the terrestrial study area.
<i>Eucalyptus caleyi</i> subsp. <i>ovendenii</i>	Ovenden's Ironbark	V	V	-	No.

Table A.1 **Flora species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)**

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
					<p>Medium sized tree distributed within the New England Tablelands from west of Guyra to the west of Tenterfield. Grows in grassy woodland between elevations of 610 to 820m in North-west Slopes Dry Sclerophyll Woodlands, Northern Tableland Dry Sclerophyll Forests and Western Slopes Dry Sclerophyll Forests. Grows on dry shallow soils of moderate fertility on granitic substrates.</p> <p>This species has not been previously recorded within 10 km of the project footprint, and the terrestrial study area does not fall within the elevational requirements (610 – 820 m) of the species (OEH, 2020c).</p>
<i>Eucalyptus magnificata</i>	Northern Blue Box		E	-	<p>No.</p> <p>Medium sized tree, recorded from a few, widely distributed populations spanning from Hillgrove east of Armidale and in the Glen Innes and Tenterfield region. Most populations occurring on travelling stock routes or private property on moderately hilly sites and at the edge of gorges at elevations between 900m - 1050m in Northern Gorge Dry Sclerophyll Forests, North-west Slopes Dry Sclerophyll Woodlands, Western Slopes Dry Sclerophyll Forests, New England Grassy Woodlands and Western Slopes Grassy Woodlands. Grows on shallow sandy or loamy soils.</p> <p>This species has not been previously recorded within 10 km of the project footprint, and the terrestrial study area does not fall within the elevational requirements (900m – 1050 m) of the species (OEH, 2020d).</p>

Table A.1 Flora species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	V	V	-	Yes. The species grows on slopes and ridges in a variety of communities including New England Dry Sclerophyll Forests, Western Slopes Dry Sclerophyll Forests, New England Grassy Woodlands and Tableland Clay Grassy Woodlands (DEWHA, 2008d). Although this species has not been previously recorded within 10 km of the project footprint, geographic, geological and habitat requirements of the species are present within the terrestrial study area.
<i>Euphrasia arguta</i>		CE	CE	-	No. Semiparasitic, erect annual herb restricted to the Nundle area of the NSW north-western slopes and tablelands. Historically this species has been collected from an area extending from Sydney to Bathurst and north to Walcha. Grows in grassy areas near rivers in a variety of communities including Upper Riverina Dry Sclerophyll Forests, Western Slopes Dry Sclerophyll Forests, Western Slopes Grassy Woodlands and Temperate Montane Grasslands. Although historically recorded, the project footprint is over 250 km from recorded restricted populations near Nundle (ALA, 2020).
<i>Grevillea beadleana</i>	Beadle's Grevillea	E	E	Yes. Cliffs, escarpments or rocky areas occur within the project footprint or within 200 m of the project footprint.	This species has previously been recorded within 10 km of the project footprint.
<i>Haloragis exalata subsp. velutina</i>	Tall Velvet Sea-berry	V	V	-	Yes. The species grows in damp, places adjacent to watercourses and on steep, rocky slopes of gorges in

Table A.1 Flora species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
					<p>New England Dry Sclerophyll Forests, Eastern Riverine Forests, Inland Riverine Forests, New England Grassy Woodlands, Northern Gorge Dry Sclerophyll Forests and Western Vine Thickets (DEWHA, 2008e).</p> <p>Although this species has not been previously recorded within 10 km of the project footprint, geographic, geological and habitat requirements of the species are present within the terrestrial study area.</p>
<i>Homopholis belsonii</i>	Belson's Panic	V	E	-	<p>No.</p> <p>Perennial grass growing on the northwest slopes and plains of NSW between Wee Waa, Goondiwindi and Glen Innes in the Brigalow Belt South Bioregion. Grows in a variety of communities including Yetman Dry Sclerophyll Forests, Semi-arid Floodplain Grasslands, Western Vine Thickets, Riverine Plain Woodlands and Subtropical Semi-arid Woodlands. Usually grows on poor soils, occasionally found on basalt enriched sites in alluvial clay soils.</p> <p>The project footprint is over 70 km from recorded populations at Glen Innes in the Brigalow Belt South Bioregion (ALA, 2020).</p>
<i>Indigofera baileyi</i>	Bailey's Indigo		E	-	<p>Yes.</p> <p>The species grows in open woodland situations in a variety of communities including New England Dry Sclerophyll Forests, Western Slopes Grasslands, Northern Escarpment Wet Sclerophyll Forests and Coastal Valley Grassy Woodlands (OEH, 2020e).</p> <p>Although this species has not been previously recorded within 10 km of the project footprint, geographic, geological and habitat requirements of</p>

Table A.1 **Flora species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)**

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
					the species are present within the terrestrial study area.
<i>Lepidium peregrinum</i>	Wandering Pepper Cress	E	E	-	<p>Yes.</p> <p>The species grows in Eastern Riverine Forests, Inland Riverine Forests and New England Grassy Woodlands. Grows on sandy alluvium (DoE, 2014b).</p> <p>The species has been recorded within 10 km of the project footprint previously and the terrestrial study area meets the geographic and habitat requirements of the species.</p>
<i>Leucopogon confertus</i>	Torrington Beard-heath	E	E	-	<p>Yes.</p> <p>The species grows in open forest and woodland in rocky areas in Northern Tableland Dry Sclerophyll Forests, New England Grassy Woodlands, and Northern Montane Heaths (DEWHA, 2008f).</p> <p>The species has been recorded within 10 km of the project footprint previously and the terrestrial study area meets the geographic and habitat requirements of the species.</p>
<i>Monotaxis macrophylla</i>	Large-leafed Monotaxis		E	-	<p>Yes.</p> <p>The species grows on rocky ridges and hillsides at elevations between 0 m to 1300 m in a variety of communities including New England Dry Sclerophyll Forests, Northern Gorge Dry Sclerophyll Forests, Northern Montane Heaths and New England Grassy Woodlands (OEH, 2020f).</p> <p>Although this species has not been previously recorded within 10 km of the project footprint, geographic, geological and habitat requirements of the species are present within the terrestrial study area.</p>

Table A.1 Flora species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
<i>Phebalium glandulosum</i> <i>subsp. eglandulosum</i>	Rusty Desert Phebalium	V	E	Yes. Granite or acid volcanic outcrops or slabs are likely to occur within the project footprint or within 50 m of the project footprint.	This species has previously been recorded within 10 km of the project footprint.
<i>Philotheca ericifolia</i>		V		-	No. Medium sized shrub distributed throughout the Central Western Slopes from the Upper Hunter Valley, to Pilliga and to the Peak Hill District. Found growing on damp sandy flats, drainage areas and gullies in dry sclerophyll open forests and woodlands. Grows on sandstone substrates in sand soils or alluvial deposits of coarse gravel on creek beds. The project footprint is over 250 km from recorded populations in south-western NSW (ALA, 2020). Geological requirements of the species are unlikely to occur within the terrestrial study area.
<i>Picris evae</i>	Hawkweed	V	V	-	Yes. Soft stemmed annual with a population distribution spanning north from the Inverell area including Inverell, Elsmore and Myall Creek, Oxley Park and Dangar Falls in the Oxley Wild Rivers National Park. Found growing in modified and disturbed areas in a variety of communities including New England Dry Sclerophyll Forests, Western Slopes Dry Sclerophyll Forests, Floodplain Transition Woodlands, New England Grassy Woodlands and Temperate Montane Grasslands. Grows in shallow black, dark grey or red-brown stony soils, reddish clay-loam or medium clay soils. Although this species has not been previously recorded within 10 km of the project footprint, geographic, geological and habitat requirements of

Table A.1 Flora species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
					the species are present within the terrestrial study area.
<i>Pimelea curviflora</i> var. <i>curviflora</i>		V	V	No Grows on sandstone substrates in shale/lateritic soils and shale/sandstone transition soils.	No. The project footprint is over 500 km from recorded populations in south-western NSW (ALA, 2020).
<i>Platyzoma microphyllum</i>	Braid Fern		E	-	No. Clumped fern confined to the Yetman district. Grows singly or in clumped populations adjacent to streams, lagoons and areas subject to periodic flooding in Western Slopes Dry Sclerophyll Forests, Yetman Dry Sclerophyll Forests, Eastern Riverine Forests, Inland Riverine Forests, Inland Floodplain Shrublands, Inland Floodplain Swamps, Montane Bogs and Fens and Northern Tableland Wet Sclerophyll Forests. Grows in sandy, swampy or clay soils. The project footprint is over 100 km from confined populations in Yetman district (ALA, 2020).
<i>Polygala linariifolia</i>	Native Milkwort		E	-	Yes. The species grows in a variety of communities including Pilliga Outwash Dry Sclerophyll Forests, New England Grassy Woodlands, North-west Alluvial Sand Woodlands, Coastal Swamp Forests, Northern Tablelands Wet Sclerophyll Forests, Fuzzy Box Woodland, White Cypress Pine-Bulloak-Ironbark Woodland, Rough-barked Apple riparian forb-grass open forest, Ironbark-Brown Bloodwood Shrubby Woodland (OEH, 2020g). A small number of the species has been recorded within 10 km of the project footprint previously and

Table A.1 **Flora species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)**

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
<i>Pomaderris queenslandica</i>	Scant Pomaderris		E	-	<p>the terrestrial study area meets the geographic and habitat requirements of the species.</p> <p>Yes.</p> <p>The species grows in sheltered woodlands with a scrubby understorey, occasionally adjacent to creeks in a variety of communities including New England Dry Sclerophyll Forests, Yetman Dry Sclerophyll Forests, Western Slopes Grassy Woodlands, Northern Montane Heaths and North Coast Wet Sclerophyll Forests (OEH, 2020h).</p> <p>Although this species has not been previously recorded within 10 km of the project footprint, geographic, geological and habitat requirements of the species are present within the terrestrial study area.</p>
<i>Prasophyllum sp. wybong</i>	Tarengo Leek Orchid	CE		-	<p>No.</p> <p>Terrestrial orchid restricted to five sites within NSW at Boorowa, Captains Flat, Ilford, a Travelling Stock Route at Delegate and 10 kilometres south-east of Muswellbrook. Found growing in open sites and patchy forest in Natural Temperate Grassland, Box-Gum Woodlands, Temperate Montane Grasslands, Southern Tableland Grassy Woodlands, Subalpine Woodlands, Tableland Clay Grassy Woodlands, Western Slopes Grassy Woodlands. This species is cryptic and most visible when flowering between October and December. Grows in fertile soils.</p> <p>The project footprint is over 600 km from recorded populations in south-western NSW (ALA, 2020). Habitat requirements of the species do not occur within the terrestrial study area.</p>

Table A.1 Flora species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
<i>Rhodamnia rubescens</i>	Scrub Turpentine			-	<p>No.</p> <p>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 <i>R. rubescens</i> typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000-1,600 mm.</p> <p>The project footprint is over 400 km from recorded populations in QLD (ALA, 2020). Habitat requirements of the species do not occur within the terrestrial study area.</p>
<i>Rutidosis heterogama</i>	Heath Wrinklewort	V	V	-	<p>Yes.</p> <p>Small perennial herb with populations located in the Cessnock to Kurri Kurri area with outlying occurrences at Howes Valley, from Wyong to Newcastle on the Central Coast and Wooli to Evans Head in Yuraygir and Bundjalung National Parks and in New England Tablelands from Torrington and Ashford south to Wandsworth south-west of Glen Innes. Grows mostly in heath and along roadsides in coastal districts in a variety of communities including North-west Slopes Dry Sclerophyll Woodlands, Western Slopes Dry Sclerophyll Forests, Northern Tableland Wet Sclerophyll Forests, Maritime Grasslands, Coastal Headland Heaths and Wallum Sand Heaths. Grows in sandy soils.</p> <p>Although this species has not been previously recorded within 10 km of the project footprint, geographic, geological and habitat requirements of the species are present within the terrestrial study area.</p>

Table A.1 Flora species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
<i>Swainsona murrayana</i>	Slender Darling Pea	V	V	-	<p>No.</p> <p>Small sparsely downy forb distributed between Jerilderie and Deniliquin areas of the southern Riverine Plain as far north as Willandra National Park, near Broken Hill and between Dubbo and Mudgee. Found growing on level plains, floodplains and depressions in a variety of communities including Riverine Chenopod Shrublands, Semi-arid Floodplain Shrublands, Western Slopes Grasslands, Brigalow Clay Plain Woodlands, Riverine Plain Woodlands and Inland Saline Lakes. Grows in heavy clay based soils ranging from grey, red and brown cracking clays to red-brown earths and loams.</p> <p>The project footprint is over 600 km from recorded populations in south-western NSW (ALA, 2020). Habitat requirements of the species do not occur within the terrestrial study area.</p>
<i>Swainsona sericea</i>	Silky Swainson-pea		V	-	<p>Yes.</p> <p>The species grows in a variety of communities including Natural Temperate Grasslands, Snow Gum (<i>Eucalyptus pauciflora</i>) Woodlands on the Monaro, Box-Gum Woodland, New England Dry Sclerophyll Forests, North-west Slopes Dry Sclerophyll Woodlands, North-west Plain Shrublands, Western Slopes Grasslands, Floodplain Transition Woodlands and Subalpine Woodlands (OEH, 2020i).</p> <p>Although this species has not been previously recorded within 10 km of the project footprint, geographic, geological and habitat requirements of the species are present within the terrestrial study area.</p>

Note: V = Vulnerable, E = Endangered, CE = Critically Endangered

A.2 Fauna species credit species

Table A.2 Fauna species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
<i>Litoria booroolongensis</i>	Booroolong Frog	E	E	-.	<p>Yes.</p> <p>The species is found in upland rivers, montane creeks and lowland rivers and creeks, particularly in permanent rocky western-flowing streams and rivers on the slopes and tablelands of NSW, with some fringing vegetation cover such as ferns, sedges or grasses (DEWHA, 2007).</p> <p>Although this species has not been previously recorded within 10 km of the project footprint, this species cannot be discounted from potentially occurring on site as appropriate habitat as part of western-flowing streams of the Great Dividing Range is within the terrestrial study area.</p>
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	CE	Mapped important areas to be checked with the NSW Biodiversity and Conservation Division (BCD).	<p>Yes – for foraging.</p> <p>Considered unlikely to be mapped as 'important habitat' as a breeding area for the species, due to location.</p> <p>Most records are from box-ironbark eucalypt forest associations and wet lowland coastal forests (DoE, 2015a).</p>

Table A.2 Fauna species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
					Although this species has not been previously recorded within 10 km of the project footprint, this species cannot be discounted from potentially occurring on site as distribution and habitat requirements of the species are present within the terrestrial study area. Could occur in suitable flowering events as non-breeding visitor.
<i>Ardeotis australis</i>	Australian Bustard		E	-	No. This species appears to be confined to areas where the upper vegetation canopy cover is less than 10% or under 2m high (NPWS 1996). Mainly occurs in open woodland, low shrubland, farmland and roost in tree or on a high vantage point on the ground (Blakers et al. 1984, NPWS 1996). Although habitat requirements of the species are present within the terrestrial study area, this species occurs further north and west and is unlikely to occur (ALA, 2020).
<i>Burhinus grallarius</i>	Bush Stone-curlew		E	-	Yes. The species occurs in lightly timbered open forest and woodland, or partly cleared

Table A.2 Fauna species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
					farmland with remnants of woodland, with a ground cover of short sparse grass and few or no shrubs where fallen branches and leaf litter are present (OEH, 2020j). Although this species has not been previously recorded within 10 km of the project footprint, this species cannot be discounted from potentially occurring on site as distribution and habitat requirements of the species are present within the terrestrial study area.
<i>Calidris ferruginea</i>	Curlew Sandpiper	CE	E	-	No. Inhabits sheltered intertidal mudflats. Also non-tidal swamps, lagoons and lakes near the coast. Infrequently recorded inland. The project footprint is over 200 km from recorded populations in coastal and near-coastal areas (ALA, 2020). Although the species can occur on suitable inland waterbodies, none are present in the terrestrial study area currently.
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo		V, EP	Yes. While Eucalypt tree species with hollows greater than 9 cm diameter occur within the	-

Table A.2 Fauna species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
				terrestrial study area, the area is outside the known distribution of the species.	
<i>Calyptrorhynchus lathamii</i>	Glossy Black-Cockatoo		V, EP	Yes. Living or dead tree with hollows greater than 15 cm diameter and greater than 5 m above ground occur within the terrestrial study area.	There are records within 10 km of the project footprint.
<i>Erythrotriorchis radiatus</i>	Red Goshawk	VU	CE	-	No. Occur in forest and woodland habitat near permanent water. In NSW prefer Melaleuca swamp forest and open eucalypt woodland. Require greater than 20 m tall trees for nesting. The species has not been recorded within 10 km of the project footprint previously. Although the terrestrial study area meets the habitat requirements of the species such as open eucalypt woodland and tall nesting trees, the species has not been confidently recorded in New South Wales in recent years.
<i>Geophaps scripta</i>	Squatter Pigeon	V	E	-	Yes. The species occurs in grassy plains, preferring sandy areas close to water.

Table A.2 Fauna species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
					Although this species has not been previously recorded within 10 km of the project footprint, this species cannot be discounted from potentially occurring on site as distribution and habitat requirements are present within the terrestrial study area, and the species occurs just over the Queensland border nearby.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle		V	Yes. Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines occur within the terrestrial study area.	There are records within 10 km of the project footprint.
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard		V	Yes. Land within 40 m of riparian woodland on inland watercourses/waterholes containing dead or dying eucalypts occur within the terrestrial study area.	-
<i>Hieraaetus morphnoides</i>	Little Eagle		V	Yes. Live (occasionally dead) large old trees within vegetation for nesting occur within the terrestrial study area.	-
<i>Lathamus discolor</i>	Swift Parrot	CE	E	As per mapped areas (note these areas have been requested but are not available in time for this report).	Only present in non-breeding season; present in northern NSW for a shorter period than southern NSW.

Table A.2 Fauna species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
					The area may be mapped as 'important habitat' for the species (although based on distribution this is considered unlikely). A request has been submitted to the NSW Biodiversity and Conservation Division (BCD) to seek to confirm whether this applies to the site, as they hold the mapping for this species.
<i>Lophochroa leadbeateri</i>	Major Mitchell's Cockatoo		V	No. While living or dead trees with hollows greater than 10 cm diameter for occur within the terrestrial study area, the area is not part of semi-arid and arid regions in which the species occur.	The terrestrial study area is not within the known distribution for this species.
<i>Lophoictinia isura</i>	Square-tailed Kite		V	Yes. Nest trees occur within the terrestrial study area.	-
<i>Ninox connivens</i>	Barking Owl		V	Yes. Living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground occur within the terrestrial study area.	-
<i>Ninox strenua</i>	Powerful Owl		V	Yes. Living or dead trees with hollow greater than 20 cm diameter occur within the terrestrial study area.	There are records within 10 km of the project footprint.

Table A.2 Fauna species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
<i>Polytelis swainsonii</i>	Superb Parrot	V	V	No. While living or dead <i>Eucalyptus blakelyi</i> , <i>E. melliodora</i> , <i>E. albens</i> , <i>E. camaldulensis</i> , <i>E. microcarpa</i> , <i>E. polyanthemos</i> , <i>E. mannifera</i> or <i>E. intertexta</i> with hollows greater than 5cm diameter; greater than 4 m above ground or trees with a DBH of greater than 30 cm occur within the terrestrial study area, the area is outside the known distribution of the species.	The project footprint is not within the known eastern inland NSW locations of this species, and although birds move north in winter, this species is unlikely to occur in the terrestrial study area (ALA, 2020).
<i>Tyto novaehollandiae</i>	Masked Owl		V	Yes. Living or dead trees with hollows greater than 20 cm diameter occur within the terrestrial study area.	-
<i>Aepyprymnus rufescens</i>	Rufous Bettong		V	-	Yes. The species occurs in a variety of habitats for coastal eucalypt forest, through tall, wet sclerophyll, to low, dry open woodland. Only occurs in areas with a sparse or grassy understorey, adjacent to areas of dense undergrowth (OEH, 2020k). Although this species has not been previously recorded within 10 km of the project footprint, this species cannot be discounted from potentially occurring on site as distribution, geological and habitat requirements of the species are

Table A.2 Fauna species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
					present within the terrestrial study area.
<i>Cercartetus nanus</i>	Eastern Pygmy-possum		V	-	<p>Yes.</p> <p>The species inhabits rainforest through to sclerophyll forest and tree heath. Banksias and myrtaceous shrubs and trees are a favoured food source (OEH, 2020).</p> <p>Although this species has not been previously recorded within 10 km of the project footprint, this species cannot be discounted from potentially occurring on site as distribution and habitat requirements of the species are present within the terrestrial study area.</p>
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	VU	V	<p>Yes.</p> <p>The terrestrial study area is within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels.</p>	-
<i>Miniopterus orianae oceanensis</i>	Eastern Bent-wing Bat		V	-	<p>Occurs from Victoria to Queensland, on both sides of the Great Dividing Range. Forms large maternity roosts (up to 100,000 individuals) in caves and mines in spring and summer. Individuals may fly</p>

Table A.2 Fauna species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
					several hundred kilometres to their wintering sites, where they roost in caves, culverts, buildings, and bridges. They occur in a broad range of habitats including rainforest, wet and dry sclerophyll forest, paperbark forest and open grasslands. Has a fast, direct flight and forages for flying insects (particularly moths) above the tree canopy and along waterways. The species has been recorded within 10 km of the project footprint previously and the terrestrial study area meets the habitat requirements of the species.
<i>Mormopterus eleryi</i>	Bristle-faced free-tailed bat, Hairy-nosed Freetail Bat		E	No. While the terrestrial study area is within 500 m of watercourses or dams surrounded by eucalypts containing hollows, the area is not part of the three disjunct locations where this species is known to occur.	The project footprint is not within the known distribution for this species.
<i>Petauroides volans</i>	Greater Glider	V	E	-	Yes. The species inhabits a variety of eucalypt forests and woodlands (DoE, 2016). Although this species has not been previously recorded within 10 km of the project footprint,

Table A.2 Fauna species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
					this species cannot be discounted from potentially occurring on site as appropriate distribution, habitat and foraging requirements are present within the terrestrial study area.
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	V	E	Yes. The terrestrial study area is within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliff lines.	-
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale		V	-	Yes. The species prefers open forests with a sparse ground cover, but also inhabits mallee and rainforests (OEH, 2020m). Although this species has not been previously recorded within 10 km of the project footprint, this species cannot be discounted from potentially occurring on site as appropriate distribution, habitat and foraging requirements are present within the terrestrial study area.
<i>Phascolarctos cinereus</i>	Koala	V	V, EP	Yes. Important habitat (however this is not a mapped important habitat area) is defined by the density of koalas and quality of habitat determined by on-site survey.	There are records within 10 km of the project footprint.

Table A.2 Fauna species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	Yes. Breeding camps may occur within the terrestrial study area.	-
<i>Vespadelus troughtoni</i>	Eastern Cave Bat		V	Yes. The terrestrial study area is within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within 2 km of old mines, tunnels, old buildings or sheds.	There are records within 10 km of the project footprint.
<i>Aprasia parapulchella</i>	Pink-tailed Legless Lizard	V	V	No. While rocky areas occur within the terrestrial study area, the area is outside the known distribution of the species.	The terrestrial study area is not within the known distribution for this species.
<i>Cacophis harriettae</i>	White-crowned Snake		V	No. While litter, surface rocks and fallen timber occur within the study area, the terrestrial study area is outside the known distribution of the species.	The terrestrial study area is not within the known distribution for this species.
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake		V	-	Yes. The species is found in a variety of habitats from wet sclerophyll forest to dry eucalypt forest on the western slopes of NSW (OEH, 2020n). Although this species has not been previously recorded within 10 km of the project footprint, this species cannot be discounted from potentially occurring on site as appropriate distribution and habitat

Table A.2 Fauna species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
					requirements are present within the terrestrial study area.
<i>Oedura rhombifer</i>	Zigzag Velvet Gecko		E	-	Yes. This species is largely arboreal, and is generally found in woodland habitats, dominated by <i>Eucalyptus sideroxylon</i> , <i>E. moluccana</i> , <i>E. blakelyi</i> and <i>Callitris</i> species (OEH, 2020o). Although this species has not been previously recorded within 10 km of the project footprint, this species cannot be discounted from potentially occurring on site as appropriate distribution and habitat requirements are present within the terrestrial study area. Records just to the southwest around Kings Plains and Severn River and over the border in Queensland.
<i>Underwoodisaurus sphyrurus</i>	Border Thick-tailed Gecko	V	V	-	Yes. The species found in undisturbed habitat remnants on rock outcrops and stony hills within eucalypt and cypress-pine open forest or woodland (DEWHA, 2008g). This species has been previously recorded within 10 km of the project footprint and the

Table A.2 Fauna species credit species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Habitat / geographic constraint present	Assessment of habitat suitability
		EPBC Act	BC Act		
					terrestrial study area meets the habitat requirements of the species.

Note: V = Vulnerable, E = Endangered, EP = Endangered Population, CE = Critically Endangered

A.3 Migratory species

Table A.3 Migratory species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)

Scientific name	Common name	Conservation status EPBC Act	Likelihood of occurrence	Rationale for likelihood ranking
<i>Apus pacificus</i>	Fork-tailed Swift	Mi	High	In New South Wales, the Fork-tailed Swift is recorded in all regions. Many records occur east of the Great Divide, however, a few populations have been found west of the Great Divide. These are widespread but scattered further west of the line joining Bourke and Dareton (DoEE 2020). Although this species has not been previously recorded within 10 km of the project footprint, this species is likely to occur flying over the terrestrial study area during the summer months as distribution and habitat requirements of the species are present.
<i>Hirundapus caudacutus</i>	White-throated Needletail	V, Mi	High	Widespread in eastern and south-eastern Australia. In eastern Australia, it is recorded in all coastal regions of Queensland and New South Wales, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains (DoEE 2020). Although this species has not been previously recorded within 10 km of the project footprint, this species is likely to occur flying over the terrestrial study area during the summer months as distribution and habitat requirements of the species are present.
<i>Monarcha melanopsis</i>	Black-faced Monarch	Mi	Moderate	In New South Wales and the Australian Capital Territory, the species occurs around the eastern slopes and tablelands of the Great Divide, inland to Coutts Crossing, Armidale, Widden Valley, Wollemi National Park, Wombeyan Caves and Canberra (DoEE 2020). Although this species has not been previously recorded within 10 km of the project footprint, this species cannot be discounted from potentially occurring within the terrestrial study area as distribution and habitat requirements of the species are present.
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	Mi	Moderate	Occurs in eastern Australia. In New South Wales, they occur on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains (DoEE 2020). This species breeds in south-eastern Australia, and although the project footprint is too far west and north for breeding records, there is potential for this species to occur on passage to wintering areas in northern Australia.
<i>Rhipidura rufifrons</i>	Rufous Fantail	Mi	High	Populations occur from about the South Australia-Victoria border, through south and central Victoria, on and east of the Great Divide in New South Wales, and north along the Queensland coastal margin (DoEE 2020). The species may occur on passage.
<i>Actitis hypoleucos</i>	Common Sandpiper	Mi	Low	Found along all coastlines of Australia and in many areas inland, the Common Sandpiper is widespread in small numbers. The population when in Australia is concentrated in northern and western Australia. The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. Generally the species forages in shallow water and on bare soft mud at the edges of wetlands (DoEE 2020). The terrestrial study area does not support suitable foraging habitat for this species.
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Mi	Low	They are widespread in most regions of New South Wales, especially in coastal areas, but they are sparse in the south-central Western Plain and east Lower Western Regions. They forage at the edge of the water of wetlands or intertidal mudflats, either on bare wet mud or sand, or in shallow water. They also forage among inundated vegetation of saltmarsh, grass or sedges (DoEE 2020).

Table A.3 **Migratory species predicted to occur within the terrestrial study area, and an assessment of habitat suitability (based on initial desktop assessment)**

Scientific name	Common name	Conservation status EPBC Act	Likelihood of occurrence	Rationale for likelihood ranking
				The terrestrial study area does not support suitable foraging habitat for this species.
<i>Calidris ferruginea</i>	Curlew Sandpiper	Mi	Low	In New South Wales, they are widespread east of the Great Divide, especially in coastal regions. They are occasionally recorded in the Tablelands and are widespread in the Riverina and south-west New South Wales, with scattered records elsewhere. They forage at the edge of the water of wetlands or intertidal mudflats, either on bare wet mud or sand, or in shallow water (DoEE 2020). The terrestrial study area does not support suitable foraging habitat for this species.
<i>Calidris melanotos</i>	Pectoral Sandpiper	Mi	Low	In New South Wales, the Pectoral Sandpiper is a scarce visitor with scattered records east of the Great Divide, from Casino and Ballina, south to Ulladulla. West of the Great Divide, the species is widespread in the Riverina and Lower Western regions. They forage at the edge of the water of wetlands, either on bare wet mud or sand, or in shallow water (DoEE 2020). The terrestrial study area does not support suitable foraging habitat for this species.
<i>Gallinago hardwickii</i>	Latham's Snipe	Mi	Moderate	The range extends inland along the east coast of Australia in the summer months, when this non-breeding visitor migrates from breeding grounds in Japan. The species forages among inundated vegetation including grass or sedges (DoEE 2020). Although this species has not been previously recorded within 10 km of the project footprint, this species cannot be discounted from potentially occurring in the terrestrial study area as distribution and habitat requirements of the species are present within the study area.
<i>Pandion haliaetus</i>	Osprey	Mi	Low	The breeding range of the Eastern Osprey extends around the northern coast of Australia (including many offshore islands) from Albany in Western Australia to Lake Macquarie in New South Wales (DoEE 2020). The study area is too far from recorded populations widespread in coastal Australia. The terrestrial study area does not support correct foraging habitat for this species.

Note: V = Vulnerable, Mi = Migratory

A.4 Aquatic species

Table A.4 Aquatic species likelihood of occurrence assessment (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Likelihood of occurrence	Rationale for likelihood ranking
		EPBC Act	FM Act		
<i>Ambassis agassizii</i>	Western population of Olive Perchlet		E	High	Occurs in both eastern (coastal) and western (Murray-Darling) drainages, but these populations may be genetically distinct. The western population of the Olive Perchlet was once widespread throughout the Murray-Darling system of South Australia, Victoria, western New South Wales and southern Queensland. This population has suffered a serious decline and is now thought to occur only at a few sites in the Darling River drainage (OEH, 2020p). DPI Fisheries data indicates the species has the potential to be located along the Mole River, with literature supporting the species occurrence (DPI 2015).
<i>Bidyanus bidyanus</i>	Silver Perch	CE	V	Low	Endemic to the Murray-Darling system (including all states and sub-basins). Hatchery-bred Silver Perch are also stocked out of their range in a number of impoundments on east coast river systems, where they seemingly fail to reproduce. However, a self-sustaining population of silver perch occurs in Cataract Dam in the Hawkesbury/Nepean system (DoE, 2013). Nearest DPI Fisheries data is located approximately 50km to the west.
<i>Maccullochella ikei</i>	Eastern Freshwater Cod	E	E	Low	Native to the Clarence and Richmond River systems of north-eastern NSW. Although once prolific in the Clarence

Table A.4 **Aquatic species likelihood of occurrence assessment (based on initial desktop assessment)**

Scientific name	Common name	Conservation status		Likelihood of occurrence	Rationale for likelihood ranking
		EPBC Act	FM Act		
					and Richmond rivers, remnant (non-stocked) populations are now only found in parts of the Clarence River and its tributaries. No remnant populations remain in the Richmond River system (DoEE, 2015b). While the PMST indicates that "species or species habitat may occur within area", the nearest DPI Fisheries data is located approximately 50km to the east.
<i>Maccullochella peelii</i>	Murray Cod	V		High	Natural distribution extends throughout the Murray-Darling basin ranging west of the divide from south east Queensland, through NSW into Victoria and South Australia. It is found in the waterways of the Murray–Darling Basin in a wide range of warm water habitats that range from clear, rocky streams to slow flowing turbid rivers, billabongs and large deep holes. Murray Cod is entirely a freshwater species and will not tolerate high salinity levels (DoEE, 2020). The PMST indicates that "species or species habitat known to occur within area", while anecdotal information sources note that the species is present within the system (likely via restocking programs).
<i>Mogurnda adspersa</i>	Southern Purple-spotted Gudgeon		E	Moderate	Occurs in inland drainages of the Murray-Darling basin as well as coastal drainages of northern NSW and Queensland (DPI, 2020).

Table A.4 Aquatic species likelihood of occurrence assessment (based on initial desktop assessment)

Scientific name	Common name	Conservation status		Likelihood of occurrence	Rationale for likelihood ranking
		EPBC Act	FM Act		
					DPI Fisheries data indicates the species has the potential to be located along the Mole River.
<i>Tandanus tandanus</i>	Murray-Darling Basin population of Eel-tailed Catfish		E	Moderate	Naturally distributed throughout the Murray-Darling Basin and in the Eastern drainages NSW north of Newcastle. Eel-tailed Catfish numbers in the Murray-Darling Basin have declined due to a range of impacts including invasive species, habitat degradation, cold water pollution and fishing pressures and are now virtually absent from the Murray, Murrumbidgee and Lachlan catchments (DPI, 2020). DPI Fisheries data indicates the species has the potential to be located along the Mole River.

Appendix B

Survey requirements – threatened species



B.1 Seasonal survey requirements

Table B.1 Seasonal surveys requirements

Scientific name	Common name	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Flora													
<i>Asterolasia beckerii</i>	Dungowan Starbush								Y	Y			
<i>Acacia pubifolia</i>	Velvet Wattle	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Acacia pycnostachya</i>	Bolivia Wattle	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Almaleea cambagei</i>	Torrington Pea									Y			
<i>Angophora exul</i>	Gibraltar Rock Apple	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Astrotricha roddii</i>	Rod's Star Hair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Boronia granitica</i>	Granite Boronia	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Cadellia pentastylis</i>	Ooline	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Callistemon pungens</i>		Y	Y							Y	Y	Y	Y
<i>Capparis canescens</i>	Wild Orange	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Dichanthium setosum</i>	Bluegrass	Y	Y	Y	Y	Y						Y	Y
<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Grevillea beadleana</i>	Beadle's Grevillea	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Haloragis exalata subsp. Velutina</i>	Tall Velvet Sea-berry	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Indigofera baileyi</i>	Bailey's Indigo	Y	Y									Y	Y
<i>Lepidium peregrinum</i>	Wandering Pepper Cress	Y	Y	Y	Y	Y						Y	Y

Table B.1 **Seasonal surveys requirements**

Scientific name	Common name	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
<i>Leucopogon confertus</i>	Torrington Beard-heath								Y	Y			
<i>Monotaxis macrophylla</i>	Large-leafed Monotaxis	Y	Y						Y	Y	Y	Y	Y
<i>Phebalium glandulosum subsp. eglandulosum</i>	Rusty Desert Phebalium									Y	Y	Y	
<i>Picris evae</i>	Hawkweed	Y	Y									Y	Y
<i>Polygala linariifolia</i>	Native Milkwort	Y	Y								Y	Y	Y
<i>Pomaderris queenslandica</i>	Scant Pomaderris	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Rutidosia heterogama</i>	Heath Wrinklewort	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Swainsona sericea</i>	Silky Swainson-pea									Y	Y	Y	
Fauna													
<i>Litoria booroolongensis</i>	Booroolong Frog											Y	Y
<i>Anthochaera phrygia</i>	Regent Honeyeater	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Burhinus grallarius</i>	Bush Stone-curlew	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Erythrotriorchis radiatus</i>	Red Goshawk						Y	Y	Y	Y	Y	Y	Y
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo				Y	Y	Y	Y	Y				
<i>Geophaps scripta</i>	Squatter Pigeon	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle							Y	Y	Y	Y	Y	Y
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard									Y	Y	Y	

Table B.1 **Seasonal surveys requirements**

Scientific name	Common name	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
<i>Hieraetus morphnoides</i>	Little Eagle								Y	Y	Y		
<i>Lathamus discolor</i>	Swift Parrot		Y	Y	Y	Y	Y	Y	Y	Y			
<i>Lophoictinia isura</i>	Square-tailed Kite	Y								Y	Y	Y	Y
<i>Ninox connivens</i>	Barking Owl					Y	Y	Y	Y	Y	Y	Y	Y
<i>Ninox strenua</i>	Powerful Owl					Y	Y	Y	Y				
<i>Tyto novaehollandiae</i>	Masked Owl					Y	Y	Y	Y				
<i>Aepyprymnus rufescens</i>	Rufous Bettong	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	Y	Y	Y							Y	Y	Y
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	Y										Y	Y
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox										Y	Y	Y
<i>Miniopterus orianae oceanensis</i>	Eastern Bentwing-bat	Y	Y										Y
<i>Petauroides volans</i>	Greater Glider	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	Y	Y	Y	Y	Y	Y						Y
<i>Phascolarctos cinereus</i>	Koala	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Vespadelus troungtoni</i>	Eastern Cave Bat	Y										Y	Y
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	Y	Y	Y								Y	Y

Table B.1 Seasonal surveys requirements

Scientific name	Common name	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
<i>Amalosia rhombifer</i>	Zigzag Velvet Gecko	Y	Y	Y	Y					Y	Y	Y	Y
<i>Underwoodisaurus sphyrurus</i>	Border Thick-tailed Gecko	Y	Y								Y	Y	Y



