



Capricornia Energy Hub CEH PHES Project

Ecological Significance of Impact Assessment MNES

Eungella PHES Pty Ltd

11 August 2023

→ **The Power of Commitment**



Project name		Capricornia Energy Hub CEH PHES Project (CEH PHES Project)					
Document title		Capricornia Energy Hub CEH PHES Project Ecological Significance of Impact Assessment MNES					
Project number		12604724					
File name		12604724_REP_SIA_PHES_Rev1.docx					
Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S3	Rev A	P. Lin L. Pratt J. Wyatt	N. Clark	On file	S. Wilson	On file	17/05/2023
S3	Rev B	T. Carvalho	N. Clark	On file	S. Wilson	On file	07/07/2023
S4	Rev 0	N. Clark	S. Wilson	On file	S. Wilson	On file	26/07/2023
S4	Rev 1	N. Clark	S. Wilson	On file	S. Wilson	On file	11/08/2023

GHD Pty Ltd ABN 39 008 488 373

145 Ann Street, Level 9

Brisbane, Queensland 4000, Australia

T +61 7 3316 3000 | **F** +61 7 3319 6038 | **E** bnemail@ghd.com | **ghd.com**

© GHD 2023

This document is and shall remain the property of GHD. The document may only be used for the purpose of assessing our offer of services and for inclusion in documentation for the engagement of GHD. Unauthorised use of this document in any form whatsoever is prohibited.

Executive summary

Overview

The Capricornia Energy Hub (CEH) Pumped Hydro-Electric Storage (PHES) Project (the CEH PHES Project), proposed by Eungella PHES Pty Ltd as trustee for the Eungella PHES Trust, is the construction and operation of a proposed approximately 750 megawatt (MW) pump/generation facility with a storage capacity of 12 gigawatt-hours (GWh) (16hr) and a water transfer volume of approximately 18 gegalitres (GL). The CEH PHES Project includes two reservoirs: the upper reservoir (UR) being a valley fill reservoir and the lower reservoir (LR) being in-stream in the Broken River. There will also be a powerhouse, structures linking the reservoirs and the powerhouse and ancillary infrastructure.

The CEH PHES Project will be connected to the electricity grid by a separate related project (the CEH Transmission Project). The CEH Transmission Project is the construction and operation of a high-voltage transmission line that extends approximately 18 kilometres (km) west from the CEH PHES Project powerhouse to a new substation at the existing Strathmore to Nebo 275 kilovolt (kV) transmission line.

This report has been prepared to identify and assess how the **CEH PHES Project** would potentially affect ecological values – namely, matters of national environmental significance (MNES) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). A separate report has been prepared for the CEH Transmission Project.

Potential impacts and mitigation measures

Siting of the development footprints and infrastructure for the proposed CEH PHES Project has been designed to avoid impacts to conservation significant terrestrial and aquatic ecological values (i.e., MNES) where possible. These include:

- CEH PHES Project reservoir locations – multiple sites were investigated with environmental factors considered as part of the site selection criteria
- Infrastructure siting – will be prioritised to existing cleared or degraded areas.

Appendix E details avoidance hierarchy measures taken to date and potential actions to further reduce impact. Despite the avoidance achieved, the construction and operation of the CEH PHES Project will still result in the removal of vegetation (and the habitat this provides), and disturbance to the ecological values of the local landscape on either a temporary or permanent basis. Impacts most likely to adversely affect MNES that were confirmed present or are likely to occur include:

- Loss of habitat
- Injury and mortality
- Disturbance of wildlife by light, noise and vibration
- Fragmentation of terrestrial habitats
- Degradation of habitats by dust, run-off and sedimentation
- Introduction and spread of weeds and pests.

A detailed suite of management and mitigation measures to address (e.g., avoid, minimise, mitigate) these impacts have been identified.

Significant impact assessment

An assessment was undertaken to determine whether the CEH PHES Project would have any significant residual impacts (i.e., significant impacts, after application of the first three steps of the mitigation hierarchy) on MNES ecological values that have been confirmed present or are considered high-to-moderate likelihood of occurrence within the study area.

These assessments were made against EPBC Act *Significant Impact Guidelines 1.1 – MNES* (DoE 2013), or where available, species-specific assessment guidelines for MNES. The following MNES matters were assessed:

- Poplar box grassy woodland on alluvial plains Threatened Ecological Community

- Black ironbox (*Eucalyptus raveretiana*)
- Granite nightshade (*Solanum graniticum*)
- Greater glider (southern and central) (*Petauroides volans*)
- Grey-headed flying-fox (*Pteropus poliocephalus*)
- Koala (*Phascolarctos cinereus*)
- Northern quoll (*Dasyurus hallucatus*)
- Yellow-bellied glider (south-eastern) (*Petaurus australis australis*)
- Squatter pigeon (southern) (*Geophaps scripta scripta*)
- White-throated needletail (*Hirundapus caudacutus*)
- Fork-tailed swift (*Apus pacificus*)
- Black-faced monarch (*Monarcha melanopsis*)
- Spectacled monarch (*Symposiachrus trivirgatus*)
- Satin flycatcher (*Myiagra cyanoleuca*)
- Rufous fantail (*Rhipidura rufifrons*)
- Estuarine crocodile (*Crocodylus porosus*).

The significant impact assessments determined that the proposed CEH PHES Project is likely or has the potential to result in significant residual impacts on five MNES: koala, greater glider, grey-headed flying-fox, northern quoll and yellow-bellied glider (Table E-1).

To address significant residual impacts to these MNES, options for environmental offsets will be provided in line with relevant offset policy and in consultation with key stakeholders.

Table E-1.1 Summary of MNES residual impacts

Species/TEC	Significance of impact
Poplar Box Grassy Woodland on Alluvial Plains TEC	Not significant
<i>Eucalyptus raveretiana</i>	Not significant
<i>Solanum graniticum</i>	Not significant
Greater glider	Significant
Grey-headed flying-fox	Significant
Koala	Significant
Northern quoll	Significant
Yellow-bellied glider	Significant
Squatter pigeon (southern)	Not significant
White-throated needletail	Not significant
Fork-tailed swift	Not significant
Terrestrial migratory birds Satin flycatcher, Rufous fantail	Not significant
Terrestrial migratory birds - Black-faced monarch, Spectacled monarch	Not significant
Estuarine crocodile	Not significant

Contents

1. Introduction	1
1.1 Proposed action	1
1.2 Purpose of this report	1
1.3 Definitions	1
1.4 Scope of this report	2
1.5 Limitations	2
2. Methodology	6
2.1 Desktop assessment	6
2.2 Terrestrial field survey methodology	7
2.3 Aquatic ecology survey methods	13
2.4 Animal ethics and legislative permits	17
2.5 Likelihood of occurrence assessment	18
2.6 Predicted habitat for conservation significant species	18
2.7 Impact area calculations	19
3. Field results	20
3.1 Threatened Ecological Communities	20
3.2 Regional Ecosystems	20
3.3 Wetlands and waterways	23
3.4 Conservation significant species results	25
4. Project impacts	26
5. Significant impact assessment	27
5.1 Poplar Box Grassy Woodland on Alluvial Plains TEC	27
5.2 Black ironbox (<i>Eucalyptus raveretiana</i>)	31
5.3 Granite nightshade (<i>Solanum graniticum</i>)	35
5.4 Greater glider (southern and central) (<i>Petauroides volans</i>)	39
5.5 Grey-headed flying-fox (<i>Pteropus poliocephalus</i>)	43
5.6 Koala (<i>Phascolarctos cinereus</i>)	46
5.7 Northern quoll (<i>Dasyurus hallucatus</i>)	50
5.8 Yellow-bellied glider (south-eastern) (<i>Petaurus australis australis</i>)	56
5.9 Squatter pigeon (southern) (<i>Geophaps scripta scripta</i>)	60
5.10 White-throated needletail (<i>Hirundapus caudacutus</i>)	64
5.11 Fork-tailed swift (<i>Apus pacificus</i>)	67
5.12 Terrestrial migratory birds – black-faced monarch, spectacled monarch, satin flycatcher and rufous fantail	69
5.13 Estuarine crocodile (<i>Crocodylus porosus</i>)	72
6. Conclusion	75
7. References	76

Table index

Table E-1.1	Summary of MNES residual impacts	ii
Table 2.1	Publicly available information sources searched during the desktop assessment	6
Table 2.2	Summary of ecological survey effort	7
Table 2.3	Summary of survey effort for conservation significant flora species	10
Table 2.4	Summary of survey effort for conservation significant fauna species	11
Table 2.5	Habitat characteristics and features recorded during habitat assessments	16
Table 2.6	River bioassessment program: habitat assessment score criteria (DoR, 2001)	17
Table 2.7	Likelihood of occurrence assessment criteria for conservation significant species	18
Table 2.8	Impact area calculation components	19
Table 2.9	Summary of estimated impact area of the CEH PHES Project on waterways	19
Table 3.1	Field verified Regional Ecosystem communities within the CEH PHES Project study area	20
Table 3.2	CEH PHES Project likelihood of occurrence summary conservation significant species	25
Table 4.1	Estimated habitat loss for MNES that were confirmed present or high to moderate likelihood of occurrence	26
Table 5.1	Summary of significance of impact on MNES	27
Table 5.2	Significant impact assessment – Poplar Box Grassy Woodland on Alluvial Plains TEC	28
Table 5.3	Significant impact assessment – Eucalyptus raveretiana	32
Table 5.4	Significant impact assessment – Solanum graniticum	36
Table 5.5	Significant impact assessment – greater glider	40
Table 5.6	Significant impact assessment – grey-headed flying-fox	43
Table 5.7	Significant impact assessment – koala	47
Table 5.8	Significant impact assessment – northern quoll	51
Table 5.9	Significant impact assessment – yellow-bellied glider	57
Table 5.10	Significant impact assessment – squatter pigeon (southern)	61
Table 5.11	Significant impact assessment – white-throated needletail	64
Table 5.12	Significant impact assessment – fork-tailed swift	67
Table 5.13	Significant impact assessment – migratory species	70
Table 5.14	Significant impact assessment – estuarine crocodile	72
Table 6.1	Summary of MNES residual impacts	75

Figure index

Figure 1.1	Project locality	3
Figure 1.2	CEH PHES Project area	4
Figure 1.3	CEH PHES components	5
Figure 2.1	Terrestrial ecology field survey effort within the CEH PHES Project study area	9
Figure 2.2	Aquatic survey effort and locations within the CEH PHES Project study area	15
Figure 3.1	Field verified Regional Ecosystems overview	22
Figure 3.2	Wetlands and waterways within, upstream and/or downstream of the CEH PHES Project study area	24
Figure 5.1	Poplar Box Grassy Woodland on Alluvial Plains TEC within the CEH PHES Project study area	30

Figure 5.2	Predicated habitat for <i>Eucalyptus raveretiana</i> located within the CEH PHES Project study area	34
Figure 5.3	Predicted habitat for <i>Solanum graniticum</i> within the CEH PHES Project study area	38
Figure 5.4	Predicted habitat for the greater glider (northern) within the CEH PHES Project study area	42
Figure 5.5	Predicted habitat for the grey-headed flying-fox within the CEH PHES Project study area	45
Figure 5.6	Predicted habitat for the koala within the CEH PHES Project study area	49
Figure 5.7	Predicted habitat for the northern quoll within the CEH PHES Project study area	55
Figure 5.8	Predicted habitat for the yellow-bellied glider (south-eastern) within the CEH PHES Project study area	59
Figure 5.9	Predicted habitat for the squatter pigeon (southern) within the CEH PHES Project study area	63
Figure 5.10	Predicted habitat for the white-throated needletail within the CEH PHES Project study area	66
Figure 5.11	Predicted habitat for the fork-tailed swift within the CEH PHES Project study area	68
Figure 5.12	Predicted habitat for terrestrial migratory species within the CEH PHES Project study area	71
Figure 5.13	Predicted habitat mapping for estuarine crocodile	74

Appendices

Appendix A	Desktop search results
Appendix B	Likelihood of occurrence assessment
Appendix C	Species habitat mapping criteria
Appendix D	Impact calculations
Appendix E	Avoidance and Mitigation Measures CEH PHES Project

Abbreviations and Acronyms

Abbreviation/acronym	Definition
ALA	Atlas of Living Australia
ARA	Animal Reacher Authority
CEH	Capricornia Energy Hub
DAWE	Department of Agriculture, Water, and the Environment
DCCEEW	Department of Climate change, Energy, the Environment and Water
DEECA	Victorian Department of Energy, Environment and Climate Action
DES	Department of Environment and Science
DEWHA	Commonwealth Department of the Environment, Water, Heritage and the Arts
DNRM	Queensland Department of Natural Resources and Mining
DoE	Department of the Environment
DoEE	Department of the Environment and Energy
DoR	Department of Resources
DSEWPaC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities
DSDMIP	Department of State Development, Tourism and Innovation
EMP	Environmental Management Plan
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
ERM	Environmental Resources Management
GHD	GHD Pty Ltd
GL	Gigalitre
GWh	Gigawatt-hours
ha	hectare
hr	hour
IUCN	International Union for Conservation of Nature
km	kilometres
km ²	square kilometres
kV	Kilovolt
LR	Lower Reservoir
m	metres
MNES	Matters of National Environmental Significance
MW	Megawatt
PHES	Pumped Hydroelectric Energy Storage
PMST	Protected Matters Search Tool
Pty Ltd	Proprietary Limited
QLR	Queensland
RE	Regional Ecosystem
SAT	Spot Assessment Technique
SDPWO Act	Queensland <i>State Development and Public Works Organisation Act 1971</i>

Abbreviation/acronym	Definition
SEVT	Semi Evergreen Vine Thicket
SIA	Significant Impact Assessment
SOP	Standard Operating Procedure
SPRAT	Species Profile and Threats Database
TEC	Threatened Ecological Communities
TSSC	Threatened Species Scientific Committee
UR	Upper Reservoir

1. Introduction

1.1 Proposed action

The Capricornia Energy Hub (CEH) Pumped Hydroelectric Energy Storage (PHES) Project (the CEH PHES Project), proposed by Eungella PHES Pty Ltd as trustee for the Eungella PHES Trust, is the construction and operation of a proposed approximately 750 megawatt (MW) pump/generation facility with a storage capacity of 12 gigawatt-hours (GWh) (16hr) and a water transfer volume of approximately 18 gegalitres (GL). The CEH PHES Project includes two reservoirs: the upper reservoir (UR) being a valley fill reservoir and the lower reservoir (LR) being in-stream in the Broken River, 80 kilometres (km) west of Mackay, Queensland (Figure 1.1). There will also be a powerhouse, structures linking the reservoirs and the powerhouse and ancillary infrastructure.

The CEH PHES Project will be connected to the electricity grid by a separate related project (the CEH Transmission Project). The CEH Transmission Project is the construction and operation of a high-voltage transmission line that extends approximately 18 km west from the CEH PHES Project powerhouse to a new substation at the existing Strathmore to Nebo 275 kilovolt (kV) transmission line.

An application has been made by the proponent companies to the Queensland Co-ordinator-General to have the combined CEH PHES and transmission projects declared a co-ordinated project under the *State Development and Public Works Organisation Act 1971* (SDPWO Act), whilst the two project components have been referred as separate actions under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The key CEH PHES Project elements, as shown in Figure 1.2 and Figure 1.3 include:

- CEH PHES Project reservoirs, comprising an upper reservoir (UR) with a valley in-fill wall, an instream lower reservoir (LR) within the Broken River and structures for operations and/or maintenance support
- Powerhouse building (housing the generating/pumping units and control room)
- Structures connecting the reservoirs and powerhouse for water conveyance, including associated inlet and outlet structures.

The CEH PHES Project will also include:

- Spillway facilities at both reservoirs for flood and dam safety management
- Switchyard
- Spoil material use or disposal locations
- Operations, maintenance and administration facilities
- Various roads and tracks to access reservoirs and ancillary infrastructure, and
- Communications facilities.

1.2 Purpose of this report

This report has been prepared to identify and assess how the **CEH PHES Project** would potentially affect ecological values – namely, matters of national environmental significance (MNES) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). A summary of the survey methodology and effort undertaken to date for the CEH PHES Project is described and field survey results presented. A significance of impact assessment is completed for ecological values that MNES. A separate report has been prepared for the CEH Transmission Project.

1.3 Definitions

For the purposes of this report, the following definitions are used:

- **Desktop search extent:** this refers to a broad desktop assessment area searched to identify all mapped/recorded environment values present or of relevance to the CEH PHES Project. The desktop search extent was a 10 km radius from the boundary of the CEH PHES Project area.

- **Project footprint:** the area incorporating CEH PHES Project infrastructure footprints, inclusive of supporting and ancillary infrastructure and access tracks, and excluding the proposed CEH Transmission Project footprints (Figure 1.3).
- **CEH PHES Project area:** the envelope of land targeted to investigate optimal locations for all of the components of the CEH PHES Project (Figure 1.2).
- **CEH PHES Project study area:** the area that was subject to field investigation as shown in Figure 2.1 and Figure 2.2..
- **Conservation significant species:** species listed as critically endangered, endangered, vulnerable or migratory under the EPBC Act.

1.4 Scope of this report

The scope of this report is to present the methodology and results of desktop and field studies undertaken to provide a significant impact assessment of the impacts of the CEH PHES Project on ecological values that are MNES and identify whether significant residual impacts will prevail post-mitigation. For all MNES confirmed present or considered to have a high or moderate likelihood of occurrence, a significance of impact assessment was undertaken in accordance with the Significant Impact Guidelines 1.1. – MNES (DoE, 2013), or where applicable, species-specific EPBC Act Policies.

1.5 Limitations

This report has been prepared by GHD for Eungella PHES Pty Ltd and may only be used and relied on by Eungella PHES Pty Ltd for the purpose agreed between GHD and Eungella PHES Pty Ltd as set out in this report. GHD otherwise disclaims responsibility to any person other than Eungella PHES Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible. The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared. The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect. The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.






Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report. Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

The impact calculations presented in this report are subject to the restrictions associated with the services and specific project for which they were generated. Site conditions and project designs may change after the date of the calculation publication. GHD expressly disclaims responsibility arising from, or in connection with any change to the site conditions; and to update the dataset if the site conditions change. Whilst every care has been taken to develop the datasets and calculations, GHD makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the dataset being inaccurate, incomplete or unsuitable in any way and for any reason.



Disclaimer: CIP makes no warranty in relation to the accuracy, reliability, completeness or suitability of the data and does not accept liability for any loss, damage or costs, including consequential damage, in relation to any use of the data in this map.

LEGEND

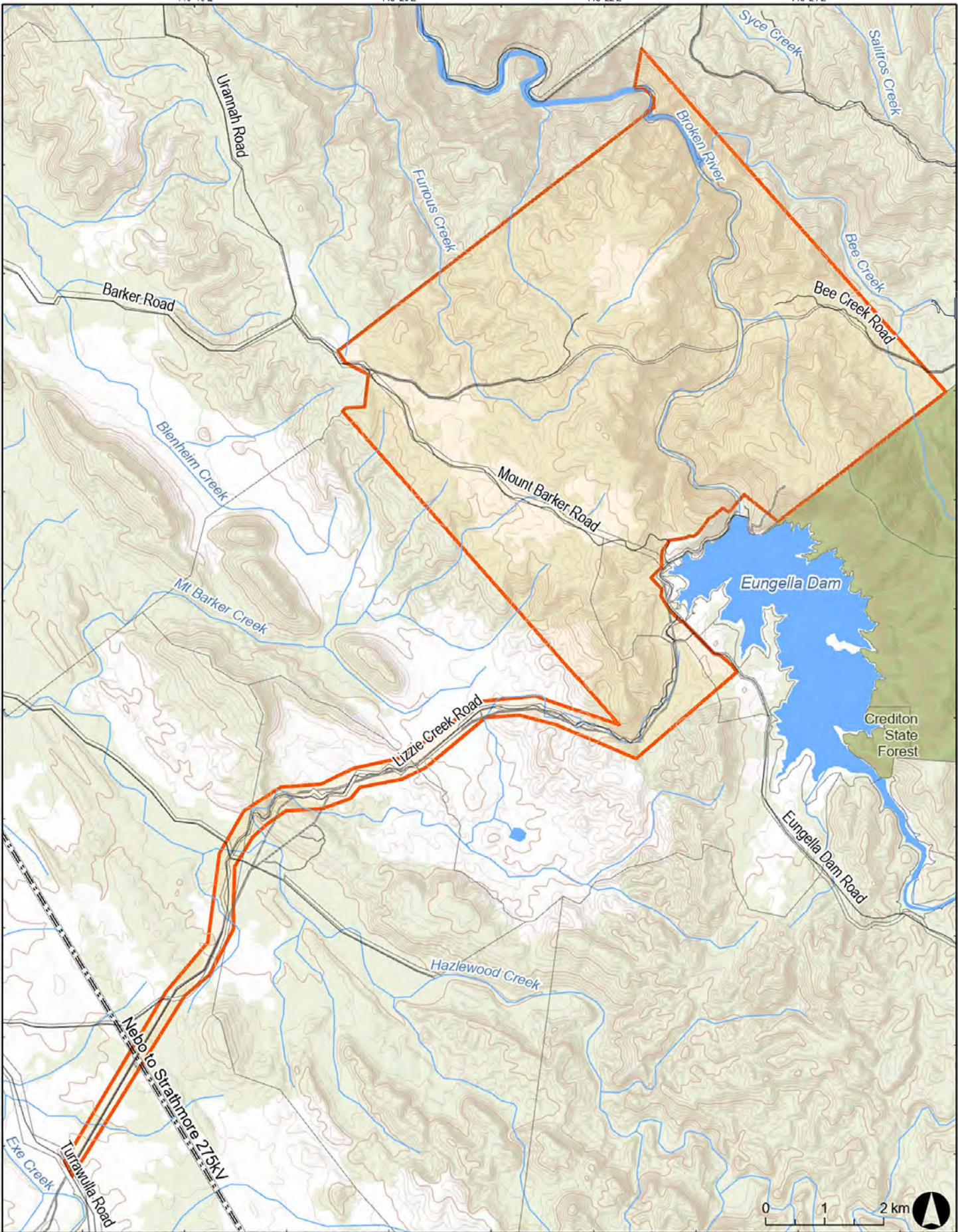
-  CEH PHES Project
-  Major road
-  Major watercourse
-  Protected areas
-  Built up areas

PROJECT				CEH PHES Project			
TITLE				Project locality			
DATE		STATUS		PRODUCED		MVC	
4/08/2023		DRAFT					
SCALE		DATUM		REV		C	
1:700,000 at A3		GDA 1994 MGA Zone 55					
FILE						FIG	
CEH-EPBC-PHES - FIG_1_1 LOCALITY - rC						1.1	

148°18'E 148°20'E 148°22'E 148°24'E

21°4'S
21°5'S
21°8'S
21°10'S
21°12'S
21°14'S

21°4'S
21°5'S
21°8'S
21°10'S
21°12'S
21°14'S



LEGEND

- PHEs Project area
- Existing transmission powerline
- Cadastre
- Existing road
- Watercourse / waterbody
- Protected areas



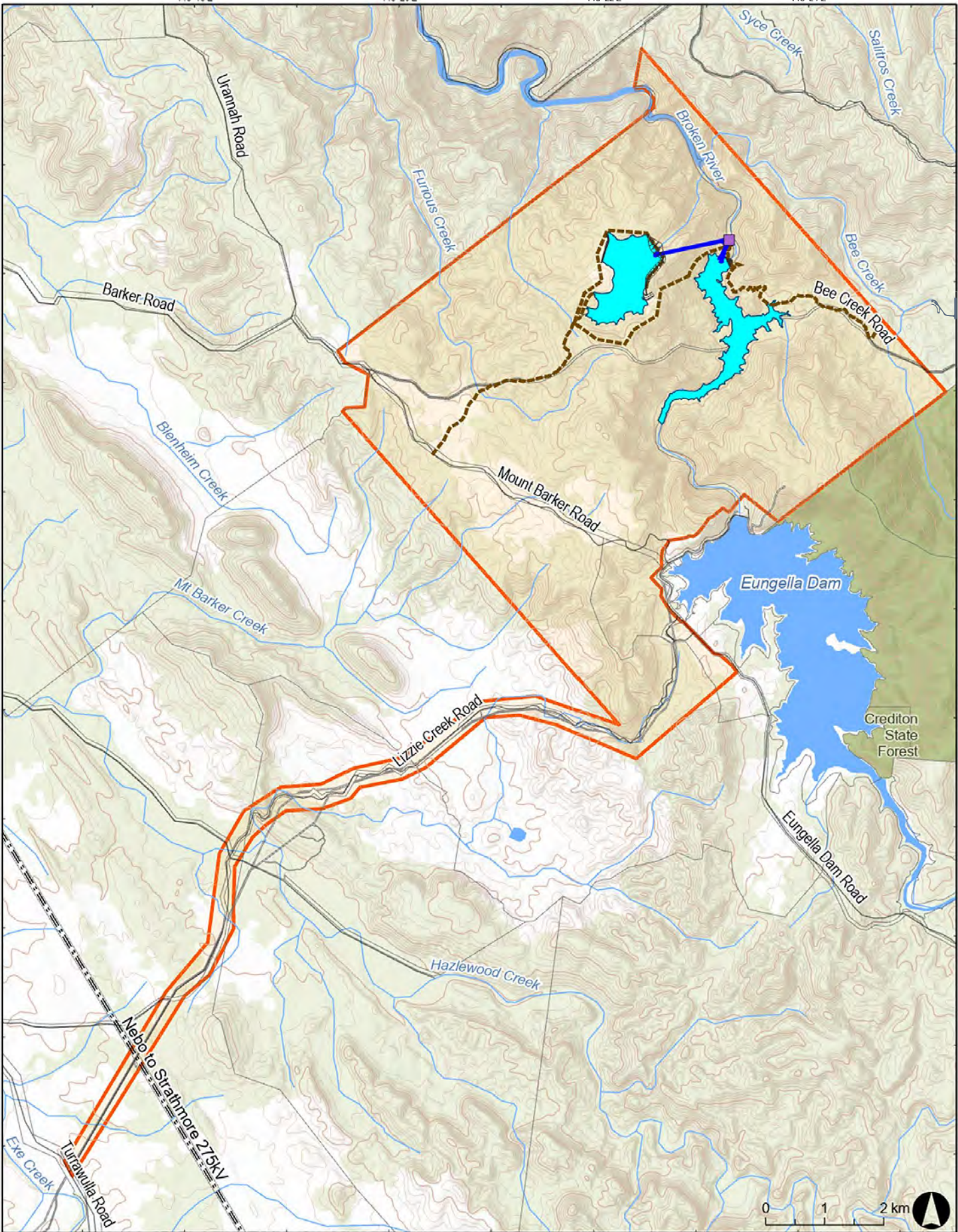
Disclaimer: CIP makes no warranty in relation to the accuracy, reliability, completeness or suitability of the data and does not accept liability for any loss, damage or costs, including consequential damage, in relation to any use of the data in this map.

PROJECT		CEH PHEs Project	
TITLE		Project area	
DATE	STATUS	PRODUCED	
3/08/2023	DRAFT	IM	
SCALE	DATUM	REV	
1:85,000 at A3	GDA 1994 MGA Zone 55	A	
FILE	FIG		
CEH-EPBC-PHEs - FIG 1_2 PROJECT AREA - rA	1.2		

148°18'E 148°20'E 148°22'E 148°24'E

21°4'S
21°5'S
21°8'S
21°10'S
21°12'S
21°14'S

21°4'S
21°5'S
21°8'S
21°10'S
21°12'S
21°14'S



LEGEND

- PHE Project area
- Proposed pumped hydro reservoirs
- Dam wall
- Proposed powerhouse
- Proposed underground head/tail race
- Proposed access track
- Existing transmission powerline
- Existing road
- Watercourse / waterbody
- Cadastre
- Protected areas



Disclaimer: CIP makes no warranty in relation to the accuracy, reliability, completeness or suitability of the data and does not accept liability for any loss, damage or costs, including consequential damage, in relation to any use of the data in this map.

PROJECT			
CEH PHE Project			
TITLE			
Pumped Hydro-electric Energy Scheme Components			
DATE	STATUS	PRODUCED	
9/08/2023	DRAFT	IM	
SCALE	DATUM	REV	
1:85,000 at A3	GDA 1994 MGA Zone 55	D	
FILE	FIG		
CEH-EPBC-PHE - FIG 1_3 COMPONENTS - rD	1.3		

2. Methodology

The ecological assessment for the CEH PHES Project included a desktop review of environmental databases, mapping layers and previous field survey reports, and a field assessment of the terrestrial and aquatic flora and fauna values of the CEH PHES Project study area. The desktop and field methodologies are detailed in the sections below.

2.1 Desktop assessment

A desktop review was undertaken to identify and collate existing information on the ecological values within the desktop search extent. State and Commonwealth desktop information sources were reviewed to obtain all available information as outlined in Table 2.1. The following existing reports of relevance to the CEH PHES Project were reviewed as part of this assessment:

- CEH PHES and Transmission Project Initial Advice Statement (CEH, 2023).
- Urannah Water Scheme Draft EIS. Report prepared for Bowen River Utilities (GHD, 2022)
- Eungella Wind Farm Ecology Assessment – November 2021 Desktop and Field Survey Results (ERM, 2021).

The desktop search results are provided in Appendix A.

Table 2.1 Publicly available information sources searched during the desktop assessment

Database name and source	Purpose of desktop search	Search extent
Department of Climate Change, Energy, the Environment and Water (DCCEEW) EPBC Act Protected Matters Search Tool (PMST)	DCCEEW PMST was used to identify threatened ecological communities (TECs) and conservation significant flora and fauna, listed under the EPBC Act that have the potential to occur (DCCEEW, 2023a).	The search was undertaken within a 10 km radius of the boundary of the CEH PHES Project area. EPBC Act Protected Matters Report was produced on 19 April 2023.
Species Profile and Threats (SPRAT) database and conservation advice.	This was queried to obtain information on species conservation status, ecology and distribution (DCCEEW, 2023b).	N/A
Department of Environment and Science (DES) Wildlife Online database	The DES Wildlife Online database was searched to retrieve historical records of flora and fauna species previously recorded within the desktop search extent (DES, 2023a).	The search was undertaken at a central co-ordinate of Latitude -20.833, Longitude: 148.3483 within a 10 km radius. The Wildlife Online database search was conducted on 21 July 2023.
Atlas of Living Australia (ALA) database	The Atlas of Living Australia database was searched to retrieve historical records of flora and fauna species previously observed within the desktop search extent (ALA, 2023).	Atlas of Living Australia searches were restricted to the CEH PHES Project area.
DES Biomaps	The DES Biomaps mapping tool was used to review specific locations, collection dates and details of species of conservation significance recorded as occurring within the desktop search extent (DES, 2023b).	Biomaps searches were restricted to the CEH PHES Project area.
DES Wetland info.	This was queried to search for information on wetland and waterways, conservation areas and flora and fauna lists (DES, 2023c).	N/A
DES Protected plants flora survey trigger mapping	The DES protected plants flora survey trigger mapping (version 7.1) was viewed to identify areas mapped as high risk for conservation	The flora survey trigger mapping was produced on 21 July 2023. The mapping was

Database name and source	Purpose of desktop search	Search extent
	significant flora species within the CEH PHES Project study area (DES, 2023d).	obtained from Queensland Globe.
Department of Resources (DoR) Vegetation management watercourse and drainage feature map (1:100000 and 1:250000).	This was queried to identify the stream order of watercourses within the CEH PHES study area (DoR, 2023).	N/A
Scientific reports and publicly available information.	A search was conducted to identify existing information on habitats, flora and fauna species previously recorded.	NA

2.2 Terrestrial field survey methodology

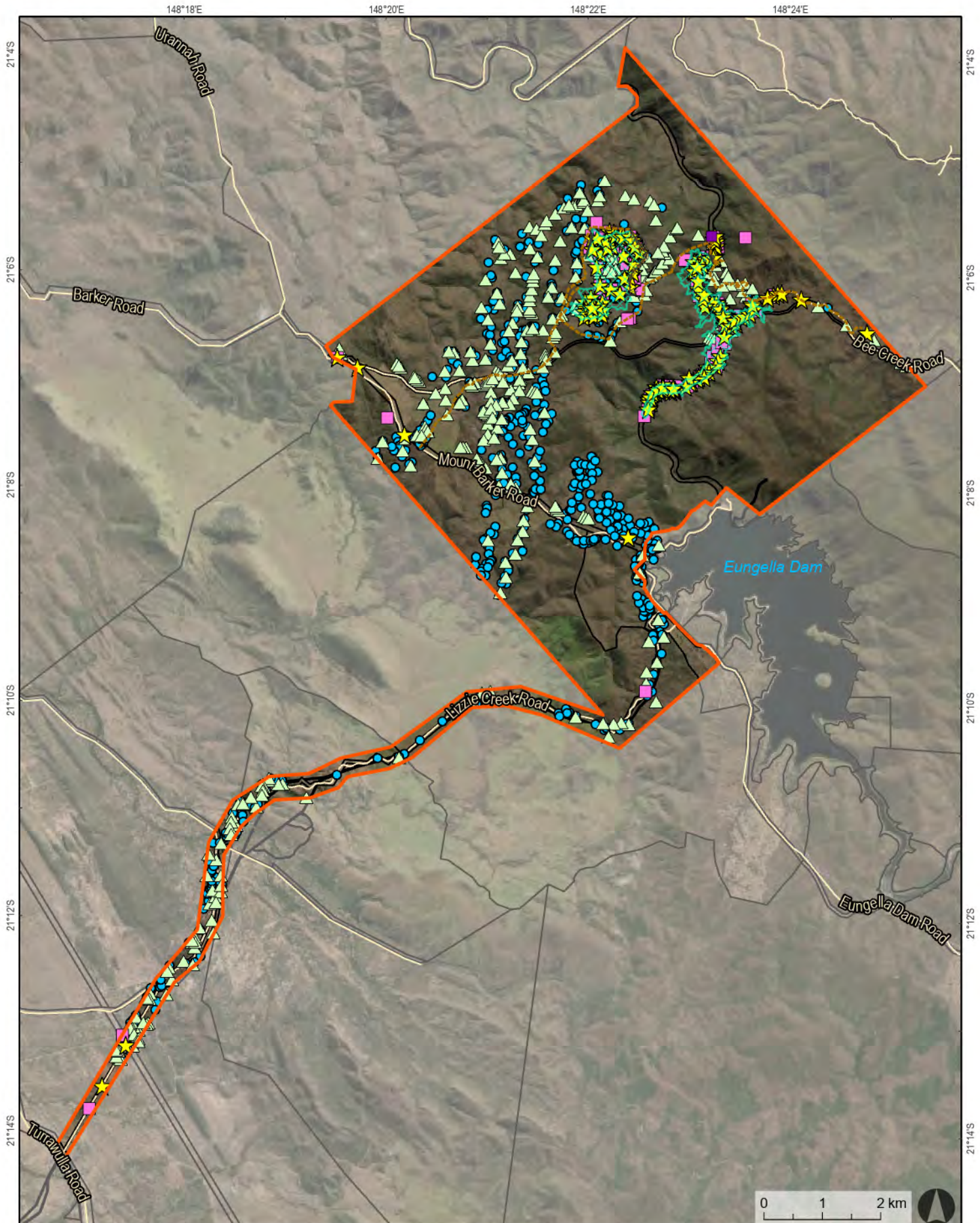
Seasonal ecological field surveys were undertaken to comprehensively assess the existing ecological values of the CEH PHES Project study area.

Field survey effort undertaken to date is shown in Figure 2.1. A summary of the methods employed during the ecological surveys is provided in Table 2.2. Additional detail is provided in Section 2.2.1 and 2.2.2 for terrestrial flora and terrestrial fauna, respectively.

Table 2.2 Summary of ecological survey effort

Survey dates	Ecologists	Days	Methodology and survey effort
Baseline flora and fauna surveys of the CEH PHES Project study area			
2020			
30 – 31 March and 20 – 21 April 2020 Autumn	One flora One fauna	Two	Quaternary vegetation assessments at 14 sites Fauna habitat assessments at 14 sites Active reptile searches at 14 sites Bird census surveys at 14 sites SAT surveys at three sites Opportunistic records at two sites
30 November and 2 – 3 December 2020 Summer	One flora One fauna	Two	Quaternary vegetation assessments at 29 sites Protected plant targeted surveys at five sites Fauna habitat assessments at 47 sites Active reptile searches at 47 sites Bird census surveys at 47 sites Bat utilisation assessment - Anabats at one site Spotlighting surveys over two nights Remote cameras at two sites SAT surveys at four sites Opportunistic records at one site
2022			
2 – 5 October 2022 Spring	Five flora Four fauna	Four	Quaternary vegetation assessments at three sites BioCondition assessments at 24 sites Fauna habitat assessments at 22 sites Active reptile searches at 24 sites Bird census surveys at 22 sites Spotlighting surveys over one night Driving flushing surveys over minimum 400 km SAT surveys at three sites
22 November – 1 December 2022	Two flora Two fauna	10	Quaternary vegetation assessments at 271 sites BioCondition assessments at 10 sites

Survey dates	Ecologists	Days	Methodology and survey effort
Spring – Summer			Fauna habitat assessments at 378 sites Active reptile searches at 403 sites Bird census surveys at 378 sites Spotlighting surveys over two nights SAT surveys at 164 sites Driving flushing surveys over minimum 600 km Opportunistic records at 82 sites
6 – 9 December 2022 Summer	One flora One fauna	Four	Quaternary vegetation assessments at 65 sites BioCondition assessments at four sites Fauna habitat assessment at 12 sites Active reptile searches at 18 sites Bird census surveys at 12 sites Bat utilisation assessment - Anabats at two sites Spotlighting surveys over one night Remote cameras at six sites SAT surveys at eight sites Driving flushing surveys over minimum 300 km Opportunistic records at 44 sites
8 – 13 May 2023 Autumn	One flora One fauna	Six	Target surveys for conservation significant species BioCondition surveys



Sources:
 Biodiversity status of 2019 remnant regional ecosystems v12.2
 Flora Survey Trigger Map for Clearing Protected Plants in Queensland v8.0

Disclaimer: CIP makes no warranty in relation to the accuracy, reliability, completeness or suitability of the data and does not accept liability for any loss, damage or costs, including consequential damage, in relation to any use of the data in this map.

LEGEND	
	PHEs Project area
	Fauna survey sites 2020
	Fauna survey sites 2022
	Flora survey sites 2020
	Flora survey sites 2022
	Dam wall
	Proposed pumped hydro reservoirs
	Proposed access track
	Proposed powerhouse
	Existing road
	Cadastre

PROJECT			
CEH PHEs Project			
TITLE			
Terrestrial ecology field survey effort within the CEH PHEs Project study area			
DATE	8/08/2023	STATUS	DRAFT
PRODUCED	IM	SCALE	1:85,000 at A3
DATUM	GDA 1994 MGA Zone 55	REV	A
FILE	CEH-EPBC-PHEs - FIG 2_1 TERRESTRIAL SURVEY - rA	FIG	2.1

2.2.1 Terrestrial flora

Flora field assessments involved quaternary surveys to field-verify Regional Ecosystems (REs), targeted surveys for Commonwealth Threatened Ecological Communities (TECs) and random meander searches for conservation significant species. Quaternary surveys were undertaken at 265 sites across the CEH PHES Project study area, as mapped in Figure 2.1. At each site, one or more of the following survey methods were applied.

2.2.1.1 Threatened Ecological Community (TEC) assessments

In suitable REs, assessments were undertaken to determine if TECs protected under the EPBC Act were present. Assessments were based on key diagnostic criteria and condition thresholds for each TEC, as specified in the Commonwealth listing advice. Where confirmed present, the TECs extent was mapped on ground, with boundaries validated/refined by cross-referencing with aerial imagery. TEC assessments were undertaken at quaternary sites where potentially suitable REs occurred in Figure 2.1

2.2.1.2 Regional Ecosystem verification

Verification of mapped REs was undertaken using quaternary level assessments in accordance with the methods detailed in Neldner et al.,(2022). Data collected includes species, structural estimation of height, and cover of the ecological dominant layer. Information on geology and landscape attributes was also collected. Range of heights from one or more sites per RE was recorded for the purpose of RE verification. Quaternary sites are shown in Figure 2.1

Where a Property Map of Assessable Vegetation (PMAV) existed over vegetation communities, no assessment was undertaken and the existing (mapping) classification was adopted. This is only relevant for PHES UR, where a PMAV is present over polygons of Category X (non-remnant) vegetation.

2.2.1.3 Targeted searches for conservation significant flora

Targeted searches for MNES conservation significant flora were undertaken in areas where previous records were documented, where high-risk flora trigger mapping intersected the CEH PHES study area and/or where suitable habitat for a conservation significant flora species was identified in the field.

Targeted searches were undertaken using recommended survey guidelines for species (where available) as described in Table 2.3. Targeted searches were undertaken for two flora species which were considered to have a reasonable likelihood of occurrence based on the presence of suitable habitat and proximity to nearby historical records: *Eucalyptus raveretiana* (black ironbox) and *Solanum graniticum* (granite nightshade). The potential occurrence of other conservation significant flora species was considered when undertaking general (quaternary) assessments across the CEH PHES Project study area.

Table 2.3 Summary of survey effort for conservation significant flora species

Species	Recommended surveys and conditions	Surveys undertaken at PHES area
<i>Eucalyptus raveretiana</i> (black ironbox)	Surveys should target semi-permanent or permanent creeks and rivers (Department of Agriculture, Water and the Environment (DAWE), 2022a)	Quaternary vegetation assessments at 265 sites Protected plants surveys at five sites
<i>Solanum graniticum</i> (granite nightshade)	No survey guidelines. Targeted surveys in suitable habitat are recommended. Suitable habitat is described as eucalypt woodland on hillsides in shallow soils derived from granite and granodiorite (Threatened Species Scientific Committee (TSSC), 2021a)	Quaternary vegetation assessments at 265 sites Protected plants surveys at confirmed locations Random meanders

Figure 2.1 shows the locations of targeted searches. The timing of the surveys was considered appropriate for *E. raveretiana* and *S. graniticum*. Where *E. raveretiana* and *S. graniticum* was encountered during the field survey, the precise location was recorded together with supplementary information including the number of individuals and the characteristics of the population and habitat.

2.2.1.4 Recording of invasive species

Prohibited or restricted invasive species as defined under the *Biosecurity Act 2014* were recorded and where relevant densities and extent were documented. The occurrence and abundance of all introduced species (flora and fauna) was recorded during the field survey.

2.2.2 Terrestrial fauna

2.2.2.1 Habitat assessment surveys

Fauna habitat assessments were undertaken at 335 sites across the CEH PHES Project study area. At each site, habitat assessments were undertaken to document the value of habitats for birds, reptiles, mammals and amphibians, based on the presence of key resources and microhabitats. Key habitat features noted included: the structural complexity of vegetation at canopy, shrub and ground layers, presence of key resources and microhabitat features including tree hollows, burrows, rocky outcrops, caves, leaf litter and woody debris and the presence of existing sources of disturbance including land-clearing, grazing, weeds and erosion.

Data from habitat assessments and desktop information informed the baseline description of ecological processes of the landscape in which the CEH PHES Project study area occurs, such as connectivity, fragmentation, site-level integrity, condition and degradation.

2.2.2.2 Targeted searches for conservation significant fauna

Targeted searches for MNES conservation significant fauna were undertaken between March 2020 and May 2023 for species considered to have a reasonable likelihood of occurrence based on the presence of suitable habitat and proximity to nearby historical records. Targeted searches were undertaken using recommended survey guidelines for species (where available) as described in Table 2.4.

Table 2.4 Summary of survey effort for conservation significant fauna species

Species	Recommended surveys and conditions	Surveys undertaken within CEH PHES Project study area
Birds		
<i>Geophaps scripta scripta</i> (squatter pigeon (southern))	Area searches/diurnal bird surveys (15 hrs over three days) Flushing surveys (10 hrs over three days) (Department of the Environment, Heritage, Water and the Arts (DEHWA), 2010).	Bird census at 335 sites (100.5 hrs over 22 days) Driving flushing surveys over 900 km.
<i>Hirundapus caudacutus</i> (white-throated needletail)	There is no survey guideline for the white-throated needletail. Surveys must occur between Oct-Apr in northern and eastern Australia (DAWE, 2022b).	Bird census at 335 sites (100.5 hrs over 22 days) (March, April, October, November, December) Habitat assessments at 335 sites (over 22 days).
<i>Myiagra cyanoleuca</i> (satin flycatcher)	There is no survey guideline for the satin flycatcher. The species can be detected through diurnal bird surveys.	Bird census at 335 sites (100.5 hrs over 22 days) Habitat assessments at 335 sites (over 22 days).
<i>Symposiachrus trivirgatus</i> (spectacled monarch)	There is no survey guideline for the spectacled monarch. The species can be detected through diurnal bird surveys.	Bird census at 335 sites (100.5 hrs over 22 days) Habitat assessments at 335 sites (over 22 days).

Species	Recommended surveys and conditions	Surveys undertaken within CEH PHES Project study area
Mammals		
<i>Dasyurus hallucatus</i> (northern quoll)	Cage trapping (May to Aug) (min. three nights) Elliott trapping (May to Aug) (min. four traps/configuration over three nights) Daytime searches for habitat Remote cameras Hair tubes Spotlighting (Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC), 2011; DAWE, 2022c).	Remote cameras (eight sites) Habitat assessments at 335 sites (over 22 days) Spotlighting surveys over six nights.
<i>Petauroides volans</i> (greater glider)	Searches for faecal pellets Spotlighting 1 km transects within areas of high densities of hollow-bearing trees (Victorian Department of Environment, Land, Water and Planning (DELWP), 2021).	SAT searches (150 sites) Spotlighting surveys over six nights.
<i>Petaurus australis australis</i> (yellow-bellied glider (south-eastern))	Spotlighting transects (1 km minimum) after dusk Listening periods (10 min) Call playback (three min broadcast of powerful owl call, two min listening period, three min broadcast of powerful owl call) (DAWE, 2022d).	Habitat assessments at 335 sites (over 22 days) Spotlighting surveys over six nights.
<i>Phascolarctos cinereus</i> (koala)	Transect and point surveys Nocturnal spotlighting Trained koala detection dogs Mark re-sight or mark-recapture Thermal detection drones Radio-tracking Camera traps Faecal pellet surveys Call playback Passive acoustics Landscape nutritional quality surveys (Youngentob <i>et al.</i> , 2021; DAWE, 2022e).	SAT searches (150 sites) Remote cameras (eight sites) Spotlighting surveys over six nights.
<i>Pteropus poliocephalus</i> (grey-headed flying-fox)	Daytime surveys for camps Surveys for vegetation communities and food plants Night-time surveys (DAWE, 2021).	Habitat assessments at 335 sites (over 22 days) Quaternary vegetation assessments at 265 sites.

2.2.2.3 Targeted searches for traces of conservation significant fauna species

Within suitable habitat, targeted searches were undertaken to detect characteristic traces of conservation significant wildlife. This included searching eucalypt woodland for koala and greater glider faecal pellets and scratches and searching rocky outcrops for latrine sites of the northern quoll.

2.2.2.4 Spot Assessment Technique

Searches for koala and greater glider faecal pellets were undertaken at 182 sites within the CEH PHES Project study area using the Spot Assessment Technique (SAT) (Phillips and Callaghan, 2011).

2.2.2.5 Bird census surveys

To survey the existing bird assemblage, bird census surveys were undertaken at 473 sites over approximately 141.9 hrs of fixed-point bird surveys using the Birds Australia census technique (Loyn, 1986). This involved undertaking a 20-minute survey of a 2-ha area recording all birds seen or heard calling.

2.2.2.6 Active searches for reptiles and frogs

At 23 sites within the CEH PHES Project study area, a 20-minute active search was undertaken to detect reptile and amphibian species. This involved actively searching beneath rocks, logs, bark, leaf litter and other microhabitats including along the edges of streams and waterbodies. Within suitable habitat, targeted searches were undertaken for conservation significant reptiles and frogs. Habitats were considered generally unsuitable for a number of other conservation significant species identified in the desktop searches.

2.2.2.7 Deployment of remote surveillance cameras and Anabat detectors

Baited remote cameras were deployed at eight locations. These cameras were left in situ for a total of 28 trap nights. The remote cameras were deployed in representative vegetation types to target conservation significant species such as the northern quoll.

Anabats were set within the CEH PHES Project study area to record the echolocations of microbat species. Anabat detectors were set at between 1 m to 2 m off the ground in suitable flyways within areas of optimal bat habitat, with a local abundance of roosting sites (i.e., hollow bearing trees and foraging habitat along watercourses, near waterbodies and in vegetated areas). Each Anabat was left in situ overnight. Recorded calls were analysed by specialist subconsultant Greg Ford. Where possible, calls were identified to species. Where calls could not be identified to species, as a result of poor quality or call overlap between species, calls were identified to a species complex.

2.2.2.8 Nocturnal active searches and spotlighting

Nocturnal active searches and spotlighting were undertaken over six nights within the CEH PHES Project study area. Nocturnal surveys involved a combination of vehicle-based spotlighting transects and nocturnal active-searches with head-torches. These targeted key habitats for conservation significant species including northern quoll, greater glider, koala, grey-headed flying-fox and *Macroderma gigas* (ghost bat).

2.2.2.9 Driving / flushing surveys

Driving / flushing surveys were undertaken to detect the squatter pigeon (southern) and other small ground-dwelling birds. Approximately 900 km was driven over the course of surveys of the CEH PHES Project study area.

2.2.2.10 BioCondition assessments

BioCondition assessments were undertaken at 38 plots across the CEH PHES Project study area. BioCondition assessments were undertaken as per the BioCondition Assessment Manual version 2.2 (Eyre *et al.*, 2015).

2.3 Aquatic ecology survey methods

The aquatic ecological assessment included a desktop review of environmental databases, mapping layers and previous field survey reports, and a field assessment of the aquatic ecological values within the study area.

The approach to the baseline study is considered appropriate with comprehensive desktop searches allowing for targeted field survey methods to be developed based on expected site conditions and species likelihood of occurrence. Field surveys were undertaken in accordance with recommended guidelines including:

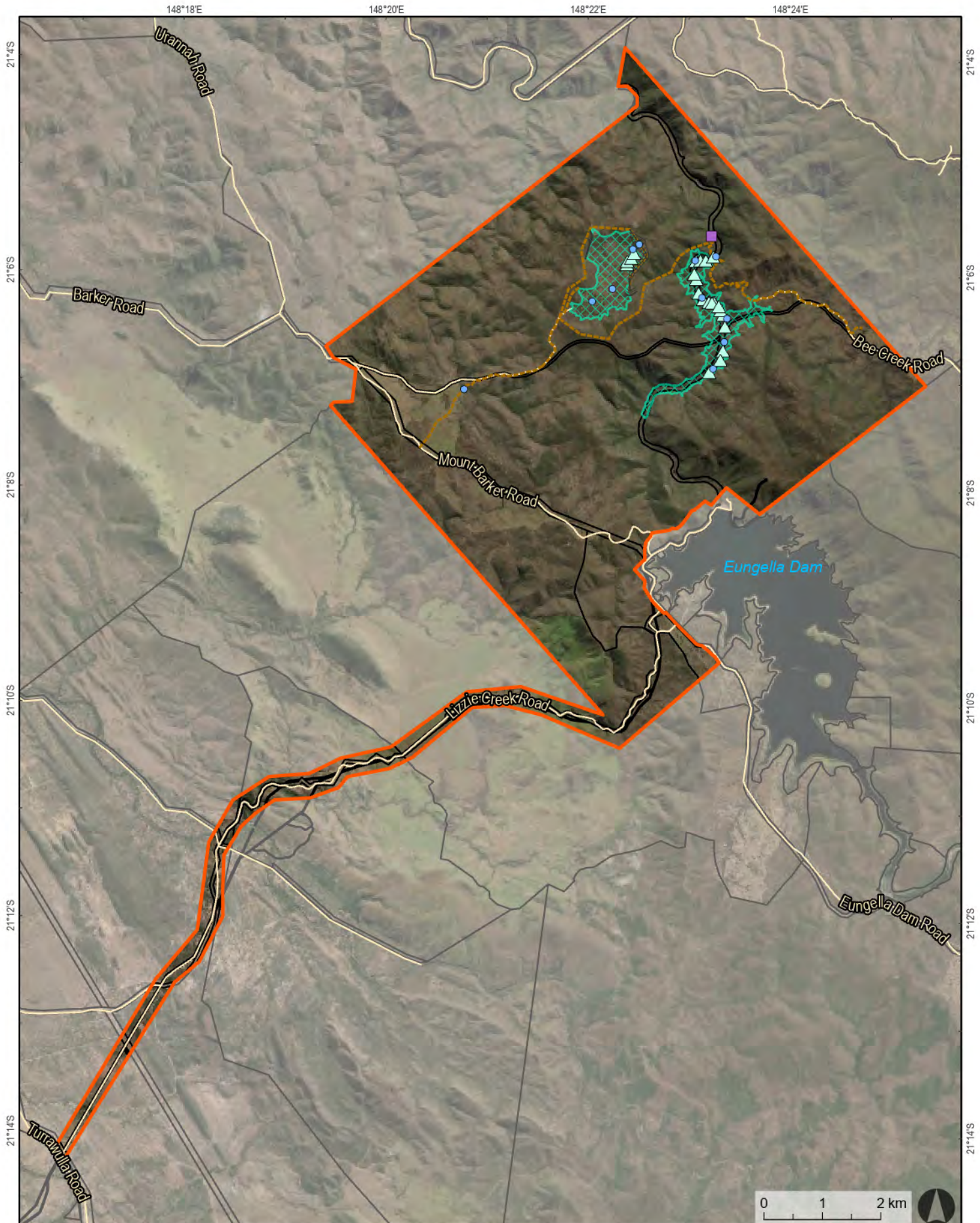
- Queensland AusRivAS Sampling and Processing Manual (Department of Natural Resources and Mines (DNRM), 2001)
- Monitoring and Sampling Manual *Environmental Protection (Water) Policy 2009* (DES, 2018)
- Survey guidelines for Australian's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the EPBC Act (Commonwealth of Australia, 2011)
- Queensland Crocodile Monitoring Plan (DES, 2018b).

Two field survey events were conducted during post-wet and pre-wet season conditions to identify and describe the existing aquatic ecological values within the CEH PHES Project study area. Post-wet conditions provide the opportunity to capture the highest diversity of flora and fauna species as waterways tend to be in good condition after flow. Surveys were undertaken from 17 – 21 April 2020 and from the 29 November – 2 December 2020 as well as from 4 – 16 October 2022 and from 23 – 26 November 2022.

Two tiers of field assessment were conducted to efficiently describe the aquatic ecological values throughout the large extent of the CEH PHES Project study area. The assessment included:

- Rapid assessments – including AusRivAS habitat assessment and bioassessment. Rapid assessments were conducted at two sites during April 2020, 12 sites during November 2020 and at eight sites during October and November 2022 within the CEH PHES study area.
- Detailed assessments – including all rapid assessments techniques and targeted habitat suitability assessments for the estuarine crocodile (*Crocodylus porosus*). Detailed assessments were conducted at three sites during December 2020 and at four sites during October and November 2022 within the CEH PHES study area.

Site locations are shown in Figure 2.2. A detailed description of each survey technique is provided in Sections 2.3.1 and 2.3.2.



- LEGEND**
- PHES Project area
 - Aquatic survey sites 2020
 - ▲ Aquatic survey sites 2022
 - Dam wall
 - Proposed pumped hydro reservoirs
 - Proposed access track
 - Proposed powerhouse
 - Existing road
 - Cadastre

Sources:
 Biodiversity status of 2019 remnant regional ecosystems v12.2
 Flora Survey Trigger Map for Clearing Protected Plants in Queensland v8.0

Disclaimer: CIP makes no warranty in relation to the accuracy, reliability, completeness or suitability of the data and does not accept liability for any loss, damage or costs, including consequential damage, in relation to any use of the data in this map.

PROJECT			
CEH PHES Project			
TITLE			
Aquatic survey effort and locations within the CEH PHES Project study area			
DATE	STATUS	PRODUCED	
8/08/2023	DRAFT	IM	
SCALE	DATUM	REV	
1:85,000 at A3	GDA 1994 MGA Zone 55	A	
FILE			FIG
CEH-EPBC-PHES - FIG 2_2 AQUATIC SURVEY - rA			2.2

2.3.1 Aquatic habitat assessment surveys

Habitat assessments were undertaken at 14 rapid and three detailed assessment sites during December 2020 and at eight rapid and four detailed assessment sites during October and November 2022, to describe the presence and condition of key aquatic habitat features and overall condition of each site. The assessments were conducted in accordance with the Queensland AusRivAS Sampling and Processing Manual (DNRM, 2001) and the Monitoring and Sampling Manual (DES, 2018a).

Habitats were characterised in terms of the key features outlined in Table 2.5. The location and extent of habitats (including potential breeding habitat) within the site were mapped and a longitudinal profile sketch of the stream reach completed. Photographs of each site were taken as an additional record of habitat conditions at the time of the survey.

An overall condition score was calculated by scoring each habitat variable against condition criteria detailed in Table 2.6. These scores were then compared between sites to identify patterns within the data and provide an ecologically relevant interpretation of the results.

Table 2.5 *Habitat characteristics and features recorded during habitat assessments*

Habitat characteristic	Key features
Channel type	Reach morphology: bank full bank height, bank full stream width, stream wetted width, normal wetted width, water depth.
Habitat diversity and extent	Variety of habitat: the presence of shallow, deep, pool, run, riffle, undercut bank, woody debris and macrophytes habitats.
Bed and bank composition	Substrate: percent representation by bedrock, boulder (>256 mm), cobble (64-256 mm), pebble (4-64 mm), gravel (2-4 mm), sand (0.05-2 mm) and silt/clay (<0.05 mm) classifications. Sediment deposits: presence of instream deposits of either sand or silt (or none).
Surface water attributes	Water quality: substrate anoxia, water surface colour and condition, the presence of water or substrate odour was noted. Hydrology: estimates of velocity.
Instream habitat	Snags and woody debris: representation of detritus (leaves, twigs), sticks (<2 cm diameter), branches (<15 cm diameter) and logs (>15 cm diameter) classifications. These were estimated in terms of cover within the reach as either none, little (1-10 percent), some (10-50 percent), moderate (50-75 percent) or extensive (>75 percent). Habitat attributes: presence of periphyton, moss, filamentous algae, macrophytes, bank overhang vegetation, trailing bank vegetation, blanketing silt and substrate anoxia. The same 'none' to 'extensive' categories were used as for snags and woody debris. Macrophytes: general characterisations of visible macrophytes.
Riparian condition	Riparian zone: width of riparian zone, percent canopy cover, percent shading, cover (none' to 'extensive') of bare ground, grass, shrubs, tress < 10 m high; trees > 10 m high and presence of exotic species.
Existing disturbances/modifications or barriers	Disturbances: impacts from humans, pastoral animals, non-pastoral animals. Presence of erosion, artificial and/or natural barriers.
Breeding habitat	Location and suitability of potential breeding habitats.

Table 2.6 River bioassessment program: habitat assessment score criteria (DoR, 2001)

Habitat variable	Poor	Fair	Good	Excellent
Bottom substrate	0 – 5	6 – 10	11 – 15	16 – 20
Embeddedness	0 – 5	6 – 10	11 – 15	16 – 20
Velocity and depth category	0 – 5	6 – 10	11 – 15	16 – 20
Channel alteration	0 – 3	4 – 7	8 – 11	12 – 15
Bottom scouring and deposition	0 – 3	4 – 7	8 – 11	12 – 15
Pool/riffle, run/bend ratio	0 – 3	4 – 7	8 – 11	12 – 15
Bank stability	0 – 2	3 – 5	6 – 8	9 – 10
Bank vegetation and stability	0 – 2	3 – 5	6 – 8	9 – 10
Streamside cover	0 – 2	3 – 5	6 – 8	9 – 10
Total	0 – 38	39 – 74	75 – 110	111 – 135

In-situ physico-chemical water quality data was measured at each wetted site where sufficient water was available. Measurements were recorded at the surface (0.1 m depth) using a calibrated water quality meter. Parameters recorded included:

- Water temperature (°C)
- pH (pH units)
- Electrical conductivity (µS/cm)
- Dissolved oxygen (mg/L and % saturation)
- Turbidity (NTU).

In-situ physico-chemical water quality data was collected to inform the assessment of habitat condition at a site.

2.3.2 Aquatic fauna

The presence of estuarine crocodile (*Crocodylus porosus*) within the CEH PHES Project study area was assessed through active searches for evidence of crocodile occurrence and assessment of habitat suitability.

Daytime active searches were undertaken at all sites for individuals, nesting sites and bank slides in accordance with the Queensland Crocodile Monitoring Plan (DES, 2018b). The suitability of habitat at each site was assessed based on water depth, water permanence, habitat size and connectivity.

2.4 Animal ethics and legislative permits

The ecological field surveys were conducted in accordance with the following permits and approvals:

- Department of Employment, Economic Development and Innovation Scientific Users Registration Certificate (Registration Number 132)
- DES Scientific Purposes Permit (permit number WISP15723315)
- Animal Research Authority issued by the accredited GHD Animal Ethics Committee.
- Blue Earth Environmental Animal Ethics approval (CA 2020/01/1341)
- General Fisheries Permit (permit number 192406).

2.5 Likelihood of occurrence assessment

An assessment was conducted to attribute a likelihood of occurrence to conservation significant species (i.e., species listed under the EPBC Act) that have been previously recorded or were predicted to occur from the desktop searches. The likelihood of occurrence assessment was based on a review of species distributions and habitat requirements, historical records for the region, the results of habitat assessments and field surveys and conservatism required due to species mobility and detectability. The likelihood of occurrence ranking was based on the framework presented in Table 2.7. The likelihood of occurrence assessment is presented in Appendix B.

Table 2.7 Likelihood of occurrence assessment criteria for conservation significant species

Category	Criteria
Confirmed present	Species has been recorded during the field survey.
High to moderate likelihood of occurrence	Species distribution is known within the desktop search extent and/or the species has been historically recorded within the desktop search extent and/or suitable habitat is present within the project area and/or species requires conservatism due to species detectability or mobility and <i>the species has not been recorded during field surveys.</i>
Low likelihood of occurrence	Species distribution is not certain/close vicinity/may occur/within range but not locally recorded within the desktop search extent and/or historical records do not occur or are distant and/or habitat is present or of low/moderate value and/or species requires conservatism due to species detectability or mobility and <i>the species has not been recorded during field surveys.</i>
Unlikely to occur	Species known distribution is not mapped within the desktop search extent and/or habitat is absent, or present but lacking and/or no conservatism is required due to species detectability or mobility and <i>the species has not been recorded in field surveys.</i>

2.6 Predicted habitat for conservation significant species

For all MNES including ecological communities and conservation significant flora and fauna species that were **confirmed present or considered to have a high to moderate likelihood of occurrence**, predicted habitat mapping was undertaken and used as a basis for assessing the significance of impacts under the EPBC Act. Predicted habitat mapping was based on species-specific habitat criteria detailed in the Commonwealth and/or state listing/conservation advice and/or other related documents (e.g., recovery plans).

As most Commonwealth habitat definitions are necessarily broad and lack detail on the spatial scale at which they can be mapped and extrapolated on the ground, a conservative approach was used, whereby compatible REs and landscape scale factors (e.g. connectivity to suitable vegetation, distance to water) were used to map initial areas of *possible* habitat. These were then field-verified using on-ground field observations of habitat condition, vegetation maturity and the presence of critical resources such as hollow-bearing trees and rocky outcrops to map areas of *predicted* habitat for each species. Criteria used to map habitat for each conservation significant species are detailed in Appendix C.

2.7 Impact area calculations

For all MNES including ecological communities and conservation significant flora and fauna species that were **confirmed present or considered to have a high to moderate likelihood of occurrence**, the area of direct impact from the CEH PHES Project was calculated based on the area of intersection between the CEH PHES Project footprint and the predictive habitat mapping for each species. The impact area calculations for each of project components are summarised in Table 2.8 and detailed in Appendix D. Potential impacts to waterways have been calculated based on the area of only the waterway which intersects with the CEH PHES Project footprint (Table 2.9).

The impact calculations do not include a small number of potential existing road upgrades that were identified following the completion of species habitat mapping. These existing road upgrades occur over a total area of 7.22 ha, however, the extent of the upgrade works, and therefore the area of vegetation clearing required, is still in the process of being determined. As part of the CEH PHES Project environmental assessment process, impact calculations will be revised where required to include these areas, and account for any other changes to the CEH PHES Project footprint that may occur as the design progresses.

Table 2.8 Impact area calculation components

Project component	Total footprint (direct impact) area (hectares)
PHES UR infrastructure and reservoir	116.67 ha
PHES LR infrastructure and reservoir	110.96 ha
Powerhouse and switchyard	0.97 ha
Access tracks	17.49 ha
Dam wall construction footprints	21.64 ha
Ancillary construction infrastructure footprints (camps, office, storage yards, workshops, batching plants, crushing and processing plants, stockpile areas, rial pads, water storage, laydown areas, disposal areas)	66 ha
Existing road upgrades within project footprint	36.42 ha

Table 2.9 Summary of estimated impact area of the CEH PHES Project on waterways

Waterway	Stream order	Impact areas
CEH PHES Project UR		
Unnamed tributary	1	0.86 ha
CEH PHES Project LR		
Broken River	4	33.41 ha
Unnamed tributary	2	0.46 ha
Unnamed tributary x 5	1	0.62 ha
Access tracks		
Proposed new tracks	4	0.15 ha
Existing tracks to be upgraded	1 - 4	0.62 ha

3. Field results

3.1 Threatened Ecological Communities

Field surveys were undertaken across the CEH PHES Project study area for the purpose of ground-truthing the presence of potential TECs. Only the Poplar Box Woodland on Alluvial Plains TEC was **confirmed present** within the footprint of the existing road upgrades. All other TECs were assessed as unlikely to occur.

3.1.1 Poplar Box Grassy Woodland on Alluvial Plains TEC

Quaternary vegetation surveys confirmed the presence of RE 11.3.2 alongside the existing access road, near the southern extent. This RE is diagnostic of the Poplar Box Grassy Woodland on Alluvial Plains TEC. BioCondition assessments within the RE determined that the vegetation meets the condition category criteria of at least 'moderate quality', as defined in the Commonwealth conservation advice (Department of the Environment and Energy (DoEE), 2019). Based on the diagnostic and condition criteria, the Poplar Box TEC was **confirmed present** within the footprint of the existing road upgrades.

3.2 Regional Ecosystems

Field-verified REs confirmed present within the CEH PHES Project study area are presented in Table 3.1. The field surveys identified multiple locations where the vegetation did not align with the DoR RE mapping. Discrepancies between field verified REs and DoR mapped REs is not unexpected as the majority of the RE polygons mapped by DoR across the CEH PHES Project study area were recorded as having a low confidence rating with regards to attribute accuracy.

An overview of field verified REs is shown in Figure 3.1. This field verified RE layer was used for all calculations and mapping presented hereafter in this report.

Table 3.1 Field verified Regional Ecosystem communities within the CEH PHES Project study area

RE code	Regional Ecosystem short description [^]
11.3.2	<i>Eucalyptus populnea</i> woodland on alluvial plains
11.3.4	<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. woodland on alluvial plains
11.3.25a	<i>Eucalyptus raveretiana</i> (sometimes emergent), <i>Eucalyptus tereticornis</i> and <i>Melaleuca fluviatilis</i> woodland.
11.3.25b	<i>Melaleuca leucadendra</i> and/or <i>M. fluviatilis</i> , <i>Nauclea orientalis</i> open forest. Riverine wetland or fringing riverine wetland.
11.3.35	<i>Eucalyptus platyphylla</i> , <i>Corymbia clarksoniana</i> woodland on alluvial plains
11.11.9	<i>Eucalyptus populnea</i> or <i>E. brownii</i> woodland on deformed and metamorphosed sediments and interbedded volcanics
11.11.13	<i>Acacia harpophylla</i> or <i>A. argyrodendron</i> low open forest with a secondary tree layer of <i>Terminalia oblongata</i> on deformed and metamorphosed sediments and interbedded volcanics
11.11.15	<i>Eucalyptus crebra</i> woodland to open woodland on deformed and metamorphosed sediments and interbedded volcanics
11.12.1/11.3.25e	<i>Eucalyptus crebra</i> woodland on igneous rocks / <i>Eucalyptus camaldulensis</i> , <i>E. tereticornis</i> woodland fringing larger, permanent water courses.
11.12.1	<i>Eucalyptus crebra</i> woodland on igneous rocks
11.12.3	<i>Eucalyptus crebra</i> , <i>E. tereticornis</i> , <i>Angophora leiocarpa</i> woodland on igneous rocks especially granite

RE code	Regional Ecosystem short description [^]
11.12.4	Semi-evergreen vine thicket and microphyll vine forest on igneous rocks
11.12.6a/11.12.7	<i>Eucalyptus crebra</i> +/- <i>Corymbia citriodora</i> and/or <i>E. acmenoides</i> +/- <i>Lophostemon suaveolens</i> woodland to open forest / <i>Eucalyptus crebra</i> woodland with patches of semi-evergreen vine thicket on igneous rocks (boulder-strewn hillsides)
11.12.6a/11.12.1	<i>Eucalyptus crebra</i> +/- <i>Corymbia citriodora</i> and/or <i>E. acmenoides</i> +/- <i>Lophostemon suaveolens</i> woodland to open forest. / <i>Eucalyptus crebra</i> woodland on igneous rocks
11.12.6a	<i>Eucalyptus crebra</i> +/- <i>Corymbia citriodora</i> and/or <i>E. acmenoides</i> +/- <i>Lophostemon suaveolens</i> woodland to open forest.
11.12.7/11.3.25	<i>Eucalyptus crebra</i> woodland with patches of semi-evergreen vine thicket on igneous rocks (boulder-strewn hillsides) / <i>E. tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines
11.12.7/11.3.25e	<i>Eucalyptus crebra</i> woodland with patches of semi-evergreen vine thicket on igneous rocks (boulder-strewn hillsides) / <i>E. camaldulensis</i> , <i>E. tereticornis</i> woodland fringing larger, permanent water courses.
11.12.7/11.12.4	<i>Eucalyptus crebra</i> woodland with patches of semi-evergreen vine thicket on igneous rocks (boulder-strewn hillsides) / Semi-evergreen vine thicket and microphyll vine forest on igneous rocks
11.12.7	<i>Eucalyptus crebra</i> woodland with patches of semi-evergreen vine thicket on igneous rocks (boulder-strewn hillsides)

[^] Dominant RE description detailed only

148°18'E 148°20'E 148°22'E 148°24'E

21°4'S

21°4'S

21°6'S

21°6'S

21°8'S

21°8'S

21°10'S

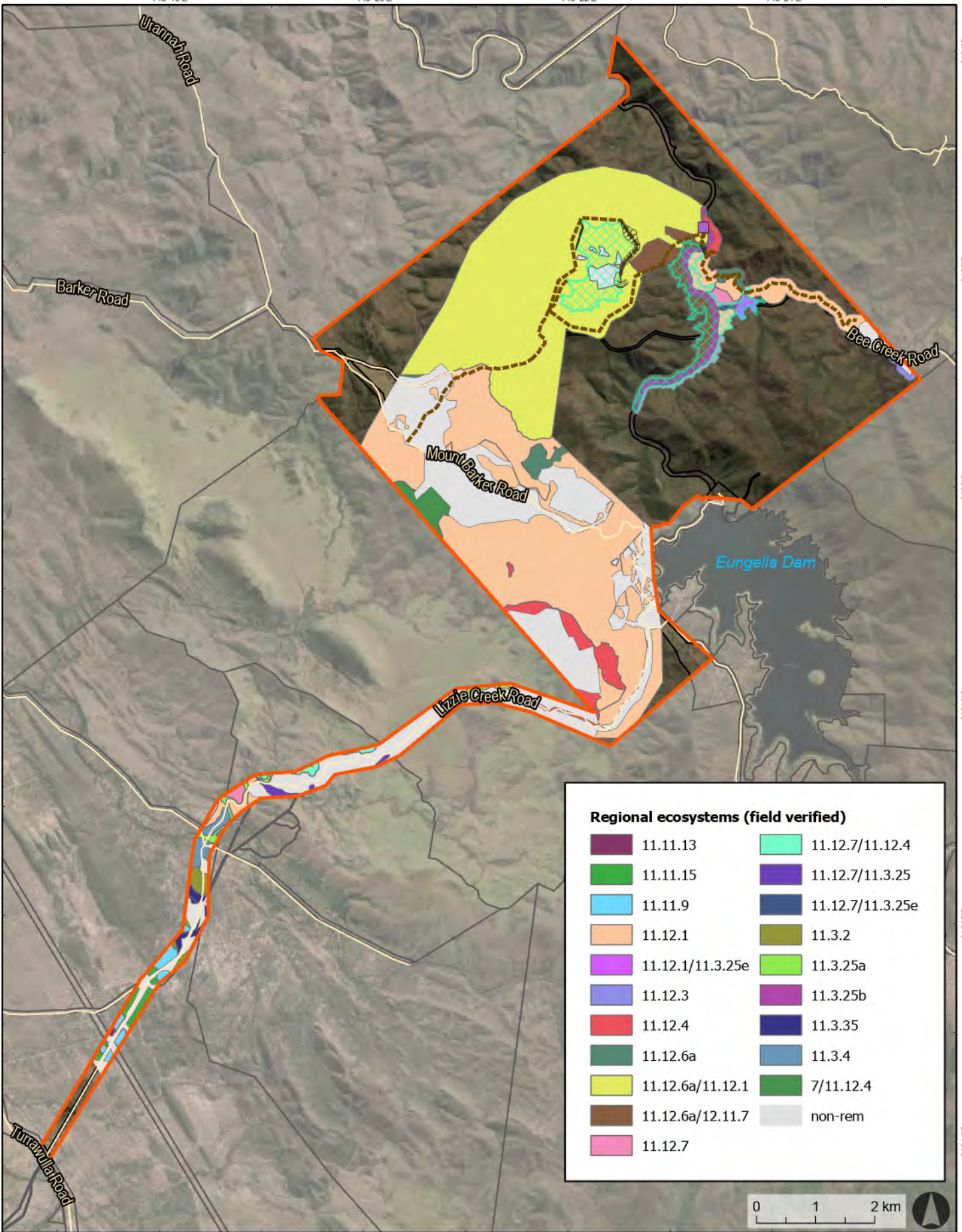
21°10'S

21°12'S

21°12'S

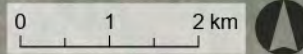
21°14'S

21°14'S



Regional ecosystems (field verified)

11.11.13	11.12.7/11.12.4
11.11.15	11.12.7/11.3.25
11.11.9	11.12.7/11.3.25e
11.12.1	11.3.2
11.12.1/11.3.25e	11.3.25a
11.12.3	11.3.25b
11.12.4	11.3.35
11.12.6a	11.3.4
11.12.6a/11.12.1	7/11.12.4
11.12.6a/12.11.7	non-rem
11.12.7	



LEGEND

- PHEs Project area
- Dam wall
- Proposed pumped hydro reservoirs
- Proposed access track
- Proposed powerhouse
- Existing road
- Cadastre

Sources:
 Biodiversity status of 2019 remnant regional ecosystems v12.2
 Flora Survey Trigger Map for Clearing Protected Plants in Queensland v8.0
 Disclaimer: CIP makes no warranty in relation to the accuracy, reliability, completeness or suitability of the data and does not accept liability for any loss, damage or costs, including consequential damage, in relation to any use of the data in this map.

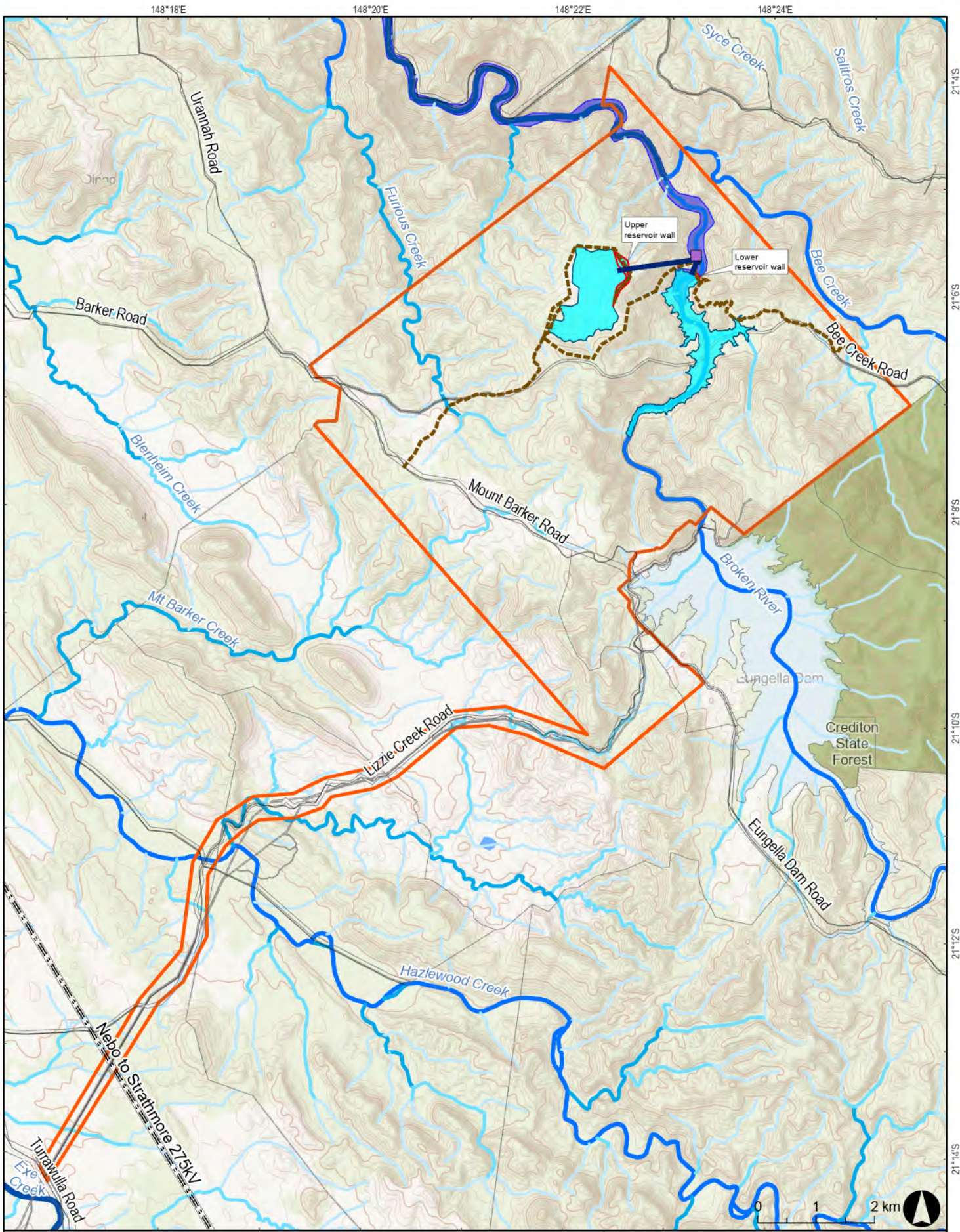
PROJECT				CEH PHEs Project		
TITLE				Regional ecosystems		
DATE	8/08/2023	STATUS	DRAFT	PRODUCED	IM	
SCALE	1:85,000 at A3	DATUM	GDA 1994 MGA Zone 55	REV	C	
FILE	CEH-EPBC-PHEs - FIG_3_1 REGIONAL ECOSYSTEMS - rC				FIG	3.1

3.3 Wetlands and waterways

The desktop review identified no protected internationally important wetlands relating to the CEH PHES Project study area and desktop search extent. The following wetlands listed under the Directory of Important Wetlands of Australia occur within, upstream and/or downstream of the CEH PHES Project study area (Figure 3.2):

- Broken River, Urannah Creek and Massey Creek Aggregation (Wetland ID: QLR199) – within and downstream of CEH PHES Project area
- Eungella Dam (Wetland ID: QLR046) – 2 km upstream of the CEH PHES Project LR
- Bowen River: Birralee - Pelican Creek (Wetland ID: QLR198) – 117 km downstream of the CEH PHES Project LR
- Burdekin-Bowen Junction and Blue Valley Weir Aggregation (Wetland ID: QLR205) – 184 km downstream of the CEH PHES Project LR
- Burdekin Delta (Wetland ID: QLR004) – 290 km downstream of the CEH PHES Project LR.

Waterways present within the CEH PHES Project study area include the Broken River and a number of un-named tributaries as shown in Figure 3.2. Field surveys confirmed habitat condition of the Broken River was Good and contained excellent bottom substrate, embeddedness, bottom scouring/deposition, bank stability, bank vegetative stability and streamside cover. Overall tributaries were in Fair condition.





Source: Directory of Important Wetlands in Australia (DIWA) Spatial Database, 23/03/2010 (ANZCW0501003820)

Disclaimer: CIP makes no warranty in relation to the accuracy, reliability, completeness or suitability of the data and does not accept liability for any loss, damage or costs, including consequential damage, in relation to any use of the data in this map.

LEGEND

- PHES Project area
- Proposed pumped hydro reservoirs
- Proposed powerhouse
- Dam wall
- Proposed underground head/tail race
- Proposed access track
- Existing transmission powerline
- Existing road

- Protected areas
- Broken River Urannah Creek and Massey Creek
- Aggregation DIWA nationally important wetland

Watercourse stream order

- 1
- 2
- 3
- 4
- 5

PROJECT				CEH PHES Project				
TITLE				Directory of important wetlands Australia				
DATE	3/08/2023	STATUS	DRAFT	PRODUCED	AC	REV	A	
SCALE	1:85,000 at A3	DATUM	GDA 1994 MGA Zone 55	FILE	CEH-EPBC-PHES - FIG 3_2 WETLANDS - rA		FIG	3.2

3.4 Conservation significant species results

Of the 41 MNES conservation significant species identified in desktop searches:

- Five were confirmed present during field studies within the CEH PHES Project study area
- Nine were considered to have a high to moderate likelihood of occurrence within the CEH PHES Project study area based on the presence of suitable habitat and nearby historical records
- Ten were considered to have a low likelihood of occurrence within the CEH PHES Project study area based on the presence of suitable habitat and nearby historical records
- One was considered unlikely to occur within the CEH PHES Project study area but it was deemed to occur downstream
- The remaining 16 species are unlikely to occur due to both the absence of suitable habitat and nearby historical records, or because their currently described range does not overlap the CEH PHES Project study area. Many of the conservation significant species identified in the desktop searches are rainforest-dependent species that have been historically recorded within the nearby Eungella National Park, which contains different vegetation communities to those within the CEH PHES Project study area.

The likelihood of occurrence assessment for each MNES is provided in Table 3.2.

Table 3.2 CEH PHES Project likelihood of occurrence summary conservation significant species

Species name	Common name	Conservation status* (EPBC Act)	Likelihood of occurrence
Conservation significant flora			
<i>Eucalyptus raveretiana</i>	Black ironbox	V	Confirmed present (in isolated watercourses along the footprint of the existing road upgrade)
<i>Solanum graniticum</i>	Granite nightshade	E	Confirmed present (96 individuals from 13 locations)
Conservation significant fauna			
<i>Petauroid volans</i>	greater glider	E	Confirmed present (along access track of CEH PHES Project UR and LR)
<i>Pteropus poliocephalus</i>	grey-headed flying-fox	V	High to moderate likelihood of occurrence
<i>Phascolarctos cinereus</i>	koala	E	Confirmed present (one juvenile observed within the transmission corridor, evidence of scat observed across the CEH PHES Project study area)
<i>Dasyurus hallucatus</i>	northern quoll	E	High to moderate likelihood of occurrence
<i>Petaurus australis australis</i>	yellow-bellied glider (south-eastern)	V	High to moderate likelihood of occurrence
<i>Geophaps scripta scripta</i>	squatter pigeon (southern)	V	Confirmed present (observed across the CEH PHES Project study area)
<i>Hirundapus caudacutus</i>	white-throated needletail	V, Mig	High to moderate likelihood of occurrence
<i>Apus pacificus</i>	fork-tailed swift	Mig	High to moderate likelihood of occurrence
<i>Monarcha melanopsis</i>	black-faced monarch	Mig	High to moderate likelihood of occurrence
<i>Symposiachrus trivirgatus</i>	spectacled monarch	Mig	High to moderate likelihood of occurrence
<i>Myiagra cyanoleuca</i>	satin flycatcher	Mig	High to moderate likelihood of occurrence
<i>Rhipidura rufifrons</i>	rufous fantail	Mig	High to moderate likelihood of occurrence
<i>Crocodylus porosus</i>	estuarine crocodile	Mig	Unlikely to occur within the CEH PHES Project study area, however, is known to occur 29 km downstream

* Conservation status: E – Endangered; V – Vulnerable; Mig – Migratory; SL – Special least concern; LC – Least concern; NL – Not Listed

4. Project impacts

During the construction phase, the CEH PHES Project is expected to result in the loss of vegetation and habitat, due to clearing for the CEH PHES Project footprints.

Without appropriate mitigation, vegetation clearing may result in direct mortality and injury of wildlife, and indirect ecological impacts such as:

- Temporary disturbance of wildlife through construction light, noise, vibration and increased vehicle movements
- Restricted fauna movement and barrier effects
- Degradation of adjacent habitats through erosion, sedimentation, and weed/pest species invasion.

The operation phase will have relatively minor, localised impacts on terrestrial ecological values. Impacts may include:

- Minor, localised disturbance of wildlife through light, noise, vibration from the powerhouse and increased vehicle movements
- Degradation of adjacent habitats from edge effects, fragmentation and spread of weed/pest species
- Direct mortality and injury of wildlife from movement of vehicles, collision with fencing, and entrapment in the reservoirs
- Degradation of downstream aquatic habitat as a result of change in flow regime and spilling events.

In aggregate, construction of the CEH PHES Project reservoirs, its ancillary infrastructure and all other construction-related vegetation disturbance will cover an area of 369.69 ha, of which approximately 329.82 ha is remnant vegetation and 2.98 ha is high-value regrowth. Construction of the CEH PHES Project will also result in the loss or modification of waterways within the footprints of the UR, LR, access tracks and construction footprints (refer to Section 2.7). Indirect impacts are likely within the Broken River downstream of the CEH PHES Project UR and LR, as a result of changes in flow regime and degradation of aquatic habitat.

Appendix E details the avoidance hierarchy measures taken to date and potential actions to further reduce impact. Despite the avoidance achieved, the CEH PHES Project will result in direct and indirect impacts to 16 MNES conservation significant species/communities confirmed present or high to moderate likelihood of occurrence within the CEH PHES Project study area. The estimated loss of predicted habitat for these species is summarised in Table 4.1, while the significance of the direct and indirect impacts of the CEH PHES Project on conservation significant species is discussed in Section 5.

Table 4.1 Estimated habitat loss for MNES that were confirmed present or high to moderate likelihood of occurrence

Species		Area of predicted habitat loss
MNES – conservation significant flora/communities		
Poplar Box Grassy Woodland on Alluvial Plains TEC		0.38 ha
Black ironbox		0.25 ha
Granite nightshade		21.76 ha
MNES – conservation significant fauna		
Greater glider		180.47 ha
Grey-headed flying-fox	Habitat critical	319.20 ha
	Foraging	39.05 ha
Koala	Habitat critical	40.29 ha
	Foraging	268.78 ha
Northern quoll	Denning	36.83 ha
	Foraging	285.97 ha
	Total habitat critical	322.80 ha

Species		Area of predicted habitat loss
Yellow-bellied glider		165.11 ha
Squatter pigeon (southern)	Nesting (habitat critical)	54.30 ha
	Foraging	216.13 ha
	Drinking	90.06 ha
White-throated needletail	Roosting	1.69 ha
	Overfly	265.42 ha
Aerial migratory birds - Fork-tailed swift		322.80 ha
Terrestrial migratory birds - Satin flycatcher, Rufous fantail		58.20 ha
Terrestrial migratory birds - Black-faced monarch, Spectacled monarch		60.26 ha
Estuarine crocodile		Indirect downstream potential impacts

5. Significant impact assessment

This section assesses the significance of the CEH PHES Project impacts on MNES that have been confirmed present or are considered high to moderate likelihood of occurrence within the CEH PHES Project study area. The significance of impact assessment has been undertaken in accordance with the *Significant Impact Guidelines 1.1 – MNES* (DoE, 2013), or where applicable, species-specific Commonwealth guidelines. The outcomes of the assessment are summarised in Table 5.1.

Table 5.1 Summary of significance of impact on MNES

Species	Significance of impact
Poplar Box Grassy Woodland on Alluvial Plains TEC	Not significant
<i>Eucalyptus raveretiana</i>	Not significant
<i>Solanum graniticum</i>	Not significant
Greater glider	Significant
Grey-headed flying-fox	Significant
Koala	Significant
Northern quoll	Significant
Yellow-bellied glider	Significant
Squatter pigeon (southern)	Not significant
White-throated needletail	Not significant
Fork-tailed swift	Not significant
Terrestrial migratory birds - Satin flycatcher, Rufous fantail	Not significant
Terrestrial migratory birds - Black-faced monarch, Spectacled monarch	Not significant
Estuarine crocodile	Not significant

5.1 Poplar Box Grassy Woodland on Alluvial Plains TEC

The CEH PHES Project is **not likely to result in a significant residual impact on the Poplar Box Grassy Woodland on Alluvial Plains TEC**. A significance of impact assessment of the CEH PHES Project on Poplar Box Grassy Woodland on Alluvial Plains TEC is provided in Table 5.2. Approximately 0.38 ha of woodland vegetation meeting the definition of the Poplar Box Grassy Woodland on Alluvial Plains TEC occurs within the footprint of the

existing road upgrades (Figure 5.1). The vegetation met the key diagnostic and threshold condition criteria (DoEE, 2019) to qualify as the TEC as detailed below.

Key diagnostic criteria:

- Appropriate location and physical environment.
 - Located within a relevant bioregion (i.e., Northern Brigalow Belt).
 - Located within the appropriate physical location: Associated with ancient and recent depositional alluvial plains with clay, clay-loam, loam and sandy loam, typically duplex soils or sodosols. This includes areas that may not be part of currently defined floodplains.
- Appropriate vegetation structure.
 - A grassy woodland to grassy open woodland with a tree crown cover of 10% or more at patch scale.
 - A tree canopy must be present that shows these features:
 - Canopy tree species are capable of reaching 10 m or more in height.
 - *Eucalyptus populnea* (Poplar Box) must be present in the canopy and is the dominant tree species.
 - Where hybrids of Poplar Box with other *Eucalyptus spp.* are present, they should be counted as part of the *Eucalyptus populnea* component of the tree canopy when assessing the previous criterion.
 - Mid layer (1-10 m) crown cover of shrubs to small trees is low, about 30% or less.
 - A ground layer (<1 m) mostly dominated across a patch by native grasses, other herbs and occasionally chenopods (during extended dry periods), ranging from sparse to thick (in response to canopy development, soil moisture, disturbance and/or management history).
 - A list of diagnostic native plant species and some of the key native fauna that make up the ecological community is given at Appendix C; although particular species may be abundant or rare, or not necessarily present, at every location.

Condition thresholds: The Poplar box grassy woodland TEC is considered to be patches that meet the key diagnostic characteristics (above) and at least the minimum condition thresholds (Moderate and High condition categories A, B, or C) set out in Table 3 of the Commonwealth listing advice for the TEC (DoEE, 2019). This includes high quality patches ≥1 ha in size and moderate and low-quality patches ≥5 ha in size.

Habitat critical to the survival of the TEC: The areas most critical to the survival of the ecological community are the best quality, most intact patches of the ecological community (as outlined in Class A – Highest condition of Table 3 of the Commonwealth listing advice). These represent those parts of the ecological community that retain the highest diversity and degree of structure and ecological functions. They represent those sites closest to the original, benchmark states of the ecological community and that must retain their inherent values through protection and ongoing management. However, this does not mean that areas that otherwise meet the minimum condition thresholds (i.e., good to moderate condition classes in Table 3 of the Commonwealth listing advice, (DoEE, 2019)), are unimportant for the future survival of the ecological community. Many of these sites may contain suites of species or habitat features that are unique or important in a regional or local context. Some of these elements can still be critical to the survival of the Poplar Box Grassy Woodland.

Impact avoidance achievable: The footprints of the existing road upgrade occur adjacent to the Poplar Box Grassy Woodland TEC in several discrete patches at the southern extent of the CEH PHES Project footprint. Substantial impact avoidance can be achieved by avoiding clearing of the TEC where possible. In areas where clearing is unavoidable, the footprint will be kept to a minimum size.

Summary of residual impact: The footprint of the existing road upgrades will result in the following impacts:

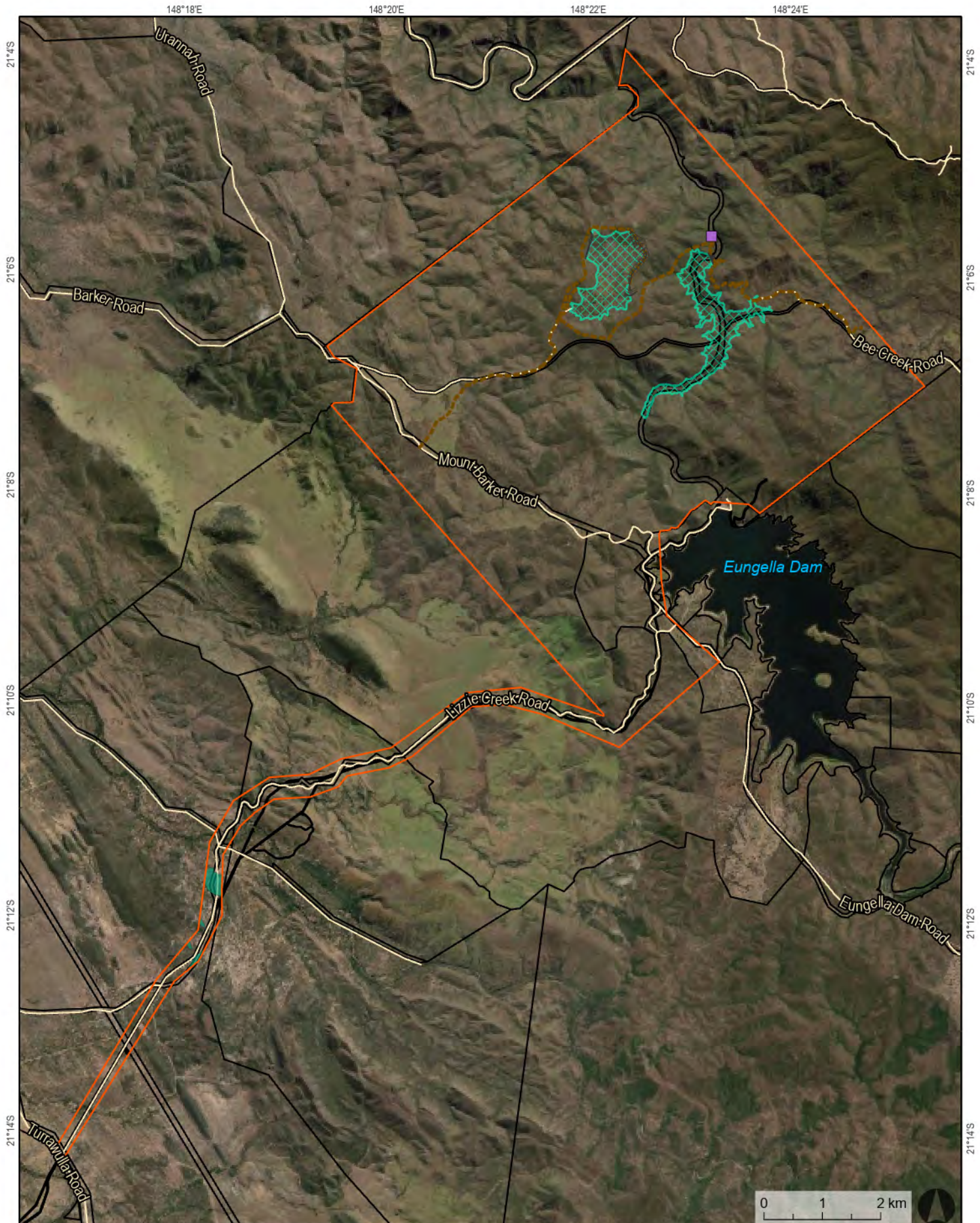
- Direct clearing of 0.38 ha of Poplar Box Grassy Woodland on Alluvial Plains TEC.
- Potential for degradation of the ground layer through some weed incursion.

The CEH PHES Project is not likely to have a significant residual impact on the Poplar Box Grassy Woodland on Alluvial Plains TEC due to the minimal area of potential impact and appropriate avoidance measures.

Table 5.2 Significant impact assessment – Poplar Box Grassy Woodland on Alluvial Plains TEC

Significant impacts criteria	Assessment
Reduce the extent of an ecological community	Unlikely

Significant impacts criteria	Assessment
	The footprint of the existing road upgrades will result in the direct loss of 0.38 ha of the Poplar Box Grassy Woodland on Alluvial Plains TEC, which at a local level, will not reduce the extent of the TEC.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	Unlikely The vegetation will not be fragmented as any vegetation required to be cleared will be tactically taken from the margins along the existing road.
Adversely affect habitat critical to the survival of an ecological community	Unlikely While an area of 0.38 ha located alongside an existing access road meets the threshold criteria for the Poplar Box Grassy Woodland on Alluvial Plains TEC, it is highly unlikely that this vegetation is critical to the survival of the ecological community – retention of this vegetation would not be necessary for the long-term maintenance of the ecological community, to maintain genetic diversity or for the recovery of the ecological community. Therefore, it is considered unlikely this action will adversely affect habitat critical to the survival of the Poplar Box Grassy Woodland on Alluvial Plains TEC.
Modify or destroy abiotic factors necessary for an ecological communities' survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	Unlikely Clearing, construction activities and operation of footprint of the existing road upgrades will not modify or destroy abiotic factors necessary for the survival of the ecological community.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, e.g., through regular burning or flora or fauna harvesting	Unlikely Activities associated with the footprint of the existing road upgrades will not cause a substantial change in the species composition of this occurrence of the TEC. A Weed Management Plan (which will include ongoing monitoring after construction activities finish) will be in place to ensure the introduction of weeds does not occur.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including but not limited to: Assisting invasive species, that are harmful to the listed ecological community, to become established, or Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.	Unlikely Activities associated with the footprint of the existing road upgrades will not cause a substantial reduction in the quality or integrity of this occurrence of the Poplar Box Grassy Woodland on Alluvial Plains TEC. A Weed Management Plan (which will include ongoing monitoring after construction activities finish) will be in place to ensure the introduction of weeds does not occur.
Interfere with the recovery of an ecological community	Unlikely This footprint of the existing road upgrades is unlikely to impact the Poplar Box Grassy Woodland on Alluvial Plains TEC within the proposed corridor, as only 0.38 ha of vegetation located within the project footprint will be cleared. This occurrence of the TEC is highly unlikely to be critical to the survival of the ecological community, and its loss is unlikely to interfere significantly with the recovery of the TEC. Therefore, it is considered unlikely this action will interfere with the recovery of the Poplar Box Grassy Woodland on Alluvial Plains TEC.



LEGEND

- PHEs Project area
- Poplar Box Grassy Woodland on Alluvial Plains TEC
- Dam wall

- Proposed pumped hydro reservoirs
- Proposed access track
- Proposed powerhouse
- Existing road
- Cadastre

Disclaimer: CIP makes no warranty in relation to the accuracy, reliability, completeness or suitability of the data and does not accept liability for any loss, damage or costs, including consequential damage, in relation to any use of the data in this map.

PROJECT			
CEH PHEs Project			
TITLE			
Poplar Box Grassy Woodland on Alluvial Plains TEC			
DATE	STATUS	PRODUCED	
9/08/2023	DRAFT	IM	
SCALE	DATUM	REV	
1:85,000 at A3	GDA 1994 MGA Zone 55	A	
FILE			FIG
CEH-EPBC-PHEs - FIG_5_1 BG WOODLAND - rA			5.1

5.2 Black ironbox (*Eucalyptus raveretiana*)

The CEH PHES Project is considered **unlikely to result in a significant impact on *E. raveretiana***. A significance of impact assessment of the CEH PHES Project on *E. raveretiana* (vulnerable under the EPBC Act) is provided in Table 5.3. Habitat mapping for *Eucalyptus raveretiana* is shown in Figure 5.2.

Status as an important population: *Eucalyptus raveretiana* is located along three local watercourses within the CEH PHES study area including Lizzie Creek, Mt Barker Creek and Hazlewood Creek (Figure 5.2), all of which flow into the Little Bowen River (which in turn flows into the Bowen River). As such, they are located in an extreme upper catchment position and their seed (which is transported by water) is likely to travel long distances downstream. Consequently, they can be considered to be a key source population for breeding and a population that plays an important role in maintaining genetic diversity. Therefore, the population in the CEH PHES study area is considered an important population under the *Significant Impact Guidelines 1.1 – MNES* (DoE, 2013).

Status as habitat critical to the survival of the species: Habitat critical to the survival of the species has not been defined for *E. raveretiana*. Therefore, the definition outlined in the *Significant Impact Guidelines 1.1 – MNES* (DoE, 2013) has been applied. This considers habitat critical to the survival of the species to be habitats that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- To maintain genetic diversity and long-term evolutionary development, or
- For the reintroduction of populations or recovery of the species or ecological community.

Potential habitat located within the CEH PHES Project study area is not considered to be critical to the survival of the species. If this population (as it exists within the footprint of the existing road upgrades) were to be completely removed (which is not proposed or likely), the species would not be critically affected. Genetic diversity would be maintained in the catchment through persistence of downstream populations in Lizzie Creek and Mt Barker Creek, and both up and downstream populations in Hazlewood Creek. The habitat in the footprint of the existing road upgrades is not necessary for any of the roles outlined in the definition, to the extent that without it, those functions would not be possible or maintainable.

The Commonwealth approved conservation and listing documentation for the *E. raveretiana* (DCCEEW, 2008; TSSC, 2012) were the primary reference documents for assessment of the impacts of the CEH PHES Project.

Impact avoidance achievable: Within the project footprint, *E. raveretiana* is restricted to isolated watercourses, adjacent to the footprint of the existing road upgrades. Clearing of this species will be avoided where possible. In areas where clearing this species is unavoidable, only the minimum required number of individuals will be removed.

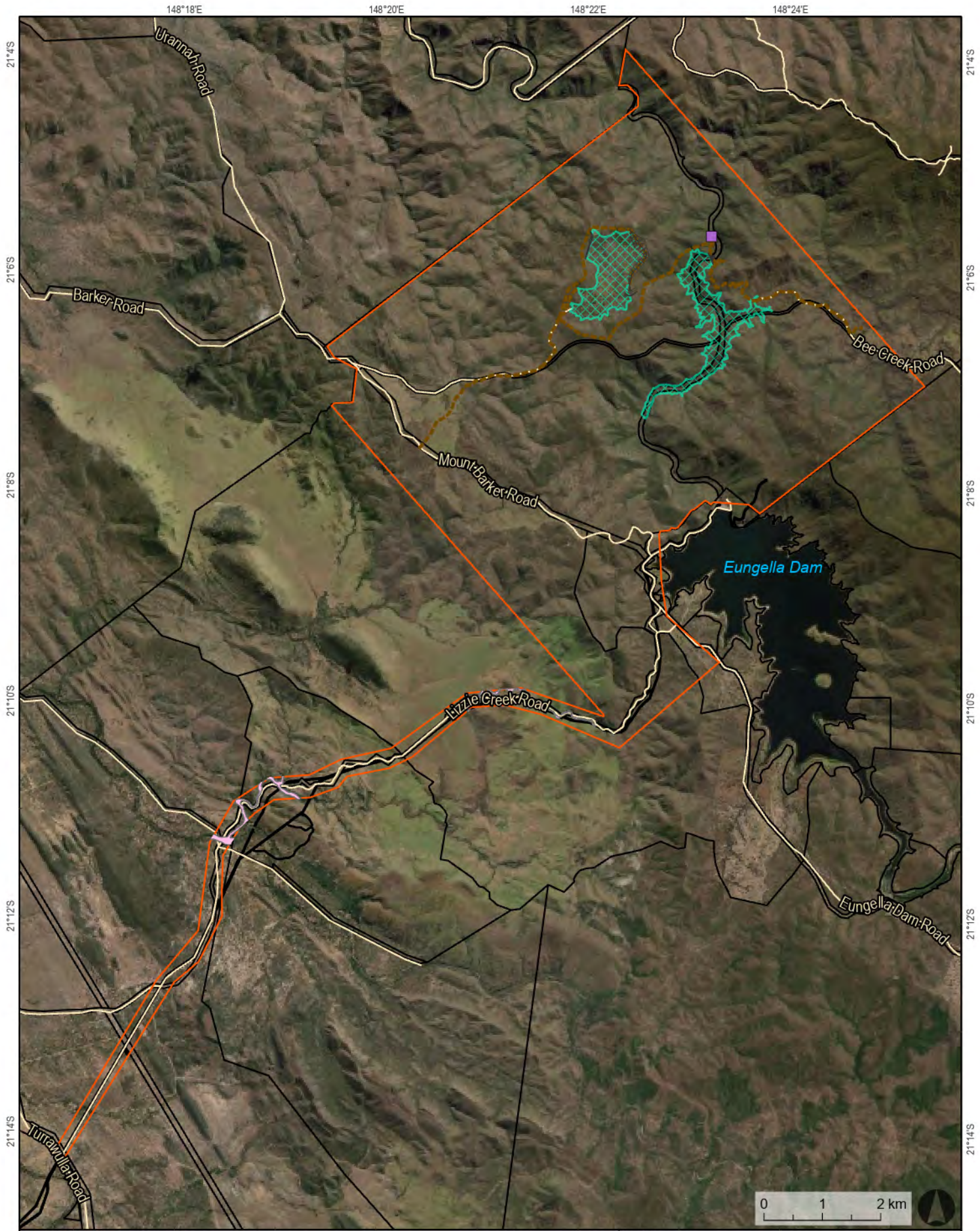
Residual impacts: Potential direct and indirect impacts on the *Eucalyptus raveretiana* include:

- Loss of 0.25 ha of habitat for *E. raveretiana*
- Minor degradation of habitat by dust, run-off and sedimentation
- Introduction and spread of weeds and pests.

Table 5.3 Significant impact assessment – *Eucalyptus raveretiana*

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	<p>Unlikely</p> <p><i>Eucalyptus raveretiana</i> was confirmed as occurring within three watercourses in the CEH PHES Project study area, and these individuals are considered to be part of a wider local population meeting the definition of important</p> <p>The project footprint will result in the removal of 0.25 ha of potential habitat. Within areas of suitable habitat, trees are generally sparse and it is likely that any clearing associated with the footprint of the existing road upgrades will completely avoid the removal of any more than a small number of mature adults. In addition, besides clearing, construction and operation activities are likely to have a negligible impact on downstream populations.</p> <p>Noting the relatively small area of loss, and that downstream populations which will support recruitment in lower section of the catchment will persist and will not be significantly unimpacted, the footprint of the existing road upgrades is unlikely to lead to a long term decrease in the size of an important population of the species.</p>
Reduce the area of occupancy of an important population	<p>Unlikely</p> <p>The CEH PHES Project footprint will result in the loss of 0.25 ha of suitable habitat for the species, and the regionally occurring population would remain substantially intact. The area of occupancy of the species as calculated by the IUCN will not be impacted at all. Thus, the footprint of the existing road upgrades will not reduce the area of occupancy of an important population of this species.</p>
Fragment an existing important population into two or more populations	<p>Unlikely</p> <p><i>Eucalyptus raveretiana</i> disperses via seed transported by water (Pollock, 2012). The footprint of the existing road upgrades will involve, at most, removal of individual large trees where the road crosses the applicable watercourses. This clearing will not interrupt watercourse channels or flows, and breeding connectivity will not be severed. Therefore, the siting of the project footprint will not fragment an existing important population.</p>
Adversely affect habitat critical to the survival of a species	<p>Unlikely</p> <p>As outlined above, habitat for <i>E. raveretiana</i> in the CEH PHES Project study area is not considered to constitute habitat critical to the survival of the species. In addition, the likely direct impact will be limited to clearing of at most a small number of adult trees, with no impact to connectivity within the population (given seed disperses via water flows in the stream channel, which will not be interrupted).</p> <p>Therefore, the footprint of the existing road upgrades will not adversely affect habitat critical to the survival of the species.</p>
Disrupt the breeding cycle of an important population	<p>Unlikely</p> <p><i>Eucalyptus raveretiana</i> seed production and release occurs in late summer to mid-autumn, which coincides with the late wet season to early dry season (Pollock, 2012). Pollock (2012) postulated that the successful establishment of seedlings may be dependent on the availability of sand and cobble beds that are moist, shaded and have been scoured of competing ground and shrub layer vegetation by flood events. Deep sands exposed to the sun appeared to be unsuitable for successful seedling establishment. Pollock (2012) noted that where it was observed, regeneration was dense, and that ‘the presence of an adjacent parent “seed-tree” appeared essential, and suggested that seed is not soil-stored, in common with virtually all <i>Eucalyptus</i> species. He also postulated that <i>E. raveretiana</i> may be transported by water, as is common in other riparian <i>Eucalyptus</i> and <i>Melaleuca</i> spp., and suggested this may be a method of spread that is of secondary importance.</p> <p>The CEH PHES Project footprint will have not interrupt water flows in the channels of watercourses it crosses and will not cause fragmentation or disruptions to breeding. Any clearing will be marginal and will not disrupt pollinators to the extent that future breeding would be significantly impacted.</p> <p>Consequently, the footprint of the existing road upgrades is unlikely to disrupt the breeding cycle of an important population.</p>
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>Unlikely</p> <p>The CEH PHES Project will result in the removal of at most a small number of adult trees and clearing within the riparian corridors in which <i>E. raveretiana</i> occurs will be minimised. Watercourse flows will not be impacted.</p> <p>Therefore, the footprint of the existing road upgrades will not modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p>

Significant impacts criteria	Assessment
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	<p>Unlikely</p> <p>One invasive species is listed as being a key threat to <i>E. raveretiana</i>, namely rubber vine (<i>Cryptostegia grandiflora</i>) (TSSC, 2012). The rubber vine threat to the species is documented as a past threat due to the biological control agent (rubber vine rust) introduced to combat rubber vine which is no longer in use (TSSC, 2012).</p> <p>Conditions identified within a Weed Management Plan regarding wash-down procedures and transfer of invasive species material or seeds will mitigate the risk of further spreading introduced species that could impact potential populations.</p> <p>Therefore, the footprint of the existing road upgrades is unlikely to result in invasive species that are harmful to <i>E. raveretiana</i> becoming established in the species habitat.</p>
Introduce disease that may cause the species to decline	<p>Unlikely</p> <p>No diseases or pathogens are identified among current known threats to <i>E. raveretiana</i>, and in a recent review of the conservation status of Australian eucalypts it was concluded that 'there is no evidence these (pathogens, rusts, galls and cankers known to occur in Australia) are substantial threats at the species level to naturally occurring eucalypt populations' (Fensham <i>et al.</i>, 2020). A Weed Management Plan will also act to reduce the potential for transmission of disease.</p> <p>Therefore, the footprint of the existing road upgrades is unlikely to introduce disease that may cause the species to decline.</p>
Interfere substantially with the recovery of the species	<p>Unlikely</p> <p>As outlined above, the CEH PHES Project footprint will have a minimal impact on existing populations occurring adjacent to the existing road, and no more than a small number of adult trees are likely to be directly impacted.</p> <p>Area of occupancy for <i>E. raveretiana</i> has been variously calculated at 75,000 ha (Pollock, 2012) and 39,600 ha (Fensham <i>et al.</i>, 2020). This road upgrades will directly impact 0.25 ha, which accounts for less than 0.01% of the total area of occupancy based on the lowest estimate (39,600 ha).</p> <p>Further, as outlined above, project footprint will not result in fragmentation, disruptions to breeding cycles, the introduction of disease or weeds or the exacerbation of threatening processes.</p> <p>Therefore, the footprint of the existing road upgrades will not interfere substantially with the recovery of the species.</p>



- LEGEND**
- PHEs Project area
 - Predicted habitat for *Eucalyptus raveretiana*
 - Dam wall
 - Proposed pumped hydro reservoirs
 - Proposed access track
 - Proposed powerhouse
 - Existing road
 - Cadastre

Disclaimer: CIP makes no warranty in relation to the accuracy, reliability, completeness or suitability of the data and does not accept liability for any loss, damage or costs, including consequential damage, in relation to any use of the data in this map.

PROJECT			
CEH PHEs Project			
TITLE			
Predicted habitat for <i>Eucalyptus raveretiana</i>			
DATE	STATUS	PRODUCED	
8/08/2023	DRAFT	IM	
SCALE	DATUM	REV	FIG
1:85,000 at A3	GDA 1994 MGA Zone 55	A	5.2
FILE			FIG
CEH-EPBC-PHEs - FIG 5_2 EUCALYPTUS - rA			5.2

5.3 Granite nightshade (*Solanum graniticum*)



Plate 5.1 Granite nightshade recorded in the CEH PHES Project study area

Construction of the CEH PHES Project is considered **unlikely to have a significant impact on granite nightshade (*Solanum graniticum*)**. *Solanum graniticum* was confirmed present at 13 locations, supporting 96 individuals, within the CEH PHES Project study area. A total of 21.75 ha of suitable habitat for *S. graniticum* is present within the CEH PHES Project footprint, including 59 individuals across five locations. Suitable habitat for the species occurs throughout areas of Eucalypt woodland mapped in the following REs:

- 11.12.1 *Eucalyptus crebra* woodland on igneous rocks.
- 11.12.6a *Eucalyptus crebra* +/- *Corymbia citriodora* and/or *E. acmenoides* +/- *Lophostemon suaveolens* woodland to open forest.
- 11.12.7 *Eucalyptus crebra* woodland with patches of semi-evergreen vine thicket on igneous rocks (boulder-strewn hillsides).

Within those broad areas, the species has a locally patchy distribution. Targeted surveys for this species substantially refined the area of mapped habitat within these REs. A significance of impact assessment of the CEH PHES Project on *S. graniticum* (endangered under the EPBC Act) is provided in Table 5.4. Habitat mapping for *S. graniticum* is shown in Figure 5.3.

Habitat critical to the survival of the species: Habitat critical to the survival of the species has not been defined for *S. graniticum*. The definition outlined in the *Significant Impact Guidelines 1.1 – MNES* (DoE, 2013) has therefore been applied. This considers habitat critical to the survival of the species to be habitats that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- To maintain genetic diversity and long-term evolutionary development, or
- For the reintroduction of populations or recovery of the species or ecological community.

Suitable habitat located within the CEH PHES Project study area is considered habitat critical to the survival of the species. The species has a constrained distribution and is only known from four locations. Accordingly, the Eungella dam habitat is considered habitat critical to the survival of the species to maintain genetic diversity and for the recovery of the species (the Eungella Dam population was previously recorded to contain only a few individuals (TSSC, 2021a)).

The Commonwealth approved conservation advice (TSSC, 2021a) was the primary reference document for assessment of the impacts of the CEH PHES Project.

Impact avoidance achievable: Targeted surveys undertaken for this species and mapping of confirmed species and suitable habitat, provides opportunities for avoidance of impact through local route-realignments, particularly ancillary infrastructure such as laydown areas and access tracks.

Residual impacts: Potential impacts on *S. graniticum* populations and habitat within the CEH PHES Project include:

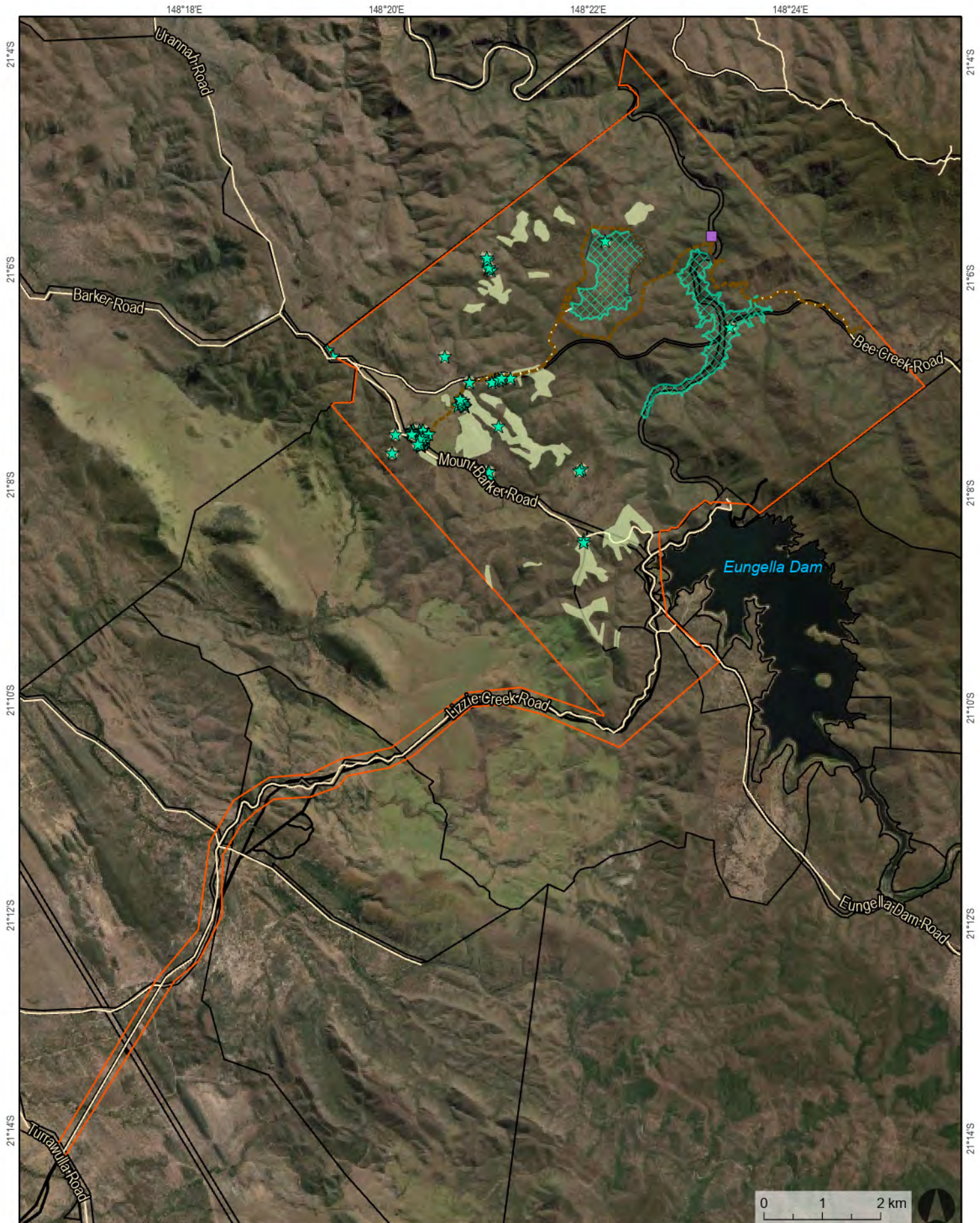
- Loss of 21.75 ha of suitable habitat.
- Introduction and spread of weeds.

The CEH PHES Project is unlikely to have a significant residual impact on *S. graniticum* due to the minimal area of direct impact and appropriate avoidance measures.

Table 5.4 Significant impact assessment – *Solanum graniticum*

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of a population	<p>Unlikely</p> <p>The CEH PHES Project will involve the clearing of suitable habitat for <i>S. graniticum</i> within the Eungella Dam population. <i>Solanum graniticum</i> is a herbaceous sub-shrub that occurs at naturally very sparse densities within suitable habitat, and surveys indicate 21.75 ha of potentially suitable habitat may be impacted, with only 3.77 ha of this within the direct footprints of the UR and LR. It is a small, relatively easily transplanted species, with easily collected seeds that can be grown-on into plants and transferred to the wild, or broadcast in adjacent suitable habitat.</p> <p>If all plants within the clearing/direct impact area are transplanted to adjacent suitable habitat, and if these transplanted populations are supplemented with broadcast seed or with plants grown from seed, then it is unlikely the CEH PHES Project will lead to a long-term decrease in the size of a population.</p>
Reduce the area of occupancy of the species	<p>Unlikely</p> <p>The CEH PHES Project will not reduce the area of occupancy of <i>S. graniticum</i>, which has actually increased from 28 km² to at least 32 km² as a result of records generated by CEH PHES Project ecology surveys. Plants will remain within the 4 km² grid square in which they are currently located, and the area of occupancy will not be reduced.</p>
Fragment an existing population into two or more populations	<p>Unlikely</p> <p>The CEH PHES Project footprint will impact habitat occupied by <i>S. graniticum</i>. There is no documentation on how seeds of this species in particular are dispersed, although Halford (TSSC, 2021a) speculates that birds are the most likely agent. Symon (1979) found that birds are the most commonly recorded agent of dispersal for <i>Solanum</i> spp. With marsupials, wild dogs, bats, wind and water also important. It is presumed that wild pigs and cattle will also have a role.</p> <p>Given that this CEH PHES Project will not restrict opportunities to access the population for these dispersal agents (wind and water are not expected to be applicable to <i>S. graniticum</i> except in exceptional circumstances), and given the localised clearing footprint (relative to the mobility of these agents), it is considered unlikely that this CEH PHES Project will fragment an existing population into two or more populations.</p>
Adversely affect habitat critical to the survival of a species	<p>Unlikely</p> <p>The habitat type in which this species occurs is extremely common in the Brigalow Belt (there is 854, 000 ha as of 2021 (Queensland Herbarium, 2021)), however, <i>S. graniticum</i> populations are highly localised within it. Targeted surveys for the species confirmed a total of 21.75 ha of suitable habitat for <i>S. graniticum</i> is present within the CEH PHES Project footprints, of which only 3.77 ha is directly within the footprints of the UR and LR.</p> <p>Avoidance of impact to suitable habitat located within areas of potential existing road upgrades and temporary construction footprints will be prioritised through local route-realignments, particularly ancillary infrastructure such as laydown areas and access tracks. Therefore, given the very small area of direct impact to this species and the opportunities for avoidance, the reduction in suitable habitat area is unlikely to adversely affect habitat critical to the survival of the species.</p>
Disrupt the breeding cycle of a population	<p>Unlikely</p> <p>Clearing for the CEH PHES Project may disrupt the breeding cycle of a small number of plants but will not substantially disrupt the breeding cycle of a population. However, those plants located within the clearing footprint will be transplanted and seed will be harvested for growing-on or broadcast in suitable adjacent habitat.</p> <p>Therefore, it is considered unlikely the CEH PHES Project will disrupt the breeding cycle of a population.</p>

Significant impacts criteria	Assessment
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>Unlikely</p> <p>The CEH PHES Project will result in the clearing/inundation of approximately 3.77 ha of suitable habitat for <i>S. graniticum</i> within the footprints of the UR and LR. Avoidance of impact to suitable habitat located within areas of potential existing road upgrades and temporary construction footprints will be prioritised through local route-realignments, particularly ancillary infrastructure such as laydown areas and access tracks.</p> <p>Given the very small area of clearing in habitat actually occupied by the species (and in similar habitat in adjacent areas), and the large area of apparently identical habitat in neighbouring areas, it is unlikely the CEH PHES Project will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent the species is likely to decline.</p>
Result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat	<p>Unlikely</p> <p>Invasive species have not been identified among current known threats to <i>S. graniticum</i> (TSSC, 2021a). Pigs are possibly consumers of this species (and may be an agent of dispersal), however pigs are already well-established in the habitat and this project will not exacerbate their prevalence. A Weed Management Plan will act to reduce the potential for transmission of disease.</p> <p>Therefore, the CEH PHES Project is unlikely to result in invasive harmful species becoming established that may cause the species to decline.</p>
Introduce disease that may cause the species to decline	<p>Unlikely</p> <p>No diseases or pathogens are identified among current known threats to <i>S. graniticum</i> (TSSC, 2021a). A Weed Management Plan will act to reduce the potential for transmission of disease.</p> <p>Therefore, the CEH PHES Project is unlikely to introduce disease that may cause the species to decline.</p>
Interfere substantially with the recovery of the species	<p>Unlikely</p> <p>It is not clear that the species is recovering from anything – it appears to be a naturally rare species whose numbers fluctuate with the seasons (TSSC, 2021a). At this site it appears to co-exist with cattle grazing (having all parts covered in spines, it is likely to be largely ignored by grazing cattle). The clearing of a relatively small area of suitable habitat will reduce the overall area of habitat for the species, but there are large areas of apparently identical habitat in the vicinity that will be retained.</p> <p>Therefore, it is unlikely that the CEH PHES Project will interfere substantially with any future recovery of the species.</p>



- LEGEND**
- PHEs Project area
 - ★ Confirmed location of *Solanum graniticum*
 - Predicted habitat for *Solanum graniticum*
 - Dam wall
 - Proposed pumped hydro reservoirs
 - Proposed access track
 - Proposed powerhouse
 - Existing road
 - Cadastre

Disclaimer: CIP makes no warranty in relation to the accuracy, reliability, completeness or suitability of the data and does not accept liability for any loss, damage or costs, including consequential damage, in relation to any use of the data in this map.

PROJECT			
CEH PHEs Project			
TITLE			
Predicted habitat for <i>Solanum graniticum</i>			
DATE	STATUS	PRODUCED	
8/08/2023	DRAFT	IM	
SCALE	DATUM	REV	
1:85,000 at A3	GDA 1994 MGA Zone 55	A	
FILE	FIG		
CEH-EPBC-PHEs - FIG_5_3 SOLANUM GRANITICUM - rA	5.3		

5.4 Greater glider (southern and central) (*Petauroides volans*)



Plate 5.2 Greater glider and faecal pellets recorded in the CEH PHES Project study area

Construction of the CEH PHES Project is **likely to result in a significant residual impact on the greater glider (southern and central)** due to adverse impacts on habitat critical to the survival of the species. A significance of impact assessment of the CEH PHES Project on the greater glider (endangered under the EPBC Act) is provided in Table 5.5. Habitat mapping for the greater glider is shown in Figure 5.4.

Habitat critical to the survival of the species: is defined as per the Commonwealth conservation advice (DCCEEW, 2022) for the greater glider (southern and central). Habitat critical to survival for the greater glider (southern and central) may be broadly defined as (noting that geographic areas containing habitat critical to survival needs to be defined by forest type on a regional basis):

- Large contiguous areas of eucalypt forest, which contain mature hollow-bearing trees and a diverse range of the species' preferred food species in a particular region; and
- Smaller or fragmented habitat patches connected to larger patches of habitat, that can facilitate dispersal of the species and/or that enable recolonization; and
- Cool microclimate forest/woodland areas (e.g., protected gullies, sheltered high elevation areas, coastal lowland areas, southern slopes); and
- Areas identified as refuges under future climate changes scenarios; and
- Short-term or long-term post-fire refuges (i.e., unburnt habitat within or adjacent to recently burnt landscapes) that allow the species to persist, recover and recolonise burnt areas.

Based on that definition, habitats within the CEH PHES Project study area would be considered habitat critical to the survival of the species based on the extent of contiguous woodland with mature hollow-bearing trees and a diverse range of preferred food species for the region.

Status as important populations: Given its endangered status, all populations of the greater glider (southern and central) are important for the conservation of the species across its range (DCCEEW, 2022). On this basis, the local population is considered an important population.

Impact avoidance achievable: Given the extent of potential habitat intersected, opportunities for impact avoidance are otherwise limited to the implementation of pre-clearance surveys and appropriate clearing protocols to avoid injury and mortality impact on individuals, rather than avoidance of impact on habitat. Any fencing constructed for the CEH PHES Project will not have barbed wire strands on the top strand, substantially minimising the potential threat of mortality due to entanglement in barbed wire fencing.

Residual impacts on the greater glider: Potential impacts on greater glider populations and habitat within the CEH PHES Project include:

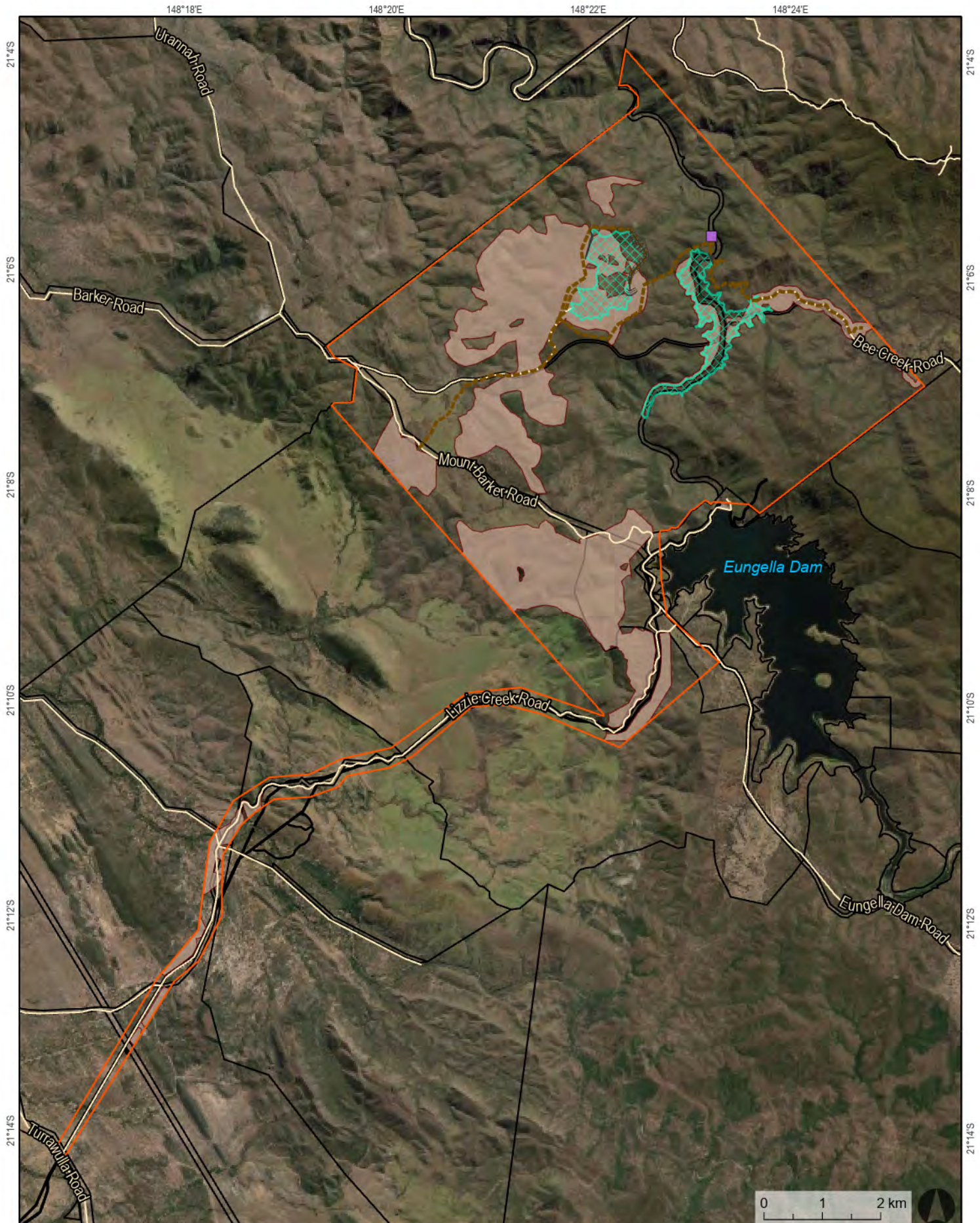
- Loss of 180.47 ha of habitat critical to the survival of the species
- Disturbance to wildlife through increased light, noise and vibration

- Habitat degradation by increased dust run-off and sedimentation
- Introduction and spread of pest fauna species and weeds
- Fragmentation and barrier effects.

Table 5.5 Significant impact assessment – greater glider

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of a population	<p>Unlikely</p> <p>The CEH PHES Project will result in the localised clearance of 180.47 ha of predicted habitat for the greater glider. Clearing of the project footprint has the potential to cause direct injury and mortality of individuals. This risk will be mitigated by the employment of a fauna spotter-catcher during clearing to check hollows in large fallen trees and relocate any encountered individuals. Sequential clearing will also be adopted to allow species to self-disperse and tree felling will occur towards cleared areas, rather than towards standing vegetation. While habitats within the project footprint at the sites of the UR and LR contained moderate densities of hollows, the highest local densities of hollows were restricted to alluvial flats. The CEH PHES Project is therefore unlikely to impact on core breeding habitat for the species. As such the CEH PHES Project is unlikely to result in a long-term decline in the size of a population.</p> <p>At a regional scale, the CEH PHES Project is not considered to lead to a long-term decrease in the size of the greater glider population. Considering the greater glider has been recorded extensively within the surrounding landscape, particularly within Crediton State Forest and Crediton Forest Reserve, the species is anticipated to remain largely unaffected due to the availability of habitat within the surrounding landscape.</p>
Reduce the area of occupancy of the species	<p>Unlikely</p> <p>The CEH PHES Project will result in localised loss of 180.47 ha of predicted habitat. This is localised in nature and is unlikely to result in the disappearance of greater gliders from an area sufficiently large to register a reduction in the area of occupancy, as measured at the 2 km x 2 km scale recommended under the EPBC Act (TSSC, 2021b). It is therefore considered unlikely that the CEH PHES Project will reduce the area of occupancy of a population of the greater glider, given the population is not at the edge of the species' range and records of the species are abundant and widely distributed in the surrounding landscape, suggesting the population is stable within the region.</p>
Fragment an existing population into two or more populations	<p>Unlikely</p> <p>The greater glider is sensitive to habitat fragmentation due to poor dispersal ability and relatively small home ranges and inability to cross areas of open ground that exceed the species' maximum gliding distance (Eyre 2006; McCarthy and Lindenmayer 1999; Lindenmayer <i>et al.</i>, 2000; Goldingay and Taylor, 2009). The species is known to have difficulty persisting in small forest fragments. Eyre (2002) has suggested that for populations to maintain viable, they would require access to interconnected native forest patches of at least 160 km². The CEH PHES Project will remove approximately 180.47 ha of predicted habitat for the greater glider. Clearing for the UR and LR is expected to result in localised habitat fragmentation that would present a local barrier to glider movement due to the size of the reservoirs exceeding the maximum gliding distance of the species (>100 m). However, continued fauna movement is likely to be facilitated by fringing riparian vegetation and adjacent woodlands. Clearing of the access road would not be of a sufficient width to act as a barrier to movement of the greater glider as will not exceed the maximum gliding distance of the species (>100 m). Overall, given the small, localised extent of clearing/inundation, the CEH PHES Project is unlikely to fragment an existing population into two or more populations.</p>
Adversely affect habitat critical to the survival of a species	<p>Likely</p> <p>Habitat critical to the survival of the greater glider consists of habitat with a diversity of Eucalypt species and an abundance of large hollows. As the species has a very limited home range, areas that support high local densities of greater glider are likely to represent habitat critical to the survival of the species. Habitat within the UR and LR had moderate densities of hollow-bearing trees and would likely represent habitat critical to the survival of the species. This was supported by the high local densities of greater gliders, with six individuals observed in a localised area during spotlighting in CEH PHES Project UR. The project footprint will result in the loss of 180.47 ha of predicted habitat. Based on the magnitude of loss, the CEH PHES Project has the potential to have a significant adverse impact on habitat that qualifies as critical habitat for this species.</p>

Significant impacts criteria	Assessment
Disrupt the breeding cycle of a population	<p>Unlikely</p> <p>The proposed sites of the UR and LR had moderate densities of hollows. Whilst 180.47 ha of predicted habitat will be impacted, the extent of habitat loss is relatively small in the local context. Once operational, the CEH PHES Project is likely to have relatively limited impact on the species, with no substantial noise, light or other disturbance impacts that would limit breeding success in the local population. As such, the CEH PHES Project is unlikely to disrupt the breeding cycle of a population.</p>
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>Unlikely</p> <p>The CEH PHES Project will remove up to 180.47 ha of predicted habitat for the species. Operational impacts are expected to be negligible, with no substantial restriction of access to habitat or barrier effects and minimal if any disturbance due to light and noise. The loss of predicted habitat is not likely to impact the species' survival in the region. As such, it is unlikely the CEH PHES Project will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p>
Result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat	<p>Unlikely</p> <p>The CEH PHES Project is unlikely to result in the introduction or spread of invasive species beyond current levels. The implementation of Weed and Pest Management Plans will further reduce potential impacts of invasive species. As such, the CEH PHES Project is unlikely to modify, destroy, remove or isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p>
Introduce disease that may cause the species to decline	<p>Unlikely</p> <p>Disease is not a known threat to the greater glider. However, the species is likely to be susceptible to <i>Phytophthora cinnamomi</i> due the soil fungus's ability to infect Eucalypt species upon which the greater glider depends for food and refuge. Biosecurity requirements (e.g., weed and seed declarations) will be implemented for the CEH PHES Project construction, and thus, the residual risk is considered low.</p>
Interfere sustainably with the recovery of the species	<p>Unlikely</p> <p>Although loss of habitat is described as a major threat to the species, while the CEH PHES Project will result in the loss of 180.47 ha of suitable habitat, large areas of suitable habitat will remain intact in proximity to the project footprint, specifically tracts of suitable habitat occur within the local landscape including in Crediton Forest Reserve (8.5 km southeast of CEH PHES Project LR), Crediton State Forest located 15 km southeast of CEH PHES Project LR, and Mia State Forest.</p> <p>Clearing for the CEH PHES Project will comprise of the minimum required. Mitigation measures employed during construction and operation will reduce direct mortality and loss of hollow-bearing trees during clearance.</p> <p>The clearing of vegetation for access tracks is unlikely to further fragment the local population as pre-existing access tracks will be utilised where possible, with only minor track widening required.</p> <p>Weed and Pest Management Plans will be implemented to reduce further impacts of invasive species, particularly for the European fox and feral cat which are listed as key threats to the greater glider.</p> <p>The CEH PHES Project UR and LR will not be fenced, thereby limiting the potential for the species to become entangled in barbed-wire fencing.</p> <p>As such the CEH PHES Project is considered unlikely to interfere with the recovery of the species.</p>



- LEGEND**
- PHEs Project area
 - Greater glider (habitat critical to survival)
 - Dam wall
 - Proposed pumped hydro reservoirs
 - Proposed access track
 - Proposed powerhouse
 - Existing road
 - Cadastre

Disclaimer: CIP makes no warranty in relation to the accuracy, reliability, completeness or suitability of the data and does not accept liability for any loss, damage or costs, including consequential damage, in relation to any use of the data in this map.

PROJECT			
CEH PHEs Project			
TITLE			
Predicted habitat for the greater glider			
DATE	STATUS	PRODUCED	
8/08/2023	DRAFT	IM	
SCALE	DATUM	REV	
1:85,000 at A3	GDA 1994 MGA Zone 55	A	
FILE			FIG
CEH-EPBC-PHEs - FIG_5_4 GREATER GLIDER - rA			5.4

5.5 Grey-headed flying-fox (*Pteropus poliocephalus*)

Construction of the CEH PHES Project is **likely to result in a significant residual impact on the grey-headed flying-fox** due to adverse impacts on habitat critical to the survival of the species and the potential to decrease the availability or quality of habitat to the extent that the species is likely to decline. A significance of impact assessment of the CEH PHES Project on the grey-headed flying-fox (vulnerable under the EPBC Act only) is provided in Table 5.6. Habitat mapping for the grey-headed flying-fox is shown in Figure 5.5.

Status as an important population: There is no formal definition of important populations for the grey-headed flying-fox. Due to the species' extensive range and movement between camps, the national population is considered a single, interbreeding population (Webb and Tidemann, 1995). While there is only one population, the CEH PHES Project area is near the edge of the species' known range. Impacts that affect the viability of the nearest flying-fox camps (located approximately 10 km east at Eungella State School and 25 km east at Finch-Hatton Gorge) are therefore likely to have heightened significance. The nearest camps are likely to be important on that basis.

Status as habitat critical to the survival of the species: The *National Recovery Plan for the grey-headed flying-fox Pteropus poliocephalus* (DAWE, 2021) identifies habitat critical to the survival of the species. Critical habitats are associated with winter and spring flowering food tree species that are in limited supply across the species' range, due to historical land clearing, predominantly in coastal areas. Habitat critical to the survival of the species includes vegetation communities that have been field-verified to contain the following dominant winter and spring flowering forage species that are within 40 km of a known roost camp: *Eucalyptus tereticornis*, *E. albens*, *E. crebra*, *E. fibrosa*, *E. melliodora*, *E. paniculata*, *E. pilularis*, *E. robusta*, *E. seeana*, *E. sideroxylon*, *E. siderophloia*, *Banksia integrifolia*, *Castanospermum australe*, *Corymbia citriodora citriodora*, *C. eximia*, *C. maculata*, *Grevillea robusta*, *Melaleuca quinquenervia* or *Syncarpia glomulifera* (Eby and Law 2008; Eby 2016; Eby et al., 2019).

The Commonwealth *National Recovery Plan for the grey-headed flying-fox Pteropus poliocephalus* (DAWE, 2021) was the primary reference document for assessment of the impacts of the CEH PHES Project.

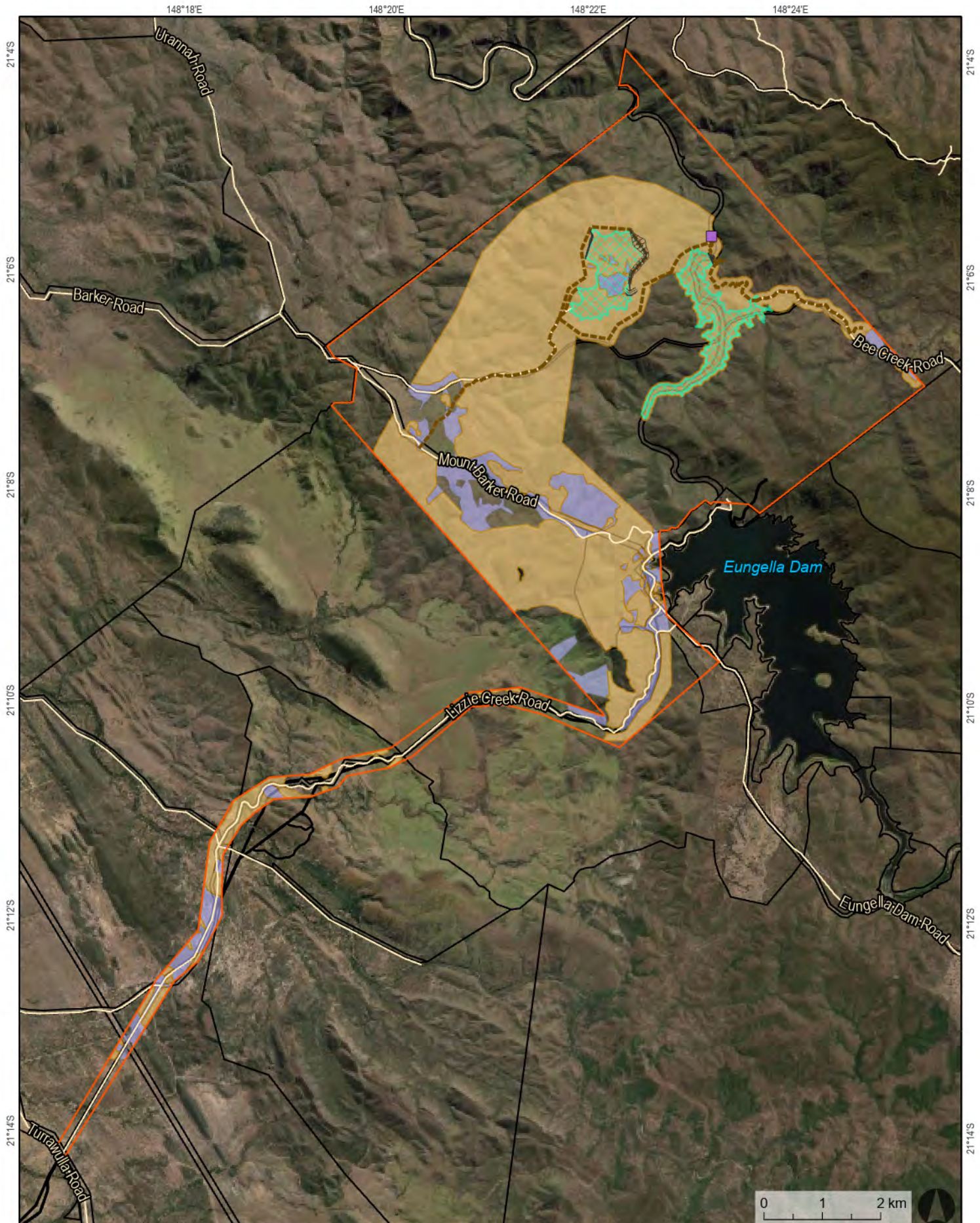
Potential impacts on grey-headed flying-fox and the species' habitat arising from CEH PHES Project include:

- Loss of 358.25 ha of habitat comprised of:
 - 319.20 ha of habitat critical to the survival of the species
 - 39.05 ha of general foraging habitat
- Injury and mortality
- Disturbance to wildlife through increased light, noise and vibration
- Habitat degradation by increased dust, run-off and sedimentation.

Table 5.6 Significant impact assessment – grey-headed flying-fox

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	<p>Unlikely</p> <p>The grey-headed flying-fox population is a single, interbreeding population and therefore not considered an important population under the definition outlined in the Commonwealth <i>Significant Impact Guidelines 1.1 – MNES</i> (DoE, 2013). However, given the nearest camp is near the edge of the species' range, it is likely to be important for maintaining the species' extent of occurrence. The project footprint will result in the direct loss of 358.25 ha of potential foraging habitat for the species, most of which (89%) would constitute habitat critical to the survival of the species due to the local abundance of key food tree species (i.e., <i>E. tereticornis</i> and <i>E. crebra</i>). The Eungella State School camp was recorded to be utilised by 500-2,499 grey-headed flying-fox individuals in February 2022. Accordingly, the CEH PHES Project habitat is within 20 km of the nearest camp (i.e., the range in which the species <i>typically</i> forages), with a second known camp (Finch Hatton Gorge) within the species' known maximum foraging range. Therefore, habitat loss associated with the CEH PHES Project has the potential to adversely impact the viability of the nearest camps. However, the potential for this to lead to a long-term population decrease is considered low.</p>

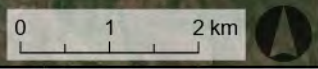
Significant impacts criteria	Assessment
Reduce the area of occupancy of an important population	<p>Unlikely</p> <p>As detailed above, the local population is not an important population. However, the nearest camp, located 10 km east of the project footprint is likely to be important, given its occurrence, near the edge of the species' known range. The CEH PHES Project will result in the loss of 358.25 ha of habitat, most of which would constitute habitat critical to the survival of the species. The loss of habitat has the potential to adversely impact the viability of the nearest camp, however this is not considered likely to reduce the area of occupancy of the species.</p>
Fragment an existing important population into two or more populations	<p>Unlikely</p> <p>The grey-headed flying-fox has an extensive range with the capacity to move large distance between camps at a national level. The loss of habitat attributed to the CEH PHES Project will have localised impact that will not pose any barrier to movement. As such, impacts attributed to the CEH PHES Project will not fragment the population into two or more populations.</p>
Adversely affect habitat critical to the survival of a species	<p>Likely</p> <p>The CEH PHES Project will cause the loss of 319.20 ha of habitat likely to be habitat critical to the survival of the species due to the abundance of important winter and spring foraging tree species (i.e., <i>E. tereticornis</i> and <i>E. crebra</i>). Based on the magnitude of the impact, this is likely to represent a significant impact on habitat critical to the survival of the species.</p>
Disrupt the breeding cycle of an important population	<p>Unlikely</p> <p>The CEH PHES Project is unlikely to disrupt the breeding cycle of an important population or important grey-headed flying-fox camps. The CEH PHES Project will have no direct impact on roosting habitat. The nearest camps are located 10 km to the east at Eungella State School, and 25 km to the east in Finch-Hatton Gorge.</p>
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>Possible</p> <p>The CEH PHES Project will result in the loss of 358.25 ha of potential foraging habitat including 319.20 ha habitat critical to the survival of the species. As this is within 20 km of two known camps, the habitat is likely to represent habitat utilised by the camp on a regular basis. Thus, habitat at the CEH PHES Project likely provides foraging resources for individuals at the Eungella State School and Finch-Hatton Gorge camps, particularly during the winter and spring resource bottleneck, or after perturbations like large-scale fires. The loss of habitat for the CEH PHES Project could contribute to the regional reduction in food resource availability with the potential to threaten the viability of the camps. On that basis, the CEH PHES Project has the potential of causing the species to decline.</p>
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	<p>Unlikely</p> <p>No invasive species are listed among the threats to the grey-headed flying-fox in the Commonwealth listing advice or Commonwealth National Recovery Plan for the species. The CEH PHES Project is unlikely to introduce or encourage the spread of any invasive species that could adversely affect the species.</p>
Introduce disease that may cause the species to decline	<p>Unlikely</p> <p>The grey-headed flying-fox is susceptible to Lyssavirus. While this is generally stable in the population, exposure to significant ecological stress can cause an increase in the incidence of Lyssavirus that can cause local declines in the species (DAWE, 2021). The CEH PHES Project will have no direct impact on camps or roosting impacts, where there would typically be increased capacity for external impacts to cause adverse stress to an extent required to induce an increase in Lyssavirus.</p>
Interfere substantially with the recovery of the species	<p>Unlikely</p> <p>The CEH PHES Project will impact 358.25 ha of predicted foraging habitat including 319.20 ha of habitat critical to the survival of the species near the edge of the species' known range. This has the potential to contribute to the adverse impacts on the nearest camps. While a low risk given the extent of habitat removal in the context of landscape-level habitat availability, if the loss jeopardised the viability of the camps, it would have the potential to interfere with the recovery of the species.</p>



- LEGEND**
- PHEs Project area
 - Grey-headed flying fox (habitat critical to survival)
 - Grey-headed flying fox (general foraging)
 - Dam wall
 - Proposed pumped hydro reservoirs
 - Proposed access track
 - Proposed powerhouse
 - Existing road
 - Cadastre

Disclaimer: CIP makes no warranty in relation to the accuracy, reliability, completeness or suitability of the data and does not accept liability for any loss, damage or costs, including consequential damage, in relation to any use of the data in this map.

PROJECT			
CEH PHEs Project			
TITLE			
Predicted habitat for the grey-headed flying-fox			
DATE	STATUS	PRODUCED	
9/08/2023	DRAFT	IM	
SCALE	DATUM	REV	FIG
1:85,000 at A3	GDA 1994 MGA Zone 55	A	5.5
FILE			FIG
CEH-EPBC-PHEs - FIG_5_5 FLYING FOX - rA			5.5



5.6 Koala (*Phascolarctos cinereus*)



Plate 5.3 Koala faecal pellets recorded in the CEH PHES Project study area

Construction of the CEH PHES Project is **likely to result in a significant residual impact on the koala**, predominantly due to adverse impacts on habitat critical to the survival of the koala. A significance of impact assessment of the CEH PHES Project on the koala (endangered under the EPBC Act) has been undertaken and is provided in Table 5.7. Habitat mapping for the koala is shown in Figure 5.6.

Habitat critical to the survival of the species: is defined in the Commonwealth conservation advice (DAWE, 2022e) for the koala. For an individual koala, these resources include access to sufficient quality food and shelter trees to meet their daily energetic requirements and reproductive needs, and a place to avoid predators. This includes forests or woodlands, road-side and rail vegetation and paddock trees, safe intervening ground matrix for travelling between trees and patches to forage and shelter and reproduce and access to vegetated corridors or paddock trees to facilitate movement between patches. These resources fall within individual koala's home ranges and allow for interaction with adjacent individuals. Under the EPBC Act, the following factors and any other relevant factors may be considered when identifying habitat that is critical to the survival of a species:

- Whether the habitat is used during periods of stress (examples: flood, drought or fire).
- Whether the habitat is used to meet essential life cycle requirements (examples: foraging, breeding, nesting, roosting, social behaviour patterns or seed dispersal processes).
- The extent to which the habitat is used by important populations.
- Whether the habitat is necessary to maintain genetic diversity and long-term evolutionary development.
- Whether the habitat is necessary for use as corridors to allow the species to move freely between sites used to meet essential life cycle requirements.
- Whether the habitat is necessary to ensure the long-term future of the species or ecological community through reintroduction or re-colonisation.
- Any other way in which habitat may be critical to the survival of a listed threatened species or a listed threatened ecological community.

Such areas, if identified, would be expected to include habitat occupied and habitat currently unoccupied, areas necessary for population processes and maintenance of genetic diversity and evolutionary potential, and areas required to accommodate future population increase, recolonisation, reintroduction, or as climate refugia.

For the purpose of this significant impact assessment, all habitat across the CEH PHES Project study area was considered habitat critical to the survival of the species, with exception areas of isolated vegetation and paddock trees in previously cleared, non-remnant areas including isolated paddock trees and areas of intervening open ground that provide opportunities for safe transit of koalas at a local scale (classified as general koala habitat).

The Commonwealth approved conservation advice for the koala (DAWE, 2022e) was the primary reference document for assessment of the impacts of the CEH PHES Project.

Potential impacts on koala populations and koala habitat arising from the CEH PHES Project include:

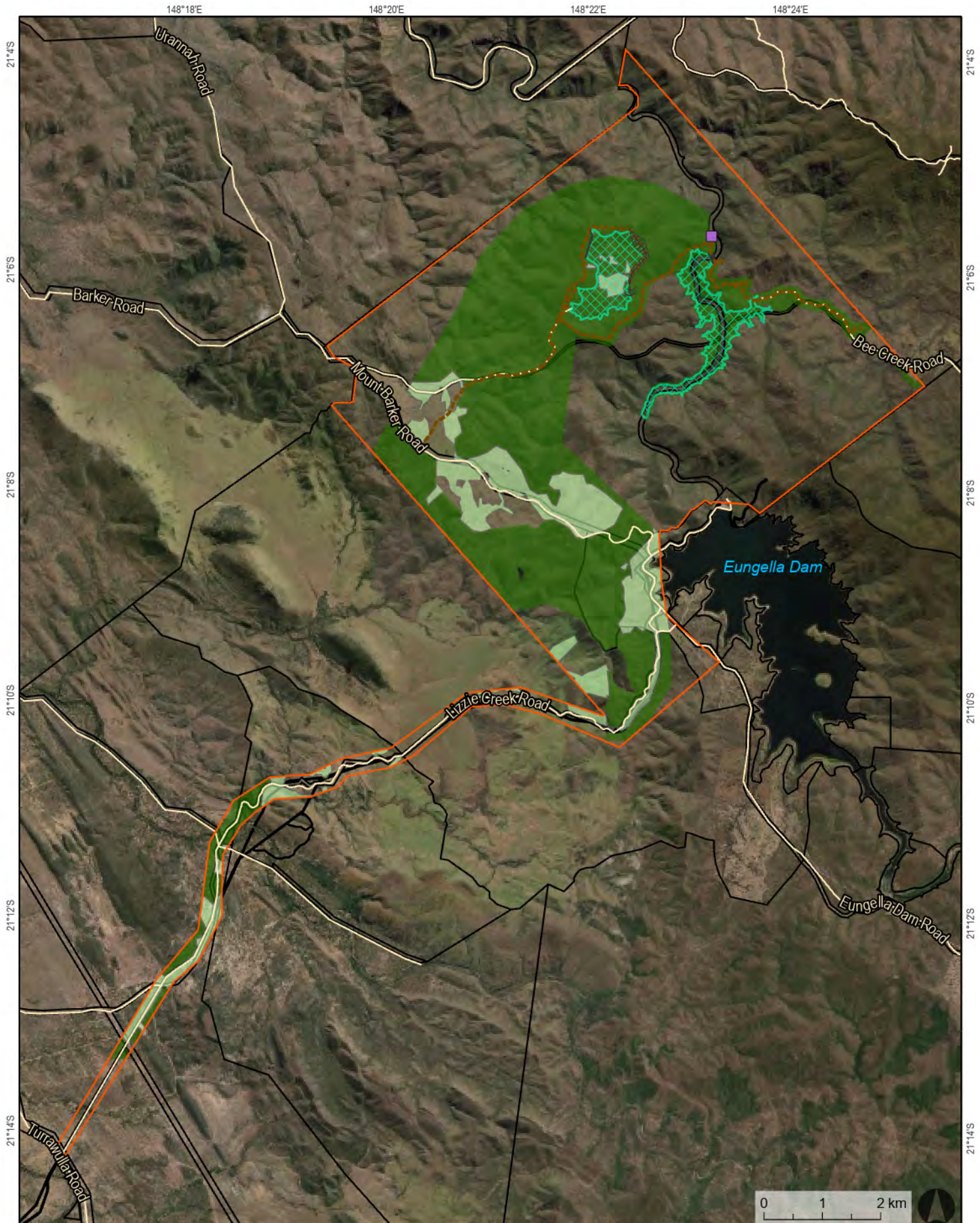
- Loss of 309.07 ha of habitat comprised of:
 - 268.78 ha of habitat critical to the survival of the koala

- 40.29 ha of general foraging habitat
- Barrier effects and restriction of koala movement
- Injury and mortality
- Habitat degradation by increased dust run-off and sedimentation
- Introduction and spread of invasive weeds and pests.

Table 5.7 Significant impact assessment – koala

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of a population	Unlikely The proposed CEH PHES Project will affect approximately 309.07 ha of suitable koala habitat. Suitable habitat is considered widely available within the surrounding landscape, the loss of 309.07 ha is unlikely to lead to long-term decrease in the size of the population. The use of sequential clearing practices and the employment of a fauna spotter-catcher during clearing will further mitigate to risks to the species. Additionally, the likelihood of vehicle strikes can be mitigated by the implementation of safe driving practices.
Reduce the area of occupancy of the species	Unlikely The CEH PHES Project will result in a direct loss of 309.07 ha of predicted habitat for the koala. Substantial koala habitat will be retained in areas adjacent to the CEH PHES Project area. Once operational, the CEH PHES Project will have negligible impact on the species, forming no barrier to koala movement. Koalas are expected to persist locally through the operation phase of the CEH PHES Project. As such the loss of koala habitat, although substantial, will not cause the species to disappear from any 2 km x 2 km area, (i.e., the scale at which area of occupancy is assessed under the EPBC Act (TSSC, 2021b)).
Fragment an existing population into two or more populations	Unlikely A total of 309.07 ha of koala habitat will be removed for the project footprint, which is largely comprised of the CEH PHES Project LR and UR. The clearing of vegetation for access tracks will further fragment the location population however pre-existing access tracks will be utilised where possible. Clearing is at a local scale and is unlikely to restrict movement of individuals to the extent that the individual parts of the local koala population becomes genetically isolated from one another. Large areas of suitable habitat will remain intact in proximity to the project footprint, specifically, Crediton Forest Reserve (8.5 km southeast of CEH PHES Project LR), Crediton State Forest located 15 km southeast of CEH PHES Project LR, and Mia State Forest.
Adversely affect habitat critical to the survival of a species	Likely The CEH PHES Project is likely to have an adverse impact on habitat critical to the survival of the species. Almost all koala habitat within the CEH PHES Project study area is habitat critical to the survival of the species. The CEH PHES Project will result in the direct removal of 268.78 ha of habitat critical to the survival of the species. The CEH PHES Project is likely to have a significant adverse impact on habitat critical to the survival of the species.
Disrupt the breeding cycle of a population	Unlikely The CEH PHES Project is not expected to disrupt the breeding cycle of the population. The koala breeding season is generally between September and March, with females giving birth to a single young between October and May. During the breeding season, males actively seek females and koala movements are more extensive. Without mitigation, the CEH PHES Project could lead to an increased risk of vehicle strike. Traffic volume, speed and visibility influence the koala collision rate. Prevelt <i>et al.</i> ,(1995) found that road kills occurred where vehicle speeds exceeded 80 km/hr and where wider habitat corridors or linear forests occurred on both sides of the road. Potential impacts will be mitigated through implementation of on-site speed limits and signage in koala habitat areas. Clearing within koala habitat areas will be planned to occur outside of peak breeding season (if possible) and standard best practice sequential clearing using koala spotters will be exercised.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely The CEH PHES Project will directly impact 309.07 ha of koala habitat. Although clearing will cause minor additional fragmentation of habitat and reduce the area of available habitat, the extent of habitat disturbance is not likely to decrease the availability or quality of habitat available to the local population to the extent that the species will decline. Furthermore, although clearing and construction activities (e.g., blasting, drilling and machinery-generated noises) are likely to significantly increase the level of noise at a local scale, these impacts are anticipated to be short-term and will not be continued during operation.

Significant impacts criteria	Assessment
Result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat	<p>Unlikely</p> <p>Invasive species including wild dogs already occur throughout the CEH PHES Project study area. Predatory species are attracted to prey opportunities presented by cleared corridors or prey moving away from disturbance areas. While new infrastructure has the potential to increase the risk of wild dog attack on koala by facilitating regional movement of dogs, these threats are already present within the receiving environment. Feral animal control measures will be implemented throughout the duration of the CEH PHES Project and have been designed to mitigate such risks.</p> <p>There is also potential for the spread of invasive weeds during the construction and operation phase. This potential will be addressed within a project specific Environmental Management Plan (EMP) and could provide the opportunity to enhance the quality of the environment utilised by the koala by providing mitigation measures to combat introduced species. The eradication of ground-covering weeds (particularly lantana) could enhance local koala movement. If mitigation measures are implemented correctly, the CEH PHES Project is unlikely to result in the introduction of invasive species that are harmful to the koala.</p>
Introduce disease that may cause the species to decline	<p>Unlikely</p> <p>The CEH PHES Project is not anticipated to introduce new diseases that may cause the species to decline. Stress may lead to an increase in the expression of chlamydia in koalas, however the implementation of mitigation measures such as sequential clearing, site speed limits, use of experienced spotter-catchers during clearing and the requirement to allow koalas to self-disperse will reduce disturbance-related stress and risk of disease. Additionally, the species is susceptible to <i>Phytophthora cinnamomi</i> due the soil fungus's ability to infect eucalypt species. Biosecurity requirements (e.g., weed and seed declarations) will be implemented for the CEH PHES Project, and thus, this risk has been assessed as low.</p>
Interfere with the recovery of the species	<p>Unlikely</p> <p>Construction of the CEH PHES Project has the potential to interfere with one limited part of the recovery plan, notably the potential to maintain the size of existing koala populations that are at risk of decline. Loss of habitat across the CEH PHES Project study area has the potential to cause a local decline in koala abundance. Other recovery plan objectives including the need to maintain the area of occupancy, improve metapopulation processes, increase community engagement in koala monitoring, conservation and management will not be adversely impacted.</p>



LEGEND	
	PHES Project area
	Koala (habitat critical to survival)
	Koala (general habitat)
	Dam wall
	Proposed pumped hydro reservoirs
	Proposed access track
	Proposed powerhouse
	Existing road
	Cadastre

Disclaimer: CIP makes no warranty in relation to the accuracy, reliability, completeness or suitability of the data and does not accept liability for any loss, damage or costs, including consequential damage, in relation to any use of the data in this map.

PROJECT				CEH PHES Project		
TITLE				Predicted habitat for the koala		
DATE	8/08/2023	STATUS	DRAFT	PRODUCED	IM	
SCALE	1:85,000 at A3	DATUM	GDA 1994 MGA Zone 55	REV	A	
FILE	CEH-EPBC-PHES - FIG 5_6 KOALA - rA				FIG	5.6

5.7 Northern quoll (*Dasyurus hallucatus*)

Construction of the CEH PHES Project is **likely to result in a significant residual impact on the northern quoll** due to the potential adverse impact on habitat critical to the survival of the species and disruption to the breeding cycle of a population. A significance of impact assessment of the CEH PHES Project on the northern quoll (endangered under the EPBC Act only) is provided in Table 5.8. Habitat mapping for the northern quoll is shown in Figure 5.7.

Important populations: of the northern quoll are identified in the Commonwealth *Referral guidelines for the northern quoll* (DoE, 2016) as:

- High density quoll populations, which occur in refuge-rich habitat critical to the survival of the species, including where cane toads are present.
- Occurring in habitat that is free of cane toads and unlikely to support cane toads upon arrival i.e., granite habitats in WA, populations surrounded by desert and without permanent water.
- Subject to ongoing conservation or research actions i.e., populations being monitored by government agencies or universities or subject to reintroductions or translocation.

Camera trapping undertaken across the local area within the CEH PHES Project study area has not captured northern quoll records, suggesting the local northern quoll population is not high-density. However, Eungella, Crediton and Clarke Ranges (areas all surrounding the CEH PHES Project study area) are listed as important populations of the northern quoll in the National recovery plan for the northern quoll (Hill and Ward, 2010). Within that broader context, the northern quoll population adjacent to the CEH PHES Project study area would constitute an 'important' population in that it contains high-density areas that have persisted long after cane toad invasion.

Habitat critical to the survival of the species: is defined in the Commonwealth *Referral guidelines for the endangered northern quoll (*Dasyurus hallucatus*)* (DoE, 2016) as:

- Off-shore islands where the northern quoll is known to exist.
- Rocky habitats such as ranges, escarpments, mesas, gorges, breakaways, boulder fields, major drainage lines or treed creek lines.
- Structurally diverse woodland or forest areas containing large diameter trees, termite mounds or hollow logs.

Dispersal and foraging habitat associated with or connecting populations important for the long-term survival of the northern quoll is also considered habitat critical to the survival of the northern quoll.

While the habitats within the CEH PHES Project study area are predominantly open woodland that would constitute foraging habitat and do not contain extensive areas of outcropping rock that would represent denning habitat, the areas of foraging (and local denning) habitat would nevertheless constitute habitat critical to the survival of the species, given their potential to connect populations that are important for the species' long-term survival.

The significance of the CEH PHES Projects' impacts on the northern quoll have been assessed using the criteria outlined in the Referral guidelines for the endangered northern quoll *Dasyurus hallucatus* (DoE, 2016) , and the conservation advice (DAWE, 2022c).

Impact avoidance achieved: CEH PHES Project infrastructure has avoided most local areas of denning habitat for the northern quoll. Despite the avoidance that has been achieved, the CEH PHES Project will have substantial residual impact on habitat critical to the survival of the species, due to the magnitude of habitat intersected. Potential for injury and mortality during clearing will be avoided by implementing industry best practice clearing protocols including sequential clearing under the direction of suitably trained and experienced spotter-catchers.

Residual impacts on the northern quoll: The construction of the CEH PHES Project has the potential to result in the following impacts on the northern quoll:

- Loss of 322.80 ha of habitat critical to the survival of the species comprised of:
 - 36.83 ha of denning habitat
 - 285.97 ha of foraging habitat
- Injury and mortality
- Habitat degradation by increased dust run-off and sedimentation

- Introduction and spread of pest fauna species and weeds
- Fragmentation and barrier effects.

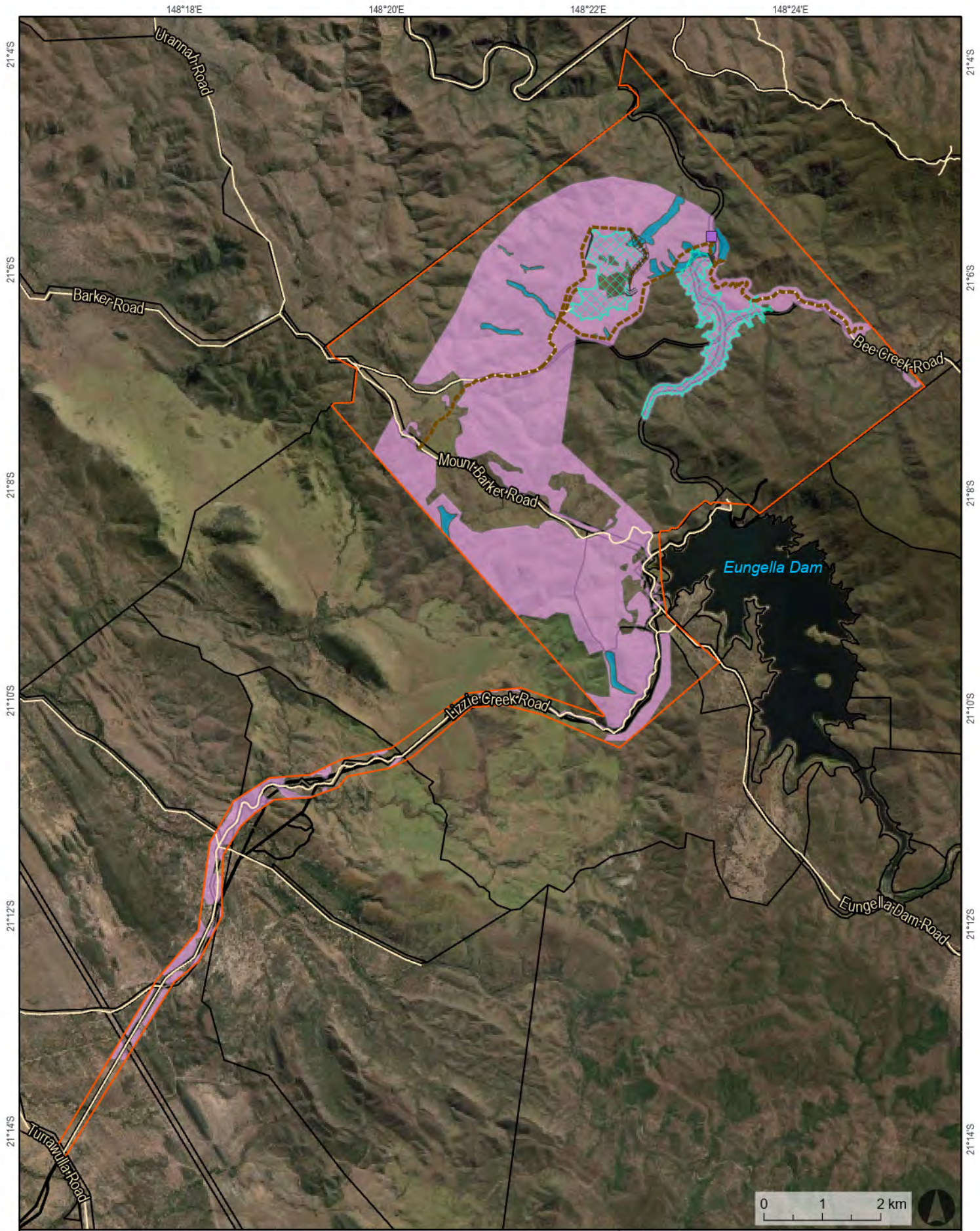
Table 5.8 Significant impact assessment – northern quoll

Significant impacts criteria	Assessment
Criteria from Referral guidelines for the northern quoll	
Result in the loss of habitat critical to the survival of the northern quoll	<p>Likely</p> <p>Construction of the CEH PHES Project will result in the loss of 285.97 ha of foraging and 36.83 ha of denning habitat that could be considered habitat critical to the survival of the northern quoll due its potential to connect important populations. Although the CEH PHES Project will result in a loss of 322.80 ha of habitat critical to the survival of the species, large areas of similar habitat, including protected areas in Crediton State Forest and Eungella National Park will remain undisturbed. While only small, localised areas of breeding/denning habitat will be impacted, construction of the CEH PHES Project is likely to result in the loss of habitat critical to the survival of the northern quoll.</p>
Decrease the size of a population important for the long-term survival of the northern quoll and therefore interfere with the recovery of the species	<p>Unlikely</p> <p>The Eungella and Clarke Range region supports an important population listed in the Commonwealth '<i>National Recovery Plan for the northern quoll</i>', as the resident population persists alongside threats, particularly, after cane toad invasion (Hill and Ward, 2010). Furthermore, the conservation importance of the Eungella population as a 'toad-smart' population has been reported in Woinarski <i>et al</i> (2008). Only minimal breeding/denning habitat will be impacted by the CEH PHES Project. Within the CEH PHES Project footprint, there will be a loss of approximately 36.83 ha of predicted denning habitat and 285.97 ha of predicted foraging habitat for the northern quoll. Such habitats are widely available within the surrounding landscape. This is unlikely to lead to long-term decrease in the population as similar habitat is widely available in the surrounding landscape including in protected areas connected to the project footprint (Eungella National Park, McCartney State Forest and Cathu State Forest).</p> <p>Whilst clearing can present additional mortality risks (generally as a result of clearing practices, vehicle strikes or increased competition for resources), these impacts are restricted to the construction phase of CEH PHES Project and unlikely to generate long-term declines. To mitigate the potential impacts of the CEH PHES Project, pre-clearance surveys will be undertaken to locate any potential breeding places of northern quolls. All clearing will be supervised by suitably trained and qualified fauna spotter-catchers. Impacts associated with the operation phase are negligible, as no additional clearing is required and vehicle movements to and from site are significantly decreased. Regardless, strict mitigation measures will be implemented throughout the CEH PHES Project lifecycle. Temporary fencing will be used during construction and permanent fencing of necessary infrastructure during operation will be used to exclude quolls from the CEH PHES Project infrastructure and limit interactions or disturbance from personnel. Daily checks of construction areas will be conducted to identify any trapped fauna. Considering the implementation of the above mitigation measures, the CEH PHES Project is unlikely to decrease the size of an important population important for the long-term survival of the northern quoll.</p>
Introduce inappropriate fire regimes or grazing activities (i.e., increasing the risk of late dry season high intensity fires to the area) that substantially degrade habitat critical to the survival of the northern quoll or decrease the size of a population important for the long term survival of the species	<p>Unlikely</p> <p>The CEH PHES Project will have no impact on fire regimes or grazing activities that could impact the quality of habitat critical to the survival of the northern quoll. Construction of the CEH PHES Project will have only minimal impact on denning or breeding habitat, while foraging resources and habitat are widely spread across the CEH PHES Project study area and adjacent habitats. The CEH PHES Project is not anticipated to increase the risk of fires, as weed and pest hygiene protocols will be implemented as part of the works and altered fire regimes are not anticipated to be required for the project. Project-specific Weed and Pest Management Plans and Bushfire Management Plan will be implemented. Cattle grazing will remain in areas adjacent to the project footprint. Accordingly, it is unlikely the construction or operation of the CEH PHES Project will introduce inappropriate fire regimes or grazing activities that could degrade habitat critical to the survival or decrease the size of and important population of the northern quoll</p>
Fragment a population important for the long term survival into two or more populations	<p>Unlikely</p> <p>The CEH PHES Project is unlikely to impact a local population of sufficient size that fragmentation could occur. Northern quolls occupy an estimated home range of 35 ha (DoE, 2016). Therefore, the clearing of a total 322.80 ha of habitat would theoretically</p>

Significant impacts criteria	Assessment
	<p>impact only a small portion of the habitat available for the greater regional population. Additionally, clearing will be largely contained within the CEH PHES Project lower reservoir. Within these areas, connecting habitat will be maintained above and below the CEH PHES Project reservoirs, and along the riparian fringe, which will allow continued fauna movement. The location of access tracks will be prioritised towards pre-existing track networks as far as practicable to limit the likelihood of additional fragmentation.</p>
<p>Result in invasive species or increases of them that are harmful to the northern quoll becoming established in its habitat, namely cane toads, feral cats, red foxes or exotic grasses which increase fire risk. This includes actions which have inadequate quarantine measures in place for movements between the mainland and offshore islands where northern quolls occur.</p>	<p>Unlikely</p> <p>Invasive species poses a significant threat to the northern quoll, specifically, cane toads (via lethal ingestion), feral cats and foxes (via predation) (Hill and Ward, 2010; Woinarski <i>et al.</i>, 2008). Cane toads are well established within the CEH PHES Project study area. There is currently little that can be done to suppress cane toad populations in Queensland (DCCEEW, 2011). However, the clearing and maintenance of access tracks may facilitate increased movement of feral predators throughout the region. These impacts will be reduced by implementing mitigation measures contained in project specific Weed and Pest Management Plans, EMP and Biosecurity Management Plan.</p>
<p>Criteria from Significant impact guidelines 1.1</p>	
<p>Lead to a long-term decrease in the size of a population of the species</p>	<p>Unlikely</p> <p>The Eungella and Clarke Range region supports an important population listed in the Commonwealth 'National Recovery Plan for the northern quoll' (Hill and Ward, 2010), as the resident population persists alongside threats, particularly, after cane toad invasion (Hill and Ward, 2010). Furthermore, the conservation importance of the Eungella population as a 'toad-smart' population has been reported in Woinarski <i>et al.</i>, (2008). Construction of the CEH PHES Project will impact only 36.83 ha of potential breeding/denning habitat for the northern quoll. While construction of the CEH PHES Project will result in a loss of 285.97ha of predicted foraging habitat, such habitats are widely available within the surrounding landscape. The area lost represents a much smaller proportion of the habitat that is available in the broader landscape associated with Crediton State Forest, Eungella National Park and the Clarke Range. This small reduction of habitat is unlikely to lead to long-term decrease in the population as similar habitat is widely available in the surrounding landscape.</p> <p>Whilst clearing can present additional mortality risks (generally as a result of clearing practices, vehicle strikes or increased competition for resources), these impacts are restricted to the construction phase and will be mitigated through routine construction controls such as the use of pre-clearance surveys and supervision of clearing by suitably qualified and experienced fauna spotter-catchers. Impacts associated with the operation phase are considered negligible, imposing no fragmentation or barrier effects on northern quoll movement as no additional clearing is required and vehicle movements to and from site are significantly decreased to baseline levels. Regardless, strict mitigation measures will be implemented throughout the CEH PHES Project lifecycle. Temporary fencing will be used during construction to limit adverse interactions or disturbance. Daily checks of construction areas will be conducted to identify any trapped fauna. Considering the implementation of the above mitigation measures, construction and operation of the CEH PHES Project is unlikely to decrease the size of an important population important for the long-term survival of the northern quoll.</p>
<p>Reduce the area of occupancy of a population</p>	<p>Unlikely</p> <p>As discussed above, the CEH PHES study area supports an important population, as outlined in the 'National Recovery Plan for the northern quoll' (Hill and Ward, 2010). The CEH PHES Project will result in a loss of 322.80 ha of potential habitat, which is largely restricted to the upper and lower reservoirs. To avoid inconsistencies and bias in assessments caused by estimating area of occupancy at different scales, TSSC, 2022b recommends standardisation of estimates by applying a 2 x 2 km grid to occurrence data. While the CEH PHES Project will result in a localised impact, the magnitude of loss is unlikely to cause the northern quoll to disappear from a 2 km x 2 km area. The CEH PHES Project is therefore unlikely to result in a reduction in the area of occupancy of the northern quoll.</p>

Significant impacts criteria	Assessment
Fragment an existing population into two or more populations	<p>Unlikely</p> <p>The CEH PHES Project is unlikely to impact a local population of sufficient size that fragmentation could occur. Northern quolls occupy an estimated home range of 35 ha (DoE, 2016). Therefore, the clearing of a total 322.80 ha of habitat would theoretically impact only a small portion of the habitat available for the greater regional population. Additionally, clearing will be largely contained within the CEH PHES Project lower reservoir. Within these areas, connecting habitat will be maintained above and below the CEH PHES Project reservoirs, and along the riparian fringe, which will allow continued fauna movement. The location of access tracks will be prioritised towards pre-existing track networks as far as practicable to limit the likelihood of additional fragmentation.</p>
Adversely affect habitat critical to the survival of a species	<p>Likely</p> <p>Construction of the CEH PHES Project will result in the loss of 285.97 ha of foraging and 36.83 ha of denning habitat that could be considered habitat critical to the survival of the northern quoll due its potential to connect important populations. Although the CEH PHES Project will result in a loss of 322.80 ha of habitat critical to the survival of the species, large areas of similar habitat, including protected areas in Crediton State Forest and Eungella National Park will remain undisturbed. While only small, localised areas of breeding/denning habitat will be impacted, construction of the CEH PHES Project is likely to result in the loss of habitat critical to the survival of the northern quoll.</p>
Disrupt the breeding cycle of a population	<p>Unlikely</p> <p>Construction of the CEH PHES Project has only minimal impact on 36.83 ha of potential breeding/denning habitat for the northern quoll. Northern quolls have a short lifespan, with most females only surviving one or two breeding seasons (DAWE, 2022c). Additionally, the intense physical effort exerted by males during the breeding season appears to cause a near-complete annual male die-off (DoE, 2016; Oakwood, 2000; Oakwood, 2002). This short life history makes them highly susceptible to disturbances and local extinction.</p> <p>While construction is expected to occur through the dry season, which coincides with the species' breeding season, the direct impact on breeding habitat is expected to be minimal. The potential for indirect impacts can be substantially reduced and avoided through routine construction mitigation controls. To mitigate the potential impacts of the CEH PHES Project construction, pre-clearance surveys will be undertaken to locate any breeding places of northern quolls. All clearing will be supervised by suitably trained and qualified fauna spotter-catchers. Temporary fencing will be used where feasible during construction to minimise movement of quolls into the construction/clearing footprint and minimise disruption to normal breeding activities and movements. Measures to reduce the impact of noise, dust and vibration will be contained within a project specific EMP. As the CEH PHES Project will not significantly fragment quoll habitat, it is unlikely to provide a barrier to quoll movement or inhibit the movements of breeding individuals in the short or long-term. However, due to a combination of increased human presence, habitat clearing and additional disturbances (e.g., noise, light and vibration), construction of the CEH PHES Project has the potential to cause localised disruption to the breeding cycle on a population of an endangered species.</p>
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>Unlikely</p> <p>The CEH PHES Project will result in the removal of 285.97 ha of potential foraging habitat and up to 36.83 ha of potential denning habitat. Clearing is to be conducted within the footprints of the upper and lower reservoirs and for adjacent infrastructure (e.g., pump houses, stockpiling and access tracks). Whilst this will result in a localised loss of habitat within the project footprint, suitable habitat is widely available at a local and regional level and the species is unlikely to decline. The indirect impacts of construction (e.g., dust, noise etc.) will be reduced using the mitigation measures detailed within a project specific EMP.</p>

Significant impacts criteria	Assessment
Result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat	<p>Unlikely</p> <p>Invasive species poses a significant threat to the northern quoll, specifically, cane toads (via lethal ingestion), feral cats and foxes (via predation) (Hill and Ward 2010; Woinarski <i>et al</i>, 2008). Cane toads are well established within the CEH PHES Project study area. There is currently little that can be done to suppress cane toad populations in Queensland (DCCEEW, 2011). However, the clearing and maintenance of access tracks may facilitate increased movement of feral predators throughout the region. These impacts will be reduced by implementing mitigation measures contained in project specific Weed and Pest Management Plan, EMP and Biosecurity Management Plan.</p>
Introduce disease that may cause the species to decline	<p>Unlikely</p> <p>There is no direct evidence of disease influencing population declines of northern quolls (Hill and Ward, 2016), however, historical research has highlighted disease as an explanation for sudden population crashes in central Queensland (Finlayson, 1934). Regardless, no diseases are known to impact the northern quoll and the CEH PHES Project will have negligible capacity to introduce or exacerbate the spread of disease to the local quoll population.</p>
Interfere with the recovery of the species	<p>Unlikely</p> <p>While some of the objectives of the Recovery Plan for the northern quoll (Hill and Ward, 2010) are relevant to habitats that occur in the local area, given it represents a stronghold in which the northern quoll has persisted long after the spread of cane toads, the small magnitude of construction and operation impact is unlikely to interfere with the long-term persistence of that population and the role the local population plays in meeting the objectives of the recovery plan.</p>



- LEGEND**
- PHEs Project area
 - Northern quoll (habitat critical to survival - denning)
 - Northern quoll (habitat critical to survival - foraging)
 - Dam wall
 - Proposed pumped hydro reservoirs
 - Proposed access track
 - Proposed powerhouse
 - Existing road
 - Cadastre

Disclaimer: CIP makes no warranty in relation to the accuracy, reliability, completeness or suitability of the data and does not accept liability for any loss, damage or costs, including consequential damage, in relation to any use of the data in this map.

PROJECT				CEH PHEs Project		
TITLE				Predicted habitat for the northern quoll		
DATE	9/08/2023	STATUS	DRAFT	PRODUCED	IM	
SCALE	1:85,000 at A3	DATUM	GDA 1994 MGA Zone 55	REV	A	
FILE	CEH-EPBC-PHEs - FIG_5_7 NORTHERN QUOLL - rA				FIG	5.7

5.8 Yellow-bellied glider (south-eastern) (*Petaurus australis australis*)

The yellow-bellied glider (south-eastern) has not been confirmed present in field surveys. Given the level of survey effort that has been undertaken for the CEH PHES Project and other proposed infrastructure elements in the local area (i.e., the associated CEH Transmission Project and other unrelated infrastructure), the failure to detect the species has increased uncertainty over the species' likelihood of occurrence. Targeted surveys are being undertaken in autumn and winter 2023 to further investigate the species' likelihood of occurrence. Until those surveys are complete, a conservative approach has been taken and the species has been considered to have a high to moderate likelihood of occurrence given the presence of suitable habitat and nearby historical records.

The CEH PHES Project is **likely to result in a significant residual impact on the yellow-bellied glider (south-eastern)** due to adverse impacts on habitat critical to the survival of the species. A significance of impact assessment of the CEH PHES Project on the yellow-bellied glider (vulnerable under the EPBC Act) is provided in Table 5.9. Habitat mapping for the yellow-bellied glider is shown in Figure 5.8.

Status as an important population: The Commonwealth conservation advice for the yellow-bellied glider (south-eastern) defines important populations as stronghold populations, ecologically or genetically distinct populations (e.g., those at the limits of the subspecies' range, outlying populations), research populations, and other populations where recovery actions are being implemented (DAWE, 2022d). The conservation advice lists a number of important populations; however, the list is not exhaustive. While the local population is not among the important populations named in the conservation advice, the nearby population (recorded from Eungella National Park) is at the northern extent of the species range. If present, the local population would constitute an important population.

Habitat critical to the survival of the species: is defined in the Commonwealth conservation advice (DAWE, 2022d) for the yellow-bellied glider as:

- Large contiguous areas of floristically diverse eucalypt forest, which are dominated by winter-flowering and smooth-barked eucalypts, including mature living hollow-bearing trees and sap trees.
- Areas identified as refuges under future climate change scenarios.
- Short or long-term post-fire refuges (i.e., unburnt habitat within or adjacent to recently burnt landscapes) that allow the species to persist, recover and recolonise burnt areas.
- Habitat corridors required to facilitate dispersal of the subspecies between fragmented habitat patches and/or that enable recolonization or movement away from threats.

For the purpose of the significant impact assessment, areas of mature Eucalypt woodland in REs where smooth-bark Eucalypts are a dominant part of the canopy that were ground-truthed to have high densities of hollows and a high level of connectivity were considered to represent habitat critical to the survival of the species. In that context, all mapped habitats consistent with the Commonwealth definition of yellow-bellied glider habitat in the CEH PHES study area were considered habitat critical to the survival of the species.

The Commonwealth approved conservation advice (DAWE, 2022d) was the primary reference document for assessment of the impacts of the CEH PHES Project.

Impact avoidance achievable: Potential for injury and mortality during clearing will be avoided by implementing industry best practice clearing protocols including sequential clearing under the direction of suitably trained and experienced spotter-catchers. Any permanent fencing constructed for the CEH PHES Project will not incorporate barbed wire on the top-strand, minimising the potential threat of mortality due to entanglement in barbed wire fencing.

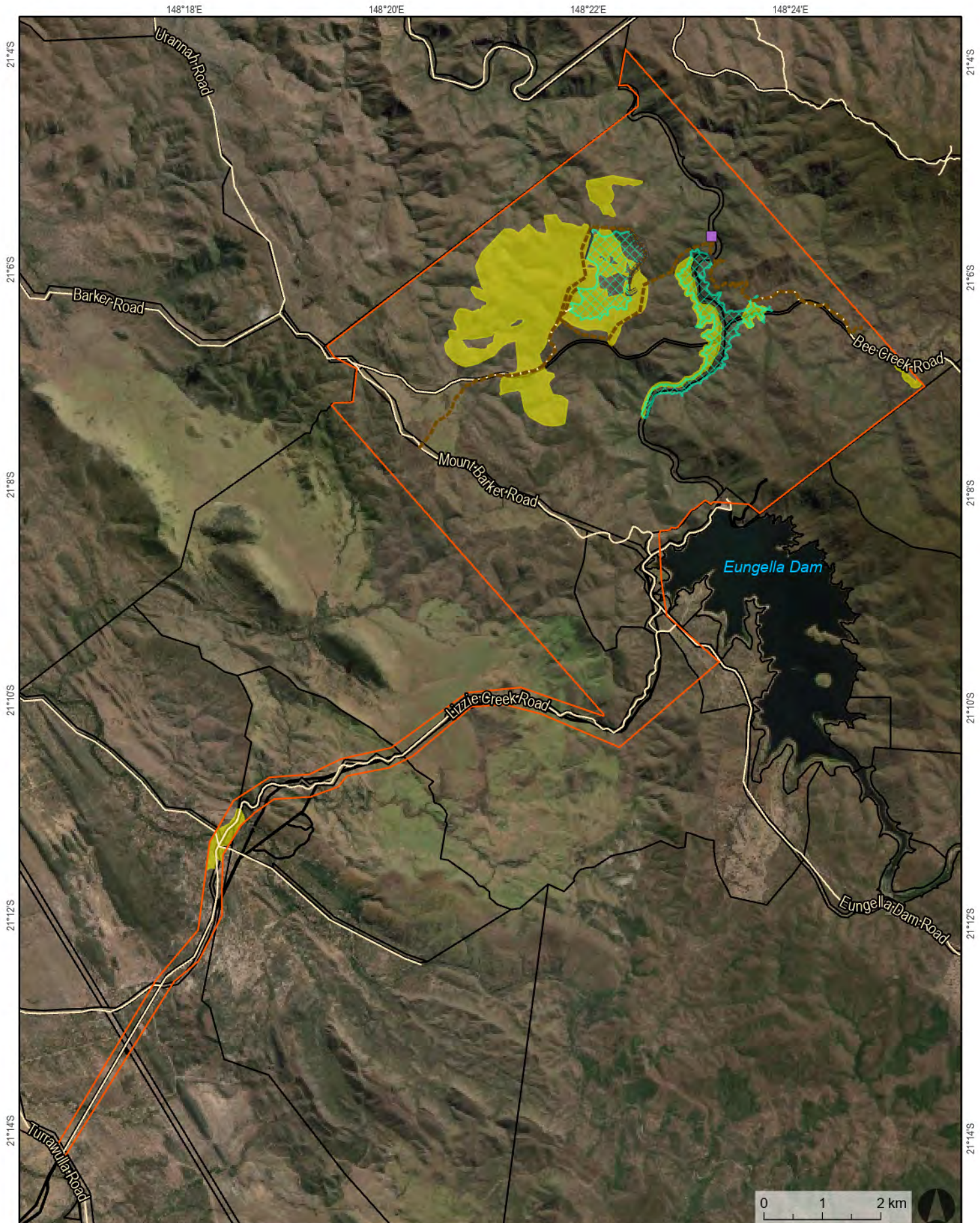
Residual impacts on the yellow-bellied glider: Potential impacts on yellow-bellied glider populations and habitat within the project footprint include:

- Loss of 165.11 ha of habitat critical to the survival of the species
- Disturbance to wildlife through increased light, noise and vibration
- Habitat degradation by increased dust run-off and sedimentation
- Introduction and spread of pest fauna species and weeds
- Fragmentation and barrier effects.

Table 5.9 Significant impact assessment – yellow-bellied glider

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	<p>Possible</p> <p>The local population would represent an important population of the yellow-bellied glider (south-eastern) given its' position at the northern extent of the sub-species range. Construction of the CEH PHES Project will result in the loss of 165.11 ha of potential denning and foraging habitat. Compared to the greater glider, the yellow-bellied glider has a requirement for large, socially exclusive home ranges and therefore requires access to a relatively large area of suitable habitat. Given their increased spatial requirements, the loss of habitat and resources could have an adverse impact on the carrying capacity of the local area, resulting in a reduction in the population size. While potential injury or mortality risks will be effectively avoided through the use of best-practice clearing protocols, the impact on habitat may be sufficient to lead to a long-term decrease in the size of an important population.</p>
Reduce the area of occupancy of an important population	<p>Unlikely</p> <p>The CEH PHES Project will result in localised loss of 165.11 ha of habitat. This is localised in nature and is unlikely to result in the disappearance of yellow-bellied gliders from an area sufficiently large to register a reduction in the area of occupancy, as measured at the 2 km x 2 km scale recommended under the EPBC Act (TSSC, 2021b). It is therefore considered unlikely that the CEH PHES Project will reduce the area of occupancy of a population of the yellow-bellied glider (south-eastern).</p>
Fragment an existing important population into two or more populations	<p>Unlikely</p> <p>As detailed above, if present, the local population would be an important population given its' location at the northern extent of the sub-species range. The yellow-bellied glider (south-eastern) is particularly vulnerable to the impacts of clearing and fragmentation due to its large, exclusive home ranges, requirement for large areas of forest, and inability to cross even small areas of cleared land (Kambouris <i>et al.</i>, 2013; Woinarski <i>et al.</i>, 2014). Despite this, the construction of the CEH PHES Project will require localised vegetation clearing. This would not be of a sufficient width to act as a barrier to movement of the yellow-bellied glider (south-eastern), as while the local clearing would exceed the maximum gliding distance of the species (120 - 140 m), at localised areas, the clearing would not restrict connectivity to habitat and would not result in any loss of movement between habitat areas. Given the small, localised extent of clearing, the CEH PHES Project is unlikely to fragment an existing population into two or more populations.</p>
Adversely affect habitat critical to the survival of a species	<p>Likely</p> <p>Construction of the CEH PHES Project will result in a loss of 165.11 ha of mature woodland habitat considered habitat critical to the survival of the species. Based on the magnitude of loss, the CEH PHES Project has the potential to have a significant adverse impact on habitat that qualifies as critical habitat for this species.</p>
Disrupt the breeding cycle of an important population	<p>Unlikely</p> <p>The CEH PHES Project footprint has been subject to historical land-clearing for cattle grazing and, in many areas, had low to moderate densities of hollows. Whilst 165.11 ha of habitat will be impacted, the extent of habitat loss is relatively small in the local context. Suitable breeding habitat is broadly available across the CEH PHES Project study area and surrounding landscape. Once operational, the CEH PHES Project is likely to have negligible impact on the species breeding capacity, with no substantial noise, light or other disturbance impacts that would limit breeding success in the local population. As such, the CEH PHES Project is unlikely to disrupt the breeding cycle of a population.</p>
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>Unlikely</p> <p>The CEH PHES Project will remove up to 165.11 ha of habitat for the species. Operational impacts are expected to be negligible, with no substantial restriction of access to habitat or barrier effects and minimal if any disturbance due to light and noise. While the loss of habitat could reduce the size of the local population, the extent of remaining habitat is such that the loss of habitat is not likely to impact the species' survival in the region. As such, it is unlikely the CEH PHES Project will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p>

Significant impacts criteria	Assessment
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	<p>Unlikely</p> <p>Predation by European foxes is considered a minor threat to the yellow-bellied glider (south-eastern) (DAWE, 2022d). However, the European fox is not a dominant pest species in the region and the CEH PHES Project is unlikely to result in the introduction or spread of invasive species beyond current levels. The implementation of a weed and pest management plan will further reduce potential impacts of invasive species. As such, the CEH PHES Project is unlikely to modify, destroy, remove or isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p>
Introduce disease that may cause the species to decline	<p>Unlikely</p> <p>Disease is not a known threat to the yellow-bellied glider (south-eastern). However, the species is likely to be susceptible to <i>Phytophthora cinnamomi</i> due the soil fungus's ability to infect eucalypt species upon which the greater glider depends for food and refuge. Biosecurity requirements (e.g., weed and seed declarations) will be implemented for the CEH PHES Project, and thus, the residual risk is considered low.</p>
Interfere substantially with the recovery of the species	<p>Unlikely</p> <p>Construction and operation of the CEH PHES Project will not interfere with any of the recovery objectives listed in the current Commonwealth conservation advice for the species.</p>



- LEGEND**
- PHEs Project area
 - Yellow-bellied glider (habitat critical to survival)
 - Dam wall
 - Proposed pumped hydro reservoirs
 - Proposed access track
 - Proposed powerhouse
 - Existing road
 - Cadastre

Disclaimer: CIP makes no warranty in relation to the accuracy, reliability, completeness or suitability of the data and does not accept liability for any loss, damage or costs, including consequential damage, in relation to any use of the data in this map.

PROJECT			
CEH PHEs Project			
TITLE			
Predicted habitat for the yellow-bellied glider			
DATE	STATUS	PRODUCED	
8/08/2023	DRAFT	IM	
SCALE	DATUM	REV	FIG
1:85,000 at A3	GDA 1994 MGA Zone 55	A	5.8
FILE			FIG
CEH-EPBC-PHEs - FIG 5_8 YB GLIDER - rA			5.8

5.9 Squatter pigeon (southern) (*Geophaps scripta scripta*)

The CEH PHES Project is **unlikely to result in a significant residual impact on the squatter pigeon (southern)**. A significance of impact assessment of the CEH PHES Project on the squatter pigeon (southern) (vulnerable under the EPBC Act) is provided in Table 5.10. Habitat mapping for the squatter pigeon (southern) is shown in Figure 5.9.

Important populations: Important populations of the squatter pigeon (southern) are defined under the Commonwealth approved conservation advice as all of the relatively small, isolated and sparsely distributed sub-populations occurring south of the Carnarvon Ranges in Central Queensland are considered to be important sub-populations of the subspecies (Squatter Pigeon Workshop, 2011). Accordingly, the local population is not an important population at a national level.

Status as habitat critical to the survival of the species: There is no formal definition of habitat critical to the survival of the species for the squatter pigeon (southern) in the Commonwealth approved conservation advice. The definition outlined in the *Significant Impact Guidelines 1.1 – MNES* (DoE, 2013) has been applied whilst considering the substantial difference in threats faced by the subspecies at the northern and southern extent of its range. Within the context of the sub-species northern range, habitat critical to the survival of the squatter pigeon (southern) has been considered to include areas of breeding (nesting) habitat, i.e., remnant and regrowth open forest and woodland that occur on suitable (stony) land zones within 1 km of permanent waterbody.

The Commonwealth approved conservation advice for the species (TSSC, 2015) was the primary reference document for assessment of the impacts of the CEH PHES Project.

Impact avoidance achievable: Given its ground-dwelling nature, the squatter pigeon (southern) is highly susceptible to injury and mortality through construction activities. Risks of injury and mortality can be effectively reduced through the implementation of routine construction controls including construction speed limits, local signage on key high-risk areas, erection of temporary exclusion fencing and pre-clearance flushing surveys by spotter catchers prior to and during clearing.

Residual impacts on the squatter pigeon (southern): Construction of the CEH PHES Project has the potential to result in the following impacts on the squatter pigeon (southern):

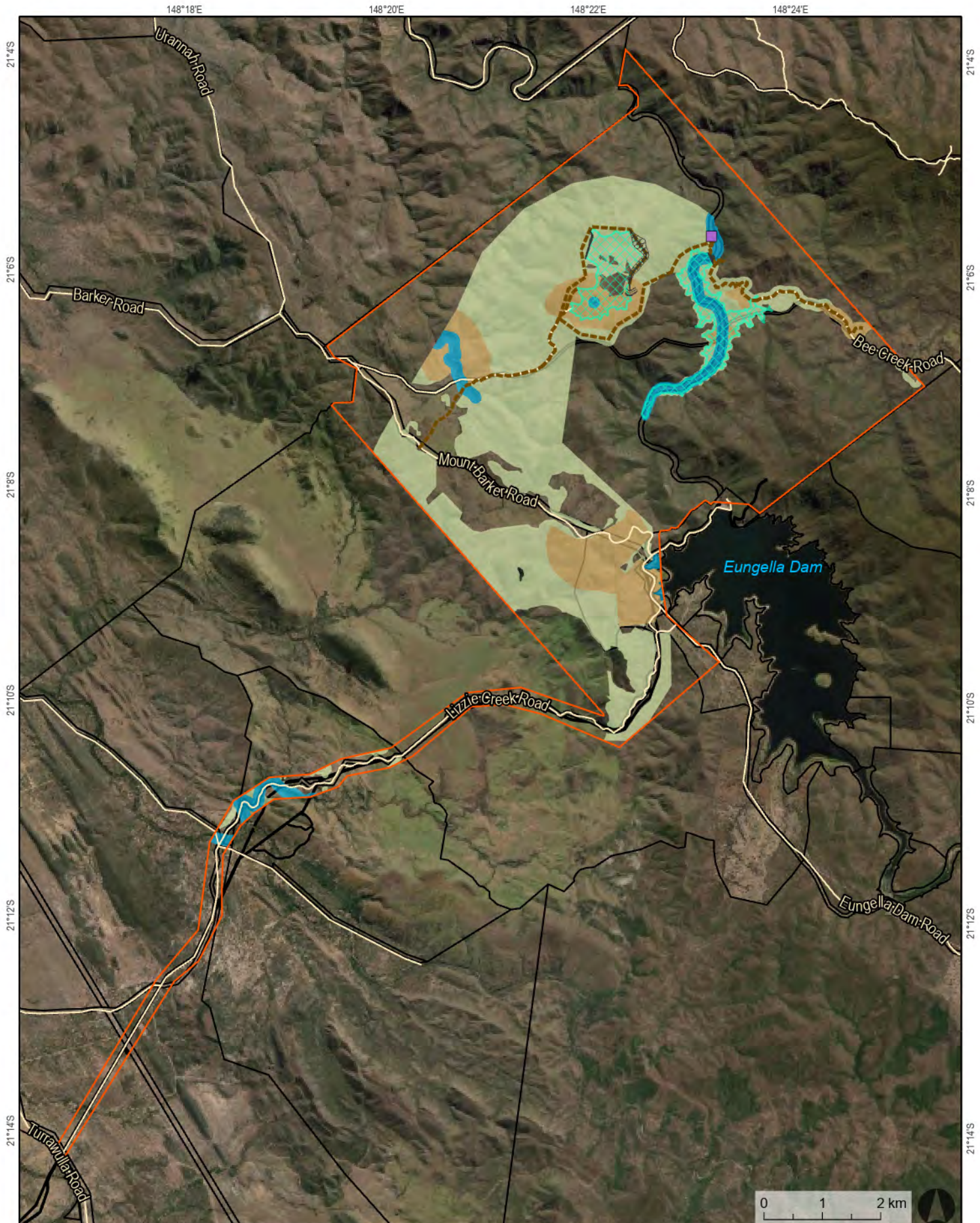
- Loss of 54.30 ha of habitat critical to the survival of the sub-species (nesting habitat)
- Loss of 90.06 ha of drinking habitat
- Loss of 216.13 ha of foraging habitat
- Injury and mortality
- Disturbance from increased light, noise and vibration
- Habitat degradation through increased dust, run-off and sedimentation
- Introduction and spread of invasive fauna species and weeds.

During the operation phase, the CEH PHES Project is expected to be relatively benign in terms of its impact with negligible noise, lighting and vibration.

Table 5.10 Significant impact assessment – squatter pigeon (southern)

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	<p>Unlikely</p> <p>The squatter pigeon (southern) is abundant within the region and the local population is not an important population at a national level. Clearing for the CEH PHES Project will result in loss of 54.30 ha of habitat critical to the survival of the species (i.e., nesting habitat), 90.06 ha of drinking habitat and 216.13 ha of predicted foraging habitat that is widely available in the surrounding landscape. While the construction activities pose a risk of injury and mortality, these risks can be effectively mitigated through routine controls. The loss of habitat is unlikely to be significant in the context of the local landscape and unlikely to influence the size of the local population. Loss of habitat in other parts (i.e., for clearing of access tracks) does not represent a permanent loss of habitat given the squatter pigeon (southern) is known to utilise cleared areas and tracks as dispersal habitat. Clearing activities and movement of vehicles during construction and operation present a risk of injury and mortality to the squatter pigeon (southern). However, these risks can be effectively mitigated with routine controls. During the operation phase, the CEH PHES Project is expected to be relatively benign in terms of its impact with minimal noise, lighting and vibration. Accordingly, the CEH PHES Project is unlikely to result in a long-term decrease in the size of an important population of the species.</p>
Reduce the area of occupancy of an important population	<p>Unlikely</p> <p>The local squatter pigeon (southern) population is not an important population. While the CEH PHES Project will result in the loss of 360.49 ha of habitat, this is likely to generate a short-term impact only, with the subspecies likely to utilise access tracks during the operation of the CEH PHES Project. The loss of 216.13 ha foraging habitat and 90.06 ha of drinking habitat is not expected to lead to a reduction in the area of occupancy of the local population, as the subspecies will not disappear from any 2 km x 2 km area, the scale at which area of occupancy is assessed under the EPBC Act (TSSC, 2021b). The subspecies is therefore likely to persist within the PHES area.</p> <p>Given the CEH PHES Project is unlikely to have any substantial impact in its operational phase and noting the continued presence of suitable habitat within the CEH PHES Project study area, the CEH PHES Project is unlikely to reduce the area of occupancy of the squatter pigeon (southern).</p>
Fragment an existing important population into two or more populations	<p>Unlikely</p> <p>The loss of 360.49 ha of habitat will occur from relatively discrete localised areas across the project footprint and will represent a permanent loss of habitat. Clearing for the CEH PHES Project will be relatively localised, and in many places will not preclude the subspecies from utilising areas after construction has been completed. The squatter pigeon (southern) is likely to actively utilise access tracks and cleared easement areas for dispersal and local movement. The subspecies often occurs in open woodland areas with high levels of anthropogenic influence. The subspecies is likely to persist and utilise many parts of the CEH PHES Project area during the operation phase. Accordingly, the CEH PHES Project is unlikely to fragment the important population into two or more populations.</p>
Adversely affect habitat critical to the survival of a species	<p>Unlikely</p> <p>Habitat critical to the survival of the species is not defined in the Commonwealth conservation advice for the squatter pigeon (southern). In the absence of any formal definition, the definition outlined in the <i>Significant Impact Guidelines 1.1 – MNES</i> (DoE, 2013) has been applied whilst considering the substantial difference in threats faced by the species between the northern and southern extent of its' range. Construction of the CEH PHES Project will result in the loss of 54.30 ha of nesting habitat that is considered to represent habitat critical to the survival of the squatter pigeon (southern) in the context of the species' northern range, where it is locally abundant and has not experienced substantial declines. Given the relatively small magnitude of impact on habitat critical to the survival of the species, the loss is not considered likely to constitute a significant impact. This assessment is based on the consideration that breeding habitat is otherwise abundant in the surrounding landscape and the impact is not necessarily permanent, with the species potentially continuing to utilise and breed in these areas after construction. Accordingly, the CEH PHES Project will not adversely affect habitat critical to the survival of the species.</p>

Significant impacts criteria	Assessment
Disrupt the breeding cycle of an important population	<p>Unlikely</p> <p>The local population is not among those important populations identified in the Commonwealth conservation advice for the squatter pigeon (southern). The CEH PHES Project will result in the loss of 54.30 ha of potential breeding habitat. Connectivity will be maintained with adjacent drinking sources and the project footprint will not impact on any drinking sites for the subspecies. Construction activities have the potential to cause short-term disruption to breeding activities immediately adjacent to construction areas. Construction will likely be undertaken during dry conditions where practicable to reduce the potential for indirect impacts to tracks and adjoining habitats from stormwater run-off from construction areas. While this coincides with the peak breeding season for the subspecies, the impact will be temporary and is unlikely to result in a loss of an entire annual cohort as the subspecies is expected to continue to breed in some areas that are located further from construction areas and the subspecies is known to breed all year round (Squatter Pigeon Workshop, 2011). The CEH PHES Project is therefore not expected to disrupt the breeding cycle of the local population.</p>
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>Unlikely</p> <p>The CEH PHES Project will result in a direct loss of 360.49 ha of potential habitat for the subspecies. Based on the abundance of suitable habitat within the surrounding landscape, and the benign nature of the CEH PHES Project during the operation phase, the subspecies is likely to persist in the local area and surrounding region. As such, the loss of habitat is not at a scale that is likely to cause the subspecies to decline. Additionally, parts of the project footprint including access tracks will remain unsealed, and these areas are likely to be actively utilised for dispersal and local movement by the subspecies. Additionally, after construction the temporary construction footprints will be revegetated and likely to provide additional habitat for the squatter pigeon (southern). Although the CEH PHES Project has the potential to indirectly decrease the quality for habitat for the subspecies through increased dust, noise and vibration, these impacts will be mitigated. Weed management that will occur within those areas over the lifetime of the CEH PHES Project, (and is currently not being managed) has the potential to increase the quality and accessibility of foraging habitat. Given the small magnitude of the loss of habitat and the potential for ongoing use of these areas, the CEH PHES Project is unlikely to cause a decline in the local population.</p>
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	<p>Unlikely</p> <p>Known feral predators of the squatter pigeon (i.e., cats and foxes) have been confirmed present and are considered to be ubiquitous within the CEH PHES Project study area. The CEH PHES Project will not introduce any external food sources that could increase the local densities of these feral predators. The footprint is currently subject to low levels of weed infestation. Implementation of routine weed management protocols contained within a project specific EMP and Weed Management Plan are expected to mitigate this risk to low levels. The CEH PHES Project is unlikely to result in invasive species that are harmful to the subspecies becoming established in habitat within and around the project footprint. Unmitigated, the CEH PHES Project has the potential to reduce the extent and quality of local foraging habitat by facilitating the on-site spread of weeds. However, the inclusion of weed management controls has the potential to enhance the local foraging habitat values.</p>
Introduce disease that may cause the species to decline	<p>Unlikely</p> <p>No diseases or pathogens are identified among current known threats to the squatter pigeon (southern). The weed-wash down and hygiene protocols that will be implemented through construction to manage the on-site spread or export of weeds will also act to reduce the potential for transmission of disease. This risks to squatter pigeons (southern) associated with disease transmission are therefore considered negligible.</p>
Interfere substantially with the recovery of the species	<p>Unlikely</p> <p>Despite the removal of 360.49 ha of predicted habitat, the CEH PHES Project is unlikely to have any substantial impact during the operational phase. Operation of the CEH PHES Project is unlikely to have any impact on the behaviour or use of habitats among the local squatter pigeon (southern) population. Implementation of Weed and Pest Management Plans and EMP for the CEH PHES Project has the potential to increase the value of some localised areas of habitats and reduce incidence of predation on the local population. The employment of a fauna spotter-catcher to survey predicted habitat during clearing will reduce the risk of individual mortality and injury. Local noise disturbance and mortality threats associated with the CEH PHES Project are also expected to be low.</p>



LEGEND	
	PHEs Project area
	Squatter pigeon (drinking habitat)
	Squatter pigeon (foraging habitat)
	Squatter pigeon (habitat critical for survival - nesting)
	Dam wall
	Proposed pumped hydro reservoirs
	Proposed access track
	Proposed powerhouse
	Existing road
	Cadastre

Disclaimer: CIP makes no warranty in relation to the accuracy, reliability, completeness or suitability of the data and does not accept liability for any loss, damage or costs, including consequential damage, in relation to any use of the data in this map.

PROJECT				CEH PHEs Project	
TITLE				Predicted habitat for the squatter pigeon (southern)	
DATE	9/08/2023	STATUS	DRAFT	PRODUCED	IM
SCALE	1:85,000 at A3	DATUM	GDA 1994 MGA Zone 55	REV	A
FILE	CEH-EPBC-PHEs - FIG 5_9 SQUATTER PIGEON - rA			FIG	5.9

5.10 White-throated needletail (*Hirundapus caudacutus*)

The CEH PHES Project is **unlikely to have a significant impact on the white-throated needletail**. A significance of impact assessment of the CEH PHES Project on the white-throated needletail (vulnerable and migratory under the EPBC Act) is provided in Table 5.11. Habitat mapping for the white-throated needletail is shown in Figure 5.10.

Status as an important population: The concept of important populations does not typically apply to species capable of migrating large distances, given their capacity to intermix and utilise habitats across a broad geographic range. Locally occurring white-throated needletails are therefore not part of an important population.

Status as habitat critical to the survival of the species: There is no formal definition of habitat critical to the survival of the species in the Commonwealth approved conservation advice for the white-throated needletail. In the absence of a formal definition, the definition outlined in the *Significant Impact Guidelines 1.1 – MNES* (DoE, 2013) has been applied. The species is predominantly aerial and was previously thought to not be reliant on terrestrial habitats (Cramp, 1985; Coventry, 1989; Tarburton, 1993) cited in DAWE (2022b). Recent research has shown the species does roost in trees, typically in tall eucalypt vegetation on ridges where the species can easily alight (Tarburton, 2021). While the extent to which terrestrial roosting habitat is utilised by the species is uncertain, terrestrial roosting habitat is likely to be considered habitat critical to the survival of the species. Roosting habitat likely to be considered habitat critical to the survival of the species was recorded along ridgelines surrounding the CEH PHES Project area.

The Commonwealth approved conservation advice for the species (TSSC, 2019) and the National Recovery Plan (DAWE, 2022b) were the primary reference documents for assessment of the impacts of the CEH PHES Project.

Impact avoidance achieved: Steep ridgelines that represent habitat critical to the survival of the species have generally been avoided in the design phase to minimise logistic and engineering constraints. This has achieved substantial avoidance of impact on habitat critical to the survival of the white-throated needletail.

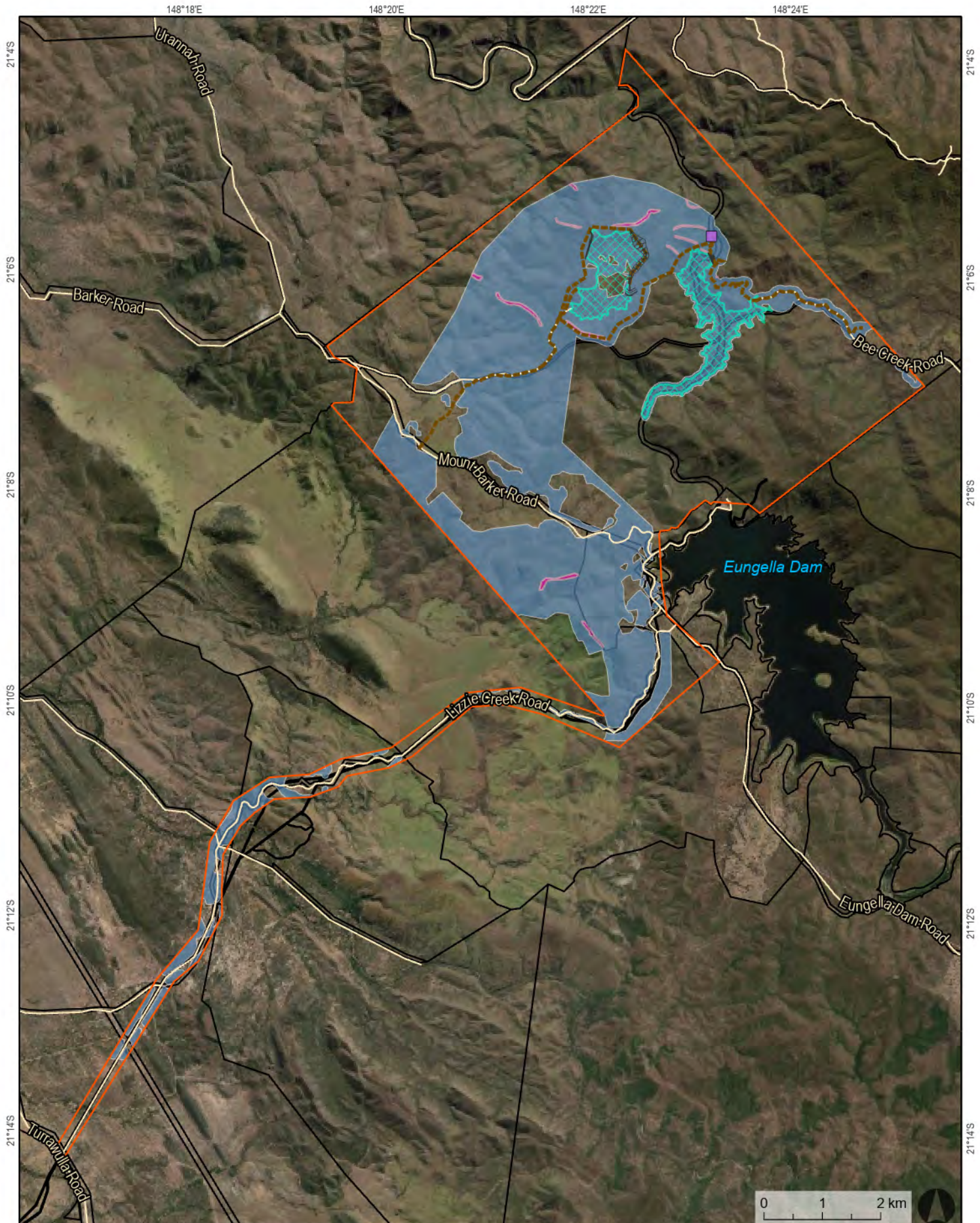
Residual impacts on the white-throated needletail: Potential impacts to white-throated needletail populations include (TSSC 2019):

- Loss of 1.69 ha of roosting habitat
- Loss of 265.42 ha of overfly habitat.

Table 5.11 Significant impact assessment – white-throated needletail

Significant impacts criteria	Assessment
Criteria from Significant impact guidelines 1.1 - vulnerable	
Lead to a long-term decrease in the size of an important population of the species	Unlikely Important populations of the white-throated needletail have not been specifically nominated in the Commonwealth conservation advice. Given the species capacity for large-scale migration, the species is unlikely to have localised important populations. The white-throated needletail is predominantly aerial and does not have typical associations with habitat (DAWE 2022b). The CEH PHES Project will result in a loss of 1.69 ha of potential roosting habitat for the species and 265.42 ha of potential overfly habitat. As such, localised clearing for the CEH PHES Project is unlikely to have any substantial impact on the species' local abundance.
Reduce the area of occupancy of an important population	Unlikely The CEH PHES Project will result in a loss of 1.69 ha of potential roosting habitat for the species. The loss of 1.69 ha of roosting habitat and localised loss of terrestrial woodland habitat is unlikely to cause a permanent disappearance of the species from a 2 km x 2 km area (TSSC, 2021b) such that there would be a decrease in the area of occupancy of the species.
Fragment an existing important population into two or more populations	Unlikely The white-throated needletail is not directly dependent on habitats at ground level and has the capacity to fly over cleared and fragmented areas. The CEH PHES Project will result in the loss of 1.69 ha of potential roosting habitat critical to the survival of the species, however potential roosting habitat is present in areas surrounding the project footprint. As such, the CEH PHES Project has no capacity to fragment the population into two or more populations.

Significant impacts criteria	Assessment
Adversely affect habitat critical to the survival of a species	<p>Unlikely</p> <p>The white-throated needletail does not have conventional habitat requirements. While the CEH PHES Project will impact 1.69 ha of potential roosting habitat critical to the survival of the species, however potential roosting habitat is present in areas surrounding the project footprint. Accordingly, vegetation clearing for the CEH PHES Project is not considered likely to adversely impact habitat critical to the survival of the species.</p>
Disrupt the breeding cycle of an important population	<p>Unlikely</p> <p>The white-throated needletail does not breed in Australia, spending its breeding season in Asia, from central and south-eastern Siberia and Mongolia, east to the Maritime Territories of Russia, Sakhalin and the Kuril Islands and south to northern Japan and north-eastern China (DAWE, 2022b). As such, the CEH PHES Project will not disrupt the breeding cycle of an important population of this species.</p>
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>Unlikely</p> <p>As detailed above, the white-throated needletail does not have conventional habitat requirements. The CEH PHES Project will impact 1.69 ha of potential roosting habitat, suitable habitat is present in areas surrounding the CEH PHES Project. Accordingly, vegetation clearing for the CEH PHES Project will not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p>
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	<p>Unlikely</p> <p>No invasive species are identified as threats to the white-throated needletail. The CEH PHES Project is unlikely to cause any increase in invasive species that could threaten local abundance of the white-throated needletail.</p>
Introduce disease that may cause the species to decline	<p>Unlikely</p> <p>Disease is not identified as a key threat to the white-throated needletail. This species' almost exclusively aerial habit means it is unlikely to have many opportunities to contract diseases that could threaten the viability of local populations. The CEH PHES Project is therefore unlikely to introduce disease that cause the species to decline.</p>
Interfere substantially with the recovery of the species	<p>Unlikely</p> <p>The CEH PHES Project is unlikely to have any substantial impact on the species, given the impact footprint will be localised, the loss of roosting habitat is small in the context of potential roosting habitat within the local and regional landscape, and the species does not have typical reliance on terrestrial habitats.</p>
Criteria from Significant impact guidelines 1.1 – migratory	
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.	<p>Unlikely</p> <p>As detailed above the habitats in the CEH PHES Project study area would not constitute important habitat for the white-throated needletail, given they would not support an ecologically significant proportion of the population during critical life cycle stages. Construction of the CEH PHES Project will result in the localised clearing of 1.69 ha of potential roosting habitat for the species and 265.42 ha of potential overfly habitat. Substantial avoidance of impact has been achieved through the design phases and the areas impacted by the CEH PHES Project represent a small proportion of the habitat available in the surrounding landscape. Overall, the CEH PHES Project is unlikely to substantially modify important habitat for the locally occurring migratory species.</p>
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	<p>Unlikely</p> <p>No invasive species are identified as threats to the white-throated needletail. The CEH PHES Project is unlikely to cause any increase in invasive species that could threaten local abundance of the white-throated needletail.</p>
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	<p>Unlikely</p> <p>The white-throated needletail does not breed in Australia, spending its breeding season in Asia, from central and south-eastern Siberia and Mongolia, east to the Maritime Territories of Russia, Sakhalin and the Kuril Islands and south to northern Japan and north-eastern China (DAWE, 2022b). As such, the CEH PHES Project will not disrupt the breeding cycle of an important population of this species.</p>



LEGEND	
	PHES Project area
	White-throated needletail (overfly area)
	White-throated needletail (habitat critical to survival - roosting)
	Dam wall
	Proposed pumped hydro reservoirs
	Proposed access track
	Proposed powerhouse
	Existing road
	Cadastre

Disclaimer: CIP makes no warranty in relation to the accuracy, reliability, completeness or suitability of the data and does not accept liability for any loss, damage or costs, including consequential damage, in relation to any use of the data in this map.

PROJECT				CEH PHES Project		
TITLE				Predicted habitat for the white-throated needletail		
DATE	9/08/2023	STATUS	DRAFT	PRODUCED	IM	
SCALE	1:85,000 at A3	DATUM	GDA 1994 MGA Zone 55	REV	A	
FILE	CEH-EPBC-PHES - FIG 5_10 WT NEEDLETAIL - rA				FIG	5.10

5.11 Fork-tailed swift (*Apus pacificus*)

The CEH PHES Project is **unlikely to result in a significant residual impact on the fork-tailed swift**. A significance of impact assessment of the CEH PHES Project on the fork-tailed swift (migratory under the EPBC Act) assessing against the migratory species criteria detailed in the *Significant Impact Guidelines 1.1 – MNES* (DoE, 2013) and considering the *Referral guidelines for 14 bird species listed as Migratory under the EPBC Act* (DoE, 2015) (Table 5.12). Predicted habitat mapping for the fork-tailed swift is provided in Figure 5.11.

Important habitat: Important habitat for the fork-tailed swift is identified in the *Referral guidelines for 14 bird species listed as Migratory under the EPBC Act* (DoE, 2015). This acknowledges that habitats in Australia are non-breeding habitat only. Non-breeding habitat requirements in Australia are relatively broad with the species occurring across a range of habitats from inland open plains to wooded areas, where it is exclusively aerial (DoE, 2015). As per in the *Significant Impact Guidelines 1.1 – MNES* (DoE, 2013), local habitat in the CEH PHES Project study area is not at the edge of the species' known range, the species is exclusively aerial as a non-breeding visitor to Australia. As such, the species only utilises the airspace above the CEH PHES Project for foraging purposes. The habitat above the project footprint is unlikely to support an ecologically significant proportion of the population during critical life cycle stages. By those measures, the local habitats are not considered important habitat.

The Commonwealth *Referral guideline for 14 birds listed as migratory species under the EPBC Act – Draft* (DoE, 2015) was the primary reference document for assessment of the impacts of the CEH PHES Project.

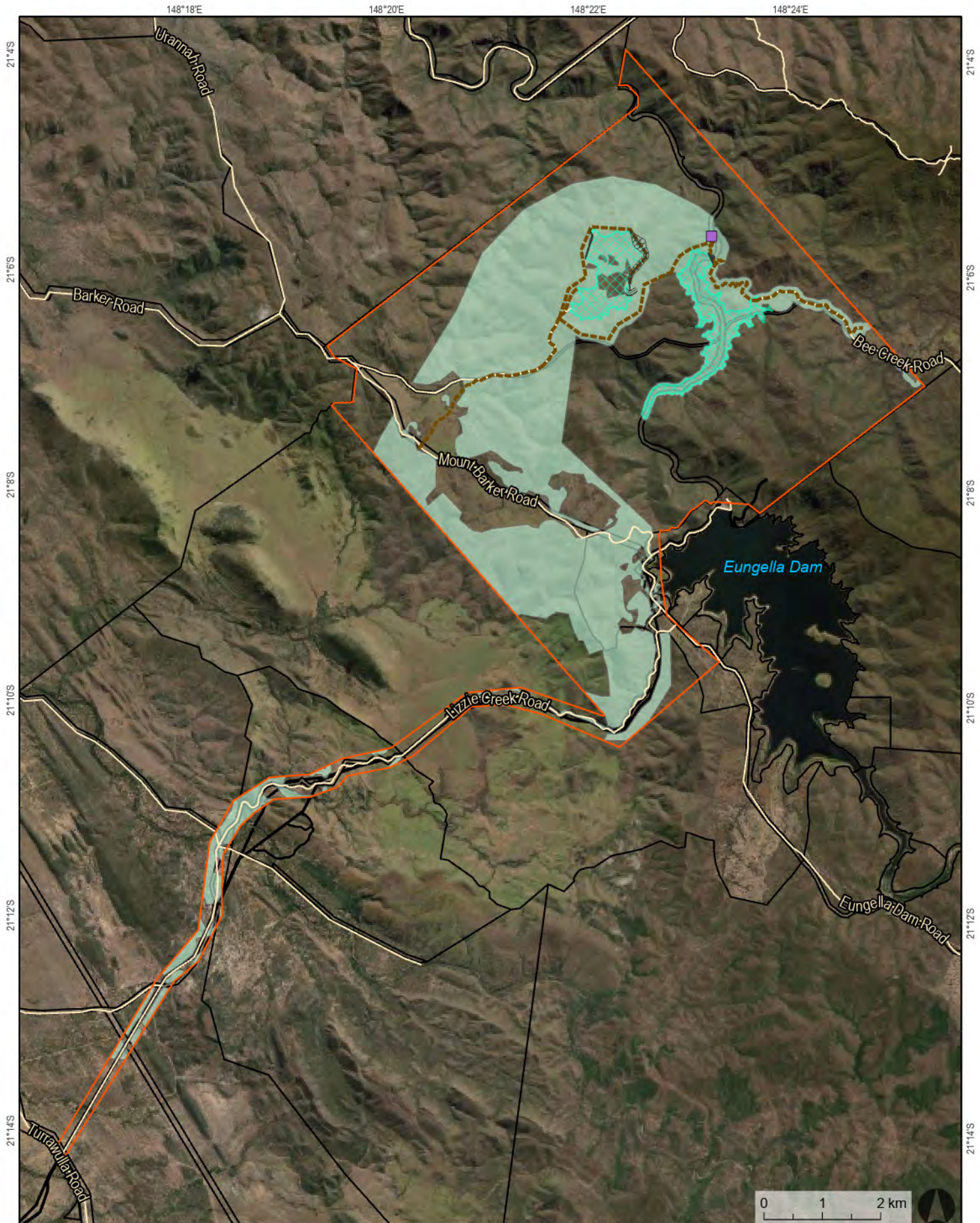
Impact avoidance achieved: As the species is exclusively aerial and does not rely on terrestrial habitat, no avoidance was required.

Residual impacts on the fork-tailed swift: Potential impacts to the fork-tailed swift may include:

- Loss of 322.80 ha of overfly habitat.

Table 5.12 Significant impact assessment – fork-tailed swift

Significant impact criteria	Assessment
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.	Unlikely As detailed above the habitats in the CEH PHES Project study area would not constitute important habitat for the fork-tailed swift, given they would not support an ecologically significant proportion of the population during critical life cycle stages. Construction of the CEH PHES Project will result in the localised clearing of 322.80 ha of woodland overfly habitat. As the species is exclusively aerial in Australia and suitable habitat is abundant in the surrounding landscape, the local loss of habitat is unlikely to have any impact on the species.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	Unlikely Given the fork-tailed swifts' exclusively aerial nature, the construction and operation of the CEH PHES Project has negligible potential to introduce invasive species that could be harmful to the species.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	Unlikely The CEH PHES Project study area does not contain breeding habitat for the fork-tailed swift. The species feeds aerially and while habitat overflown by the species will be impacted, the loss of habitat is unlikely to have any influence on the local foraging capacity to the extent that it could influence an ecologically significant proportion of the population.



- LEGEND**
- PHEs Project area
 - Fork-tailed swift (overfly habitat)
 - Dam wall
 - Proposed pumped hydro reservoirs
 - Proposed access track
 - Proposed powerhouse
 - Existing road
 - Cadastre

Disclaimer: CIP makes no warranty in relation to the accuracy, reliability, completeness or suitability of the data and does not accept liability for any loss, damage or costs, including consequential damage, in relation to any use of the data in this map.

PROJECT			
CEH PHEs Project			
TITLE			
Predicted habitat for the fork-tailed swift			
DATE	STATUS	PRODUCED	
9/08/2023	DRAFT	IM	
SCALE	DATUM	REV	
1:85,000 at A3	GDA 1994 MGA Zone 55	A	
FILE			FIG
CEH-EPBC-PHEs - FIG_5_11 FT SWIFT - rA			5.11

5.12 Terrestrial migratory birds – black-faced monarch, spectacled monarch, satin flycatcher and rufous fantail

In addition to the white-throated needletail and fork-tailed swift, four additional EPBC Act listed migratory species are considered likely to occur within the CEH PHES Project study area – black-faced monarch, spectacled monarch, satin flycatcher and rufous fantail.

The CEH PHES Project is **unlikely to result in a significant residual impact on terrestrial migratory birds**. A significance of impact assessment of the CEH PHES Project on the black-faced monarch, satin flycatcher, rufous fantail, and spectacled monarch (migratory under the EPBC Act) against the migratory species criteria detailed in the *Significant Impact Guidelines 1.1 – MNES* (DoE, 2013), is provided in Table 5.13. Predictive habitat mapping for terrestrial migratory birds is shown in Figure 5.12.

Important habitat: As detailed in the *Significant impact guidelines 1.1* (DoE, 2013), an area of ‘important habitat’ for a migratory species is:

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

Black-faced monarch: The black-faced monarch is a wet forest-specialist, restricted to rainforest and wet sclerophyll. Most habitat in the CEH PHES Project study area is open woodland with negligible value for the species. Suitable local habitat within the CEH PHES Project study area is restricted to isolated patches of semi-evergreen vine thicket. These are unlikely to represent important habitat as they are not at the edge of the species’ known range and are likely to be utilised by small numbers of individuals for foraging, roosting purposes and breeding. No communal areas that support an ecologically significant proportion of the population during critical life cycle stages are present. By those measures, the local habitats are not considered important habitat.

Spectacled monarch: The spectacled monarch is restricted to dense forest, occurring in rainforest, wet sclerophyll, mangroves and other dense forest. Most habitat in the CEH PHES Project study area is open woodland with negligible value for the species. Suitable local habitat within the CEH PHES Project study area is restricted to isolated patches of semi-evergreen vine thicket. These are unlikely to represent important habitat as they are not at the edge of the species’ known range and are likely to be utilised by small numbers of individuals for foraging, roosting and breeding purposes. No communal areas that support an ecologically significant proportion of the population during critical life cycle stages are present. By those measures, the local habitats are not considered important habitat.

Satin flycatcher: The satin flycatcher breeds in south-eastern Australia and migrates seasonally to Queensland during the winter months. As such, its’ use of winter habitat is for foraging, roosting and movement purposes only. The species typically favours wet densely vegetated gullies. Local habitats for the satin flycatcher are not at the edge of the species’ known range and are likely to be utilised by small numbers of individuals for foraging and roosting purposes during the non-breeding season. No communal areas that support an ecologically significant proportion of the population during critical life cycle stages are present. By those measures, the local habitats are not considered important habitat.

Rufous fantail: The rufous fantail is restricted to moist, dense habitats, including mangroves, rainforest, riparian forests and thickets, and wet eucalypt forests with a dense understorey. Local habitats for the rufous fantail are not at the edge of the species’ known range and are likely to be utilised by small numbers of individuals for foraging, roosting and breeding purposes. No communal areas that support an ecologically significant proportion of the population during critical life cycle stages are present. By those measures, the local habitats are not considered important habitat.

The Commonwealth *Referral guideline for 14 birds listed as migratory species under the EPBC Act – Draft* (DoE 2015) was the primary reference document for assessment of the impacts of the CEH PHES Project.

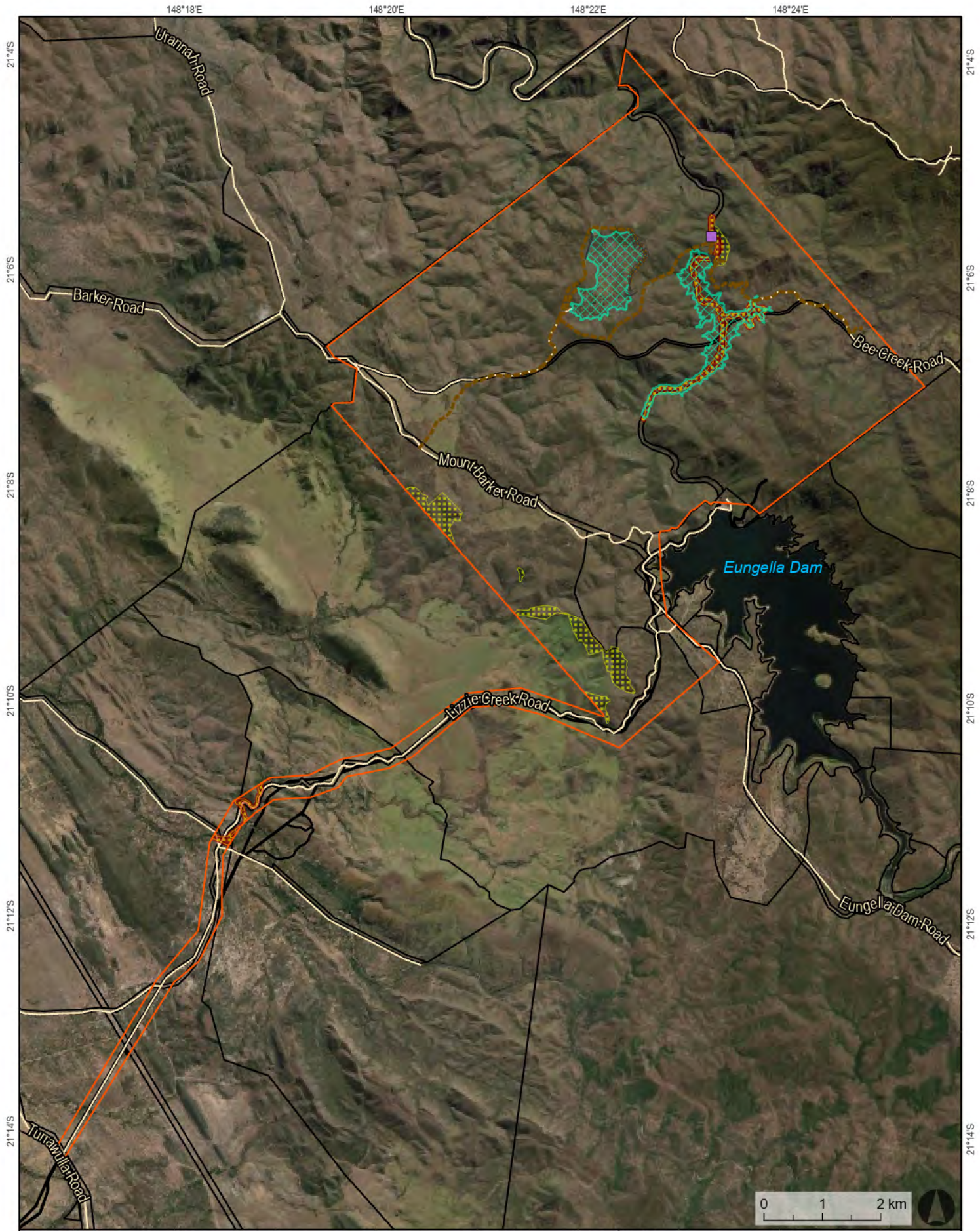
Impact avoidance achieved: The CEH PHES Project footprint has avoided most large areas of dense semi-evergreen vine thicket that represent suitable habitat for the species.

Residual impacts on migratory species: Potential impacts to black-faced monarch, satin flycatcher, rufous fantail and spectacled monarch populations may include:

- Loss of 60.26 ha of habitat that is not considered ‘important habitat’ for black-faced monarch and spectacled monarch
- Loss of 58.20 ha of habitat that is not considered ‘important habitat’ for satin flycatcher and rufous fantail
- Habitat degradation through increased dust, run-off and sedimentation
- Introduction and spread of pest fauna species and weeds.

Table 5.13 Significant impact assessment – migratory species

Significant impact criteria	Assessment
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.	Unlikely Construction of the CEH PHES Project will result in a loss of 60.26 ha of potential for the black-faced monarch and spectacled monarch, and 58.20 ha of potential habitat for the satin flycatcher and rufous fantail; however the habitats impacted are do not meet the criteria of ‘important habitat’, as they do not support an ecologically significant proportion of the population during critical life stages. Substantial avoidance of impact has been achieved through the design phases and the areas impacted by the CEH PHES Project represent a small proportion of the habitat available in the surrounding landscape. Overall, the CEH PHES Project is unlikely to substantially modify important habitat for the locally occurring migratory species.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	Unlikely Feral cats and European foxes are known occur in the area. Both species represent invasive species that are harmful to migratory species and increase predation pressure of species resting within the CEH PHES Project study area. Considering the species are already locally established, the construction of the CEH PHES Project is unlikely to introduce additional invasive fauna to the CEH PHES Project area. In addition, the CEH PHES Project will implement project specific Weed and Pest Management Plans in order to reduce the occurrence of pest species within the local region. Invasive flora species poses a threat to migratory species through the degradation of habitat and potential impacts to foraging resources. The risk of invasive flora species has been addressed by the requirement of weed and seed declaration for all vehicles on site. Additionally, weed management practiced implemented, targeted towards reducing weed abundance and encroachment into the area.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	Unlikely The CEH PHES Project footprint does not impact any habitat that would support ecologically significant proportions of the population of the black-faced monarch, spectacled monarch, satin flycatcher or rufous fantail. Locally, the satin flycatcher is a winter visitor to the CEH PHES study area, with breeding occurring between Queensland and New South Wales during summer. While the other species can breed in the region, important breeding habitat for all species would be located in rainforest areas in nearby Eungella National Park. The small, isolated pockets of semi-evergreen vine thicket that occur within the CEH PHES Project study area are likely to have limited breeding value and would support small numbers of individuals and therefore not constitute important habitat areas under the definition outlined in the <i>Significant Impact Guidelines 1.1 – MNES</i> (DoE, 2013).



LEGEND	
	PHEs Project area
	Rufous fantail & satin flycatcher habitat
	Black-faced monarch & spectacled monarch habitat
	Dam wall
	Proposed pumped hydro reservoirs
	Proposed access track
	Proposed powerhouse
	Existing road
	Cadastrate

Disclaimer: CIP makes no warranty in relation to the accuracy, reliability, completeness or suitability of the data and does not accept liability for any loss, damage or costs, including consequential damage, in relation to any use of the data in this map.

PROJECT				CEH PHEs Project		
TITLE				Predicted habitat for migratory species		
DATE	9/08/2023	STATUS	DRAFT	PRODUCED	IM	
SCALE	1:85,000 at A3	DATUM	GDA 1994 MGA Zone 55	REV	A	
FILE	CEH-EPBC-PHEs - FIG 5_12 MIGRATORY - rA				FIG	5.12

5.13 Estuarine crocodile (*Crocodylus porosus*)

The CEH PHES Project is **unlikely to have a significant impact on the estuarine crocodile**. A significance of impact assessment of the CEH PHES Project on the estuarine crocodile (migratory EPBC Act) against the migratory species criteria detailed in the *Significant Impact Guidelines 1.1 – MNES* (DoE, 2013), is provided in Table 5.14.

Distribution and important habitat: Estuarine crocodiles are found in a wide range of habitats including rivers, estuaries, creeks, swamps, lagoons, and billabongs. Within Queensland, the distribution of the estuarine crocodiles generally extends from Gladstone in the south through to the Cape York Peninsula in the north and across to the border with the Northern Territory in the west (Cogger, 2000). Individual estuarine crocodiles have occasionally been observed as far south as the New South Wales border. This species is limited in their upstream movement primarily by physical barriers such as escarpments and instream water infrastructure, such as dams and weirs (Cogger, 2000). The estuarine crocodile prefers elevated, isolated freshwater swamps or floating rafts of vegetation as nesting habitat (DAWE, 2020).

In Queensland, the species is usually restricted to coastal waterways and floodplain wetlands (Read *et al.*, 2007). This species is unlikely to utilise tributary habitats as these habitats are generally ephemeral and therefore lack permanent, deep water for shelter and foraging resources (Read *et al.*, 2004b).

The estuarine crocodile was not recorded within the CEH PHES Project study area during field surveys. The species is known to inhabit the Bowen River and has been historically recorded within the Broken River as far upstream as 30 km below the CEH PHES Project LR. The crocodile is therefore considered known to occur within the pools, runs, and riffles within the main river channel of the lower Broken River. Estuarine crocodiles are only known to occur at elevations of less than 250 m which is downstream of the CEH PHES Project LR on the Broken River. As the CEH PHES Project area is above the known distribution of the species and habitat conditions within the upper Broken River are generally not suitable for this species, the estuarine crocodile is considered unlikely to occur within the footprint of the CEH PHES Project LR. The species is also unlikely to occur in the smaller tributaries and ephemeral waterways. The distribution of the crocodile and confirmed records of the species are shown on Figure 5.13.

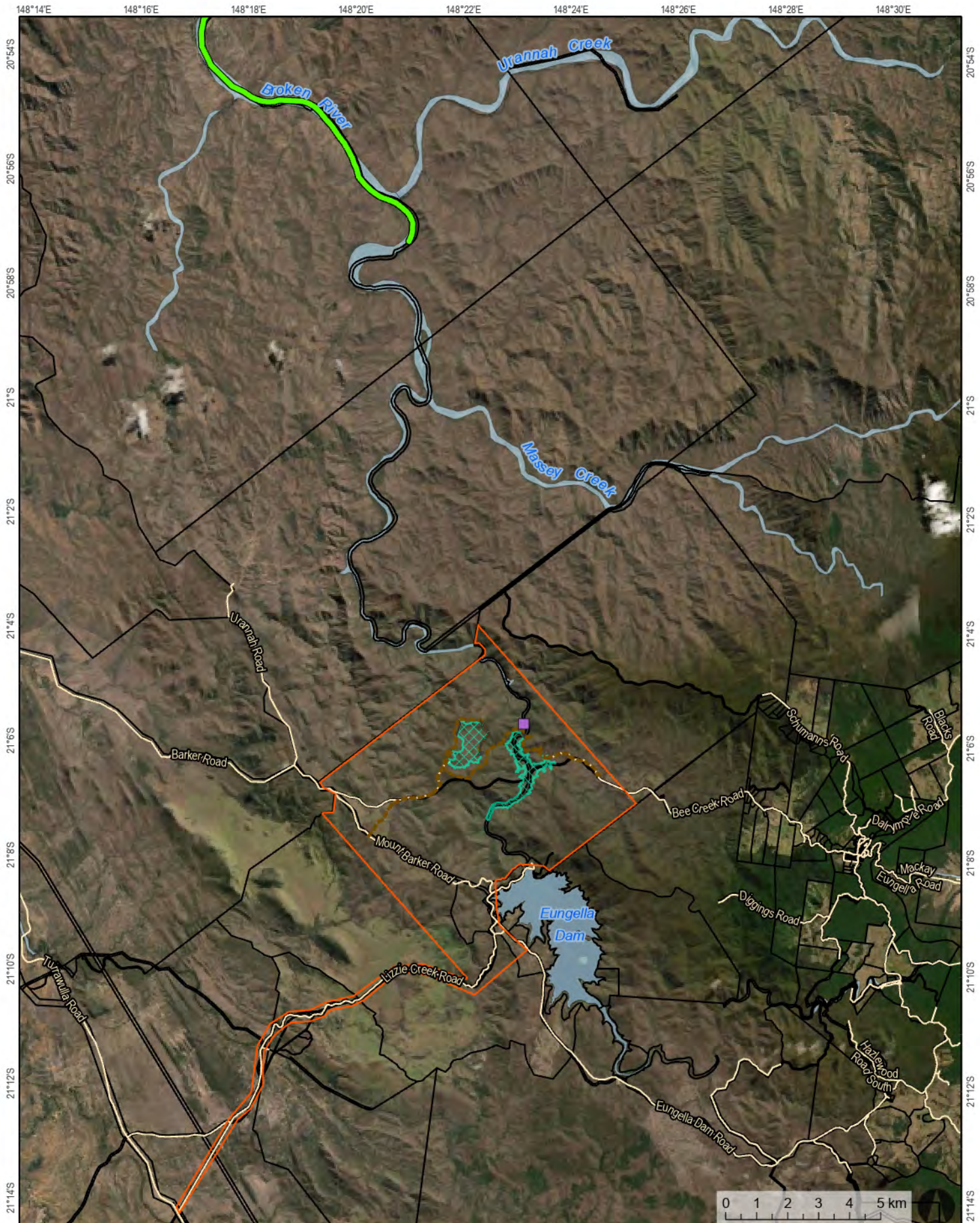
Residual impacts on the estuarine crocodile: Potential downstream impacts may include:

- Modification of flows and degradation of habitat within confirmed downstream habitat.

Table 5.14 Significant impact assessment – estuarine crocodile

Significant impact criteria	Assessment
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.	<p>Unlikely</p> <p>The habitat present within the CEH PHES Project study area is not of critical importance to the species at particular life-cycle stages and is not habitat which is at the limit of the species range. Therefore, the CEH PHES study area is not important habitat for the estuarine crocodile in accordance with the <i>Significant Impact Guidelines 1.1 – MNES</i> (DoE, 2013).</p> <p>No direct impact to the species or species' habitat will occur as a result of the CEH PHES Project footprint. Degradation of habitat downstream of the lower reservoirs through release/spill of poor water quality and/or change in flow regime has the potential impact isolated individuals only. The CEH PHES Project will not substantially modify, destroy or isolate an area of important habitat for the migratory estuarine crocodile.</p>
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	<p>Unlikely</p> <p>The CEH PHES study area is not important habitat for the estuarine crocodile and therefore no impact to important habitat for a migratory species will occur. A construction EMP and operation phase EMP will be implemented to control the introduction and spread of invasive species within and downstream of the project footprints.</p>
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	<p>Unlikely</p> <p>The Broken River does not support an ecologically significant proportion of the population of this species. Low abundances of estuarine crocodiles are unlikely to be present, with the majority of the population inhabiting the Burdekin basin, downstream from the CEH PHES study area.</p>

Significant impact criteria	Assessment
	<p>No direct impact to the species lifecycle will occur as a result of the CEH PHES Project. Degradation of habitat downstream of the lower reservoirs through release/spill of poor water quality and/or change in flow regime has the potential impact isolated individuals only. The CEH PHES Project will not seriously disrupt the lifecycle of an ecologically significant proposition of the estuarine crocodile population.</p>



- LEGEND**
- PHEs Project area
 - Estuarine crocodile habitat
 - Dam wall
 - Proposed pumped hydro reservoirs
 - Proposed access track
 - Proposed powerhouse
 - Existing road
 - Cadastre

Disclaimer: CIP makes no warranty in relation to the accuracy, reliability, completeness or suitability of the data and does not accept liability for any loss, damage or costs, including consequential damage, in relation to any use of the data in this map.

PROJECT				CEH PHEs Project		
TITLE				Predicted habitat for estuarine crocodile		
DATE	8/08/2023	STATUS	DRAFT	PRODUCED	IM	
SCALE	1:160,000 at A3	DATUM	GDA 1994 MGA Zone 55	REV	A	
FILE	CEH-EPBC-PHEs - FIG 5_13 ESTUARINE CROCODILE - rA				FIG	5.13

6. Conclusion

Baseline desktop analyses and field surveys were undertaken to assess the MNES values of the CEH PHES Project study area. Field surveys included assessment for MNES values such as ecological communities, threatened species and their habitats.

Construction of the CEH PHES Project will affect a number of environmental values, and result in a loss of remnant vegetation, inundation of waterways, and associated loss/modification of supporting habitat for MNES flora and fauna matters. Despite efforts to avoid impacts to environmental values, the CEH PHES Project is anticipated to result in a variety of temporary and permanent impacts to MNES values through construction and operation. These impacts will be addressed through a comprehensive and rigorously applied environmental management regime.

Nonetheless, after avoidance and mitigation, significance of impact assessments for MNES values indicate that the CEH PHES Project will result in a significant residual impact on five MNES: koala, greater glider, grey-headed flying-fox, northern quoll and yellow-bellied glider, as outlined in Table 6.1.

For one species, the yellow-bellied glider, there is insufficient information to make a definitive assessment, with further survey effort scheduled to provide necessary information. For this species, a conservative assessment has been undertaken assuming significant impacts are possible. For all species significantly impacted, options for environmental offsets will be investigated and implemented.

As further work is conducted on the CEH PHES Project, designs, footprint changes and implementation of further mitigation measures will likely result in reductions to habitat loss and impacts on MNES species.

Table 6.1 Summary of MNES residual impacts

Species/TEC	Significance of impact
Poplar Box Grassy Woodland on Alluvial Plains TEC	Not significant
<i>Eucalyptus raveretiana</i>	Not significant
<i>Solanum graniticum</i>	Not significant
Greater glider	Significant
Grey-headed flying-fox	Significant
Koala	Significant
Northern quoll	Significant
Yellow-bellied glider	Significant
Squatter pigeon (southern)	Not significant
White-throated needletail	Not significant
Fork-tailed swift	Not significant
Terrestrial migratory birds Satin flycatcher, Rufous fantail	Not significant
Terrestrial migratory birds - Black-faced monarch, Spectacled monarch	Not significant
Estuarine crocodile	Not significant

7. References

Atlas of Living Australia (ALA) (2023). Available from: <https://www.ala.org.au/>

Capricornia Energy Hub (2023). PHES and Transmission Projects Initial Advice Statement, submitted to Office of the Coordinator General April 2023.

Clayton, P.D, Fielder, D.F, Howell, S, Hill, C.J (2006). Aquatic biodiversity assessment and mapping method (AquaBAMM): a conservation values assessment tool for wetlands with trial application in the Burnett River catchment. Environmental Protection Agency, Brisbane. State of Queensland.

Cogger, H. (2000). Reptiles & amphibians of Australia (6th ed.). Sydney: Reed New Holland.

Commonwealth of Australia (2011) Survey guidelines for Australia's threatened fish: Guidelines for detecting fish listed as threatened under the EPBC Act. Department of Sustainability, Environment, Water Population and Communities

Coventry, P. (1989). Comments on airborne sightings of White-throated Needletails *Hirundapus caudacutus*. *Australian Bird Watcher*, 13:36-37.

Department of Agriculture, Water and the Environment (DAWE) (2020) Conservation Advice for Estuarine crocodile *Crocodylus porosus*, Commonwealth of Australia.

Department of Agriculture, Water and the Environment (DAWE) (2021). National Recovery Plan for the Grey-headed Flying-fox *Pteropus poliocephalus*. Canberra: Commonwealth of Australia.

Department of Agriculture, Water and the Environment (DAWE) (2022a). Conservation Advice for *Eucalyptus raveretiana* (black iron box). Commonwealth of Australia.

Department of Agriculture, Water and the Environment (DAWE) (2022b). Conservation Advice for *Hirundapus caudacutus* (white-throated needletail). Commonwealth of Australia.

Department of Agriculture, Water and the Environment (DAWE) (2022c). Conservation Advice for *Dasyurus hallucatus* (Northern quoll, Digul (Gogo-Yimidir), Wijingadda (Dambimangari), Wiminji (Martu)). Commonwealth of Australia.

Department of Agriculture, Water and the Environment (DAWE) (2022d). Conservation Advice for *Petaurus australis* (yellow-bellied glider (south-eastern)). Commonwealth of Australia.

Department of Agriculture, Water and the Environment (DAWE) (2022e). Conservation Advice for *Phascolarctos cinereus* (Koala) combined populations of Queensland, New South Wales and the Australian Capital Territory. Commonwealth of Australia.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2022) Conservation Advice for *Petauroides volans* (greater glider (southern and central)). Available from [254-conservation-advice-05072022](https://www.environment.gov.au/254-conservation-advice-05072022) ([environment.gov.au](https://www.environment.gov.au/))

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2023a) Protected Matters Search Tool. Available from: <https://www.dcceew.gov.au/environment/epbc/protected-matters-search-tool>.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2023b) Species profile and Threats Database. Available from: <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>

Department of Environment, Land, Water and Planning (DELWP) (2021) Greater Glider. State of Victoria.

Department of Environment and Science (DES) (2018) Monitoring and Sampling Manual *Environmental Protection (Water) Policy 2009*. State of Queensland.

Department of Environment and Science (DES) (2020) Aquatic Conservation Assessments (ACA) and AquaBAMM. State of Queensland.

Department of Environment and Science (DES) (2023a) WildNet database, species profile searches. Accessed February 2022. Available from <https://www.qld.gov.au/environment/plants-animals/species-information/wildnet>.

Department of Environment and Science (DES) (2023b). BioMaps, Queensland Government, Accessed February 2022. Available from <https://qldspatial.information.qld.gov.au/biomaps/>.

Department of Environment and Science (DES) (2023c) Wetland maps and data. Accessed February 2022. Available from <https://wetlandinfo.des.qld.gov.au/wetlands/facts-maps/get-mapping-help/wetland-maps/>

Department of Environment and Science (DES) (2023d) Protected plants flora survey trigger map. Available from: <https://environment.des.qld.gov.au/licences-permits/plants-animals/protected-plants/map-request.php>

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010). Survey guidelines for Australia's threatened birds. Canberra. Available from: <https://www.awe.gov.au/sites/default/files/documents/survey-guidelines-birds-april-2017.pdf>.

Department of Natural Resources and Mines (DNRM) (2001) Queensland AusRivAS Sampling and Processing Manual.

Department of the Environment (DoE) (2013). *Matters of National Environmental Significance - Significant impact guidelines 1.1*. Commonwealth of Australia.

Department of the Environment (DoE) (2015) *Draft referral guideline for 14 birds listed as migratory species under the EPBC Act*.

Department of the Environment (DoE) (2016) EPBC Act Referral Guideline for the endangered northern quoll *Dasyurus hallucatus*, Commonwealth of Australia.

Department of the Environment and Energy (DoEE) (2008) Approved Conservation Advice for *Eucalyptus raveretiana* (Black Ironbox). Commonwealth of Australia.

Department of the Environment and Energy (DoEE) (2019). Conservation Advice (including listing advice) for the Poplar Box Grassy Woodland on Alluvial Plains. Commonwealth of Australia.

Department of Resources (DoR) (2023) Vegetation Management Maps: Request a property vegetation management report or map. Available from: <https://www.qld.gov.au/environment/land/management/vegetation/maps/map-request>.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2011) Survey guidelines for Australia's threatened mammals. Commonwealth of Australia.

Eby, P. (1996). Interactions between the Grey-headed Flying Fox *Pteropus poliocephalus* (Chiroptera: Pteropodidae) and its diet plants - seasonal movements and seed dispersal. Ph.D. Thesis, University of New England, Armidale.

Eby, P. and Law, B. (2008) Ranking the feeding habitats of Grey-headed Flying-foxes for conservation management. A report for a report for The Department of Environment and Climate Change and Water (NSW) and The Department of Environment, Water, Heritage and the Arts.

Eby, P., Sims, R. and Bracks, J. (2019). Flying-fox Foraging Habitat Mapping NSW: a seamless map for assessing temporal and spatial patterns of habitat quality for flying-foxes. Report to Local Government Association New South Wales.

ERM (2021) REP Eungella Wind Farm Ecology Assessment – November 2021 Desktop and Field Survey Results.

Eyre, T. J. (2002). Habitat preferences and management of large gliding possums in southern Queensland. Ph.D. thesis, Southern Cross University, Lismore.

Eyre, T. J. (2006). Regional habitat selection by large gliding possums at forest stand and landscape scales in southern Queensland, Australia. I. Greater Glider (*Petauroides volans*). *Forest Ecology and Management* 235, 270-282.

Eyre, T.J., Kelly, A.L, Neldner, V.J., Wilson, B.A., Ferguson, D.J., Laidlaw, M.J. and Franks, A.J. (2015). BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2.

Fensham, R.J., Laffineur, B., Collingwood, T.D., Beech, E., Bell, S., Hopper, S.D., Phillips, G, Rivers, M.C., Walsh, N. and White, M. (2020) Rarity or decline: Key concepts for the Red List of Australian eucalypts. *Biological Conservation*, 243, 108455.

Finlayson, H.H. (1934). On mammals from the Dawson and Fitzroy valleys; central coastal Queensland – Part II. *Transactions of the Royal Society of South Australia* 58, 218-231.

- GHD (2022). Urannah Water Scheme Draft EIS. Report prepared for Bowen River Utilities.
- Goldingay, R.L. and Taylor, B.D. (2009). Gliding performance and its relevance to gap crossing by the squirrel glider (*Petaurus norfolcensis*). *Australian Journal of Zoology*, 57(2): 99-104.
- Hill, B.M. & S.J. Ward (2010). National Recovery Plan For the Northern Quoll *Dasyurus hallucatus*. Commonwealth of Australia.
- IUCN (2022). Standards and Petitions Committee. <https://www.iucn.org/commissions/species-survival-commission/about/ssc-committees/standards-and-petitions-committee>
- Kambouris, P. J., Kavanagh, R. P., Rowley, K. (2013). Distribution, habitat preferences and management of the yellow-bellied glider, *Petaurus australis*, on the Bago Plateau, New South Wales: A reassessment of the population and its status. *Wildlife Research*, 40(7):599.
- Lindenmayer, D. B., Lacy, R. C. and Pope, M. L. (2000). Testing a simulation model for population viability analysis. *Ecological Applications* 10: 580–597.
- Loyn, R.H. (1986). The 20 minute search—a simple method for counting forest birds. *Corella*, 10: 58–60.
- McCarthy, M. A., and Lindenmayer, D. B. (1999). Conservation of the greater glider (*Petauroides volans*) in remnant native vegetation within exotic plantation forest. *Animal Conservation* 2: 203-209.
- Neldner, V.J., Wilson, B.A., Dillewaard, H.A., Ryan, T.S., Butler, D.W., McDonald, W.J.F, Richter, D., Addicott, E.P. and Appelman, C.N. (2022) Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland. Version 6.0. Updated April 2022. Queensland Herbarium, Queensland Department of Environment and Science, Brisbane.
- Oakwood, M. (2000). Reproduction and demography of the northern quoll, *Dasyurus hallucatus*, in the lowland savanna of northern Australia. *Australian Journal of Zoology*, 48: 519-539.
- Oakwood, M. (2002). Spatial and social organization of a carnivorous marsupial *Dasyurus hallucatus* (Marsupialia: Dasyuridae). *Journal of Zoology*, 257: 237-248.
- Phillips, S. and Callaghan, J. (2011). The Spot Assessment Technique: A tool for determining localised levels of habitat use by koalas *Phascolarctos cinereus*. *Australian Zoologist*, 35 (3): 774-780.
- Prevett, P., Hives, N., Cerini, G. (1995). Koala Protection and Fenced Freeways. Report to Vicroads No 1. Ballarat Bypass Project. Ballarat University College, Ballarat.
- Queensland Herbarium (2008). Specimen label information – *Solanum graniticum*. State of Queensland.
- Read, M., Grigg, G., Irwin, S., Shanahan, D., Franklin, C. (2007). Satellite Tracking Reveals Long Distance Coastal Travel and Homing by Translocated Estuarine Crocodiles, *Crocodylus porosus*. *PloS one*, 2. e949. 10.1371/journal.pone.0000949.
- Squatter Pigeon Workshop (2011). Proceedings from the workshop for the Squatter Pigeon (southern). 14-15 December 2011. Toowoomba Office of the Queensland Parks and Wildlife Service.
- Symon, D.E. (1979). Fruit diversity and dispersal in *Solanum* in Australia. *Journal of the Adelaide Botanic Gardens* 1(6): 321-331.
- Tarburton, M.K. (1993). Radiotracking a White-throated Needle-tail to roost. *Emu*, 93:121-124.
- Tarburton, M.K. (2021). Recent increase in knowledge about numbers and flight behaviour in the white-throated needle-tail *Hirundapus caudacutus*. *Australian Field Ornithology* 38:124-130.
- The Department of State Development, Tourism and Innovation (DSDMIP) (2022) Queensland waterways for waterway barrier works spatial data layer V2.0.
- Threatened Species Scientific Committee (TSSC) (2012). Commonwealth Listing Advice on *Eucalyptus raveretiana* (Black Ironbox). Commonwealth of Australia.
- Threatened Species Scientific Committee (TSSC) (2015). Conservation Advice *Geophaps scripta scripta* (squatter pigeon (southern)). Canberra: Department of the Environment.
- Threatened Species Scientific Committee (TSSC) (2019). Conservation Advice *Hirundapus caudacutus* (white-throated needle-tail). Canberra: Department of the Environment.

Threatened Species Scientific Committee (TSSC) (2021a). Conservation Advice *Solanum graniticum* (Granite nightshade). Canberra: Department of Agriculture, Water and the Environment.

Threatened Species Scientific Committee (TSSC) (2021b). Guidelines for assessing the conservation status of native species according to the *Environment Protection and Biodiversity Conservation Act 1999* and *Environment Protection and Biodiversity Conservation Regulations 2000*. Commonwealth of Australia.

Webb, N. and C. Tidemann (1995). Hybridisation between black (*Pteropus alecto*) and grey-headed (*P. poliocephalus*) flying-foxes (Megachiroptera: Pteropodidae). *Australian Mammalogy*. 18:19-26.

Woinarski, J. C. Z., Burbidge, A. A., Harrison, P. L. (2014) The Action Plan for Australian Mammals. CSIRO Publishing, Collingwood.

Woinarski, J.C.Z., M. Oakwood, J. Winter, S. Burnett, D. Milne, P. Foster, H. Myles & B. Holmes (2008). Surviving the toads: patterns of persistence of the northern quoll *Dasyurus hallucatus* in Queensland. *Report submitted to the Natural Heritage Trust Strategic Reserve Program*.

Youngentob, K.N, Marsh, K.F., Skewes, J. (2021). A review of koala habitat assessment criteria and methods. Report prepared for the Department of Agriculture, Water and the Environment, Canberra. Commonwealth of Australia.

Appendices

Appendix A

Desktop search results



Australian Government

Department of Climate Change, Energy,
the Environment and Water

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 19-Apr-2023

[Summary](#)

[Details](#)

[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

Summary

Matters of National Environment Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar)	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	27
Listed Migratory Species:	16

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	21
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	3
Regional Forest Agreements:	None
Nationally Important Wetlands:	2
EPBC Act Referrals:	5
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities

[[Resource Information](#)]

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

Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community known to occur within area	In buffer area only
Broad leaf tea-tree (Melaleuca viridiflora) woodlands in high rainfall coastal north Queensland	Endangered	Community may occur within area	In buffer area only
Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin	Endangered	Community likely to occur within area	In feature area
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community likely to occur within area	In feature area
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area	In feature area

Listed Threatened Species

[[Resource Information](#)]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.

Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat known to occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat known to occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
Neochmia ruficauda ruficauda Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Poephila cincta cincta Southern Black-throated Finch [64447]	Endangered	Species or species habitat may occur within area	In feature area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat may occur within area	In feature area
FROG			
Taudactylus eungellensis Eungella Day Frog [1887]	Endangered	Species or species habitat likely to occur within area	In feature area
MAMMAL			
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area	In feature area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Petauroides volans Greater Glider (southern and central) [254]	Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Petaurus australis australis Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat known to occur within area	In feature area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
PLANT			
Arthraxon hispidus Hairy-joint Grass [9338]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Dichanthium queenslandicum King Blue-grass [5481]	Endangered	Species or species habitat may occur within area	In buffer area only
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Eucalyptus raveretiana Black Ironbox [16344]	Vulnerable	Species or species habitat known to occur within area	In feature area
Omphalea celata [64586]	Vulnerable	Species or species habitat known to occur within area	In feature area
Ozothamnus eriocephalus [56133]	Vulnerable	Species or species habitat known to occur within area	In feature area
Samadera bidwillii Quassia [29708]	Vulnerable	Species or species habitat may occur within area	In feature area
Solanum graniticum Granite Nightshade [84819]	Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
-----------------	---------------------	---------------	---------------

REPTILE

[Denisonia maculata](#)

Ornamental Snake [1193]

Vulnerable

Species or species habitat likely to occur within area

In feature area

[Egernia rugosa](#)

Yakka Skink [1420]

Vulnerable

Species or species habitat may occur within area

In feature area

Listed Migratory Species

[[Resource Information](#)]

Scientific Name	Threatened Category	Presence Text	Buffer Status
-----------------	---------------------	---------------	---------------

Migratory Marine Birds

[Apus pacificus](#)

Fork-tailed Swift [678]

Species or species habitat likely to occur within area

In feature area

Migratory Marine Species

[Crocodylus porosus](#)

Salt-water Crocodile, Estuarine Crocodile [1774]

Species or species habitat likely to occur within area

In buffer area only

Migratory Terrestrial Species

[Cuculus optatus](#)

Oriental Cuckoo, Horsfield's Cuckoo [86651]

Species or species habitat known to occur within area

In feature area

[Hirundapus caudacutus](#)

White-throated Needletail [682]

Vulnerable

Species or species habitat known to occur within area

In feature area

[Monarcha melanopsis](#)

Black-faced Monarch [609]

Species or species habitat known to occur within area

In feature area

[Motacilla flava](#)

Yellow Wagtail [644]

Species or species habitat may occur within area

In feature area

[Myiagra cyanoleuca](#)

Satin Flycatcher [612]

Species or species habitat known to occur within area

In feature area

[Rhipidura rufifrons](#)

Rufous Fantail [592]

Species or species habitat known to occur within area

In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Symposiachrus trivirgatus as Monarcha trivirgatus Spectacled Monarch [83946]		Species or species habitat known to occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area	In feature area

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area overfly marine area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Breeding likely to occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat may occur within area overfly marine area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area overfly marine area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area	In feature area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Symposiachrus trivirgatus as Monarcha trivirgatus Spectacled Monarch [83946]		Species or species habitat known to occur within area overfly marine area	In feature area
Reptile			
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area	In buffer area only

Extra Information

State and Territory Reserves [\[Resource Information \]](#)

Protected Area Name	Reserve Type	State	Buffer Status
Crediton	Forest Reserve	QLD	In feature area
Doongella	Nature Refuge	QLD	In buffer area only
Eungella	National Park	QLD	In buffer area only

Nationally Important Wetlands [\[Resource Information \]](#)

Wetland Name	State	Buffer Status
Broken River, Urannah Creek and Massey Creek Aggregation	QLD	In feature area
Eungella Dam	QLD	In feature area

EPBC Act Referrals [\[Resource Information \]](#)

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Bowen Renewable Energy Hub Pumped Hydro-electric Scheme	2020/8706		Completed	In buffer area only
Urannah Dam and Pipelines Project	2020/8708		Completed	In feature area

Controlled action

Hillalong coal mine and associated infrastructure project	2012/6566	Controlled Action	Post-Approval	In buffer area only
---	-----------	-------------------	---------------	---------------------

Not controlled action

Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
Nebo to Strathmore 275kV Transmission Line	2006/2997	Not Controlled Action	Completed	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

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

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

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

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

[© Commonwealth of Australia](#)

Department of Climate Change, Energy, the Environment and Water

GPO Box 3090

Canberra ACT 2601 Australia

+61 2 6274 1111



Queensland Government

WildNet species list

Search Criteria: Species List for a Defined Area
Species: All
Type: All
Queensland status: All
Records: All
Date: All
Latitude: 20.9892 to 21.3303
Longitude: 148.1607 to 148.4770
Email: elise.odner@ghd.com
Date submitted: Thursday 27 Apr 2023 12:21:30
Date extracted: Thursday 27 Apr 2023 12:30:02

The number of records retrieved = 551

Disclaimer

Information presented on this product is distributed by the Queensland Government as an information source only. While every care is taken to ensure the accuracy of this data, the State of Queensland makes no statements, representations or warranties about the accuracy, reliability, completeness or suitability of any information contained in this product.

The State of Queensland disclaims all responsibility for information contained in this product and all liability (including liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any way for any reason. Information about your Species lists request is logged for quality assurance, user support and product enhancement purposes only.

The information provided should be appropriately acknowledged as being derived from WildNet database when it is used. As the WildNet Program is still in a process of collating and vetting data, it is possible the information given is not complete. Go to the WildNet database webpage (<https://www.qld.gov.au/environment/plants-animals/species-information/wildnet>) to find out more about WildNet and where to access other WildNet information products approved for publication. Feedback about WildNet species lists should be emailed to wildlife.online@des.qld.gov.au.

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	amphibians	Bufo	<i>Rhinella marina</i>	cane toad	Y			4
animals	amphibians	Hylidae	<i>Litoria caerulea</i>	common green treefrog		C		3
animals	amphibians	Hylidae	<i>Litoria chloris</i>	orange eyed treefrog		C		14
animals	amphibians	Hylidae	<i>Litoria gracilentia</i>	graceful treefrog		C		1
animals	amphibians	Hylidae	<i>Litoria inermis</i>	bumpy rocketfrog		C		2/1
animals	amphibians	Hylidae	<i>Litoria latopalmata</i>	broad palmed rocketfrog		C		7
animals	amphibians	Hylidae	<i>Litoria rubella</i>	ruddy treefrog		C		3
animals	amphibians	Hylidae	<i>Litoria wilcoxii</i>	eastern stony creek frog		C		20/19
animals	amphibians	Limnodynastidae	<i>Limnodynastes peronii</i>	striped marshfrog		C		10
animals	amphibians	Limnodynastidae	<i>Platyplectrum ornatum</i>	ornate burrowing frog		C		2
animals	amphibians	Myobatrachidae	<i>Mixophyes fasciolatus</i>	great barred frog		C		6
animals	amphibians	Myobatrachidae	<i>Pseudophryne raveni</i>	copper backed broodfrog		C		2
animals	birds	Acanthizidae	<i>Acanthiza nana</i>	yellow thornbill		C		12
animals	birds	Acanthizidae	<i>Acanthiza pusilla</i>	brown thornbill		C		24/4
animals	birds	Acanthizidae	<i>Acanthiza reguloides</i>	buff-rumped thornbill		C		9/8
animals	birds	Acanthizidae	<i>Gerygone fusca</i>	western gerygone		C		1
animals	birds	Acanthizidae	<i>Gerygone mouki</i>	brown gerygone		C		12
animals	birds	Acanthizidae	<i>Gerygone olivacea</i>	white-throated gerygone		C		17/1
animals	birds	Acanthizidae	<i>Gerygone palpebrosa</i>	fairy gerygone		C		1
animals	birds	Acanthizidae	<i>Sericornis frontalis</i>	white-browed scrubwren		C		27
animals	birds	Acanthizidae	<i>Sericornis magnirostra</i>	large-billed scrubwren		C		6
animals	birds	Acanthizidae	<i>Smicronis brevirostris</i>	weebill		C		2
animals	birds	Accipitridae	<i>Accipiter cirrocephalus</i>	collared sparrowhawk		C		4
animals	birds	Accipitridae	<i>Accipiter fasciatus</i>	brown goshawk		C		1
animals	birds	Accipitridae	<i>Accipiter novaehollandiae</i>	grey goshawk		C		3
animals	birds	Accipitridae	<i>Aquila audax</i>	wedge-tailed eagle		C		18
animals	birds	Accipitridae	<i>Aviceda subcristata</i>	Pacific baza		C		7
animals	birds	Accipitridae	<i>Elanus axillaris</i>	black-shouldered kite		C		1
animals	birds	Accipitridae	<i>Erythrotriorchis radiatus</i>	red goshawk		E	E	1
animals	birds	Accipitridae	<i>Haliaeetus leucogaster</i>	white-bellied sea-eagle		C		3
animals	birds	Accipitridae	<i>Haliastur sphenurus</i>	whistling kite		C		13
animals	birds	Accipitridae	<i>Milvus migrans</i>	black kite		C		1
animals	birds	Alcedinidae	<i>Ceyx azureus</i>	azure kingfisher		C		4
animals	birds	Alcedinidae	<i>Dacelo leachii</i>	blue-winged kookaburra		C		1
animals	birds	Alcedinidae	<i>Dacelo novaeguineae</i>	laughing kookaburra		C		42/1
animals	birds	Alcedinidae	<i>Todiramphus macleayii</i>	forest kingfisher		C		12
animals	birds	Alcedinidae	<i>Todiramphus sanctus</i>	sacred kingfisher		C		1
animals	birds	Anatidae	<i>Anas gracilis</i>	grey teal		C		7
animals	birds	Anatidae	<i>Anas superciliosa</i>	Pacific black duck		C		27
animals	birds	Anatidae	<i>Aythya australis</i>	hardhead		C		14
animals	birds	Anatidae	<i>Chenonetta jubata</i>	Australian wood duck		C		24
animals	birds	Anatidae	<i>Cygnus atratus</i>	black swan		C		8
animals	birds	Anatidae	<i>Nettion coromandelianus</i>	cotton pygmy-goose		C		5
animals	birds	Anhingidae	<i>Anhinga novaehollandiae</i>	Australasian darter		C		15
animals	birds	Apodidae	<i>Aerodramus terraereginae</i>	Australian swiftlet		C		2
animals	birds	Apodidae	<i>Hirundapus caudacutus</i>	white-throated needletail		V	V	3

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Ardeidae	<i>Ardea alba modesta</i>	eastern great egret		C		12
animals	birds	Ardeidae	<i>Ardea intermedia</i>	intermediate egret		C		7
animals	birds	Ardeidae	<i>Ardea pacifica</i>	white-necked heron		C		2
animals	birds	Ardeidae	<i>Bubulcus ibis</i>	cattle egret		C		1
animals	birds	Ardeidae	<i>Egretta garzetta</i>	little egret		C		1
animals	birds	Ardeidae	<i>Egretta novaehollandiae</i>	white-faced heron		C		15
animals	birds	Ardeidae	<i>Ixobrychus flavicollis</i>	black bittern		C		1
animals	birds	Ardeidae	<i>Nycticorax caledonicus</i>	nankeen night-heron		C		1
animals	birds	Artamidae	<i>Artamus cinereus</i>	black-faced woodswallow		C		1
animals	birds	Artamidae	<i>Artamus personatus</i>	masked woodswallow		C		2
animals	birds	Artamidae	<i>Artamus superciliosus</i>	white-browed woodswallow		C		1
animals	birds	Artamidae	<i>Cracticus nigrogularis</i>	piebald butcherbird		C		29/1
animals	birds	Artamidae	<i>Cracticus torquatus</i>	grey butcherbird		C		3
animals	birds	Artamidae	<i>Gymnorhina tibicen</i>	Australian magpie		C		39
animals	birds	Artamidae	<i>Melloria quoyi</i>	black butcherbird		C		1
animals	birds	Artamidae	<i>Strepera graculina</i>	piebald currawong		C		37
animals	birds	Burhinidae	<i>Burhinus grallarius</i>	bush stone-curlew		C		11
animals	birds	Cacatuidae	<i>Cacatua galerita</i>	sulphur-crested cockatoo		C		33
animals	birds	Cacatuidae	<i>Calyptorhynchus banksii</i>	red-tailed black-cockatoo		C		12
animals	birds	Cacatuidae	<i>Eolophus roseicapilla</i>	galah		C		4
animals	birds	Campephagidae	<i>Coracina lineata</i>	barred cuckoo-shrike		C		2
animals	birds	Campephagidae	<i>Coracina maxima</i>	ground cuckoo-shrike		C		2
animals	birds	Campephagidae	<i>Coracina novaehollandiae</i>	black-faced cuckoo-shrike		C		18
animals	birds	Campephagidae	<i>Coracina papuensis</i>	white-bellied cuckoo-shrike		C		5
animals	birds	Campephagidae	<i>Edolisoma tenuirostre</i>	common cicadabird		C		6
animals	birds	Campephagidae	<i>Lalage leucomela</i>	varied triller		C		4
animals	birds	Casuariidae	<i>Dromaius novaehollandiae</i>	emu		C		1
animals	birds	Charadriidae	<i>Elseya melanops</i>	black-fronted dotterel		C		3
animals	birds	Charadriidae	<i>Vanellus miles</i>	masked lapwing		C		14
animals	birds	Charadriidae	<i>Vanellus miles novaehollandiae</i>	masked lapwing (southern subspecies)		C		8
animals	birds	Charadriidae	<i>Vanellus tricolor</i>	banded lapwing		C		1
animals	birds	Cisticolidae	<i>Cisticola exilis</i>	golden-headed cisticola		C		1
animals	birds	Climacteridae	<i>Cormobates leucophaea</i>	white-throated treecreeper		C		3
animals	birds	Climacteridae	<i>Cormobates leucophaea intermedia</i>	white-throated treecreeper (intermediate)		C		23
animals	birds	Columbidae	<i>Chalcophaps longirostris</i>	Pacific emerald dove		C		6
animals	birds	Columbidae	<i>Columba leucomela</i>	white-headed pigeon		C		1
animals	birds	Columbidae	<i>Geopelia humeralis</i>	bar-shouldered dove		C		2
animals	birds	Columbidae	<i>Geopelia placida</i>	peaceful dove		C		8
animals	birds	Columbidae	<i>Geophaps scripta scripta</i>	squatter pigeon (southern subspecies)		V	V	12
animals	birds	Columbidae	<i>Leucosarcia melanoleuca</i>	wonga pigeon		C		1
animals	birds	Columbidae	<i>Lopholaimus antarcticus</i>	topknot pigeon		C		15
animals	birds	Columbidae	<i>Macropygia phasianella</i>	brown cuckoo-dove		C		22
animals	birds	Columbidae	<i>Ocyphaps lophotes</i>	crested pigeon		C		4
animals	birds	Columbidae	<i>Ptilinopus magnificus</i>	wompoo fruit-dove		C		12
animals	birds	Columbidae	<i>Ptilinopus regina</i>	rose-crowned fruit-dove		C		7

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Columbidae	<i>Ptilinopus superbus</i>	superb fruit-dove		C		3
animals	birds	Coraciidae	<i>Eurystomus orientalis</i>	dollarbird		C		6
animals	birds	Corcoracidae	<i>Struthidea cinerea</i>	apostlebird		C		3
animals	birds	Corvidae	<i>Corvus orru</i>	Torresian crow		C		45
animals	birds	Corvidae	<i>Corvus sp.</i>			C		1
animals	birds	Cuculidae	<i>Cacomantis flabelliformis</i>	fan-tailed cuckoo		C		13
animals	birds	Cuculidae	<i>Centropus phasianinus</i>	pheasant coucal		C		8
animals	birds	Cuculidae	<i>Chalcites basalis</i>	Horsfield's bronze-cuckoo		C		1
animals	birds	Cuculidae	<i>Chalcites lucidus</i>	shining bronze-cuckoo		C		9
animals	birds	Cuculidae	<i>Chalcites minutillus russatus</i>	Gould's bronze-cuckoo		C		1
animals	birds	Cuculidae	<i>Cuculus optatus</i>	oriental cuckoo		SL		1
animals	birds	Cuculidae	<i>Eudynamys orientalis</i>	eastern koel		C		8
animals	birds	Cuculidae	<i>Scythrops novaehollandiae</i>	channel-billed cuckoo		C		3
animals	birds	Dicaeidae	<i>Dicaeum hirundinaceum</i>	mistletoebird		C		9
animals	birds	Dicruridae	<i>Dicrurus bracteatus</i>	spangled drongo		C		11
animals	birds	Estrildidae	<i>Neochmia temporalis</i>	red-browed finch		C		16
animals	birds	Estrildidae	<i>Taeniopygia bichenovii</i>	double-barred finch		C		5
animals	birds	Falconidae	<i>Falco berigora</i>	brown falcon		C		3
animals	birds	Falconidae	<i>Falco cenchroides</i>	nankeen kestrel		C		10
animals	birds	Gruidae	<i>Antigone rubicunda</i>	brolga		C		2
animals	birds	Hirundinidae	<i>Hirundo neoxena</i>	welcome swallow		C		4
animals	birds	Hirundinidae	<i>Petrochelidon ariel</i>	fairy martin		C		2
animals	birds	Hirundinidae	<i>Petrochelidon nigricans</i>	tree martin		C		3
animals	birds	Jacanidae	<i>Irediparra gallinacea</i>	comb-crested jacana		C		3
animals	birds	Laridae	<i>Chlidonias hybrida</i>	whiskered tern		C		3
animals	birds	Laridae	<i>Chroicocephalus novaehollandiae</i>	silver gull		C		1
animals	birds	Laridae	<i>Hydroprogne caspia</i>	Caspian tern		SL		5
animals	birds	Locustellidae	<i>Cincloramphus timoriensis</i>	tawny grassbird		C		3
animals	birds	Maluridae	<i>Malurus melanocephalus</i>	red-backed fairy-wren		C		15
animals	birds	Megapodiidae	<i>Alectura lathamii</i>	Australian brush-turkey		C		7
animals	birds	Meliphagidae	<i>Acanthorhynchus tenuirostris</i>	eastern spinebill		C		10
animals	birds	Meliphagidae	<i>Bolemoreus hindwoodi</i>	Eungella honeyeater		V		15
animals	birds	Meliphagidae	<i>Caligavis chrysops</i>	yellow-faced honeyeater		C		14/3
animals	birds	Meliphagidae	<i>Entomyzon cyanotis</i>	blue-faced honeyeater		C		28
animals	birds	Meliphagidae	<i>Lichmera indistincta</i>	brown honeyeater		C		4
animals	birds	Meliphagidae	<i>Manorina flavigula</i>	yellow-throated miner		C		15
animals	birds	Meliphagidae	<i>Manorina melanocephala</i>	noisy miner		C		6
animals	birds	Meliphagidae	<i>Meliphaga lewinii</i>	Lewin's honeyeater		C		37
animals	birds	Meliphagidae	<i>Meliphaga notata</i>	yellow-spotted honeyeater		C		1
animals	birds	Meliphagidae	<i>Melithreptus albogularis</i>	white-throated honeyeater		C		20
animals	birds	Meliphagidae	<i>Melithreptus gularis</i>	black-chinned honeyeater		C		1
animals	birds	Meliphagidae	<i>Myzomela obscura</i>	dusky honeyeater		C		10
animals	birds	Meliphagidae	<i>Myzomela sanguinolenta</i>	scarlet honeyeater		C		18
animals	birds	Meliphagidae	<i>Philemon citreogularis</i>	little friarbird		C		3
animals	birds	Meliphagidae	<i>Philemon corniculatus</i>	noisy friarbird		C		26
animals	birds	Meliphagidae	<i>Stomiopera flava</i>	yellow honeyeater		C		5

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Meropidae	<i>Merops ornatus</i>	rainbow bee-eater		C		11
animals	birds	Monarchidae	<i>Carterornis leucotis</i>	white-eared monarch		C		1
animals	birds	Monarchidae	<i>Grallina cyanoleuca</i>	magpie-lark		C		17
animals	birds	Monarchidae	<i>Monarcha melanopsis</i>	black-faced monarch		SL		9
animals	birds	Monarchidae	<i>Myiagra cyanoleuca</i>	satin flycatcher		SL		4
animals	birds	Monarchidae	<i>Myiagra rubecula</i>	leaden flycatcher		C		8
animals	birds	Monarchidae	<i>Symposiachrus trivirgatus</i>	spectacled monarch		SL		8
animals	birds	Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian pipit		C		7
animals	birds	Neosittidae	<i>Daphoenositta chrysoptera</i>	varied sittella		C		9
animals	birds	Oriolidae	<i>Oriolus sagittatus</i>	olive-backed oriole		C		1
animals	birds	Oriolidae	<i>Sphecotheres vieilloti</i>	Australasian figbird		C		16
animals	birds	Otididae	<i>Ardeotis australis</i>	Australian bustard		C		6
animals	birds	Pachycephalidae	<i>Colluricincla harmonica</i>	grey shrike-thrush		C		17
animals	birds	Pachycephalidae	<i>Colluricincla megarhyncha</i>	little shrike-thrush		C		6
animals	birds	Pachycephalidae	<i>Pachycephala pectoralis</i>	golden whistler		C		15
animals	birds	Pachycephalidae	<i>Pachycephala rufiventris</i>	rufous whistler		C		18
animals	birds	Pandionidae	<i>Pandion haliaetus cristatus</i>	eastern osprey		SL		1
animals	birds	Pardalotidae	<i>Pardalotus punctatus</i>	spotted pardalote		C		3
animals	birds	Pardalotidae	<i>Pardalotus striatus</i>	striated pardalote		C		26/1
animals	birds	Passeridae	<i>Passer domesticus</i>	house sparrow	Y			1
animals	birds	Pelecanidae	<i>Pelecanus conspicillatus</i>	Australian pelican		C		16
animals	birds	Petroicidae	<i>Eopsaltria australis</i>	eastern yellow robin		C		17
animals	birds	Petroicidae	<i>Microeca flavigaster</i>	lemon-bellied flycatcher		C		2
animals	birds	Phalacrocoracidae	<i>Microcarbo melanoleucos</i>	little pied cormorant		C		19
animals	birds	Phalacrocoracidae	<i>Phalacrocorax carbo</i>	great cormorant		C		4
animals	birds	Phalacrocoracidae	<i>Phalacrocorax sulcirostris</i>	little black cormorant		C		19
animals	birds	Phalacrocoracidae	<i>Phalacrocorax varius</i>	pied cormorant		C		4
animals	birds	Phasianidae	<i>Synoicus ypsilophorus</i>	brown quail		C		1
animals	birds	Pittidae	<i>Pitta versicolor</i>	noisy pitta		C		11
animals	birds	Podargidae	<i>Podargus strigoides</i>	tawny frogmouth		C		4
animals	birds	Podicipedidae	<i>Podiceps cristatus</i>	great crested grebe		C		10
animals	birds	Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian grebe		C		13
animals	birds	Pomatostomidae	<i>Pomatostomus temporalis</i>	grey-crowned babbler		C		2
animals	birds	Psittaculidae	<i>Alisterus scapularis</i>	Australian king-parrot		C		10
animals	birds	Psittaculidae	<i>Aprosmictus erythropterus</i>	red-winged parrot		C		5
animals	birds	Psittaculidae	<i>Platycercus adscitus</i>	pale-headed rosella		C		38/1
animals	birds	Psittaculidae	<i>Platycercus elegans</i>	crimson rosella		C		4
animals	birds	Psittaculidae	<i>Trichoglossus chlorolepidotus</i>	scaly-breasted lorikeet		C		6
animals	birds	Psittaculidae	<i>Trichoglossus moluccanus</i>	rainbow lorikeet		C		27
animals	birds	Psophodidae	<i>Psophodes olivaceus</i>	eastern whipbird		C		22
animals	birds	Ptilonorhynchidae	<i>Chlamydera nuchalis</i>	great bowerbird		C		2
animals	birds	Ptilonorhynchidae	<i>Sericulus chrysocephalus</i>	regent bowerbird		C		9
animals	birds	Rallidae	<i>Fulica atra</i>	Eurasian coot		C		6
animals	birds	Rallidae	<i>Gallinula tenebrosa</i>	dusky moorhen		C		13
animals	birds	Rallidae	<i>Porphyrio melanotus</i>	purple swamphen		C		2
animals	birds	Recurvirostridae	<i>Himantopus leucocephalus</i>	pied stilt		C		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Rhipiduridae	<i>Rhipidura albiscapa</i>	grey fantail		C		42
animals	birds	Rhipiduridae	<i>Rhipidura leucophrys</i>	willie wagtail		C		16
animals	birds	Rhipiduridae	<i>Rhipidura rufifrons</i>	rufous fantail		SL		8
animals	birds	Strigidae	<i>Ninox boobook</i>	southern boobook		C		4
animals	birds	Strigidae	<i>Ninox connivens</i>	barking owl		C		6
animals	birds	Strigidae	<i>Ninox strenua</i>	powerful owl		V		1
animals	birds	Threskiornithidae	<i>Threskiornis molucca</i>	Australian white ibis		C		3
animals	birds	Threskiornithidae	<i>Threskiornis spinicollis</i>	straw-necked ibis		C		18
animals	birds	Turdidae	<i>Zoothera heinei</i>	russet-tailed thrush		C		4
animals	birds	Turnicidae	<i>Turnix maculosus</i>	red-backed button-quail		C		2
animals	birds	Tytonidae	<i>Tyto javanica</i>	eastern barn owl		C		1
animals	birds	Tytonidae	<i>Tyto novaehollandiae</i>	masked owl		C		1
animals	birds	Zosteropidae	<i>Zosterops lateralis</i>	silveryeye		C		7
animals	insects	Papilionidae	<i>Papilio aegaeus</i>					2
animals	malacostracans	Parastacidae	<i>Cherax depressus</i>					1
animals	mammals	Acrobatidae	<i>Acrobates pygmaeus</i>	feathertail glider		C		1
animals	mammals	Canidae	<i>Canis familiaris (dingo)</i>	dingo				1
animals	mammals	Dasyuridae	<i>Dasyurus hallucatus</i>	northern quoll		C	E	7
animals	mammals	Macropodidae	<i>Osphranter robustus</i>	common wallaroo		C		1
animals	mammals	Macropodidae	<i>Petrogale inornata</i>	unadorned rock-wallaby		C		1
animals	mammals	Muridae	<i>Hydromys chrysogaster</i>	water rat		C		2
animals	mammals	Ornithorhynchidae	<i>Ornithorhynchus anatinus</i>	platypus		SL		5
animals	mammals	Petauridae	<i>Petaurus australis australis</i>	yellow-bellied glider (southern subspecies)		V	V	2
animals	mammals	Petauridae	<i>Petaurus norfolcensis</i>	squirrel glider		C		1
animals	mammals	Phalangeridae	<i>Trichosurus vulpecula</i>	common brushtail possum		C		1
animals	mammals	Phascolarctidae	<i>Phascolarctos cinereus</i>	koala		E	E	9
animals	mammals	Pseudocheiridae	<i>Petauroides armillatus</i>	central greater glider		E	E	26
animals	mammals	Pseudocheiridae	<i>Pseudocheirus peregrinus</i>	common ringtail possum		C		6
animals	mammals	Pteropodidae	<i>Nyctimene robinsoni</i>	eastern tube-nosed bat		C		1
animals	mammals	Tachyglossidae	<i>Tachyglossus aculeatus</i>	short-beaked echidna		SL		1
animals	ray-finned fishes	Ambassidae	<i>Ambassis agassizii</i>	Agassiz's glassfish				9
animals	ray-finned fishes	Anguillidae	<i>Anguilla reinhardtii</i>	longfin eel				13
animals	ray-finned fishes	Ariidae	<i>Neoarius graeffei</i>	blue catfish				1
animals	ray-finned fishes	Atherinidae	<i>Craterocephalus stercusmuscarum</i>	flyspecked hardyhead				240
animals	ray-finned fishes	Belonidae	<i>Strongylura krefftii</i>	freshwater longtom				3
animals	ray-finned fishes	Centropomidae	<i>Lates calcarifer</i>	barramundi				50
animals	ray-finned fishes	Cichlidae	<i>Oreochromis mossambica</i>	Mozambique mouthbrooder	Y			5
animals	ray-finned fishes	Clupeidae	<i>Nematalosa erebi</i>	bony bream				494
animals	ray-finned fishes	Eleotridae	<i>Hypseleotris galii</i>	firetail gudgeon				5
animals	ray-finned fishes	Eleotridae	<i>Mogurnda adspersa</i>	southern purplespotted gudgeon				7
animals	ray-finned fishes	Eleotridae	<i>Oxyeleotris lineolata</i>	sleepy cod				166
animals	ray-finned fishes	Melanotaeniidae	<i>Melanotaenia splendida splendida</i>	eastern rainbowfish				10
animals	ray-finned fishes	Plotosidae	<i>Neosilurus ater</i>	black catfish				2
animals	ray-finned fishes	Plotosidae	<i>Neosilurus hyrtlii</i>	Hyrtl's catfish				1
animals	ray-finned fishes	Plotosidae	<i>Tandanus tandanus</i>	freshwater catfish				2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	ray-finned fishes	Pseudomugilidae	<i>Pseudomugil signifer</i>	Pacific blue eye				12
animals	ray-finned fishes	Terapontidae	<i>Amniataba percoides</i>	barred grunter				6
animals	ray-finned fishes	Terapontidae	<i>Hephaestus fuliginosus</i>	sooty grunter				216
animals	ray-finned fishes	Terapontidae	<i>Leiopotherapon unicolor</i>	spangled perch				95
animals	ray-finned fishes	Toxotidae	<i>Toxotes chatareus</i>	sevenspot archerfish				1
animals	reptiles	Chelidae	<i>Eseya irwini</i>	Irwin's turtle		C		2
animals	reptiles	Chelidae	<i>Emydura macquarii krefftii</i>	Krefft's river turtle		C		43
animals	reptiles	Chelidae	<i>Wollumbinia latisternum</i>	saw-shelled turtle		C		12
animals	reptiles	Diplodactylidae	<i>Amalosa rhombifer</i>	zig-zag gecko		C		2
animals	reptiles	Diplodactylidae	<i>Oedura monillis</i>	ocellated velvet gecko		C		3/1
animals	reptiles	Gekkonidae	<i>Gehyra dubia</i>	dubious dtella		C		2/1
animals	reptiles	Gekkonidae	<i>Heteronotia binoei</i>	Bynoe's gecko		C		1
animals	reptiles	Scincidae	<i>Carlia rubigo</i>	orange-flanked rainbow skink		C		2/1
animals	reptiles	Scincidae	<i>Carlia schmeltzii</i>	robust rainbow-skink		C		1
animals	reptiles	Scincidae	<i>Carlia vivax</i>	tussock rainbow-skink		C		2
animals	reptiles	Scincidae	<i>Concinnia brachysoma</i>	northern bar-sided skink		C		1
animals	reptiles	Scincidae	<i>Ctenotus taeniolatus</i>	copper-tailed skink		C		1
animals	reptiles	Scincidae	<i>Glaphyromorphus punctulatus</i>	fine-spotted mulch-skink		C		2/2
animals	reptiles	Scincidae	<i>Lampropholis delicata</i>	dark-flecked garden sunskink		C		1
animals	reptiles	Scincidae	<i>Liburnascincus mundivensis</i>	outcrop rainbow-skink		C		1
animals	reptiles	Scincidae	<i>Lygisaurus foliorum</i>	tree-base litter-skink		C		1
animals	reptiles	Scincidae	<i>Morethia taeniopleura</i>	fire-tailed skink		C		1
animals	reptiles	Scincidae	<i>Praeteropus auxilliger</i>	sandstone legless skink		C		2/2
animals	reptiles	Scincidae	<i>Pygmaeascincus timlowi</i>	dwarf litter-skink		C		1
animals	uncertain	Indeterminate	<i>Indeterminate</i>	Unknown or Code Pending				10
fungi	Agaricomycetes	Polyporaceae	<i>Lenzites</i>					1/1
fungi	arthoniomycetes	Arthoniaceae	<i>Cryptothecia eungellae</i>			C		1/1
fungi	lecanoromycetes	Caliciaceae	<i>Dirinaria confluens</i>			C		1/1
fungi	lecanoromycetes	Collemataceae	<i>Collema</i>					1/1
fungi	lecanoromycetes	Parmeliaceae	<i>Parmotrema cooperi</i>			C		1/1
fungi	lecanoromycetes	Physciaceae	<i>Heterodermia comosa</i>			C		1/1
fungi	lecanoromycetes	Physciaceae	<i>Physcia jackii</i>			C		2/2
plants	Florideophyceae	Ceramiaceae	<i>Pandorea</i>					1/1
plants	land plants	Acanthaceae	<i>Brunoniella australis</i>	blue trumpet		C		1/1
plants	land plants	Acanthaceae	<i>Brunoniella spiciflora</i>			C		1/1
plants	land plants	Acanthaceae	<i>Pseuderanthemum variabile</i>	pastel flower		C		1/1
plants	land plants	Amaranthaceae	<i>Achyranthes aspera</i>			C		1/1
plants	land plants	Anacardiaceae	<i>Schinus terebinthifolius</i>		Y			2/2
plants	land plants	Apocynaceae	<i>Cynanchum viminalis subsp. brunonianum</i>			C		1/1
plants	land plants	Apocynaceae	<i>Gomphocarpus physocarpus</i>	balloon cottonbush	Y			2/2
plants	land plants	Apocynaceae	<i>Leichhardtia microlepis</i>			C		1/1
plants	land plants	Apocynaceae	<i>Leichhardtia viridiflora subsp. viridiflora</i>			C		1/1
plants	land plants	Apocynaceae	<i>Parsonsia rotata</i>	veinless silkpod		C		1/1
plants	land plants	Apocynaceae	<i>Parsonsia straminea</i>	monkey rope		C		1/1
plants	land plants	Apocynaceae	<i>Wrightia versicolor</i>			C		1/1
plants	land plants	Araliaceae	<i>Astrotricha biddulphiana</i>			C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	land plants	Araliaceae	<i>Hydrocotyle acutiloba</i>			C		2/2
plants	land plants	Araliaceae	<i>Polyscias australiana</i>	ivory basswood		C		2/2
plants	land plants	Araliaceae	<i>Polyscias elegans</i>	celery wood		C		1/1
plants	land plants	Asteraceae	<i>Apowollastonia spilanthisoides</i>			C		1/1
plants	land plants	Asteraceae	<i>Calotis cuneifolia</i>	burr daisy		C		1/1
plants	land plants	Asteraceae	<i>Calotis dentex</i>	white burr daisy		C		1/1
plants	land plants	Asteraceae	<i>Crassocephalum crepidioides</i>	thickhead	Y			1/1
plants	land plants	Asteraceae	<i>Gynura drymophila</i> var. <i>drymophila</i>			C		1/1
plants	land plants	Asteraceae	<i>Hypochaeris radicata</i>	catsear	Y			1/1
plants	land plants	Asteraceae	<i>Lagenophora sublyrata</i>			C		2/2
plants	land plants	Asteraceae	<i>Ozothamnus cassinioides</i>			C		1/1
plants	land plants	Asteraceae	<i>Peripleura bicolor</i>			C		1/1
plants	land plants	Asteraceae	<i>Peripleura hispidula</i> var. <i>setosa</i>			C		1/1
plants	land plants	Asteraceae	<i>Picris angustifolia</i> subsp. <i>carolorum-henricorum</i>			C		1/1
plants	land plants	Asteraceae	<i>Pluchea dentex</i>	bowl daisy		C		1/1
plants	land plants	Asteraceae	<i>Senecio</i>					1/1
plants	land plants	Asteraceae	<i>Senecio brigalowensis</i>			C		1/1
plants	land plants	Asteraceae	<i>Senecio prenanthoides</i>			C		1/1
plants	land plants	Asteraceae	<i>Sigesbeckia orientalis</i>	Indian weed		C		1/1
plants	land plants	Asteraceae	<i>Verbesina encelioides</i>	crownbeard	Y			1/1
plants	land plants	Asteraceae	<i>Xerochrysum bracteatum</i>	golden everlasting daisy		C		1/1
plants	land plants	Asteraceae	<i>Youngia japonica</i>			C		1/1
plants	land plants	Basellaceae	<i>Anredera cordifolia</i>	Madeira vine	Y			1/1
plants	land plants	Bombacaceae	<i>Lagunaria queenslandica</i>			C		1/1
plants	land plants	Boraginaceae	<i>Cordia dichotoma</i>			C		1/1
plants	land plants	Boraginaceae	<i>Ehretia acuminata</i> var. <i>pilosula</i>			C		1/1
plants	land plants	Boraginaceae	<i>Ehretia grahamii</i>			C		2/2
plants	land plants	Braithwaiteaceae	<i>Braithwaitea sulcata</i>			C		1/1
plants	land plants	Byttneriaceae	<i>Hannafordia shanesii</i>			C		1/1
plants	land plants	Campanulaceae	<i>Wahlenbergia gracilis</i>	sprawling bluebell		SL		1/1
plants	land plants	Cannabaceae	<i>Celtis paniculata</i>	native celtis		C		2/2
plants	land plants	Capparaceae	<i>Capparis lasiantha</i>	nipan		C		1/1
plants	land plants	Casuarinaceae	<i>Allocasuarina luehmannii</i>	bull oak		C		1/1
plants	land plants	Celastraceae	<i>Denhamia disperma</i>			C		3/2
plants	land plants	Celastraceae	<i>Pleurostyliya opposita</i>			C		2/2
plants	land plants	Chenopodiaceae	<i>Dysphania ambrosioides</i>		Y			1/1
plants	land plants	Cleomaceae	<i>Sieruela monophylla</i>		Y			1/1
plants	land plants	Combretaceae	<i>Terminalia porphyrocarpa</i>			C		2/2
plants	land plants	Convolvulaceae	<i>Xenostegia tridentata</i>			C		1/1
plants	land plants	Cucurbitaceae	<i>Neoalsomitra capricornica</i>			C		1/1
plants	land plants	Cycadaceae	<i>Cycas media</i> subsp. <i>media</i>			SL		1/1
plants	land plants	Cyperaceae	<i>Cyperus compressus</i>		Y			2/2
plants	land plants	Cyperaceae	<i>Cyperus distans</i>			C		1/1
plants	land plants	Cyperaceae	<i>Cyperus polystachyos</i> var. <i>polystachyos</i>			C		1/1
plants	land plants	Cyperaceae	<i>Fimbristylis pauciflora</i>			C		1/1
plants	land plants	Cyperaceae	<i>Fimbristylis velata</i>			C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	land plants	Dilleniaceae	<i>Hibbertia acicularis</i>			C		1/1
plants	land plants	Erythroxylaceae	<i>Erythroxylum australe</i>	cocaine tree		C		2/2
plants	land plants	Euphorbiaceae	<i>Acalypha eremorum</i>	soft acalypha		C		1/1
plants	land plants	Euphorbiaceae	<i>Alchornea thozetiana</i>			C		1/1
plants	land plants	Euphorbiaceae	<i>Claoxylon tenerifolium subsp. tenerifolium</i>			C		1/1
plants	land plants	Euphorbiaceae	<i>Croton insularis</i>	Queensland cascarilla		C		1/1
plants	land plants	Euphorbiaceae	<i>Euphorbia thymifolia</i>		Y			1/1
plants	land plants	Euphorbiaceae	<i>Excoecaria dallachyana</i>	scrub poison tree		C		1/1
plants	land plants	Euphorbiaceae	<i>Macaranga tanarius</i>	macaranga		C		1/1
plants	land plants	Euphorbiaceae	<i>Omphalea celata</i>			V	V	11/11
plants	land plants	Euphorbiaceae	<i>Ricinocarpus ledifolius</i>	scrub wedding bush		C		4/4
plants	land plants	Geraniaceae	<i>Geranium homeanum</i>			C		1/1
plants	land plants	Goodeniaceae	<i>Dampiera adpressa</i>			C		1/1
plants	land plants	Haloragaceae	<i>Gonocarpus humilis</i>			C		2/2
plants	land plants	Haloragaceae	<i>Gonocarpus micranthus subsp. ramosissimus</i>			C		1/1
plants	land plants	Haloragaceae	<i>Haloragis heterophylla</i>	rough raspweed		C		1/1
plants	land plants	Haloragaceae	<i>Myriophyllum verrucosum</i>	water milfoil		C		1/1
plants	land plants	Hemerocallidaceae	<i>Dianella fruticans</i>			C		4/4
plants	land plants	Hydrocharitaceae	<i>Hydrilla verticillata</i>	hydrilla		SL		1/1
plants	land plants	Hydrocharitaceae	<i>Ottelia alismoides</i>			SL		1/1
plants	land plants	Hypericaceae	<i>Hypericum gramineum</i>			C		1/1
plants	land plants	Johnsoniaceae	<i>Tricoryne anceps subsp. pterocaulon</i>			C		1/1
plants	land plants	Lamiaceae	<i>Anisomeles moschata</i>			C		1/1
plants	land plants	Lamiaceae	<i>Callicarpa pedunculata</i>	velvet leaf		C		1/1
plants	land plants	Lamiaceae	<i>Clerodendrum floribundum</i>			C		1/1
plants	land plants	Lamiaceae	<i>Coleus australis</i>			C		1/1
plants	land plants	Lamiaceae	<i>Coleus diversus</i>			C		7/7
plants	land plants	Lamiaceae	<i>Mentha satureioides</i>	native pennyroyal		C		2/2
plants	land plants	Lamiaceae	<i>Prostanthera cryptandroides subsp. euphrasioides</i>			C		1/1
plants	land plants	Lamiaceae	<i>Prostanthera eungella</i>			CR		4/4
plants	land plants	Lauraceae	<i>Cryptocarya macdonaldii</i>	McDonald's laurel		C		1/1
plants	land plants	Laxmanniaceae	<i>Eustrephus latifolius</i>	wombat berry		C		1/1
plants	land plants	Leguminosae	<i>Acacia dietrichiana</i>			C		1/1
plants	land plants	Leguminosae	<i>Acacia falciformis</i>	broad-leaved hickory		C		2/2
plants	land plants	Leguminosae	<i>Acacia harpophylla</i>	brigalow		C		1/1
plants	land plants	Leguminosae	<i>Acacia julifera subsp. julifera</i>			C		1/1
plants	land plants	Leguminosae	<i>Acacia multisiлика</i>			C		1/1
plants	land plants	Leguminosae	<i>Acacia salicina</i>	doolan		C		1/1
plants	land plants	Leguminosae	<i>Acacia sparsiflora</i>			C		1/1
plants	land plants	Leguminosae	<i>Aphyllodium biarticulatum</i>			C		2/1
plants	land plants	Leguminosae	<i>Bossiaea carinalis</i>			C		1/1
plants	land plants	Leguminosae	<i>Cassia tomentella</i>			C		1/1
plants	land plants	Leguminosae	<i>Crotalaria brevis</i>			C		1/1
plants	land plants	Leguminosae	<i>Crotalaria mitchellii</i>			C		1/1
plants	land plants	Leguminosae	<i>Crotalaria mitchellii subsp. mitchellii</i>			C		1/1
plants	land plants	Leguminosae	<i>Cullen patens</i>	bullamon lucerne		C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	land plants	Leguminosae	<i>Galactia tenuiflora</i> var. <i>lucida</i>			C		1/1
plants	land plants	Leguminosae	<i>Glycine clandestina</i> var. <i>sericea</i>			C		1/1
plants	land plants	Leguminosae	<i>Hardenbergia violacea</i>			C		1/1
plants	land plants	Leguminosae	<i>Heliodendron thozetianum</i>			C		4/4
plants	land plants	Leguminosae	<i>Hovea parvicalyx</i>			C		1/1
plants	land plants	Leguminosae	<i>Indigofera brevidens</i>			C		4/4
plants	land plants	Leguminosae	<i>Lysiphyllum hookeri</i>	Queensland ebony		C		1/1
plants	land plants	Leguminosae	<i>Senna costata</i>			C		1/1
plants	land plants	Leguminosae	<i>Senna occidentalis</i>	coffee senna	Y			2/2
plants	land plants	Leguminosae	<i>Tephrosia purpurea</i> var. <i>sericea</i>			C		2/2
plants	land plants	Loganiaceae	<i>Strychnos psilosperma</i>	strychnine tree		C		2/2
plants	land plants	Loranthaceae	<i>Dendrophthoe homoplastica</i>			C		1/1
plants	land plants	Loranthaceae	<i>Diplatia furcata</i>			C		1/1
plants	land plants	Loranthaceae	<i>Lysiana subfalcata</i>			C		1/1
plants	land plants	Loranthaceae	<i>Muellerina eucalyptoides</i>			C		1/1
plants	land plants	Lythraceae	<i>Lythrum paradoxum</i>			C		1/1
plants	land plants	Malvaceae	<i>Abutilon oxycarpum</i> var. <i>oxycarpum</i>			C		1/1
plants	land plants	Malvaceae	<i>Helicteres semiglabra</i>			C		2/1
plants	land plants	Malvaceae	<i>Hibiscus heterophyllus</i>			C		1/1
plants	land plants	Malvaceae	<i>Hibiscus krichauffianus</i>			C		1/1
plants	land plants	Malvaceae	<i>Hibiscus meraukensis</i>	Merauke hibiscus		C		1/1
plants	land plants	Malvaceae	<i>Hibiscus phyllochlaenus</i>			C		2/2
plants	land plants	Meteoriaceae	<i>Papillaria leuconeura</i>			C		1/1
plants	land plants	Molluginaceae	<i>Glinus lotoides</i>	hairy carpet weed		C		1/1
plants	land plants	Molluginaceae	<i>Glinus oppositifolius</i>			C		1/1
plants	land plants	Moraceae	<i>Ficus rubiginosa</i> forma <i>rubiginosa</i>			C		1/1
plants	land plants	Myrtaceae	<i>Backhousia angustifolia</i>	narrow-leaved backhousia		C		4/4
plants	land plants	Myrtaceae	<i>Corymbia aureola</i>			C		1/1
plants	land plants	Myrtaceae	<i>Corymbia erythrophloia</i>	variable-barked bloodwood		C		1/1
plants	land plants	Myrtaceae	<i>Corymbia intermedia</i>	pink bloodwood		C		1/1
plants	land plants	Myrtaceae	<i>Corymbia trachyphloia</i> subsp. <i>trachyphloia</i>			C		1/1
plants	land plants	Myrtaceae	<i>Eucalyptus acmenoides</i>			C		1/1
plants	land plants	Myrtaceae	<i>Eucalyptus cloeziana</i>	Gympie messmate		C		1/1
plants	land plants	Myrtaceae	<i>Eucalyptus drepanophylla</i>			C		4/4
plants	land plants	Myrtaceae	<i>Eucalyptus drepanophylla</i> x <i>Eucalyptus melanophloia</i>			C		1/1
plants	land plants	Myrtaceae	<i>Eucalyptus exserta</i>	Queensland peppermint		C		1/1
plants	land plants	Myrtaceae	<i>Eucalyptus moluccana</i>	gum-topped box		C		1/1
plants	land plants	Myrtaceae	<i>Eucalyptus montivaga</i>			C		4/4
plants	land plants	Myrtaceae	<i>Eucalyptus persistens</i>			C		3/3
plants	land plants	Myrtaceae	<i>Eucalyptus platyphylla</i> x <i>Eucalyptus tereticornis</i>			C		1/1
plants	land plants	Myrtaceae	<i>Eucalyptus raveretiana</i>	black ironbox		C	V	6/6
plants	land plants	Myrtaceae	<i>Eucalyptus resinifera</i>	red mahogany		C		1/1
plants	land plants	Myrtaceae	<i>Gossia bidwillii</i>			C		2/2
plants	land plants	Myrtaceae	<i>Lophostemon grandiflorus</i> subsp. <i>riparius</i>			C		1/1
plants	land plants	Myrtaceae	<i>Melaleuca bracteata</i>			C		1/1
plants	land plants	Myrtaceae	<i>Melaleuca paludicola</i>			C		2/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	land plants	Myrtaceae	<i>Melaleuca trichostachya</i>			C		1/1
plants	land plants	Myrtaceae	<i>Melaleuca viminalis</i>			C		1/1
plants	land plants	Neckeraceae	<i>Thamnobryum pandum</i>			C		2/2
plants	land plants	Octoblepharaceae	<i>Octoblepharum albidum</i>			C		1/1
plants	land plants	Oleaceae	<i>Ligustrum australianum</i>			C		1/1
plants	land plants	Ophioglossaceae	<i>Sceptridium australe</i>			C		2/2
plants	land plants	Orchidaceae	<i>Diuris luteola</i>	northern yellow donkeys tails		SL		1/1
plants	land plants	Orchidaceae	<i>Pterostylis nutans</i>			SL		2/2
plants	land plants	Orchidaceae	<i>Pterostylis pearsonii</i>			SL		1/1
plants	land plants	Orthotrichaceae	<i>Macromitrium</i>					1/1
plants	land plants	Orthotrichaceae	<i>Macromitrium archeri</i>			C		1/1
plants	land plants	Orthotrichaceae	<i>Macromitrium hemitrichodes</i>			C		1/1
plants	land plants	Oxalidaceae	<i>Oxalis</i>					1/1
plants	land plants	Phyllanthaceae	<i>Bridelia leichhardtii</i>			C		1/1
plants	land plants	Phyllanthaceae	<i>Flueggea leucopyrus</i>			C		1/1
plants	land plants	Phyllanthaceae	<i>Glochidion apodogynum</i>			C		1/1
plants	land plants	Phyllanthaceae	<i>Phyllanthus microcladus</i>			C		1/1
plants	land plants	Phyllanthaceae	<i>Poranthera microphylla</i>	small poranthera		C		1/1
plants	land plants	Phytolaccaceae	<i>Phytolacca octandra</i>	inkweed	Y			2/2
plants	land plants	Piperaceae	<i>Peperomia leptostachya</i>			C		1/1
plants	land plants	Pittosporaceae	<i>Pittosporum spinescens</i>			C		2/2
plants	land plants	Plantaginaceae	<i>Plantago debilis</i>	shade plantain		C		1/1
plants	land plants	Plantaginaceae	<i>Scoparia dulcis</i>	scoparia	Y			2/1
plants	land plants	Plantaginaceae	<i>Veronica plebeia</i>	trailing speedwell		C		3/3
plants	land plants	Poaceae	<i>Aristida calycina</i> var. <i>praealta</i>			C		1/1
plants	land plants	Poaceae	<i>Aristida gracilipes</i>			C		1/1
plants	land plants	Poaceae	<i>Aristida lazaridis</i>			C		1/1
plants	land plants	Poaceae	<i>Aristida lignosa</i>			C		1/1
plants	land plants	Poaceae	<i>Aristida personata</i>			C		1/1
plants	land plants	Poaceae	<i>Arundinella nepalensis</i>	reedgrass		C		1/1
plants	land plants	Poaceae	<i>Bothriochloa bladhii</i> subsp. <i>bladhii</i>			C		2/2
plants	land plants	Poaceae	<i>Capillipedium parviflorum</i>	scented top		C		1/1
plants	land plants	Poaceae	<i>Capillipedium spicigerum</i>	spicytop		C		1/1
plants	land plants	Poaceae	<i>Cenchrus ciliaris</i>		Y			2/2
plants	land plants	Poaceae	<i>Chloris gayana</i>	rhodes grass	Y			1/1
plants	land plants	Poaceae	<i>Chloris virgatica</i>	tall chloris		C		1/1
plants	land plants	Poaceae	<i>Chloris virgata</i>	feathertop rhodes grass	Y			1/1
plants	land plants	Poaceae	<i>Chrysopogon fallax</i>			C		2/2
plants	land plants	Poaceae	<i>Cymbopogon refractus</i>	barbed-wire grass		C		2/2
plants	land plants	Poaceae	<i>Cynodon dactylon</i> var. <i>dactylon</i>		Y			1/1
plants	land plants	Poaceae	<i>Dichanthium aristatum</i>	angleton grass	Y			1/1
plants	land plants	Poaceae	<i>Dichanthium sericeum</i> subsp. <i>sericeum</i>			C		2/2
plants	land plants	Poaceae	<i>Dichanthium tenue</i>	small bluegrass		C		1/1
plants	land plants	Poaceae	<i>Digitaria ciliaris</i>	summer grass	Y			1/1
plants	land plants	Poaceae	<i>Digitaria minima</i>			C		1/1
plants	land plants	Poaceae	<i>Digitaria parviflora</i>			C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	land plants	Poaceae	<i>Echinochloa colona</i>	awnless barnyard grass	Y			1/1
plants	land plants	Poaceae	<i>Eleusine indica</i>	crowsfoot grass	Y			1/1
plants	land plants	Poaceae	<i>Enneapogon gracilis</i>	slender nineawn			C	1/1
plants	land plants	Poaceae	<i>Enneapogon lindleyanus</i>				C	1/1
plants	land plants	Poaceae	<i>Enneapogon nigricans</i>	niggerheads			C	1/1
plants	land plants	Poaceae	<i>Entolasia marginata</i>	bordered panic			C	1/1
plants	land plants	Poaceae	<i>Eragrostis cilianensis</i>		Y			2/2
plants	land plants	Poaceae	<i>Eragrostis elongata</i>				C	1/1
plants	land plants	Poaceae	<i>Eragrostis megalosperma</i>				C	1/1
plants	land plants	Poaceae	<i>Eragrostis pubescens</i>				C	1/1
plants	land plants	Poaceae	<i>Eragrostis spartinoides</i>				C	2/2
plants	land plants	Poaceae	<i>Eriachne pallescens var. pallescens</i>				C	1/1
plants	land plants	Poaceae	<i>Eulalia aurea</i>	silky browntop			C	1/1
plants	land plants	Poaceae	<i>Heteropogon contortus</i>	black speargrass			C	1/1
plants	land plants	Poaceae	<i>Heteropogon triticeus</i>	giant speargrass			C	1/1
plants	land plants	Poaceae	<i>Megathyrsus maximus var. pubiglumis</i>		Y			2/2
plants	land plants	Poaceae	<i>Melinis repens</i>	red natal grass	Y			1/1
plants	land plants	Poaceae	<i>Oplismenus aemulus</i>	creeping shade grass			C	1/1
plants	land plants	Poaceae	<i>Panicum decompositum var. decompositum</i>				C	1/1
plants	land plants	Poaceae	<i>Panicum simile</i>				C	1/1
plants	land plants	Poaceae	<i>Paspalidium gracile</i>	slender panic			C	1/1
plants	land plants	Poaceae	<i>Perotis rara</i>	comet grass			C	1/1
plants	land plants	Poaceae	<i>Poa labillardierei var. labillardierei</i>	tussock grass			C	1/1
plants	land plants	Poaceae	<i>Sarga leiocladum</i>				C	3/3
plants	land plants	Poaceae	<i>Sehima nervosum</i>				C	1/1
plants	land plants	Poaceae	<i>Setaria surgens</i>				C	3/3
plants	land plants	Poaceae	<i>Sporobolus fertilis</i>	giant Parramatta grass	Y			1/1
plants	land plants	Poaceae	<i>Thellungia advena</i>	coolibah grass			C	1/1
plants	land plants	Poaceae	<i>Themeda triandra</i>	kangaroo grass			C	1/1
plants	land plants	Poaceae	<i>Tragus australianus</i>	small burr grass			C	1/1
plants	land plants	Poaceae	<i>Urochloa panicoides var. panicoides</i>		Y			2/2
plants	land plants	Polygonaceae	<i>Persicaria hydropiper</i>	water pepper			C	1/1
plants	land plants	Polygonaceae	<i>Persicaria orientalis</i>	princes feathers			C	1/1
plants	land plants	Polygonaceae	<i>Polygonum plebeium</i>	small knotweed			C	1/1
plants	land plants	Polypodiaceae	<i>Drynaria rigidula</i>				SL	2/2
plants	land plants	Polypodiaceae	<i>Platyserium veitchii</i>	silver elkhorn			SL	2/2
plants	land plants	Polypodiaceae	<i>Pyrrosia confluens</i>				SL	1/1
plants	land plants	Potamogetonaceae	<i>Potamogeton tepperi</i>				SL	1/1
plants	land plants	Potamogetonaceae	<i>Potamogeton tricarinatus</i>	floating pondweed			SL	2/2
plants	land plants	Proteaceae	<i>Grevillea helmsiae</i>				C	1/1
plants	land plants	Proteaceae	<i>Grevillea longistyla</i>				C	1/1
plants	land plants	Proteaceae	<i>Grevillea parallela</i>				C	1/1
plants	land plants	Proteaceae	<i>Hakea lorea subsp. lorea</i>				C	1/1
plants	land plants	Proteaceae	<i>Persoonia amaliae</i>				C	3/3
plants	land plants	Pteridaceae	<i>Adiantum atroviride</i>				SL	1/1
plants	land plants	Pteridaceae	<i>Adiantum hispidulum var. minus</i>				SL	1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	land plants	Pteridaceae	<i>Pellaea muelleri</i>			SL		1/1
plants	land plants	Ranunculaceae	<i>Ranunculus lappaceus</i>	common buttercup		C		3/3
plants	land plants	Rhamnaceae	<i>Alphitonia excelsa</i>	soap tree		C		1/1
plants	land plants	Rhamnaceae	<i>Ventilago ecorollata</i>			C		1/1
plants	land plants	Rosaceae	<i>Rubus parvifolius</i>	pink-flowered native raspberry		C		1/1
plants	land plants	Rosaceae	<i>Rubus probus</i>			C		1/1
plants	land plants	Rubiaceae	<i>Antirhea putaminosa</i>			C		1/1
plants	land plants	Rubiaceae	<i>Cyclophyllum coprosmoides</i> var. <i>coprosmoides</i>			C		1/1
plants	land plants	Rubiaceae	<i>Galium spathulatum</i>			C		1/1
plants	land plants	Rubiaceae	<i>Opercularia hispida</i>	hairy stinkweed		C		1/1
plants	land plants	Rubiaceae	<i>Pavetta australiensis</i> var. <i>australiensis</i>			C		1/1
plants	land plants	Rubiaceae	<i>Psychotria daphnoides</i>			C		1/1
plants	land plants	Rubiaceae	<i>Psydrax johnsonii</i>			C		2/2
plants	land plants	Rubiaceae	<i>Psydrax odorata</i> forma <i>australiana</i>			C		1/1
plants	land plants	Rubiaceae	<i>Psydrax odorata</i> subsp. <i>australiana</i>			C		1/1
plants	land plants	Rubiaceae	<i>Randia</i> sp. (Shute Harbour D.A.Halford Q811)			C		1/1
plants	land plants	Rubiaceae	<i>Spermacoce brachystema</i>			C		1/1
plants	land plants	Rubiaceae	<i>Triflorensia ixoroides</i>			C		1/1
plants	land plants	Rutaceae	<i>Acronychia laevis</i>	glossy acronychia		C		2/2
plants	land plants	Rutaceae	<i>Clausena brevistyla</i>	clausena		C		1/1
plants	land plants	Rutaceae	<i>Coatesia paniculata</i>			C		1/1
plants	land plants	Rutaceae	<i>Geijera salicifolia</i>	brush wilga		C		1/1
plants	land plants	Rutaceae	<i>Glycosmis trifoliata</i>			C		1/1
plants	land plants	Rutaceae	<i>Micromelum minutum</i>	clusterberry		C		1/1
plants	land plants	Rutaceae	<i>Zieria smithii</i>			C		1/1
plants	land plants	Sapindaceae	<i>Alectryon subdentatus</i>			C		2/2
plants	land plants	Sapindaceae	<i>Atalaya salicifolia</i>			C		1/1
plants	land plants	Sapindaceae	<i>Dodonaea dodecandra</i>			C		2/1
plants	land plants	Sapotaceae	<i>Amorphospermum antilogum</i>			C		1/1
plants	land plants	Sapotaceae	<i>Planchonella myrsinifolia</i> subsp. <i>myrsinifolia</i>			C		1/1
plants	land plants	Scrophulariaceae	<i>Verbascum virgatum</i>	twiggy mullein	Y			2/2
plants	land plants	Solanaceae	<i>Lycianthes shanesii</i>			C		1/1
plants	land plants	Solanaceae	<i>Solanum densevestitum</i>			C		1/1
plants	land plants	Solanaceae	<i>Solanum graniticum</i>	granite nightshade		E	E	2/2
plants	land plants	Solanaceae	<i>Solanum opacum</i>	green berry nightshade		C		1/1
plants	land plants	Sparrmanniaceae	<i>Corchorus tomentellus</i>			C		2/1
plants	land plants	Sparrmanniaceae	<i>Grewia latifolia</i>	dysentery plant		C		2/2
plants	land plants	Sparrmanniaceae	<i>Grewia scabrella</i>			C		4/4
plants	land plants	Sparrmanniaceae	<i>Triumfetta pilosa</i>		Y			1/1
plants	land plants	Sterculiaceae	<i>Brachychiton rupestris</i>			SL		1/1
plants	land plants	Symplocaceae	<i>Symplocos puberula</i>			C		1/1
plants	land plants	Thymelaeaceae	<i>Wikstroemia indica</i>	tie bush		C		1/1
plants	land plants	Violaceae	<i>Viola betonicifolia</i>			C		1/1
plants	land plants	Violaceae	<i>Viola hederacea</i>			C		1/1
plants	land plants	Vitaceae	<i>Cayratia acris</i>	hairy grape		C		2/2
plants	land plants	Vitaceae	<i>Cissus cardiophylla</i>			C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	land plants	Vitaceae	<i>Tetrastigma petraeum</i>			C		1/1

CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992*.

The codes are Extinct (EX), Extinct in the Wild (PE), Critically Endangered (CR), Endangered (E), Vulnerable (V), Near Threatened (NT), Special Least Concern (SL) and Least Concern (C).

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999*.

The values of EPBC are Extinct (EX), Extinct in the Wild (XW), Critically Endangered (CE), Endangered (E), Vulnerable (V) and Conservation Dependent (CD).

Records - The first number indicates the total number of records of the taxon (wildlife records and species listings for selected areas).

This number is output as 99999 if it equals or exceeds this value. A second number located after a / indicates the number of specimen records for the taxon.

This number is output as 999 if it equals or exceeds this value.

Appendix B

Likelihood of occurrence assessment

Species name	EPBC Act status	NC Act status	Source	Habitat requirements	Project area in species mapped distribution	Nearby historical records	Habitat presence and quality	Species recorded in field surveys	Conservatism required due to species detectability	Conservatism required due to species mobility	Likelihood of occurrence
Threatened ecological communities											
Broad leaf tea-tree (<i>Melaleuca viridiflora</i>) woodlands in high rainfall coastal north Queensland	E	-	PMST	The Broadleaf tea-tree (<i>Melaleuca viridiflora</i>) woodlands in high rainfall coastal north Queensland are woodland occurrences with dominant <i>M. viridiflora</i> in the canopy and diverse grasses, sedges, and forbs in the ground layer. This community is limited to the Wet Tropics and Central Mackay Coast bioregions in Queensland (DCCEEW 2012). This unique woodland community predominantly thrives within 20km of the coast and on floodplains, benefiting from high rainfall (DCCEEW 2012). Its known occurrences are primarily located between Mossman in the north and Yeppoon in the south, with occasional gaps where it meets the coast in the Brigalow Belt North bioregion (DCCEEW 2012).	Species may occur in study area	Yes but distant	Not present	No	No	No	Unlikely to occur The Broadleaf tea-tree (<i>Melaleuca viridiflora</i>) was not recorded during field surveys, additionally, no REs diagnostic of the Broadleaf tea-tree TEC were present within the CEH PHES Project study area. Accordingly, the TEC is unlikely to occur.
Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant)	E	-	PMST	<i>Acacia harpophylla</i> (brigalow) is a silver-foliaged shrub or tree and is the dominant or co-dominant species in this TEC. In Queensland, the TEC is found in the Brigalow Belt North, Brigalow Belt South, Mulga Lands, Darling Riverine Plains and Southeast Queensland bioregions (DCCEEW 2013b). Brigalow TEC tends to occur on acidic and salty clay soils, with deep cracking clay soils and gilgai. The TEC occurs largely within the 500-750 mm annual rainfall belt (DCCEEW 2013b). Floristically, Brigalow TEC varies considerably.	Within range	Yes	Not present	No	No	No	Unlikely to occur The Brigalow TEC was not recorded during field surveys, additionally, no REs diagnostic of the Brigalow TEC were present within the CEH PHES Project study area. Accordingly, the TEC is unlikely to occur.
Natural grasslands of the Central Queensland Highlands and northern Fitzroy Basin	E	-	PMST	The 'Natural grasslands' TEC is typically composed of a mixture of forbs (i.e. broad-leaved herbs) and native grasses (DEWHA 2008; 2009). While species composition in grasslands can vary throughout their range and are influenced by factors such as rainfall, soil, geology and land use history (TSSC 2009), the TEC is traditionally dominated by <i>Dichanthium</i> spp. (bluegrasses). Tree canopy is typically minimal to absent in the TEC and is normally presented as a scattering of individuals with projective crown cover of <10 per cent. As identified by the IBRA, the TEC occurs across eight subregions within the Brigalow Belt North and Brigalow Belt South bioregions (DEWHA 2008).	Within range	Yes	Not present	No	No	No	Unlikely to occur The Natural grasslands TEC was not recorded during field surveys, additionally, no REs diagnostic of the Natural grasslands TEC were present within the CEH PHES Project study area. Accordingly, the TEC is unlikely to occur.
Poplar box grassy woodland on alluvial plains	E		PMST	The 'Poplar box grassy woodland' TEC varies from a grassy woodland to grassy open woodland structure. This TEC typically exhibits as an open forest structure with an overstorey dominated by <i>Eucalyptus populnea</i> (poplar box) and an understorey predominantly composed of perennial forbs and grasses (DEE 2019). The structure and composition of vegetation in the ecological community are primarily determined by topography, hydrology, fire regimes, soil fertility, disturbance and management history (DEE 2019). The ecological community is largely recorded in gently undulating to flat landscapes and occasionally on gentle slopes on a wide range of soil types of alluvial and depositional origin (DEE 2019). The TEC expands over seven bioregions including: Brigalow Belt North, Brigalow Belt South, Southeast	Within range	Yes	Present	Present. Patches of the TEC were confirmed present along areas of the existing access road	No	No	Confirmed present The Poplar box TEC was recorded during field surveys along the existing access road within the CEH PHES Project study area.

Species name	EPBC Act status	NC Act status	Source	Habitat requirements	Project area in species mapped distribution	Nearby historical records	Habitat presence and quality	Species recorded in field surveys	Conservatism required due to species detectability	Conservatism required due to species mobility	Likelihood of occurrence
				Queensland, Cobar Peneplain, Darling Riverine Plains, NSW South Western Slopes and Riverina.							
Semi-evergreen vine thickets of the Brigalow belt (north and south) and Nandewar bioregions	E	-	PMST,	The 'Semi-evergreen vine thicket' TEC is considered an extreme form of dry seasonal subtropical rainforest. It occurs in subtropical seasonally dry climates, on soils of high to medium fertility. The TEC is generally characterized by the prominence of trees with microphyll sized leaves. . In Queensland, the TEC structure often becomes lower and more open in rocky situations and/or with decreasing rainfall (McDonald 2010). The Semi-evergreen vine thicket TEC does not have any condition criteria. Therefore any vegetation community that has the necessary structure and species composition would represent Semi-evergreen vine thicket TEC, regardless of patch size and condition.	Within range	Yes	Present but lacking	No	No	No	Unlikely to occur The Semi-evergreen vine thicket TEC was not recorded during field surveys, additionally, no RES diagnostic of the Semi-evergreen vine thicket TEC were present within the CEH PHES Project study area. Accordingly, the TEC is unlikely to occur.
Conservation significant flora											
<i>Arthraxon hispidus</i> Hairy-joint Grass	V	V	PMST	Slender, tufted, creeping perennial grass. In Queensland it occurs north to Port Douglas, and west with disjunct occurrences around springs in Carnarvon National Park ; however, most occurrences are from Noosa southwards. Found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps (Halford 1998; DECC NSW 2005), as well as woodland (DEWHA 2008b).	Within range	No	Present	No	No	No	Low likelihood of occurrence In Queensland, this species has not been recorded north of Monto and the Carnarvon Gorge, with most records from the coastal strip in the Sunshine Coast/Toowoomba/Gold Coast area (AVH 2022b). A record in AVH from near Lake Galilee is from 1861, has no location notes associated with it, and is almost certainly in the wrong location. Given suitable habitat is present for the species in the study area and has been nominated by the EPBC protected matters search tool, it has been assessed as 'low likelihood'. However, this is generally considered unlikely given its known distribution does not extend closer than 500 km south of the study area, and extensive survey effort for numerous projects and by the Queensland Herbarium and other experienced observers expended across central and north Queensland in the last 50 years has not detected it anywhere Suitable habitat may be present within the CEH PHES Project study areas in riparian vegetation.
<i>Dichanthium queenslandicum</i> King Blue-grass	E	V	PMST	A perennial, tufted, erect grass to 80 cm tall. Occurs from near Dalby north to about 90 km north of Hughenden and west as far as Clermont. Occurs on black cracking clay in tussock grasslands mainly in association with other species of blue grasses (TSSC 2013a).	Species range within 35km	Yes but distant	Not present	No	No	No	Unlikely to occur The nearest record is located approximately 35 km west of the CEH PHES Project study area. Suitable habitat is not present within the CEH PHES Project study areas.
<i>Dichanthium setosum</i> Bluegrass	V	LC	PMST	Erect perennial grass to about 0.7 m. Occurs from Toowoomba to Lynd Junction in the Brigalow Belt, Cape York Peninsula, Desert Uplands, Einasleigh Uplands, North West Highlands and South East Queensland bioregions. Occurs in heavy soils (predominantly cracking clays or alluvium, often in gilgai) in woodland or open woodland usually dominated by Acacia (brigalow) and/or Eucalyptus species (DES 2022d).	Yes	Yes but distant	Present	No	No	No	Unlikely to occur The nearest record is located approximately 32 km south of the CEH PHES Project study area. Habitat requirements for this species are broad, however despite this it remains a rarely collected species, especially north of Emerald. Although suitable habitat appears to be present in the RE 11.12.1, this habitat is widespread in the bioregion (854, 000 ha) and the species is rarely collected within it.
<i>Eucalyptus raveretiana</i> Black ironbox	V	LC	PMST	Large tree. This species has a wide distribution in coastal and sub-coastal areas of Queensland, from south of Townsville to Nebo. Grows along watercourses and occasionally river flats or open	Yes	Yes	Present	Yes	No	No	Confirmed present This species was recorded in isolated watercourses along the existing road extension investigation area.

Species name	EPBC Act status	NC Act status	Source	Habitat requirements	Project area in species mapped distribution	Nearby historical records	Habitat presence and quality	Species recorded in field surveys	Conservatism required due to species detectability	Conservatism required due to species mobility	Likelihood of occurrence
				woodland. It does not occur in pure stands, but is co-dominant with species such as <i>Melaleuca leucadendra</i> , <i>M. fluviatilis</i> , <i>Eucalyptus tereticornis</i> , <i>Corymbia tessellaris</i> (DAWE 2022b).							
<i>Omphalea celata</i>	V	V	PMST	Small tree growing to 12 m high with glossy, cream coloured bark occurs in fragmented SEVT or araucarian microphyll vine forest. Recorded along watercourses in steep sided gorges and gullies on weathered metamorphic or granitic soils (DES 2022e). Associated species include <i>Eucalyptus raveretiana</i> , <i>E. tereticornis</i> , <i>Lysiphyllum hookeri</i> and <i>Ficus opposita</i> .	Species habitat may occur	Yes but distant	Present	No	No	No	Low likelihood of occurrence <i>Omphalea celata</i> is listed as vulnerable under the EPBC Act and the NC Act. It is a small tree known from three sites in eastern central Queensland, in very small populations from the Eungella/Homevale National Park area and from Gloucester Island National Park. It has been recorded growing in association with rocky gullies and gorges in microphyll vine forest and semi-evergreen vine thicket, on both granite and metamorphic rock (DEWHA 2008c). Records for the species occur approximately 10 km south of the CEH PHES Project study area in Hazlewood Gorge (AVH, 2022c). Suitable habitat for this species is located in vegetation growing beside the Broken River. However, despite large areas of suitable habitat for this species throughout the Eungella area, it is seldom present and appears to be genuinely rare. Consequently, although suitable habitat is present, it is located 20 km from the nearest known records in a different catchment, and has been assessed as 'low likelihood'.
<i>Ozothamnus ericephalus</i>	V	V	PMST; WO	Shrub to approximately 1 m high. Restricted to east-central Queensland between Bowen and Mackay. Occurs in a range of habitat types including the margins of disturbed notophyll vine forest, margins of gallery forest, microphyll vine forest. It is also known from the edge of creek banks and in crevices on steep granite slopes, often in sunny situations. It is known from moderate to high elevations ranging from 380–950 m. It occurs on skeletal, sandy or gravelly soils or occasionally deeper red-brown clay loams derived from granites and sandstones (DAWE 2022j; DEWHA 2008d).	Species range in close vicinity	Yes but distant	No ideal habitat present, however,, some less ideal habitat present in small areas	No	No	No	Low likelihood of occurrence It is a woody shrub recorded from rocky escarpments, slopes and creek gullies in closed rainforest margins and in sclerophyll open forest from the Bowen area, Eungella National Park and its near vicinity, and the Turrawulla Range (DEWHA 2008d). Records for the species occur 11 km south west of the study area in the Turrawulla Range, and 9 km north east of the study area, to the north of the Eungella township (AVH, 2022e). The study area does not contain rainforest, although mesic environments with species found in vine thicket occur in the Broken River gorge, and sclerophyll open forest is present in small areas fringing the Broken River. Therefore, this species has been assessed as 'low likelihood'.
<i>Samadera bidwillii</i> Quassia	V	V	PMST	A small shrub or tree growing up to 6 m tall with red flowers and fruit and stiff and leathery leaves that are green and glossy. <i>S. bidwillii</i> is endemic to QLD, occurring from Mackay to Tweed Heads (DAWE 2020). It commonly occurs in lowland rainforest but can also be found in open forest or woodland. <i>S. bidwillii</i> is commonly found in areas adjacent to temporary and permanent watercourses. Commonly occurs on lithosols, skeletal soils, loam soils, sands, silts and sands with clay subsoils (DEWHA 2008e).	Species may occur in study area	No	Not present	No	No	No	Unlikely to occur The nearest record is located over 100 km east of the CEH PHES Project study areas on Scawfell Island off the coast of Mackay. Known records from the mainland identify records only as far north as Saint Lawrence.
<i>Solanum graniticum</i>	E	E	PMST, WO	Sprawling herb to 0.3 m. Endemic to Queensland, occurs on Gloucester Island, adjacent mainland areas and at Eungella Dam. It grows in open eucalypt woodland on hillsides with shallow soil derived from granite or granodiorite. Associated species include <i>Eucalyptus drepanophylla</i> and	Within the range and widespread (mapped as likely to	Yes	Suitable habitat present and relatively widespread within the	Species recorded from a number of locations in	Moderate – species has a patchy distribution and is relatively	No	Confirmed present The species has been recorded from a number of locations within the CEH PHES Project study area.

Species name	EPBC Act status	NC Act status	Source	Habitat requirements	Project area in species mapped distribution	Nearby historical records	Habitat presence and quality	Species recorded in field surveys	Conservatism required due to species detectability	Conservatism required due to species mobility	Likelihood of occurrence
				<i>Corymbia erythrophloia</i> (Queensland Herbarium, 2012b; DES2022f).	occur in SPRAT)		PHES UD and access tracks	spring 2022 surveys	small ground plant		
Conservation significant fauna											
Birds											
<i>Actitis hypoleucos</i> Common sandpiper	Mig	SL	PMST	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 (DAWE 2022l).	Within the range but not locally recorded (mapped as may occur in SPRAT)	No	No preferred habitat present	No	No	Moderate	Unlikely to occur There is limited preferred habitat for the species identified within the CEH PHES Project study areas. One record of the species occur within Eungella National Park (over 20 km east), however as most of the historical records are associated with coastal habitat, it is considered the species is unlikely to occur within the CEH PHES Project study area.
<i>Apus pacificus</i> Fork-tailed swift	Mig	SL	PMST	In Australia, the species mostly occur over inland plains but sometimes above foothills or in coastal areas, cliffs and beaches and also over islands and sometimes well out to sea. The species can also occur over settled areas, including towns, urban areas and cities. The species has been recorded mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes. The sometimes occur above rainforests, wet sclerophyll forest or open forest or plantations of pines (DAWE 2022m).	Within the range and widespread (mapped as likely to occur in SPRAT)	Distant record exists 53km, numerous records occur across the Eungella region	Species is aerial and has no specific habitat requirements	No	No	High – High mobility and widespread distribution	High to Moderate likelihood of occurrence While the closest historical record is approximately 53 km east, records of the species occurs across the Eungella region. The species is typically found above open plains, as such the fork-tailed swift is considered as 'high to moderate likelihood of occurrence' within the CEH PHES Project study area.
<i>Calidris acuminata</i> Sharp-tailed sandpiper	Mig	SL	PMST	Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage. In Queensland, they are recorded in most regions, being widespread along much of the coast and are very sparsely scattered inland (DAWE 2022n).	Within the range but not locally recorded (mapped as may occur in SPRAT)	Nearest record 50km from Project area	No preferred habitat present	No	No	Moderate – High mobility but outside typical range	Unlikely to occur There is limited preferred habitat for the species within the PHES. The nearest record is approximately 50 km east of the PHES. As such the species is considered unlikely to occur within the CEH PHES Project study area.
<i>Calidris ferruginea</i> Curlew sandpiper	CE, Mig	CR	PMST	The curlew sandpiper mainly occurs along the coastlines of Australia. They are in smaller numbers across inland water of Queensland. Known to inhabit sheltered intertidal mudflats, and ephemeral and permanent lakes and dams (DAWE 2022o).	Within the range but not locally recorded (mapped as may occur in SPRAT)	Nearest record 50km from Project area	Limited habitat present	No	No	Moderate – High mobility but outside typical range	Unlikely to occur There is limited preferred habitat for the species within the PHES. The nearest record is approximately 50 km east of the CEH PHES Project study area. As such the species is considered unlikely to occur within the CEH PHES Project study area.
<i>Calidris melanotos</i> Pectoral sandpiper	Mig	SL	PMST	Prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation (DAWE 2022p).	Within the range but not locally recorded (mapped as may occur in SPRAT)	Nearest record 50km from Project area	Limited habitat present	No	No	Moderate – High mobility but outside typical range	Unlikely to occur There is limited preferred habitat for the species within the PHES. The nearest record is approximately 50 km southeast of the CEH PHES Project study area. As such the species is considered unlikely to occur within the CEH PHES Project study area.
<i>Cuculus optatus</i> Oriental cuckoo	Mig	SL	PMST	The species inhabits coastal regions across northern and eastern Australia, as well as offshore islands. Species utilises a range of vegetated habitats, including monsoon rainforests, wet	Within the range but not locally recorded (mapped as	Nearest record 50km from Project area	Present	No	No	High – High mobility and widespread distribution	Low likelihood of occurrence Preferred habitat in the form of eucalypt forest and woodlands were widespread within the CEH PHES Project study areas. The species is an uncommon migrant to Queensland coastal areas. The closest

Species name	EPBC Act status	NC Act status	Source	Habitat requirements	Project area in species mapped distribution	Nearby historical records	Habitat presence and quality	Species recorded in field surveys	Conservatism required due to species detectability	Conservatism required due to species mobility	Likelihood of occurrence
				sclerophyll forests, open woodlands and along the edges of forests (Australian Wildlife 2022).	may occur in SPRAT)						record of the species is approximately 50 km northeast of the CEH PHES Project study area. Based on the presence of suitable habitat, the species has a low likelihood of occurrence.
<i>Erythrotriorchis radiatus</i> Red goshawk	V	E	PMST; WO	The red goshawk occurs in coastal and sub-coastal areas in wooded and forested lands of tropical and warm-temperate Australia and nests in tall trees within 1 km of permanent water (DAWE 2022q).	Area is mapped as 'likely to occur' in SPRAT profile however species' QLD range has contracted to Cape York (Garnett & Baker 2020)	Nearest recent record, 23 km east of the Project area recorded in 1996	Moderate-value habitat was recorded within the Project area	No	Moderate – species is cryptic given its reliance on ambush predation	Moderate	Low likelihood of occurrence Preferred habitat in the form of eucalypt woodlands and semi-closed forest, particularly ecotones and riparian corridors, were recorded within the CEH PHES Project study area and surrounding environments. The species has been historically recorded within the desktop search extent, and based on the suitability of habitat, the species has potential to occur. However, it has experienced a recent, rapid northward contraction, and is now rarely encountered south of southern Cape York in Queensland (Garnett & Baker 2020).
<i>Falco hypoleucos</i> Grey falcon	V	V	PMST	This species occurs in arid to semi-arid Australia, mainly found where annual rainfall is less than 500 mm. It frequents timbered lowland plains, particularly acacia shrublands crossed by tree-lined watercourses, treeless areas, tussock grassland and open woodland (TSSC 2020).	Species' range is typically restricted to low rainfall areas with less than 500mm annual rainfall	No nearby recent historical records – nearest record, located 72 km east was from 1908	No suitable habitat within the Project area	No	No	No	Unlikely to occur The preferred habitat of the species is not present within the study area. The species has not been historically recorded in the desktop search extent. The species appears absent from east of the Great Dividing Range. Based on the absence of suitable habitat and historical records, the species is unlikely to occur.
<i>Gallinago hardwickii</i> Latham's snipe	Mig	SL	PMST	The species inhabits permanent and ephemeral freshwater wetlands with low, dense vegetation (DAWE 2020). Species sometimes occurs in habitats that have saline or brackish water, such as saltmarshes, mangrove creeks, around bays and beaches (DAWE 2022r).	Within the known distribution – mapped as likely to occur in SPRAT	Nearest record 50km from CEH PHES Project study area	Minimal habitat	No	No	Moderate – High mobility but outside typical range	Unlikely to occur Preferred habitat is generally lacking from the CEH PHES Project study area. The species has not been historically recorded in the desktop search extent. The closest record is approximately 50 km southeast. Based on the lack of historical records and suitable habitat, the species is considered unlikely to occur.
<i>Geophaps scripta scripta</i> Squatter pigeon (southern)	V	V	PMST; WO	The species occurs in open-forests to sparse, open-woodlands and scrub that are dominated by <i>Eucalyptus</i> , <i>Corymbia</i> and <i>Acacia</i> or <i>Callitris</i> species, remnant and regrowth within 3 km of water (DAWE 2022s).	Within the known distribution – mapped as likely to occur in SPRAT	The species has been historically recorded in the desktop search extent	Suitable habitat is abundant and widespread within the PHES	Species has been recorded in the PHES	N/A	N/A	Confirmed present Preferred habitat is present within the CEH PHES Project study area and species has been historically recorded within the search extent. Many individuals were recorded during field surveys within the PHES project area. The species is likely to utilise the majority of the CEH PHES Project study area.
<i>Hirundapus caudacutus</i> White-throated needletail	V; Mig	V	PMST; WO	Almost exclusively aerial, it does prefer wooded, inland areas and heathland. In coastal areas they have been seen flying over mudflats and beaches. Widespread throughout eastern and south-eastern Australia. It has been recorded along all coastal regions of QLD and NSW (DAWE 2022t).	Within the known distribution – mapped as likely to occur in SPRAT	The species has been historically recorded in the desktop search extent	Species is aerial and has no specific habitat requirements	No	No	High – Species is highly mobile and wide ranging	High to Moderate likelihood of occurrence The species has been historically recorded within the desktop search extent. Preferred habitat is present within the CEH PHES Project study area. Species is highly nomadic and occurs over a wide range of environments. This species is likely to forage over the CEH PHES Project study area.
<i>Monarcha melanopsis</i> Black-faced monarch	Mig	SL	PMST, WO	Species inhabits rainforest ecosystems that include semi-deciduous vine thickets, complex notophyll vine-forests, tropical rainforests, subtropical rainforests, mesophyll thicket/shrubland, warm and cool temperate rainforest, and dry rainforest (DAWE 2022v).	Within the known distribution – mapped as likely to	The species has been historically recorded in the desktop	Suitable habitat is present in vine thicket areas in and	No	No	No	High to Moderate likelihood of occurrence Preferred habitat for this species is locally abundant in the PHES LD investigation area. The species has been recorded within the desktop search extent and has a high likelihood of occurring in vine thicket areas in the CEH PHES Project study area.

Species name	EPBC Act status	NC Act status	Source	Habitat requirements	Project area in species mapped distribution	Nearby historical records	Habitat presence and quality	Species recorded in field surveys	Conservatism required due to species detectability	Conservatism required due to species mobility	Likelihood of occurrence
					occur in SPRAT	search extent	adjacent to the PHES LD				
<i>Symposiachrus trivirgatus</i> Spectacled monarch	Mig	SL	PMST, WO	The species prefers thick understory habitats in rainforests, wet sclerophyll forests and mangroves (Birdlife Australia 2022).	Within the known distribution – mapped as likely to occur in SPRAT	The species has been historically recorded in the desktop search extent	Suitable habitat is present in vine thicket areas in and adjacent to the PHES LD	No	No	No	High to Moderate likelihood of occurrence Preferred habitat for this species is locally abundant in the PHES LD investigation area. The species has been recorded within the desktop search extent and has a high likelihood of occurring in vine thicket areas in the CEH PHES Project study area.
<i>Motacilla flava</i> Yellow wagtail	Mig	SL	PMST	The species is found in open country near swamps, salt marshes, sewage ponds, grassed surrounds to airfields, bare ground, occasionally on drier inland plains (Morcombe 2004).	Within the mapped distribution of the species but in an area with no local records – mapped as 'may occur' in SPRAT	There are no nearby historical records of the species	No suitable habitat present in Project area	No	No	No	Unlikely to occur Habitat within the CEH PHES Project study area is considered marginal for the species. The species has not been historically recorded within the desktop search extent. Considering this, the species is considered unlikely to occur within the CEH PHES Project study area.
<i>Myiagra cyanoleuca</i> Satin flycatcher	Mig	SL	PMST, WO	The species occurs in heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, typically near wetlands and watercourses (DAWE 2022w).	Within the known distribution – mapped as likely to occur in SPRAT	The species has been historically recorded in the desktop search extent	Suitable habitat is present in vine thicket areas in and adjacent to the PHES LD	No	No	No	High to Moderate likelihood of occurrence Preferred habitat for this species is locally abundant in the PHES LD investigation area. The species has been recorded within the desktop search extent and has a high likelihood of occurring in vine thicket areas in the CEH PHES Project study area.
<i>Neochmia ruficauda</i> Star finch	E	E	PMST	The species occurs in low numbers in central Queensland. Mainly inhabits grasslands and grassy woodlands in close proximity to permanent freshwater. Species are closely associated to habitats that consist certain tree species, including <i>Eucalyptus coolabah</i> , <i>Eucalyptus tereticornis</i> , <i>Eucalyptus tessellaris</i> , <i>Melaleuca leucadendra</i> , <i>Eucalyptus camaldulensis</i> and <i>Casuarina cunninghamii</i> (DEWHA 2008i).	Within the known distribution – mapped as likely to occur in SPRAT but species has an area of occupancy of 20km ² within that range	There are no nearby historical records and the species has been rarely sighted in recent decades	Suitable, low to moderate value habitat is present in the Project area	No	No	No	Unlikely to occur While the CEH PHES Project study area occurs within the species' known range, very few records of the species have been recorded in recent decades and its distribution is poorly known. The species population is believed to be as little as 50 breeding birds. This bird is extremely uncommon in central Queensland, and may now be regionally extinct (Ward et al. 2022). The species has not been historically recorded within the desktop search extent.
<i>Numenius madagascariensis</i> Eastern curlew	CE, Mig	E	PMST	The eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (DCCEEW 2015b). This species forages on soft, sheltered, intertidal sand- or mudflats, often near mangroves, on saltflats, saltmarshes, rockpools, coastal reefs and ocean beaches near the tideline (Morcombe 2004).	Within the range but not locally recorded (mapped as may occur in SPRAT)	No	Limited habitat present	No	No	Moderate – High mobility but outside typical range	Unlikely to occur There is limited preferred habitat for the species. The species has not been historically recorded in the desktop search extent. All records from the region are restricted to areas east of the Great Dividing Range. On this basis, the species is considered unlikely to occur.
<i>Pandion haliaetus</i> Osprey	Mig	SL	PMST, WO	The species occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers. They require extensive areas of open fresh, brackish or saline water for foraging (DAWE 2022x).	Yes	Yes	Limited habitat present	No	No	High – High mobility and widespread distribution	Low likelihood of occurrence The species has been historically recorded within the desktop search extent. Preferred habitat is generally lacking from the CEH PHES Project study area, however suitable habitat is widely abundant in the surrounding landscape. Therefore the species has a low likelihood of occurrence, moving through the landscape.

Species name	EPBC Act status	NC Act status	Source	Habitat requirements	Project area in species mapped distribution	Nearby historical records	Habitat presence and quality	Species recorded in field surveys	Conservatism required due to species detectability	Conservatism required due to species mobility	Likelihood of occurrence
<i>Poephila cincta cincta</i> Black-throated finch (southern)	E	E	PMST	Mainly inhabits grassy, open woodlands and forests, often in the vicinity of water. The subspecies are closely associated to habitats that are dominated by <i>Eucalyptus</i> , <i>Corymbia</i> , and <i>Melaleuca</i> (DAWE 2022y).	Within the mapped distribution of the species but in an area with no local records – mapped as 'may occur' in SPRAT	There are no nearby historical records of the species	Low to moderate quality habitat is present in the Project area	No	No	While the species is mobile a low level of conservatism is required given the Project area is not in an area where the species has been known to occur	Unlikely to occur While the CEH PHES Project study area occurs within the subspecies historical range, the subspecies has experienced widespread declines from the region. The subspecies has not been historically recorded within the desktop search extent. The value of habitats within the CEH PHES Project study area were considered low due to the low diversity of native grasses. On this basis the subspecies is considered unlikely to occur.
<i>Rhipidura rufifrons</i> Rufous fantail	Mig	SL	PMST; WO	Species inhabits wet sclerophyll forests, often in gullies dominated by eucalypts and usually within a dense shrubby understorey that often includes ferns (DAWE 2022z).	Within the known distribution – mapped as likely to occur in SPRAT	The species has been historically recorded in the desktop search extent	Suitable habitat is present in vine thicket areas in and adjacent to the PHES LD	No	No	No	High to Moderate likelihood of occurrence Preferred habitat for this species is locally abundant in the PHES LD investigation area. The species has been recorded within the desktop search extent and has a high likelihood of occurring in vine thicket areas in the CEH PHES Project study area.
<i>Rostratula australis</i> Australian painted-snipe	E	E	PMST	The species generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps, claypans and waterlogged grasslands (TSSC 2013b).	Within the known distribution – mapped as likely to occur in SPRAT	There are no nearby historical records of the species	Limited, sub-optimal habitat present	No	No	Moderate – species is mobile	Low likelihood of occurrence Habitat within the CEH PHES Project study area are generally not consistent with those typically used by the species. The species has not been historically recorded within the desktop search extent. However, sub-optimal habitat occurs and therefore the species may occur.
<i>Tyto novaehollandiae kimberli</i> Masked owl (northern)	V	V	PMST	The species inhabits riparian forest, rainforest, open forest, <i>Melaleuca</i> swamps, edges of mangroves, margins of sugar cane fields. They nest in hollow-bearing trees within closed forest and forage on small to medium-sized terrestrial animals in open woodland (TSSC 2015b).	Within the mapped distribution of the species but in an area with no local records – mapped as 'may occur' in SPRAT	There are no nearby historical records of the species	Limited, sub-optimal habitat present	No	No	No	Unlikely to occur Potential habitat for this species was identified throughout the CEH PHES Project study area, however this species has not been previously recorded within this region. On this basis, the species is considered unlikely to occur.
Mammals											
<i>Dasyurus hallucatus</i> Northern quoll	E	LC	PMST	Occurs in a range of habitats, including open dry sclerophyll forest and woodland, riparian woodland, low dry vine thicket, the margins of notophyll vine-forest, mangroves, sugarcane farms and in urban areas. They are most abundant in hilly or rocky areas close to permanent water. Quolls are likely to disappear in areas where less than 50-70% woodland remains within a 4 km radius. (DAWE 2022ab).	Within the species known distribution – mapped as likely to occur in SPRAT	The species has been historically recorded 11 km northeast (2008), and southeast (2003) of the CEH PHES Project study area	Suitable denning and foraging habitat has been recorded in the Project area	The species was recorded on remote surveillance cameras deployed at PHES UD	N/A	N/A	High to Moderate likelihood of occurrence The species has not been recorded in the CEH PHES Project study area. However the species has been recorded to the west in previous PHES options (PHES 4 and 8) and suitable habitat exists across the CEH PHES Project study area
<i>Macroderma gigas</i> Ghost bat	V	E	PMST	This species is known to occur in rainforest areas, vine shrub, open woodlands and arid zone (McKenzie and Hall 2008), and roosts in caves, rock crevices and old mine shafts (TSSC 2016a).	Within the species known distribution – mapped as likely to occur in SPRAT	The species has been historically recorded nearby, with one record (2004) 16 km south	Foraging habitat is present – however roosting habitat is relatively limited in	The species has not been recorded in field surveys	Given the species' limited foraging range, a level of conservatism is needed when interpreting	No	Low likelihood of occurrence Preferred roosting habitat for the species is generally not present within the CEH PHES Project study area, however woodland areas represent potential foraging habitat. The species has one historical record from 2004 within the desktop search extent, approximately 16 km southwest of the CEH PHES Project study area. Although suitable foraging habitat is present,

Species name	EPBC Act status	NC Act status	Source	Habitat requirements	Project area in species mapped distribution	Nearby historical records	Habitat presence and quality	Species recorded in field surveys	Conservatism required due to species detectability	Conservatism required due to species mobility	Likelihood of occurrence
						of the CEH PHES Project study area	value and the species does not forage far from roosting habitat		absence from field surveys		the species is known to forage on average within 1.9 km and typically less than 5 km from diurnal roosts (TSSC 2016a). The closest known roost is Cape Hillsborough (70 km east).
<i>Petauroides volans</i> Greater glider	V	V	PMST; WO	This species is largely restricted to eucalypt forests and woodlands with high densities of hollow-bearing trees. Modelling suggests that they require native forest patches of at least 160 km ² to maintain viable populations (TSSC 2016b).	Within the species known distribution – mapped as likely to occur in SPRAT	The species has been historically recorded in the desktop search extent	Suitable denning and foraging habitat is relatively extensively distributed in the Project area	The species has been recorded in spotlighting and scats found in the Project area	N/A	N/A	Confirmed present The greater glider was recorded from seven locations within the CEH PHES Project study area during spotlighting. Faecal pellets were confirmed from three locations in the CEH PHES Project study area. Suitable habitat was recorded across the CEH PHES Project study area.
<i>Petaurus australis australis</i> Yellow-bellied glider (south-eastern)	V	V	PMST, WO	This species occurs in eucalypt-dominated forests and woodlands, with a preference for mature old-growth forests that provide suitable hollow habitat for foraging and shelter. The species occurs in both wet and dry sclerophyll forests. Smooth barked eucalypts are important due to the foraging substrates they provide (DAWE 2022ac).	Within the species known distribution – mapped as may occur in SPRAT	A small number of historical records are known from the desktop search extent	Suitable denning and foraging habitat is distributed in the Project area	The species has not been recorded in spotlighting and no evidence of feeding activity has been seen in extensive surveys	Yes Insufficient nocturnal survey undertaken to date. Surveys scheduled for Autumn and Winter 2023	No	High to Moderate likelihood of occurrence Suitable eucalypt woodland habitat is present in the CEH PHES Project study area. The species has been historically recorded within the desktop search extent. No evidence of the species has been recorded. However more surveys are required to determine likelihood of occurrence. A conservative assessment of high to moderate likelihood has been considered until those surveys are completed.
<i>Phascolarctos cinereus</i> Koala	E	E	PMST; WO	Within the region, koalas occur in sub-humid <i>Eucalyptus</i> dominated forests and woodlands in riparian and non-riparian environments, and some <i>Acacia</i> dominated forests and woodlands in non-riparian environments (DAWE 2022e).	Within the species known distribution – mapped as likely to occur in SPRAT	The species has been historically recorded in the desktop search extent	Suitable denning and foraging habitat is relatively extensively distributed in the Project area	The species has been recorded in spotlighting and scats found in the Project area	N/A	N/A	Confirmed present Koala faecal pellets were recorded within <i>Eucalyptus</i> woodland at 13 locations within the CEH PHES Project study area,. The species has been historically recorded within the desktop search extent. Suitable habitat for this species was widespread within the CEH PHES Project study areas.
<i>Pteropus poliocephalus</i> Grey-headed flying-fox	V	LC	PMST; WO	The species roosts in rainforest patches, stands of <i>Melaleuca</i> , mangroves and riparian vegetation and forages widely in rainforests, open forests, closed and open woodlands, <i>Melaleuca</i> swamps and <i>Banksia</i> woodlands). The species is known to forage up to 15-50 km from roosting sites (DAWE 2022g)	Within the species known distribution – mapped as likely to occur in SPRAT	The species has been historically recorded in the desktop search extent	Suitable foraging habitat is extensively distributed in the Project area. No roosting habitat is present.	The species has not been recorded in surveys of the Project area	No	Moderate – species is able to forage at least 40 km from roost camps (Eby 1991) – the nearest camp is located 25 km east of the Project area	High to Moderate likelihood of occurrence The Finch Hatton Gorge (camp ID 323) flying-fox camp (approximately 25 km east) recorded grey-headed flying-fox (500-2,499 individuals during 2020). The grey-headed flying fox has also been historically recorded within the desktop search extent (approximately 10 km southeast of the CEH PHES Project study area). Accordingly, foraging habitats within the PHES are within foraging range of the nearest camp. Considering suitable foraging habitat is present in the CEH PHES Project study area, the species is considered high to moderate likelihood of occurrence.
Reptiles											
<i>Crocodylus porosus</i> Estuarine crocodile	Mig	V	PMST	Estuarine crocodiles are found in a wide range of habitats including rivers, estuaries, creeks, swamps, lagoons, and billabongs. This species prefers elevated, isolated freshwater swamps or floating rafts of vegetation as nesting habitat.	Within the mapped distribution of the species but in an area with no local records – mapped as 'may occur' in SPRAT	There are no nearby historical records of the species	No suitable habitat present in the CEH PHES Project study area	No	No	No	High to moderate likelihood of occurrence in lower Broken River This species has been historically recorded in the lower Broken River. Unlikely to occur in upper Broken River or tributaries The upper Broken River tributaries and ephemeral waterways (all) are not suitable habitat and are above the species known distribution.

Species name	EPBC Act status	NC Act status	Source	Habitat requirements	Project area in species mapped distribution	Nearby historical records	Habitat presence and quality	Species recorded in field surveys	Conservatism required due to species detectability	Conservatism required due to species mobility	Likelihood of occurrence
<i>Denisonia maculata</i> Ornamental snake	V	V	PMST	The preferred habitat is within, or adjacent to, habitat that is favoured by frogs. The species is known to prefer woodlands and open forests associated with moist areas, particularly gilgai mounds and depressions in REs on landzone 4, but also lake margins and wetlands (DAWE 2014a).	Within the species known distribution – mapped as may occur in SPRAT	There are no nearby historical records of the species	No suitable habitat present in the CEH PHES Project study area	No	Conservatism required when suitable habitat present. However no suitable present.	No	Unlikely to occur Although essential habitat is broadly mapped within the surrounding landscape, no suitable habitat occurs within the CEH PHES Project study area. The species has not been historically recorded within the desktop search extent. On this basis the species is considered unlikely to occur.
<i>Egernia rugosa</i> Yakka skink	V	V	PMST	This species typically occurs in open dry sclerophyll forest, woodland and scrub, especially within the Mulga Land and Brigalow Belt South Bioregion. Species is typically found under partly buried rocks, logs, tree stumps, root cavities and abandoned burrows (DAWE 2014b).	Within the species known distribution – mapped as may occur in SPRAT	There are no nearby historical records of the species	Limited, sub-optimal habitat present in CEH PHES Project study area	No	Conservatism required when suitable habitat present. However very limited suitable present.	No	Low likelihood of occurrence The species has not been historically recorded within the desktop search extent and is not known from the surrounding region. The species is however highly cryptic and the CEH PHES Project study area is included within the modelled distribution of the species. As such, the species has low likelihood of occurrence
Amphibians											
<i>Rheobatrachus vitellinus</i> Northern gastric Brooding- frog	E	EX	WO	The species was found exclusively in undisturbed rainforest in the Clarke Range (which includes the Eungella National Park), mid-eastern Queensland (DAWE 2020). The species was recorded in pristine rainforest and occurred in shallow, rocky, broken-water areas where water flowed quickly in cascades, riffles and trickles (DAWE 2022ad).	The species distribution is not mapped as it is considered extinct under the EPBC Act.	Historical records of the species exist in the desktop search extent, however are all prior to 1980's	Species habitat is not present in the Project area – restricted to rainforest at higher elevation	No	The species is hard to detect, but mainly due to its rarity (prior to extinction).	No	Unlikely to occur The species has been historically recorded within the desktop search extent, associated with the Clarke Range. However, the species has not been seen since the mid 1980's and is considered to be extinct. On this basis the species is considered unlikely to occur.
<i>Taudactylus eungellensis</i> Eungella day frog	E	E	PMST, WO	Restricted to the ranges of west Mackay, Queensland between 200 and 1000 m. Occurs from Clarke Range to Finch Hatton Gorge and Crediton. Habitats including small creeks in rainforest and wet sclerophyll forests. Inhabits steep, rocky sections of stream within splash zones of waterfalls (TSSC 2017).	Within the species known distribution – mapped as likely to occur in SPRAT	The species has been historically recorded in the desktop search extent	Habitat is generally unsuitable. Sub-optimal habitat in vine thicket streams is present at the PHES LD	No	Species can be difficult to detect due to seasonality in activity	No	Low likelihood of occurrence Although there are historical records of the species in the desktop search extent, all are from rainforest areas east of the CEH PHES Project study area. The species is generally not recorded west of the Clarke Ranges. Habitat is generally unsuitable as the species is restricted to rainforest streams. Due to the presence of limited areas of sub-optimal habitat (i.e. streams fringed by vine thicket) there is a very remote chance the species could occur.

Appendix C

Species habitat mapping criteria

Species or Value	Habitat description in Commonwealth/State listing advice	Criteria used to map habitat
Species listed under the Commonwealth EPBC Act		
<i>Eucalyptus raveretiana</i>	<p><i>E. raveretiana</i> habitat has been defined as per the Approved Conservation Advice (DEWHA, 2008) and the listing advice (TSSC, 2012) for the species.</p> <p>This species occurs on the banks of rivers, creeks and other watercourses, on clayey or loamy soil (Queensland Herbarium, 2008). Altitudinal range is 0–300 m and annual rainfall is 650–1100 mm. It does not occur in pure stands but is co-dominant with species such as <i>Melaleuca leucadendra</i>, <i>Melaleuca fluviatilis</i>, <i>Eucalyptus tereticornis</i> and <i>Corymbia tessellaris</i>, and occasionally in semi-evergreen vine thicket.</p>	<p>This species is predicted to occur in the following REs:</p> <p>RE 11.3.25 <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines</p> <p>RE 11.3.25a <i>Eucalyptus raveretiana</i> (sometimes emergent), <i>Eucalyptus tereticornis</i> and <i>Melaleuca fluviatilis</i> woodland.</p>
<i>Solanum graniticum</i>	<p><i>Solanum graniticum</i> habitat has been defined as per the Approved Conservation Advice (TSSC, 2021a) for the species.</p> <p>The species occurs in eucalypt woodland on hillsides in shallow soils derived from granite and granodiorite. At the Eungella Dam population, <i>Corymbia erythrophloia</i> is commonly present (RE 11.12.1). The species appears to be naturally rare and is somewhat cryptic in terms of presence or absence of above-ground biomass (TSSC, 2021a).</p>	<p>Polygons generated around confirmed were created by generating a 100 m buffer around each record, merging these buffers where they overlapped, then subtracting areas of vegetation that are known to be incompatible with the species (eg the RE 11.12.6 and 11.12.14) and open, completely cleared space.</p> <p>The following features have been used to generate the inferred habitat mapping:</p> <p>RE is either 11.12.1 or 11.12.7, or non-remnant areas with a canopy structure known to meet the species composition and structural characteristics outlined above.</p> <p>Aerial photo signature indicates open woodland to woodland, with the spaces between canopies demonstrating a uniform pattern (indicative of a ground layer dominated by <i>B. pertusa</i>).</p> <p>Extensively cleared non-remnant areas have been excluded.</p> <p>Landscape position has been restricted to ridgelines and areas adjacent to them, using aerial photography and contour mapping.</p>
Koala	<p>Koala habitat definition</p> <p>Koala habitat has been defined using the criteria outlined in the current Commonwealth listing advice (DAWE, 2022c) and the National Recovery Plan for the Koala (<i>Phascolarctos cinereus</i>) (DAWE, 2022b).</p> <p>The koala is a specialist foliovore that browses predominantly on the leaves of <i>Eucalyptus</i>, <i>Corymbia</i> and <i>Lophostomen</i> (DAWE, 2022a).</p> <p>Non-food (shelter) tree species are an essential resource to koalas. Koalas use shelter trees to thermoregulate, especially during hot days (Briscoe <i>et al.</i>, 2015;</p>	<p>Koala habitat</p> <p>Mapping of koala habitat included all forest, woodland, open woodland, shrubland with emergent food or shelter trees, roadside and rail vegetation and accessible paddock trees (including areas of intervening open ground between trees) where these areas contain:</p> <p>Known koala food tree species for the Bioregion including: <i>Eucalyptus brownii</i>, <i>E. camaldulensis</i>, <i>E. chloroclada</i>, <i>E. conica</i>, <i>E. coolabah</i>, <i>E. crebra</i>, <i>E.</i></p>

Species or Value	Habitat description in Commonwealth/State listing advice	Criteria used to map habitat
	<p>Crowther <i>et al.</i>,2014; Ellis <i>et al.</i>,2009; Ellis <i>et al.</i>,2010a; Pfeiffer <i>et al.</i>,2005) and to avoid predators (Melzer <i>et al.</i>,2003).</p> <p>Preferred koala food and shelter tree species vary regionally, with known food and shelter trees defined for each Bioregion in Youngentob <i>et al.</i>, 2021.</p> <p>Koala habitat is determined in space and time through the following factors:</p> <ul style="list-style-type: none"> • Food and shelter tree preferences within the koalas' home range • Landscape scale considerations including patch size, form and the context of home ranges within the landscape, including patches of forest, riparian, linear and roadside vegetation associations, open ground, corridors and scattered paddock trees used for breeding or dispersal <p>Key factors that influence the quality of habitat for koalas are the presence and density of preferred food tree species (Melzer <i>et al.</i>,2014; Moore and Foley 2000; Stalenberg <i>et al.</i>,2014; Whisson <i>et al.</i>,2016; Woodward <i>et al.</i>,2008); food trees' nutritional foliar chemistry (Ellis <i>et al.</i>,2009; Moore and Foley 2005; More <i>et al.</i>,2004; Wallis <i>et al.</i>,2010) (section 28), and shelter trees and vegetation structure (Ellis <i>et al.</i>,2002; Ellis <i>et al.</i>,2009; Ellis <i>et al.</i>,2013; Pfeiffer <i>et al.</i>,2005; Smith <i>et al.</i>,2013; Woodward <i>et al.</i>,2008).</p> <p>While habitat needed to meet individual koalas' daily requirements include a range of forests or woodlands, road-side and rail vegetation and paddock trees, safe intervening ground matrix for travelling between vegetation areas, at a population level, crucial habitat is considered to include:</p> <ul style="list-style-type: none"> • Habitats that provide sufficient amount and quality of resources to support a viable biological population where mortality, survival, and recruitment are balanced or recruitment increasing to optimal carrying capacity and within the bounds of natural fluctuations • Patches and corridors important for gene flow • Areas that provide climate refugia including drainage lines, riparian zones and patches that are resilient to drying conditions due to favourable hydrological conditions 	<p><i>drepanophylla</i>, <i>E. dura</i>, <i>E. exserta</i>, <i>E. fibrosa</i>, <i>E. laevopinea</i>, <i>E. largiflorens</i>, <i>E. longirostrata</i>, <i>E. major</i>, <i>E. melanophloia</i>, <i>E. macrocarpa</i>, <i>E. moluccana</i>, <i>E. ochrophloia</i>, <i>E. orgadophila</i>, <i>E. populnea</i>, <i>E. punctate</i>, <i>E. salgina</i>, <i>E. sideroxylon</i>, <i>E. tereticornis</i>.</p> <p>Or known shelter tree species for the Bioregion including: <i>Acacia harpophylla</i>, <i>A. salicina</i>, <i>A. tephрина</i>, <i>Corymbia citriodora</i>, <i>C. dallachiana</i>, <i>C. erythrophloia</i>, <i>C. intermedia</i>, <i>C. tessellaris</i>, <i>E. acmenoides</i>, <i>E. baileyana</i>, <i>E. cambageana</i>, <i>E. decorticans</i>, <i>E. platyphylla</i>, <i>E. thozetiana</i>, <i>Melaleuca bracteata</i>.</p> <p>Mapping criteria, differentiating habitat into habitat critical to the survival of the species and areas of general habitat unlikely to represent habitat critical to the survival of the species are detailed below.</p>
	<p>Habitat critical to the survival of the species</p> <p>There is currently no formal definition of habitat critical to the survival of the koala. This is because there is insufficient knowledge and data to unambiguously identify and spatially delineate habitat critical to the survival of the species (DAWE, 2022). In the absence of a formal definition, habitat critical to the survival of the koala should be determined using the broad guidelines specified for species under the EPBC Act (DAWE, 2022). This should consider the following factors:</p> <p>(a) whether the habitat is used during periods of stress (e.g. flood, drought or fire);</p>	<p>Criteria used to map habitat critical to the survival of the koala</p> <p>Areas of habitat critical to the survival of the koala have been considered to include interconnected areas of habitat that provide sufficient amount and quality of food and shelter resources to support a viable koala population, provide corridors for gene flow and drought and climate refugia. For the purposes of this assessment, this has been considered to include all areas of remnant forest, woodland, open woodland and shrubland within the following RE communities field-verified at 382</p>

Species or Value	Habitat description in Commonwealth/State listing advice	Criteria used to map habitat
	<p>(b) whether the habitat is used to meet essential life cycle requirements (examples: foraging, breeding, nesting, roosting, social behaviour patterns or seed dispersal processes);</p> <p>(c) the extent to which the habitat is used by important populations;</p> <p>(d) whether the habitat is necessary to maintain genetic diversity and long-term evolutionary development;</p> <p>(e) whether the habitat is necessary for use as corridors to allow the species to move freely between sites used to meet essential life cycle requirements;</p> <p>(f) whether the habitat is necessary to ensure the long-term future of the species or ecological community through reintroduction or re-colonisation;</p> <p>(g) any other way in which habitat may be critical to the survival of a listed threatened species or a listed threatened ecological community.</p> <p>While habitat needed to meet individual koalas daily requirements include a range of forests or woodlands, road-side and rail vegetation and paddock trees, safe intervening ground matrix for travelling between vegetation areas, at a population level, crucial habitat is considered to include:</p> <ul style="list-style-type: none"> • Habitats that provide sufficient amount and quality of resources to support a viable biological population where mortality, survival, and recruitment are balanced or recruitment increasing to optimal carrying capacity and within the bounds of natural fluctuations • Patches and corridors important for gene flow • Areas that provide climate refugia including drainage lines, riparian zones and patches that are resilient to drying conditions due to favourable hydrological conditions 	<p>locations, which contain the known koala food and shelter trees listed above as diagnostic criteria.</p> <p>8.12.9 <i>Eucalyptus tereticornis</i> +/- <i>Corymbia intermedia</i> +/- <i>Lophostemon suaveolens</i> woodland on undulating uplands on Mesozoic to Proterozoic igneous rocks</p> <p>8.12.32 <i>Corymbia intermedia</i> +/- <i>E. portuensis</i> +/- <i>E. exserta</i> open forest to woodland with areas of <i>Allocasuarina</i> spp. +/- <i>Banksia integrifolia</i> open forest on high ranges on Mesozoic to Proterozoic igneous rocks</p> <p>11.9.4a Semi-evergreen vine thicket or <i>Acacia harpophylla</i> with a semi-evergreen vine thicket understorey on fine-grained sedimentary rocks</p> <p>11.9.10 <i>Eucalyptus populnea</i> open forest with a secondary tree layer of <i>Acacia harpophylla</i> and sometimes <i>Casuarina cristata</i> on fine-grained sedimentary rocks</p> <p>11.3.4 <i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. woodland on alluvial plains</p> <p>11.3.35 <i>Eucalyptus platyphylla</i>, <i>Corymbia clarksoniana</i> woodland on alluvial plains</p> <p>11.3.25 <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines</p> <p>11.3.25a <i>Eucalyptus raveretiana</i> (sometimes emergent), <i>Eucalyptus tereticornis</i> and <i>Melaleuca fluviatilis</i> woodland.</p> <p>11.3.25e <i>Eucalyptus camaldulensis</i>, <i>E. tereticornis</i> woodland fringing larger, permanent water courses.</p> <p>11.3.2 <i>Eucalyptus populnea</i> woodland on alluvial plains</p> <p>11.12.7 <i>Eucalyptus crebra</i> woodland with patches of semi-evergreen vine thicket on igneous rocks (boulder-strewn hillsides)</p> <p>11.12.6a <i>Eucalyptus crebra</i> +/- <i>Corymbia citriodora</i> and/or <i>E. acmenoides</i> +/- <i>Lophostemon suaveolens</i> woodland to open forest.</p> <p>12.11.7 <i>Eucalyptus crebra</i> woodland on metamorphics +/- interbedded volcanics</p> <p>11.12.1 <i>Eucalyptus crebra</i> woodland on igneous rocks</p>

Species or Value	Habitat description in Commonwealth/State listing advice	Criteria used to map habitat
	<p>General koala habitat</p> <p>The definition of koala habitat includes areas of isolated vegetation and paddock trees in previously cleared, non-remnant areas including isolated paddock trees and areas of intervening open ground that provide opportunities for safe transit of koalas at a local scale. These areas may be important for facilitating koala movement, however they would be areas with low abundance and quality of food and shelter trees and areas of tenuous connectivity and high risk (relative to other movement opportunities in the surrounding landscape). While koalas could move through these areas, they would carry high local threats from dog attack and are therefore unlikely to represent crucial areas for gene flow or drought or climate refugia.</p>	<p>11.12.3 <i>Eucalyptus crebra</i>, <i>E. tereticornis</i>, <i>Angophora leiocarpa</i> woodland on igneous rocks especially granite</p> <p>11.11.9 <i>Eucalyptus populnea</i> or <i>E. brownii</i> woodland on deformed and metamorphosed sediments and interbedded volcanics</p> <p>11.11.15 <i>Eucalyptus crebra</i> woodland to open woodland on deformed and metamorphosed sediments and interbedded volcanics</p> <p>11.11.13 <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> low open forest with a secondary tree layer of <i>Terminalia oblongata</i> on deformed and metamorphosed sediments and interbedded volcanics</p> <p>Criteria used to map general koala habitat</p> <p>Areas of general koala habitat that would not constitute habitat critical to the survival of the koala included areas of regrowth woodland within the RE communities detailed above and scattered food and shelter trees in areas of non-remnant vegetation. These were mapped using high resolution aerial imagery based on ground-truthed information from field observations to map individual scattered paddock trees (and intervening areas of open ground) where trees occur within approximately 200 m of other trees or vegetation patches.</p>
Greater glider	<p>Central greater glider habitat</p> <p>Greater glider habitat has been defined based on the formal habitat definition in the Commonwealth listing advice for the species (DCCEEW 2022).</p> <p>The greater glider (southern and central) is largely restricted to eucalypt forests and woodlands of eastern Australia. It is typically found in highest abundance in taller, montane, moist eucalypt forests on fertile soils, with relatively old trees and abundant hollows but also occurs in drier habitats in south-eastern Qld (Eyre 2004).</p> <p>During the day the greater glider (southern and central) shelters in tree hollows, with a particular preference for large hollows (diameter >10 cm) in large, old trees (Henry 1984; Kehl and Borsboom 1984; Lindenmayer <i>et al.</i>, 1991; Smith <i>et al.</i>, 2007; Goldingay 2012). Both live and standing dead trees are used for denning (Goldingay 2012), however the species prefers to use live hollow-bearing trees when adequate numbers are available (Kehl & Borsboom 1984; Kavanagh and Wheeler 2004; Lindenmayer <i>et al.</i>, 2004)</p>	<p>Central greater glider habitat</p> <p>Remnant Eucalypt forest and woodland in the following field-verified REs that contained mature hollow-bearing trees (as observed in field surveys) and occur in polygons connected to (i.e. with gaps less than 20m) larger networks of remnant woodland and forest >160 km²:</p> <p>8.12.9 <i>Eucalyptus tereticornis</i> +/- <i>Corymbia intermedia</i> +/- <i>Lophostemon suaveolens</i> woodland on undulating uplands on Mesozoic to Proterozoic igneous rocks</p> <p>8.12.32 <i>Corymbia intermedia</i> +/- <i>E. portuensis</i> +/- <i>E. exserta</i> open forest to woodland with areas of <i>Allocasuarina</i> spp. +/- <i>Banksia integrifolia</i> open forest on high ranges on Mesozoic to Proterozoic igneous rocks</p> <p>11.9.10 <i>Eucalyptus populnea</i> open forest with a secondary tree layer of <i>Acacia harpophylla</i> and</p>

Species or Value	Habitat description in Commonwealth/State listing advice	Criteria used to map habitat
	<p>The probability of occurrence of the species is positively correlated with the availability of tree hollows (Andrews <i>et al.</i>,1994; Smith <i>et al.</i>,1994a,b; Lindenmayer <i>et al.</i>,2020), which is a key limiting resource. Greater gliders (southern and central) can be found in regrowth forest provided sufficient hollows are present (Macfarlane 1988; Lindenmayer <i>et al.</i>,1990a), and conversely are absent when there are insufficient hollows. In the Grafton/Casino region of NSW, the species was not recorded from surveyed sites containing fewer than six tree hollows per hectare (Smith <i>et al.</i>,1994). In southern Qld, the species appears to require at least 2–4 live den trees for every 2 ha of suitable forest habitat (Eyre 2002). In five studies across its geographic range, the greater glider was found to utilise 25 different tree species for denning (Goldingay 2012).</p> <p>The greater glider (southern and central) is primarily folivorous, with a diet mostly comprising eucalypt leaves supplemented by buds and flowers (Kehl & Borsboom 1984; Kavanagh & Lambert 1990; van der Ree <i>et al.</i>,2004).</p> <p>Greater gliders are sensitive to fragmentation (McCarthy & Lindenmayer 1999a,b; Lindenmayer <i>et al.</i>,2000; Eyre 2006; Taylor & Goldingay 2009). Although greater gliders have small home ranges, their low reproductive rate and sensitivity to disturbance means they tend to become locally extinct in small and fragmented habitat patches.</p> <p>It is difficult to identify the smallest patch size used, as this likely varies across the range depending on vegetation type, quality, connectivity and other environmental factors. Greater gliders have been found in habitat patches <10 ha in some fragmented and remnant forest patches in the southern part of their geographic range (Pope <i>et al.</i>,2004; Lindenmayer 2002), but have been found to require access to larger habitat patches in Queensland, with modelling indicating some Queensland populations required connectivity to at least 160 km² of remnant forest to maintain viable populations ((Eyre 2002).</p> <p>Habitat critical to the survival of the species</p> <p>Habitat critical to survival for the greater glider (southern and central) may be broadly defined as (noting that geographic areas containing habitat critical to survival needs to be defined by forest type on a regional basis):</p> <ul style="list-style-type: none"> • Large contiguous areas of eucalypt forest, which contain mature hollow-bearing trees¹ and a diverse range of the species' preferred food species in a particular region; and • Smaller or fragmented habitat patches connected to larger patches of habitat, that can facilitate dispersal of the species and/or that enable recolonization; and • Cool microclimate forest/woodland areas (e.g. protected gullies, sheltered high elevation areas, coastal lowland areas, southern slopes); and • Areas identified as refuges under future climate changes scenarios; and 	<p>sometimes <i>Casuarina cristata</i> on fine-grained sedimentary rocks</p> <p>11.3.4 <i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. woodland on alluvial plains</p> <p>11.3.35 <i>Eucalyptus platyphylla</i>, <i>Corymbia clarksoniana</i> woodland on alluvial plains</p> <p>11.3.25 <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines</p> <p>11.3.25a <i>Eucalyptus raveretiana</i> (sometimes emergent), <i>Eucalyptus tereticornis</i> and <i>Melaleuca fluviatilis</i> woodland.</p> <p>11.3.25e <i>Eucalyptus camaldulensis</i>, <i>E. tereticornis</i> woodland fringing larger, permanent water courses.</p> <p>11.3.25b <i>Melaleuca leucadendra</i> and/or <i>M. fluviatilis</i>, <i>Nauclea orientalis</i> open forest. Riverine wetland or fringing riverine wetland.</p> <p>11.3.2 <i>Eucalyptus populnea</i> woodland on alluvial plains</p> <p>11.12.7 <i>Eucalyptus crebra</i> woodland with patches of semi-evergreen vine thicket on igneous rocks (boulder-strewn hillsides)</p> <p>11.12.6a <i>Eucalyptus crebra</i> +/- <i>Corymbia citriodora</i> and/or <i>E. acmenoides</i> +/- <i>Lophostemon suaveolens</i> woodland to open forest.</p> <p>12.11.7 <i>Eucalyptus crebra</i> woodland on metamorphics +/- interbedded volcanics</p> <p>11.12.1 <i>Eucalyptus crebra</i> woodland on igneous rocks</p> <p>11.12.3 <i>Eucalyptus crebra</i>, <i>E. tereticornis</i>, <i>Angophora leiocarpa</i> woodland on igneous rocks especially granite</p> <p>11.11.9 <i>Eucalyptus populnea</i> or <i>E. brownii</i> woodland on deformed and metamorphosed sediments and interbedded volcanics</p> <p>11.11.15 <i>Eucalyptus crebra</i> woodland to open woodland on deformed and metamorphosed sediments and interbedded volcanics</p> <p>11.11.13 <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> low open forest with a secondary tree layer of <i>Terminalia oblongata</i> on deformed and metamorphosed sediments and interbedded volcanics</p>

Species or Value	Habitat description in Commonwealth/State listing advice	Criteria used to map habitat
	<ul style="list-style-type: none"> Short-term or long-term post-fire refuges (i.e. unburnt habitat within or adjacent to recently burnt landscapes) that allow the species to persist, recover and recolonise burnt areas. 	<p>RE habitat mapping was used to provide the foundation, and was refined by removing areas ground-truthed to have low densities of mature trees.</p> <p>Habitat critical to the survival of the species</p> <p>All mapped habitat was considered habitat critical to the survival of the species.</p>
Squatter pigeon (southern)	<p>Squatter pigeon habitat</p> <p>Squatter pigeon (southern) habitat has been defined based on the formal habitat definition in the Commonwealth listing advice for the species (DAWE 2022).</p> <p>Habitat is generally defined as open-forests to sparse, open-woodlands and scrub that are (Baldwin 1975; Beruldsen 1972; Cooper <i>et al.</i>,2014; EPA 2006; Frith 1982b; Leach 1988; North 1913-14; Squatter Pigeon Workshop 2011)</p> <ul style="list-style-type: none"> Mostly dominated in the overstorey by Eucalyptus, Corymbia, Acacia or Callitris species Remnant, regrowth or partly modified vegetation communities, and within 3 km of water bodies or courses. <p>Breeding habitat: Occurs on stony rises occurring on sandy or gravelly soils, within 1 km of a suitable, permanent waterbody (Squatter Pigeon Workshop 2011). In Queensland, the Commonwealth listing advice specifically nominates RE Land Zone 5 (well-draining, sandy or loamy soils on low, gently sloping, flat to undulating plains and foothills) and RE Land Zone 7 (lateritic (duplex) soils on low 'jump-ups' and escarpments) as suitable foraging and breeding habitat for the species.</p> <p>Foraging habitat: Any remnant or regrowth open-forest to sparse, open-woodland or scrub dominated by Eucalyptus, Corymbia, Acacia or Callitris species, on sandy or gravelly soils, within 3 km of a suitable, permanent or seasonal waterbody (Squatter Pigeon Workshop 2011). As detailed above, this includes RE land zone 5 and 7. Ground-level vegetation is typically patchy with vegetation cover rarely exceeding 33% (Squatter Pigeon Workshop 2011).</p> <p>Drinking sites: Waterbodies that provide suitable drinking sites for the subspecies occur on the lower, gentle slopes and plateaus of sandstone ranges (equivalent to Queensland RE Land Zone 10), alluvial clay soils on river or creek flats (represented by Queensland RE Land Zone 3) or non-alluvial clay soils on flats or plains which are not associated with current alluvial deposits (represented by Queensland RE Land Zone 4).</p> <p>Dispersal habitat: Any forest or woodland occurring between patches of foraging or breeding habitat, and suitable waterbodies. Such patches of vegetation tend not to be suitable for the subspecies' foraging or breeding, but facilitate the local movement of the subspecies between patches of foraging habitat, breeding habitat and/or waterbodies, or the wider dispersal of</p>	<p>Squatter pigeon habitat</p> <p>Mapping of squatter pigeon (southern) habitat was based on remnant and regrowth vegetation coinciding with the following RE communities that are identified by the Queensland (DoR) essential habitat mapping framework as essential habitat factors for the squatter pigeon (southern) as a basis for mapping. This was differentiated into breeding, foraging and dispersal habitat based on the categories below.</p> <p>Breeding habitat: Remnant and regrowth open forest and woodland in the following REs that occur on suitable (stony) land zones and occur within 1 km of permanent waterbody. While the Commonwealth listing advice nominates only land zone 5 and 7 as suitable breeding habitat, as no land zone 5 or 7 occurs within proximity of the local records, land zone 12 RE have been included due to their suitable stony substrate:</p> <p>8.12.9 <i>Eucalyptus tereticornis</i> +/- <i>Corymbia intermedia</i> +/- <i>Lophostemon suaveolens</i> woodland on undulating uplands on Mesozoic to Proterozoic igneous rocks</p> <p>8.12.32 <i>Corymbia intermedia</i> +/- <i>E. portuensis</i> +/- <i>E. exserta</i> open forest to woodland with areas of <i>Allocasuarina</i> spp. +/- <i>Banksia integrifolia</i> open forest on high ranges on Mesozoic to Proterozoic igneous rocks</p> <p>11.12.1 <i>Eucalyptus crebra</i> woodland on igneous rocks</p> <p>11.12.3 <i>Eucalyptus crebra</i>, <i>E. tereticornis</i>, <i>Angophora leiocarpa</i> woodland on igneous rocks especially granite</p> <p>11.12.6a <i>Eucalyptus crebra</i> +/- <i>Corymbia citriodora</i> and/or <i>E. acmenoides</i> +/- <i>Lophostemon suaveolens</i> woodland to open forest.</p> <p>11.12.7 <i>Eucalyptus crebra</i> woodland with patches of semi-evergreen vine thicket on igneous rocks (boulder-strewn hillsides)</p>

Species or Value	Habitat description in Commonwealth/State listing advice	Criteria used to map habitat
	<p>individuals in search of reliable water sources during the dry season or during droughts (Squatter Pigeon Workshop 2011). Waterbodies that are suitable for the squatter pigeon (southern) occur on RE land zones 10, 3 and 4 (DAWE 2022). Hence, where natural foraging or breeding habitat occurs (i.e. on RE Land Zones 5 and 7), the squatter pigeon (southern) may be found in vegetation types growing on the above soil types (DAWE 2022). Clay soils usually support denser vegetation types which the Squatter Pigeon (southern) is unlikely to use as foraging or breeding habitat</p> <p>Habitat critical to the survival of the species</p> <p>Habitat critical to the survival of the species has not been defined for the squatter pigeon (southern). The definition outlined in the Significant impact guidelines 1.1 (DoE 2013) has been applied. This considers habitat critical to the survival of a species or ecological community' to be areas that are necessary:</p> <ul style="list-style-type: none"> • For activities such as foraging, breeding, roosting, or dispersal • For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators) • To maintain genetic diversity and long term evolutionary development, or • For the reintroduction of populations or recovery of the species or ecological community. 	<p>Foraging habitat: Remnant and regrowth open forest and woodland in the REs nominated below that occur on sandy or stony land zones and occur within 3 km of permanent or seasonal water:</p> <p>8.12.9 <i>Eucalyptus tereticornis</i> +/- <i>Corymbia intermedia</i> +/- <i>Lophostemon suaveolens</i> woodland on undulating uplands on Mesozoic to Proterozoic igneous rocks</p> <p>8.12.32 <i>Corymbia intermedia</i> +/- <i>E. portuensis</i> +/- <i>E. exserta</i> open forest to woodland with areas of <i>Allocasuarina</i> spp. +/- <i>Banksia integrifolia</i> open forest on high ranges on Mesozoic to Proterozoic igneous rocks</p> <p>11.11.9 <i>Eucalyptus populnea</i> or <i>E. brownii</i> woodland on deformed and metamorphosed sediments and interbedded volcanics</p> <p>11.11.15 <i>Eucalyptus crebra</i> woodland to open woodland on deformed and metamorphosed sediments and interbedded volcanics</p> <p>11.12.1 <i>Eucalyptus crebra</i> woodland on igneous rocks</p> <p>11.12.3 <i>Eucalyptus crebra</i>, <i>E. tereticornis</i>, <i>Angophora leiocarpa</i> woodland on igneous rocks especially granite</p> <p>11.12.6a <i>Eucalyptus crebra</i> +/- <i>Corymbia citriodora</i> and/or <i>E. acmenoides</i> +/- <i>Lophostemon suaveolens</i> woodland to open forest.</p> <p>11.12.7 <i>Eucalyptus crebra</i> woodland with patches of semi-evergreen vine thicket on igneous rocks (boulder-strewn hillsides)</p> <p>RE communities immediately adjacent to the river (RE 11.3.25) were not mapped as foraging habitat due to high scour which reduced foraging values.</p> <p>Drinking habitat: A 100m buffer of all permanent waterbodies (including farm dams and watercourses with stream order 3 and above) that occur on land zone 3, 4 and 10 including the following REs</p> <p>11.3.2 <i>Eucalyptus populnea</i> woodland on alluvial plains</p> <p>11.3.4 <i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. woodland on alluvial plains</p> <p>11.3.25 <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines</p>

Species or Value	Habitat description in Commonwealth/State listing advice	Criteria used to map habitat
		<p>11.3.25a <i>Eucalyptus raveretiana</i> (sometimes emergent), <i>Eucalyptus tereticornis</i> and <i>Melaleuca fluviatilis</i> woodland.</p> <p>11.3.25e <i>Eucalyptus camaldulensis</i>, <i>E. tereticornis</i> woodland fringing larger, permanent water courses.</p> <p>11.3.25b <i>Melaleuca leucadendra</i> and/or <i>M. fluviatilis</i>, <i>Nauclea orientalis</i> open forest. Riverine wetland or fringing riverine wetland.</p> <p>11.3.35 <i>Eucalyptus platyphylla</i>, <i>Corymbia clarksoniana</i> woodland on alluvial plains</p> <p>Dams – marked via field observation and aerial imagery</p> <p>Dispersal habitat: Any remnant and regrowth open forest and woodland communities that occur between areas of foraging or breeding habitat and suitable waterbodies on land zone 3, 4 or 10.</p> <p>11.3.4 <i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. woodland on alluvial plains</p> <p>11.3.35 <i>Eucalyptus platyphylla</i>, <i>Corymbia clarksoniana</i> woodland on alluvial plains</p> <p>11.3.25 <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines</p> <p>11.3.25a <i>Eucalyptus raveretiana</i> (sometimes emergent), <i>Eucalyptus tereticornis</i> and <i>Melaleuca fluviatilis</i> woodland.</p> <p>11.3.25e <i>Eucalyptus camaldulensis</i>, <i>E. tereticornis</i> woodland fringing larger, permanent water courses.</p> <p>11.3.25b <i>Melaleuca leucadendra</i> and/or <i>M. fluviatilis</i>, <i>Nauclea orientalis</i> open forest. Riverine wetland or fringing riverine wetland.</p> <p>11.3.2 <i>Eucalyptus populnea</i> woodland on alluvial plains</p> <p>Habitat critical to the survival of the species</p> <p>In the current context, all breeding and foraging habitat was considered habitat critical to the survival of the species.</p>
Grey-headed flying fox	<p>Grey-headed flying-fox habitat</p> <p>Grey-headed flying-fox habitat has been defined based on the formal definition outlined in the Commonwealth listing advice for the species (DAWE 2022) and</p>	<p>Grey-headed flying-fox foraging habitat</p> <p>No roosting habitat occurs within the CEH PHES Project area. The nearest known roosting camp is located at</p>

Species or Value	Habitat description in Commonwealth/State listing advice	Criteria used to map habitat
	<p>the <i>National Recovery Plan for the Grey-headed Flying-fox Pteropus poliocephalus</i> (DAWE 2021).</p> <p>Roosting habitat: Roost vegetation includes rainforest patches, stands of <i>Melaleuca</i>, mangroves and riparian vegetation (Nelson 1965a; Ratcliffe 1931), but colonies also use highly modified vegetation in urban and suburban areas (Birt <i>et al.</i>,1998; Tidemann & Vardon 1997; van der Ree <i>et al.</i>,2005). The species can maintain fidelity to roost sites for extended periods (Lunney & Moon 1997), although new sites have been colonised (Tidemann & Vardon 1997), cited in DAWE (2022)).</p> <p>Foraging habitat: The grey-headed flying-fox feeds primarily on blossoms and fruit in canopy vegetation, and supplements this diet with leaves (Parry-Jones and Augee 1991, Eby 1995, Eby 1998, Tidemann 1999, Hall and Richards 2000). Major food plants include the fruit and blossom of rainforest species, especially <i>Ficus</i> spp., and blossoms of myrtaceous species such as <i>Eucalyptus</i>, <i>Corymbia</i> and <i>Angophora</i>, <i>melaleucas</i>, <i>banksias</i> (Eby and Law 2008) and the fruit and flowers of <i>Syzygium</i> spp. (Roberts 2006, Eby 1991).</p> <p>The primary food source is blossom from <i>Eucalyptus</i> and related genera but in some areas it also utilises a wide range of rainforest fruits (Eby 1998). None of the vegetation communities used by the grey-headed flying-fox produce continuous foraging resources throughout the year. As a result, the species has adopted complex migration traits in response to ephemeral and patchy food resources ((Duncan <i>et al.</i>,1999; Eby 1996, 1998; Nelson 1965a; Parry-Jones and Augee 1992; Spencer <i>et al.</i>,1991), cited in DAWE (2022)).</p> <p>Grey-headed flying-foxes forage over extensive areas and have been known to fly as far as 40 km to feed, before returning to their roost the same night (Eby 1991).</p> <p>Habitat critical to the survival of the species</p> <p>Habitat critical to the survival of the species includes plant species that flower in winter and spring, when foraging resources are in limited supply. Important winter and spring vegetation communities are those that contain <i>Eucalyptus tereticornis</i>, <i>E. albens</i>, <i>E. crebra</i>, <i>E. fibrosa</i>, <i>E. melliodora</i>, <i>E. paniculata</i>, <i>E. pilularis</i>, <i>E. robusta</i>, <i>E. seeana</i>, <i>E. sideroxylon</i>, <i>E. siderophloia</i>, <i>Banksia integrifolia</i>, <i>Castanospermum australe</i>, <i>Corymbia citriodora citriodora</i>, <i>C. eximia</i>, <i>C. maculata</i>, <i>Grevillea robusta</i>, <i>Melaleuca quinquenervia</i> or <i>Syncarpia glomulifera</i> (Eby and Law 2008; Eby 2016; Eby et al., 2019).</p>	<p>Eungella State School, with between 500 and 2,499 grey-headed flying-foxes recorded in February 2022.</p> <p>Critical winter foraging habitat was mapped as remnant and regrowth woodland and open woodland communities that correspond with the following REs that are dominated by winter and spring forage species:</p> <p>11.3.4 <i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. woodland on alluvial plains</p> <p>11.3.25 <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines</p> <p>11.3.25a <i>Eucalyptus raveretiana</i> (sometimes emergent), <i>Eucalyptus tereticornis</i> and <i>Melaleuca fluviatilis</i> woodland.</p> <p>11.3.25b <i>Melaleuca leucadendra</i> and/or <i>M. fluviatilis</i>, <i>Nauclea orientalis</i> open forest. Riverine wetland or fringing riverine wetland.</p> <p>11.3.25e <i>Eucalyptus camaldulensis</i>, <i>E. tereticornis</i> woodland fringing larger, permanent water courses.</p> <p>11.3.2 <i>Eucalyptus populnea</i> woodland on alluvial plains</p> <p>11.12.7 <i>Eucalyptus crebra</i> woodland with patches of semi-evergreen vine thicket on igneous rocks (boulder-strewn hillsides)</p> <p>11.12.6a <i>Eucalyptus crebra</i> +/- <i>Corymbia citriodora</i> and/or <i>E. acmenoides</i> +/- <i>Lophostemon suaveolens</i> woodland to open forest.</p> <p>12.11.7 <i>Eucalyptus crebra</i> woodland on metamorphics +/- interbedded volcanics</p> <p>11.12.1 <i>Eucalyptus crebra</i> woodland on igneous rocks</p> <p>11.12.3 <i>Eucalyptus crebra</i>, <i>E. tereticornis</i>, <i>Angophora leiocarpa</i> woodland on igneous rocks especially granite</p> <p>11.11.15 <i>Eucalyptus crebra</i> woodland to open woodland on deformed and metamorphosed sediments and interbedded volcanics</p> <p>Suitable foraging habitat was mapped as remnant and regrowth <i>Eucalypt</i> woodland and open woodland communities that correspond with field-verified REs that</p>

Species or Value	Habitat description in Commonwealth/State listing advice	Criteria used to map habitat
		<p>include known food tree species. These include the following RE communities:</p> <p>8.12.9 <i>Eucalyptus tereticornis</i> +/- <i>Corymbia intermedia</i> +/- <i>Lophostemon suaveolens</i> woodland on undulating uplands on Mesozoic to Proterozoic igneous rocks</p> <p>8.12.32 <i>Corymbia intermedia</i> +/- <i>E. portuensis</i> +/- <i>E. exserta</i> open forest to woodland with areas of <i>Allocasuarina</i> spp. +/- <i>Banksia integrifolia</i> open forest on high ranges on Mesozoic to Proterozoic igneous rocks</p> <p>11.9.10 <i>Eucalyptus populnea</i> open forest with a secondary tree layer of <i>Acacia harpophylla</i> and sometimes <i>Casuarina cristata</i> on fine-grained sedimentary rocks</p> <p>11.3.35 <i>Eucalyptus platyphylla</i>, <i>Corymbia clarksoniana</i> woodland on alluvial plains</p> <p>11.11.9 <i>Eucalyptus populnea</i> or <i>E. brownii</i> woodland on deformed and metamorphosed sediments and interbedded volcanics</p> <p>11.11.15 <i>Eucalyptus crebra</i> woodland to open woodland on deformed and metamorphosed sediments and interbedded volcanics</p> <p>8.12.32 <i>Corymbia intermedia</i> +/- <i>E. portuensis</i> +/- <i>E. exserta</i> open forest to woodland with areas of <i>Allocasuarina</i> spp. +/- <i>Banksia integrifolia</i> open forest on high ranges on Mesozoic to Proterozoic igneous rocks</p> <p>Individual patches of grey-headed flying-fox food trees within areas of non-remnant vegetation. These were mapped using high resolution aerial imagery based on ground-truthed information from field observations.</p> <p>Habitat critical to the survival of the species</p> <p>Habitat critical to the survival of the species was mapped as areas of foraging habitat that were dominated by winter and spring forage species and occur within 40 km of (i.e. foraging distance) of the nearest roost camp as detailed above.</p>
Yellow-bellied glider (southern)	<p>Yellow-bellied glider habitat</p> <p>Yellow-bellied glider habitat has been defined based on the formal definition outlined in the Commonwealth listing advice for the species (DCCEEW 2022).</p>	<p>Yellow-bellied glider habitat</p> <p>Mapping of habitat for the yellow-bellied glider has been based on all remnant within the following REs that support tall, smooth-barked eucalypts including preferred</p>

Species or Value	Habitat description in Commonwealth/State listing advice	Criteria used to map habitat
	<p>The yellow-bellied glider (south-eastern) occurs in eucalypt-dominated woodlands and forests, including both wet and dry sclerophyll forests (Kavanagh <i>et al.</i>,1995; Rees <i>et al.</i>,2007). Abundance is highly dependent on habitat suitability, which is in turn determined by forest age and floristics (Woinarski <i>et al.</i>,2014).</p> <p>The subspecies shows a preference for large patches of mature old growth forest that provide suitable trees for foraging and shelter (Milledge <i>et al.</i>,1991; Eyre & Smith 1997; Incoll <i>et al.</i>,2001; Eyre & Goldingay 2003; Eyre 2002, 2004; van der Ree <i>et al.</i>,2004; Kavanagh <i>et al.</i>,2021). There is also a clear preference for forests with a high proportion of winter-flowering and smooth-barked eucalypts (Kavanagh 1987a; Eyre & Smith 1997; Eyre 2004; Irish & Kavanagh 2011; Woinarski <i>et al.</i>,2014).</p> <p>Smooth-barked eucalypts are important due to the range of foraging substrates (and therefore food resources) they provide, as loose bark hanging in strips from these trees provides shelter for insect prey (Eyre & Smith 1997). Yellow-bellied gliders (south-eastern) also require some level of floristic diversity to provide a year-round food supply, and they are unlikely to persist in forests dominated by only one or two tree species (Kavanagh 1987a). Home ranges are necessarily large, because the trees used as foraging substrates are dispersed and use of trees can vary through time and space (Woinarski <i>et al.</i>,2014).</p> <p>Goldingay and Possingham (1995) suggest that minimum habitat areas of 180–350 km² are required to maintain a viable subpopulation, with a minimum of 150 glider groups within a habitat area required to achieve a probability of persistence of 0.95 over 100 years. The subspecies has very low dispersal capabilities over spaces larger than its gliding distance. Average gliding distance in low-canopy forest has been documented at 25.2 m, and it is suggested a glide ratio (horizontal distance/height dropped) of 2.0 should be used to estimate gliding distance for management decisions (Goldingay 2014).</p> <p>During the day, the yellow-bellied glider (south-eastern) shelters in hollows found in large, old trees, usually more than one metre in diameter (Kambouris <i>et al.</i>,2013). Hollow-bearing trees are a critical habitat feature for the yellow-bellied glider (south-eastern) (Goldingay 2011; Goldingay <i>et al.</i>,2019) due to their usage as dens. Hollow-bearing trees used by the yellow-bellied glider (south-eastern) are primarily living, smooth-barked eucalypts of multiple species.</p> <p>The yellow-bellied glider feeds on insects and exudates from incisions cut in smooth-bark eucalypts with preferred food trees including grey gums (<i>Eucalyptus longirostrata</i> and <i>Eucalyptus biturbinata</i>), forest red gum (<i>Eucalyptus tereticornis</i>), gum-topped box (<i>Eucalyptus mollucana</i>) and spotted gum (<i>Corymbia citriodora</i>) (Queensland Museum 2022).</p> <p>Habitat critical to the survival of the species</p>	<p>food tree species as detailed in Appendix A of (DCCEEW 2022):</p> <p>And occur in polygons connected to (i.e. with gaps less than 20m) larger networks > 160 km² of remnant forest and open forest (i.e. vegetation communities with higher tree densities than woodland and open woodland)</p> <p>8.12.9 <i>Eucalyptus tereticornis</i> +/- <i>Corymbia intermedia</i> +/- <i>Lophostemon suaveolens</i> woodland on undulating uplands on Mesozoic to Proterozoic igneous rocks</p> <p>11.3.4 <i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. woodland on alluvial plains</p> <p>11.3.25 <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines</p> <p>11.3.25a <i>Eucalyptus raveretiana</i> (sometimes emergent), <i>Eucalyptus tereticornis</i> and <i>Melaleuca fluviatilis</i> woodland.</p> <p>11.3.25b <i>Melaleuca leucadendra</i> and/or <i>M. fluviatilis</i>, <i>Nauclea orientalis</i> open forest. Riverine wetland or fringing riverine wetland.</p> <p>11.3.25e <i>Eucalyptus camaldulensis</i>, <i>E. tereticornis</i> woodland fringing larger, permanent water courses.</p> <p>11.12.6a <i>Eucalyptus crebra</i> +/- <i>Corymbia citriodora</i> and/or <i>E. acmenoides</i> +/- <i>Lophostemon suaveolens</i> woodland to open forest.</p> <p>11.12.3 <i>Eucalyptus crebra</i>, <i>E. tereticornis</i>, <i>Angophora leiocarpa</i> woodland on igneous rocks especially granite</p> <p>Habitat critical to the survival of the species</p> <p>All foraging and denning habitat was considered habitat critical to the survival of the species.</p>

Species or Value	Habitat description in Commonwealth/State listing advice	Criteria used to map habitat
	<p>Habitat critical to the survival of the yellow-bellied glider (south-eastern) may be broadly defined as areas containing the following attributes (noting that geographic areas containing habitat critical to survival needs to be defined by forest type on a regional basis):</p> <ul style="list-style-type: none"> • Large contiguous areas of floristically diverse eucalypt forest, which are dominated by winter-flowering and smooth-barked eucalypts, including mature living hollow-bearing trees and sap trees (see Appendix A); • Areas identified as refuges under future climate change scenarios; • Short or long-term post-fire refuges (i.e., unburnt habitat within or adjacent to recently burnt landscapes) that allow the species to persist, recover and recolonise burnt areas; • Habitat corridors required to facilitate dispersal of the subspecies between fragmented habitat patches and/or that enable recolonization or movement away from threats. yellow-bellied gliders (south-eastern) have a glide ratio (horizontal distance/height dropped) of around 2.0, and corridors spanning gaps larger than the distance gliders are likely to be able to travel should be considered critical to the survival. There is not enough evidence to define the canopy and width characteristics of appropriate corridors. In the absence of such information, a precautionary approach should be taken to maximise dispersal by considering all habitat corridors in the species' range to be habitat critical to the survival; and • Areas in which some trees have evidence of use for sap extraction by yellow-bellied glider (south-eastern). 	
Northern quoll	<p>Northern quoll habitat</p> <p>Northern quoll habitat has been defined based on the formal definition outlined in the Commonwealth listing advice for the species (DAWE 2022), the Referral guidelines for the endangered northern quoll <i>Dasyurus hallucatus</i> (DoE 2016) and in the National Recovery Plan for the Northern quoll <i>Dasyurus hallucatus</i> (Hill and Ward 2010).</p> <p>The northern quoll occupies a diversity of habitats across its range which includes rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert (Threatened Species Scientific Committee 2005aq). Northern Quoll habitat generally encompasses some form of rocky area for denning purposes with surrounding vegetated habitats used for foraging and dispersal.</p> <p>Denning habitat: Denning habitat is typically associated with some form of rocky area. Rocky habitats are usually of high relief, often rugged and dissected.</p> <p>Foraging/dispersal habitat: Dispersal habitat includes a broad range of vegetated habitats in areas surrounding denning habitat.</p> <p>Habitat critical to the survival of the species</p>	<p>Northern quoll habitat</p> <p>Mapping of northern quoll habitat was based on remnant and regrowth Eucalypt forest, woodland and shrubland in areas within proximity to rocky refugial habitat.</p> <p>Denning habitat: Denning habitat was mapped in areas of Eucalypt woodland with outcropping granite boulders. Within the CEH PHES Project study area this was located in the following RE:</p> <p>11.12.4 Semi-evergreen vine thicket and microphyll vine forest on igneous rocks</p> <p>11.12.6a <i>Eucalyptus crebra</i> +/- <i>Corymbia citriodora</i> and/or <i>E. acmenoides</i> +/- <i>Lophostemon suaveolens</i> woodland to open forest.</p> <p>11.12.7 <i>Eucalyptus crebra</i> woodland with patches of semi-evergreen vine thicket on igneous rocks (boulder-strewn hillsides)</p>

Species or Value	Habitat description in Commonwealth/State listing advice	Criteria used to map habitat
	<p>Habitat critical to survival is that where northern quolls are least exposed to threats or least likely to be in the future. Given the threats imposed by cane toads, feral predators, inappropriate fire regimes, habitat destruction and degradation, two particular broad habitat types fall into this category: rocky areas and offshore islands. A recent survey found the most abundant remnant northern quoll populations on the Queensland coast were at sites with large boulders (Foster and Oakwood pers. comm. 2008). Rocky areas retain water and have a diversity of microhabitats, so support higher floristic diversity and productivity and thus greater prey density and/or diversity compared to non-rocky adjacent country (Burnett 1997). In addition, cats forage less effectively in rocky areas. Their topographic complexity may also serve to ameliorate fire impacts, and they are typically not used for livestock production.</p>	<p>As 11.12.7 typically occurred in mixed heterogeneous polygons with 11.12.1 an RE which does not typically support outcropping rock. Areas with denning habitat were separated based on examination of high-resolution aerial imagery.</p> <p>Foraging habitat: All remnant and regrowth forest, woodland and shrubland within 10 km of denning habitat.</p> <p>Habitat critical to the survival of the species</p> <p>All denning habitat is considered habitat critical to the survival of the species</p>
White-throated needletail	<p>White-throated needletail habitat</p> <p>White-throated needletail habitat has been defined based on the formal habitat definition in the Commonwealth listing advice for the species (TSSC 2019; DAWE 2022) and recent peer-reviewed literature (Tarburton 2021).</p> <p>In Australia, the White-throated Needletail is mostly aerial, from heights of less than 1 m up to more than 1000 m above the ground (Coventry 1989; Tarburton 1993). Although they occur over most types of habitat, they are recorded most often above wooded areas, including open forest and rainforest, and may also fly below the canopy between trees or in clearings (Higgins 1999). The species is a non-breeding migrant to Australia (TSSC 2019).</p> <p>Roosting habitat: The species roosts in trees amongst dense foliage in the canopy or in hollows ((Corben <i>et al.</i>, 1982; Day 1993; Quested 1982; Tarburton 1993, 2015) cited in TSSC (2019)). Roosting is typically on vertical trunks and upper branches of trees at the edge of forest breaks or on ridgetops, where birds would have some height to gain air-speed when departing in the morning (Tarburton 2021).</p> <p>Foraging habitat: In Australia, white-throated needletails almost always forage aerially, at heights up to 'cloud level', above a wide variety of habitats ranging from heavily treed forests to open habitats, such as farmland, heathland or mudflats (Learmonth 1951; McDonald 1938; Tarburton 1993; Templeton 1991). Because they are aerial, it has been stated that conventional habitat descriptions are inapplicable (Cramp 1985), but there are, nevertheless, certain preferences exhibited by the species. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland (Higgins 1999), cited in DAWE (2022))</p>	<p>White throated needletail</p> <p>Due to the species' aerial nature, the species has no strict reliance on defined foraging habitats. Foraging habitat has not been mapped on that basis. Roosting habitat has been mapped based on the criteria outlined below.</p> <p>Roosting habitat: Suitable roosting habitat has been mapped in all Eucalypt woodland REs that occur within 20 m of ridgetops and cliffs (identified from elevation contour mapping) where drops allow birds to readily alight from tree-tops.</p> <p>Habitat critical to the survival of the species: All roosting habitat has been considered habitat critical to the survival of the species.</p>
Fork-tailed swift	Fork-tailed swift habitat	Fork-tailed swift habitat

Species or Value	Habitat description in Commonwealth/State listing advice	Criteria used to map habitat
	<p>Fork-tailed swift habitat has been defined based on the formal habitat definition in the Commonwealth listing advice for the species (DAWE 2022g).</p> <p>The fork-tailed swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes. The sometimes occur above rainforests, wet sclerophyll forest or open forest or plantations of pines (Higgins 1999). They forage aerially, up to hundreds of metres above ground, but also less than 1 m above open areas or over water (DAWE 2022g). They likely roost aerially, but are occasionally observed to land (Higgins 1999), cited in DAWE (2022g)).</p>	<p>Due to the species exclusively aerial nature, habitat has not been mapped for the species.</p>
<p>Black-faced monarch, Spectacled monarch, Satin flycatcher, Rufous fantail</p>	<p>Black-faced monarch</p> <p>Habitat for the black-faced monarch has been defined based on the descriptions outlined in the Draft Referral Guideline for 14 bird listed as migratory species under the EPBC Act (DoE 2015).</p> <p>Wet forest specialist, found mainly in rainforest and wet sclerophyll forest, especially in sheltered gullies and slopes with a dense understorey of ferns and/or shrubs (DoE 2015).</p> <p>Spectacled monarch</p> <p>Habitat for the spectacled monarch has been defined based on the descriptions outlined in the Draft Referral Guideline for 14 bird listed as migratory species under the EPBC Act (DoE 2015).</p> <p>The spectacled monarch occurs in dense vegetation, mainly in rainforest but also in moist forest or wet sclerophyll and occasionally in other dense vegetation such as mangroves, drier forest and woodlands (DoE 2015).</p> <p>Satin flycatcher</p> <p>Habitat for the satin flycatcher has been defined based on the descriptions outlined in the Draft Referral Guideline for 14 bird listed as migratory species under the EPBC Act (DoE 2015).</p> <p>The satin flycatcher occurs in Eucalypt forest and woodlands, at high elevations when breeding. They are particularly common in tall wet sclerophyll forest, often in gullies or along water courses. In woodlands they prefer open, grassy woodland types. During migration, habitat preferences expand, with the species recorded in most wooded habitats except rainforests. Wintering birds in northern Qld will use rainforest - gallery forests interfaces, and birds have been recorded wintering in mangroves and paperbark swamps (DoE 2015).</p> <p>Rufous fantail</p>	<p>Black-faced monarch and Spectacled monarch habitat</p> <p>Habitat for the spectacled monarch has been mapped in areas of riparian Eucalypt forest with a closed canopy and dense gullies:</p> <p>11.9.4a Semi-evergreen vine thicket or <i>Acacia harpophylla</i> with a semi-evergreen vine thicket understorey on fine-grained sedimentary rocks</p> <p>11.3.25 <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines</p> <p>11.3.25a <i>Eucalyptus raveretiana</i> (sometimes emergent), <i>Eucalyptus tereticornis</i> and <i>Melaleuca fluviatilis</i> woodland.</p> <p>11.3.25b <i>Melaleuca leucadendra</i> and/or <i>M. fluviatilis</i>, <i>Nauclea orientalis</i> open forest. Riverine wetland or fringing riverine wetland.</p> <p>11.3.25e <i>Eucalyptus camaldulensis</i>, <i>E. tereticornis</i> woodland fringing larger, permanent water courses.</p> <p>11.12.4 Semi-evergreen vine thicket and microphyll vine forest on igneous rocks</p> <p>Rufous fantail and Satin flycatcher</p> <p>Habitat for the rufous fantail has been mapped in areas of riparian Eucalypt forest and dry eucalypt forests and woodland:</p> <p>11.3.25 <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines</p>

Species or Value	Habitat description in Commonwealth/State listing advice	Criteria used to map habitat
	<p>Habitat for the rufous fantail has been defined based on the descriptions outlined in the Draft Referral Guideline for 14 bird listed as migratory species under the EPBC Act (DoE 2015).</p> <p>The rufous fantail occurs in moist, dense habitats, including mangroves, rainforest, riparian forests and thickets, and wet eucalypt forests with a dense understorey. When on passage a wider range of habitats are used including dry eucalypt forests and woodlands and Brigalow shrublands</p>	<p>11.3.25a <i>Eucalyptus raveretiana</i> (sometimes emergent), <i>Eucalyptus tereticornis</i> and <i>Melaleuca fluviatilis</i> woodland.</p> <p>11.3.25b <i>Melaleuca leucadendra</i> and/or <i>M. fluviatilis</i>, <i>Nauclea orientalis</i> open forest. Riverine wetland or fringing riverine wetland.</p> <p>11.3.25e <i>Eucalyptus camaldulensis</i>, <i>E. tereticornis</i> woodland fringing larger, permanent water courses.</p>
Estuarine crocodile	<p>Estuarine crocodile habitat</p> <p>The distribution within Australia is from Gladstone in the east, Darwin in the north and Broome in the west. This species is known to occur in inland swamps and marshes, lakes, estuaries and coastal waters (Webb et al. 1987, cited in DAWE 2022). Estuarine crocodiles are only likely to be present to an elevation of 250 m and up to hundreds of kilometres upstream. Meso-habitat preference is for permanent pool habitat which is deeper than 0.5 m with velocity that is low to moderate and low/nil turbulence.</p> <p>Riparian vegetation preferred for nesting includes <i>Melaleuca</i> spp., with aquatic vegetation including <i>Poaceae</i>, <i>Cyperaceae</i>, <i>Typhaceae</i>, <i>Restionaceae</i>. Bank substrates are typically mud, sand and dirt which is with leaf litter, sticks and grasses present.</p>	<p>Estuarine crocodile habitat</p> <p>Surveyed waterways – Broken River and Bowen River with permanent water up to 0.5 m deep and to an elevation of 250 m. Historical records and traditional owner observations were also taken into consideration.</p> <p>This species is not predicted to occur in the CEH PHES Project area.</p>

Appendix D

Impact calculations

RE impact calculations

<i>Project component</i>	<i>Vegetation status</i>	<i>RE</i>	<i>Impact area (ha)</i>
CEH PHES Project LR	Remnant	11.12.1	19.96614127
		11.12.1/11.3.25e	6.873208598
		11.12.6a	0.002981278
		11.12.6a/11.12.1	0.026267266
		11.12.6a/12.11.7	38.54378732
		11.12.7	8.898055645
		11.12.7/11.3.25e	2.087617191
		11.3.25b	34.1086847
		Total	110.5067433
CEH PHES Project UR	Remnant	11.12.6a/11.12.1	97.58917212
		Total	97.58917212
	Non-remnant		19.07895119
		Total	19.07895119
Dam construction footprints	Remnant	11.12.1	0.442709544
		11.12.4	1.48727942
		11.12.6a/11.12.1	15.79756103
		11.12.6a/12.11.7	2.892608773
		11.3.25b	1.023033475
		Total	21.64319224
Powerhouse and switchyard	Remnant	11.12.6a/11.12.1	0.715923713
		11.3.25b	0.253099373
		Total	0.969023086
Access tracks	Remnant	11.12.1	1.543129828
		11.12.1/11.3.25e	0.006989964
		11.12.4	0.565578347
		11.12.6a	0.722901846
		11.12.6a/11.12.1	11.9352003
		11.12.6a/12.11.7	2.059032401
		11.3.25b	0.605208224
		Total	17.43804091
	Non-remnant		0.048421037
		Total	0.048421037
Ancillary infrastructure		Specific footprints still to be confirmed	66.00
		Total	66
Existing public road upgrades	Remnant	11.12.1	10.19116
		11.12.1/11.3.25e	0.074062

<i>Project component</i>	<i>Vegetation status</i>	<i>RE</i>	<i>Impact area (ha)</i>
		11.12.3	0.516298
		11.12.4	1.442911
		11.12.6a/11.12.1	4.60129
		11.12.6a/12.11.7	0.056442
		11.12.7/11.3.25	0.216275
		11.3.2	0.379909
		11.3.25a	0.212401
		11.3.35	0.103409
		11.3.4	0.862213
		Total	18.65637011
		Non-remnant	non-rem
		Total	17.75871

Conservation significant species and matters impact calculations (ha)

MNES conservation significant species		CEH PHEs Project UR	CEH PHEs Project LR	Dam wall construction footprints (temporary)	Powerhouse	Access tracks	Ancillary infrastructure	Existing road upgrades	Total
MNES conservation significant flora									
Poplar Box Grassy Woodland on Alluvial Plains TEC		–	–	–	–	–	–	0.38	0.38
Black ironbox		–	–	–	–	–	–	0.25	0.25
Granite nightshade		1.22	2.56	–	–	–	14	3.98	21.76
MNES conservation significant fauna									
Greater glider		74.37	50.36	8.16	–	3.79	33	10.80	180.47
Grey-headed flying-fox	General foraging	19.08	–	–	–	0.05	10	9.92	39.05
	Habitat critical to survival	97.59	110.51	20.16	0.97	16.87	56	17.11	319.20
Koala	General foraging	19.08	–	–	–	0.05	10	11.17	40.29
	Habitat critical to survival	97.59	76.40	19.13	0.72	16.27	43	15.68	268.78
Northern quoll	Denning habitat	3.70	3.64	4.17	0.47	1.84	23	–	36.83
	Foraging habitat	93.88	106.86	17.47	0.50	15.60	33	18.66	285.97
	Total habitat critical to the survival	97.59	110.51	21.64	0.97	17.44	56	18.66	322.80
Yellow-bellied glider		74.37	42.66	8.16	–	3.64	33	3.28	165.11
	Nesting	36.21	8.12	2.49	–	2.82	0	4.66	54.30

Appendix E

**Avoidance and Mitigation Measures CEH
PHES Project**

ATTACHMENT 3: AVOIDANCE AND MITIGATION MEASURES CEH PHES PROJECT

Siting of the development footprints and infrastructure for the proposed CEH PHES Project has been designed to avoid impacts to ecological values where possible. These include:

1. PHES reservoir locations – multiple sites were investigated with environmental factors considered as part of the site selection criteria; and
2. Infrastructure siting – prioritised where possible to existing cleared or degraded areas.

Having avoided impacts where possible, the construction and operation of the CEH PHES Project will still result in the removal of vegetation (and the habitat this provides), and disturbance to the ecological values of the local landscape on either a temporary or permanent basis. Impacts most likely to adversely affect MNES that were confirmed present or are likely to occur include:

1. Loss of habitat;
2. Injury and mortality;
3. Disturbance of wildlife by light, noise and vibration;
4. Fragmentation of terrestrial habitats;
5. Degradation of habitats by dust, run-off and sedimentation; and
6. Introduction and spread of weeds and pests.

Habitat loss – Avoidance

Seven alternative locations (see Att 2, Figure 5) were considered and assessed during Pre-Feasibility Studies (PFS). A detailed multi-criteria assessment (MCA) framework was used to assess the feasibility, benefits and constraints of each option and ranked them accordingly. The proposed location was selected taking into account:

1. Relativity of environmental impacts on flora, fauna and aquatic ecology;
2. Topography, geological and geotechnical investigations;
3. Catchment yield;
4. Hydrology;
5. Land holders, Traditional Owners and land tenure; and
6. Network connection.

Habitat Loss – Mitigation

Notwithstanding the avoidance measures, loss of vegetation (and the habitat it provides) associated with the proposed action is an unavoidable impact. Measures will be undertaken to minimise and mitigate the impacts of unavoidable vegetation and habitat loss and these may include:

1. Implementing a biodiversity offsets strategy;
2. Investigate translocation of MNES species where possible (for example, this may be possible with *Solanum graniticum*);
3. Restrict clearing to the smallest area needed for construction of roads, services, access and cut and fill;
4. Locate laydown areas, site offices and other temporary works areas in areas already subject to existing disturbance or within future inundation areas wherever possible;
5. Demarcate no-go areas of ecological sensitivity both on site and in construction plans, including all vegetation not to be cleared. All vegetation to be retained should be surveyed and clearly demarcated;
6. Felled vegetation could be mulched and reused on site. Hollow logs and large debris can be salvaged for the use of habitat creation/enhancement outside the extent of works;
7. Rehabilitate and revegetate temporary construction areas as soon as possible after the completion of local construction works;
8. Implement a Construction Environmental Management Plan (EMP) inclusive of pre-clearance survey prior to construction.

9. Implement management measures which may include seed collection and propagation of conservation significant flora species:

Performance criteria will be established to monitor and audit the successful delivery of the actions outlined above. Specific details will be refined as construction plans are finalised, but as a general guide, these should include:

1. No damage or degradation of ecologically sensitive sites beyond demarcated construction zones;
2. No vegetation clearing occurs where an alternative option to site infrastructure/disturbance area exists in cleared/degraded land;
3. All temporary disturbance areas are rehabilitated to at least their pre-disturbance floristic composition and ecological condition, and preferably an improved condition.

Regular monitoring and auditing will be undertaken, with corrective actions strictly enforced where performance criteria are not being met.

Injury and mortality

Measures will be undertaken to minimise and mitigate the impacts of injury and mortality to fauna and these may include:

1. Enforce on-site speed limits to restrict the incidence of vehicle strike;
2. Clearly demarcate no-go areas of sensitive vegetation and habitat, including all vegetation and habitat not to be cleared;
3. Utilise fauna friendly fencing;
4. Capture and relocation of conservation significant fauna species if entrapped within the construction footprint;
5. Undertake pre-clearance surveys of construction (clearing) areas to identify and demarcate hollow-bearing trees, hollow logs, nests and other potential breeding sites for conservation significant fauna prior to vegetation removal;
6. Engage suitably qualified and experienced fauna spotter-catchers to supervise all clearing activities within areas of high ecological value (i.e., areas of predicted habitat for conservation significant species, areas with high densities of hollow-bearing trees, rocky outcrops, riparian vegetation associated with waterways);
7. Use of sequential clearing practices and hire of suitably qualified koala spotters;
8. Allow koalas to move out of the clearing footprint of their own accord wherever possible;
9. Follow the Queensland Government's guidelines for koala-friendly fencing where fencing required around construction areas and infrastructure;
10. Minimise the number of vehicle movements during construction through the use of local construction camps and buses to transport construction personnel;
11. Educate employees regarding the presence of EPBC Act listed species, particularly species with increased risk of injury and mortality such as the squatter pigeon (southern) and koala due to their slow moving and sedentary nature;
12. Erect warning signage near high-risk areas such as areas of local habitat for the squatter pigeon (southern). Squatter pigeon awareness will be included in all worker inductions. A register of squatter pigeon (southern) sightings will be maintained to identify areas that have a high risk of collision;
13. Inspect trenches, excavations and machinery daily for the presence of trapped fauna;
14. Minimise the time that excavations are open and place escape poles or structures within excavations to allow fauna to escape;
15. Flush areas of predicted habitat for the squatter pigeon (southern) immediately prior to clearing (i.e. spotter-catcher to walk in front of clearing machinery);
16. Identify the closest vet or wildlife carer prior to construction commencing. Relevant contact details to be included Construction EMP and circulated during pre-start material to all relevant staff;
17. Develop adverse incident response procedures to detail actions to be taken in the event of wildlife injury or mortality during clearing. This will include procedures for capture and transport of injured wildlife to qualified veterinarian or humane on-site euthanasia and formalisation of arrangements with a local veterinarian to treat and care for wildlife injured during for the construction period.

Performance criteria will be established to monitor and audit successful delivery of the actions outlined above. Specific details will be refined as construction plans are finalised, but as a general guide, these should include:

1. No disturbance of active and utilised breeding sites for conservation significant-species – where active breeding sites for conservation-significant species are identified, construction activities will be managed to allow for breeding to be successfully completed;
2. No injury or mortality of conservation-significant species due to vehicle and plant movements linked to the action;
3. No injury or mortality of conservation-significant species as a result of entanglement in fencing (or other site infrastructure), nor entrapment in excavations.

Regular monitoring and auditing will be undertaken, with corrective actions strictly enforced where performance criteria are not being met.

The following measures could be instigated to mitigate injury and mortality of wildlife during the operation phase:

1. Limit vehicle movements to daylight hours only to avoid times of heightened wildlife collision risk (where practicable);
2. Restrict the number of daily vehicle movements as far as practicable;
3. Restrict vehicle movements to designated access roads;
4. Enforce speed limits along access roads;
5. Educate maintenance and operations employees on the ecological sensitivities of the area and species at risk of collision (i.e. the northern quoll, squatter pigeon (southern) and koala);
6. Erect warning signage at local hotspots for the squatter pigeon (southern) to alert drivers to the risks at those locations;
7. Include regular checks within the Operational EMP in areas where native wildlife may become entrapped;
8. Include fauna escape devices in areas where native fauna may become entrapped.

Performance criteria will be established to monitor and audit the successful delivery of the actions outlined above. Specific details will be refined as construction plans are finalised, but as a general guide, these should include:

1. No injury or mortality of conservation-significant species due to vehicle movements once the proposed action is operational;
2. No injury or mortality of conservation-significant species due to entanglement in fencing (or other site infrastructure).

Regular monitoring and auditing will be undertaken, with corrective actions strictly enforced where performance criteria are not being met.

Habitat degradation by increased dust, run-off and sedimentation

Measures will be undertaken to minimise and mitigate the impacts of habitat degradation by increased dust run-off and sedimentation and these may include:

1. Temporary coffer dams will be installed to bund the construction footprint and support a watercourse management strategy. These bunds will act to minimise mobilisation of sediments during construction, dissipate noise and vibration levels and mitigate downstream degradation of water quality as far as practicable;
2. Bed and banks restoration to pre-existing profiles and riparian vegetation re-establishment outside of the inundation area following completion of works;
3. Water quality conditions will be monitored to confirm conditions downstream are maintained in accordance with guidelines and allow for adaptive management in the event that impacts are detected. Actions will include pre, during and post construction monitoring in accordance with the Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC and ARMCANZ 2000);
4. Maintenance of environmental flows during construction to maintain connectivity and health of downstream habitats;
5. Erosion and sediment control measures employed during construction will be consistent with the practices described in the International Erosion Control Association, Best Practice Erosion and Sediment Control Guideline and/or Queensland Division of the Australian Institute of Engineers' Erosion and Sediment Control: Engineering Guidelines for Queensland Construction Sites;
6. The Construction EMP will include a Dust Management Plan;
7. Restrict speed limits and other traffic control mechanisms to minimise dust generation;

8. Undertake routine dust suppression and monitoring during dry conditions to minimise dust dispersal during construction;
9. Rehabilitate disturbed areas as soon as is practicable to minimise exposed surface periods;
10. Designate appropriate locations for soil stockpiles, rubbish and waste materials on site and safely secure until disposed material;
11. Monitor weather conditions during construction and establish extreme weather stand-down and temporary control protocols to minimise adverse outcomes resulting from extreme weather events;
12. Develop and implement a Waste and Hazardous Materials Management Plan including fuel and chemical storage protocols and spill responses.

For the operations phase, the requirement for environmental flow releases from the lower reservoir will be investigated as part of the Burdekin Basin Water Plan. If required, the intake and outlet will be designed to select and release water of a suitable quality to downstream reaches. Releases would occur in accordance with environmental flow objectives for ecosystem protection.

A Water Quality Management Plan which will include monitoring of the potential impact of the storage operation on aquatic ecosystems. This will be undertaken in accordance with the Water Monitoring Data Collection Standards (DNRME, 2020), and will include a risk-based approach to design a fit for purpose monitoring program in response to risk of impact to downstream water quality, bank condition and aquatic fauna mortality.

Performance criteria will be established to monitor and audit successful delivery of the list of actions outline above. Specific details will be refined as construction plans are finalised, but as a general guide, these should include:

1. No erosion and/or sediment run-off is observed entering watercourses, or in remnant vegetation/habitat for conservation-significant species;
2. Dust levels do not exceed recommended maximum thresholds for ecologically sensitive receivers.

Regular monitoring and auditing will be undertaken, with corrective actions strictly enforced where performance criteria are not being met.

Disturbance to wildlife through increased light, noise and vibration

A range of mitigation measures are available to minimise the impact that noise, light, vibration and disturbance on local wildlife populations. The following measures will be investigated to minimise the impacts of light, noise and vibration during construction:

1. Service and maintain all plant and equipment to minimise machinery noise as much as possible;
2. Develop and implement a Traffic Management Plan for the construction site to control vehicle movements and speeds and reduce the unnecessary generation of vehicular noise;
3. Minimise the number of vehicle movements during construction through the use of local construction camps and buses to transport construction personnel;
4. Restrict large scale operations such as vegetation clearing and blasting to daylight hours wherever possible to reduce the need for lighting and resultant light spill into adjacent habitat and to reduce noise and vibration impacts on nocturnal fauna species;
5. Minimise site lighting to the minimum needed for safety. Install directional lighting and shields to minimise light spill outside of the immediate work areas having consideration for health and safety requirements;
6. Comply with construction vehicle maintenance schedules and operational restrictions designed to limit noise impacts during construction;
7. Minimise use of blasting or fire warning blast prior to demolition blast;
8. Allow sufficient buffer distance between high-risk area and nominated blast zones as far as practical;
9. Minimise blasting during northern quoll breeding season (June to September).

During operations, mitigation measures may include:

1. Incorporate noise-suppression design features in the design of the pumping station;
2. Inspect and maintain all vehicles, machinery and plant regularly to minimise operational noise;

3. Restrict vehicle movements as far as practicable and minimise night driving. Enforce no off-road driving;
4. Restrict lighting to the minimum level required for safe operation of the site;
5. Install directional lighting and shields to minimise light spill outside immediate work areas;
6. Minimise operational alarms within external works areas. Utilise white noise reversing alarms and operational alarms wherever possible.

Performance criteria will be established to monitor and audit successful delivery of the actions outlined above. Specific details will be refined as construction plans are finalised, but as a general guide, these should include:

1. No illumination of remnant vegetation by construction lighting;
2. No injury or mortality of conservation-significant species due to vehicle and plant movements linked to the proposed action.
3. No substantial change in the occurrence and abundance of species in habitats surrounding the project area compared to a (pre-development) baseline.

Regular monitoring and auditing will be undertaken, with corrective actions strictly enforced where performance criteria are not being met.

Introduction and spread of pest fauna species and weeds

Measures will be undertaken to minimise and mitigate the introduction of weeds and pests and these may include:

1. Develop and implement Weed and Pest Management Plans to inform all construction activities that outlines protocols to prevent the introduction of weed and pest species into the area and minimise the spread of declared weeds and pests within the site;
2. Undertake prevention and management of pest animal and invasive species in accordance with the *Biosecurity Act 2014*. Likewise, management of declared local pests and invasive species will be undertaken in accordance with relevant local government strategies and plans, including the *Mackay Regional Council Biosecurity Plan 2017 – 2021*;
3. Establish appropriate on-site waste-storage and disposal protocols, with designated waste-storage areas and appropriate (i.e., closed) waste receptacles and frequent waste disposal schedules to minimise attracting feral animals (e.g., dogs and pigs);
4. Include weed and pest management protocols in all worker inductions;
5. Prohibit employees from bringing domestic animals onto the construction accommodation camps or site;
6. Enforce strict weed hygiene protocols including weed-washdowns, inspections and weed and seed certifications of all vehicles, machinery and plant prior to entering the construction site. Wash-downs and inspections should also be undertaken regularly for vehicles travelling to different parts of the site to minimise internal spread of weeds within the works area;
7. Enforce no off-road driving;
8. Undertake pre-construction inventory and mapping of all weed-affected areas and identify areas of high risk that should be designated as no-go areas or areas requiring active weed management during and after construction;
9. Undertake periodic inspections of weed-affected areas throughout the construction period and implement weed control to weeds of management concern, including declared and environmental weeds;
10. Identify and control all declared weed infestations on the construction site throughout construction;
11. Monitor treated areas to assess the success of declared pest/weed eradication;
12. Rehabilitate and revegetate temporary works areas as soon as possible to minimise the potential for weed establishment;
13. Utilise stockpiled topsoil and mulched vegetation during landscaping and revegetation;
14. Utilise native species endemic to the region in revegetation to minimise importation of plants;
15. Undertake regular post-construction monitoring of rehabilitation areas and high-risk weed areas.

Performance criteria will be established to monitor and audit the successful delivery of the actions outlined above. Specific details will be refined as construction plans are finalised, but as a general guide, these should include:

1. No establishment of previously unrecorded weed species at or near the construction sites;

2. No outbreaks of locally-occurring weeds at previously unaffected/uninfested sites;
3. No increase in the occurrence or abundance of feral animal species.

Regular monitoring and auditing will be undertaken, with corrective actions strictly enforced where performance criteria are not being met.

Fragmentation and barrier effects

The following mitigation measures will be investigated as part of construction environmental management plans to limit fragmentation and minimise disruption of connectivity:

1. Limit construction or temporary fencing or utilise wildlife permeable fencing where risk of injury is low;
2. Follow the Queensland Government's guidelines for koala-friendly fencing where fencing required around construction areas and infrastructure;
3. Demarcate areas of native vegetation requiring removal to equipment operators and supervisors before any clearance to ensure disturbance is minimised;
4. Maintain areas of existing vegetation to assist in providing a source of seed for local rehabilitation works;
5. Use native species for rehabilitation wherever possible. If native species are unsuccessful introduced stoloniferous grasses may be to achieve rapid surface coverage.

Performance criteria will be established to monitor and audit the successful delivery of the actions outlined above. Specific details will be refined as construction plans are finalised, but as a general guide, these should include:

1. No injury or mortality of conservation-significant species because of entanglement in fencing (or other site infrastructure), nor entrapment in excavations;
2. No injury or mortality of conservation-significant species due to vehicle and plant movements linked to the operation;
3. Weeds do not establish at edges created because of construction activities – where new weed infestations are observed, these will be managed in accordance with the site-specific Weed and Pest Management Plan.

Regular monitoring and auditing will be undertaken, with corrective actions strictly enforced where performance criteria are not being met.

The following measures will be investigated as part of operational environmental management plans to mitigate the permanent fragmentation impacts associated with operation of the transmission infrastructure:

1. Limit permanent exclusion fencing at site;
2. Maintain areas of existing vegetation to assist in providing a source of seed for local rehabilitation works; and
3. Rehabilitate and revegetate temporary areas to minimise the permanent operational footprint.

Performance criteria will be established to monitor and audit the successful delivery of the actions outlined above. Specific details will be refined as construction plans are finalised, but as a general guide, these should include:

1. No reduction in habitat connectivity within areas of habitat for conservation-significant species due to maintenance/operational clearing during the proposed action operation phase;
2. No restriction to the movement of conservation-significant species due to permanent fencing for the proposed action.

Regular monitoring and auditing will be undertaken, with corrective actions strictly enforced where performance criteria are not being met.



ghd.com

→ **The Power of Commitment**