Offset strategy

Colac Pipeline Upgrade

Barwon Water

12 March 2026

→ The Power of Commitment

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Executive summary

This report is subject to, and must be read in conjunction with, the limitations set out in section 1 and the assumptions and qualifications contained throughout the Report.

The Colac Pipeline provides the bulk water supply to Colac, Victoria. The existing water main transfers water from the West Gellibrand and Olangolah Reservoirs in the Otways to supply the township of Colac, which has a population of approximately 25,000 people. Current and projected failure rates of the pipeline and associated supply interruptions pose an unacceptable risk to the essential supply of water to Colac. Barwon Water has identified the need to replace the most critical remaining sections of the existing Colac Pipeline (the Project) to provide a secure supply of water for Colac and minimise the risk of ongoing supply interruptions and associated maintenance requirements. It is important for the upgrade of these critical sections to proceed as soon as possible to minimise unacceptable risks to the essential supply of water to Colac.

The project was referred to the Department of Climate Change, Energy, the Environment and Water (DCCEEW; EPBC 2022-09343), and on 23 December 2022 a delegate of the Minister for the Environment and Water decided that the proposed action is a controlled action as it is likely to have a significant impact on listed threatened species and communities (sections 18 and 18A) protected under Part 3 of the EPBC Act and that the project will be assessed by preliminary documentation. The final preliminary documentation (GHD 2023a) included:

– Attachment 10: Offset Strategy for the Colac Pipeline Upgrade Project, Rev 1, September 2024 (GHD 2023d)
– Attachment 11: Proposed Offset Site 120 Ridge Road, Kawarren – Offset Management Plan, Version 06, August 2023 (Biosis, 2023)
– Attachment 12: Proposed Offset Site 245 Distillery Creek Road, Aireys Inlet – Offset Management Plan, Version 1.3, September 2023 (ABZECO 2023)

The project was approved with conditions by the delegate of the Minister on 17 January 2024 (DCCEEW 2024). Following this, the property at 120 Ridge Road, Kawarren became unavailable for an offset site. To facilitate the change in offset sites, a variation of conditions attached to the approval was issued by the Minister (or delegate) on 26 July 2024. Condition 7 of the varied approval conditions requires an Offset Strategy to be submitted to the department for approval by the Minister. This offset strategy has been revised to remove reference to the site at 120 Ridge Road, Kawarren and replace with the newly proposed offset site at 450 Morris Track, Lavers Hill. Information presented within this document regarding the Distillery Creek Road, Aireys Inlet offset site remains largely unchanged, with the exception of some minor grammatical and referencing updates.

The impacts assessment undertaken by GHD on behalf of Barwon Water, as presented in the final preliminary documentation (GHD 2023a), determined that the proposed action is likely to result in an adverse residual significant impact on the endangered Gang-gang Cockatoo (*Callocephalon fimbriatum*), vulnerable Yellow-bellied Glider (*Petaurus australis australis*) and vulnerable Long-nosed Potoroo (*Potorous tridactylus trisulcatus*). Consequently, Barwon Water propose to secure offsets that compensate for the residual adverse impacts of the proposed action on the three species.

The type and extent of habitat to be removed is limited to long and short linear strips along the edge of a patch. The habitats within the study area are well represented along the extent of the pipeline corridor and extensive areas of better quality habitat is located adjacent to the pipeline corridor in the form of remnant forest and woodland, which will be retained. However, the habitat will be permanently modified and, in some places, entirely removed (e.g., cleared easement) thus reducing the area of habitat.

The expected impacts of the project on Gang-gang Cockatoo, Yellow-bellied Glider and Long-nosed Potoroo are presented in the table below.

Species	Extent of habitat to be removed or modified following the implementation of pre-construction measures
Gang-gang Cockatoo	All vegetation within the impact area is either foraging, roosting and or connected habitat for Gang-gang Cockatoo (7.31 ha). Removal of up to 16 potentially hollow-bearing trees. Removal of habitat that is deemed suitable future breeding habitat (e.g., trees identified with unsuitable hollows or tree species currently without hollows of suitable size (i.e., diameter at breast height (dbh) in the proposed action area, but would be likely to develop hollows in the future).
Yellow-bellied Glider	A large portion of vegetation within the impact area is considered known foraging, potential denning and breeding habitat for Yellow-bellied Glider (5.07 ha). Removal of up to 13 potentially hollow-bearing trees. Removal of habitat that is deemed suitable future breeding habitat (e.g., trees that would be likely to develop hollows in the future).
Long-nosed Potoroo	The proposed action will remove or modify up to 7.81 ha of identified and potential habitat for Long-nosed Potoroo from within the proposed action area.

In order to provide the offsets for the potential residual impacts, two offset sites have been identified and form this Offset Strategy:

1. Offset site 1 – 450 Morris Track, Lavers Hill (33.01 ha). Targeted surveys were completed for the Yellow-bellied Glider, Gang-gang Cockatoo and Long-nosed Potoroo. The proposed offset site is heavily forested and forms part of a larger forested area. The western boundary connects to the Great Otway National Park, and the northern, eastern and southern boundaries connect to the Otway Forest Park and freehold forested land. The proposed offset site comprises 33.01 hectares (ha) of native vegetation, and has high value for wildlife. As a result of the targeted surveys, the Yellow-bellied Glider and Gang-gang Cockatoo were detected, while Long-nosed Potoroo was not. The offset site will be secured by a Section 69 Agreement with DEECA on title security and will be actively managed for 10 years in accordance with the Offset Management Plan (OMP, in preparation, ABZECO 2024a). At the end of 10 years of active management, in accordance with the OMP the site is required to be maintained in perpetuity so that it meets or is in better condition than the minimum required offset commitments.
2. Offset site 2 – 245 Distillery Creek Road, Aireys Inlet (29.43 ha). Targeted surveys for the Long-nosed Potoroo (*Potorous tridactylus trisulcatus*) including habitat and vegetation assessments were completed and the species was recorded at the site and is considered resident within the site. Gang-gang Cockatoo foraging habitat was also recorded on site. The proposed offset site is privately owned by Barwon Water and forms part of an uncleared and unused portion of a property that also includes an operational Water Reclamation Plant. The proposed offset site is contiguous with the Great Otway National Park, with largely continuous intact native vegetation. The offset site will be secured by a Section 69 Agreement with DEECA on title security and will be actively managed for 10 years in accordance with the OMP (ABZECO 2023). At the end of 10 years of active management, in accordance with the OMP the site is required to be maintained in perpetuity so that it meets or is in better condition than the minimum required offset commitments.

The table below provides a summary of the potential for the Offset Strategy to counterbalance the potential residual impacts to the MNES.

MNES	Residual impact	Habitat area required to offset 100% of impact	Offset package proposed
Gang-gang Cockatoo (*Callocephalon fimbriatum*)	Habitat loss of 7.31 ha X quality 7 = 5.12 ha	30.34 ha	Offset site 1 - 33.01 ha = 108.79% of direct offset
Yellow-bellied Glider (*Petaurus australis australis*)	Habitat loss of 5.07 ha X quality 7 = 3.55 ha	19.06 ha	Offset site 1 - 33.01 ha = 173.23% of direct offset
Long-nosed Potoroo (*Potorous tridactylus trisulcatus*)	Habitat loss of 7.81 ha X quality 7 = 5.47 ha	29.35 ha	Offset site 2 - 29.43 ha = 100.25% of direct offset

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1. Introduction

The Colac Pipeline provides the bulk water supply to Colac, Victoria. The existing water main transfers water from the West Gellibrand and Olangolah Reservoirs in the Otways to supply the township of Colac, which has a population of approximately 25,000 people. Current and projected failure rates of the pipeline and associated supply interruptions pose an unacceptable risk to the essential supply of water to Colac. Sections of the pipeline have been progressively replaced in recent years (2003 - 2010), currently totalling approximately 30% of the total pipeline length. The remaining pipeline length is subject to future progressive replacement and upgrade in stages.

Barwon Water has identified the need to replace the most critical remaining sections of the existing Colac Pipeline to provide a secure supply of water for Colac and minimise the risk of ongoing supply interruptions and associated maintenance requirements. Replacement of the critical pipeline sections constitutes the proposed action for this project. It is important for the upgrade of these critical sections to proceed as soon as possible to minimise unacceptable risks to the essential supply of water to Colac.

The total action area is 11.48 hectares and comprises the extent where proposed permanent and temporary upgrade activities will occur, including pipeline trenching, construction laydown areas and access roads. Works will be mostly confined to a 10 m-wide construction corridor throughout the 5 km length of the proposed upgrade over five (5) different sections. The total clearing footprint is 7.81 ha of native vegetation and habitat removal, which includes 0.151 hectares of vegetation previously removed as part of the geotechnical investigation stage. The total clearing footprint is a conservative estimate based on a maximum trench width of 4 m. Through using trench shields to minimise trench width (typically to 1.2 m) and implementation of mitigation measures, the total clearing footprint is likely to be less.

The project was referred to the Department of Climate Change, Energy, the Environment and Water (DCCEEW; EPBC 2022-09343), and on 23 December 2022 a delegate of the Minister for the Environment and Water decided i) that the proposed action is a controlled action as it is likely to have a significant impact on listed threatened species and communities (sections 18 and 18A) protected under Part 3 of the EPBC Act, and ii) that the project will be assessed by preliminary documentation. The final preliminary documentation submission (GHD 2023a) included:

– Attachment 10: Offset Strategy for the Colac Pipeline Upgrade Project, Rev 1, September 2024 (GHD 2023d)
– Attachment 11: Proposed Offset Site 120 Ridge Road, Kawarren – Offset Management Plan, Version 06, August 2023 (Biosis, 2023)
– Attachment 12: Proposed Offset Site 245 Distillery Creek Road, Aireys Inlet – Offset Management Plan, Version 1.3, September 2023 (ABZECO 2023)

The project was approved with conditions by the delegate of the Minister on 17 January 2024 (DCCEEW 2024). Following this, the property at Ridge Road became unavailable for an offset site. To facilitate this change, a variation of conditions attached to the approval was issued by the Minister (or delegate) on 26 July 2024. Condition 7 of the varied approval conditions requires an Offset Strategy to be submitted to the department for approval by the Minister. The strategy has been revised to remove reference to the site at 120 Ridge Road, Kawarren and replace with the newly proposed offset site at 450 Morris Track, Lavers Hill. Information presented within this document regarding the Distillery Creek Road, Aireys Inlet offset site remains unchanged, with the exception of some minor grammatical and referencing updates.

The impacts assessment undertaken by GHD on behalf of Barwon Water, as presented in the final preliminary documentation (GHD 2023a), determined that the proposed action is likely to result in an adverse residual significant impact on the endangered Gang-gang Cockatoo (*Callocephalon fimbriatum*), vulnerable Yellow-bellied Glider (*Petaurus australis australis*) and vulnerable Long-nosed Potoroo (*Potorous tridactylus trisulcatus*). Consequently, Barwon Water propose to secure offsets that compensate for the residual adverse impacts of the proposed action on the three species.

This document details the *Offset Strategy* prepared by GHD as requested by DCCEEW through condition 7 of the varied approval conditions.

The offset sites will be secured by a Section 69 Agreement with DEECA on title security and will be actively managed for 10 years in accordance with the Offset Management Plans (ABZECO 20241; 2024b). At the end of 10 years of active management, in accordance with the OMP the sites are required to be maintained in perpetuity so that they meet or are in better condition than the minimum required offset commitments. The Offset Management Plans and section 69 documentation for both proposed offset sites have been/are being developed by ABZECO as Native Vegetation Offset Register registered offset site assessors (ABZECO 2024a; 2024b).

1.1 Scope and structure of this report

The primary aim of this report is to demonstrate compliance with condition 7 of the varied approval conditions and the requirements for an Offset Strategy in accordance with the relevant offset guidance documents produced by DCCEEW (Section 1.1.2). The requirements of condition 7 are listed in Table 1.

Table 1 Varied approval condition requirement and relevant section within this report

Condition 7 requirements	Report section
The Offset Strategy must, to the satisfaction of the Minister:	
a) Be prepared in accordance with the Environmental Offsets Policy	Section 2.2 Table 3
b) Identify and propose one or more environmental offsets suitable to compensate for the residual significant impacts of the Action on Gang-gang Cockatoo, Yellow-bellied Glider and Long-nosed Potoroo	Section 3 – Proposed offset sites
c) Include summary information on the residual impacts to protected matters that will be compensated for by the proposed offset including all areas of habitat, and the habitat quality, for protected matters at all locations impacted by the Action which the offset is to address	Section 2 – Offset requirements
d) Detail the areas of offset habitat, and the habitat quality, required for protected matters at each proposed offset site	Section 3 – Proposed offset sites
e) Specify achievable proposed offset outcomes and timeframes for their achievement	Offset site 1 – Section 3.2.4.3 Offset management plans Offset site 2 – Section 3.3.4.3 Offset management plans
f) Specify a monitoring program to determine progress towards, attainment of and maintenance of the proposed environmental outcomes for the protected matters	Offset site 1 – Section 3.2.4.3 Offset management plans Offset site 2 – Section 3.3.4.3 Offset management plans
g) Specify how and at what frequency offsets management results, monitoring program findings and assessments of offset outcomes will be reported to the department and the general public, and	Offset site 1 – Section 3.2.4.3 Offset management plans Offset site 2 – Section 3.3.4.3 Offset management plans
h) Detail how each offset site will be protected, including securement, and how offset outcomes for the protected matters will be maintained at least until the expiry of this approval	Offset site 1 – Section 3.2.4.1 – Site security Offset site 2 – Section 3.3.4.1 – Site security

1.1.1 Summary of reference terms

The key reference terms used throughout this document are presented below, and are consistent with terms and definitions supplied in all documentation for this project:

– The **study site** is 34.12 ha and includes the existing pipeline corridor, the five sections of pipeline to be replaced (5 km in length), the existing vehicle access track (Pipeline Road) and a buffer of approximately 15 m surrounding the access track (Figure 1).

– The **study area** is the area that includes the study site or the offset site and the surrounding area to a 10 km radius. This description covers a much broader area than the action area or offset sites; the additional information captured from the study area has been used to provide context to assess the significance of ecological features identified within the study site or offset site (for example, whether they are part of a larger area, or whether there is the potential for impacts on ecological features outside the study site/offset site).
– The **proposed action area (PAA)** – also referred to in other documentation as the proposed construction corridor (impact area). It is within the study site and is 11.48 ha and represents the area where impacts on ecological values are proposed within the construction corridor (Figure 1).
– The **offset site(s)** refers to one or both proposed offset sites (Figure 2 and Figure 3) located at:
    - 450 Morris Track, Lavers Hill, Victoria (Offset site 1) – it should be noted that the proposed offset site is a subset of the area for which targeted surveys were undertaken (proposed offset site is 33.01 ha of a larger 78.68 ha property owned by Barwon Water)
    - 245 Distillery Creek Road, Aireys Inlet, Victoria (Offset site 2) – 29.43 ha of a larger property owned by Barwon Water

1.1.2 Key guidance and technical documents

The following documents were used in the development of this offset strategy:

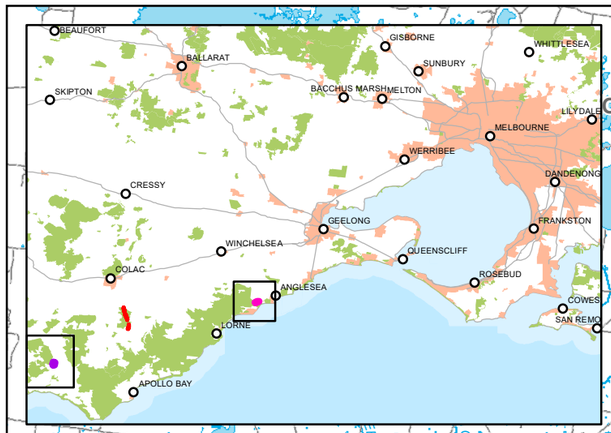
– Department of Agriculture, Water and the Environment (DAWE) (2022a). Conservation Advice for *Callocephalon fimbriatum* (Gang-gang Cockatoo). Canberra: Department of Agriculture, Water and the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/768-conservation-advice-02032022.pdf. In effect under the EPBC Act from 02-Mar-2022
– DAWE (2022b). Conservation Advice for *Petaurus australis australis* (yellow-bellied glider (south-eastern)). Canberra: Department of Agriculture, Water and the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/87600-conservation-advice-02032022.pdf. In effect under the EPBC Act from 02-Mar-2022
– DAWE (2022c). Conservation Advice for *Potorous tridactylus* (southern long-nosed potoroo). [online]. Published by Department of Agriculture, Water and the Environment (DAWE). Available from: https://www.environment.gov.au/biodiversity/threatened/species/pubs/86367-conservation-advice-02032022.pdf
– Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2012a), *Environment Protection and Biodiversity Conservation Act 1999, Environmental Offsets Policy*, Department of Sustainability, Environment, Water, Population and Communities, Canberra. Available from: https://www.dcceew.gov.au/sites/default/files/documents/offsets-policy_2.pdf
– DSEWPaC (2012b), How to use the offsets assessment guide, Department of Sustainability, Environment, Water, Population and Communities, Canberra. Available from: https://www.dcceew.gov.au/sites/default/files/documents/offsets-how-use.pdf
– DSEWPaC (2012c), Offsets assessment guide (excel document), Department of Sustainability, Environment, Water, Population and Communities, Canberra. Available from: https://www.dcceew.gov.au/environment/epbc/publications/epbc-act-environmental-offsets-policy

1.1.3 Relationship with existing reports

This offset strategy draws upon information presented in, and should be read in conjunction with, the following reports:

– ABZECO (2024). 450 Morris Track, Lavers Hill Environment Protection and Biodiversity Conservation Act 1999 (2022/09343) Yellow-bellied Glider *Petaurus australis australis* (south eastern) and Gang-gang Cockatoo *Callocephalon fimbriatum* Offset Management Plan, Version 1.2, September 2024. In preparation by ABZECO as of 16/09/2024
– ABZECO (2023). 245 Distillery Creek Road, Aireys Inlet Environment Protection and Biodiversity Conservation Act 1999 (2022/09343) Long-nosed Potoroo *Potorous tridactylus tridactylus* (South-East Mainland) Offset Management Plan, Version 1.3, September 2023

- GHD (2024) Proposed Offset Site – Morris Track, Lavers Hill, Targeted fauna and vegetation survey report. Report to Barwon Water by GHD Pty Ltd, September 2024 (see Appendix A of this report)
- GHD (2023a) *Final Preliminary Documentation Response – Colac Pipeline Project*. Document prepared for Barwon Water by GHD Pty Ltd for public comment, Rev 2, December 2023
- GHD (2023b) *Targeted surveys for Yellow-bellied Glider and Gang-Gang Cockatoo – Colac Pipeline Project.* Survey report (revised). Document prepared for Barwon Water by GHD Pty Ltd, June 2023
- GHD (2023c) Proposed Offset Site – 245 Distillery Creek Road, Aireys Inlet, Targeted fauna and vegetation survey report. Report to Barwon Water by GHD Pty Ltd, June 2023 – (see Appendix B of this report). Note, the area and boundary of the proposed offset site discussed in GHD (2023c) were indicative in nature and have since been confirmed (as presented in this Offset Strategy) based on the current land title and surveyor site plan.
- GHD (2021) *Colac Pipeline Upgrade (W1426): Ecological Impacts*. Report prepared for Barwon Water by GHD Pty Ltd



COLAC
BIRREGURRA
DEANS MARSH
BARONGAROOK
FORREST
GELLIBRAND
WENSLEYDALE
MODEWARRE
TORQUAY
JAN JUC
ANGLESEA
AIREYS INLET
FAIRHAVEN
WYE RIVER
KENNETT RIVER
SKENES CREEK
APOLLO BAY
MARENGO
HORDERN VALE

OTWAY FOREST PARK
GREAT OTWAY NATIONAL PARK

BIRREGURRA CREEK
BARWON RIVER
ATKIN CREEK
BARONGAROOK EAST BRANCH CREEK
MATTHEWS CREEK
DEANS MARSH CREEK
YAN YAN GURT CREEK
BROOKMAKERS CREEK
WORMBETE CREEK
WORMBETE CREEK EAST BRANCH
RETREAT CREEK
ANGLESEA RIVER
RAVEN CREEK
THOMPSON CREEK
MERRIGIG CREEK
BREAKFAST CREEK
SALT CREEK
DISTILLERY CREEK
PAINKALAC CREEK
MOGGS CREEK
SPOUT CREEK
REEDY CREEK
GRASSY CREEK
COALMINE CREEK
PENNYROYAL CREEK
DEANS CREEK
BOUNDARY CREEK
GULLY
TIRRENGOWA DRAIN
TOMAHAWK CREEK
MURREE CREEK
TEN MILE CREEK
BARWON RIVER EAST BRANCH
DIVIDING CREEK
PORCUPINE CREEK
YAHOO CREEK
GUM GULLY CREEK
DAMER CREEK
KENNEDYS CREEK
GELLIBRAND RIVER
LOVE CREEK
DEWING CREEK
DEAN CREEK
CALLAHAN CREEK NORTH BRANCH
SEYMOUR CREEK
SPLITTER CREEK
ERSKINE RIVER
STOWY CREEK
JUTTLE CREEK
PARKINSON CREEK
SMALL CREEK
SAINT GEORGE RIVER
CHERRY TREE CREEK
KING CREEK
MACKIE CREEK
GARVEY CREEK
SHEOAK CREEK
RUSTY CREEK
BOGGY CREEK
COLE CREEK
CARLISLE RIVER
LARDNER CREEK EAST BRANCH
ASPLIN CREEK
LARDNER CREEK
MCDONALD CREEK
LARDNER CREEK WEST BRANCH
NOONDAY CREEK
MONDAY CREEK
OLANGOLAH CREEK
BARRAMUNGA CREEK
BARWON RIVER WEST BRANCH
CUMBERLAND RIVER
JAMESON CREEK
SEPARATION CREEK
WYE RIVER
KENNETT RIVER WEST BRANCH
HITCHCOCK GULLY
MONASH GULLY
GREY RIVER
KENNETT RIVER
CARISBROOK CREEK
SMYTHE CREEK
NETTLE CREEK
SUGARLOAF CREEK
ORCHARD CREEK
SAGE GULLY
SKENES CREEK
WILD DOG CREEK
IRVING CREEK
BROWN CREEK
PETTICOAT CREEK
VON MUELLER CREEK
BARHAM RIVER EAST BRANCH
FALLS CREEK
BARHAM RIVER
BARHAM RIVER WEST BRANCH
MILFORD CREEK
BEAUTY GULLY
SEAVIEW CREEK
MARSH CREEK
BEECH CREEK
AIRE RIVER
CONGRAM CREEK
LITTLE AIRE CREEK
FARRELL CREEK
YOUNGS CREEK
CIANCIO CREEK
FORD RIVER EAST BRANCH
FORD RIVER WEST BRANCH
SANDY CREEK
ARKINS CREEK
CAMP CREEK
LEAHY CREEK
CRIMONINE CREEK
CHAPPLE CREEK
CHAPPLE CREEK SOUTH BRANCH
SKINNER CREEK
ATKINSON CREEK
NARIEL CREEK
JOHANNA RIVER
STAFFORD CREEK
WAIT-A-WHILE CREEK
CLEARWATER CREEK
REDWATER CREEK
CALDER RIVER
MILANESIA CREEK
POYNTON CREEK
FORD RIVER
DEEP CREEK
DUCK CREEK
PARKER RIVER
GEARY RIVER
BLANKET BAY CREEK
SHEPPARD CREEK

Legend

- Road
- Watercourse
- Proposed action area (pipeline alignment)
- Offset site 1 - 450 Morris Track, Lavers Hill
- Offset site 2 - 245 Distillery Creek Road
- Water area
- National Parks and State Forests

Paper Size ISO A3

0 1.5 3 4.5 6 7.5

Kilometers

Map Projection: Lambert Conformal Conic
Horizontal Datum: GDA 1994
Grid: GDA 1994 VICGRID94

N

GHD

Barwon Water
Colac Pipeline Upgrade Offset Strategy

Location of offset sites and proposed action area

Project No. **31-37032**
Revision No. **A**
Date **23/08/2024**

FIGURE 1

\\ghdnet\ghd\AU\Melbourne\Projects\31\37032\GIS\Maps\Working\Ecology\2024\3137032_001_ALL_offsetsites_rev.mxd

Data source:DEECA 2023,VicMap,2023 ;Aerial Imagery: Vicmap Basemap- Vicgrid Basemap - VicGrid94 - Aerial Data Custodian, Data Set Name/Title, Version/Date. Created by:macabral

2. Offset requirements

To determine the appropriate offset strategy for the project, the offset requirement must first be calculated. The following section calculates the offset requirement for each MNES in accordance with Commonwealth Environmental Offsets Policy (DSEWPAC 2012a). Preliminary offset calculations were reviewed by DCCEEW in the previous iteration of the proposed offset strategy for this project, and were accepted by DCCEEW on 17 January 2024 via the issue of EPBC Act approval (DCCEEW 2024). The preliminary offset calculations for Gang-gang Cockatoo (section 2.2.2) and Yellow-bellied Glider (section 2.2.3) have been updated to incorporate the newly proposed 450 Morris Track offset site (instead of 120 Ridge Road offset site). The preliminary offset calculations for Long-nosed Potoroo (section 2.2.4) remain unchanged from the version previously accepted by DCCEEW.

2.1 Summary of impacts

Following the completion of the significant impact assessment process (GHD 2021 and GHD 2023a), it was determined three EPBC Act listed species (Gang-gang Cockatoo, Yellow-bellied Glider and Long-nosed Potoroo), are likely to be significantly impacted by the proposed action following the consideration of:

– Targeted surveys for the Yellow-bellied Glider and Gang-gang Cockatoo (noting presence of the Long-nosed Potoroo was assumed for the majority of the alignment based on survey and historical records and extrapolation of habitat types)
– The implementation of all pre-construction phase avoidance and minimisation measures
– The extent of potential impacts
– Possible outcomes by implementing construction phase avoidance and minimisation measures

During the design phase of the proposed action, measures were implemented to reduce the extent of vegetation and habitat removal from the proposed action area. There is also an opportunity to further reduce impacts during the construction stage of the project using the following techniques:

– An arborist will be engaged to be onsite during construction to assist with micro-siting of the pipeline alignment as well as stockpiling, laydown and storage areas, to avoid impacts to Tree Protection Zones (TPZs) where possible
– Barwon Water's construction contractor will be required to use a trench shield during construction, which will reduce the typical trench width from 4 m to 1.2 m. This will increase the distance from the edge of the trench to impacted trees by 1.4 m on each side of the trench.

However, before construction, it is not possible to quantify how much (e.g., number of trees or extent of native vegetation impacts) the construction phase measures will effectively reduce impacts, or if the measures will reduce the impacts to an acceptable level to avoid a significant impact to the three species. Consequently, the extent of habitat removal identified in Table 2 represents the impacts with the implementation of pre-construction measures only and is adopted as the extent of residual impact for each species for the proposed action.

On this basis, the proposed action is likely to result in an adverse residual significant impact on the Gang-gang Cockatoo, Yellow-bellied Glider and Long-nosed Potoroo. Table 2 provides a summary of the extent of the potential residual impacts to each of the three species, following the implementation of mitigation measures.

Table 2 Extent of residual impacts following implementation of mitigation measures

Species	Extent of habitat to be removed or modified following the implementation of pre-construction measures	Possible further reduction of impacts following additional mitigation measures to be implemented during construction phase
Gang-gang Cockatoo	Vegetation within the impact area is either foraging, roosting and/or connecting habitat for Gang-gang Cockatoo (7.31 ha). Removal of up to 16 potentially hollow-bearing trees. Removal of habitat that is deemed suitable future breeding habitat (e.g., trees identified with currently unsuitable hollows or tree species currently without hollows of suitable size (i.e., diameter at breast height; dbh) in the proposed action area that would be likely to develop hollows in the future).	Reduction of number of hollow-bearing trees removed that may provide breeding habitat. Reduction of number of future hollow-bearing trees removed. Reduction in area of foraging habitat removed.
Yellow-bellied Glider	A large portion of vegetation within the impact area is considered known foraging, potential denning and breeding habitat for Yellow-bellied Glider (5.07 ha). Removal of up to 13 potentially hollow-bearing trees. Removal of habitat that is deemed suitable future breeding habitat (e.g., trees that would be likely to develop hollows in the future).	Reduction of number of hollow-bearing trees removed that may provide breeding and denning habitat. Reduction of number of future hollow-bearing trees removed. Reduction in area of foraging habitat removed.
Long-nosed Potoroo	The proposed action will remove or modify up to 7.81 ha of identified and potential habitat for Long-nosed Potoroo from within the proposed action area.	Reduction in area of foraging habitat removed.

This offset strategy was developed, assuming the loss of all vegetation within the construction corridor and the residual impacts as reported in Table 2. Whilst it is noted that there may be opportunities to further avoid and minimise impacts on biodiversity values (such as native vegetation and EPBC-listed species habitat) this strategy outlines proposed options available to Barwon Water to identify and progress towards securing offsets with the assumption that impacts cannot be reduced.

2.2 Offset requirements

Suitable offsets for each of three threatened species are determined by complying with the overarching principles listed in Table 3 and as displayed in Figure 1 and the requirements detailed in the *EPBC Act Environmental Offsets Policy* (DSEWPaC 2012a) and *EPBC Act How to use the offsets assessment guide* (DSEWPaC 2012b).

The *EPBC Act Environmental Offsets Policy* provides 10 overarching principles which when applied will determine the suitability of the proposed offsets for residual impacts. Table 3 summarises each principle and provides responses to indicate the appropriateness of the proposed offset sites. The suitability of a proposed offset is considered as part of the decision as to whether or not to approve a proposed action under the EPBC Act (DSEWPaC 2012a).

Table 3 EPBC Act Offset overarching principles that are applied when determining the suitability of offsets

Offset principles	Response
1. Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the protected matter.	Two sites have been identified and assessed as meeting the offset requirements for the Gang-Gang Cockatoo and Yellow-bellied Glider (450 Morris Track, Lavers Hill) and Long-nosed Potoroo (245 Distillery Creek Road, Aireys Inlet). The offset values and calculations provided within this strategy are at least three times the area of the reported residual impact area. Furthermore, the proposed offsets are of an equivalent quality to the impact area habitat prior to implementation of management measures. For example: – Gang-gang Cockatoo – impact area 7.31 ha – proposed offset area 33.01 ha (450 Morris Track, Lavers Hill), which equates to more than four times the impact area. Species frequently utilises the offset site as part of its broader home range – Yellow-bellied Glider – impact area 5.07 ha – proposed offset area 33.01 ha (450 Morris Track, Lavers Hill), which equates to more than six times the impact area. Species considered to regularly use the offset site and is possibly resident with the offset site

Offset principles	Response
	– Long-nosed Potoroo – impact area 7.81 ha – proposed offset area 29.43 ha (245 Distillery Creek Road, Aireys Inlet), which equates to more than three times the impact area. Species considered resident within the site The proposed offsets exceed the minimum of 90% of the total offsets required for each MNES following the introduction of management measures designed to reduce the identified threats at each of the sites. By securing the offset site at 450 Morris Track, a large patch of habitat on private land, which is considered a local linkage/corridor for the Gang-gang Cockatoo and Yellow-bellied Glider, will be protected. Securing the 245 Distillery Creek Road offset site will protect known habitat for the Long-nosed Potoroo and contribute to the greater reserve system in the local area for this and other species.
2. Suitable offsets must be built around direct offsets but may include other compensatory measures.	The proposed offset sites exceed the minimum of 90% of the total offset requirement for each MNES. The management of habitat through ongoing protection and associated on-ground measures to improve vegetation condition is considered to be a direct offset. Once secured, offset sites would be managed in accordance with the Offset Management Plans (OMPs).
3. Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter.	The proposed offset sites will be secured in proportion to the level of statutory protection that applies to the MNES associated with the project, in accordance with the EPBC Act (see sections 3.2.4 and 3.3.4). This means MNES of greater conservation status have greater offset requirements as calculated in the *Offset assessment guide*. Gang-gang Cockatoo – Endangered Yellow-bellied Glider – Vulnerable Long-nosed Potoroo – Vulnerable
4. Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter.	The offset values and calculations provided within this strategy are greater than three times the area of the reported residual impact area. Furthermore, the offsets are of an equivalent quality to the impact area habitat prior to implementation of management measures. For example: – Gang-gang Cockatoo – impact area 7.31 ha – proposed offset area 33.01 ha (450 Morris Track, Lavers Hill) – Yellow-bellied Glider – impact area 5.07 ha – proposed offset area 33.01 ha (450 Morris Track, Lavers Hill) – Long-nosed Potoroo – impact area 7.81 ha – proposed offset area 29.43 ha (245 Distillery Creek Road, Aireys Inlet)
5. Suitable offsets must effectively account for and manage the risks of the offset not succeeding.	The offset sites will be secured under a Section 69 agreement with Victorian Department of Environment, Energy and Climate Action (DEECA) in accordance with the Conservation, Forests and Lands Act 1987. The legally secured offset sites will be managed by the landowner (Barwon Water) under a legal contract and site-specific OMPs that will contain a risk assessment detailing relevant risk and mitigation measures for each offset site. The OMPs enable land practices that promote positive outcomes for MNES.
6. Suitable offsets must be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs.	No specific offsets for MNES are prescribed under any State or Local Government offset prescriptions relevant to the project area. The project has met the offset obligations in regards to the Victorian process under the *Planning and Environment Act 1987* as demonstrated by secured Native Vegetation Credits. The proponent notes that the existing offsets purchased to comply with State offset obligations cannot be used to satisfy the MNES required offsets.
7. Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable.	The legally secured offsets will be actively managed by the landowner (Barwon Water) under the supervision a suitably qualified ecologist. The decrease in condition scores of the offsets within the proposed timeframes are considered to be a conservative approach given the potential risks associated with vegetation and habitat quality decreasing without active management. Conversely, the implementation of appropriate management actions (to be outlined within the OMPs) are considered likely to improve the quality of communities/habitat. This will be achieved through proven management actions and monitored throughout the 10-year management period to ensure the desired environmental outcomes have been achieved for the offset sites (i.e., adaptive management for greater ecological gains).

Offset principles	Response
8. Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.	Governance includes monitoring and reporting by a suitably qualified and independent ecologist with reports submitted to DCCEEW for each 12-month period following commencement. Reports will provide a summary of management actions completed and include an assessment of their combined success against OMP objectives, in accordance with the *Annual Compliance Report Guidelines* (Commonwealth of Australia 2023). Management of the proposed offset sites will also include independent audits (every five (5) years) and reporting by a suitably qualified ecologist. Audit findings and recommendations will be discussed and agreed with the landowner (Barwon Water) and implemented accordingly.
9. Suitable offsets must be informed by scientifically robust information and incorporate the precautionary principle in the absence of scientific certainty	The proposed two sites meet the offset requirements for the Gang-Gang Cockatoo and Yellow-bellied Glider (450 Morris Track, Lavers Hill) and Long-nosed Potoroo (245 Distillery Creek Road, Aireys Inlet). Targeted surveys were undertaken in March of 2023 (for 245 Distillery Creek Road, Aireys Inlet) and in February and March 2024 (for 450 Morris Track, Lavers Hill) following a review of relevant literature to determine the best methods and effort to detect each species. The Yellow-bellied Glider and Gang-gang Cockatoo were recorded at the 450 Morris Track offset site and the Long-nosed Potoroo was recorded at the 245 Distillery Creek Road site. The surveys determined that each species was either resident (e.g., Long-nosed Potoroo) or frequently used the habitat within the site (e.g., Gang-gang Cockatoo and Yellow-bellied Glider were frequently observed within the Lavers Hill property but breeding/residency within the offset site could not be confirmed). See details of survey techniques, effort, timing and adequacy in section 3 and Appendix A and Appendix B for each offset site.
10. In assessing the suitability of an offset, government decision-making will be conducted in a consistent and transparent manner.	The purpose of this document is to provide a strategy for how offsets will be achieved that meet the offset requirements, which identifies and documents in a transparent manner the values of each offset site.

Section 2.2.1 provides the process for determining the habitat quality score for the proposed action area and the offset sites in accordance with *How to use the offsets assessment guide* (DSEWPaC 2012b) documentation.

Sections 2.2.2 - 2.2.4 provide a review of the following for each of the three species: 1. Quality of habitat impacted within the project area, 2. Quantum of impact and 3. Estimated offset requirement.

2.2.1 Process for determining habitat *quality* score

The ***quality*** score for an area of habitat is a measure of how well a particular site is predicted to support a particular threatened species or ecological community and contribute to its ongoing viability. The quality is scored out of 10 for offsets assessment guide calculations. Three components contribute to the calculation of habitat quality:

1. *Site condition* – This is the condition of a site in relation to the ecological requirements of a threatened species or ecological community. This includes considerations such as vegetation condition and structure, the diversity of habitat species present, and the number of relevant habitat features.
2. *Site context* – This is the relative importance of a site in terms of its position in the landscape, taking into account the connectivity needs of a threatened species or ecological community. This includes considerations such as movement patterns of the species, the proximity of the site in relation to other areas of suitable habitat, and the role of the site in relation to the overall population or extent of a species or community.
3. *Species stocking rates* – This is the usage and/or density of a species at a particular site. The principle acknowledges that a particular site may have a high value for a particular threatened species, despite appearing to have poor condition and/or context. It includes considerations such as survey data for a site in regards to a particular species population or, in the case of a threatened ecological community this may be a number of different populations. It also includes consideration of the role of the site population in regards to the overall species population viability or community extent.

The weighting given to each component is dependent on the ecological requirements of the impacted species or ecological community. For example, for some species the most important consideration is the location of a site in the landscape, whereas for others the presence of important habitat features on the site itself may be the most important influencing factor (DSEWPaC 2012b).

Approach to determining habitat quality score for project site and offset areas

A qualitative rather than quantitative approach was taken due to the lack of site-specific empirical data to determine the score for the three components that contribute to the calculation of quality of habitat. The approach was also informed by examples presented in other offset proposals where available and in the absence of species-specific examples (e.g., Gang-gang Cockatoo and Yellow-bellied Glider), offset documentation for similar species was reviewed.

For this project, the approach for determining the habitat quality score for the proposed action area and the offset sites consisted of the following steps:

1. Review of information from:
    a. Conservation advice description and references within for the habitat requirements for each species
    b. The location and historical occurrence of Victorian Biodiversity Atlas (VBA) and Atlas of Living Australia (ALA) records for each species in same/similar habitats within 10 km of the site and the proximity/connectivity of those records with the site
2. Description of habitat and survey findings from ecological surveys and targeted surveys of the impact area and the proposed offset sites
3. Review of species-specific or other examples for scoring of the three components where available
4. Determination of criteria and weighting for the three components:
    a. Site condition
    b. Site context
    c. Species stocking rates
5. Application of scores, justification and review

2.2.2 Determining offsets for Gang-gang Cockatoo

2.2.2.1 Suitable offsets

The DCCEEW conservation advice for the Gang-gang Cockatoo (DAWE 2022a) notes that suitable offsets may include:

– Restoration of the quality and extent of feeding and breeding habitat
– Restoration of native forest and woodlands adjacent to habitat critical to the survival to reduce edge effects
– Management of threats in and adjacent to habitat critical to the survival
– Other compensatory measures that will help address knowledge gaps to improve and maximise efficiency of the recovery of the species

2.2.2.2 Area of habitat impacted

A detailed assessment of impacts is provided in GHD (2021) and GHD (2023a, 2023b). Following the targeted surveys in the study site including the PAA, during the Gang-gang Cockatoo's breeding and non-breeding season, a review of the original area estimate regarding foraging and roosting/breeding habitat was undertaken. The extent of habitat to be removed or modified following the implementation of pre-construction measures includes:

– Up to 7.31 ha of foraging habitat. This area excludes parts of the action area that are cleared easement sections which are regularly maintained and without trees.
– Up to 6 ha of potential roosting and potential breeding habitat. The area of foraging habitat includes potential breeding and roosting habitat and habitat potentially suitable for breeding in future (e.g., habitat with trees identified with currently unsuitable hollows or tree species currently without hollows of suitable size in the proposed action area, that would be likely to develop hollows in the future). Within this area there are up to 16 hollow-bearing trees that could be used for breeding currently that could be removed by the proposed action.

No Gang-gang Cockatoo were observed to occupy or investigate hollows within the PAA during targeted surveys undertaken during the breeding season (November and December 2022 and January 2023) for the species.

The type and extent of habitat for each section in the PAA to be removed that is relevant to this species consists of a combination of long and short linear strips along the edge of the remnant forest where it meets the existing easement.

The habitats within the PAA are well represented along the extent of the pipeline corridor and extensive areas of equal or better quality habitat is located adjacent to the pipeline corridor in the form of remnant forest and woodland, which will be retained (e.g., the Great Otway National Park). However, the habitat within the PAA may be permanently modified and, in some places, entirely removed and replaced by habitat unsuitable for the species (e.g., cleared easement) thus reducing the area of habitat.

2.2.2.3 Habitat quality score assessment criteria

The quality of threatened species' habitat is scored out of ten for the offsets assessment guide calculations. DCCEEW instructions for the offsets assessment guide identify three site characteristics that may contribute to quality: 'site condition', 'site context' and 'species stocking rate'. These three attributes must be weighted according to their relative importance to the offset calculations based on the ecology of the relevant species or community (DSEWPaC 2012b) (i.e., their relative contribution to the total score out of 10).

The following criteria were used to determine habitat quality scores for the Gang-gang Cockatoo.

Site condition

– 4 (high) – diversity of relevant habitats (e.g., multiple EVCs or other documented habitat types), each habitat has all structural elements (e.g., understorey, midstorey, emergent/tall trees) and all known habitat features (e.g., evidence of breeding hollows, foraging (food) species), high species diversity within each habitat type, high VQA score (0.50 - 0.99) and no obvious disturbance
– 3 (medium-high) – moderate to high diversity of habitats (e.g., multiple EVCs or documented habitat types), each habitat has the majority of structural elements (e.g., ground cover, understorey and/or midstorey), and some known and potential habitat features (e.g., presence of potential breeding hollows, foraging species), moderate to high species diversity and high VQA score (0.50 - 0.75) and obvious (e.g., one or two small area of cleared/modified habitat) but not substantial disturbance
– 2 (medium) – moderate diversity habitats (e.g., 1 or 2 EVCs or documented habitat types), each habitat has the majority of structural elements (e.g., ground cover, understorey and/or midstorey), and most habitat features, moderate species diversity and moderate VQA score (0.25 - 0.50) and obvious and sometimes substantial (e.g., multiple cleared areas of habitat) disturbance
– 1 (low) – single habitat type with one or two structural elements missing/degraded, few habitat features, low diversity, low VQA score (< 0.25) and obvious disturbance

Note: When considering site condition criteria, all elements must be reviewed and used to develop the score. For example, a site may have a number or one EVC. EVCs are a surrogate for habitat types, however, the structural elements within each EVC (habitat type) are also very important as multiple EVCs may be present but lack tall trees or hollow-bearing trees, hence missing key habitat elements, whereas one EVC may present all structural elements. There are a variety of scenarios that may not fit neatly within a single criterion, therefore, it is important to justify why the site is scored according to the criteria selected (refer Table 4). For example, to achieve a score of 4, all criteria must be meet or full justification with information supplied from targeted surveys must be provided to substantiate the score.

Site context

– 3 (high) – excellent connectivity (e.g., < 100 m between site and next patch of habitat) – site is part of a much larger area of continuous habitat OR provides an important local or regional linkage for the species to other areas of known habitat. Site is considered important habitat (conservation advice). No substantial barriers to movement of the species (e.g., cleared paddocks). Site has few threats/ threats not considered substantial.
– 2 (medium) – good connectivity (e.g., > 100 m - < 500 m) from next patch of habitat). Provides local linkage for the species to other areas of potential or known habitat. Site may or may not be considered important habitat (conservation advice). Site has few threats/ threats are obvious, one or more considered substantial (e.g., evidence of regular tree felling for firewood).
– 1 (low) – poor connectivity, site is very isolated (e.g., > 500 m from next patch of habitat). May act as a 'stepping stone' through an otherwise degraded landscape, with possible local linkage for the species to other areas of potential habitat. Site may or may not be important habitat (conservation advice). Site has obvious threats/one or more may be considered substantial.

Note: The Gang-gang Cockatoo is a mobile species, but habitat fragmentation possibly inhibits dispersal and foraging efficiency. When considering its dispersal ability, a conservative approach was taken and the distances suggested are guidance only. There are a variety of scenarios that may not fit neatly within a single criterion, therefore, it is important to justify why the site is scored according to the criteria selected (refer Table 4).

Species stocking rate

– 3 (high) – site provides known breeding habitat and/or species is a resident within the site, as determined by targeted surveys. Note – a single tree could support breeding habitat for the species therefore a larger area that is frequented by the species regularly with evidence of daily foraging and resting particularly during the breeding season but not necessarily proven for breeding should also be considered as equally important
– 2 (medium) – species frequently utilises the site as part of its broader home range, as determined by targeted surveys
– 1 (low) – species occasionally uses the site as part of its broader home range
– 0 – species not recorded within the site or nearby the site following targeted surveys/no historical records within site

2.2.2.4 Quality of habitat impacted and offset sites

Table 4 details the score assessment and justification for each characteristic for the proposed action area (impact area) and both offset sites for Gang-gang Cockatoo. Based on the inputs in Table 4, 'Impact calculator – quantum of impact – quality' (i.e., the quality of habitat to be impacted) was scored as 7/10 overall and the quality of habitat for offset site 1 was 8/10. The data for offset site 2 is presented in Table 4 but is not scored as this site is not proposed to be used as an offset for this species. Offset site 1 alone satisfies the offset requirements, but benefits for the species are expected to be gained for both offset sites. Offset site 2 is not proposed to be used as an offset for this species for the project.

2.2.2.5 Quantum of impact

An impact area of 7.31 hectares has been entered in the 'area of habitat' field and '7/10 quality' has been entered in the 'quality' field in the 'impact calculator' section of the offsets assessment guide for Gang-gang Cockatoo habitat. When the above values for area of habitat impacted and quality of habitat impacted are entered in the offsets assessment guide calculations (DAWE 2020b), the 'Quantum of Impact' is calculated as 5.12 'adjusted Hectares'.

2.2.2.6 Estimated offset requirement

A preliminary offsets assessment guide calculation (Appendix E) was performed as a guide to the size and type of offset that would be required to meet the EPBC Act offset requirements for the project's impacts on Gang-gang Cockatoo habitat.

Based on the preliminary offsets assessment guide calculation, the project would require an offset of at least 30.34 hectares of Gang-gang Cockatoo habitat. Potential offset sites have been identified that contain the required area of the habitat (33.01 ha) and are described in section 3.1.

Table 4 Gang-gang Cockatoo – Quality of habitat score considering site condition, site context, species stocking rate

Component (DSEWPaC 2012b)	Proposed action area (GHD 2021 and GHD 2023b)	Offset site – 450 Morris Track (GHD 2024 – Appendix A and ABZECO 2024a – in prep)	Offset site – 245 Distillery Creek Road (GHD 2023c – Appendix B and ABZECO 2023) NOTE – data presented, however, site not proposed as offsite for this species
Site condition	*Score 3*	*Score 3*	*N/A*
What is the structure and condition of the vegetation on the site?	Proposed action area (PAA) consists of a corridor with a vehicle track and two vegetation types: 1. a maintained easement which is regularly slashed/mowed with occasional large old trees and 2. remnant vegetation forming the edge (created by the access track/easement 5-10 m wide) of an extensive area of intact habitat within Great Otway National Park. The remnant component is heavily forested with structurally and floristically diverse habitats. Five Ecological Vegetation Classes (EVCs 16, 48, 17, 198, 8) – vegetation/habitat types. Historical logging (> 40 years ago) within parts of the National Park and within the state forest (Otway Forest Park). Approximately 30% of the PAA recently burnt (April 2022) with historical fire sign present (> 5 years) in other parts. Vegetation Quality Assessment outcomes – habitat condition score ranging from 0.41 - 0.57	The site consists almost entirely of native vegetation with large trees, logs and a dense understorey and midstorey. There are two cleared tracks within the Lavers Hill property, one (approximately 200 m long) to the east, north of Chapple Creek, and the other (approximately 2.1 km long and ending beyond offset site) to the south-east, south of Chapple Creek. The track south of Chapple Creek has been excluded from the offset site area. Structurally and floristically diverse habitats. Three EVCs (#201, 30, 31) – vegetation/habitat types. Historical logging (mostly 100+ years ago) within parts of the site. No sign of recent substantial fires. Vegetation Quality Assessment outcomes – habitat condition score ranging from 0.78-0.84.	Heavily forested with tall trees and dense understorey layer. Only access tracks and bushfire buffer zones cleared of native vegetation. Structurally and floristically diverse habitats. Three EVCs (198, 48 and 136) – vegetation/habitat types. Vegetation Quality Assessment outcomes – habitat condition score ranging from 0.56-0.72 (noting a lower score due to absence of large trees in one EVC habitat zone).
What is the diversity of relevant habitat species present (including both endemic and non-endemic)?	Relevant habitat species include overstorey (tree) and understorey (shrub) layers: Six Eucalyptus species Four Acacia species 14 other shrub and tree species	Relevant habitat species include overstorey (tree) and understorey (shrub) layers: Three Eucalyptus species Three Acacia species 17 other shrub and tree species	Relevant habitat species include overstorey (tree) and understorey (shrub) layers: Four Eucalyptus species Four Acacia species Nine other shrub and tree species

Component (DSEWPaC 2012b)	Proposed action area (GHD 2021 and GHD 2023b)	Offset site – 450 Morris Track (GHD 2024 – Appendix A and ABZECO 2024a – in prep)	Offset site – 245 Distillery Creek Road (GHD 2023c – Appendix B and ABZECO 2023) NOTE – data presented, however, site not proposed as offsite for this species
What relevant habitat features are on the site?	Foraging habitat 7.31 ha Roosting/resting habitat up to 6 ha Potential breeding habitat – up to 16 suitable hollow-bearing trees within PAA Suitable future breeding habitat (e.g., trees identified with currently unsuitable hollows or tree species currently without hollows of suitable size in the proposed action area that would be likely to develop hollows in the future).	Foraging and roosting/resting habitat 33.01 ha. Potential breeding habitat – up to 12 known or potential hollow-bearing trees within the offset site, with up to 80 recorded within the broader 450 Morris Track property. Suitable future breeding habitat (e.g., trees identified with currently unsuitable hollows or tree species currently without hollows of suitable size that are likely to develop hollows in the future).	Foraging habitat 29.43 ha Potential roosting/resting habitat – up to 29.43 ha Potential breeding habitat (no hollow counts completed, although hollows of suitable dimensions noted in E. obliqua/baxteri noted).
Site context	*Score 3*	*Score 3*	*N/A*
What is the connectivity with other suitable/known habitat or remnants?	Located within the Great Otway National Park and Otway State Forest – part of an extensive contiguous area over 2000 ha. 365 historical records of the species within 10 km of the PAA. There are historical records for this species within every patch of vegetation within the study area. From a review of VBA records, there is a consistent year-round presence within the study area. No major barriers to the movement of this species within the PAA or into or out of the PAA.	The proposed offset site is heavily forested and forms part of a larger forested area. The western boundary connects to the Great Otway National Park, and the northern, eastern and southern boundaries connect to the Otway Forest Park and freehold forested land. Gang-gang Cockatoo is known from the area surrounding the offset site and within the offset site itself. There are 18 VBA records and 121 ALA records from the study area (10 km area surrounding the offset site). No major barriers to the movement of this species within the offset site or into or out of the offset site.	Surrounded by the Great Otway National Park with the exception of the Barwon Water 20 ha Blue Gum plantations located to the south off Distillery Creek Road 35 historical records (VBA and ALA) from within 10 km of the site No major barriers to the movement of this species within the offset site or into or out of the offset site.
What is the importance of the site in relation to the overall species population or the occurrence of the community?	7.31 ha of foraging habitat – According to the Conservation Advice Guidelines (DAWE 2022a), habitat critical to the survival of the Gang-gang Cockatoo includes all foraging habitat during both the breeding and non-breeding season. Although the habitats of the PAA are well connected, the extent of habitat impacted is limited to linear strips along the edge of the existing easement.	33.01 ha of foraging habitat – According to the Conservation Advice Guidelines (DAWE 2022a), habitat critical to the survival of the Gang-gang Cockatoo includes all foraging habitat during both the breeding and non-breeding season. Potential breeding habitat (not confirmed) currently or in future.	29.43 ha of foraging habitat – According to the Conservation Advice Guidelines (DAWE 2022a), habitat critical to the survival of the Gang-gang Cockatoo includes all foraging habitat during both the breeding and non-breeding season.

Component (DSEWPaC 2012b)	Proposed action area (GHD 2021 and GHD 2023b)	Offset site – 450 Morris Track (GHD 2024 – Appendix A and ABZECO 2024a – in prep)	Offset site – 245 Distillery Creek Road (GHD 2023c – Appendix B and ABZECO 2023) NOTE – data presented, however, site not proposed as offsite for this species
What threats occur on or near site?	Sections 19 and 20 are within/adjacent to the Otway Forest Park and/or private land. The activities permitted within these land use types (e.g., minor firewood harvesting, trail bike riding, horse-riding, etc.) do not entirely promote conservation actions that protect threatened species. Evidence of illegal timber harvesting (e.g., felled/sawn trees) was noted during surveys within Great Otway National Park. Deer were present and have capacity to degrade habitat/change habitats over time. Deer evidence was regularly recorded along Porcupine Creek and deer were heard during nocturnal surveys. Introduced honey bee hive noted at two locations near the PAA – potential nest/hollow competition. Weeds have the capacity to degrade habitat quality over time. Potential evidence of the pathogen *Phytophthora cinnamomi* e.g., grass-tree dieback. Fire – although most recent fires likely to have caused short term disturbance – not catastrophic	Deer have capacity to degrade habitat/change habitats over time. Deer presence was obvious (e.g., camera trap images, scat, browsing). Weeds have the capacity to degrade habitat quality over time. *Rubus fruticosus* spp. agg. (Blackberry) was present in low numbers on the outer edges of the internal tracks with scattered occurrences further south. *Cirsium vulgare* (Spear Thistle) was only observed at a single location as a juvenile plant in the south-east corner of the offset site. *Rubus fruticosus* spp. agg. (Blackberry) and *Cirsium vulgare* (Spear Thistle), are listed under the *Catchment and Land Protection Act 1994* (CaLP Act) as a controlled weed with the former also listed as a Weed of National Significance (WoNS). Currently zoned Farming. There is a risk that farming activities could occur if the land was not secured and the quality of the habitat for the species could be impacted/area reduced. Proposed protection through Section 69 Agreement on title land security.	Deer have capacity to degrade habitat/change habitats over time. Deer presence was obvious (e.g., scat, tracks, wallows). Weeds have the capacity to degrade habitat quality over time (< 1% coverage across site). Potential evidence of the pathogen *Phytophthora cinnamomi* was recorded in the offset site, e.g., grass-tree dieback. Currently zoned Public Use. There is a risk that development activities could occur and the quality of the habitat for the species is impacted/area reduced. Proposed protection through Section 69 Agreement with DEECA on title land security.

Component (DSEWPaC 2012b)	Proposed action area (GHD 2021 and GHD 2023b)	Offset site – 450 Morris Track (GHD 2024 – Appendix A and ABZECO 2024a – in prep)	Offset site – 245 Distillery Creek Road (GHD 2023c – Appendix B and ABZECO 2023) NOTE – data presented, however, site not proposed as offsite for this species
Species stocking rate	*Score 1*	*Score 2*	*N/A*
What is the presence of the species on the site? (i.e., confirmed/modelled) What is the density of species known to utilise the site? What is the role of the site population in regards to the overall species population?	Targeted surveys completed in May 2022 and November – December 2022 and January 2023 recorded few instances of Gang-gang Cockatoos using habitat within the PAA. In both seasons, Gang-gang Cockatoos were sighted flying through the forest, resting and/or foraging mostly in the northern section of the PAA. The species was recorded on 11 different occasions (different dates/times) across four locations during diurnal and opportunistic bird surveys within the study site. During the November-December survey (breeding season), Gang-gang Cockatoos were recorded outside the study site, in the same habitat and general location as the birds recorded during May 2022 surveys (norther section of PAA). Sixteen (16) potentially hollow-bearing trees were recorded within the proposed action area, however, most were not of suitable size or age to be suitable for Gang-gang Cockatoo breeding. These trees could provide future breeding habitat. None of the Gang-gang Cockatoos observed were seen to occupy hollow-bearing trees or interact with any hollows.	Targeted surveys were completed during the breeding season in February and March 2024. A total of 33 records of the Gang-gang Cockatoo were made during the site visits. Most of the records were of birds heard, but sometimes the birds were seen, either flying through the forest, or less often perching or foraging. The Gang-gang Cockatoo was heard each day during the 6-day site visit and during the device collection visit. The Gang-gang Cockatoo was heard at all times of day when observations were amassed, but more observations were made in the early morning and late evening, which suggests that birds are likely to have been roosting within or very near the offset site. While no evidence of breeding or nesting at the site was detected during the site visits, up to 80 potential hollow-bearing trees were identified within the Lavers Hill property, 12 of which occur within the offset site. Furthermore, the trees in the forest at the site are of sufficient age and size and in such large numbers (estimated to be > 2000 large trees within the broader Lavers Hill property and > 950 large trees within the offset site) that there is expected to be a far greater number of hollows present than was recorded during surveys (i.e., hollows that cannot be seen from the ground). Suitable future breeding habitat (e.g., trees identified with currently unsuitable hollows or tree species currently without hollows of suitable size that are likely to develop hollows in the future) is also available. Breeding at the site is considered possible.	No surveys undertaken for species. Likely to be present year round for foraging given habitat types Historical and recent records within 500 m in connected habitats
Total score	**7**	**8**	**N/A**

2.2.3 Determining offsets for Yellow-bellied Glider

2.2.3.1 Area of habitat impacted

A detailed assessment of impacts is provided in GHD (2021) and GHD (2023a, 2023b). Following the targeted surveys within the study site including the PAA, during the Yellow-bellied Glider's breeding and non-breeding season, a review of the original area estimate regarding foraging and breeding habitat was undertaken. The extent of habitat to be removed or modified following the implementation of pre-construction measures includes up to of 5.07 ha of vegetation, inclusive of up to 13 potential hollow-bearing trees within the impact area, considered to be known foraging, potential denning and breeding habitat. The 5.07 ha includes habitat suitable for future breeding (e.g., trees that would be likely to develop hollows in the future).

The type and extent of habitat for each section in the PAA to be removed that is relevant to this species consists of a combination of long and short linear strips along the edge of the remnant forest where it meets the existing easement.

The habitats within the PAA are well represented along the extent of the pipeline corridor and extensive areas of equal or better quality habitat is located adjacent to the pipeline corridor in the form of remnant forest and woodland, which will be retained (e.g., the Great Otway National Park). However, the habitat within the PAA may be permanently modified and, in some places, entirely removed and replaced by habitat unsuitable for the species (e.g., cleared easement) thus reducing the area of habitat.

2.2.3.2 Habitat quality score assessment criteria

The following criteria were used to determine habitat quality scores for the Yellow-bellied Glider.

Site condition

– 4 (high) – diversity of relevant habitats (e.g., multiple EVCs or other documented habitat types), each habitat has all structural elements (e.g., understorey, midstorey, tall trees) and all known habitat features (e.g., evidence of breeding hollows, smooth and rough barked Eucalyptus), high species diversity within each habitat type including foraging (food) species, high or very high VQA score (0.5 - 0.99) and no obvious disturbance.
– 3 (medium-high) – moderate to high diversity of habitats (e.g., multiple EVCs or other documented habitat types), each habitat has the majority of structural elements (e.g., understorey and/or midstorey, tall trees), and known and potential habitat features (e.g., presence of potential breeding hollows, smooth barked Eucalyptus), moderate to high species diversity and moderate to high VQA score (0.5 - 0.75) and obvious (e.g., one or two small area of cleared/modified habitat) but not substantial disturbance.
– 2 (medium) – moderate diversity habitats (e.g., one or two EVCs or documented habitat types), each habitat has the majority of structural elements (e.g., ground cover, understorey and/or midstorey), and most habitat features, moderate species diversity and moderate VQA score (0.25 - 0.50) and obvious and substantial disturbance (e.g., multiple areas of cleared/modified habitat).
– 1 (low) – single relevant habitat type with one or two structural elements missing/degraded, few habitat features, low diversity, low VQA score (< 0.25) and obvious disturbance.

Note: When considering site condition criteria, all elements must be reviewed and used to develop the score. For example, a site may have a number or one EVC. EVCs are a surrogate for habitat types, however, the structural elements within each EVC (habitat type) are also very important as multiple EVCs may be present but lack hollow-bearing trees for breeding and denning, hence missing key habitat elements, whereas one EVC may present all structural elements. There are a variety of scenarios that may not fit neatly within a single criterion therefore it is important to justify why the site is scored according to the criteria selected (refer Table 5).

Site context

– 3 (high) – excellent connectivity – site part of a much larger area of continuous habitat with obvious habitat linkages (e.g., no obvious gaps) OR at least 25 ha with no gap (cleared of all vegetation) exceeding 25 m in width (less than a sealed single lane road and easement) between site and next patch. Provides an important local or regional linkage for the species to other areas of known habitat. Site is considered important habitat (conservation advice). Site has few threats/threats not considered substantial.

– 2 (medium) – good connectivity. Patch greater than 25 ha, however, gap between site and next patch obvious (> 25 m). Provides local linkage for the species to other areas of potential or known habitat. Site may or may not be considered important habitat (conservation advice). Site has few threats/threats are obvious, one or more may be considered substantial (e.g., evidence of regular tree felling for firewood, busy road intersects site).
– 1 (low) – poor connectivity with one or more gap with next nearest patch of suitable habitat. Patch size may vary (e.g., 25 - 80 ha) but at least one gap with next nearest patch > 50 m away. May act as a 'stepping stone' through an otherwise degraded landscape possible local linkage for the species to other areas of potential habitat. Site may or may not be important habitat (conservation advice). Site has obvious threats/more than one may be considered substantial.

Note: The Yellow-bellied Glider is a mobile species, however, relies upon well connected habitats and habitat patches of a minimum size (e.g., plausible home range of 25 - 85 ha, Craig 1985; Goldingay 1992; Goldingay & Kavanagh 1993; Goldingay & Possingham 1995; Goldingay & Quin 2004 cited in DAWE 2022b). The subspecies (*Petaurus australis australis*) has very low dispersal capabilities over spaces larger than its gliding distance. The maximum gliding distance may be up to 120 m - 140 m (Kavanagh & Rohan-Jones 1982; Kambouris et al. 2013; Goldingay 2014 cited in DAWE 2022b), though management should be informed by average gliding performance (Goldingay 2014 cited in DAWE 2022b). When considering its dispersal ability, a conservative approach was taken and the distances suggested are guidance only. There are a variety of scenarios that may not fit neatly within a single criterion, therefore, it is important to justify why the site is scored according to the criteria selected (refer Table 5).

Species stocking rate

– 3 (high) – known breeding habitat and/or species a resident within the site, as determined by targeted surveys. Note – a single tree could support breeding habitat for the species therefore a larger area that is frequented by the species regularly (e.g., over at least five (5) consecutive nights) with evidence of nightly onsite activity including foraging should also be considered as equally important.
– 2 (medium) – species frequently utilises the site as part of its broader home range, as determined by targeted surveys.
– 1 (low) – species occasionally uses the site as part of its broader home range.
– 0 – species not recorded within the site or nearby the site following targeted surveys, and few if any historical records.

2.2.3.3 Quality of habitat impacted and offset sites

Table 5 details the score assessment and justification for each characteristic for the proposed action area (impact area) and the proposed offset site for the Yellow-bellied Glider. Based on the inputs in Table 5, 'Impact calculator – quantum of impact – quality' (i.e., the quality of habitat to be impacted) was scored as 7/10 overall and the quality of habitat for offset site 1 was 8/10. Given the lack of data and only marginal habitat available for the Yellow-bellied Glider within offset site 2, the data for this site is not presented in this report. Offset site 2 is not proposed to be used as an offset for this species for the project.

2.2.3.4 Quantum of impact

An impact area of 5.07 hectares has been entered in the 'area of habitat' field and '7/10 quality' has been entered in the 'quality' field in the 'impact calculator' section of the offsets assessment guide for Yellow-bellied Glider habitat. When the above values for area of habitat impacted and quality of habitat impacted are entered in the offsets assessment guide calculations (DAWE 2020b), the 'Quantum of Impact' is calculated as 3.55 'adjusted Hectares'.

2.2.3.5 Estimated offset requirement

A preliminary offsets assessment guide calculation (Appendix E) was performed as a guide to the size and type of offset that would be required to meet the EPBC Act offset requirements for the project's impacts on Yellow-bellied Glider habitat.

Based on the preliminary offsets assessment guide calculation, the project would require an offset of around 19.06 hectares of Yellow-bellied Glider habitat. Potential offset sites have been identified that contain the required area of the habitat (33.01 ha) and are described in section 3.1.

Table 5 Yellow-bellied Glider – Quality of habitat score considering site condition, site context, species stocking rate

Component (DSEWPaC 2012b)	Proposed action area (GHD 2021 and GHD 2023b)	Offset site – 450 Morris Track (GHD 2024 – Appendix A and ABZECO 2024a)
Site condition	*Score 2*	*Score 3*
What is the structure and condition of the vegetation on the site?	PAA consists of a corridor with a vehicle track and two vegetation types: 1. A maintained easements which is regularly slashed/mowed with occasional large old trees 2. Remnant vegetation forming the edge (created by the access track/easement) of an extensive area of intact habitat within Great Otway National Park The remnant component is heavily forested with structurally and floristically diverse habitats. Four relevant Ecological Vegetation Classes (EVCs 16, 48, 17, 198) – vegetation/habitat types. Historical logging (> 40 years ago) within parts of the National Park and within the state forest (Otway Forest Park). Approximately 30% of the PAA recently burnt (April 2022) with historical fire sign present (> 5 years) in other parts. Vegetation Quality Assessment outcomes – habitat condition score ranging from 0.41-0.57 Not all habitats within PAA used by Yellow-bellied Glider (YBG)	The site consists almost entirely of native vegetation with large trees, logs and a dense understorey and midstorey. There are two bulldozed tracks within the Lavers Hill property, one (approximately 200 m long) to the east, north of Chapple Creek, and the other (approximately 2.1 km long and ending beyond offset site) to the south-east, south of Chapple Creek. The track south of Chapple Creek has been excluded from the offset site area. Structurally and floristically diverse habitats. Three EVCs (201, 30, 31) – vegetation/habitat types. Historical logging (mostly 100+ years ago) within parts of the site. No sign of recent substantial fires. Vegetation Quality Assessment outcomes – habitat condition score ranging from 0.78-0.84. The Yellow-bellied Glider was recorded from all habitats within the Lavers Hill property.
What is the diversity of relevant habitat species present (including both endemic and non-endemic)?	Relevant habitat species include overstorey (tree) and understorey (shrub) layers Six Eucalyptus species 18 other shrub and tree species	Relevant habitat species include overstorey (tree) and understorey (shrub) layers Three Eucalyptus species 17 other shrub and tree species
What relevant habitat features are on the site?	Tall trees with excellent connectivity for gliding Foraging habitat up to 5.07 ha including known feed trees *E. obliqua, E. viminalis, E. baxteri, E. ovata* Potential denning/breeding habitat – up to 13 suitable hollow-bearing trees within PAA Suitable future denning/breeding habitat (e.g., trees identified with currently unsuitable hollows or tree species currently without hollows of suitable size in the proposed action area that are likely to develop hollows in the future).	Tall trees with excellent connectivity for gliding Foraging habitat up to 33.01 ha including known feed trees *E. obliqua, E. viminalis.* Potential denning/breeding habitat – up to 80 potential hollow-bearing trees were identified within the Lavers Hill property, 12 of which occur within the offset site. Furthermore, the trees in the forest at the site are of sufficient age and size and in such large numbers (estimated to be > 2000 large trees within the broader Lavers Hill property and > 950 large trees within the offset site) that there is expected to be a far greater number of hollows present than was recorded during surveys (i.e., hollows that cannot be seen from the ground) and to support future hollow-development. Breeding at the site is considered likely, but was not confirmed.

Component (DSEWPaC 2012b)	Proposed action area (GHD 2021 and GHD 2023b)	Offset site – 450 Morris Track (GHD 2024 – Appendix A and ABZECO 2024a)
Site context	*Score 3*	*Score 3*
What is the connectivity with other suitable/known habitat or remnants?	Located within the Great Otway National Park and Otway State Forest – part of an extensive contiguous area over 2000 ha. There are 62 records of the Yellow-bellied Glider within the study area (ALA and VBA 2022). The Yellow-bellied Glider was recorded on 15 different occasions (different dates/times) across seven locations (some including repeat survey sites) during the listening period prior to spotlighting or during spotlight surveys during targeted surveys. All locations were within 10 km (most 1 - 2 kms) and within habitats well connected to the PAA	The proposed offset site is heavily forested and forms part of a larger forested area. The western boundary connects to the Great Otway National Park, and the northern, eastern and southern boundaries connect to the Otway Forest Park and freehold forested land. Yellow-bellied Glider is known from the area surrounding the offset site. No minor or major barriers to the movement the Yellow-bellied Glider or other gliding or arboreal mammal species through or into/out of the site to adjoining habitats. There are six (6) VBA records and seven (7) ALA records from the study area (10 km area surrounding the offset site).
What is the importance of the site in relation to the overall species population or the occurrence of the community?	The species Conservation Advice (DAWE 2022b) lists important populations of the species – those individuals identified as part of the recent surveys within the PAA are part of the subpopulation of the species within the Otways which is part of the known important Western Victoria population listed by DAWE (DAWE 2022b). The PAA contains habitat that is part of the larger area of habitat in the study area that is critical habitat including large contiguous areas of floristically diverse eucalypt forest, with winter flowering and smooth-barked eucalypts (albeit confined to a few areas), mature living hollow-bearing trees and sap trees. However, parts of the PAA are recently burnt. Although the habitats of the PAA are well connected, the extent of habitat impacted is limited to linear strips along the edge of the remnant where it meets the existing easement.	The species Conservation Advice (DAWE 2022b) lists important populations of the species – those individuals identified as part of the recent surveys within the site are part of the subpopulation of the species within the Otways which is part of the known important Western Victoria population listed by DAWE (DAWE 2022b). The site contains habitat that is part of the larger area of habitat in the study area that is critical habitat (DAWE 2022b) including large contiguous areas of floristically diverse eucalypt forest, with winter flowering and smooth-barked eucalypts (throughout the site), mature living hollow-bearing trees and sap trees. Species likely to be breeding resident within the offset site (not confirmed).

Component (DSEWPaC 2012b)	Proposed action area (GHD 2021 and GHD 2023b)	Offset site – 450 Morris Track (GHD 2024 – Appendix A and ABZECO 2024a)
What threats occur on or near site?	Sections 19 and 20 are within/adjacent the Otway Forest Park and adjacent to private land. The activities permitted within these land use types (e.g., minor firewood harvesting, trail bike riding, horse-riding, etc.) do not entirely promote conservation actions that protect threatened species. Evidence of illegal timber harvesting (e.g., felled/sawn trees) was noted during surveys within Great Otway National Park. Deer were present and have capacity to degrade habitat/change habitats over time. Deer evidence was regularly recorded along Porcupine Creek and deer were heard during nocturnal surveys. Introduced honey bee hive noted at two locations near the PAA – potential nest competition Weeds have the capacity to degrade habitat quality over time Potential evidence of the pathogen *Phytophthora cinnamomi,* e.g., grass-tree dieback. Fire – although most recent fires likely to have caused short term disturbance – not catastrophic	Deer have capacity to degrade habitat/change habitats over time. Deer presence was obvious (e.g., camera trap images, scat, browsing). Weeds have the capacity to degrade habitat quality over time. *Rubus fruticosus* spp. agg. (Blackberry) was present in low numbers on the outer edges of the internal tracks with scattered occurrences further south. *Cirsium vulgare* (Spear Thistle) was only observed at a single location as a juvenile plant in the south-east corner of the offset site. *Rubus fruticosus* spp. agg. (Blackberry) and *Cirsium vulgare* (Spear Thistle), are listed under the *Catchment and Land Protection Act 1994* (CaLP Act) as a controlled weed with the former also listed as a Weed of National Significance (WoNS). Currently zoned Farming. There is a risk that farming activities could occur and the quality of the habitat for the species is impacted/area reduced. Proposed protection through Section 69 Agreement on title land security
Species stocking rate	*Score 2*	*Score 2*

Component (DSEWPaC 2012b)	Proposed action area (GHD 2021 and GHD 2023b)	Offset site – 450 Morris Track (GHD 2024 – Appendix A and ABZECO 2024a)
What is the presence of the species on the site? (i.e., confirmed/modelled) What is the density of species known to utilise the site? What is the role of the site population in regards to the overall species population?	Targeted surveys in May 2022, recorded YBG from three sites within and in close proximity (< 50 m) to the PAA and three off site locations from the analysis and review of acoustic data. The YBG was also recorded on 15 different occasions (different dates/times) across seven locations (some including repeat survey sites) during the listening period prior to spotlighting or during spotlight surveys. One of the seven locations was within 30 m of the study site, at Porcupine Creek. All other locations were off site. Three of the remaining locations are south of the study site within 50 m of Pipeline Track and/or different sections of Porcupine Creek. The locations off Pipeline Track and Porcupine Creek outside the study site north of Ridge Road are within habitats contiguous with the habitats of the study site, and have no major natural barriers (e.g., steep sided hills or major river crossings) that would prevent the YBG from moving through this area. The gliders observed and heard along Fawcett Track were located in contiguous habitat along a drainage line that connects with Porcupine Creek. One observation of Yellow-bellied Glider using a hollow was recorded whilst spotlighting in the Porcupine Creek area. The glider was then observed to move up the trunk to the back of the tree away from the spotlight. After 1 - 2 minutes of searching, the tree the glider was observed in a hollow. The tree with the hollow is located within the study site but not in the proposed project impact area.	Targeted surveys were completed during February 2024 and March 2024. YBG calls were recorded using PAM from all eight sites within the Lavers Hill property and for 19 consecutive survey nights from within the property (all sites combined). The species was also recorded on 67 different occasions (different dates/times) across 15 locations during the listening period prior to spotlighting or during spotlight surveys within the Lavers Hill property, including within the offset site. Two focal areas of concurrent Yellow-bellied Glider activity were evident within the Lavers Hill property (north-east and south-west of the property), which suggests that there is more than one family group using the property and at least one group that uses, and potential resides in, the offset site (in the south-west). Yellow-bellied Gliders were also heard outside the Lavers Hill property (i.e., heard while standing on the site boundary) to the south, west, east and north. The presence of historical and recent feed sign also demonstrates a history of regular use and occurrence within and adjoining the offset site. Given the reported home range (plausible home range 25 - 85 ha, DAWE 2022b) and area of available habitat within the proposed offset site (33.01 ha) it is likely that the offset site provides regular habitat for at least one family group of Yellow-bellied Glider. However, given conclusive evidence of breeding/denning trees within the offset site was not confirmed during targeted surveys, the species is conservatively not considered to be solely dependent on habitat within the offset site.
Total score	**7**	**8**

2.2.4 Determining offsets for Long–nosed Potoroo

2.2.4.1 Area of habitat impacted

The proposed action will remove or modify up to 7.81 ha of identified habitat and potential habitat for the Long-nosed Potoroo from within the PAA from across five different vegetation types. Higher quality habitats for this species (e.g., areas with dense understorey) are located in specific areas along the PAA. The cleared pipeline corridor within the PAA consists of a maintained grassy verge without trees between the road/track and intact remnant vegetation (at least 0.5 ha), and is low quality occasional foraging habitat that lacks any structure and would not be used by this species for breeding or refuge.

Investigation of the PAA concluded that the species may regularly use the intact vegetation sections of the PAA for foraging, particularly forested/dense areas of habitat located along creeks including Porcupine Creek and in low lying areas with dense vegetation. However, the species is considered unlikely to nest or breed within the PAA, particularly within the cleared pipeline corridor because of the small linear shape of the available habitat and also the lack of suitable habitat in the grassy verge (absence of dense ground cover and shrub layer).

The extent of habitat for this species is limited to long and short linear strips along the edge of the remnant forest where it meets the existing easement, consisting of moderate to dense understorey, ground cover and good tree canopy cover.

Habitats for this species within the PAA are well represented along the extent of the pipeline corridor and extensive areas of equal or better quality habitat occurs adjacent to the pipeline corridor in the form of remnant forest and woodland, which will be retained (e.g., the Great Otway National Park). However, the habitat within the PAA may be permanently modified and, in some places, entirely removed and replaced by habitat unsuitable for the species (e.g., cleared easement) thus reducing the area of habitat.

2.2.4.2 Habitat quality score assessment criteria

The following criteria were used to determine habitat quality scores for the Long-nosed Potoroo.

Site condition

– 4 (high) – high diversity of relevant habitats (e.g., multiple EVCs or documented habitat types), containing foraging, refuge and breeding resources (e.g., dense understorey layer to provide cover, but with sufficient open space beneath the sub-canopy to allow foraging), each habitat has all relevant structural elements intact (e.g., ground cover, understorey and midstorey), high to very high VQA score (0.5 - 0.75) and no obvious disturbance (e.g., no cleared areas).
– 3 (medium-high) – moderate to high diversity of habitats (e.g., multiple EVCs or documented habitat types), each habitat has the majority of relevant structural elements (e.g., ground cover, understorey and/or midstorey), moderate to high species diversity and moderate to high VQA score (0.5 - 0.75) and some but not obvious disturbance (e.g., weed coverage < than 1% of the site, some cleared areas such as the grassy maintained verge along the edge of the remnant patch).
– 2 (medium) – moderate diversity habitats (e.g., one or two EVCs), each habitat has the majority of structural elements (e.g., ground cover, understorey and/or midstorey), and most habitat features, moderate species diversity and moderate VQA score (0.25 - 0.50) and moderate obvious disturbance (e.g., > 1% weed coverage of the site, multiple cleared areas).
– 1 (low) – 1 relevant habitat, with one or two structural elements missing/degraded, few habitat features, low diversity, low VQA score (< 0.25) and obvious disturbance.

Note: When considering site condition criteria, all elements must be reviewed and used to develop the score. There are a variety of scenarios that may not fit neatly within a single criterion, therefore it is important to justify why the site is scored according to the criteria selected (refer Table 6).

Site context

– 3 (high) – excellent connectivity – site is part of a much larger area of continuous habitat OR acts as an important local or regional linkage for the species to other areas of known habitat. If identified as a linkage area, the site must be 0.1 km^2 (10 ha)[1] or greater with no gap (cleared of all vegetation) exceeding 15 m in width (less than an unsealed single lane road and easement) between site and next patch. Site is considered important habitat (conservation advice). Site has few threats or threats that are not yet considered substantial (e.g., fox may be present but activity not obvious after surveys). The land use/tenure provides protection for the species (e.g., the Great Otway National Park).
– 2 (medium) – good connectivity. Provides local linkage for the species to other areas of potential or known habitat, however, some obvious gaps (> 15 m) or potential barriers (e.g., busy local road or highway) to movement of species within nearby patches of habitat. If identified as a linkage area the site must be 0.1 km^2 (10 ha) or greater. Site has obvious threats but not considered substantial. Site may or may not be considered important habitat (conservation advice). The land use/tenure provides some protection, however, cannot offer the same security as a National Park (e.g., Portions of the action area are Sections 19 and 20 are within/adjacent the Otway Forest Park and/or private land. The activities permitted within these land use types (e.g., minor firewood harvesting, trail bike riding etc) do not entirely promote conservation actions that protect threatened species.
– 1 (low) –site is isolated patch with poor or no obvious connectivity. Size of site may vary, however, patch must be greater than 0.16 km^2 (400 x 400 m) to support some occurrences of the species, if the site is isolated from other patches (e.g., no linkage to surrounding habitat patches, with gaps greater than 15 m and potential barriers). May act as a patch within an otherwise degraded landscape for the species. The land use/tenure may provide opportunities for security for all or part of the site. May or may not be important habitat (conservation advice). Site has obvious threats/one or more may be considered substantial (e.g., lots of fox evidence).

Note: The Long-nosed Potoroo is not considered a mobile species and is easily impacted by habitat fragmentation. When considering its dispersal ability, a conservative approach was taken and the distances suggested are for guidance only. There are a variety of scenarios that may not fit neatly within a single criterion, therefore it is important to justify why the site is scored according to the criteria selected (refer Table 6).

Species stocking rate

– 3 (high) – known breeding habitat and/or species considered a resident within the site, as determined by recent surveys or recent (e.g., within five years) historical records
– 2 (medium) – species utilises the site as part of its broader home range, as determined by recent surveys and/or recent (e.g., within 5 - 10 years) historical records
– 1 (low) – species not recently recorded within the site but may use the site as part of its broader home range/habitat patch,
– 0 – species not recorded within or near the site, as determined by targeted surveys, and few if any historical records nearby

2.2.4.3 Quality of habitat impacted and offset sites

Table 7 details the score assessment and justification for each characteristic for the proposed action area (impact area) and both offset sites. Based on the inputs in Table 7, 'Impact calculator – quantum of impact – quality' (i.e., the quality of habitat to be impacted) was scored as 7/10 overall and the quality of habitat for offset site 2 was 8/10. The data for offset site 1 is presented in Table 6 but is not scored as this site is not proposed to be used as an offset for this species. Offset site 2 alone satisfies the offset requirements, but benefits for the species are expected to be gained for both offset sites. Offset site 1 is not proposed to be used as an offset for this species for the project.

[1] Habitat patch size is important, as the Long-nosed Potoroo rarely occurs in remnant vegetation patches smaller than 0.1 km^2 (10 ha) with some occurrences in habitats 0.16 - 0.40 km^2 (16 - 40 ha) and most occurrences in habitats 0.41 km^2 (41 ha) and greater (DAWE 2022c)

2.2.4.4 Quantum of impact

An impact area of 7.81 hectares has been entered in the ‘area of habitat’ field and ‘7/10 quality’ has been entered in the ‘quality’ field in the ‘impact calculator’ section of the offsets assessment guide for Long-nosed Potoroo habitat. When the above values for area of habitat impacted and quality of habitat impacted are entered in the offsets assessment guide calculations (DAWE 2020b), the ‘Quantum of Impact’ is calculated as 5.47 ‘adjusted Hectares’.

2.2.4.5 Estimated offset requirement

A preliminary offsets assessment guide calculation (Appendix E) was performed as a guide to the size and type of offset that would be required to meet the EPBC Act offset requirements for the project’s impacts on Long-nosed Potoroo habitat.

These preliminary offset calculations for Long-nosed Potoroo were previously submitted to DCCEEW as Attachment 10: Offset Strategy for the Colac Pipeline Upgrade Project (GHD 2023d) of the final preliminary documentation (GHD 2023a) and accepted via the approval issued in January 2024 (DCCEEW 2024). No change has been made to the calculations previously submitted and accepted.

Based on the preliminary offsets assessment guide calculation, the project would require an offset of around 29.43 hectares of Long-nosed Potoroo habitat. Potential offset sites have been identified that contain the required area of the habitat and are described in section 3.1.

Table 6 Long-nosed Potoroo – Quality of habitat score considering site condition, site context, species stocking rate

Component (DSEWPaC 2012b)	Proposed action area (GHD 2021 and GHD 2023b)	Offset site – 450 Morris Track (GHD 2024 – Appendix A and ABZECO 2024a) NOTE – data presented, however, site not proposed as offsite for this species	Offset site – 245 Distillery Creek Road (GHD 2023c – Appendix B and ABZECO 2023)
Site condition	*Score 3*	*N/A*	*Score 3*
What is the structure and condition of the vegetation on the site?	PAA consists of a corridor with a vehicle track and two vegetation types: 1. A maintained easements which is regularly slashed/mowed with occasional large old trees 2. Remnant vegetation forming the edge (created by the access track/easement 5 - 10 m wide) of an extensive area of mostly intact habitat within Great Otway National Park and Otway Forest Park The remnant component is heavily forested with structurally and floristically diverse habitats. Five relevant Ecological Vegetation Classes (EVCs 16, 48, 17, 198, 18) – vegetation/habitat types. Historical logging (> 40 years ago) within parts of the National Park and within the state forest (Otway Forest Park). Approximately 30% of the PAA recently burnt (April 2022) with historical fire sign present (> 5 years) in other parts. Vegetation Quality Assessment outcomes – habitat condition score ranging from 0.41 - 0.57. All habitats within PAA could be used by the species, although habitats along maintained grassy verge, and recently burnt area considered lower quality.	The site consists almost entirely of native vegetation with large trees, logs and a dense understorey and midstorey. There is a small clearing within the proposed offset site near Chapple Creek and two short bulldozed tracks, one (approximately 200 m long) to the east, north of Chapple Creek, and the other (approximately 2.1 km long and ending beyond the site boundary) to the south-east, south of Chapple Creek. The track south of Chapple Creek has been excluded from the offset site area. Structurally and floristically diverse habitats. Three EVCs (201, 30, 31) – vegetation/habitat types. Historical logging (mostly 100+ years ago) within parts of the site. No sign of recent substantial fires. Vegetation Quality Assessment outcomes – habitat condition score ranging from 0.78-0.84. The entire offset site is considered potential habitat for Long-nosed Potoroo as a mostly intact dense ground-cover and understorey layer occurs throughout the offset site – however, there are no records to support usage.	Heavily forested with moderate tree cover and moderate to mostly dense understorey and ground cover layer throughout site, across a moderate to gentle slope with small gullies/minor drainage lines. Only access tracks and bushfire buffer zones cleared of native vegetation. Structurally and floristically diverse habitats. Three EVCs (198, 48 and 16) – vegetation/habitat types. Vegetation Quality Assessment outcomes – habitat condition score ranging from 0.58 - 0.88 (noting a lower score due to absence of large trees in one EVC habitat zone). All habitat types within site used by LNP. Species present within site and considered resident.
What is the diversity of relevant habitat species present (including both endemic and non-endemic)?	Relevant species habitat include species forming sparse to dense understorey and ground cover layer 14 shrub layer species	Relevant species habitat include species forming moderate to dense understorey and ground cover layer 17 shrub layer species	Relevant species habitat include species forming sometimes sparse to often moderate to dense understorey and ground cover layer 25 shrub layer species

Component (DSEWPaC 2012b)	Proposed action area (GHD 2021 and GHD 2023b)	Offset site – 450 Morris Track (GHD 2024 – Appendix A and ABZECO 2024a) NOTE – data presented, however, site not proposed as offsite for this species	Offset site – 245 Distillery Creek Road (GHD 2023c – Appendix B and ABZECO 2023)
What relevant habitat features are on the site?	Sparse to often dense understorey/ground cover layer Majority of the 7.81 ha largely continuous habitat. The PAA consists of known or potential habitat for this species, of which most is located in the Porcupine Creek area (Section 23) and the Dividing Creek area (Section 25i)	33.01 ha of potential continuous habitat as a mostly intact dense ground-cover and understorey layer occurs throughout the offset site.	29.43 ha of high quality continuous known habitat for the species, with sparse to often moderate to dense understorey and ground cover layer. Species known to occur within the offset site.
Site context	*Score 2*	*N/A*	*Score 2*
What is the connectivity with other suitable/known habitat or remnants?	Located within the Great Otway National Park and Otway State Forest – part of an extensive contiguous area over 2000 ha. At least 75 historical records from within 10 km of the PAA. There are five records from connected habitats within 1 - 2 kms of the PAA including one recorded from 1993 within the PAA area from the southern tip of Section 24 – south of Porcupine Creek. This record from 1993 is within the same area of vegetation/habitat from the recent May 2022 surveys in habitat of Porcupine Creek. There are no major barriers preventing the movement of the species within the study site with the exception of the wider than average east-west road easement and firebreak of Link Track and Parkes Lodge Road Section (combined road/firebreak is greater than 40 m wide). The road is commonly used by local residents and an east-west link between Kawarren and Forrest or Barwon Downs, therefore vehicle strike, particularly for ground fauna attempting to traverse the gap at night may be an issue	The proposed offset site is heavily forested and forms part of a larger forested area. The western boundary connects to the Great Otway National Park, and the northern, eastern and southern boundaries connect to the Otway Forest Park and freehold forested land. There are 23 VBA records and one ALA record from the study area (10 km area surrounding the offset site). Long-nosed Potoroo is known from the area near to the offset site (recent records in connected habitat off Mount McKenzie Track, approximately 2.4 km to the west of the site). There are no major barriers preventing the movement of fauna within the offset site, however, roads and cleared roadside vegetation (i.e., along Morris Track) may increase predation risk and create minor barriers for ground mammals into and out of the offset site. However, this is not considered significant for the potoroo, which is larger than most small ground mammals and can cross the gap quickly, if necessary. While no sightings of Long-nosed Potoroo were made during the site visits, the site may still be used by the species occasionally or rarely, or may be colonised by the species if populations in nearby areas grow and disperse.	Surrounded by the Great Otway National Park with the exception of the Barwon Water 20 ha Blue Gum plantations located to the south off Distillery Creek Road. There are no major barriers preventing the movement of this species within the offset site or in and out of the proposed offset site. A small section of the proposed offset site boundary shared with the water reclamation plant is fenced (approximately 600 m) which restricts the north-south movement of fauna, however, the area is otherwise surrounded by reserve or vegetated area, apart from Distillery Creek Road, however, this is not considered significant for the potoroo, which is larger than most small ground mammals and can cross the gap quickly, if necessary. At least 41 historical records from the within 10 km of the site. The nearest historical record for the species is approximately 1.4 km south-west opposite the junction of Loves Track and Iron Bark Drive, off Distillery Creek Road from 2018. More recently Parks Victoria detected Long-nosed Potoroo approximately 4.5 km west of the site during spring of 2022 using camera traps near the entrance of Duck Ponds track, just off Bambra Road (pers comm Claire Miller, Ranger West Coast District, Parks Victoria). This record like all records within 5 kms of the offset site is within continuous habitat connect to the proposed offset site.

Component (DSEWPaC 2012b)	Proposed action area (GHD 2021 and GHD 2023b)	Offset site – 450 Morris Track (GHD 2024 – Appendix A and ABZECO 2024a) NOTE – data presented, however, site not proposed as offsite for this species	Offset site – 245 Distillery Creek Road (GHD 2023c – Appendix B and ABZECO 2023)
What is the importance of the site in relation to the overall species population or the occurrence of the community?	According to the conservation advice for the species (DAWE 2022c) the habitat critical to the survival of the southern long-nosed potoroo includes occupied forested habitats larger than 0.1 km^2. The PAA is part of an area of important habitat. Although the habitats of the PAA are well connected, the extent of habitat impacted is limited to linear strips along the edge of the existing easement consisting of moderate to dense understorey, ground cover and good tree canopy cover.	Given the lack of historical and recent survey records, the site is unlikely to be considered habitat critical to the survival of the species. However, the offset site is 33.01 ha and well connected with surrounding habitat (no substantial barriers) with dispersal capabilities allowing for movements into and out of the offset site.	The site is considered as habitat critical to the survival of the species (0.29 km^2). Importantly it is well connected with surrounding habitat (no obvious barriers) within a protected reserve with dispersal capabilities allowing for movements into and out of the site. Species known to occur within the offset site.
What threats occur on or near site?	Sections 19 and 20 are within/adjacent the Otway Forest Park and adjacent to private land. The activities permitted within these land use types (e.g., minor firewood harvesting, trail bike riding, horse-riding, etc.) do not entirely promote conservation actions that protect threatened species Predators – Cats and fox were present. Fox was regularly recorded in all sections of the PAA during camera trap and field observations. Evidence of illegal timber harvesting (e.g., felled/sawn trees) was noted during surveys within Great Otway National Park. Deer were present and have capacity to degrade habitat/change habitats over time. Deer evidence was regularly recorded along Porcupine Creek and deer were heard during nocturnal surveys. Weeds have the capacity to degrade habitat quality over time (< 1% coverage across site). Potential evidence of the pathogen *Phytophthora cinnamomi,* e.g., grass-tree dieback Rabbits – competition and can degrade habitat over time	Predators – Cats and fox were regularly recorded during camera trap and field observations. Deer have capacity to degrade habitat/change habitats over time. Deer presence was obvious (e.g., camera trap images, scat, browsing). Weeds have the capacity to degrade habitat quality over time. *Rubus fruticosus* spp. agg. (Blackberry) was present in low numbers on the outer edges of the internal tracks with scattered occurrences further south. *Cirsium vulgare* (Spear Thistle) was only observed at a single location as a juvenile plant in the south-east corner of the offset site. *Rubus fruticosus* spp. agg. (Blackberry) and *Cirsium vulgare* (Spear Thistle), are listed under the *Catchment and Land Protection Act 1994* (CaLP Act) as a controlled weed with the former also listed as a Weed of National Significance (WoNS). Currently zoned Farming. There is a risk that farming activities could occur and the quality of the habitat for the species is impacted/area reduced. Proposed protection through Section 69 Agreement on title land security.	Predators – Cats and Foxes. Cats recorded on camera traps. Deer have capacity to degrade habitat/change habitats over time. Deer presence was obvious (e.g., scat, tracks, wallows). Weeds have the capacity to degrade habitat quality over time (< 1% coverage across site). Potential evidence of the pathogen *Phytophthora cinnamomi* was recorded in the offset site, e.g., grass-tree dieback. Currently zoned Public Use. There is a risk that development activities could occur and the quality of the habitat for the species is impacted/area reduced. However, other harmful activities are not permitted, e.g., firewood collection. Proposed protection through Section 69 Agreement on title land security.

Component (DSEWPaC 2012b)	Proposed action area (GHD 2021 and GHD 2023b)	Offset site – 450 Morris Track (GHD 2024 – Appendix A and ABZECO 2024a) NOTE – data presented, however, site not proposed as offsite for this species	Offset site – 245 Distillery Creek Road (GHD 2023c – Appendix B and ABZECO 2023)
	Fire – although most recent fires likely to have caused short term disturbance – not catastrophic		
Species stocking rate	*Score 2*	*NA*	*Score 3*
What is the presence of the species on the site? (i.e., confirmed/modelled) What is the density of species known to utilise the site? What is the role of the site population in regards to the overall species population?	One image from a recent video (GHD 2023b) of LNP within the study site approximately 20 - 30 m from the PAA Likely to be more LNP with study site particularly within the Porcupine Creek area. Possible resident within better quality habitats of the study site, however, the PAA represents a portion of the overall habitat required by the species.	Unknown – not recorded within the offset site despite targeted surveys. Recent records in nearby areas (most recently in 2022 approximately 2.4 km west of the site).	Species resident within site. The LNP was recorded using camera traps from 5 sites and 360 images over the course of 24 of the 25 survey days (all sites combined). Based on the distance between each camera location and time/date of the images, at least three, possibly four, LNP individuals were recorded within the proposed offset site. Activity patterns of the species were examined and it was revealed that the species was most active during the night and also active to a lesser extent during the hours before sunset and after sunrise.
Total score	**7**	**NA**	**8**

3. Proposed offset sites

Section 3 provides the following information for each of the proposed offset sites:

– A description of the offset and including location, size, condition and environmental values
– Details of the surveys undertaken in accordance with the survey guidelines used to confirm the presence of the protected matter at the offset site
– Details of the quality of the offset site including vegetation condition assessment (VQA) and habitat characteristics for the protected matter, and a comparison of these values in relation to the impact site
– Details of on-going threats to the protected matter at the offset site

Figure 1 displays each offset site with regard to the proposed action area. Figure 2 and Figure 3 display each offset site. Key information regarding each of these points is provided below with detailed information (e.g., detailed methods and results) provided in the site-specific offset survey reports in Appendix A (450 Morris Track, Lavers Hill) and Appendix B (245 Distillery Creek Road, Aireys Inlet).

Section 3.2 presents new information relating to the recently proposed offset site at 450 Morris Track. Section 3.3 was previously submitted to DCCEEW as Attachment 10 (GHD 2023d) of the final preliminary documentation (GHD 2023a).

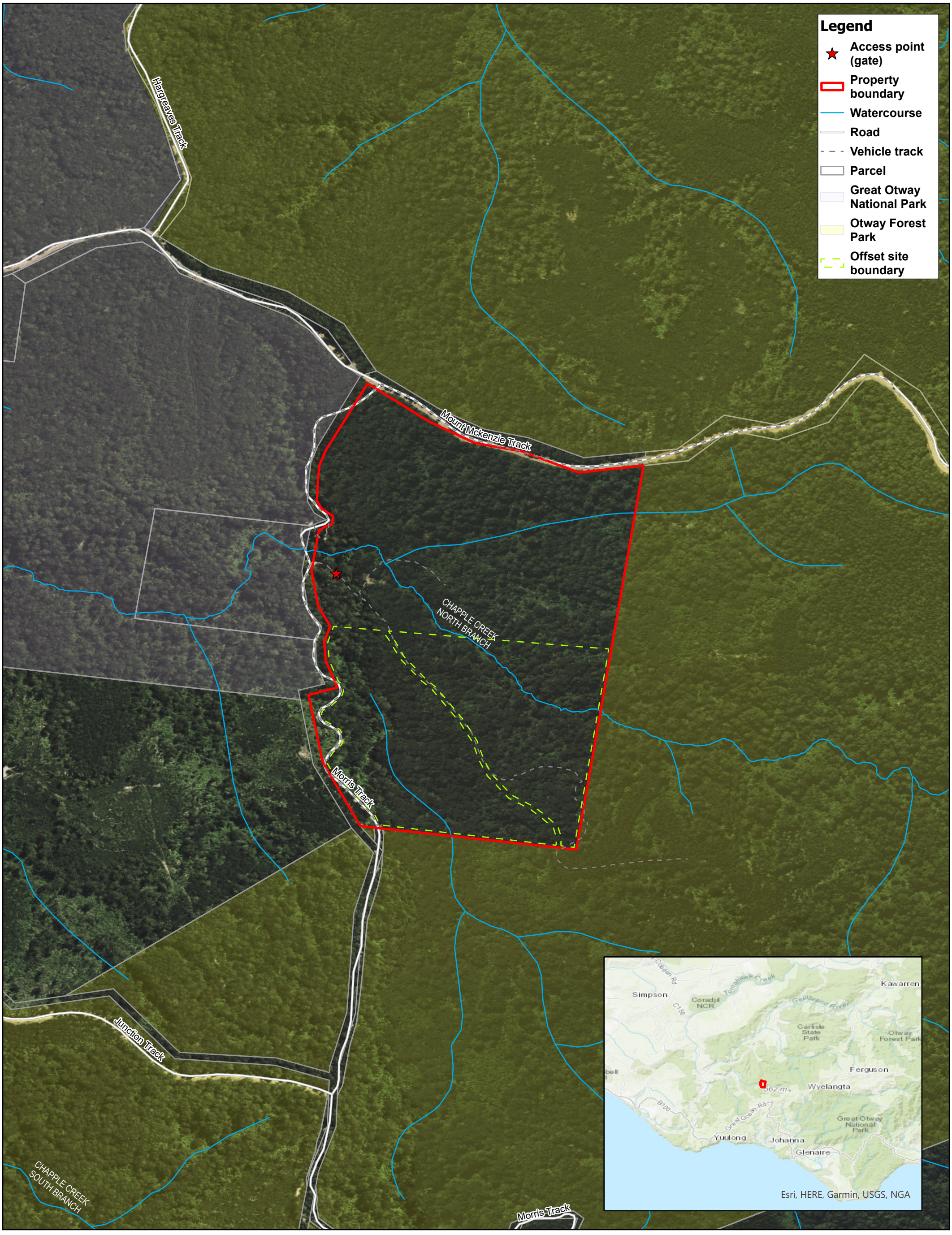
3.1 Offset sites summary description

The proposed offset sites are described in Table 7.

Table 7 Summary description of each proposed offset site

Item	Offset site 1 – 450 Morris Track, Lavers Hill	Offset site 2 – Distillery Creek Road, Aireys Inlet
Location, size and tenure	Privately owned property (owned and to be managed by Barwon Water). Located approximately 38 km southwest of Colac, 4 km north-northeast of Lavers Hill, 100 km south-west of Geelong, and 40 km south-west of the Colac pipeline project site. The proposed offset site is heavily forested and forms part of a larger forested area. The western boundary connects to the Great Otway National Park, and the northern, eastern and southern boundaries of the property connect to the Otway Forest Park and freehold forested land. Located within Otway Ranges Bioregion and managed area of the Colac Otway Shire and Corangamite Catchment Management Authority. Proposed offset site is 33.01 ha of a larger 78.68 ha privately owned property (owned and to be managed by Barwon Water).	Privately owned land – managed by Barwon Water as part of the Aireys Inlet Water Reclamation Plant facility. Located 2.5 km north of Aireys Inlet, within the Otway Plain Bioregion and managed area of the Surf Coast Shire and Corangamite Catchment Management Authority. Proposed offset site is 29.43 ha of the 31.4 ha area managed by Barwon Water and is surrounded by the Great Otway National Park.

Item	Offset site 1 – 450 Morris Track, Lavers Hill	Offset site 2 – Distillery Creek Road, Aireys Inlet
Environmental values	The site consists almost entirely of native vegetation with large trees, logs and a dense understorey and midstorey. There are two bulldozed tracks within the Lavers Hill property, one (approximately 200 m long) to the east, north of Chapple Creek, and the other (approximately 2.1 km long and ending beyond offset site) to the south-east, south of Chapple Creek. The track south of Chapple Creek runs through the offset site but has been excluded from the offset site area. Three Ecological Vegetation Classes were mapped in the offset site by ABZECO (ABZECO 2024a): Shrubby Wet Forest (EVC 201), Cool Temperate Rainforest (EVC 31) and Wet Forest (EVC 30). Preliminary mapping undertaken by GHD to inform habitat values of the Lavers Hill property was also undertaken (Appendix A), which included the mapping of Riparian Forest (EVC 18). The condition of the vegetation across each EVC was relatively consistent with scores ranging from 0.78 - 0.84. 70 fauna species were identified at the site, including 66 native species (10 mammals, 51 birds, one reptile, two amphibians and two invertebrates) and four non-native species.	EVC/habitat types (Sedgy Riparian Woodland (EVC 198), Heathy Woodland (EVC 48), and Lowland Forest (EVC 16)) form continuous remnant vegetation throughout the site providing high quality habitat, particularly for the Long-nosed Potoroo, including a largely continuous moderate to dense understorey/shrub layer. 74 fauna species were identified at the site from a combination of targeted and opportunistic surveys, including 68 native species (14 mammals, 49 birds, three amphibian and two reptiles) and six non-native species.
Landscape context	The site occurs within the Farming Zone (FZ) and has historically been used for logging. Given the general size of the existing alive trees, however, logging is considered unlikely to have been recent or involving clear-felling. Surrounding land beyond the proposed offset site is likely to have similar quality vegetation. There are no major barriers preventing the movement of fauna within the offset site, however, roads and cleared roadside vegetation (i.e., along Morris Track) may increase predation risk and create minor barriers for ground mammals into and out of the offset site.	The site occurs within Public Use Zone (PUZ). There are no major barriers preventing the movement of fauna within the offset site or in and out of the proposed offset site. The site is surrounded by the Great Otway National Park with the exception of a small earth quarry and the Barwon Water 20 ha Blue Gum plantations located to the south off Distillery Creek Road.
MNES presence and habitat	**Present – Yellow-bellied Glider and Gang-gang Cockatoo** 33.01 ha of high quality foraging habitat and potential denning and/or breeding habitat for the Yellow-bellied Glider. Species considered to regularly use the offset site, and is potentially resident. 33.01 ha of high quality foraging, resting and roosting habitat for the Gang-gang Cockatoo, and potential (but not confirmed) breeding habitat. 33.01 ha of potential habitat for Long-nosed Potoroo, but no species' records within the site.	**Present – Long-nosed Potoroo** 29.43 ha of high quality foraging, shelter and breeding habitat for the Long-nosed Potoroo. Species considered resident within offset site. 29.43 ha of foraging, resting, roosting and potential breeding habitat for the Gang-gang Cockatoo. Unlikely to support Yellow-bellied Glider given habitat types.



Paper Size ISO A3

0 50 100 150 200 250

Meters

Horizontal Datum: GDA 1994
Grid: GCS GDA 1994

N

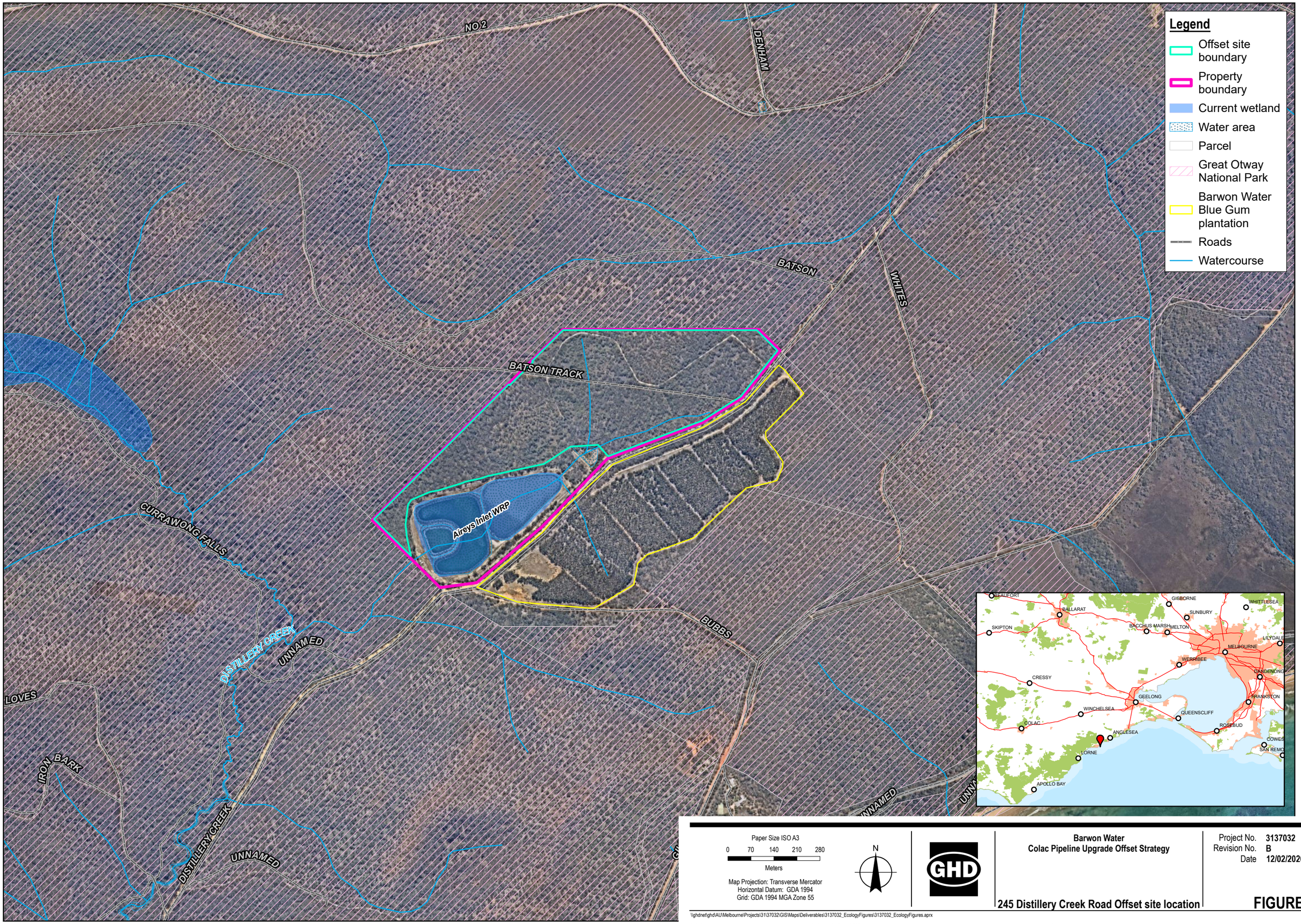
Barwon Water
Colac Pipeline Upgrade Offset Strategy

Proposed offset site location
450 Morris Track, Lavers Hill

Project No. **3137032**
Revision No. **A**
Date **9/08/2024**

FIGURE 2

\\ghdnet\ghd\AU\Melbourne\Projects\31\37032\GIS\Maps\Working\Ecology\2024\Lavers hill offset site\3137032_Lavers Hill offset site.aprx



Paper Size ISO A3

0 70 140 210 280

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

Barwon Water
Colac Pipeline Upgrade Offset Strategy

245 Distillery Creek Road Offset site location

Project No. **3137032**
Revision No. **B**
Date **12/02/2026**

FIGURE 3

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Data source:DEECA 2023,VicMap,2023 ;Aerial Imagery: Vicmap Basemap- Vicgrid Basemap - VicGrid94 - Aerial Data Custodian, Data Set Name/Title, Version/Date. Created by:macabral

3.2 Offset site 1 – 450 Morris Track, Lavers Hill

3.2.1 Survey methods and results

Survey methods and effort were informed by information sources listed in section 2.2.1 of Appendix A, but also required consideration of project timelines and safety and animal ethics requirements (e.g., working at height when installing cage traps, potential for animal injury/death using hair tubes). Consequently, the methods did not strictly follow all advice offered in the reviewed resources (e.g., no cage trapping for Yellow-bellied Glider or hair-tube surveys for Long-nosed Potoroo). Table 8 provides a summary of the survey, methods, effort and results for the offset site.

The survey was undertaken over the following periods:

– Four GHD ecologists (Craig Grabham, Richard Retallick, Will Wilson and Emma Pacholli) over a six-day period: 12 - 17 February 2024
– Two GHD botanists (Brendan Janissen and Armando Gillado): 14 - 16 February 2024
– Two GHD ecologists (Armando Gillado and Lukas Fellows): 29 February 2024 - 1 March 2024

Table 8 Summary of survey methods, timing and effort for offset site 1 – 450 Morris Track

Method timing and effort	Survey adequacy
Passive Acoustic Monitoring (PAM) 8 x PAM (AudioMoth) locations at least 350 m apart for between 15 - 19 consecutive nights between 12/02/2024 and 01/03/2024. Programmed to record from 8:30 pm - 1:30 am and 4:00 am - 6:30 am (8.5 hours each night) throughout Lavers Hill property. Depending on the steepness of terrain and aural detection range, AudioMoths were located approximately 350 - 470 m apart.	According to Whisson et al (2021) – Yellow-bellied Glider (YBG) vocalisations were most common in the four hours after sunset, and rainfall negatively influenced detection probability, especially during the autumn/winter sampling period. Detection of YBG with PAM requires programmed PAMs to record for four hours after sunset, for a minimum of six nights with minimal inclement weather (i.e., seeking little or no wind or rain). The survey period should be extended to 12 nights when rain or wind are forecast. Not suitable for Gang-gang Cockatoo as the recording period was not optimised for this mostly diurnal species. ***Summary of survey effort and outcomes*** No issues noted using this technique. The analysis was restricted to the four hour period from sunset onwards (approximately 9:00 pm - 1:00 am) which is accepted as the most productive period for vocalisations. Eight sites for between 15 - 19 consecutive nights for approximately 120 survey-nights. Favourable conditions were recorded for the majority of the survey period, however, there were several nights of rain and/or wind. However, there was sufficient survey effort (e.g., duration and number of sites) to overcome any issues (e.g., inclement weather) that may have impacted this method. YBG vocalisations were recorded at 8 of the 8 PAM sites during the survey (including the 4 PAM sites within or immediately near the offset site).
Spotlighting Transect and opportunistic surveys completed for 4 nights (12/02/24 and 14 - 16/02/24) at approximately 2 hours each night within the Lavers Hill property.	Suitable survey technique for detecting the YBG (DSE 2011, DSEWPaC 2011, DAWE 2022b, Goldingay et al 2017). Not suitable for Gang-gang Cockatoo or Long-nosed Potoroo. ***Summary of survey effort and outcomes*** Some issues noted using this technique, particularly restricted visibility to tree canopy in areas where there was dense midstorey vegetation. This limitation somewhat offset by the YBG being a vocal species that would expect to be heard vocalising if present. Approximately 23 person hours over four nights throughout the Lavers Hill property. YBG recorded on 63 occasions (aural or visual) across the Lavers Hill property over 4 nights during the listening period prior to spotlighting or during spotlight surveys.
Camera ground 17 sites within the Lavers Hill property for up to 17 days and nights between 12/02/24 and 01/03/24. 15 of the 17 cameras were baited, and 2 were placed along existing animal trails/tracks and were unbaited.	Suitable survey technique for detecting the Long-nosed Potoroo (DEPI 2013, DSEWPaC 2011, Robley et al various dates). Not suitable for Gang-gang Cockatoo or Yellow-bellied Glider ***Summary of survey effort and outcomes*** One camera recorded for only eight days as battery died prematurely. No other issues noted using this technique. Seventeen sites for 280 survey-nights. Approximately one camera per 4.5 ha. Eight camera sites occur within the offset site. At least 17 fauna species were recorded including small ground mammals (Long-nosed Bandicoot), however, the Long-nosed Potoroo was not recorded.

Method timing and effort	Survey adequacy
Diurnal bird survey 24 x 20 min point or transect count searches in or along boundary of the Lavers Hill property between 12 - 17/02/24 and between 29/02/24 and 1/03/24. Opportunistic bird lists taken while undertaking other survey activities from 12 - 17/02/24 and 29/02/24 and 1/03/24.	Suitable survey technique for detecting Gang-gang Cockatoo (DAWE 2022b) and other cockatoo/parrot species (DEWHA 2010). ***Summary of survey effort and outcomes*** No issues recorded. Although the survey was undertaken during the documented Gang-gang Cockatoo breeding season it was outside the typical breeding period (October - January, Higgins 1999) and it is possible that young had fledged and were not reliant on tree hollows. Therefore, the chance of encountering breeding events and species-hollow interactions was reduced. 24 surveys over seven days (excluding opportunistic observations). 33 records of Gang-gang Cockatoo were recorded during the 8 days on site in or nearby the Lavers Hill property, including within the offset site.
Habitat assessment More than 40 locations where habitat was assessed, including: – Searches for suitable foraging habitat (e.g., feed trees, digs) – Denning and nesting habitat (e.g., hollow-bearing trees)	Daytime searches for suitable habitat is an accepted method for all species. Documentation of feed trees is a suitable technique for detecting presence of Yellow-bellied Glider (DSEWPC 2011) Searching for sign for the Long-nosed Potoroo (e.g., digs) can be problematic as diggings are usually indistinguishable from other similar species. ***Summary of survey effort and outcomes*** The tree transect survey recorded 205 large canopy trees within the Lavers Hill property. The total number of large trees within the proposed offset site was estimated by adding the total number of large trees per EVC. Although not a definitive number, it is estimated from a subset that approximately 2,016 large trees are present within the Lavers Hill property and 968 large trees within the offset site. These large trees ranged from 70 cm DBH up to and exceeding 250 cm. Approximately 80 potentially hollow-bearing trees were recorded within the property (12 within the proposed offset site), which is certainly a gross underestimate of the total number of hollow-bearing trees present within the offset site. Identifying hollow-bearing trees was often challenging, as the view of trees was often hindered by the angle and height of the tree and dense midstorey of branches/leaves that obstructed the view of the trunks/branches of larger trees. However, given the estimated number of large trees (e.g., 2,000+ within the Lavers Hill property and 950+ within the offset site), it is possible that many trees within the offset site are still of an age that they are yet to develop medium to large hollows. Where live hollow-bearing trees were identified, the size of the tree ranged from 70 - 250 + cm DBH. Of the 12 trees identified with hollows or potential hollows within the offset site, only two trees were confirmed to contain hollows suitable for either the Gang-gang Cockatoo or Yellow-bellied Glider according to the criteria presented in Section 2.3.5, e.g., located 5 m or more above the ground with an entrance diameter of at least 10 cm but less than 30 cm. No obvious signs of occupation were observed for these hollows. All large trees without hollows (or with only small hollows that weren't visible from the ground) are also likely to develop suitable hollows in the future. It is important to note that not all hollow-bearing trees were recorded within the offset site and the number presented in this report greatly underestimates the number of hollows within the offset site.
Vegetation Quality Assessment (VQA) Four sites – preliminary flora and vegetation assessment to inform habitat values for target fauna species. One representative assessment in each Ecological Vegetation Class (EVC)	Vegetation Quality Assessment (VQA) methods in accordance with the: *Native vegetation: sustaining a living landscape. Vegetation Quality Assessment Manual-Guidelines for applying the habitat hectares scoring method, Version 1.3* (DSE 2004). Three assessments completed, one in each EVC. Due to the terrain and difficult-to-access areas of the site, the Patch Tree calculations were completed via transects of the offset site. The transects were approximately 250 m - 450 m long and 20 m wide. Five transects were surveyed across the Lavers Hills property, traversing all EVCs. In addition, detailed EVC mapping and VQA scores were obtained from ABZECO for the offset site and these are used in this report.

3.2.2 Quality of the offset site 1

Table 9 compares habitat values between the offset site and proposed action area (PAA).

Table 9 450 Morris Track Offset site summary, compared with the PAA

Values	450 Morris Track	Proposed Action Area (PAA)
Vegetation Quality Assessment (VQA)	EVC and VQA data was obtained from ABZECO (ABZECO 2024a). Three Ecological Vegetation Classes were identified in the offset site: Wet Forest (EVC 30), Cool Temperate Rainforest (EVC 31) and Shrubby Wet Forest (EVC 201). The condition of the vegetation across each EVC was relatively consistent. Wet Forest (EVC 30) – Habitat score 0.78. Cool Temperate Rainforest (EVC 31) – Habitat scores from 0.82 – 0.84. Shrubby Wet Forest (EVC 201) – Habitat score 0.82.	The field assessment resulted in the observation and mapping of five EVCs: Lowland Forest (EVC 16) – Habitat score 0.76 Heathy Woodland (EVC 48) – Habitat score 0.60 Sedgy Riparian Woodland (EVC 198) – Habitat score 0.69 Swampy Riparian Woodland (EVC 83) – Habitat score 0.71 Wet Heathland (EVC 8) – Habitat score 0.76
Habitat values for the Gang-gang Cockatoo	Potential hollows at suitable height above ground and entrance diameter. Multiple recent survey records within this offset site. Entire area foraging habitat including known feed tree species *E. obliqua* and *E. viminalis.* Multiple other foraging species recorded (all Eucalypt species and Acacia species) A total of 33 records of the Gang-gang Cockatoo were made during the site visit. Most of the records were of birds heard, but sometimes the birds were seen, either flying through the forest, or less often perching or foraging. None of the Gang-gang Cockatoos observed were seen to occupy hollow-bearing trees or interact with any hollows. Most observations were made in the early morning and late evening, which suggests that birds are likely to have been roosting at or very near the site. All 33.01 ha of vegetation within the proposed offset site (approximately 20.15 ha of EVC 30, 3.59 ha of EVC 31 and 9.27 ha of EVC 201) is considered foraging and roosting habitat, and potentially breeding habitat. Of the 80 hollow-bearing trees recorded within the property, 12 occur within the offset site but only 2 were confirmed to be suitable for this species. The majority of suitable hollow-bearing trees occur within EVC 201 – Shrubby Wet Forest.	All vegetation within the impact area is either foraging, roosting and or connected habitat (7.31 ha). Up to 16 potential hollow-bearing trees within the PAA. The PAA contains habitat that is deemed suitable future breeding habitat (e.g., trees identified with currently unsuitable hollows or tree species currently without hollows of suitable size in the proposed action area that would be likely to develop hollows in the future).

Values	450 Morris Track	Proposed Action Area (PAA)
Habitat values for the Yellow-bellied Glider	Species recorded from within offset site during survey. Yellow-bellied Gliders were successfully recorded using PAM and spotlighting each night of the survey within the offset site. The Lavers Hill property appeared to have at least two focal areas of concurrent Yellow-bellied Glider activity (north-central and south-west), which suggests that there is more than one family group at the property and at least one family group the uses the offset site (south-west). Tall trees with excellent connectivity for gliding Potential hollows at suitable height above ground and entrance diameter. Eighteen feed trees were recorded during the survey, of which five are within the offset site. Most of the feed trees recorded were smooth-barked gums (*Eucalyptus regnans* or *E. viminalis*), but small numbers were rough-barked eucalypts (*E. obliqua*). Feed trees varied in their apparent level of current use, with old and recent chew marks seen. Feed trees typically had 50 or more feed marks; some had as few as five marks, all old, while others had up to 300 (estimated) of old and recent chews. The presence of historical and recent feed sign demonstrates a history of regular use and occurrence within the offset site. All 33.01 ha of vegetation within the proposed offset site (approximately 20.15 ha of EVC 30, 3.59 ha of EVC 31 and 9.27 ha of EVC 201) is considered foraging and potential denning habitat. Of the 80 hollow-bearing trees recorded within the property, 12 occur within the offset site but only 2 were confirmed to be suitable for this species. Given the reported home range (plausible home range 25-85 ha, DAWE 2022b) and area of available habitat within the proposed offset site (33.01 ha) it is likely that the offset site provides regular habitat for at least one family group of Yellow-bellied Glider (possibly resident).	A large portion of vegetation within the impact area is considered to be known foraging, potential denning and breeding habitat (5.07 ha). Up to 13 potentially hollow-bearing trees occur within the PAA. The PAA contains habitat that is deemed suitable future breeding habitat (e.g., trees that would be likely to develop hollows in the future).
Habitat values for the Long-nosed Potoroo	Species was not recorded within this offset site, and this site is not proposed as an offset for this species. Entire area considered potential habitat as there is mostly a dense intact ground cover and understorey layer which is well connected throughout the offset site/property. While no sightings of Long-nosed Potoroo were made during the site visit, the site may still be used by the species occasionally or rarely, or may be colonised by the species if populations in nearby areas grow and disperse (recent records in connnected habitat 2.4 km west of the site).	The proposed action will remove or modify up to 7.81 ha of identified and potential habitat from within the proposed action area. The type and extent of habitat for each section to be removed that is relevant to this species is limited to linear strips along the edge of a patch less than 5 m consisting of dense understorey-midstorey. The habitats within the study area are well represented along the extent of the pipeline corridor and extensive areas of equal or better quality habitat is located adjacent to the pipeline corridor in the form of remnant forest and woodland, which will be retained. However, the habitat will be permanently modified and, in some places, entirely removed and replaced by habitat unsuitable for the species (e.g., cleared easement) thus reducing the area of habitat.

3.2.3 Threatening processes at Offset site 1

Feral animals

Four feral animals were recorded within the Lavers Hill property during the surveys:

- European Red Fox (*Vulpes vulpes*) – recorded on motion-sensing cameras (23 images across five locations within the Lavers Hill property, including within the offset site) and via scat observed within the offset site
- Cat (*Felis catus*) – recorded on motion-sensing cameras (481 images across six locations within the Lavers Hill property, including within the offset site) and passive acoustic monitoring site PAM4
- Fallow Deer (*Cervus dama*) – recorded on motion-sensing cameras (36 images across two locations, including within the offset site) and via scat and browsing observed within the offset site
- Common Blackbird (*Turdus merula*) – Heard and seen during bird surveys and incidentally while traversing the offset site

The Black Slug (*Arion ater*) was observed at a dwelling not far from the Lavers Hill property (within 3 km), but not within the site itself. This is a recently introduced species, and the ecological threat that it poses is not known. Future assessments of the offset site should watch for this species.

Domestic animals

A fresh large scat was found on 12/03/24 along the main entrance path to the Lavers Hill property near Morris Track. The scat included fresh remains of a rat, and given its size, was likely the scat of a dog, wild or domestic.

Weeds and pathogens

Of the eleven flora species considered introduced within the Lavers Hill property, six of these are considered environmental weeds in Victoria. Two of the eleven, *Rubus fruticosus* spp. agg. (Blackberry) and *Cirsium vulgare* (Spear Thistle), are listed under the *Catchment and Land Protection Act 1994* (CaLP Act) as a controlled weed with the former also listed as a Weed of National Significance (WoNS).

Within the Lavers Hill property, weeds were more common at the entrance, but reduced in cover quickly as you entered the offset site. Non-native grasses, such as *Dactylis glomerata* (Cock's-foot) and *Anthoxanthum odoratum* (Sweet Vernal-grass), were common along tracks at the entrance to the Lavers Hill property but became less common as vegetation density increased towards the offset site and were essentially absent from the offset site itself. However, *Rubus fruticosus* spp. agg. (Blackberry) was present in low numbers on the outer edges of the internal tracks with scattered occurrences within the offset site. *Cirsium vulgare* (Spear Thistle) was only observed at a single location as a juvenile plant in the south-east corner of the offset site.

3.2.4 Offset site establishment and management

3.2.4.1 Site security

Offset sites will be legally secured to ensure the ongoing protection of the vegetation and fauna habitat of the offset area. A Section 69 Agreement of the *Conservation, Forests and Lands Act 1987* will be the process in which the offset site is secured in this instance. The landholder's preference is for a section 69 agreement.

3.2.4.2 Funding of offset site purchase and management

The funding for the offset sites will be provided by Barwon Water to DEECA. Although the site is currently owned by Barwon Water the terms of the funding are governed by both contractual and statutory processes. Funds for Offset site 1 will be released by DEECA over the course of the 10-year management period.

The offset funding incorporates assessment costs, management costs, monitoring costs and compensation for opportunity costs, the detail of which are agreed contractually with the offset site owners.

3.2.4.3 Offset management plans

An Offset Management Plan (OMP) is being finalised in consultation with the Offset Landowner/to be approved by DCCEEW to ensure that the offset site is maintained, monitored and results in a gain for the MNES over the management period (ABZECO 2024a).

A summary of the key components of the OMP, as they relate to the relevant varied approval condition requirements (conditions 7e to h) are provided below.

Proposed offset outcomes

The OMP includes the following overarching environmental outcomes:

– Allow for ongoing legal protection to ensure the conservation management of 33.01 ha of EPBC Act Offset site for the period of the OMP (10 years), the life of the approval for EPBC 2022/09343 and thereafter into perpetuity
– Physical protection of the habitat area from manageable threats which would conflict with the conservation objectives of the Offset site
– Maintenance and improvement of the extent and condition of Gang-gang Cockatoo and Yellow-bellied Glider habitat measured by the condition of the forest habitat and the ongoing presence of these species within the offset site

All high threats to native vegetation condition and Gang-gang Cockatoo and Yellow-bellied Glider habitat improvement, including weeds, pest animals, soil disturbance, hydrology, vegetation condition and recruitment, must be controlled.

High threats requiring control at Offset site 1 include:

– Declared noxious and environmental weeds
– Declared pest animals and high threat feral animals
– Central spur track requiring revegetation and remediation
– Risk of inappropriate fire regime
– Risk of *Phytophthora* (dieback)
– Risk of flooding
– Other threats as identified or that may appear during the 10-year active management period

Most of the threats identified on site pose a high risk to Gang-gang Cockatoo and Yellow-bellied Glider and are spread throughout the Lavers Hill property so no one threat takes priority over another. All threats need to be managed across the entire site. The specific performance indicators for management of each key threat, including methods and timing of management actions are detailed in the OMP (ABZECO 2024a).

Proposed management actions

A summary of the key management actions to be implemented within Offset site 1 to manage the high threats within the site for the 10-year active management period and thereafter in perpetuity (if required) include:

– Weed control: Weed species can outcompete native plants and reduce the quality of midstorey foraging habitat and recruitment of trees which could provide future breeding habitat for Gang-gang Cockatoo and Yellow-bellied Glider. All woody weeds on site must be eliminated and all high threat herbaceous and grassy weeds eliminated to < 1% cover. With regard to adaptive management, if weed cover is not responding as expected, timing and methods will be reviewed to ensure they are suitable for the target species and alternative methods will be trialled and frequency of weed control increased as necessary.
– Pest control: The aim of pest animal control is to protect the population of Gang-gang Cockatoo and Yellow-bellied Glider from predation by foxes and cats (direct mortality) and impacts on foraging habitat and future breeding habitat by rabbits and deer. Fox baiting will be undertaken in accordance with the Parks Victoria fox baiting program used in parts of the surrounding Great Otway National Park. Fox dens, where present, will also be destroyed through fumigation and collapse. Fox control shooting will also be undertaken in conjunction with deer shooting and any rabbit shooting. Annual cat trapping is also proposed. With regard to adaptive management, if pest animal numbers are increasing then frequency and location of control and control methods will be reviewed, modified and updated as appropriate.

– Preventing inappropriate fire regimes: Inappropriate fire regimes are listed as a key threat to Gang-gang Cockatoo and Yellow-bellied Glider within their respective conservation advice (DAWE 2022a and DAWE 2022b). Inappropriate fire regimes (i.e., intense bushfires or planned burns) can result in the direct mortality of individuals, remove Gang-gang Cockatoo and Yellow-bellied Glider breeding sites, reduce the availability of quality foraging sites, and increase individuals' vulnerability to other threatening processes (such as predators or competitors). The offset site is long unburnt and failing to secure the offset site will increase the likelihood of inappropriate fire regimes occurring (i.e., due to unplanned ignitions as a result of public access to the site, or reduced ability to control fire and fuel load within the site, i.e., for planned burns). Fire can kill and destroy live (and dead) hollow bearing trees and if too frequent and or intense can reduce flora species diversity and cover over time. Fire must be prevented from affecting the offset site where possible. Barwon Water will liaise with PV and DEECA each year at the commencement of the fire season to communicate the requirement to not burn the site if planned burns are going to be undertaken nearby in the future. DEECA have provided assurance that a wildfire would be suppressed as soon as possible after it is detected to protect natural assets. Barwon Water will liaise with Forest Fire Management Victoria (FFMV) regularly to reconfirm the importance of protecting the site from fire. If fire impacts the site, then intensive follow up weed and pest control must be undertaken until native vegetation has recovered sufficiently to suppress weeds and pests. Efforts to prevent fire from impacting on the offset site (and managing threats, if fire occurs) is expected to benefit Gang-gang Cockatoo and Yellow-bellied Glider, by maintaining and improving habitat that could otherwise be lost or degraded by fire.
– Preventing disturbance and altered land use. The offset property is zoned Farming Zone (FZ) therefore there is a risk that some of the habitat will be lost to agricultural use (e.g., grazing) if not protected as an offset site, which could result in direct habitat removal and/or degradation of habitat for Gang-gang Cockatoo and Yellow-bellied Glider. Additionally, if not secured as an offset it is possible that public access to the site will persist or increase for recreational purposes (i.e., trail bikes, four-wheel driving) which could increase the spread of weeds and plant pathogens (i.e., *Phytopthora*) into the site via tyres, footwear and other equipment. Vehicles, foot traffic, illegal hunting and illegal firewood collection can also cause noise, damage to vegetation and soil and alter hydrology or quality of waterways which can degrade habitat for Gang-gang Cockatoo and Yellow-bellied Glider. The availability and security of the offset site provides an important patch of local habitat linking adjacent habitats to the west (Great Otway National Park) and north, east and south (Otway Forest Park and freehold forested land), which further consolidates the value of habitat in the property. Monitoring of unauthorised site access (and implementation of measures to prevent unauthorised access, such as installation of gates and cameras, if required) is expected to reduce the risk of public access that may introduce key threats that could impact on habitat for Gang-gang Cockatoo and Yellow-bellied Glider. With regard to adaptive management, if existing measures are ineffective in protecting the site from threats then repairs, upgrades or additional measures such as erecting site fencing will be implemented.

If monitoring indicated that high threats are increasing despite implementing management, then methods will be reviewed and modified. This may include increasing the frequency of control, the location of control and/or the methods.

A full description of management actions and the specific performance indicators for management of each key threat, including methods and timing of management actions are detailed in the OMP (ABZECO 2024a).

Monitoring program

Under the Section 69 Agreement, landowners are required to monitor the offset site quarterly for threats and submit a report annually to the Native Vegetation Offset Register (NVOR) using the bespoke template prepared by the Site Assessor. A report must be provided for each year of the ten years of this management plan and execution of the Section 69 Agreement and thereafter at the reasonable request of the Secretary. Reports must be prepared using the Annual Report template provided by the Department and prepared by the site assessor.

The monitoring program at Offset site 1 will include the following:

Quarterly site inspection for threats (weeds, dieback, pest animals, flooding, illegal activities, fire, central track regeneration, etc.).

The offset site will be visually inspected four times a year (spring, summer, autumn and winter) to identify and record threats. The following information will be collected and provided to DEECA NVOR using the annual report template and can also be used to complete the annual report to DCCEEW:

- Date and time
- Name and place of work of person undertaking the site visit
- Evidence of unauthorised site access
- The condition of any fencing/gates/signage
- The cover of high threat weeds and any mature plants present
- The trend in weed cover across the site compared to previous years (increasing/decreasing)
- Any new and emerging weed species in the site including along the site boundaries
- Evidence of dieback in canopy Trees or understory shrubs
- Evidence of existing or new pest animals
- Evidence of any fire (extent, location, date)
- Evidence of macropod overgrazing/overbrowsing
- The condition of waterways including evidence of flooding or erosion
- Evidence of Cinnamon Fungus
- Evidence of rubbish dumping
- Evidence of any new threats

Annual photo point monitoring

Annual photo point monitoring of threat management is a requirement under a Section 69 Agreement. Photopoint monitoring is where repeat photographs are taken from a fixed point. They can show work done, results and improvement or deterioration in site condition over time. Photos will be included in the Annual Report to DEECA NVOR and can also be included in the annual report to DCCEEW.

Annual camera trapping – threat detection

Annual camera trapping will be undertaken in eight locations across the offset site to monitor the site each year to detect the presence and indicative population numbers of each threat including deer, cats, foxes, and to detect native animals such as macropods, and new or emerging threats such as pigs or unauthorised access. The monitoring results must be documented in the annual DCCEEW and DEECA NVOR reports. The specific methods to be employed for camera trapping can be found within the Offset Management Plan (ABZECO 2024a).

Over the 10-year period the location of these camera traps can be moved or additional camera traps used if required to confirm threat activity in different locations. The following data must be recorded:

- Dates cameras were deployed and collected, camera type and settings
- Number of effective camera trapping days, dates deployed, number of cameras set – any issues (e.g., equipment failure)
- Name and place of work of person undertaking camera trapping
- General description of weather conditions (e.g., storms, dry weather, warm weather etc.)
- Threats recorded at each camera location including type, number of detections, ages and activity if able to be determined
- Native vertebrate fauna (species, number or detection, and age class if able to be identified)

Biennial monitoring for Gang-gang Cockatoo and Yellow-bellied Glider, including targeted surveys and habitat monitoring (years 2, 4, 6, 8 and 10)

Biennial targeted surveys must be undertaken to confirm the continuing presence of Gang-gang Cockatoo and Yellow-bellied Glider and provide an indication of abundance, which would help to determine if suitable habitat is being maintained and/or improved within the offset site.

The surveys will be undertaken in late spring to early summer during the active Gang-gang Cockatoo breeding season when they are more likely to be calling, feeding and nesting. This provides the opportunity to collect data on use of hollows and suitable food sources (i.e., tree and understory species). They are also known to move to wet sclerophyll forests (habitat present in the offset site) during the summer months (DAWE 2022a). Yellow-bellied Gliders have territories and are vocal so individuals are likely to be detectable year round (DAWE 2022b).

Surveys will include diurnal bird surveys for Gang-gang Cockatoo as they are active in the daytime and call playback with spotlighting for Yellow-bellied Glider at night as they are nocturnal. If spotlighting does not detect Yellow-bellied Glider then PAM monitoring will be undertaken as a follow up method to assess their presence. Similar survey methods and survey locations to those used by during the initial targeted surveys (see Appendix A) to confirm these species and suitable habitat onsite will be used. This will allow a comparison of data with subsequent monitoring data and to build on the knowledge around Gang-gang Cockatoo and Yellow-bellied Glider at the site.

In conjunction with the targeted surveys, monitoring of Gang-gang Cockatoo and Yellow-bellied Glider habitat in the offset site must be undertaken in years 2, 4, 6, 8 and 10 to assess the progress of the OMP against the agreed management commitments to maintain and/or improve Gang-gang Cockatoo and Yellow-bellied Glider habitat. This will assist with risk management by providing feedback to guide adaptive management (if required). The results must be included in the annual report to DCCEEW and DEECA NVOR.

Further details and specific information relating to the methodology and monitoring requirements are provided in the OMP (ABZECO 2024a).

Reporting requirements

An annual report must be provided to DCCEEW each year of the 10 years of the OMP for the purposes of monitoring, compliance, and auditing to assess performance of the offset. The annual DCCEEW report must include:

- ***Site information***: relevant site information must be included, such as landowner of the offset site, location and address of the offset site, offset site number, offset plan reference number, responsible authority, report number, signature and date
- ***Habitat management progress***:
  - Results of quarterly site visits for threats (i.e., presence of weeds, dieback, pest animals, flooding, illegal activities, fire, central track regeneration, etc.)
  - Results of annual camera trapping program for threats, including comparison with previous years data
  - Results of Gang-gang Cockatoo and Yellow-bellied Glider surveys (years 2, 4, 6, 8 and 10), including comparison with previous years data
  - Results and photos from Gang-gang Cockatoo and Yellow-bellied Glider habitat monitoring (years 2, 4, 6, 8 and 10) including comparison with previous years data
  - An assessment of the effectiveness of management actions including unsuccessful and successful management methods and any adaptive management used to achieve the management goals
  - An evaluation of the likelihood of the site meeting the agreed management commitments by the end of year 10 of the OMP
- Records of inductions signed and completed by each of Barwon Water's and subcontractor staff members entering and/or undertaking work on site, the training they received, who delivered the training, content of the training and actions completed to prevent weed seeds/propagules and Phytophthora entering the site
- Details of any non-compliance with approval conditions (including not undertaking management actions), environmental incidents and emergencies with details of how these have been addressed

At the expiry of the EPBC Act approval, Barwon Water must have the offset site assessed by a suitably qualified ecologist to provide the following information:

- A determination of whether or not the offset outcomes specified in the OMP have been achieved
- Details of the areas and habitat quality of Gang-gang Cockatoo and Yellow-bellied Glider

Barwon Water must also notify DCCEEW in writing of any offset outcomes specified in the approved OMP which have not been achieved and the likely reasons that the achievement of each offset outcome has not been realised. If the assessment determines that offset outcomes have not been realised, then methods for ongoing management will be reviewed and modified. This may include increasing the frequency of control, the location of control and/or the methods. Examples of adaptive management actions are provided in the section above with further detail provided in the OMP (ABZECO 2024a).

Further details and specific information relating to reporting requirements are provided in the OMP (ABZECO 2024a).

3.3 Offset site 2 – Distillery Creek Road, Aireys Inlet

Information presented within this section remains unchanged from the previous issue to DCCEEW via Attachment 10 (GHD 2023d) of the final preliminary documentation (GHD 2023a) which was accepted by the Minister via the January approval, with the exception of some minor grammatical and referencing updates, and further detail provided regarding proposed management actions and monitoring and reporting requirements.

3.3.1 Survey methods and results

Survey methods and effort were informed by information sources listed in section 2.2.1 of Appendix B, but also required consideration of project timelines and safety requirements (e.g., bushfire risks for animal trapping). Consequently, the methods did not strictly follow all advice offered in the reviewed resources (e.g., hair-tubes and trapping surveys for Long-nosed Potoroo were not used). Table 10 provides a summary of the survey, methods, effort and results for the offset site.

The survey was undertaken over the following periods:

– GHD Senior Ecologist Craig Grabham and Barwon Water Project Manager Nathan Stones – 3 March 2023. Camera deployment and habitat assessment
– GHD Senior Ecologist Craig Grabham and GHD Senior Botanist Zoe Jellie – 28 March 2023. Camera retrieval, habitat and vegetation assessment

Table 10 Summary of survey methods, timing, effort and results for offset site 2 – 245 Distillery Creek Road

Timing and effort	Survey adequacy
Camera trap 8 sites for 25 consecutive days (3 - 28/03/2023)	Suitable survey technique for detecting the Long-nosed Potoroo (DEPI 2013, DSEWPAC 2011, Stevens et al 2010, Robley et al various dates). ***Summary of survey effort and outcomes*** Camera location c1 of 9 sites – technical issues, no fauna images captured 8 sites for 200 survey-nights; approximately 1 camera per 3.7 ha The Long-nosed Potoroo was recorded at 5 of the 9 sites from 360 images. The species was recorded on 24 of the 25 survey dates. Based on the distance between each camera location and the time/date of the images, at least three and possibly four Long-nosed Potoroo individuals were recorded within the proposed offset site. Up to 21 fauna species were identified from camera images and video including seven birds, one reptile and up to 13 mammals. Most images of fauna could be identified to species. Small mammals (e.g., possible antechinus) were challenging, because of their small size and rapid movements, and not all individuals could be confidently identified to species.
Habitat assessment Nine sites – habitat assessment (2.2.5), corresponding with each camera location	Daytime searches for suitable habitat is an accepted method for all species (DEPI 2013, DEWHA 2011). ***Summary of survey effort and outcomes*** Many diggings were recorded, however, were likely a combination of species including echidna wallaby and/or Long-nosed Potoroo. Searching for sign for the Long-nosed Potoroo (e.g., digs) can be problematic as diggings are usually indistinguishable from other similar species therefore should not be used as primary method or only method.
Vegetation Quality Assessment (VQA) Five sites – flora and vegetation assessment	Vegetation Quality Assessment (VQA) methods in accordance with the: *Native vegetation: sustaining a living landscape. Vegetation Quality Assessment Manual-Guidelines for applying the habitat hectares scoring method, Version 1.3* (DSE 2004).

3.3.2 Quality of the offset site 2

Table 11 compares habitat values between the offset site and proposed action area (PAA).

Table 11 245 Distillery Creek Road Offset site summary, compared with the PAA

Values	245 Distillery Creek Road	Proposed Action Area (PAA)
Vegetation Quality Assessment (VQA)	Three EVCs (198, 48 and 16) – vegetation/habitat types. Vegetation Quality Assessment outcomes – habitat condition score ranging from 0.58 – 0.88 (noting a lower score in one EVC habitat zone due to absence of large trees)	The field assessment resulted in the observation and mapping of five EVCs: Lowland Forest (EVC 16) – Habitat score 0.76 Heathy Woodland (EVC 48) – Habitat score 0.60 Sedgy Riparian Woodland (EVC 198) – Habitat score 0.69 Swampy Riparian Woodland (EVC 83) – Habitat score 0.71 Wet Heathland (EVC 8) – Habitat score 0.76
Habitat values for the Gang-gang Cockatoo	Heavily forested with tall trees and dense understorey layer. Only access tracks and bushfire buffer zones cleared of native vegetation. Foraging habitat – up to 29.43 ha Potential roosting/resting habitat – up to 29.43 ha Potential breeding habitat (no hollow counts completed, although hollows of suitable dimensions noted in *E. obliqua/baxteri* noted).	All vegetation within the impact area is either foraging, roosting and or connected habitat (7.31 ha). Up to 16 potential hollow-bearing trees within the PAA. The PAA contains habitat that is deemed suitable future breeding habitat (e.g., trees identified with currently unsuitable hollows or tree species currently without hollows of suitable size in the proposed action area that would be likely to develop hollows in the future).
Habitat values for the Yellow-bellied Glider	Habitat types unlikely to support the Yellow-bellied Glider. Site lacks large areas of smooth-barked Eucalyptus.	A large portion of vegetation within the impact area is considered to be known foraging, potential denning and breeding habitat (5.07 ha). Up to 13 potential hollow-bearing trees occur within the PAA. The PAA contains habitat that is deemed suitable future breeding habitat (e.g., trees that would be likely to develop hollows in the future).
Habitat values for the Long-nosed Potoroo	Heavily forested with moderate tree cover and moderate to mostly dense understorey and ground cover layer throughout site, across a moderate to gentle slope with small gullies/minor drainage lines. Only access tracks and bushfire buffer zones cleared of native vegetation. 29.43 ha of high quality continuous habitat for the species, with sparse to often moderate to dense understorey and ground cover layer. Surrounded by the Great Otway National Park. The site is considered as habitat critical to the survival of the species. Importantly it is well connected with surrounding habitat (no obvious boundaries) within a protected reserve with dispersal capabilities allowing for movements into and out of the site. Species' presence confirmed during surveys.	The proposed action will remove or modify up to 7.81 ha of identified and potential habitat from within the proposed action area. The type and extent of habitat for each section to be removed that is relevant to this species is limited to linear strips along the edge of a patch consisting of dense understorey-midstorey. The habitats within the study area are well represented along the extent of the pipeline corridor and extensive areas of equal or better quality habitat is located adjacent to the pipeline corridor in the form of remnant forest and woodland, which will be retained. However, the habitat will be permanently modified and, in some places, entirely removed and replaced by habitat unsuitable for the species (e.g., cleared easement) thus reducing the area of habitat.

3.3.3 Threatening processes at Offset site 2

Feral animals

Four feral animals were recorded within the offset property during the surveys (see Appendix B Figure 6):

- Cat (*Felis catus*) – at least two individuals, possibly three recorded from three camera locations
- European Red Fox (*Vulpes vulpes*) – recorded from tracks and scat within the offset site. A fox was also sighted crossing Distillery Creek Road whilst driving to the offset site
- Deer – unknown deer species were recorded from tracks from within the offset site. Deer including Fallow Deer are regularly sighted in the local area (pers comm C. Grabham)
- European Rabbit (*Oryctolagus cuniculus)* – observed along Distillery Creek Road and possible scat and digs recorded near boundary of the offset site

Domestic animals

Dog tracks were recorded from within the offset site, likely the result of people/dogs using the tracks within the offset site for walking/recreation. Wild dogs may also occur in the area.

Weeds and pathogens

Of the six flora species considered introduced, one (*Chrysanthemoides monilifera*, Boneseed) is listed under the *Catchment and Land Protection Act 1994* (CALP Act) as a controlled weed and is also listed as a Weed of National Significance (WoNS).

Within the offset site, the transects determined that weeds were more common and abundant near the edge of the patch of native vegetation and along the tracks, than within the native vegetation itself.

Pathogens such as *Phytophthora cinnamomi* move through native vegetation and affect certain species susceptible to the pathogen. The pathogen *Phytophthora cinnamomi* was possibly recorded in the offset site in the form of grass-tree dieback.

3.3.4 Offset site establishment and management

3.3.4.1 Site security

Offset sites will be legally secured to ensure the ongoing protection of the vegetation and fauna habitat of the offset area. A Section 69 Agreement with DEECA under the *Conservation, Forests and Lands Act 1987* will be the process in which the offset site is secured in this instance. The landholder's preference is for a section 69 agreement.

3.3.4.2 Funding of offset site

The funding for the offset sites will be provided by Barwon Water to DEECA. Although the site is currently owned and managed by Barwon Water, the terms of the funding are governed by both contractual and statutory processes. Funds for Offset site 2 will be released by DEECA over the course of the 10-year management period.

The offset funding incorporates assessment costs, management costs, monitoring costs and compensation for opportunity costs, the detail of which are agreed contractually with the offset site owners.

3.3.4.3 Offset management plans

An Offset Management Plan (OMP) was developed (ABZECO 2023) in consultation with the Offset Landowner (Barwon Water)/DEECA, submitted to DCCEEW as Attachment 12 (ABZECO 2023) of the final preliminary documentation (GHD 2023a) and approved by DCCEEW via the January 2024 approval conditions. The purpose of the OMP is to ensure that the offset site is maintained, monitored and results in a gain for the MNES over the management period. The OMP will be finalised once reviewed by DEECA as part of the Section 69 application (currently underway). Any changes to the OMP will be in agreement with Barwon Water (the offset owner) and the relevant statutory authorities.

A summary of the key components of the OMP, as they relate to the relevant varied approval condition requirements (conditions 7e to h) are provided below.

Proposed offset outcomes

The OMP includes the following overarching environmental outcomes:

– Allow for ongoing legal protection to ensure the conservation management of 29.43 ha of EPBC Act Offset site for the period of the OMP, the life of the approval for EPBC 2022/09343 and thereafter into perpetuity
– Physical protection of the habitat area from manageable threats and any other recreational activities which would conflict with the conservation objectives of the Offset site
– Maintenance and improvement of the extent and condition of Long-nosed Potoroo habitat measured by the condition of the habitat and the ongoing presence of Long-nosed Potoroo within the offset site

All high threats to native vegetation condition and Long-nosed Potoroo habitat improvement, including weeds, pest animals, threats to soil structure, natural water flow, vegetation condition and the recruitment cycle, must be controlled.

High threats requiring control at Offset site 2 include:

– Threats to habitat condition from illegal vehicle access
– High threat weeds
– Pest animals
– Tracks and track erosion requiring revegetation and remediation
– Inappropriate fire regime
– *Phytophthora*
– Rubbish left on site
– Other threats identified or that may appear during the 10-year active management period

Most of the threats identified on site pose a high risk to Long-nosed Potoroo and are spread throughout the offset site so no one threat takes priority over another. All threats need to be managed across the entire site. The specific performance indicators for management of each key threat, including methods and timing of management actions are also detailed in the OMP (ABZECO 2023).

Proposed management actions

A summary of the key management actions to be implemented within Offset site 2 to manage the high threats within the site for the 10-year active management period and thereafter in perpetuity (if required) include:

– Weed control: Weed control is required to prevent weeds impacting Long-nosed Potoroo habitat on site. All woody weeds on site must be eliminated and all high threat herbaceous and grassy weeds eliminated to < 1% cover. With regard to adaptive management, if weed cover is not responding as expected, timing and methods will be reviewed to ensure they are suitable for the target species and alternative methods will be trialled and frequency of weed control increased as necessary.
– Pest control: The aim of pest animal control is to protect the population of Long-nosed Potoroo from predation by foxes and cats and impacts on habitat by rabbits and deer. Fox baiting will be undertaken in accordance with the Parks Victoria fox baiting program used in parts of the surrounding Great Otway National Park and Anglesea Heath. Fox dens, where present, will also be destroyed through fumigation and collapse. Deer control shooting and cat trapping is proposed, and potentially fox shooting and rabbit shooting. With regard to adaptive management, if pest animal numbers are increasing then frequency and location of control and control methods will be reviewed, modified and updated as appropriate.
– Preventing inappropriate fire regimes: Inappropriate fire regimes are listed as a threat to Long-nosed Potoroo within its conservation advice (DAWE 2022c). High frequency fires can result in change habitat structure and fires that coincide with breeding can potentially decrease breeding success. Fires can also increase individuals' vulnerability to other threatening processes (such as predators). Barwon Water will engage with Parks Victoria to assist with maintaining majority of the site in an unburnt condition for over 20 years. After 20 years of being unburnt, ecological mosaic burning is proposed. If fire impacts the site, then intensive follow up pest control must be undertaken and supplementary planting if vegetation is not recovering post fire. Efforts to prevent fire from impacting on the offset site (and managing threats, if fire occurs) is expected to benefit Long-nosed Potoroo, by maintaining and improving habitat that could otherwise be lost or degraded by fire.

– Other ongoing management commitments include:
    - Control all high threats
    - Control rubbish dumping
    - Undertake track remediation including prevention and repair of erosion and revegetation
    - Protect the site from being readily accessible by persons (i.e., exclude persons, other than those required for management or monitoring)
    - Monitor threats throughout the year (at least once per quarter)
    - Report to DCCEEW and DEECA on management obligations, actions and results
    - Retain all standing trees (dead or alive)
    - Retain all logs, fallen timber and leaf litter
    - Exclude stock

If monitoring indicated that high threats are increasing despite implementing management, then methods will be reviewed and modified. This may include increasing the frequency of control, the location of control and/or the methods.

A full description of management actions and the specific performance indicators for management of each key threat, including methods and timing of management actions are detailed in the OMP (ABZECO 2023).

Monitoring program

Under the Section 69 Agreement, landowners are required to monitor the offset site quarterly for threats and submit a report annually to the Native Vegetation Offset Register (NVOR) using the bespoke template prepared by the Site Assessor (ABZECO). A report must be provided for each year of the ten years of this management plan and execution of the Section 69 Agreement and thereafter at the reasonable request of the Secretary. Reports must be prepared using the Annual Report template provided by the Department and prepared by the site assessor.

The monitoring program at Offset site 2 will include the following:

Quarterly site inspection for threats (weeds, dieback, pest animals, illegal activities, fire, etc.)

The offset site will be visually inspected four times a year (spring, summer, autumn and winter) to identify and record threats. The following information will be collected and provided to DEECA NVOR using the annual report template and can also be used to complete the annual report to DCCEEW:

– The cover of high threat weeds and any mature plants present
– The trend in weed cover across the site compared to previous years (increasing/decreasing)
– Any new and emerging weed species in the site including along the site boundaries
– Evidence of dieback in canopy Trees, Grass-trees or shrubs
– Evidence of existing pest animals
– Evidence of new pest animals
– The condition of any fencing/gates/signage
– Evidence of illegal site access and remediation works
– Evidence of firewood collection
– The condition of the tracks including regeneration
– Evidence of rubbish dumping
– Regeneration of vegetation in the wetland area after drainage pipe removal
– Evidence of any fire (extent, location, date)
– Evidence of any new threats

Annual photo point monitoring

Annual photo point monitoring of threat management is a requirement under a Section 69 Agreement. Photopoint monitoring is where repeat photographs are taken from a fixed point. They can show work done, results and improvement or deterioration in site condition over time. Photos will be included in the annual report to DEECA NVOR and can also be included in the annual report to DCCEEW.

Biennial monitoring for Long-nosed Potoroo, including habitat monitoring (years 2, 4, 6, 8 and 10)

Monitoring must be undertaken by a qualified and experienced ecologist in years 2, 4, 6, 8 and 10 to assess the progress of the OMP against the agreed management commitments to improve and maintain Long-nosed Potoroo habitat. This will assist with risk management by providing feedback to guide adaptive management (if required). The results must be included in the annual report to DCCEEW. Surveys, including camera trapping, and habitat condition monitoring will be undertaken every two years in spring. The results must be included in the annual report to DCCEEW and DEECA NVOR for each year of monitoring.

Further details and specific information relating to monitoring requirements are provided in the OMP (ABZECO 2023).

Reporting requirements

An annual report must be provided to DCCEEW each year of the 10 years of the OMP for the purposes of monitoring, compliance, and auditing to assess performance of the offset.

The annual DCCEEW report must include:

- ***Site information***: relevant site information must be included, such as landowner of the offset site, location and address of the offset site, offset site number, offset plan reference number, responsible authority, report number, signature and date
- Habitat management progress:
  - Results of quarterly site visits for threats (i.e., presence of weeds, dieback, pest animals, flooding, illegal activities, fire, etc.)
  - Results of Long-nosed Potoroo camera trapping (years 2, 4, 6, 8 and 10), including comparison with previous years data
  - Results and photos from Long-nosed Potoroo habitat monitoring (years 2, 4, 6, 8 and 10), including comparison with previous years data
  - An assessment of the effectiveness of management actions including unsuccessful and successful management methods and any adaptive management used to achieve the management goals
  - An evaluation of the likelihood of the site meeting the agreed management commitments by the end of year 10 of the OMP
- Records of inductions signed and completed by each of Barwon Water's and subcontractor staff members entering and/or undertaking work on site, the training they received, who delivered the training, content of the training and actions completed to prevent weed seeds/propagules and Phytophthora entering the site
- Details of any non-compliance with approval conditions (including not undertaking management actions), environmental incidents and emergencies with details of how these have been addressed

At the expiry of the EPBC Act approval, Barwon Water must have the offset site assessed by a suitably qualified ecologist to provide the following information:

- A determination of whether or not the offset outcomes specified in the OMP have been achieved
- Details of the areas and habitat quality of Long-nosed Potoroo

Barwon Water must also notify DCCEEW in writing of any offset outcomes specified in in the approved OMP which have not been achieved and the likely reasons that the achievement of each offset outcome has not been realised. If the assessment determines that offset outcomes have not been met, then methods for ongoing management will be reviewed and modified. This may include increasing the frequency of control, the location of control and/or the methods. Examples of adaptive management actions are provided in the section above with full detail to be provided in the OMP (ABZECO 2023).

Further details and specific information relating to reporting requirements are provided in the OMP (ABZECO 2023).

4. Offset strategy summary

This document presents a summary of the potential residual impacts and subsequent offset requirements for the Project under Commonwealth legislation, along with the proposed Offset Strategy by which the Project will offset those residual impacts. This fulfils the requirements under the *Environment Protection and Biodiversity Conservation* (EPBC) *Act 1999* Environmental Offsets Policy (DSEWPaC 2012a) for the Project to submit an 'Offset Strategy'. The production of this document is an iterative process and will be further developed in consultation with relevant stakeholders.

In order to provide the offsets for the potential residual impacts, two offset sites have been identified and form this Offset Strategy:

1. Offset site 1 – 450 Morris Track, Lavers Hill. Targeted surveys were completed for the Yellow-bellied Glider, Gang-gang Cockatoo and Long-nosed Potoroo. The proposed offset site is heavily forested and forms part of a larger forested area. The western boundary connects to the Great Otway National Park, and the northern, eastern and southern boundaries of the broader property connect to the Otway Forest Park and freehold forested land. The proposed offset site comprises 33.01 hectares (ha) of native vegetation, and has high value for wildlife, including MNES. As a result of the targeted surveys, the Yellow-bellied Glider and Gang-gang Cockatoo were detected at the site, while Long-nosed Potoroo was not. The offset site will be secured by a Section 69 Agreement on title security and will be actively managed for 10 years in accordance with the OMP. At the end of 10 years of active management, in accordance with the OMP the site is required to be maintained in perpetuity so that it meets or is in better condition than the minimum required offset commitments.
2. Offset site 2 – 245 Distillery Creek Road, Aireys Inlet. Targeted surveys for the Long-nosed Potoroo (*Potorous tridactylus trisulcatus*) were completed and the species was recorded at the site. Gang-gang Cockatoo foraging habitat was also recorded on site. The proposed offset site is privately owned by Barwon Water and forms part of an uncleared and unused portion of property that also includes an operational Water Reclamation Plant. The proposed offset site is contiguous with the Great Otway National Park, with largely continuous moderate to dense understorey/shrublayer within the intact native vegetation. The offset site is 29.43 ha, and will be secured by a Section 69 Agreement on title security and will be actively managed for 10 years in accordance with the OMP. At the end of 10 years of active management, in accordance with the OMP the site is required to be maintained in perpetuity so that it meets or is in better condition than the minimum required offset commitments.

The table below provides a summary of the potential for the Offset Strategy to counterbalance the potential residual impacts to MNES resulting from the Project.

Table 12 Summary of offset package

MNES	Residual impact	Habitat area required to offset 100% of impact	Offset package proposed
Gang-gang Cockatoo (*Callocephalon fimbriatum*)	Habitat loss of 7.31 ha X quality 7 = 5.12 ha	30.34 ha	Offset site 1 - 33.01 ha = 108.79% of direct offset
Yellow-bellied Glider (*Petaurus australis australis*)	Habitat loss of 5.07 ha X quality 7 = 3.55 ha	19.06 ha	Offset site 1 - 33.01 ha = 173.23% of direct offset
Long-nosed Potoroo (*Potorous tridactylus trisulcatus*)	Habitat loss of 7.81 ha X quality 7 = 5.47 ha	29.35 ha	Offset site 2 - 29.43 ha = 100.25% of direct offset

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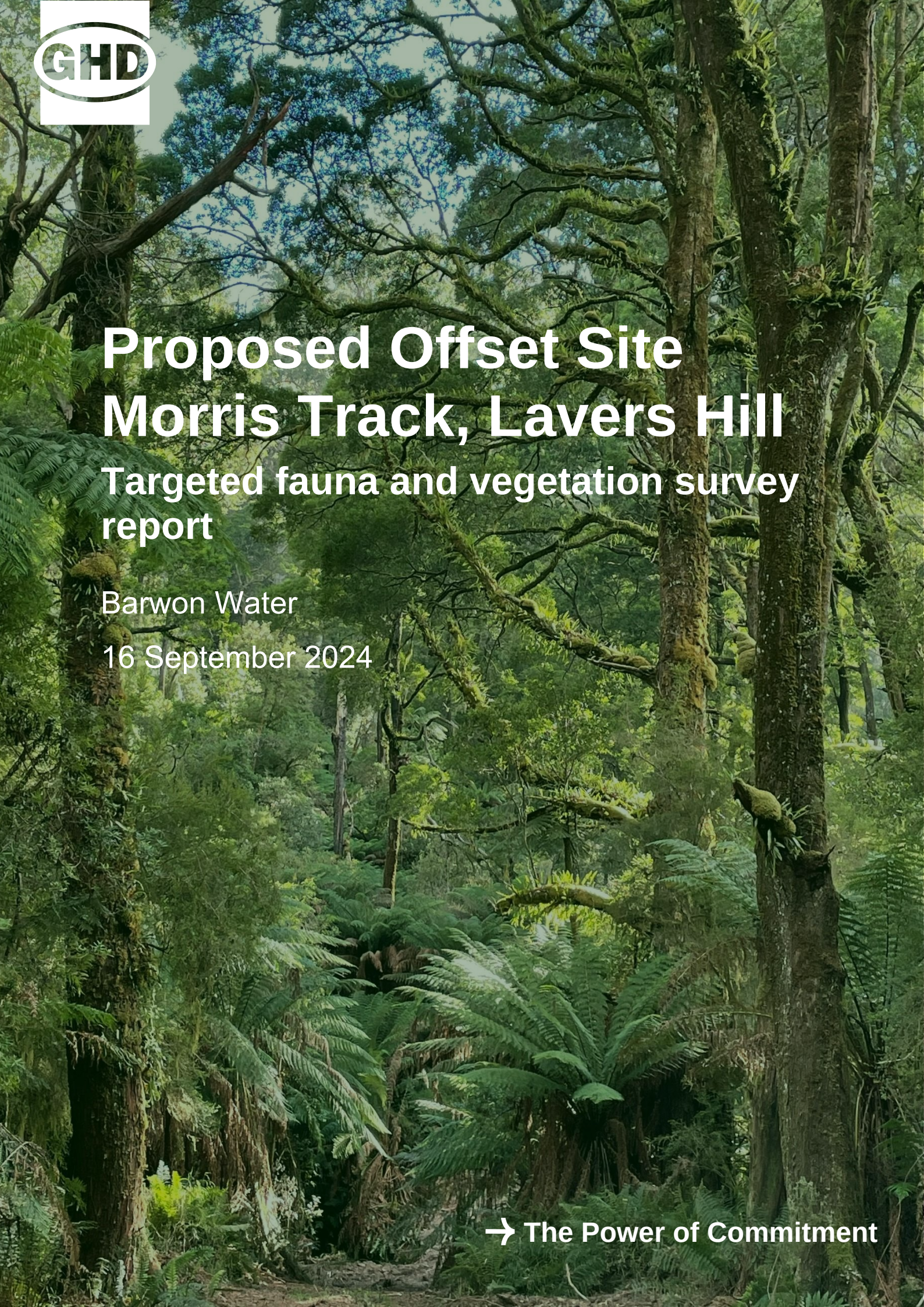
Appendices

Appendix A

Offset site 1 – 450 Morris Track, Lavers Hill – Survey Report



Proposed Offset Site Morris Track, Lavers Hill

Targeted fauna and vegetation survey report

Barwon Water

16 September 2024

→ The Power of Commitment

Project name		Colac Pipeline Upgrade (W1426)					
Document title		Proposed Offset Site – Morris Track, Lavers Hill | Targeted fauna and vegetation survey report					
Project number		3137032					
File name		3137032-REP_Colac Pipeline Upgrade - Proposed Offset site Lavers Hill -Targeted fauna and vegetation survey report					
Status Code	**Revision**	**Author**	**Reviewer**		**Approved for issue**		
			Name	**Signature**	**Name**	**Signature**	**Date**
S3	A	R Retallick	C Grabham		R Proctor		27/04/2024
S4	0	R Retallick	C Grabham		R Proctor		18/04/2024
S4	1	L Fellows	S Bidwell		R Proctor		16/09/2024

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Executive summary

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.2 and the assumptions and qualifications contained throughout the Report.

Scope and methods

GHD was engaged by Barwon Water to complete a targeted fauna and habitat survey for the proposed offset property at 450 Morris Track which is located on the east side of Morris Track, at and south of where Morris Track meets Mount McKenzie Track in Lavers Hill, Victoria. Targeted surveys were completed for the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed Yellow-bellied Glider (*Petaurus australis australis*), Gang-gang Cockatoo (*Callocephalon fimbriatum*) and Long-nosed Potoroo (*Potorous tridactylus trisulcatus*) to understand the value of the site and its potential to meet offset requirements under the EPBC Act offset policy. The targeted assessment included:

– Passive acoustic monitoring (PAM), spotlighting and habitat assessments, including searches for hollow-bearing trees and feed signs to understand the presence and distribution of the Yellow-bellied Glider in the offset site
– Diurnal bird survey and habitat assessments incorporating searches for hollow-bearing trees suitable for the Gang-gang Cockatoo to understand the presence and distribution of the species in the offset site
– Camera trapping and habitat assessments to understand the presence and distribution of the Long-nosed Potoroo in the offset site

The proposed offset site

The proposed offset site is heavily forested and forms part of a larger forested area. The western boundary connects to the Great Otway National Park, and the northern, eastern and southern boundaries connect to the Otway Forest Park and freehold forested land. The proposed offset site comprises 74.41 hectares (ha) of native vegetation, and has high value for wildlife.

The site consists almost entirely of native vegetation with large trees, logs and a dense understorey and midstorey. Ecological Vegetation Class (EVC) 201 (Shrubby Wet Forest) (36.57 ha) dominates the drier slopes and ridges, with EVC 30 (Wet Forest) (6.14 ha) on the wetter slopes and EVC 31 (Cool Temperate Rainforest) (28.28 ha) in the gullies and waterways. EVC 18 (Riparian Forest) occurs in smaller patches (3.42 ha) towards the southwest and southeast of the site.

Chapple Creek (north branch) runs west through the site, with a range of tributaries. The northern boundary of the property follows Mount McKenzie Track along a ridge, and the property itself is characterised by steep, predominately south-facing terrain, ranging from approximately 250 m elevation at the north and south of the property to 190 m elevation towards the centre-west of the property, where Chapple Creek occurs.

There is a small clearing within the proposed offset site near Chapple Creek and two short bulldozed tracks, one (approximately 200 m long) to the east, north of Chapple Creek, and the other (approximately 2.1 km long and ending beyond the site boundary) to the south-east, south of Chapple Creek.

Evidence of historical logging was recorded throughout the site during the recent survey in the form of sawn large tree stumps, some with diameters of ≥1.5 m. Records of bushfires in the area suggest the last major fire to affect the offset site was the January 1939 Black Friday fires.

Key survey findings

During the survey, 70 fauna species were identified at the site, including 66 native species (10 mammals, 51 birds, one reptile, two amphibians and two invertebrates) and four non-native species. Nine species of conservation significance were detected, including two of the three targeted species – Yellow-bellied Glider and Gang-gang Cockatoo were detected, while Long-nosed Potoroo was not. Survey conditions were suitable for detecting the target species of fauna.

Four feral animals were recorded within or nearby the offset site (Cat, Fallow Deer, Red Fox and Common Blackbird) and of the 11 weed species found, six are considered environmental weeds in Victoria. Two of the species are listed under the *Catchment and Land Protection Act 1985* (CALP Act) as controlled weeds and *Rubus fruticosus* spp. agg. (Blackberry) is also listed as a Weed of National Significance (WoNS).

Gang-gang Cockatoo

A total of 33 records of the Gang-gang Cockatoo were made during the site visit. Most of the records were of birds heard, but sometimes the birds were seen, either flying through the forest, or less often perching or foraging. The Gang-gang Cockatoo was heard each day during the site visit and during the follow up visit for device collection. The Gang-gang Cockatoo was heard at all times of day, with more observations in the early morning and late evening, suggesting that birds are likely to roost at the site.

The proposed offset site provides highly suitable habitat for the Gang-gang Cockatoo. All 74.41 ha of vegetation within the offset site is considered foraging and roosting habitat, and observations at the site show that the species uses the site for these activities. Furthermore, while no evidence of breeding or nesting at the site was detected during the site visit, 22 trees with suitable hollows were recorded during the survey. Furthermore, the trees in the forest at the site are or sufficient age and size and in such large numbers and with hollows (estimated to be >2000 large trees within the site, with potential for hollows and future hollow-development), that breeding at the site is considered possible.

Yellow-bellied Glider

The site provides ideal habitat for the Yellow-bellied Glider, as shown by the survey results. Spotlighting at the site resulted in 67 detections of the Yellow-bellied Glider in or near the offset property. All but one of these were of vocalisations; one glider was seen gliding across Mount McKenzie Track. Yellow-bellied Glider calls were heard on each night of spotlighting across 15 locations. Yellow-bellied Glider calls were also recorded using Passive Acoustic Monitoring (PAM) from all eight sites for 19 consecutive survey nights from within the offset site (all monitoring sites combined).

The site appeared to have two focal areas of concurrent Yellow-bellied Glider activity (north-central and south-west), suggesting that there is more than one family group at the site.

Eighteen feed trees were recorded across the site during the survey, mostly smooth-barked gums (*Eucalyptus regnans* or *E. viminalis*), but also rough-barked eucalypts (*E. obliqua*). Feed trees varied in use, but typically had 50 or more feed marks, with some estimated to have up to 300 chews. Old and recent chew marks were seen. The presence of historical and recent feed sign demonstrates a history of regular use and occurrence within the offset site. Given this information, the species is considered a resident of the offset site.

All 74.41 ha of vegetation within offset site is considered foraging and denning habitat. There are estimated to be 22 trees with suitable hollows for the species and >2000 large trees within the site with potential for hollows and future hollow-development.

Long-nosed Potoroo

The Long-nosed Potoroo was not detected during the site visit, but it is known to occur within the nearby area, with the most recent historical record in 2022. The site contains suitable habitat for the Long-nosed Potoroo and for other small to medium ground-dwelling mammals (i.e., Southern Brown Bandicoot, Long-nosed Bandicoot), and the detection of the Long-nosed Bandicoot demonstrates that medium ground-dwelling mammals persist at this site, despite the presence of cats and foxes. All 74.41 ha of vegetation within offset site is considered to be potential habitat for potoroos and bandicoots.

Conclusion

The offset site provides highly suitable habitat for the Gang-gang Cockatoo and Yellow-bellied Glider, and both species were confirmed present at the site during the site assessment. While the Long-nosed Potoroo was not detected during the site visit, the site is still considered to provide potential habitat for the species. Potoroos may use the site occasionally or rarely, or may colonise the site in future if populations in nearby areas grow and disperse.

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Appendices

1. Introduction

The Colac Pipeline Upgrade project covers the proposed replacement of five sections (Sections 19, 20, 21, 23 and 25i) (approximately 5 kilometres in length) of the existing Colac Pipeline that are considered to be at high risk of future failure. The existing main transfers water from the West Gellibrand and Olangolah Reservoirs in the Otways to supply the township of Colac, in south-western Victoria. The existing pipeline is approximately 28 km long in total and is located in the Great Otway National Park, Otway Forest State Park, road reserves and private property. This scope of works forms part of a larger Barwon Water remediation program to replace the existing pipeline, which is duplicate or triplicate in certain sections and prone to failure, with a single 600 millimetre (mm) main (nominal) to maintain water security for Colac.

An assessment of the potential impacts on Matters of National Environmental Significance (MNES) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was undertaken in 2022 and it was determined that there may be significant residual impacts on three listed species: Yellow-bellied Glider (*Petaurus australis australis*), Gang-gang Cockatoo (*Callocephalon fimbriatum*) and Long-nosed Potoroo (*Potorous tridactylus trisulcatus*).

If residual impacts are likely to be significant, then details of an offset package to compensate for residual impacts on MNES must be provided. An offset package would consist of an offset proposal (Offset Strategy) and key commitments and management actions for delivering and implementing a proposed offset (i.e., an Offset Management Plan for an Offset Site).

GHD was engaged by Barwon Water to assess a property at 450 Morris Track, Lavers Hill, Victoria. The assessment included targeted fauna surveys for the three listed species named above, and a vegetation survey of the site.

1.1 Purpose and scope of this report

The purpose of this report is to present the methods and results for the targeted fauna and habitat survey for the proposed offset property at 450 Morris Track, on the south-east corner of the intersection of Morris Track and Mount McKenzie Track, near Lavers Hill, Victoria. Habitat assessments and targeted fauna surveys were completed for the EPBC Act listed Yellow-bellied Glider (*Petaurus australis australis*), Gang-gang Cockatoo (*Callocephalon fimbriatum*) and Long-nosed Potoroo (*Potorous tridactylus trisulcatus*) to understand the value of the site and its potential to meet offset requirements under the EPBC Act offset policy. The scope includes:

- A description of the offset site, including location, size, condition and environmental values
- A desktop review of records for the three target fauna species within the study area
- Field investigation, using targeted and opportunistic survey methods to understand the presence and distribution of the three fauna species and habitats within the offset site (the offset property) and details of the surveys undertaken in accordance with survey guidelines for each species where available
- Field survey to document the quality and extent of native vegetation using vegetation quality assessment (VQA) methods within the offset site and a comparison of these values in relation to the impact site
- Details of ongoing threats to the protected matters at the offset site
- A report (this document) detailing the desktop review, methods and results of the targeted survey

1.2 Limitations and assumptions

This report has been prepared by GHD for Barwon Water and may only be used and relied on by Barwon Water for the purpose agreed between GHD and Barwon Water as set out in section 1.1 of this report. GHD otherwise disclaims responsibility to any person other than Barwon Water arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

This report provides the survey methods and results, but does not provide an analysis of offset obligations in regards to the proposed project, nor does it constitute an Offset Management Plan. 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 services undertaken by GHD in connection with preparing this report have the following limitations:

– The field assessment was limited to an ecological assessment of vascular plant species (ferns, conifers and flowering plants) and terrestrial vertebrate fauna. The field assessment did not include any non-vascular flora (e.g. mosses, liverworts, lichens), fungi, or terrestrial invertebrates, except where listed threatened species are known or are suspected to occur. Fauna survey techniques and limitations are listed in section 2.2.
– The assessment included a field investigation during late summer for flora species, which is not an optimal time of year for conducting botanical assessments in the Otway Ranges Bioregion, as many native flora are difficult or impossible to locate or identify at this time of year, due to a lack of reproductive material and/or the seasonal nature of some species (in particular, native orchids and forbs that may flower for limited periods during spring or flower at other times of the year). Additional native species may be recorded at the site at other times of the year. Therefore, it is considered possible that threatened flora may be present, but were not detected during the survey because of the timing of the survey (e.g. threatened species that emerge in spring/early summer would not have been detected). The assessment did not involve targeted surveys for threatened flora, however, did include identification of flora that were fertile and/or flowering at the time of the field investigations.
– The assessment involved the use of FieldMaps for ArcGIS mapping application to record site information. This mapping tool was accurate to within ten metres on site
– The opinions, conclusions and any recommendations in this report are based on conditions encountered, observations made and information reviewed up to the date of preparation of the report. As GHD was only present on specific dates and certain time periods, this report is only indicative (and not definitive) of flora, fauna and communities present on the site. Flora, fauna and communities (whether in type or quantity) can change at different times throughout the year (due to factors including seasonal changes, external events or third-party intervention), and it is generally not possible to observe such changes where only a discrete site visit has taken place. 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.

1.3 Proposed offset site

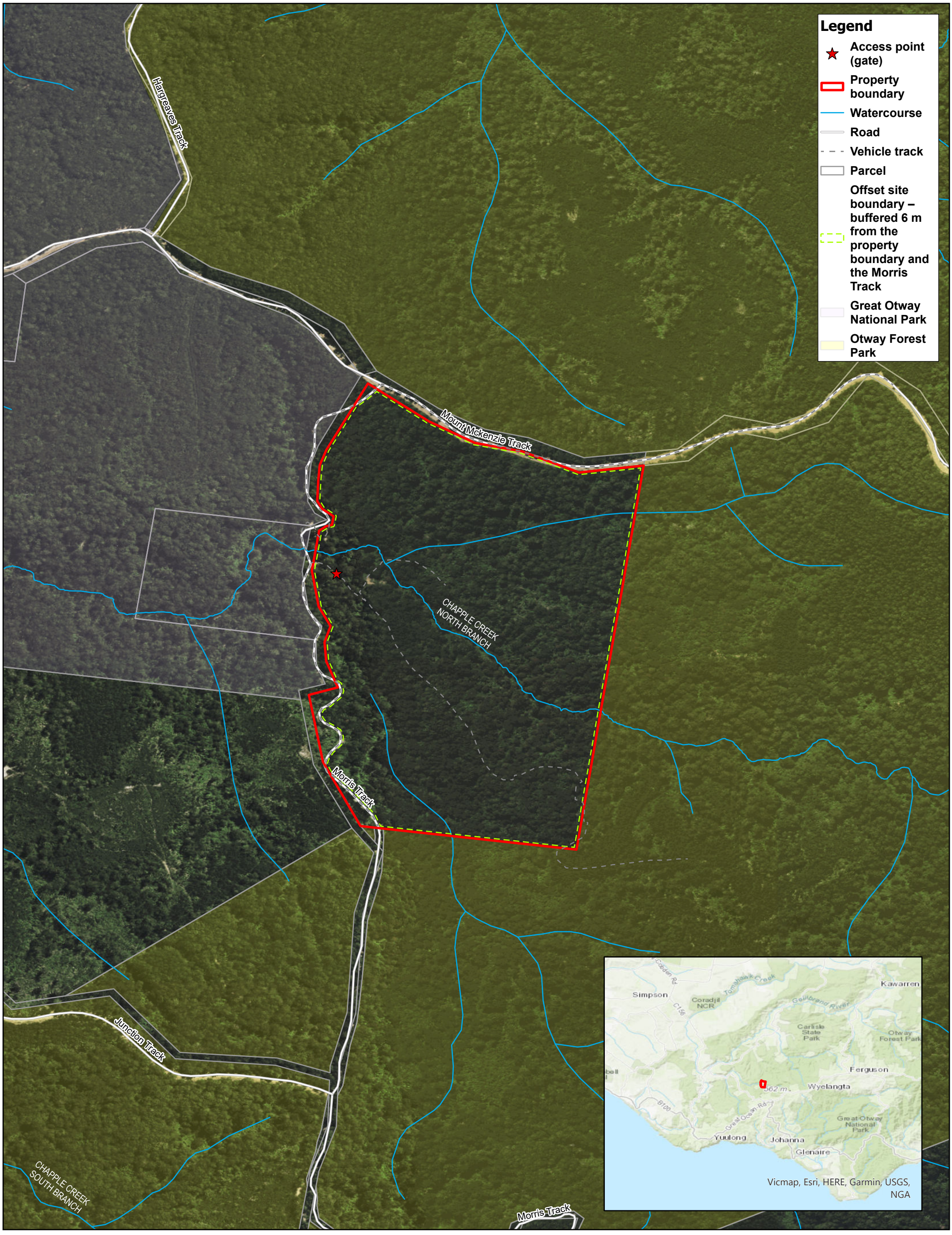
The proposed **offset site** is 450 Morris Track, the property on the south-east corner of the intersection of Morris Track and Mount McKenzie Track, near Lavers Hill, Victoria. It is located approximately 38 km southwest of Colac, 4 km north-northeast of Lavers Hill, 100 km south-west of Geelong, and 40 km south-west of the Colac pipeline project site.

Access to the site is currently from Morris Track, immediately south of the Chapple Creek crossing. There is a vehicular track (with locked gate) into the site, and from there, only two tracks occur within the site itself. Both tracks have been recently cleared by a bulldozer, but whether there were existing tracks prior to the clearing is not known. One track continues along the entrance track through and beyond the site for approximately 2.1 km (from Morris Track). It follows a ridge towards the southeast corner of the site, then ends in the forest approximately 270 m beyond (east of) the site boundary. The other track heads north from the entrance track approximately 150 m east of Morris Track. It heads north into a small cleared area (approximately 0.5 ha), crosses Chapple Creek, then bends around to the east then south-east, ending in the forest approximately 200 m past Chapple Creek.

There is evidence within the site of past logging. At numerous locations, large, old stumps were observed. Given the general size of the existing alive trees, however, logging is considered unlikely to have been recent or clear-felling. The property is approximately 78.68 ha and the proposed offset site within the property is approximately 74.41 ha. The proposed offset area excludes a 6 m buffer from the property boundary and Morris Track. The portions of the property that are not included within the proposed offset site are shown in Figure 2:

The term **study area** refers to a broader region surrounding the offset site and includes the offset site and a 10 km buffer. The additional information captured has been used to provide context to assess the significance of ecological features identified within the offset site (for example, whether they occur across a larger area). The broader study area was only assessed at a desktop level.

According to DEECA's NatureKit Map, the study area occurs within the Otway Ranges (OtR) bioregion. The study area occurs wholly within the Colac Otway Shire and the Corangamite Catchment Management Authority (CCMA) area.



Paper Size ISO A3

0 50 100 150 200 250

Meters

Horizontal Datum: GDA 1994
Grid: GCS GDA 1994

N

Barwon Water
Colac Pipeline Upgrade Offset Strategy

Project No. **3137032**
Revision No. **A**
Date **17/04/2024**

Proposed offset site location

FIGURE 1

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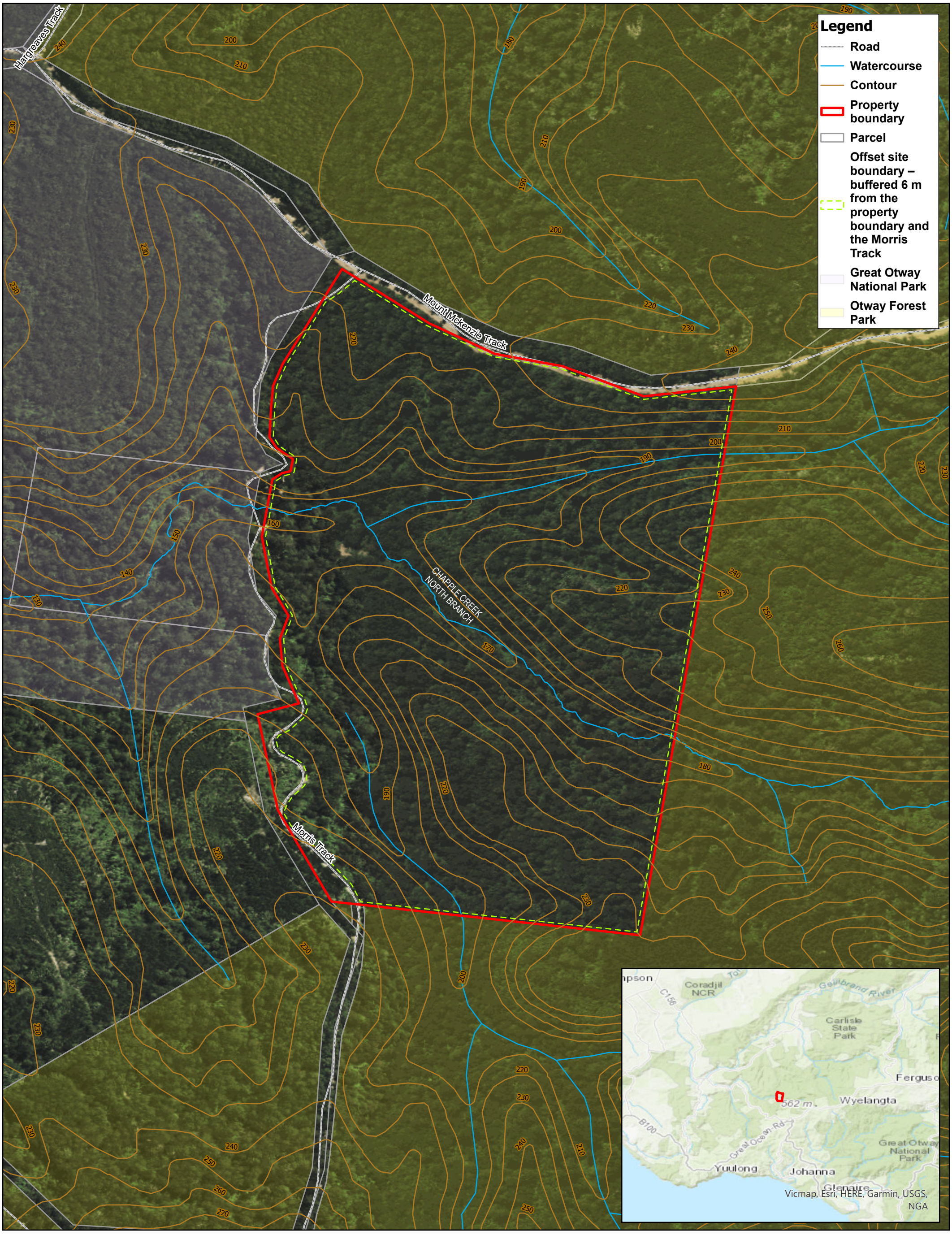

Paper Size ISO A3

0 50 100 150 200

Meters

Horizontal Datum: GDA 1994
Grid: GCS GDA 1994

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GHD

Barwon Water
Colac Pipeline Upgrade Offset Strategy

Proposed offset site location with contours

Project No. **3137032**
Revision No. **B**
Date **15/04/2024**

FIGURE 2

\\ghdnet\ghd\AU\Geelong\Projects\31\37032\GIS\Maps\Working\Ecology\2024\Lavers hill offset site\3137032_Lavers Hill offset site.aprx

2. Methods

2.1 Desktop review

A desktop assessment of data base records and other information sources to assist with planning for field surveys and understanding the historical occurrence of threatened species within the offset site was undertaken. The following sources were reviewed:

- Commonwealth EPBC *Act 1999* Protected Matters Search Tool (PMST) (maintained by the Department of Climate Change, Energy, the Environment and Water (DCCEEW 2024), (10 km buffer of the offset site)
- Victorian Biodiversity Atlas (VBA) for the records of the Yellow-bellied Glider, Gang-gang Cockatoo, Long-nosed Potoroo and a list of all terrestrial flora and fauna species recorded within a 10 km buffer of the offset site DEECA (2024a)
- Commonwealth Atlas of Living Australia (ALA, 2024) – to identify additional records not included in the Victorian Biodiversity Atlas database within a 10 km buffer of the offset site for the Yellow-bellied Glider, Gang-gang Cockatoo and Long-nosed Potoroo. The ALA is a collaborative, digital and open infrastructure that aggregates biodiversity data from multiple sources throughout Australia, and includes records not contained within the VBA. The ALA receives support through the Australian Government's National Collaborative Infrastructure Strategy and is hosted by the Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- NatureKit Maps – which provide GIS mapping, maintained by DEECA, including modelled mapping of extant and pre-1750 Ecological Vegetation Classes (EVCs) and known threatened species records (DEECA 2024b)
- NVIM Maps – which provide the Location Map, the Current Wetland Layer, the Strategic Biodiversity Score and the Native Vegetation Condition Score for the offset site (DEECA 2024c)
- Department of Agriculture, Water and the Environment (2022a). Conservation Advice for *Petaurus australis australis* (Yellow-bellied Glider (south-eastern)). Canberra: Department of Agriculture, Water and the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/87600-conservation-advice-02032022.pdf. In effect under the EPBC Act from 02-Mar-2022
- Department of Agriculture, Water and the Environment (2022b). Conservation Advice for *Callocephalon fimbriatum* (Gang-gang Cockatoo). Canberra: Department of Agriculture, Water and the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/768-conservation-advice-02032022.pdf. In effect under the EPBC Act from 02-Mar-2022
- Department of Agriculture, Water and the Environment (2022c). Conservation Advice for *Potorous tridactylus trisulcatus* (Southern Long-nosed Potoroo). Canberra: Department of Agriculture, Water and the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/86367-conservation-advice-02032022.pdf. In effect under the EPBC Act from 02-Mar-2022
- Department of Environment and Primary Industries (DEPI) (2013) Action Statement No. 254, Long-nosed Potoroo *Potorous tridactylus - Flora and Fauna Guarantee Act 1988*
- Palmer, G (2019) Wildlife of the Otways and Shipwreck Coast
- Aerial imagery of the offset site

Figure 3 (Appendix A-1) displays VBA and ALA records for all species of MNES within the study area with the exception of the three targeted species. Figure 4 (Appendix A-1) displays VBA and ALA records for Long-nosed Potoroo, Gang-Gang Cockatoo and Yellow-bellied Glider.

2.2 Survey methods

2.2.1 Review of survey techniques

The Conservation Advice and Action Statements (and references within) and other information sources for the Gang-gang Cockatoo, Yellow-bellied Glider and Long-nosed Potoroo were reviewed to understand the most appropriate survey method/s to detect the species.

The following documents were also considered when determining appropriate survey techniques and effort:

Gang-gang Cockatoo

- Australian National University (no date) Gang-gang Cockatoo feather identification handbook; understanding our local Gang-gang populations through genetic analysis. Supported by ACT Government, Environment and Sustainability Development. Source: https://www.environment.act.gov.au/nature-conservation/conservation-and-ecological-communities/gang-gang-cockatoo-feather-collection-project.
- Davey C & Mulvaney M (2020) Report on a survey of breeding activity of the Gang-gang Cockatoo within urban Canberra 2019-2020. Canberra Bird Notes, 45, 3
- Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010) Survey Guidelines for Australia's Threatened Birds
- NSW Scientific Committee (2008) Gang-gang Cockatoo *Callocephalon fimbriatum*. Review of Current Information in NSW. NSW Scientific Committee, Hurstville, NSW

Yellow-bellied Glider

- Department of Sustainability and Environment (DSE) (2011a) Approved Survey Standards: Yellow-bellied Glider *Petaurus australis*. 2 May 2011. Version 1.0
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) (2011) Survey Guidelines for Australia's Threatened Mammals
- Goldingay RL, Carthew SM & Daniel M (2019) Characteristics of the den trees of the Yellow-bellied Glider in western Victoria. Australian Journal of Zoology 66, 179-184
- Irish P & Kavanagh R (2011) Distribution, habitat preference and conservation status of the yellow-bellied glider (*Petaurus australis*) in The Hills Shire, northwestern Sydney. Australian Zoologist 35, 941-952
- Kambouris PJ, Kavanagh RP & Rowley KA (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, 599-614
- NPWS (National Parks and Wildlife Service) (2003) Recovery Plan for the Yellow-bellied Glider (*Petaurus Australis*). National Parks and Wildlife Service (NSW), Hurstville
- Rees M, Paull DJ & Carthew SM (2007) Factors influencing the distribution of the Yellow-bellied Glider (*Petaurus australis australis*) in Victoria, Australia. Wildlife Research 34, 228-233
- Whisson DA, McKinnon F, Lefoe M, Rendall AR (2021) Passive acoustic monitoring for detecting the Yellow-bellied Glider, a highly vocal arboreal marsupial. PLoS ONE 16(5): e0252092. https://doi.org/10.1371/journal.pone.0252092

Long-nosed Potoroo

- Department of Sustainability and Environment (DSE) (2011b) Approved Survey Standards: Long-footed Potoroo *Potorous longipes*. 2 May 2011. Version 1.0
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) (2011) Survey Guidelines for Australia's Threatened Mammals
- Frankham G, Reed R, Fletcher T & Handasyde K (2011). Population ecology of the long-nosed potoroo (*Potorous tridactylus*) on French Island, Victoria. Australian Mammalogy. 33. 10.1071/AM10051
- Robley, A., Gormley A., Triggs, B., Albert, R., Bowd, M., Hatfield. C., McDonald, R., Rowe, C., Scott, K., and Smith, A. (2014) Glenelg Ark 2005–2013: Evidence of the Benefits for Native Mammals of Sustained Fox Control. Arthur Rylah Institute for Environmental Research Technical Report Series. Department of Environment and Primary Industries, Heidelberg, Victoria

- Robley, A., Moloney, P.D. and Le Duc, E. (2022). Glenelg Ark—2020 monitoring and evaluation update. Arthur Rylah Institute for Environmental Research Technical Report Series No. 340. Department of Environment, Land, Water and Planning, Heidelberg, Victoria
- Robley, A., Moloney, P., Stringer, L. and Donald, S. (2020) Glenelg Ark 2005–2019: Long-term predator and native mammal response to predator control. Arthur Rylah Institute for Environmental Research Technical Report Series. Department of Environment and Primary Industries, Heidelberg, Victoria
- Stevens, M., Rudolph, G., Christian, F., and Frey, S. (2010). Pilot survey for Long-nosed Potoroo and Southern Brown Bandicoot using remote camera in the Grampians National Park, February to April 2009. Field Report 3. Unpublished

2.2.2 Survey approach

The following sections outline the survey approach and targeted field survey methods used to detect Gang-gang Cockatoo, Yellow-bellied Glider and Long-nosed Potoroo within the offset site (Figure 5, Appendix A-1).

Survey methods and effort were informed by information sources listed in section 2.2.1, but also required consideration of project timelines and safety requirements (e.g., working at height when installing cage traps). Consequently, the methods did not strictly follow all advice offered in the reviewed resources (e.g., no cage trapping for Yellow-bellied Glider or hair-tube surveys for Long-nosed Potoroo).

As noted in DAWE (2022a) recent studies for the Yellow-bellied Glider have forgone trapping in favour of a count of night-time calls, often with a playback used to stimulate calling. Passive acoustic monitoring (PAM) is increasingly being used for the survey of vocalising wildlife species that are otherwise cryptic and/or difficult to survey (e.g., Whisson et al 2021). The Yellow-bellied Glider is one of the most vocal marsupials. Its loud shrieking calls are audible up to 500 m away, making auditory sampling suitable for the species (DAWE 2022a). Goldingay *et al.*, (2017) made use of night-time calling in response to broadcasts of calls of both Yellow-bellied Glider (south-eastern) and predatory owls. DSE (2011) note that the Yellow-bellied Glider is active throughout the year, thus spotlight transects can be effective at any time of year, with little seasonal variation in effectiveness, provided the weather conditions are suitable. The presence of Yellow-bellied Gliders is often revealed by their distinctive vocalisations, whereas visual detections are sometimes difficult because of their spotlight shyness and poor reflective eyeshine (Wintle et al. 2005). This survey used a combination of PAM, spotlighting and habitat assessments to determine the species' occurrence within the offset site.

The conservation advice for the Gang-gang Cockatoo (DAWE 2022b) notes that arguably the most reliable survey method for the species is the 500 m radius area search, with 2-hectare (ha), 20-minute (min) area searches (as used by Birdlife Australia) also noted as another survey method. This survey used a combination of diurnal bird point count and transect area surveys, opportunistic surveys and habitat assessments to determine the species' occurrence within the offset site.

DEPI 2013 noted that numerous surveys (cited within DEPI 2013) have targeted Long-nosed Potoroos or employed techniques that are known to detect potoroos, including predator scat analysis, remote camera, hair tube and live trapping techniques. Older techniques, such as live trapping and predator scat analysis, have been replaced or supplemented successively by newer methods, such as hairtubing and remote cameras. The latter appears to be especially effective at detecting Long-nosed Potoroos (DEPI 2013). Survey programs including the Land Conservation Council Regional surveys, forest block surveys, pre-logging coupe surveys, the monitoring programs associated with the Ark projects including Glenelg Ark (Robely et al 2022) and Grampians Ark have all successfully used remote cameras and or/hairtubing. Survey guidelines developed by the DSEWPC (2011) include the following techniques: daytime searches for potentially suitable habitat resources and signs of activity (e.g., diggings); collection of predator scats; soil plot surveys for tracks; and baited cameras. However, observers should be aware that Long-nosed Potoroo diggings are usually indistinguishable in the field from those of sympatric species like bandicoots, where the Long-nosed Potoroo occurs in sympatry with other potoroo or small wallaby species, and tracks cannot be distinguished, or may be difficult to distinguish between species. This survey used a combination of baited cameras, opportunistic surveys for predator scat, spotlighting and survey sign (e.g., tracks and digs) to determine the species' occurrence within the offset site.

The survey was undertaken over three periods:

– Four GHD ecologists (Craig Grabham, Richard Retallick, Will Wilson and Emma Pacholllli) over a six-day period: 12 - 17 February 2024
– Two GHD botanists (Brendan Janissen and Armando Gillado):14 - 16 February 2024
– Two GHD ecologists (Armando Gillado and Lukas Fellows): 29 February 2024 – 1 March 2024

All work was completed under the following permits:

– *Wildlife Act 1975* Management and Research Authorisation (Permit #10009413)
– Parks Victoria permit (number 10009148)
– Animal Ethics Scientific Procedures Fieldwork Licence GHD SPFL20067

Table 1 Summary of survey methods, timing and effort

Method	Location – site number (Figure 5 Appendix A-1 reference)	Timing and effort	Survey adequacy
Passive Acoustic Monitoring	PAM 1 - 8	8 x PAM locations at least 350 m apart for between 15 - 19 consecutive nights between 12/02/2024 and 1/03/2024. Programmed to record from 8:30 pm - 1:30 am and 4:00 am - 6:30 am (8.5 hrs each night) Depending on the steepness of terrain and aural detection range, AudioMoths were located approximately 350 - 470 m apart.	According to Whisson et al (2021) – YBG vocalisations were most common in the four hours after sunset, and rainfall negatively influenced detection probability, especially during the autumn/winter sampling period. Detection of Yellow-bellied Gliders with PAM requires programmed PAMs to record for four hours after sunset, for a minimum of six nights with minimal inclement weather (i.e., seeking little or no wind or rain). The survey period should be extended to 12 nights when rain or wind are forecast. Not suitable for Gang-gang Cockatoo as the recording period was not optimised for this mostly diurnal species. *Summary of survey effort/outcomes for offset site* No issues noted using this technique. The analysis was restricted to the four hour period from sunset onwards (approximately 9:00 pm - 1:00 am) which is accepted as the most productive period for vocalisations. Eight sites for approximately 120 survey-nights. Favourable conditions were recorded for the majority of the survey period, however, there were several nights of rain and/or wind (see section 3.2.1). However, there was sufficient survey effort (e.g. duration and number of sites) to overcome any issues (e.g. inclement weather) that may have impacted this method. YBG vocalisations were recorded at 8 of the 8 PAM sites during the survey.
Spotlighting*	4 nights	Transect and opportunistic surveys completed for 4 nights (12/02/24 and 14-16/02/24) at approximately 2 hours each night.	Suitable survey technique for detecting the YBG (DSE 2011, DEWHA 2011, DAWE 2022a, Goldingay et al 2017). Not suitable for Gang-gang Cockatoo or Long-nosed Potoroo. *Summary of survey effort outcomes for offset site* Some issues noted using this technique, particularly restricted visibility to tree canopy in areas where there was dense midstorey vegetation. This limitation somewhat offset by the YBG being a vocal species that would expect to be heard vocalising if present. Approximately 23 person hours over 4 nights.

Method	Location – site number (Figure 5 Appendix A-1 reference)	Timing and effort	Survey adequacy
			YBG recorded 63 occasions (aural or visual) across the site over 4 nights during the listening period prior to spotlighting or during spotlight surveys.
Cameras - ground	CG 1-17	17 sites for up to 17 days and nights between 12/02/24 and 01/03/24. Fifteen of the 17 cameras were baited, and 2 were placed along existing animal trails/tracks and were unbaited.	Suitable survey technique for detecting the Long-nosed Potoroo (DEPI 2013, DEWHA 2011, Robley et al various dates). Not suitable for Gang-gang Cockatoo or Yellow-bellied Glider. *Summary of survey effort outcomes for offset site* One camera recorded for only 8 days as battery died prematurely. No other issues noted using this technique. 17 sites for 280 survey-nights/ approximately 1 camera per 4.5 ha. At least 17 fauna species were recorded including small ground mammals, however, the Long-nosed Potoroo was not recorded.
Diurnal bird survey	DB 1-24	24 x 20 min point or transect count searches in or along boundary of the offset site between 12-17/02/24 and between 29/02/24 and 1/03/24. Opportunistic bird lists taken while undertaking other survey activities from 12-17/02/24 and 29/02/24 and 1/03/24.	Suitable survey technique for detecting the GGC (DAWE 2022b) and other cockatoo/parrot species (DEWHA 2011). *Summary of survey effort/outcomes for offset site* No issues recorded. Although the survey was undertaken during the documented breeding season it was outside the typical breeding period (October – January, Higgins 1999) and it is possible that young had fledged and were not reliant on tree hollows. Therefore we were unable to maximise the chance of encountering breeding events and species-hollow interactions. 24 surveys over 7 days (excluding opportunistic observations). 33 records of Gang-gang Cockatoo were recorded during the 8 days on site in or nearby the offset site.
Habitat assessment	HA 1 - 40	More than 40 locations where habitat was assessed, including: – Searches for suitable foraging habitat (e.g., feed trees, digs) – Denning and nesting habitat (e.g., hollow-bearing trees).	Daytime searches for suitable habitat is an accepted method for all species. Documentation of feed trees Suitable technique for detecting presence of Yellow-bellied Glider (DSEWPC 2011). Searching for sign for the Long-nosed Potoroo (e.g. digs) can be problematic as diggings are usually indistinguishable from other similar species.
VQA	HZ1 -4	Four sites – flora and vegetation assessment (section 2.4). One representative assessment in each EVC.	Vegetation Quality Assessment (VQA) methods in accordance with the: *Native vegetation: sustaining a living landscape. Vegetation Quality Assessment Manual-Guidelines for applying the habitat hectares scoring method, Version 1.3* (DSE 2004). Four assessments completed, one in each EVC.

Table notes: *Call playback was not done at Lavers Hill because the target species was heard calling spontaneously each night.

2.3 Targeted fauna survey methods

2.3.1 Passive Acoustic Monitoring (PAM)

This section provides a summary of the deployment of PAM devices in the study area. A detailed description of the acoustic data analysis is provided in Appendix A-2.

PAM devices (AudioMoth, Open Acoustic Devices – UK) were deployed at eight sites, during February 2024. Although the devices were programmed to record for most of the night, the analysis focused on the main calling period reported for the species, based on an acoustic study from the Central Highlands of Victoria (Whisson et al. 2021). The study reported that detection of Yellow-bellied Gliders with PAM devices requires recording to be programmed for four hours after sunset, for a minimum of six nights with minimal inclement weather (i.e., light or no wind or rain). It is recommended that the survey period is extended to 12 nights when rain or wind are forecast. Each AudioMoth device was programmed using the AudioMoth Configuration App (Version 1.10.1., Open Acoustic Devices), as follows:

– Sample rate: 32000 Hz (32 kHz)
– Gain: medium
– Enable sleep/record cycle: on (Sleep duration: 5 seconds/Record duration: 55 seconds thus each file is 55 seconds)
– Recording period – all night, each night starting 8:30 pm, approx. 0.5 hrs before sunset to 1:30 am, then 4:00 am – 6:30 am approximately 1 hr following sunrise
– Enable filtering: band pass (0.1 kHz – 16.0 kHz)

AudioMoths were housed inside the AudioMoth IPX7 waterproof case, with the microphone adjacent to a small hole. All devices were strapped to a tree trunk or limb no wider than 6 cm diameter at a height of 2.0 – 2.5 m and at least 1.5 m away from dense foliage. Upon deployment, the date/time, device number, habitat type, presence of suitable habitat and habitat disturbance were recorded. Photographs of the location and the device in situ were recorded. All devices were retrieved at the time of the final site visit. The status of some devices was checked during the deployment period to reduce the risk of data loss from theft, low battery, damage or malfunction.

2.3.2 Spotlight and thermal monocular survey

Spotlighting transects were undertaken by two ecologists walking along tracks within the offset site and along the edge of the offset site during February 2024. Hand-held spotlights or strong head-torches were used to detect the presence/absence of nocturnal fauna, particularly arboreal fauna, by ‘eye shine’ and hearing or seeing animal movement. Transects commenced following a 10-minute period of listening for animal vocalisations and scanning hollow-bearing trees for emerging fauna at the start of the transect.

Opportunistically, we also used a thermal monocular (Hikmicro Owl OQ25) to scan for animals at the start of the survey during the listening period and at intervals during the spotlighting transect. The thermal monocular was not used as the primary detection technique, rather as a complimentary technique to the spotlighting, given the lack of published information regarding its effectiveness for detecting Yellow-bellied Glider.

Upon detecting an animal, binoculars and/or a camera were used for species identification. A GPS waypoint was then created for each sighting. Waypoints were either projected to the approximate location of the animal (estimated as best as possible, generally thought to be within +/- 50 m accuracy), or taken directly underneath where the animal was located, if the animal was seen.

We attempted to undertake at least 2 hours of spotlighting each night within the offset site. From tracks, visibility into the forest was often obscured by the dense midstorey vegetation. Random/opportunistic spotlight surveys were also undertaken whilst driving between sections of the offset site.

2.3.3 Camera survey

Seventeen motion-activated cameras were deployed for 11-17 days to target native ground mammals during February 2024. Cameras were attached to the nearest tree 1-1.5 m above the ground (Plate 1). Fifteen of the 17 cameras had a lure of truffle-infused olive oil, peanut butter, honey and rolled oats, secured to the ground or base of nearby tree in a tea strainer 2-3 m in front of the camera. Additional oil was dripped onto the ground below and around the lure. Cameras were set to take three images and/or a 15 second video per trigger, with each day representing a repeat survey of the monitoring site. The remaining two cameras were not baited but were instead positioned along existing tracks/animal trails to opportunistically detect native and/or non-native fauna (i.e., deer, foxes, cats, kangaroos, wallabies).

Three infrared camera models were used (Reconyx HyperFire IR, BestGuard IR and KeepGuard IR). All camera models are weatherproof, encased in an integrated hard plastic cover. Each camera takes colour images by daylight, and automatically adjusts to take black-and-white images at night and in low light conditions. For images in darkness or low light, the camera has an infrared 10 m flash, rather than visible white flash. Image resolution was 10-15 MB per image. Camera sensitivity was set to ‘moderate’ (not ‘high’, not ‘low’). The photographs were downloaded from each camera and reviewed for the presence of target species and other species of interest.

Plate 1 Examples of camera traps deployed

2.3.4 Diurnal bird surveys

Audio-visual surveys for diurnal birds involved one or two experienced ecologists identifying birds visually (using binoculars) and aurally (from their calls). Surveys were undertaken using point survey and transect search methods. Point surveys involved an ecologist listening to calls and using binoculars to record the presence and number of all birds at each location for a 20-minute period. Transect searches involved slowly walking tracks for 20 minutes, recording birds seen or heard. Surveys were undertaken in the early and mid-morning, and in the late afternoon and within the hour leading to sunset, in order to capture peak bird activity periods and the possibility of Gang-Gang Cockatoos leaving or returning to roosting sites or hollow trees.

During each bird survey, the following was recorded:

– Targeted species observations (heard/seen, number, behaviour)
– Other bird species and observations including use of hollows

Opportunisitc bird surveys were also conducted concurrently with other activities (i.e., habitat assessment, fauna camera setup/check/collection) with all new birds species seen or heard being recorded.

2.3.5 Habitat assessment

The habitat assessment included:

– Field survey of the habitats within the offset site to determine extent and occurrence of habitat for the Yellow-bellied Glider, Gang-gang Cockatoo and Long-nosed Potoroo within the offset site, including the documentation of sign (e.g. feed tree, diggings) and suitable refuge and breeding habitat (e.g. hollows, dense understorey vegetation)
– Brief assessment of habitat type and quality at nearby 'off site' locations with historical records for any of the species (if applicable)
– Review of existing vegetation mapping and alignment with species' habitat requirements following field surveys

The daytime field habitat assessment involved two ecologists walking along all tracks and traversing through the forest to access parts of the site where no tracks exist (see track log Figure 5 Appendix A-1) to assess and map fauna habitat favourable for the target species. The northern section of the site was accessed via Mount McKenzie Track that follows the northern boundary of the site, and the short bulldozed track within the site itself. The southern section was accessed via Morris Track and the bulldozed track that extends to the south-east coner of the property. The assessment also assisted with identifying some of the potential locations to focus targeted survey effort (e.g., PAM locations, diurnal bird, spotlighting and camera).

This method was used so that habitat assessments were relatively standardised and repeatable, with the ability to extrapolate likelihood of species' presence in other areas of similar EVC and condition, particularly when the species was not detected following the use of targeted survey methods.

Signs of foraging and foraging habitat

Arboreal species (in particular the Yellow-bellied Glider) are known to leave marks on the trunks of trees as they climb or feed on sap. When foraging on 'feed trees', Yellow-bellied Gliders cut distinctive V-shaped sap-feeding notches into specific trees, which they tend to repeatedly visit and recut to feed on the sap. The resulting scars on certain tree trunks are highly distinctive and their occurrence in an area indicates that an arboreal species (most often Yellow-bellied Glider) is present at the site (DSEWPC 2011).

Scratch marks made by claws leave long lasting signs on tree trunks that can easily be detected by an observer surveying trees for signs of fauna activity. Scratches are not always distinguishable between species, and are not specific to mammals (for example, goannas also climb trees), however, detecting the presence of these signs means that trees can be targeted by direct survey methods such as spotlight surveys or stag watching (DSEWPC 2011).

For each tree with signs of foraging or other evidence, the following information was recorded:

– Vegetation type/EVC
– Tree species
– Signs of disturbance (e.g. fire)
– Evdience of fauna use (e.g. species in hollow, chew marks, scatches)
– Yellow-bellied Glider sap-tree feeding notch (fresh, historical, both – approximate number of notches)
– Photos

Denning-nesting habitat (hollow-bearing tree information)

Hollow-bearing trees and very large trees that were likely to support hollows were recorded within the offset site. Hollows were observed from the ground, often with the aid of binoculars. For each tree known or likely to have hollows, the following information was recorded as far as practicable:

– Vegetation type/EVC
– Tree species
– Number of hollows observed
– Approximate location and height of each hollow (categorised, < 5 m, 5-10 m, > 10 m)
– Diameter opening of each hollow (categorised - <10 cm, 10-30 cm, >30 cm)

– Health of tree
– Signs of disturbance (e.g. fire)
– Evidence of fauna occupation or use (e.g. species in hollow, chew marks, scatches)
– Photos (of hollows deemed potentailly suitable for target species)

Table 2 provides a summary of the hollow characterisics used to guide the field assessment. It is important to note that it is often difficult to accurately assess hollow characterisitcs (e.g. entrance diameter) from the ground, and some trees may have hollows that cannot be seen from the ground. Therefore, a conservative approach was taken when determining the suitability of hollows for each species.

The hollow information collected was later compared to the information published for each species (e.g. DAWE 2022a and 2022b) in order to understand the extent of potential denning and breeding habitat for the Yellow-bellied Glider and potential breedng habitat for the Gang-gang Cockatoo. It is also important to note that trees containing hollows that were deemed unsuitable for the target species at the time of the assessment may develop suitable hollows in the future and are therefore important as they provide future opportunities for roosting, denning and breeding. Furthermore, due to the difficulty of the terrain and time constraints, we were not able to count every hollow/hollow-bearing tree in the property.

Table 2 ***Favourable hollow characteristics for Gang-gang Cockatoo and Yellow-bellied Glider, derived from literature used to assist collection of data in the field***

Hollow characteristic	Gang-gang Cockatoo	Yellow-bellied Glider
Height above ground	range 5 - 9.4 m, assume at least 5 m	range 5.2 – 9.5 m, assume at least 5 m
Hollow entrance (span, height)	minimum 12 cm	not available
Hollow entrance (diameter)	range 9 - 24 cm	average 10.6 cm
Type of hollow favoured	any (trunk or limb)	any (trunk or limb)
Signs of occupation	Chew marks around rim/entrance	Smoothing of rim/entrance

Table 2 information from DAWE 2022a and 2022b, Davey & Mulvaney 2020, Goldingay et al 2019

2.4 Flora and vegetation

The aim of the vegetation assessment was to determine the types and extent of native vegetation across the site and habitat condition in relation to the threatened fauna species and identify existing or potential threats to the vegetation quality of the site.

The flora assessment involved the evaluation of remnant patches of native vegetation, non-native vegetation and scattered trees in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP 2017). The assessment included undertaking a Vegetation Quality Assessment (VQA), mapping the extent and condition of native vegetation within the offset site, including:

– Defining and mapping the relevant EVCs
– Mapping and measuring Patch Trees that meet the benchmark to be considered Large Trees
– Compiling an inventory of native and non-native flora, together with their conservation status and origin
– Identifying significant weed species including those declared under relevant state and national legislation, policy or strategy, e.g. *Catchment and Land Protection Act 1994* (CaLP Act) and National Weeds Strategy

Due to the terrain and difficult-to-access areas of the site, the Patch Tree calculations were completed via transects of the offset site. The transects were approximately 250 m – 450 m long and 20 m wide. Five transects were surveyed across the site, traversing all EVCs present including Wet Forest (EVC 30), Cool Temperate Rainforest (EVC 31), Riparian Forest (EVC 18) and Shrubby Wet Forest (EVC 201). The density of large trees measured during the transect surveys were extrapolated across the site relative to the extent of each EVC present, to provide an estimate of the total number of large patch trees within the site (Figure 5, Appendix A-1).

The Vegetation Quality Assessment (VQA) was completed within representative patches of the four EVCs present at the site.

2.5 Nomenclature and conservation status

2.5.1 Flora

Common and scientific names for plants follow the Victorian Biodiversity Atlas (VBA) (Version 3.2.8).

Conservation status was determined in accordance with the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act).

Native vegetation is defined in the Victoria Planning Provisions as 'plants that are indigenous to Victoria, including trees, shrubs, herbs and grasses'. For the purpose of the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP 2017), native vegetation is classified into two categories, a **Patch** of vegetation or a **Scattered Tree**:

- A **Patch** of native vegetation is either:
  - An area of native vegetation where at least 25% of the total perennial understorey plant cover is native
  - Any area with three or more native patch trees where the drip line of each tree touches the drip line of at least one other tree, forming a continuous canopy
  - Any mapped wetland included in the Current wetlands map (available on DEECA online mapping tools)
- A **Scattered tree** is a native canopy tree that does not form part of a patch

Other forms of vegetation include:

- **Planted native vegetation**, i.e., includes non-indigenous native species and areas of revegetation
- **Scattered native plants**, i.e., patches of vegetation dominated by introduced species where less than 25% of the total perennial understorey plant cover is native
- **Non-native vegetation**, i.e., vegetation that comprises entirely introduced flora

2.5.2 Protected Flora

Protected flora under the FFG Act 1988 includes:

1. Plant taxa (species, subspecies or varieties) listed as threatened under the FFG Act
2. Plant taxa belonging to communities listed as threatened under the FFG Act
3. Plant taxa that are declared protected by the Minister. These are taxa which are not threatened but require protection for other reasons.

For the purposes of this report the term 'protected flora' is used only for those species in the third (declared protected flora) category described above i.e., plants that are 'declared' protected flora under the FFG Act (DEECA 2024c).

There are two different categories for declared protected flora: generally protected flora (GP) and restricted use protected flora (RU) The FFG Act also distinguishes between three types of take and permit requirements under the FFG Act differ between the two categories of protected flora and the type of take. Types of take and permit requirements are summarised in Table 1 below. **Incidental take** applies to Powercor works and 'general protected' and 'restricted use protected' are also defined below:

'Generally protected flora' refers to all other protected flora that are impacted by take for all other reasons (e.g., development, infrastructure maintenance works, etc.) and can include those species at risk of both commercial/personal take and incidental take.

'Restricted use protected flora' are those flora that are exclusively impacted by take for commercial or personal use (e.g., not at risk from other activities). Take for other reasons (e.g., take incidental to track maintenance etc.) is not restricted as long as reasonable care is taken not to impact the taxon.

Table 3 Permit requirements for generally protected and restricted use Protected flora

Type of Take	Definition	Generally Protected Flora (GP)	Restricted Use Protected Flora (RU)
Incidental Take	Where plants are taken to make space for something else – for example, clearing for the construction or maintenance of a building, road, or pipeline; clearing for grazing or cropping; or clearing to construct bushfire fuel break. Any take where the intent is not to obtain a specimen of the plant, but to simply remove it, is incidental take.	Permit Required	No Permit Required
Take for Sale	Includes take for the purpose of making the plant available for sale, regardless of whether it has actually been sold.	Permit Required	Permit Required
Take for Personal Use	Includes any other reason for obtaining a specimen of the plant – for example, to collect or propagate, for use as food or fibre, for research or display.	Permit Required	Permit Required

2.5.3 Vegetation communities

Native vegetation in Victoria is mapped in units known as Ecological Vegetation Classes (EVCs). EVCs are described according to a combination of floristic, life form and ecological characteristics, and through an inferred fidelity to particular environmental attributes.

Each EVC occurs under a common regime of ecological processes within a given biogeographic range, and may contain multiple floristic communities.

Other vegetation types that may occur in Victoria include vegetation communities listed as threatened under the EPBC Act and/or the FFG Act. These have separate vegetation classification systems, each of which is also separate to the EVC classification system. As such, any single patch of native vegetation occurring within the subject site (or anywhere in Victoria) will be classifiable as a particular EVC, and may also be separately classified as a threatened ecological community under the EPBC Act, and/or as another vegetation community under the FFG Act.

2.5.4 Fauna species and fauna communities

Unless otherwise noted, common and scientific names for fauna follow the VBA database (Version 3.2.8).

The conservation significance of fauna was determined in accordance with the EPBC Act and the Victorian FFG Act. The EPBC Act and the FFG Act list a number of threatened fauna communities, at a national or state scale, respectively. Fauna communities known or potentially occurring within the study area are only considered if they are listed under either of these Acts.

2.5.5 Weeds

The *loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants* is a listed key threatening process under the EPBC Act. In addition, *invasion of native vegetation by 'environmental weeds'*, is a listed potentially threatening process under the FFG Act.

During the field survey, a list of all flora species observed within the offset site was created. This includes environmental weeds, noxious weeds listed under the *Catchment and Land Protection Act 1994* (CaLP Act) and Weeds of National Significance (WoNS). All such weed species are listed in Appendix A-5.

3. Survey results

3.1 Offset site overview

The proposed offset site is heavily forested and forms part of a larger forested area. The western boundary connects to the Great Otway National Park, and the northern, eastern and southern boundaries connect to the Otway Forest Park and freehold forested land. The proposed offset site comprises 74.41 hectares (ha) of native vegetation, and has high value for wildlife.

The site consists almost entirely of native vegetation with large trees, logs and a dense understorey and midstorey. EVC 201 (Shrubby Wet Forest) (36.57 ha) dominates the drier slopes and ridges, with EVC 30 (Wet Forest) (6.14 ha) on the wetter slopes and EVC 31 (Cool Temperate Rainforest) (28.28 ha) in the gullies and waterways. EVC 18 (Riparian Forest) occurs in smaller patches (3.42 ha) towards the southwest and southeast of the site.

Chapple Creek (north branch) runs west through the site, with a range of tributaries. The northern boundary of the property follows Mount McKenzie Track along a ridge, and the property itself is characterised by steep, predominately south-facing terrain, ranging from approximately 250 m elevation at the north and south of the property to 190 m elevation towards the centre-west of the property, where Chapple Creek occurs.

There is a small clearing within the proposed offset site near Chapple Creek and two short bulldozed tracks, one (approximately 200 m long) to the east, north of Chapple Creek, and the other (approximately 2.1 km long and ending beyond the site boundary) to the south-east, south of Chapple Creek.

Evidence of historical logging was recorded throughout the site during the recent survey in the form of sawn large tree stumps, some with diameters of ≥1.5 m. Timber and farming were the main industries in the Lavers Hill area, with sawmills established from 1900 at nearby Lavers Hill. Lavers Hill township was destroyed by bushfire in 1919 and the timber industry declined by the 1920s through over-logging[1]. Forest Fire Management Victoria records of bushfires in the area suggest the last major fire that may have affected the offset site was the January 1939 Black Friday fires [2].

The Victorian Strategic Management Prospects (SMP)[3] is a spatial tool that determines where and how cost-effective actions could make the biggest difference to the protection of Victorian species and communities. The SMP tool through NatureKit identifies the offset site as ranking between 39-67/100 for the benefit to Victorian biodiversity via permanent protection of the land. The SMP also identifies through modelled data threats for an area, this offset site is at risk of pig, deer, fox, cat, and weeds. The offset site is within SMP Summary Area 760 full details of the strategic opportunities and cost benefit analysis is detailed within the Summary Area SMP Output Summary (Appendix A-4).

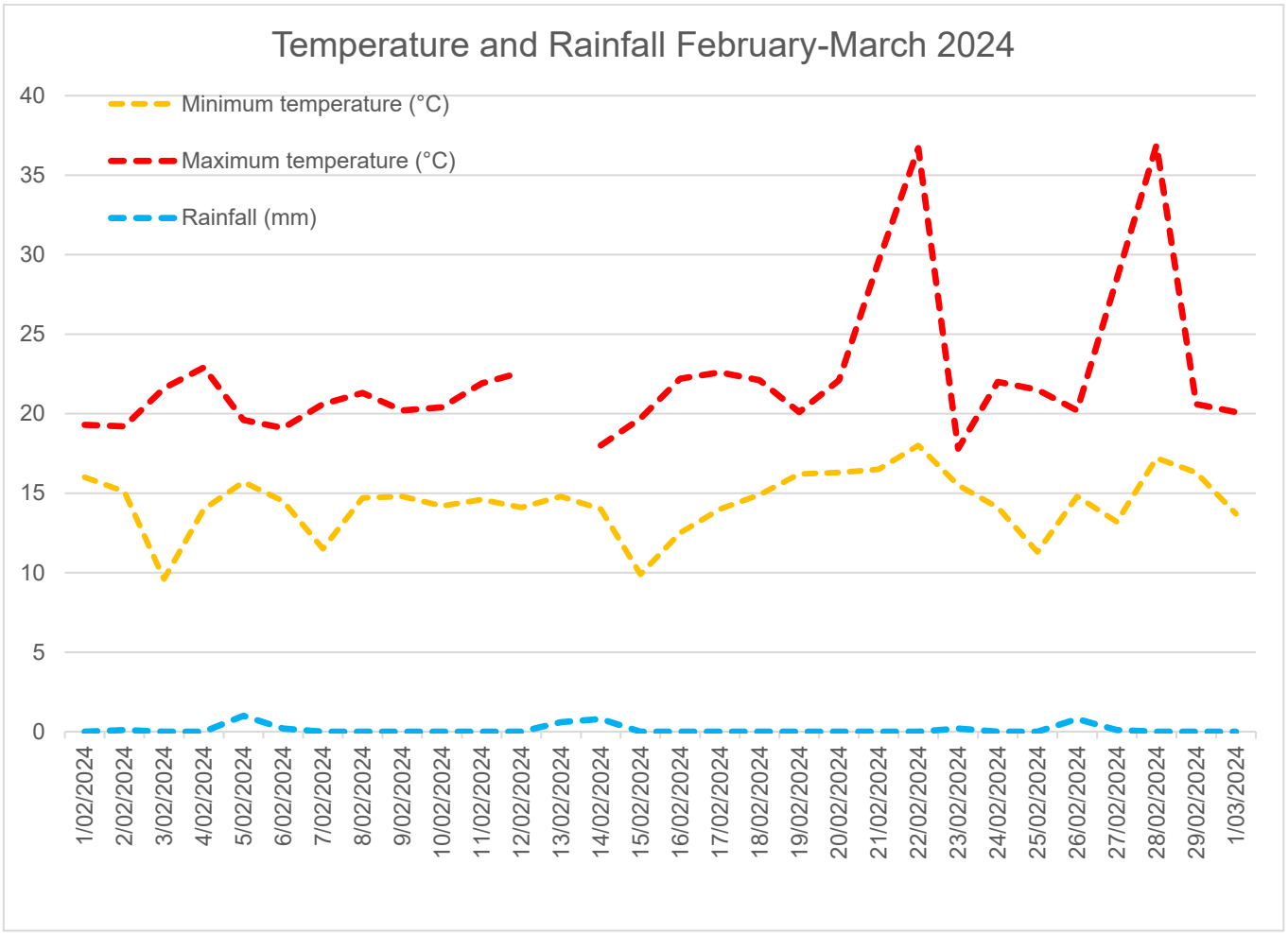
3.2 Fauna surveys

3.2.1 Survey conditions

A brief summary of the weather conditions taken from field observations during each survey period is provided below:

– 12-17 February 2024 – generally warm to hot temperatures with occasional low wind gusts. Survey conditions generally suitable with no barriers to detection (e.g. heavy rainfall or wind) experienced (thunderstorm and windy conditions experienced on 13/02/2024 – no surveying done that day due to bushfire risk).
– 29 February – 1 March 2024 – generally mild to warm temperatures (following a hotter period in the days prior). Survey conditions generally suitable with no barriers to detection (e.g. heavy rainfall or wind) experienced.

[1] https://www.surfcoast.vic.gov.au/files/assets/public/04-experience/tourism/gor/gor_heritage_centre.pdf
[2] https://www.ffm.vic.gov.au/__data/assets/pdf_file/0015/20247/1939_Black_Friday_fires.pdf
[3] https://www.environment.vic.gov.au/biodiversity/choosing-actions-for-nature/how-to-use-strategic-management-prospects



Graph 1 ***Temperature and Rainfall during survey period (source BOM, Horden Vale (rainfall) c. 13 km from site and Cape Otway (temperature) approx 22 km from site)***

3.2.2 Summary of species recorded from desktop assessment and field survey

3.2.2.1 Desktop assessment

In total, 175 fauna species are documented to occur within the study area (VBA and ALA results)[4]. These include 40 mammals (31 native and nine non-native), 112 birds (108 native and four non-native), ten reptiles (all native), seven frogs (all native) and six invertebrates (all native). A further 44 fauna species are predicted to occur or have habitat occurring within the study area (PMST), but are not recorded in the study area in the VBA. These are all native species, and include four mammals, 39 birds, and one frog. Therefore, in total, 219 terrestrial fauna species are identified for the study site in the desktop assessment.

Of the fauna identified, 68 species are considered threatened under the EPBC Act (48) or FFG Act (58) . These include 14 mammals, 47 birds, one reptile, two frogs and four invertebrates.

In addition, 33 bird species are listed as migratory under the EPBC Act, many of which are seabirds (shearwaters, petrels, albatrosses and allies) or shorebirds (plovers, sandpipers and allies), which are not likely to occur within the site.

The VBA and ALA have records of all three of the target fauna species in the study area. There are six VBA records (and seven ALA records) of the Yellow-bellied Glider (most recently in 2021), 23 VBA records (and one ALA record) of the Long-nosed Potoroo (most recently in 2022), and 18 VBA records (and 121 ALA records) of the Gang-gang Cockatoo (most recently in 2016).

[4] This assessment focusses on terrestrial habitats and excludes aquatic fauna (fish and invertebrates), marine mammals (e.g., cetaceans, seals) and marine reptiles, but includes seabirds (albatrosses, penguins, petrels, shearwaters, prions) which may flyover this site occasionally.

3.2.2.2 Field survey

During the survey, 70 fauna species were identified at the site, including 66 native species and four non-native species (see Appendix A-3). The native species included:

– 10 mammals
– 51 birds
– 1 reptile
– 2 amphibians
– 2 invertebrates

For this report, species of conservation significance are those that are listed as threatened under the EPBC Act or FFG Act, or listed as migratory under the EPBC Act. Nine species of conservation significance were detected (Table 4), including two of the three targeted species – Yellow-bellied Glider and Gang-gang Cockatoo were detected, while Long-nosed Potoroo was not.

Table 4 Threatened and migratory fauna species detected

Species group	EPBC Act	FFG Act	Migratory	Total
Mammals	1 (Yellow-bellied Glider)	1 (Yellow-bellied Glider)	-	1
Birds	3 (Gang-gang Cockatoo, Blue-winged Parrot, White-throated Needletail)	4 (Grey Goshawk, Masked Owl, Gang-gang Cockatoo, White-throated Needletail)	3 (White-throated Needletail, Rufous Fantail, Satin Flycatcher)	7
Reptiles	-	-	-	0
Frogs	-	-	-	0
Invertebrates	-	1 (Otway Black Snail)	-	1
Total	4	6	3	9

3.2.3 Passive acoustic monitoring

Yellow-bellied Glider calls were recorded using PAM from all eight sites for 19 consecutive survey nights (all sites combined) (Figure 5, Appendix A-1). Table 5 provides a summary of the Yellow-bellied Glider calls recorded for each night of the survey for each PAM site. The analysis presented in Appendix A-2 focussed on the four-hour period from sunset onwards (approximately 8:30 pm – 12:30 am) and for a 1 hour period prior to sunrise. Random sampling of data was also completed for other periods. It is possible that additional calls for each site were recorded during the period from 12:30 am – 6:30 am at each site.

Table 5 provides a summary of the first and last calls recorded by each PAM unit compared to sunrise and sunset for each site. The period following sunset and before sunrise whilst light is referred to as civil twilight or dusk /dawn. This period following sunset is when many nocturnal fauna including the Yellow-bellied Glider emerge from their diurnal refuge (e.g., den sites in hollow-bearing trees). Calls recorded during this period indicate that the species may occupy den site(s) within the site or close (< 500 m) to the site. Calls recorded within this period before sunrise may also indicate an individual returning to a den site. At least six calls were recorded within the 30 minute period (Table 5) including one call within 20 mins of sunset (PAM3, 23/02/24) and one call was recorded within 25 mins of sunrise (PAM8, 19/02/24). Both calls are of particular importance as this is the period when there is obvious sunlight, therefore indicating the individual was calling from or very close to a den site (see Table 5).

Table 5 Summary of PAM results – Yellow-bellied Glider calls per site per night

Date	PAM1 – g22_	PAM2 – g23_	PAM3 – g8_	PAM4 – g9_	PAM5 – g24_	PAM6 – g11_	PAM7 – g10	PAM8- g17	Total number calls (number of sites per date YBG recorded)
12/02/2024	4	8	ns	1	ns	ns	ns	ns	13 (3)
13/02/2024	1	6	ns	1	ns	ns	ns	ns	8 (3)
14/02/2024	2	ns	ns	2	7	3	3	ns	17 (5)
15/02/2024	15	6	-	10	7	2	6	-	46 (6)
16/02/2024	6	-	2	16	4	11	4	5	48 (7)
17/02/2024	5	14	-	11	-	9	3	1	43 (6)
18/02/2024	2	-	-	18	4	5	2	3	34 (6)
19/02/2024	7	10	4	9	7		3	24	64 (7)
20/02/2024	9	-	-	11	-	3	8	5	36 (5)
21/02/2024	-	1	-	5	5	1	3	2	17 (6)
22/02/2024	6	3	-	11	-	-	1	2	23 (6)
23/02/2024	17	4	1	15	-	3	2	-	42 (6)
24/02/2024	10	2	7	8	32	5	1	1	66 (8)
25/02/2024	27	17	1	16	3	3	1	1	69 (8)
26/02/2024	5	2	3	3	7	2	5	1	28 (8)
27/02/2024	18	8	-	7	9	2	2	-	46 (6)
28/02/2024	8	2	-	1	-	-	1	-	12 (4)
29/02/2024	ns	ns	ns	ns	ns	ns	1	6	7 (2)
1/03/2024	ns	ns	ns	ns	ns	ns	4	8	12 (2)
Total number of calls per site and (number of survey nights recorded per site)	142 (16)	83 (13)	18 (10)	144 (16)	85 (13)	49 (12)	50 (17)	59 (12)	630

Table notes: ns = not surveyed. – YBG not recorded during analysis period. Note: it is likely that some vocalisations recorded at same time by multiple units originate from the same individual, however, given the distance between PAM sites (e.g., 350 m minimum) and the terrain/density of vegetation this scenario is uncommon.

Table 6 First and last calls for Yellow-bellied Glider compared to sunrise and sunset times (date order)

PAM site	Date	Time	Sunrise/Sunset	Call timing compared to sunrise/sunset	Nearest site(s)
PAM1	17/02/2024	6:26:42 AM	6:55 AM/8:24 PM	Approx. 30 mins before sunrise, start of dawn	PAM6 – 350 m north-west and PAM2 – 360 m south-east
PAM8	***19/02/2024***	***6:36:25 AM***	***6:58 AM/8:21 PM***	***Approx. 25 mins before sunrise, dawn***	***PAM7 – 455 m west***
PAM7	20/02/2024	8:51:11 PM	6:59 AM/8:20 PM	Approx. 30 mins past sunset, dusk near final light (note: two additional calls at 8:54 pm and 8:57 pm)	PAM8 – 455 m east

PAM site	Date	Time	Sunrise/Sunset	Call timing compared to sunrise/sunset	Nearest site(s)
PAM2	22/02/2024	6:27:41 AM	7:01 AM/8:19 PM	Approx. 30 mins before sunrise, dawn	PAM1 – 350 m south-east
PAM4	22/02/2024	8:58:50 PM	7:01 AM/8:19 PM	Approx. 40 mins past sunset, dusk final light (Note: one additional call at 8:59 pm)	PAM3 – 355 m south-east
PAM3	***23/02/2024***	***8:33:48 PM***	***7:02 AM/8:16 PM***	***Approx. 20 mins past sunset, dusk***	***PAM4 – 355 m north-west and PAM1 – 365 m south***
PAM2	25/02/2024	8:44:48 PM	7:04 AM/8:15 PM	Approx. 30 mins past sunset, dusk near final light	PAM1 – 360 m north-west
PAM7	26/02/2024	8:49:09 PM	7:05 AM/8:12 PM	Approx. 35 mins past sunset, dusk final light (Note: two additional calls at 8:50 and 8:53 pm)	PAM8 – 455 m east

Table notes: Sunset/sunrise - source: Time and Date - Lavers Hill, Vic - https://www.timeanddate.com/sun/@2160495?month=2&year=2024.

3.2.4 Spotlighting

Four nights of spotlighting were done at the site. Spotlighting surveys recorded a total of 21 fauna species (Table 7).

The Yellow-bellied Glider was heard 67 times during the four nights of spotlighting (calls were heard each night), across 15 locations (including repeat survey sites). The site appeared to have two focal areas of concurrent Yellow-bellied Glider activity (north-central and south-west), which suggests that there is more than one family group at the site. Yellow-bellied Gliders were also heard outside the site (i.e., heard while standing on the site boundary) to the south, west, east and north.

Table 7 Spotlighting survey dates and effort

Date	Location	Time start	Time end	Observers	Survey effort (person-hours)
12/2/24	North and western parts of site, along Mount McKenzie Track then Morris Track.	21:00	23:35	2 (CG/WW)	5hrs 10mins
12/2/24	South and south-east parts of site, along bulldozed tracks within property	21:00	23:38	2 (RR/EP)	5hrs 16mins
14/2/24	North part of site, along Mount McKenzie Track, west to east.	21:00	22:11	3 (WW/RR/EP)	3hrs 33 mins
14/2/24	South-west part of site, along Morris Track.	22:16	22:50	3 (WW/RR/EP)	1hr 42mins
15/2/24	Attempted triangulation on Yellow-bellied Glider location – south-west part of site.	20:55	22:35	3 (WW/RR/EP)	4hrs 20mins
16/2/24	Western part of site, along Morris Track, south to north.	20:15	22:45	2 (RR/EP)	3hrs 0mins
				Total	**23hrs 1min**

Table 8 Summary of observations (counts) from spotlighting surveys

Species	12/2/24	14/2/24	15/2/24	16/2/24	Total
Mammals					
Common Ringtail Possum	5	2	1	5	**13**
Feathertail Glider				1	**1**
Long-nosed Bandicoot				3	**3**
Short-beaked Echidna				1	**1**
Sugar Glider		1			**1**
Swamp Wallaby	1	3		1	**5**
Yellow-bellied Glider*	8	11	38	10	**67**
Possible Antechinus	1				**1**
Possible Bush Rat	1				**1**
Possible rodent			1		**1**
Birds					
Australian Owlet-nightjar	1	1			**2**
Bassian Thrush				1	**1**
Eastern Yellow Robin			1		**1**
Laughing Kookaburra	1			4	**5**
Masked Owl*	3				**3**
Pacific Black Duck	1				**1**
Southern Boobook*	4	5	4	2	**15**
Tawny Frogmouth				1	**1**
Yellow-tailed Black Cockatoo				2	**2**
Frogs					
Geocrinia victoriana#		2		1	**3**
Litoria ewingi	1	1		1	**3**
Total	**27**	**26**	**45**	**33**	**131**

Table notes – * counts are of calls heard, which does not necessarily equate to individuals. # Now named Otway Smooth Frog, *Geocrinia sparsiflora*

3.2.5 Cameras

A total of 7,848 videos and images were taken by motion-sensing cameras across the 17 sites. A large proportion of images (2,840; 36%) were triggered by non-fauna movements. All but one of the cameras performed well with no technical issues reported – one camera was triggered incessantly for unknown reasons, and ran out of battery power or card space after eight days.

At least 17 fauna species were identified from camera images and video including eight birds and nine mammals. Most images of fauna could be identified to species, but many could not. Small mammals (e.g., possible antechinus or rodents) were challenging, because of their small size and rapid movements, and not all images could be confidently identified. No images of Long-nosed Potoroo or Southern Brown Bandicoot were recorded, but images were obtained of Long-nosed Bandicoot.

Table 9 Summary of camera analysis

Common name	Scientific name	Sites (of 17)	Notes
Mammals			
Agile Antechinus	*Antechinus agilis*	7	-
Bush Rat	*Rattus fuscipes*	11	-
Common Ringtail Possum	*Pseudocheirus peregrinus*	4	-
Long-nosed Bandicoot	*Perameles nasuta*	4	Plate 3
Swamp Rat	*Rattus lutreolus*	1	-
Swamp Wallaby	*Wallabia bicolor*	9	Plate 2
Cat*	*Felis catus*	6	Plate 6
Red Fox*	*Vulpes vulpes*	5	Plate 6
Fallow Deer*	*Cervus dama*	2	Plate 5
Unidentified mammal	NA	15	Includes Antechinus, rodents
Birds			
Bassian Thrush	*Zoothera lunulata*	8	Plate 4
Brown Thornbill	*Acanthiza pusilla*	1	-
Brush Bronzewing	*Phaps elegans*	1	-
Eastern Yellow Robin	*Eopsaltria australis*	7	-
Grey Shrike-thrush	*Colluricincla harmonica*	4	-
Satin Bowerbird	*Ptilonorhynchus violaceus*	10	Plate 4
White-browed Scrubwren	*Sericornis frontalis*	6	-
Common Blackbird*	*Turdus merula*	2	-

*Table note * – introduced species.*

Plate 2 *Example of image captured of Swamp Wallaby*

Plate 3 ***Examples of images captured of Long-nosed Bandicoot – both photos***

Plate 4 ***Examples of images captured of birds: top, Satin Bowerbird; bottom, Bassian thrush***

Plate 5 ***Examples of images captured of non-native fauna: Fallow Deer both photos – note fawn with adult in bottom photo***

Plate 6 *Examples of images captured of non-native fauna: Top photo – Red Fox; Bottom photo, Feral Cat*

3.2.6 Diurnal bird surveys

A total of 24 diurnal bird surveys were completed during the site assessments, resulting in 45 species being recorded. An additional seven bird species were detected incidentally. The total number of bird species detected at the site (52) represents 46% of the 112 bird species recorded within the study area to date (VBA 2024).

Five threatened and three migratory bird species were detected within the site (Table 10), and all except one (Masked Owl) were detected during diurnal bird surveys.

Table 10 Threatened and migratory bird species detected at the site

Common name	Scientific name	Threatened (EPBC Act)	Threatened (FFG Act)	Migratory (EPBC Act)
Blue-winged Parrot	*Neophema chrysostoma*	VU		
Gang-gang Cockatoo	*Callocephalon fimbriatum*	EN	E	
Grey Goshawk	*Accipiter novaehollandiae*		E	
Masked Owl	*Tyto novaehollandiae*		CE	
White-throated Needletail	*Hirundapus caudacutus*	VU	V	Mi
Rufous Fantail	*Rhipidura rufifrons*			Mi
Satin Flycatcher	*Myiagra cyanoleuca*			Mi
Total	***Total***	**3**	**4**	**3**

Table notes – VU/V – vulnerable; EN/E – Endangered; CE – Critically Endangered; Mi – Migratory.

3.2.7 Observations of the three target species

3.2.7.1 Gang-gang Cockatoo observations

A total of 33 records of the Gang-gang Cockatoo were made during the site visit, including seven observations made during the diurnal bird surveys. Most of the records were of birds heard, but sometimes the birds were seen, either flying through the forest, or less often perching or foraging.

The Gang-gang Cockatoo was heard each day of the survey (8 days on site including during targeted bird surveys and opportunistic observations). (Figure 3), with up to 13 birds observed in any one day (Figure 4). Counts of Gang-gang Cockatoos were generally higher on 29/02/24 and 1/03/24 than during the 6-day site visit (12 – 17/02/24), which may indicate that birds are moving around more at that time.

No juvenile birds were recorded, and no other evidence of nesting or breeding (e.g., hollow use) was recorded.

The Gang-gang Cockatoo was heard at all times of day when observations were amassed (Figure 5), but more observations were made in the early morning and late evening, which suggests that birds are likely to have been roosting at the site. One bird survey done at approximately 8 pm on 29/02/24 on Morris Track near the entrance track to the property detected Gang-gang Cockatoo, with observations to suggest that birds were potentially roosting in trees near to that point.

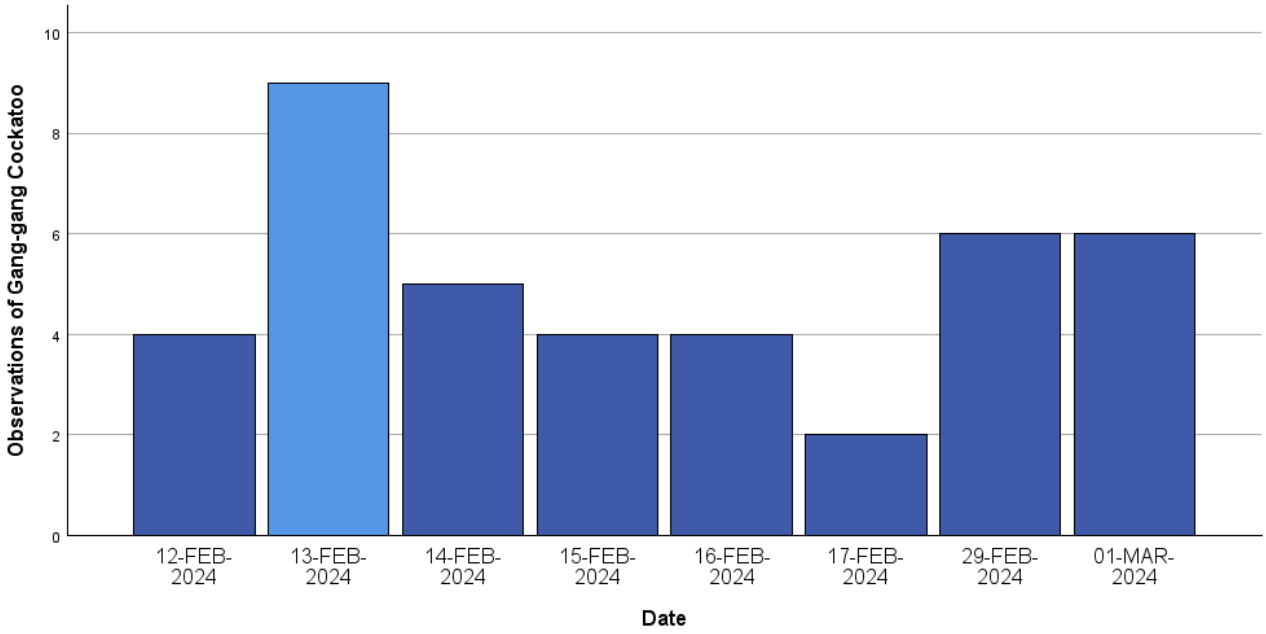


Figure 3 *Count of observations of Gang-gang Cockatoo during the site visit*

Note that no assessments at the site were done on 13/02/24 due to high fire danger ratings. Observations for 13/02/24 are from Lavers Hill, approximately 3 km from the site.

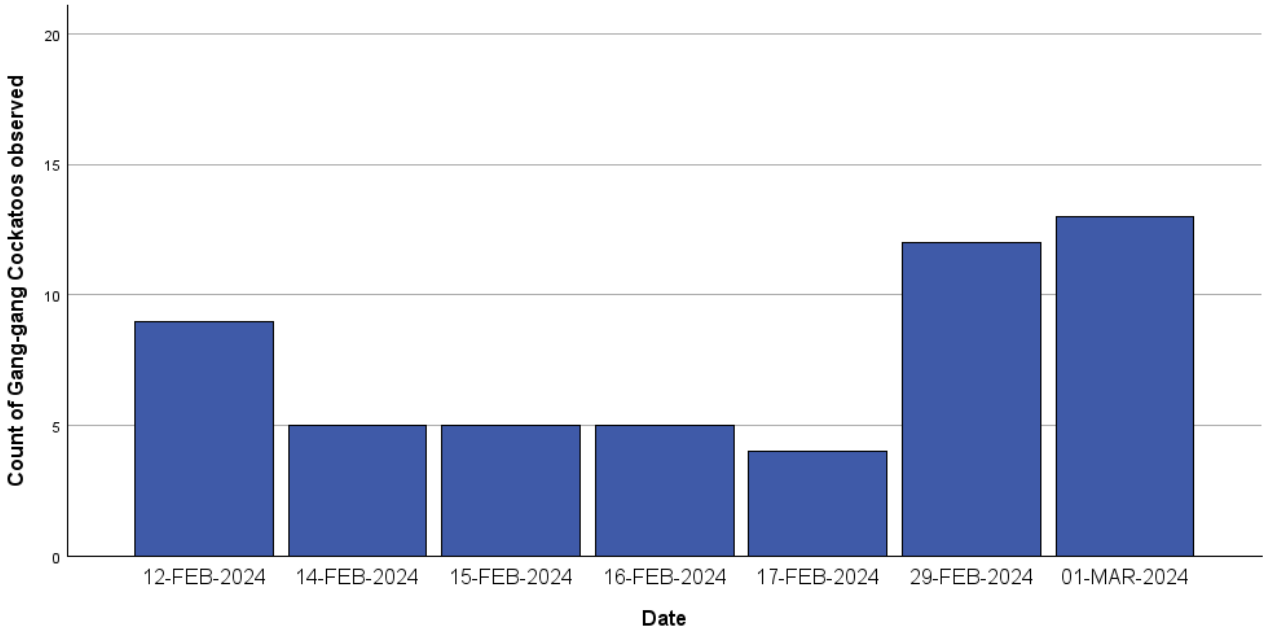


Figure 4 *Count of Gang-gang Cockatoos observed/heard during the site visit*

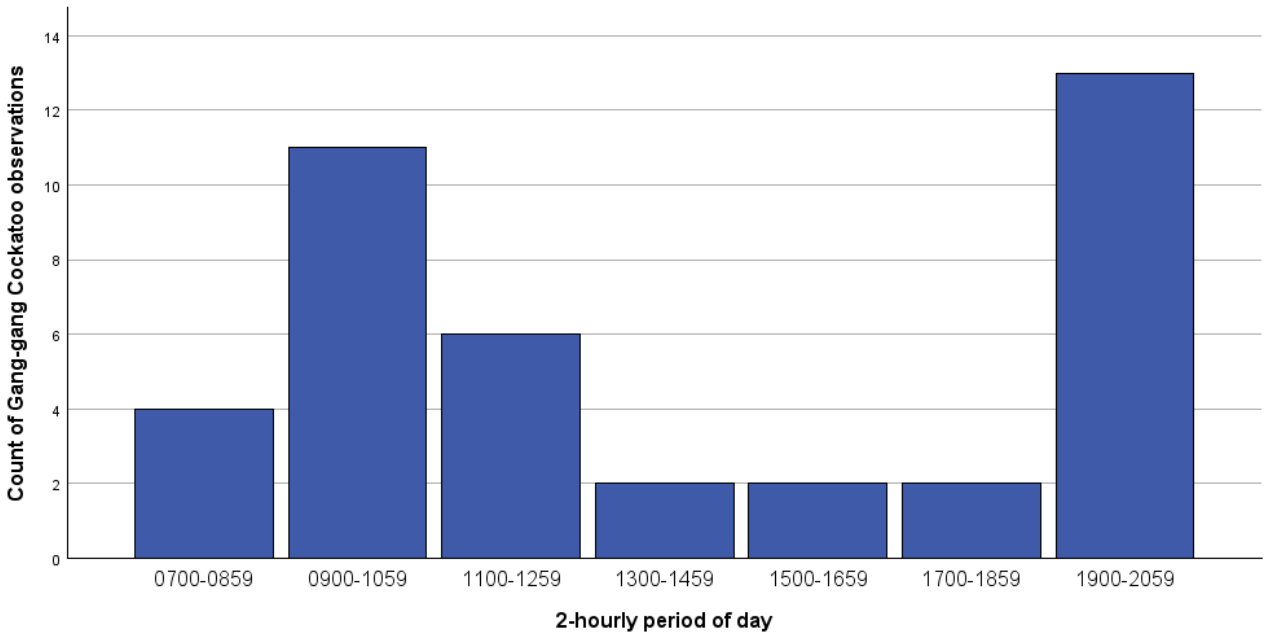


Figure 5 Count of Gang-gang Cockatoo observations grouped by time of day (two-hourly intervals)

The frequency with which Gang-gang Cockatoo was heard/seen suggests that this species was residing in the area at the time of the site visit.

No signs of breeding or nesting were observed at the site, but the habitat there is suitable for nesting activity. There are plenty of large eucalypt trees with large hollows across the site. None of the Gang-gang Cockatoos observed within the site were seen to occupy hollow-bearing trees or interact with any hollows.

3.2.7.2 Yellow-bellied Glider

3.2.7.2.1 Animals heard/seen

The Yellow-bellied Glider is known from the area surrounding the offset site. There are six VBA records and seven ALA records (Figure 4 Appendix A-1), most recently in 2021.

Spotlighting resulted in 67 detections of the Yellow-bellied Glider in or near the offset property. All but one of these were of vocalisations; one glider was seen gliding across Mount McKenzie Track on 12/03/24 at 9:32 pm. The individual was first heard calling from within the site approximately 200 m south of Mount McKenzie track. It was then heard moving and calling as it progressed north toward McKenzie Track from within the site.

It is important to note that a number of the vocalisations heard during the survey are likely to have been made by the same animals – 67 detections does not mean 67 animals.

Yellow-bellied Glider calls were heard on each night of spotlighting across 15 locations. Based on vocalisations and time of night (i.e., where animals are at the start of the night), the site appeared to have two focal areas of concurrent Yellow-bellied Glider activity (north-central and south-west), which suggests that there is more than one family group at the site. Yellow-bellied Gliders were also heard outside the site (i.e., heard while standing on the site boundary) to the south, west, east and north.

Table 11 Counts of Yellow-bellied Glider detections across the four nights of spotlighting

Species	Date				
	12/2/24	14/2/24	15/2/24	16/2/24	Total
Yellow-bellied Glider*	8	11	38	10	**67**

3.2.7.2.2 Feed trees

Eighteen feed trees were recorded across the site during the survey (Figure 7 Appendix A-1). Most of the feed trees were smooth-barked gums (*Eucalyptus regnans* or *E. viminalis*), but small numbers were rough-barked eucalyptus (*E. obliqua*).

Feed trees varied in their apparent level of current use, with old and recent chew marks seen. Feed trees typically had 50 or more feed marks; some had as few as five marks, all old, while others had up to 300 (estimated) of old and recent chews.

Searching for signs of feeding (e.g., v-shaped marks) was sometimes problematic because of the height at which the feed marks often occur (e.g., 20 m +) and in some circumstances the difficulty distinguishing feed marks from other marks on a tree (e.g., insect damage, cockatoo chews) at height, even with the assistance of binoculars. Furthermore, the view was often hindered by the angle of the tree, branches and nearby trees. Plate 7 displays examples of feed trees recorded within the offset site.

Plate 7 Examples of Yellow-bellied Glider feed trees (v-shape marks) recorded within the offset site. Top left, tope right and bottom left are smooth-barked eucalypts (E. viminalis/E. regnans); Bottom right is a rough-barked eucalypt (E. obliqua)

3.2.7.3 Long-nosed Potoroo

No sightings of Long-nosed Potoroo were made during the site visit. However, there are recent records of this species in nearby areas (there are 23 VBA records and one ALA record of the Long-nosed Potoroo within the 10 km study area, most recently in 2022), and the site may still be used by the species occasionally or rarely, or may be colonised by the species if populations in nearby areas grow and disperse. The site contains suitable habitat for the Long-nosed Potoroo and for other small to medium ground-dwelling mammals (i.e., Southern Brown Bandicoot, Long-nosed Bandicoot). The Long-nosed Bandicoot was heard and seen during spotlighting and detected on cameras (see section 3.2.8), and diggings were seen at the site, likely made by Long-nosed Bandicoot, but possibly made by Long-nosed Potoroo or Southern Brown Bandicoot.

A recently used grass burrow/shelter was observed towards the eastern part of the site, which is likely to have been used by a medium-sized ground-dwelling mammal (Plate 8).

Plate 8 ***Refuge in dense clump of sword-grass and wire-grass, likely to have been created and used by a medium-sized ground-dwelling mammal***

3.2.8 Observations of other fauna and fauna sign

In addition to the Gang-gang Cockatoo and Yellow-bellied Glider, a range of other significant fauna were detected at the site (Table 12).

Table 12 ***Other significant fauna observations***

Common name	Scientific name	EPBC	FFG
Mammals			
Krefft's Glider (Sugar Glider)	*Petaurus notatus*		
Feathertail Glider	*Acrobates pygmaeus*		
Long-nosed Bandicoot	*Perameles nasuta*		
Birds			
Blue-winged Parrot	*Neophema chrysostoma*	VU	
White-throated Needletail	*Hirundapus caudacutus*	VU	V
Grey Goshawk	*Accipiter novaehollandiae*		E
Masked Owl	*Tyto novaehollandiae*		CE
Yellow-tailed Black Cockatoo	*Zanda funerea*		
Reptile			
Southern Water Skink	*Eulamprus tympanum tympanum*		

Common name	Scientific name	EPBC	FFG
Invertebrates			
Otway Black Snail	*Victaphanta compacta*		E
Burrowing Crayfish	*Engaeus sp.*		V

Observations of small arboreal mammals (Krefft's Glider (Sugar Glider) and Feathertail Glider) at the site indicates that the forest is in good condition, with good habitat diversity and structure.

Observations of Long-nosed Bandicoot (heard and seen during spotlighting and detected on 32 images across 4 cameras) demonstrate that small to medium sized ground-dwelling mammals persist at the site. This suggests that other threatened species (such as Southern Brown Bandicoot and Long-nosed Potoroo, which were not detected) could persist in the site, or recolonise the site if surrounding populations expand and disperse.

Two species of bird listed as vulnerable under the EPBC Act were observed or heard (Blue-winged Parrot and White-throated Needletail), along with two species of bird listed as vulnerable under the FFG Act (Grey Goshawk and Masked Owl) (Note, the White-throated Needletail is listed under both the EPBC Act and the FFG Act). The sighting of threatened species generally shows that habitats are in good condition. The Masked Owl (which was heard only) is generally rare in Victoria, and relies on the presence of large hollows in tall eucalypts. Those habitat features are readily available at the site. Observations of the non-threatened Yellow-tailed Black Cockatoo also suggest that the forest is suitable for large forest fauna that are dependent on large hollows for nesting/denning.

The Southern Water Skink is not a threatened species, but observations of this species in the Lavers Hill area do not appear to be common.

At numerous locations, chimneys of one or more species of burrowing crayfish were found (Plate 9). It is likely that at least some of the chimneys are constructed by either or both of two threatened species, both of which are listed as vulnerable under the FFG Act: Otway Burrowing Crayfish (*Engaeus fultoni*) and Hairy Burrowing Crayfish (*Engaeus sericatus*).

The Otway Black Snail was observed within the site, mostly as empty shells, but also as live snails (Plate 10).

Locations of observations of species listed as threatened are shown in Figure 7 Appendix A-1.

Plate 9 *Examples of Burrowing Crayfish chimneys observed at the offset site*

Plate 10 *Otway Black Snail photos from offset site*

3.3 Vegetation and habitat assessment

3.3.1 Flora species

The VBA and PMST have records of 712 flora from within the study area (10 km radius of the offset site). These records include 476 native species, 205 introduced species, and 23 native but non-indigenous to the area. During the field assessment, 57 flora species were identified, including 46 native species and 11 introduced species (Appendix A-5).

During the field assessment one FFG Act threatened flora species, *Nematolepis squamea* subsp*. squamea* (Satinwood) (Vulnerable), was observed. This species was observed at multiple locations within the areas mapped as Shrubby Wet Forest (EVC 201) (Figure 6, Appendix A-1).

In addition to threatened flora, another 14 species listed as protected (specifically Restricted use protected flora) under the FFG Act were recorded during the field assessment (Appendix A-5). These included species from the Protected families of *Asteraceae,* protected genera of *Acacia* and members of *Pteridophyta* (ferns and fern allies).

3.3.2 Habitat and Vegetation (EVC) types

Remnant native vegetation in the study area has been mapped by DEECA at a scale of 1:25,000. The 2005 EVC mapping indicates that two EVCs are modelled within the offset site:

– Wet Forest (EVC 30), least concern in the Otway Ranges bioregion
– Cool Temperate Rainforest (EVC 31), endangered in the Otway Ranges bioregion
– Shrubby Wet Forest (EVC 201), least concern in the Otway Ranges bioregion
– Riparian Forest (EVC 18), least concern in the Otway Ranges bioregion

During the field assessment, four EVCs were identified in the offset site:

– Wet Forest (EVC 30)
– Cool Temperate Rainforest (EVC 31)
– Shrubby Wet Forest (EVC 201)
– Riparian Forest (EVC 18)

Mapping of EVCs was determined using dominant canopy species, life form cover (particularly tree ferns, ground ferns and medium shrubs) and landscape position. Wet Forest (EVC 30), Shrubby Wet Forest (EVC 201) and Riparian Forest (EVC 18) contained a similar mixture of dominant canopy species and varied only slightly in their life form covers of tree fern, ground fern and medium shrubs. As such, in transitional areas, such as slopes, it is difficult to differentiate among EVCs and these areas likely contain a mosaic of multiple. Emergent eucalypts were observed within the Cool Temperate Rainforest (EVC 31) mapped to the south of the offset site suggesting it may have once been bordered by Wet Forest (EVC 30) as described in the EVC benchmark and mapped by ABZECO in the Offset Management Plan that is in development (L. Rodda, pers. com. 14 August 2024). Evidence of historical selective logging within the offset site supports this. However, the dominance of *Acacia melanoxylon* (Blackwood) and high tree fern cover in these patches suggest Cool Temperate Rainforest (EVC 31) extends beyond what is modelled to occur.

The condition of the vegetation across each EVC was relatively contiguous and therefore it was determined that a single habitat hectare assessment would be undertaken for each EVC.

Figure 6 (Appendix A-1) shows the location of each EVC mapped during the field assessment. The habitat hectare scores are provided within the Table 14. A description of each EVC as it occurred within the proposed offset site is outlined below in Table 13.

Table 13 Vegetation type and description within property and proposed offset site

Vegetation type and description	Key habitat characteristics for targeted species	Characteristic photographs
EVC 30 Wet Forest **Habitat Zone 1** **Conservation status: Least Concern** Approximately 6.14 ha within offset site. The canopy consists of tall *Eucalyptus regnans* (Mountain Ash), *Eucalyptus obliqua* (Messmate Stringybark) and *Eucalyptus viminalis* subsp. *viminalis (*Manna Gum). The midstory includes a variety of understorey tree species and shrubs including *Acacia melanoxylon* (Blackwood), *Prostanthera lasianthos,* (Victorian Christmas Bush), *Pittosporum bicolor* (Banyalla), *Pomaderris aspera* (Hazel Pomaderris), *Hedycarya angustifolia* (Austral Mulberry), *Nematolepis squamea* subsp. *squamea* (Satinwood), *Olearia argophylla* (Musk Daisy-bush) and *Cassinia aculeata* subsp. *aculeata* (Common Cassinia). The understorey contained a diverse range of smaller shrubs, forbs and graminoids including *Acaena novae-zelandiae* (Bidgee-widgee), *Coprosma quadrifida* (Prickly Currant-bush), *Hydrocotyle hirta* (Hairy Pennywort), *Lepidosperma elatius* var. *ensiforme* (Tall Sword-sedge), *Notelaea ligustrina* (Privet Mock-olive), *Pteridium esculentum* subsp. *esculentum* (Austral Bracken) and *Tetrarrhena juncea* (Forest Wire-grass). Ferns were a dominant feature of the understory and included *Polystichum proliferum* (Mother Shield-fern), *Microsorum pustulatum* subsp. *pustulatum* (Kangaroo Fern), *Cyathea australis* (Rough Tree-fern), *Blechnum wattsii* (Hard Water-fern) and *Dicksonia antarctica* (Soft Tree-fern).	***Yellow-bellied Glider*** – Species recorded from within habitat type during survey – Tall trees with excellent connectivity for gliding – Known feed trees including *E. viminalis*, *E. regnans* and *E. obliqua.* – Potential hollows at suitable height above ground and entrance diameter (see Figure 6 Appendix A-1) ***Gang-gang Cockatoo*** – Species observed in this habitat type during survey – Entire area foraging habitat including known feed tree species *E. obliqua.* Multiple other foraging species recorded (all Eucalypt species and Acacia species) – Potential hollows at suitable height above ground and entrance diameter (see Figure 6 Appendix A-1) ***Long-nosed potoroo*** – Species was not recorded within this habitat type – Entire area considered potential habitat as there is mostly a dense intact ground cover and understorey layer which is well connected throughout the offset site/property	

Vegetation type and description	Key habitat characteristics for targeted species	Characteristic photographs
EVC 31 Cool Temperate Rainforest **Habitat Zone 2** **Conservation status: Endangered** Approximately 28.27 ha within offset site. This HZ was present in gullies along watercourses and was relatively species-poor, likely due to poor light availability. The canopy consists of tall *Acacia melanoxylon* (Blackwood) with occasional emergent *Eucalyptus regnans* (Mountain Ash). The tree fern cover was generally >30% and included *Dicksonia antarctica* (Soft Tree-fern) and *Cyathea australis* (Rough Tree-fern). Other tree and shrubs species included *Hedycarya angustifolia* (Austral Mulberry), *Coprosma quadrifida* (Prickly Currant-bush) and *Prostanthera lasianthos* (Victorian Christmas-bush). The understory was generally species-poor but contained ground ferns epiphytes and herbs including *Blechnum chambersii* (Lance Water-fern), *Clematis aristata* (Mountain Clematis), *Microsorum pustulatum* subsp. *pustulatum* (Kangaroo Fern) and *Asplenium gracillimum* (Mother Spleenwort).	***Yellow-bellied Glider (YBG)*** – Tall trees with excellent connectivity for gliding – Known feed trees including *E. regnans.* Smooth barked gums and feed sign trees were most commonly recorded within this habitat type – Potential hollows at suitable height above ground and entrance diameter – Recent survey records within this habitat type ***Gang-gang Cockatoo*** – Entire area foraging habitat including known feed tree species multiple Eucalypt species and other species – Potential hollows at suitable height above ground and entrance diameter (see Figure 6) – Recent survey records within this habitat type ***Long-nosed potoroo*** – Species was not recorded within this habitat type – Entire area considered potential habitat as there is mostly a dense intact ground cover and understorey layer which is well connected throughout the offset site/property	

Vegetation type and description	Key habitat characteristics for targeted species	Characteristic photographs
EVC 201 Shrubby Wet Forrest **Habitat Zone 3** **Conservation status: Least Concern** Approximately 36.57 ha within offset site. The canopy consists of tall *Eucalyptus regnans* (Mountain Ash) and *Eucalyptus obliqua* (Messmate Stringybark). The midstory includes a variety of understorey tree species and shrubs including *Acacia melanoxylon* (Blackwood), *Pittosporum bicolor* (Banyalla), *Pomaderris aspera* (Hazel Pomaderris), *Hedycarya angustifolia* (Austral Mulberry), *Nematolepis squamea* subsp. *squamea* (Satinwood), *Olearia argophylla* (Musk Daisy-bush), *Olearia lirata* (Snowy Daisy-bush) and *Coprosma quadrifida* (Prickly Currant-bush). The understorey contained a diverse range of smaller shrubs, forbs and graminoids including *Lepidosperma elatius* var. *ensiforme* (Tall Sword-sedge), *Notelaea ligustrina* (Privet Mock-olive), *Pteridium esculentum* subsp. *esculentum* (Austral Bracken), *Clematis aristata* (Mountain Clematis) *Stellaria flaccida* (Forest Starwort) *Hydrocotyle hirta* (Hairy Pennywort), *Gonocarpus tetragynus* (Common Raspwort) and *Tetrarrhena juncea* (Forest Wire-grass). Ferns were a common feature of the understory and included *Polystichum proliferum* (Mother Shield-fern), *Microsorum pustulatum* subsp. *pustulatum* (Kangaroo Fern), *Cyathea australis* (Rough Tree-fern), *Blechnum wattsii* (Hard Water-fern) and *Dicksonia antarctica* (Soft Tree-fern).	***Yellow-bellied Glider*** – Species recorded from within habitat type during survey – Tall trees with excellent connectivity for gliding – Known feed trees including *E. regnans* and *E. obliqua* – Potential hollows at suitable height above ground and entrance diameter (see Figure 6 Appendix A-1) ***Gang-gang Cockatoo*** – Species observed in this habitat type during survey – Entire area foraging habitat including known feed tree species *E. obliqua.* Multiple other foraging species recorded (all Eucalypt species and Acacia species) – Potential hollows at suitable height above ground and entrance diameter (see Figure 6 Appendix A-1) ***Long-nosed potoroo*** – Species was not recorded within this habitat type – Entire area considered potential habitat as there is mostly a dense intact ground cover and understorey layer which is well connected throughout the offset site/property	

Vegetation type and description	Key habitat characteristics for targeted species	Characteristic photographs
EVC 18 Riparian Forrest **Habitat Zone 4** **Conservation status: Least Concern** Approximately 3.42 ha within offset site. This HZ was present as narrow corridors, generally on higher slopes adjacent to Cool Temperate Rainforest (EVC 31). The canopy consists of tall *Eucalyptus viminalis subsp. viminalis* (Manna Gum). The midstory includes a variety of understorey tree species and shrubs including *Acacia melanoxylon* (Blackwood), Coprosma quadrifida (Prickly Currant-bush) and *Olearia argophylla* (Musk Daisy-bush). The understory was generally species-poor but contained tree ferns, ground ferns, epiphytes and herbs including *Cyathea australis* (Rough Tree-fern), *Dicksonia antarctica* (Soft Tree-fern) *Blechnum chambersii* (Lance Water-fern), *Blechnum wattsii* (Hard Water-fern), *Clematis aristata* (Mountain Clematis), *Microsorum pustulatum* subsp. *pustulatum* (Kangaroo Fern) and *Asplenium gracillimum* (Mother Spleenwort). Ground ferns were a dominant feature of the understory with a cover ≥25%.	***Yellow-bellied Glider*** – Species recorded from within habitat type during survey – Tall trees with excellent connectivity for gliding – Known feed trees including *E. viminalis* – Potential hollows at suitable height above ground and entrance diameter (see Figure 6 Appendix A-1) ***Gang-gang Cockatoo*** – Species observed in this habitat type during survey – Foraging habitat including known feed tree species *E. viminalis* and other foraging species recorded – Potential hollows at suitable height above ground and entrance diameter (see Figure 6 Appendix A-1) ***Long-nosed potoroo*** – Species was not recorded within this habitat type – Entire area considered potential habitat as there is mostly a dense intact ground cover and understorey layer which is well connected throughout the offset site/property	

Table 14 Vegetation Quality Assessment for the EVCs present at the proposed offset site

Habitat Zone			HZ 1	HZ 2	HZ 3	HZ 4
Bioregion			**Otway Ranges**	**Otway Ranges**	**Otway Ranges**	**Otway Ranges**
EVC #			**30**	**31**	**201**	**18**
EVC Name			**Wet Forest**	**Cool Temperate Rainforest**	**Shrubby Wet Forest**	**Riparian Forest**
		Max Score	**Score**	**Score**	**Score**	**Score**
Site condition	Large Trees	10	6	10	10	10
	Tree Canopy Cover	5	5	5	5	3
	Lack of Weeds	15	15	15	15	15
	Understory	25	15	15	15	15
	Recruitment	10	6	10	6	6
	Organic Litter	5	5	5	5	5
	Logs	5	4	5	5	5
	Standardiser	1	1	1	1	1
	Total Site Score	75	56	65	61	59
Landscape value	Patch Size*	10	8	8	8	8
	Neighbourhood	10	6	6	6	6
	Distance to Core	5	4	4	4	4
Habitat Score			**74**	**83**	**79**	**77**
Habitat points = #/100			**0.74**	**0.83**	**0.79**	**0.77**

*When patches extend outside of the offset site, modelled EVC extent and aerial imagery was used to estimate patch size

3.3.3 Threatened species and communities

Database searches for the study area (PMST) identified that threatened species and communities are known or likely to occur within the study area:

3.3.3.1 Threatened ecological communities

EPBC Act-listed communities

Three EPBC Act-listed communities were modelled as 'May' occur in the study area:

– *White Box-Yellow Box- Blakely's Red Gum Grassy Woodland* (Critically Endangered)
– Natural Damp Grassland of the Victorian Coastal Plains (Critically Endangered)
– Giant Kelp Marine Forests of South East Australia (Endangered)

None of these EPBC communities were recorded within the offset site nor are they considered likely to be present given the EVCs and habitat types present within the site.

FFG Act-listed communities

One threatened ecological community, *Cool Temperate Rainforest Community,* is present in the offset site within areas mapped as Cool Temperate Rainforest (EVC 31).The Cool Temperate Rainforest Community description has been defined by DEECA in the FFG Act Action Statement 238 – Rainforest communities (DSE 2009):

> *Rainforest is defined ecologically as forest vegetation with a more-or-less continuous rainforest tree canopy of variable height, and a characteristic diversity of other plant species and life forms. Cool Temperate Rainforest is dominated by combinations of Myrtle Beech (Nothofagus cunninghamii), Southern Sassafras (Atherosperma moschatum = A. moschatum subsp. moschatum), Black Olive-berry (Elaeocarpus holopetalus) and Blackwood (Acacia melanoxylon) according to the site, the dominant tree species varying with the longitude. Cool Temperate Rainforest includes closed transitional and seral communities, with emergent eucalypts, that are similar in botanical composition to mature rainforests in which eucalypts are absent. In these situations a more or less closed rainforest canopy occurs beneath the emergent eucalypts. The understorey is typically dominated by Musk Daisy-bush (Olearia argophylla), Austral Mulberry (Hedycarya angustifolia) and tree-ferns, with a ground stratum dominated by ferns. Epiphytes are abundant on both trees and tree-ferns, and a rich bryophyte flora is also present. In undisturbed conditions, Cool Temperate Rainforest has a closed canopy.*
>
> *Cool Temperate Rainforest occurs in the Otway and Strzelecki ranges, Central Highlands and East Gippsland. It often occurs along the margins of streams or forms more extensive stands where it has been undisturbed and protected from fire*.

Cool Temperate Rainforest (EVC 31) was mapped in gullies within the offset site and generally followed water courses (Plate 11 and Plate 12). A total of 6.14 ha of this EVC was mapped as within the offset site as HZ2, which presents vegetation characteristics in line with the DEECA description (DSE 2009). Details of the vegetation present within HZ2 can be found in Table 13.

Plate 11 Cool Temperate Rainforest (EVC 31) with a dense cover of tall tree ferns

Plate 12 Cool Temperate Rainforest (EVC 31) along a watercourse with a canopy dominated by Blackwood and high tree fern cover

3.3.4 Large trees and hollow-bearing trees

Large trees

Within the offset site, data for large trees was collected as described in section 2.4 along with data collected during fauna habitat assessments. A summary of large tree numbers for each EVC is provided in Table 15.

The tree transect survey recorded 205 large canopy trees within the offset site. The total number of large trees within the proposed offset site was estimated by adding the total number of large trees per EVC (Table 15). Although not a definitive number for the offset site, it is estimated from a subset that approximately 2,016 large trees are present within the proposed offset site. These large trees ranged from 70 cm DBH up to and exceeding 250 cm.

Table 15 Large tree numbers calculated for each EVC recorded within the proposed offset site

EVC	Benchmark DBH* to be considered a large tree (cm)	Total area mapped (ha)	Large trees per/ha	Estimated total large trees per EVC within proposed offset site
Wet Forest (30)	90	6.14	9.00	55
Cool Temperate Rainforest (31)	70	28.28	33.33	942
Shrubby Wet Forest (201)	90	36.57	25.30	925
Riparian Forest (18)	80	3.42	27.50	94
	Offset site total	**74.41**		**2,016**

* Diameter at breast height (1.3 m)

Hollow-bearing trees

Approximately 80 hollow-bearing trees were recorded within the property (76 within the offset site), which is certainly a gross underestimate of the total number of hollow-bearing trees present within the offset site. Identifying hollow-bearing trees was often challenging, as the view of trees was often hindered by the angle and height of the tree and dense midstorey of branches/leaves that obstructed the view of the trunks/branches of larger trees. However, given the estimated number of large trees (e.g., 2,000 +), it is possible that many trees within the offset site are still of an age that they are yet to have developed medium to large hollows. Where live hollow-bearing trees were identified, the size of the tree ranged from 70 – 250 + cm DBH.

Although identifying hollow-bearing trees was challenging, there were other signs that indicated the presence of hollow-bearing trees within the offset site including the regular presence of bird species that are dependent on hollows for nesting (e.g., Crimson Rosella and Australian King-parrot). In addition to these smaller parrots, birds that require larger nest hollows, such as the Sulphur-crested Cockatoo and Yellow-tailed Black-Cockatoo were also recorded within the site.

Of the 80 trees identified with hollows, 22 trees were recorded with hollows suitable for either the Gang-gang Cockatoo or Yellow-bellied Glider according to the criteria presented in section 2.3.5 – e.g., located 5 m or more above the ground with an entrance diameter of at least 10 cm but less than 30 cm. Of the 22 trees with potentially suitable hollows, 20 were smooth barked (*E. regnans* or *E. viminalis*) and two were a stringybark (*E. obliqua).* No obvious signs of occupation were observed for these hollows.

All large trees without hollows (or have only small hollows that weren't visible from the ground) are also likely to develop suitable hollows in the future. Figure 6, Appendix A-1 displays all trees with hollows within the offset site. It is important to note that not all hollow-bearing trees were recorded within the offset site and the number presented in this report definitely underestimates the number of hollows within the offset site.

3.4 Threats

Threats to an offset site are usually physical either from feral (pest animals), invasive plant species, disease or from land clearing, however, all threats can result in a decrease of vegetation quality at the offset site which will negatively affect threatened species. Feral animals can cause land degradation by promoting soil erosion, stream turbidity, the spread of weeds, and can threaten native plant species and animals through competition, habitat destruction and predation. They also have the potential to act as reservoirs for diseases that affect native wildlife.

3.4.1 Feral animal species

Four non-native animal species were recorded within the offset property during the surveys:

– Red Fox (*Vulpes vulpes*) – recorded on motion-sensing cameras (23 images across five locations; Table 16) and via scat observed within the offset site
– Cat (*Felis catus*) – recorded on motion-sensing cameras (481 images across six locations; Table 16) and passive acoustic monitoring site PAM4
– Fallow Deer (*Cervus dama*) – recorded on motion-sensing cameras (36 images across two locations; Table 16) and via scat and browsing observed within the offset site (Plate 13)
– Common Blackbird – Heard and seen during bird surveys and incidentally while traversing the site

A fresh large scat was found on 12/03/24 along the main entrance path to the site near Morris Track (Plate 13). The scat included fresh remains of a rat, and given its size, was likely the scat of a dog, feral or domestic.

The Black Slug (*Arion ater*) was observed (Plate 13) at a dwelling not far from the site (within 3 km), but not within the site itself. This is a recently introduced species, and the ecological threat that it poses is not known. Future assessments of the site should watch for this species.

Table 16 Summary of feral fauna detected on motion-sensing cameras

Common name	Scientific name	Sites (of 17)	Count of images
Cat	*Felis catus*	6	481
Red Fox	*Vulpes vulpes*	5	23
Fallow Deer	*Cervus dama*	2	36

Plate 13 ***Images of non-native fauna in or near the offset site – Top – tree ferns browsed by deer; Bottom left – Black Slug; Bottom right – Large predator scat, likely dog***

3.4.2 Weeds and pathogens

Of the eleven species considered introduced, six of these are considered environmental weeds in Victoria. Two of the eleven, *Rubus fruticosus* spp. agg. (Blackberry) and *Cirsium vulgare* (Spear Thistle), are listed under the *Catchment and Land Protection Act 1985* (CALP Act) as a controlled weed with the former also listed as a Weed of National Significance (WoNS).

Within the offset site weeds were more common at the entry but reduced in cover quickly as you entered the offset site. Non-native grasses, such as *Dactylis glomerata* (Cock's-foot) and *Anthoxanthum odoratum* (Sweet Vernal-grass), were common along tracks at the entrance to the offset site but became less common as vegetation density increases towards the centre. *Rubus fruticosus* spp. agg. (Blackberry) was present in low numbers on the outer edges of the internal tracks with scattered occurrences further in (Figure 8 Appendix A-1). *Cirsium vulgare* (Spear Thistle) was only observed at a single location as a juvenile plant.

Weed infestations pose a significant threat to native vegetation, in particular the above species can easily smother recruitment and therefore decrease the ability of the EVC to recruit and sustain canopy cover. These species also outcompete many understorey species reducing the biodiversity and strata composition of the EVC. Many weeds can also provide habitat to pest animals.

Pathogens such as *Phytophthora cinnamomi* move through native vegetation and selectively affect species susceptible to the pathogen. *Phytophthora cinnamomi* was not observed in the study site at the time of this assessment, however, it is known to occur in the study area. *Phytophthora cinnamomi* is spread through soil, water o r pla nt material mo vement. "Dieback ca used b y the ro ot-rot fungus *Phytophthora cinnamomi'* is listed as a key threatening process under the EPBC Act. Detecting *Phytophthora cinnamomi* is difficult as it can lay dormant for long periods of time during dry seasons.

4. Summary of survey outcomes

4.1 Gang-gang Cockatoo

The Gang-gang Cockatoo is known from the area surrounding the offset site. There are 18 VBA records and 121 ALA records (Figure 4 Appendix A-1) from the study area (10 km area surrounding the offset site), most recently in 2016.

A total of 33 records of the Gang-gang Cockatoo were made during the site visit. Most of the records were of birds heard, but sometimes the birds were seen, either flying through the forest, or less often perching or foraging. The Gang-gang Cockatoo was heard each day during the 6-day site visit and during the device collection visit. The Gang-gang Cockatoo was heard at all times of day when observations were amassed, but more observations were made in the early morning and late evening, which suggests that birds are likely to have been roosting at the site.

The offset site provides highly suitable habitat for the Gang-gang Cockatoo. All 74.41 ha of vegetation within offset site is considered foraging and roosting habitat, and observations at the site show that the species uses the site for these activities. Furthermore, while no evidence of breeding or nesting at the site was detected during the site visit, the trees in the forest at the site are or sufficient age and size and in such large numbers and with hollows, that breeding at the site is considered possible. Of the 80 hollow-bearing trees recorded within the study site, 22 are considered suitable for this species.

As with previous studies undertaken by GHD (see *GHD 2023 – Colac Pipeline Upgrade (W1426) Targeted surveys for the Yellow-bellied Glider and Gang-gang Cockatoo – survey report revised*; *Proposed Offset Site 120 Ridge Road Kawarren - Targeted fauna and vegetation survey report* and *GHD 2023 - Proposed Offset Site 245 Distillery Creek Road Aireys Inlet - Targeted fauna and vegetation survey*) the use of the woodland and forest habitat for breeding in the Otway region by Gang-gang Cockatoo requires further investigation. The majority of Gang-gang Cockatoo records in the Otway region are from February to May, with a consistent, relatively low number of records across other times of the year (VBA, ALA 2024). It is possible a large proportion of mature birds in the Otway region migrate locally in summer to breed in taller, denser forests with abundant hollow-bearing trees, possibly within older longer unlogged forest within areas of the Otways. However, Gang-gang Cockatoo use of forest habitat within and surrounding the offset site for breeding cannot be ruled out, given that they are recorded throughout the year in the study area, and that suitable breeding habitat is present.

The migration of other Gang-gang Cockatoo populations in Victoria (such as east and northeast of Melbourne) are understood to migrate during the breeding season to cooler, higher elevation forests (DAWE 2022b). The pattern of Gang-gang Cockatoo observations in the Otway region suggests this population is present in the area throughout the year, potentially indicating birds breed, feed and raise young here. Investigations completed by GHD in late 2022 (GHD 2023) included surveys in the broader area to increase the opportunity of recording Gang-gang Cockatoos breeding in the area generally. Gang-gang Cockatoos observed at locations relatively close to the Colac pipeline study site (approximately 6 km north-east of the offset site) and other areas nearby including the Barwon Reservoir and Pennyroyal (approximately 15-20 km east of the offset site) were also observed resting and foraging only. Further east in, closer to the coast and in taller, older and largely unlogged vegetation near Lorne on the Erskine falls track, two birds were observed inspecting a hollow in a tall Eucalypt along Erskine Creek during November 2022. The incidental observation of behaviour suggesting breeding may occur in the Lorne area. The surveys provide some support to the idea that Gang-gang Cockatoo breeding activity in the Otway region differs to that of other populations west of Melbourne (i.e., around Lorne) and that detailed surveys such as radiotracking may be required to form a definitive understanding.

4.2 Yellow-bellied Glider

The Yellow-bellied Glider is known from the area surrounding the offset site. There are six VBA records and seven ALA records, most recently in 2021.

The site provides ideal habitat for the Yellow-bellied Glider, as shown by the survey results. Spotlighting at the site resulted in 67 detections of the Yellow-bellied Glider in or near the offset property. All but one of these were of vocalisations; one glider was seen gliding across Mount McKenzie Track. Yellow-bellied Glider calls were heard on each night of spotlighting across 15 locations.

Yellow-bellied Glider calls were also recorded using PAM from all eight sites for 19 consecutive survey nights from within the offset site (all monitoring sites combined).

Eighteen feed trees were recorded during the survey of which nine are within the offset site. Most of the feed trees were smooth-barked gums (*Eucalyptus regnans* or *E. viminalis*), but small numbers were rough-barked eucalypts (*E. obliqua*). Feed trees varied in their apparent level of current use, with old and recent chew marks seen. Feed trees typically had 50 or more feed marks; some had as few as five marks, all old, while others had up to 300 (estimated) of old and recent chews. The presence of historical and recent feed sign demonstrates a history of regular use and occurrence within the offset site. Given this information the species is considered a resident of the offset site.

All 74.41 ha of vegetation within offset site is considered foraging and denning habitat. Of the 80 hollow-bearing trees recorded within the site, approximately 22 are considered suitable for this species.

DAWE (2022a and references within) report that the species lives in family groups of two to six individuals of varying age and sex composition, throughout an exclusive home range of approximately 50–65 ha (plausible range 25–85 ha) (Craig 1985; Goldingay 1992; Goldingay & Kavanagh 1993; Goldingay & Possingham 1995; Goldingay & Quin 2004 cited in DAWE 2022a). Given the reported home range and area of available habitat within the proposed offset site (74.41 ha) it is likely that offset site supports at least one family group of Yellow-bellied Glider. Based on the timing and location of vocalisations from the spotlighting and PAM results (i.e., where animals are at the start of the night), the site appeared to have at least two focal areas of concurrent Yellow-bellied Glider activity (north-central and south-west), which also suggests that there is more than one family group at the site. Yellow-bellied Gliders were also heard outside the site (i.e., heard while standing on the site boundary) to the south, west, east and north.

4.3 Long-nosed Potoroo

There are 23 VBA records and one ALA record of the Long-nosed Potoroo within the 10 km study area, most recently in 2022 at approximately 2.4 km west of the site off Mount Mckenzie Track. The site contains suitable habitat for the Long-nosed Potoroo and for other small to medium ground-dwelling mammals (i.e., Southern Brown Bandicoot, Long-nosed Bandicoot). The Long-nosed Bandicoot was heard and seen during spotlighting and detected on cameras, and diggings and a grass burrow were seen at the site, likely made by Long-nosed Bandicoot, but possibly made by Long-nosed Potoroo or Southern Brown Bandicoot.

While no sightings of Long-nosed Potoroo were made during the site visit, the site may still be used by the species occasionally or rarely, or may be colonised by the species if populations in nearby areas grow and disperse.

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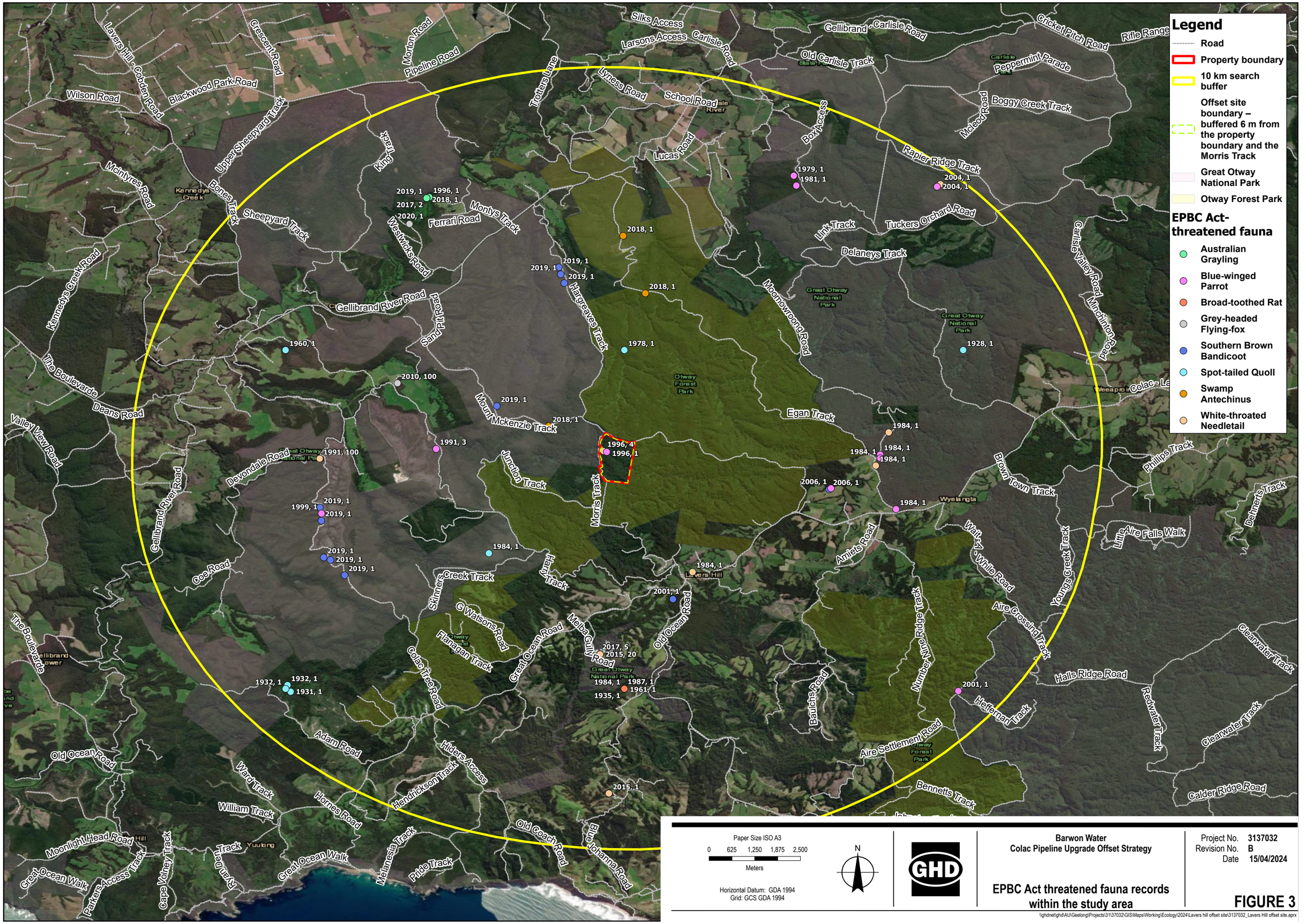
Appendices

Appendix A-1

Figures 3 - 8



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Grid: GCS GDA 1994

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GHD

Barwon Water
Colac Pipeline Upgrade Offset Strategy

Project No. **3137032**
Revision No. **B**
Date **15/04/2024**

EPBC Act threatened fauna records within the study area

FIGURE 3

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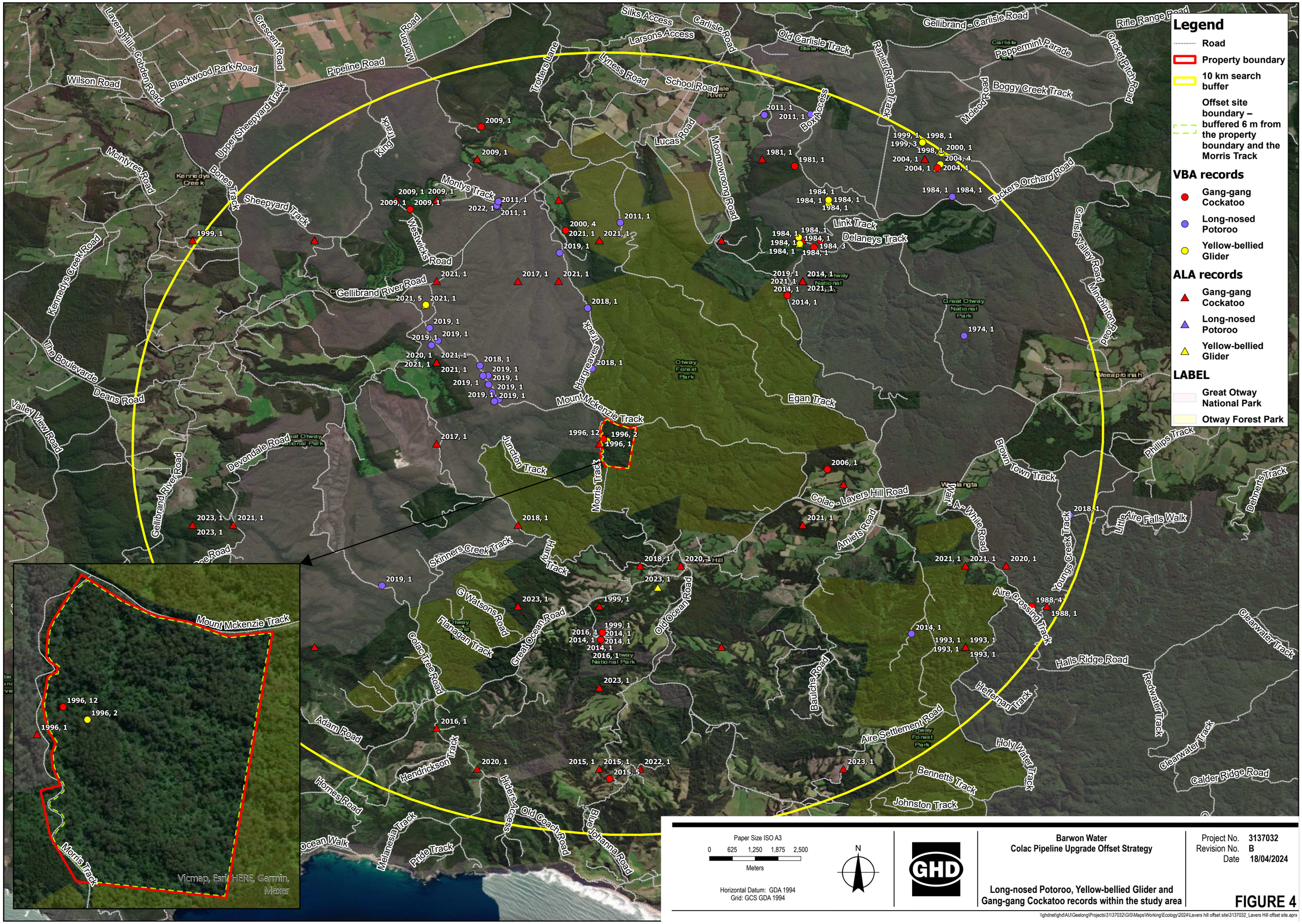

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Barwon Water
Colac Pipeline Upgrade Offset Strategy

Long-nosed Potoroo, Yellow-bellied Glider and Gang-gang Cockatoo records within the study area

Project No. **3137032**
Revision No. **B**
Date **18/04/2024**

FIGURE 4

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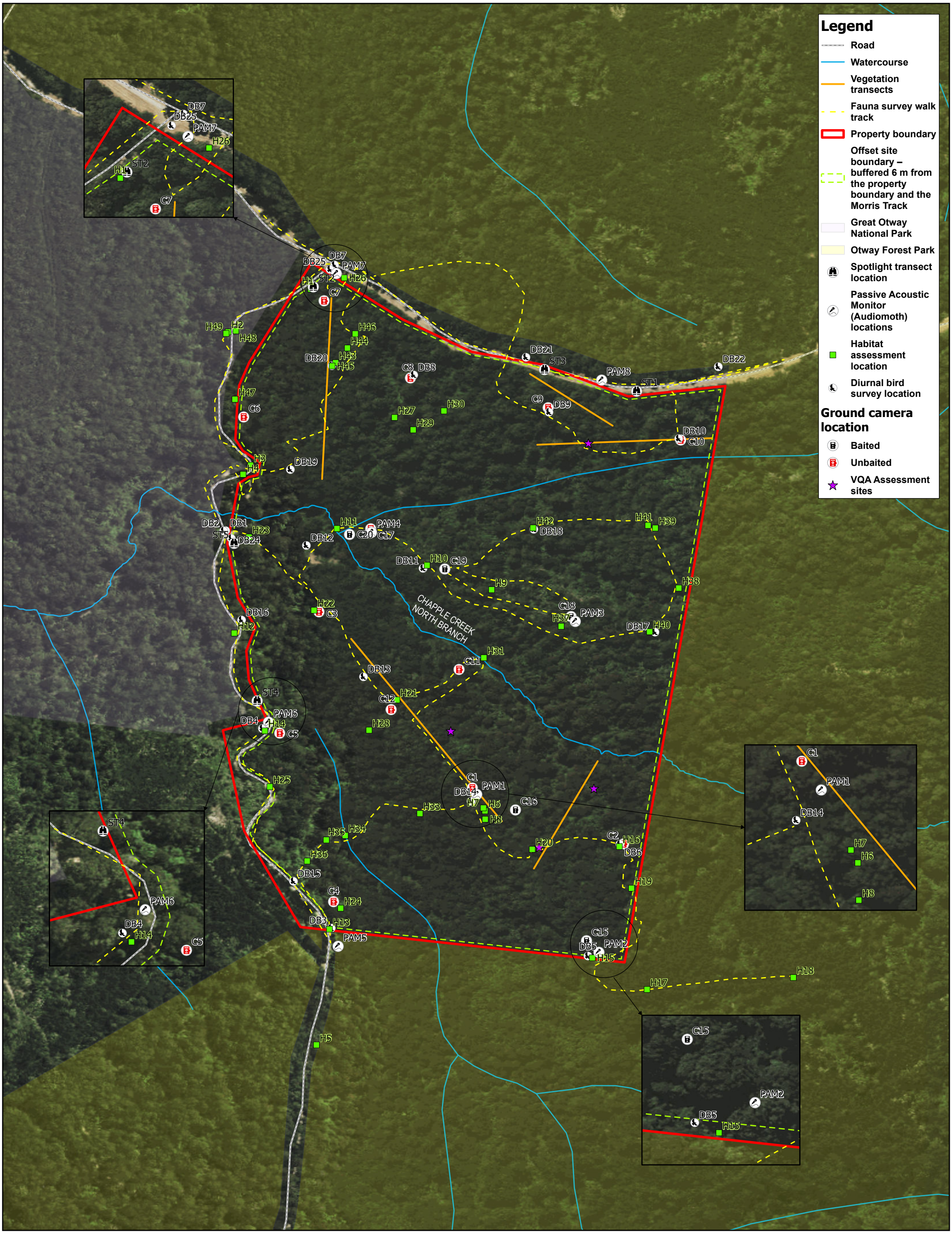

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Barwon Water
Colac Pipeline Upgrade Offset Strategy

Survey method

Project No. **3137032**
Revision No. **B**
Date **18/04/2024**

FIGURE 5

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Mount Mckenzie Track

Morris Track

CHAPPLE CREEK NORTH BRANCH

Legend

- Road
- Watercourse
- Property boundary
- Offset site boundary – buffered 6 m from the property boundary and the Morris Track

EVCs

- 18 - Riparian Forest (HZ4)
- 30 - Wet Forest (HZ1)
- 31 - Cool Temperate Rainforest (HZ2)
- 201 - Shrubby Wet Forest (HZ3)
- Weed species
- Large canopy tree
- Hollow-bearing tree
- Parcel
- Great Otway National Park
- Otway Forest Park

Paper Size ISO A3

0 50 100 150

Meters

Horizontal Datum: GDA 1994
Grid: GCS GDA 1994

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Barwon Water
Colac Pipeline Upgrade Offset Strategy

Project No. **3137032**
Revision No. **B**
Date **15/04/2024**

Vegetation and habitat types

FIGURE 1

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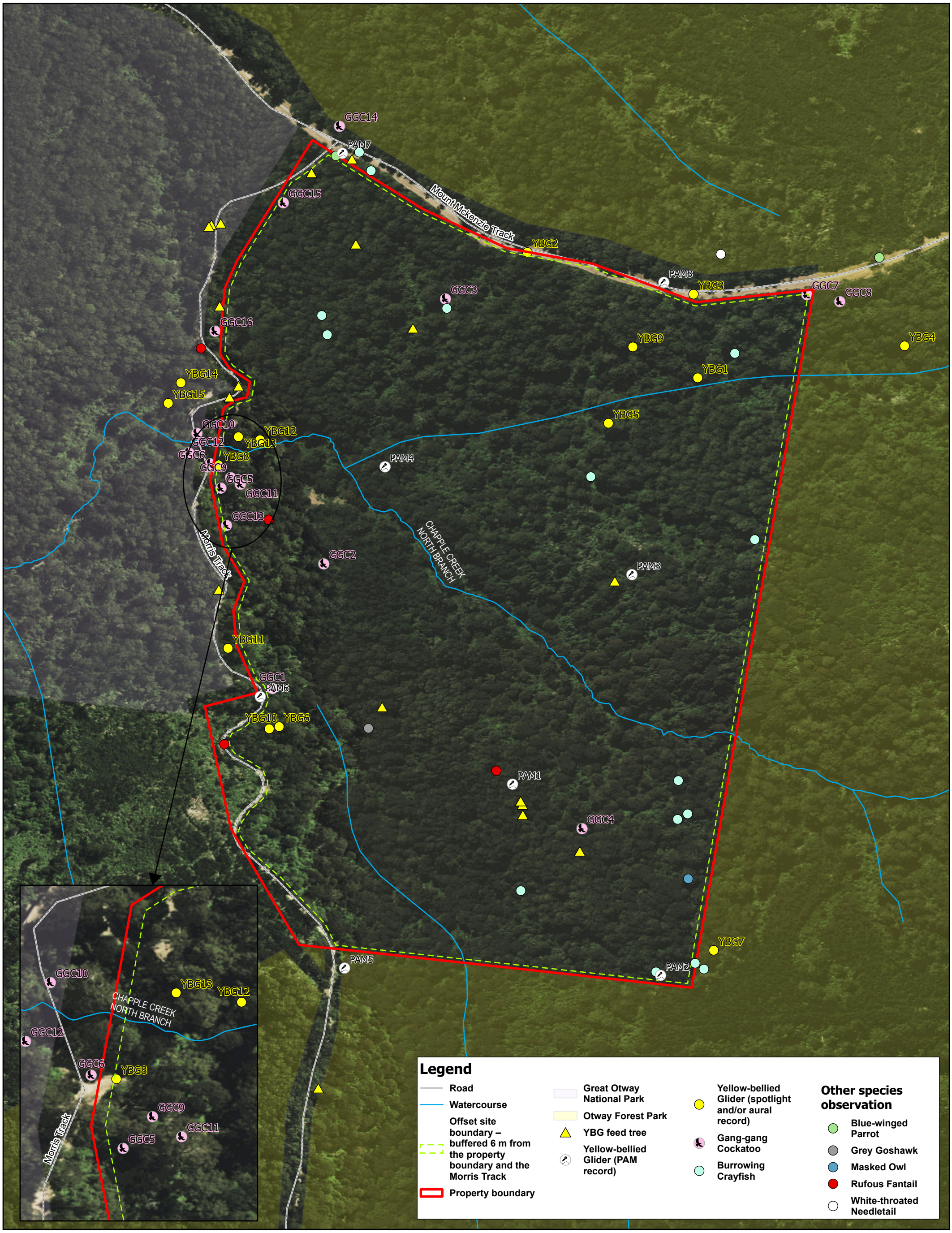

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GHD

Barwon Water
Colac Pipeline Upgrade Offset Strategy

Project No. 3137032
Revision No. B
Date 18/04/2024

Fauna survey results

FIGURE 7

\\ghdnet\ghd\AU\Geelong\Projects\31\37032\GIS\Maps\Working\Ecology\2024\Lavers hill offset site\3137032_Lavers Hill offset site.aprx

Mount Mckenzie Track

CHAPPLE CREEK NORTH BRANCH

Morris Track

Legend

- Road
- Watercourse
- Offset site boundary – buffered 6 m from the property boundary and the Morris Track
- Property boundary

LABELSHORT

- Great Otway National Park
- Otway Forest Park

Weeds

- Blackberry
- Spear Thistle

Pest animal

- Deer
- Red Fox

Paper Size ISO A3

0 43 86 129 172

Meters

Horizontal Datum: GDA 1994
Grid: GCS GDA 1994

N

GHD

Barwon Water
Colac Pipeline Upgrade Offset Strategy

Project No. **3137032**
Revision No. **B**
Date **18/04/2024**

Pest animals and weed species

FIGURE 8

\\ghdnet\ghd\AU\Geelong\Projects\31\37032\GIS\Maps\Working\Ecology\2024\Lavers hill offset site\3137032_Lavers Hill offset site.aprx

Appendix A-2

PAM methods and analysis

Passive Acoustic Monitoring

Audio data collation and analysis

The following sections provide a description for the collation and classification of calls using .wav files recorded by AudioMoth units. The aim of the basic cluster analysis process is to identify a broad range of signals representing the target species of interest (in this case the Yellow-bellied Glider) from sites over the course of the survey period.

A total of 56339 .wav files were recorded for all sites combined for the entire survey period. The following sections provide a step-by-step description for the classification of animal vocalisations calls using .wav files recorded by AudioMoth units.

Step 1 – Download of audio data post field surveys

Audio data (.wav files) recorded by each AudioMoth device were downloaded to a computer and then to a portable hard drive for backup. A hierarchical folder system was used to store and catalogue the data using a unique numbering system that could later be applied to the different sites (site number/name). This allowed for accurate and consistent presentation of data throughout the analysis.

Step 2 – Basic cluster analysis

Using the signal parameters and cluster analysis functions in Kaleidoscope Pro (KP, Wildlife Acoustics version 5.4.0) the raw .wav files were processed for signals of interest (e.g., within the acoustic range of the target species). Prior to applying the settings, target species vocalisations were examined from the following sources to better determine the parameters to be applied for the basic cluster analysis process:

– Whisson DA, McKinnon F, Lefoe M, Rendall AR (2021) Passive acoustic monitoring for detecting the Yellow-bellied Glider, a highly vocal arboreal marsupial. PLoS ONE 16(5): e0252092. https://doi.org/10.1371/journal.pone.0252092
– Nocturnal Bird and Mammal Calls of NE NSW (cd, Nature Sound by David Stewart)
– Vocalisations recorded with a handheld recorder by C. Grabham at Dando's campground during surveys undertaken for Barwon Water May 2022
– In-situ vocalisations from other PAM recordings from surveys undertaken at the following localities in the Otways region – Ridge Road, Gellibrand-Kawarren; Pipeline Track, Kawarren; Ten Mile Creek/Robinsons Road, Birnam; and Moggs Creek Picnic Ground, Moggs Creek

Analysis of all recordings was undertaken and compared with the designated settings under the signal parameters function. Once a signal has passed these parameters (the specified criteria), it is considered to be a detected signal and is passed to the cluster analysis (CA) module. The CA module analyses detected signals for similar patterns based on the designated settings under the CA parameters function. Based on these parameters, the process designates each detected signal as part of a cluster. Clusters are initially named, starting with cluster 000, cluster 001, cluster 002 and so on. The largest number of similar detected signals are assigned to cluster 000, the next largest to cluster 001, and so on. Subsequent clusters are ordered to be most similar to those that come before. The following settings were applied:

Signal Parameters

– Minimum and Maximum Frequency Range (Hz): 250 – 9000. This broad range represented the vocalisations of the target species – Yellow-bellied Glider
– Minimum and maximum length of detection (seconds): 1 – 10
– Maximum inter-syllabe gap (seconds): 1

Cluster analysis

– Maximum distance from cluster centre to include outputs in cluster.csv: 2 (to ensure no signals of interest were ignored)
– FFT Window: 10.67 ms (to allow for a greater resolution of frequency aiming to better define low frequency sounds)
– Maximum states: 12 (mid range recommended default)
– Maximum distance to cluster centre for building clusters: 0.5 recommended default

– Maximum clusters: 100

Step 3 – Manual review and labelling of clusters

Signals of interest were identified as a result of the basic cluster analysis process. A signal of interest may have contained a single syllable or a single call (vocalisation consisting of multiple consecutive syllables) from a single species, or may have contained syllables or calls from multiple species.

The following process was applied to review and label each of the designated clusters:

– The top 100 detections (based on analysis of the *Top1 distance output* number for each cluster) was manually review by viewing the spectrogram window in KP and for some files the audio was listened to using the playback function
– Files were then labelled according to the target species or other species
– This process was completed for each cluster
– Additional analysis of vocalisations from approximately 9:00 pm – 11:00 pm following sunset each night was undertaken to determine calling time between locations to assist with understanding the number of individuals within the offset site

Survey results

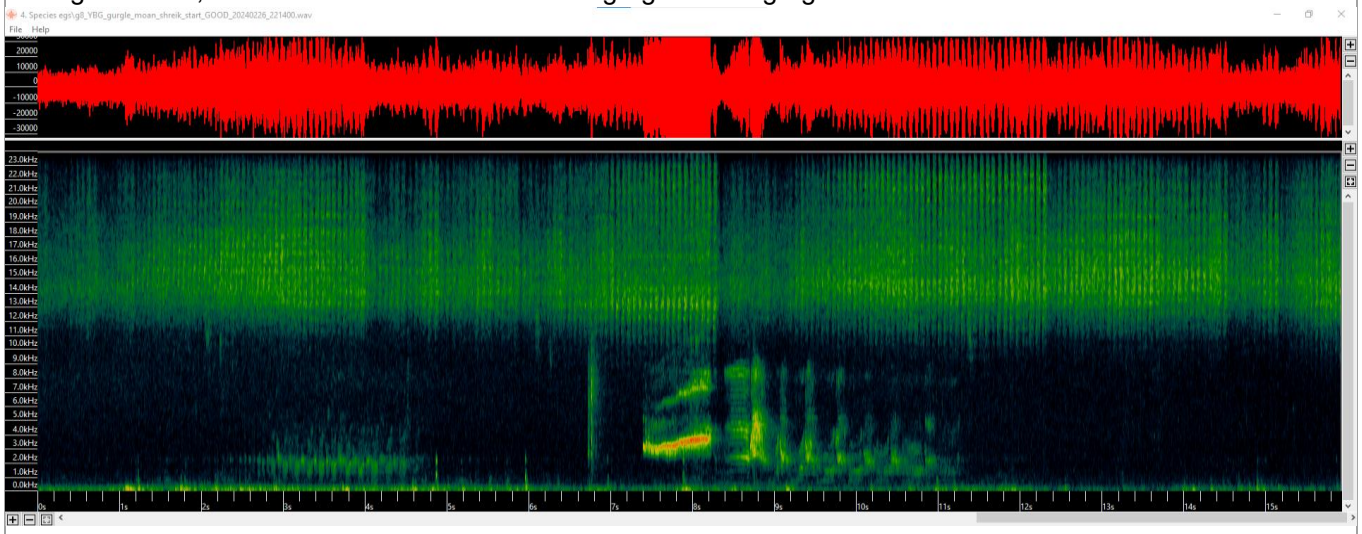
At least nine species were recorded using PAM during the survey including the Yellow-bellied Glider at all sites. Diurnal bird species were also recorded at each site, however, the focus of the analysis was Yellow-bellied Glider and nocturnal fauna and diurnal birds were not counted.

Table B1 Summary of nocturnal species recorded at each site from sound analysis

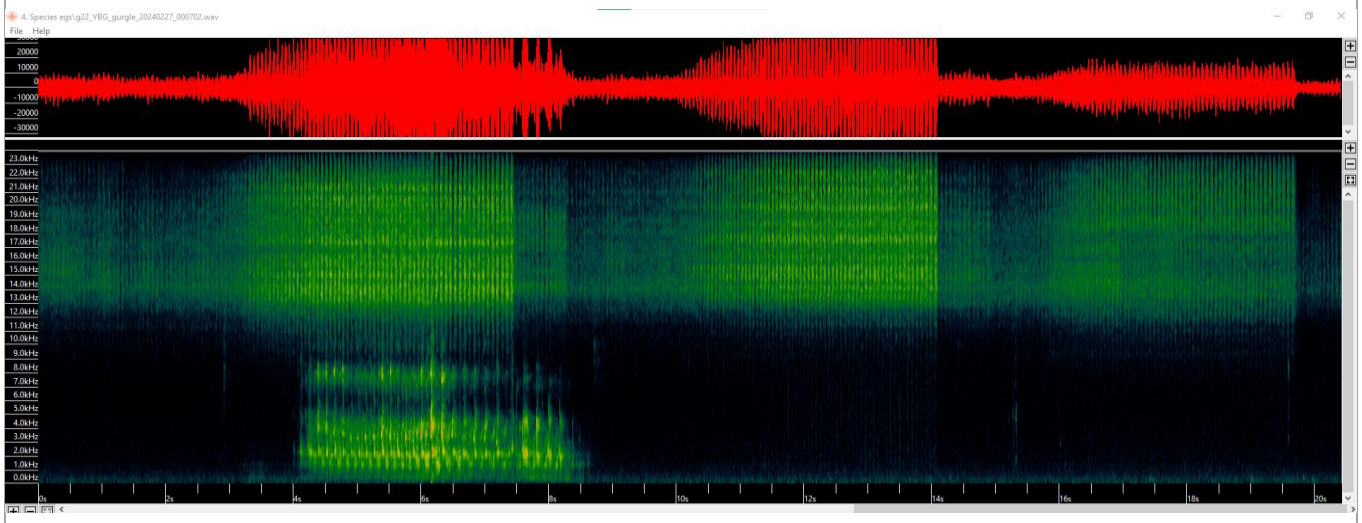
Species	PAM7 g10	PAM6 g11	PAM8 g17	PAM1 g22	PAM2 g23	PAM5 g24	PAM3 g8	PAM4 g9
Yellow-bellied Glider	✓	✓	✓	✓	✓	✓	✓	✓
Koala	-	-	-	-	✓	-	-	-
Ringtail Possum	✓	-	-	✓	✓	✓	✓	✓
Cat	-	-	-	-	-	-	-	✓
Litoria ewingii	✓	-	-	✓	✓	-	-	✓
Geocrinia sparsiflora	✓	-	-	✓	✓	-	-	✓
Owlet Nightjar	✓	✓	✓	✓	✓	✓	✓	✓
Boobook Owl	✓	✓	✓	✓	✓	✓	✓	✓
Tyto species. Most calls Masked Owl, however, other calls poor quality	✓	✓	✓	✓	✓	✓	✓	✓

Spectrogram examples of Yellow-bellied Glider Calls (Kaleidoscope Pro). Note: time scale varies for each view

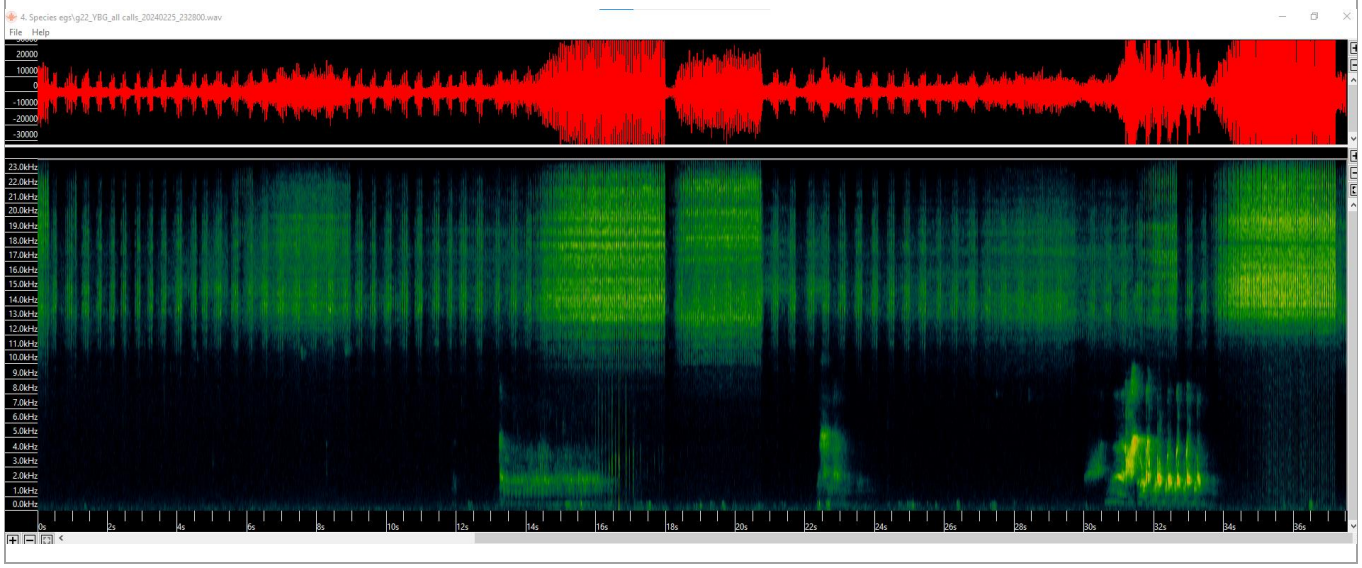
PAM g8 – 22:41, 26/02/2024 Yellow-bellied Glider gurgle/shriek/gurgle



PAM g22 – 00:07, 27/02/2024 – Yellow-bellied Glider moan then low gurgle call



Pam g22 – 23:28, 25/02/2024 – Yellow-bellied Glider low gurgle/shreik/start shreik then gurgle



Appendix A-3

Fauna species list

GHD survey – X = observed during survey, s = scat, S = observed during spotlighting, C = in situ camera, PAM = passive acoustic monitoring device, ho = heard only, os = offsite within 500 m of offset site, digs = obvious scratching, soil disturbance, e.g., conical digs (likely created by bandicoots), tracks = animal tracks * = introduced

Legislation

EPBC - Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*; FFG - Victorian *Flora and Fauna Guarantee Act 1988*

Status of species

CR -Critically Endangered; EN – Endangered; VU – Vulnerable; Mi – Migratory; * - Non-native

Detection method

S – Spotlighting; C – Motion-sensing camera; PAM – Passive Acoustic Monitoring; I – Incidental; B – Bird surveys

Table C1 Fauna list GHD field surveys, February 2024

Common name	Scientific name	EPBC	FFG	Detection method
Mammals				
Short-beaked Echidna	*Tachyglossus aculeatus*			S
Agile Antechinus	*Antechinus agilis*			S,C
Long-nosed Bandicoot	*Perameles nasuta*			S,C
Common Ringtail Possum	*Pseudocheirus peregrinus*			S,C
Yellow-bellied Glider	*Petaurus australis*	VU	E	S, PAM
Krefft's Glider (Sugar Glider)	*Petaurus notatus*			S
Feathertail Glider	*Acrobates pygmaeus*			S
Swamp Wallaby	*Wallabia bicolor*			S,C,B
Bush Rat	*Rattus fuscipes*			C
rodent?				C
Swamp Rat	*Rattus lutreolus*			C
Fallow Deer*	*Cervus dama*			C,I
Red Fox*	*Vulpes vulpes*			S,C,I
Cat (feral)*	*Felis catus*			C
Birds				
Common Bronzewing	*Phaps chalcoptera*			B
Brush Bronzewing	*Phaps elegans*			B
Pacific Black Duck	*Anas superciliosa*			S
Grey Goshawk	*Accipiter novaehollandiae*		E	B
Australian Hobby	*Falco longipennis*			B
Southern Boobook	*Ninox boobook*			S
Masked Owl	*Tyto novaehollandiae*		CE	S
Yellow-tailed Black-Cockatoo	*Zanda funerea*			S,B,I
Gang-gang Cockatoo	*Callocephalon fimbriatum*	EN	E	B,I
Sulphur-crested Cockatoo	*Cacatua galerita*			B
Australian King-parrot	*Alisterus scapularis*			B
Crimson Rosella	*Platycercus elegans*			B

Common name	Scientific name	EPBC	FFG	Detection method
Blue-winged Parrot	*Neophema chrysostoma*	VU		B,I
Tawny Frogmouth	*Podargus strigoides*			S
Australian Owlet-nightjar	*Aegotheles cristatus*			S
Laughing Kookaburra	*Dacelo novaeguineae*			S,B
White-throated Needletail	*Hirundapus caudacutus*	VU/Mi	V	B
Fan-tailed Cuckoo	*Cacomantis flabelliformis*			B
Bassian Thrush	*Zoothera lunulata*			B,I,C
Grey Fantail	*Rhipidura fuliginosa*			B
Rufous Fantail	*Rhipidura rufifrons*	Mi		B
Leaden Flycatcher	*Myiagra rubecula*			B
Satin Flycatcher	*Myiagra cyanoleuca*	Mi		B
Rose Robin	*Petroica rosea*			B
Eastern Yellow Robin	*Eopsaltria australis*			B,C
Golden Whistler	*Pachycephala pectoralis*			B
Olive Whistler	*Pachycephala olivacea*			B
Grey Shrike-thrush	*Colluricincla harmonica*			B
Crested Shrike-tit	*Falcunculus frontatus*			B
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*			B
Striated Thornbill	*Acanthiza lineata*			B
Brown Thornbill	*Acanthiza pusilla*			B
White-browed Scrubwren	*Sericornis frontalis*			B,C
Superb Fairy-wren	*Malurus cyaneus*			B
White-throated Treecreeper	*Cormobates leucophaeus*			B
Mistletoebird	*Dicaeum hirundinaceum*			B
Spotted Pardalote	*Pardalotus punctatus*			B
Striated Pardalote	*Pardalotus striatus*			B
Silvereye	*Zosterops lateralis*			B
White-naped Honeyeater	*Melithreptus lunatus*			B
Brown-headed Honeyeater	*Melithreptus brevirostris*			B
Eastern Spinebill	*Acanthorhynchus tenuirostris*			B
Yellow-faced Honeyeater	*Caligavis chrysops*			B
Crescent Honeyeater	*Phylidonyris pyrrhoptera*			B
New Holland Honeyeater	*Phylidonyris novaehollandiae*			B
Little Wattlebird	*Anthochaera chrysoptera*			B
Red Wattlebird	*Anthochaera carunculata*			B
Satin Bowerbird	*Ptilonorhynchus violaceus*			B,C
Forest Raven	*Corvus tasmanicus*			B
Pied Currawong	*Strepera graculina*			B
Grey Currawong	*Strepera versicolor*			B
Common Blackbird*	*Turdus merula*			B

Common name	Scientific name	EPBC	FFG	Detection method
Reptiles				
Southern Water Skink	*Eulamprus tympanum tympanum*			I
Frogs				
Victorian Smooth Froglet	*Geocrinia victoriana*			S,I
Southern Brown Tree Frog	*Litoria ewingii*			S
Invertebrates				
Otway Black Snail	*Victaphanta compacta*		E	I
Burrowing Crayfish	*Engaeus sp.*			I

Appendix A-4

Summary Area SMP Output Summary

Summary Area SMP Output Summaries

SMP v4.0 Report created on 24 March, 2023

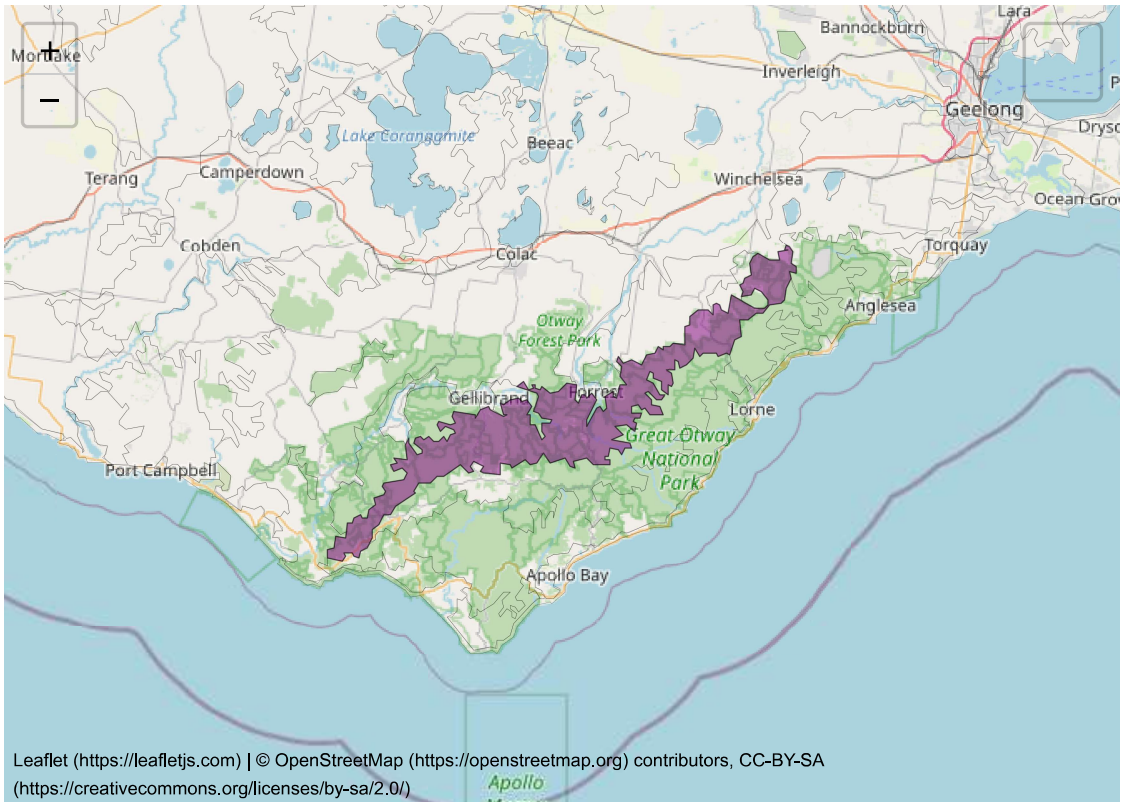
Summary unit760

This report shows the Strategic Management Prospects (SMP) summary output for Summary unit760. It should be read in conjunction with the Benefit, Threat, Cost and Benefit-Cost models for individual actions in NatureKit.

All Summary Area reports and individual action models can be viewed in NatureKit (https://naturekit.biodiversity.vic.gov.au/).

For more information on the science of SMP and how to use SMP, including video guides, visit Choosing actions for nature (https://www.environment.vic.gov.au/biodiversity/choosing-actions-for-nature) on the DEECA website.

Map of Summary Area



Overview of Summary Area

Polygon area	45347 Ha
Native veg. cover	69 %
Public land	69 %
Number of species with more than 5% of their Victorian range in polygon	0 Amphibians, 19 Plants, 0 Birds, 0 Mammals, 0 Reptiles
Species that have more than 50% of their Victorian range in polygon	

FFG listed species with more than 20% of their Victorian range in polygon	Nematolepis squamea subsp. squamea

Outputs for Summary Area

Median cost-effectiveness and median benefit of actions

The table below shows the median and range of cost-effectiveness (CE) and benefit ranks for individual and integrated actions within the Summary Area. Use this table to determine the most cost-effective and most beneficial actions and combinations of actions in the Summary Area.

The **Median Cost-effectiveness Rank** provides a state-wide comparison of the relative cost-effectiveness of different actions in specific locations. It can be used to identify actions that are expected to deliver relatively large net biodiversity benefits per unit cost. Biodiversity benefits are summed across all species, with greater weighting given to rare and threatened species and to species with depleted populations or habitats. The median cost-effectiveness rank helps identify actions that will collectively maximise benefit to as many species as possible across the state, consistent with Victoria's Biodiversity 2037 Plan (https://www.environment.vic.gov.au/biodiversity/biodiversity-plan).

The columns for **Area in Top 15% (Ha)** and **Area in Top 5% (Ha)** show the number of hectares within the Summary Area where a particular action ranks among the top 15% or top 5% for cost-effectiveness across Victoria. These location-specific actions represent the most cost-effective actions to maximise biodiversity benefit across the state.

This table can also be viewed in the NatureKit browser. Select the SMP by Summary Area layer, click on the polygon of interest and the first link in the Summary Area pop-up window.

Column visibility ▾ CSV

Action	Relevant Area (Ha)	Median Cost-effectiveness Rank	Cost-effectiveness Range	Area in Top 5% (Ha)	Area in Top 15% (Ha)	Median Benefit Rank	Range of Benefits
Control Goats	80	99	82-99	75	80	97	41-97
Control Pigs	37771	97	84-99	35771	37763	68	43-97
Control Rabbits	1145	89	61-97	204	636	79	34-97
Control Deer	36707	81	36-97	1514	8091	72	42-98
Control Cats_Foxes_Goats	78	79	40-86	0	5	96	49-98
Control Cats_Foxes	33740	74	0-96	8	2515	86	0-99
Control Cats_Foxes_Pigs	32240	69	46-94	0	1621	89	58-99
Control Non-Woody Weeds	31705	68	4-93	0	1264	43	1-77
Control All Weeds	40556	68	40-93	0	1063	59	20-88
Control Foxes	40556	65	19-93	0	1769	75	16-98
Control Cats	33740	65	31-93	0	1590	77	22-98
Control Cats_Foxes_Rabbits	314	64	37-87	0	13	84	48-98

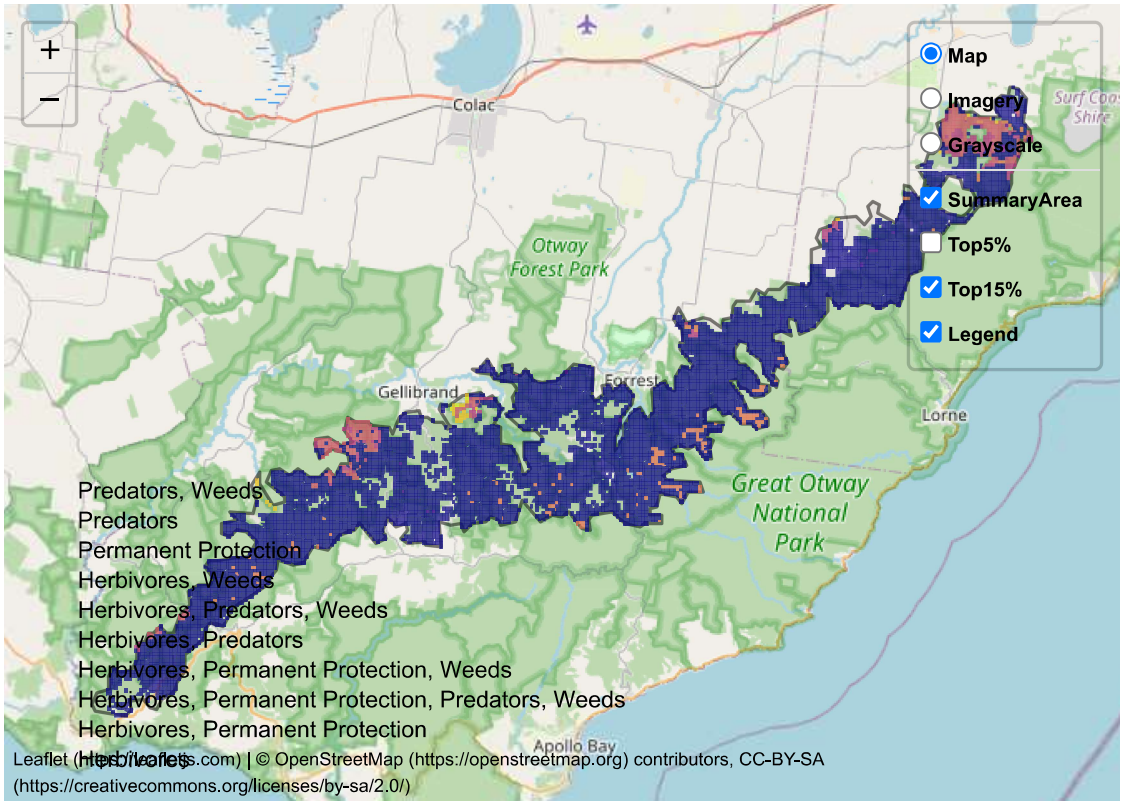
Action	Relevant Area (Ha)	Median Cost-effectiveness Rank	Cost-effectiveness Range	Area in Top 5% (Ha)	Area in Top 15% (Ha)	Median Benefit Rank	Range of Benefits
Control Goats_Permanent Protection	18	58	32-75	0	0	93	63-97
Control Overabundant Kangaroos	8107	57	24-92	0	897	49	23-93
Control Woody Weeds	40556	57	18-94	0	93	41	1-86
Control Grazing_AllWeeds	17224	55	28-97	134	641	82	57-99
Control Cats_Foxes_Goats_Permanent Protection	17	52	19-66	0	0	93	51-97
Control Cats_Foxes_Pigs_Permanent Protection	3465	47	24-85	0	0	89	59-99
Control Cats_Foxes_Permanent Protection	3892	45	10-85	0	5	87	27-99
Control Grazing	17224	44	17-96	66	412	79	46-99
Control Cats_Foxes_Rabbits_Permanent Protection	133	43	23-58	0	0	90	62-98
Permanent Protection	10079	42	0-99	46	54	84	0-99
Control Rabbits_Permanent Protection	599	39	11-58	0	0	85	41-96
Control Cats_Permanent Protection	3892	38	12-79	0	0	77	32-98
Control Grazing_AllWeeds_Permanent Protection	10018	34	16-94	0	24	85	67-99
Control Deer_Permanent Protection	7410	32	18-89	0	14	72	50-98
Control Foxes_Permanent Protection	10079	32	8-79	0	0	75	23-98
Control Pigs_Permanent Protection	8669	31	18-97	10	84	68	45-97
Control Grazing_Permanent Protection	10018	27	12-91	0	5	81	57-99
Control All Weeds_Permanent Protection	10079	23	9-77	0	0	59	23-88

Action	Relevant Area (Ha)	Median Cost-effectiveness Rank	Cost-effectiveness Range	Area in Top 5% (Ha)	Area in Top 15% (Ha)	Median Benefit Rank	Range of Benefits
Control Overabundant Kangaroos_Permanent Protection	3934	20	6-77	0	0	51	25-93
Control Non-Woody Weeds_Permanent Protection	8728	18	0-77	0	0	47	1-77
Control Woody Weeds_Permanent Protection	10079	14	2-67	0	0	38	9-79

Most cost-effective locations for integrated action

The map below shows where integrated actions are most cost-effective in the Summary Area. Hover over the coloured pixels to see which actions are relevant for each location. The colours reflect broad categories, and specific actions will appear on hover. Toggle between the **Top 5%** and **Top 15%** most cost-effective actions in the layer list at top right.

To view more detail about where to carry out the relevant actions in the Summary Area, use the Benefit-Cost (purple) models of individual actions in NatureKit.



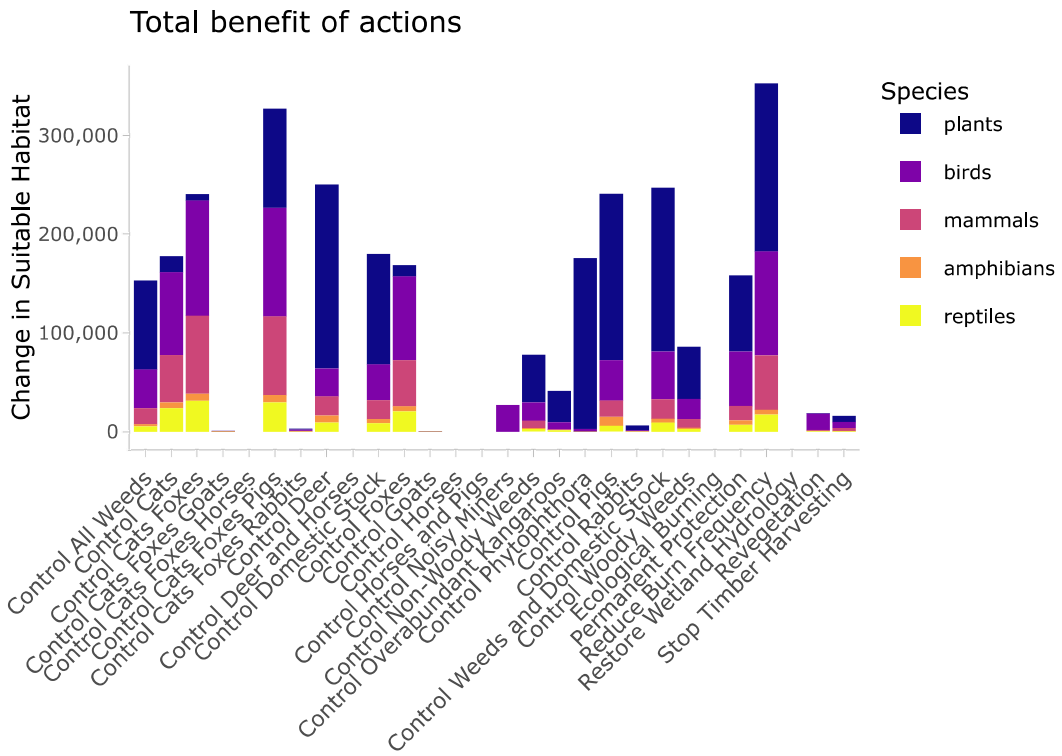
*In the legend **Herbivores** refers to controlling any combination of wild deer, feral goats, feral horses, overabundant kangaroos, feral pigs, rabbits, or domestic stock. **Predators** refers to controlling feral cats and / or foxes. Hover over pixels to see the specific actions.*

Total benefit of actions, per taxonomic group

The bar plot below shows which actions will provide the highest relative biodiversity benefit for each taxonomic group in the Summary Area.

Use this plot to see how much benefit could be gained through each action, summed across all species in the Summary Area. The x-axis shows each of the actions in the SMP analysis, and the y-axis shows the potential benefit, measured as **Change in Suitable Habitat (CSH)**, of undertaking each action in the Summary Area. The bars show the benefit to each taxonomic group and the combined total benefit.

The benefit value assumes that each action is undertaken wherever the corresponding threat is present within the Summary Area, or where the action is relevant, e.g. all cleared areas are revegetated.

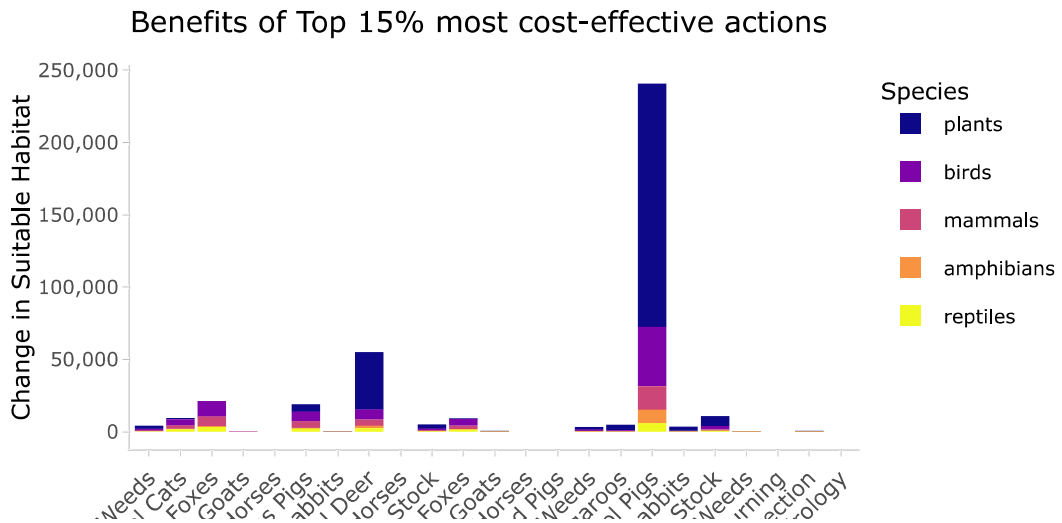


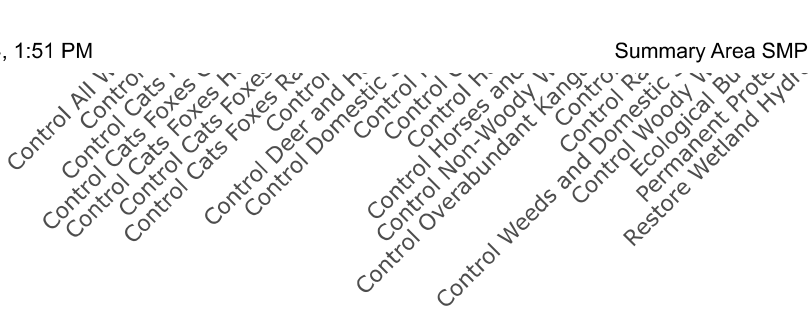
Benefits of Top 15% most cost-effective actions, per taxonomic group

The bar plot below shows the biodiversity benefit per taxonomic group of the Top 15% most cost-effective actions in the Summary Area.

Use this plot to see the potential benefit, measured as **Change in Suitable Habitat (CSH)**, of actions in the Summary Area that rank in the top 15% of most cost-effective actions state-wide. The benefit value assumes that each action is undertaken wherever the corresponding threat is present within the Summary Area, or where the action is relevant, e.g. all cleared areas are revegetated.

The x-axis of the bar plot shows each of the costed actions in the SMP analysis, and the y-axis shows the Change in Suitable Habitat (CSH) available for each of the actions in the Summary Area. The y axis shows both the total benefit and how much each action benefits each taxonomic group.



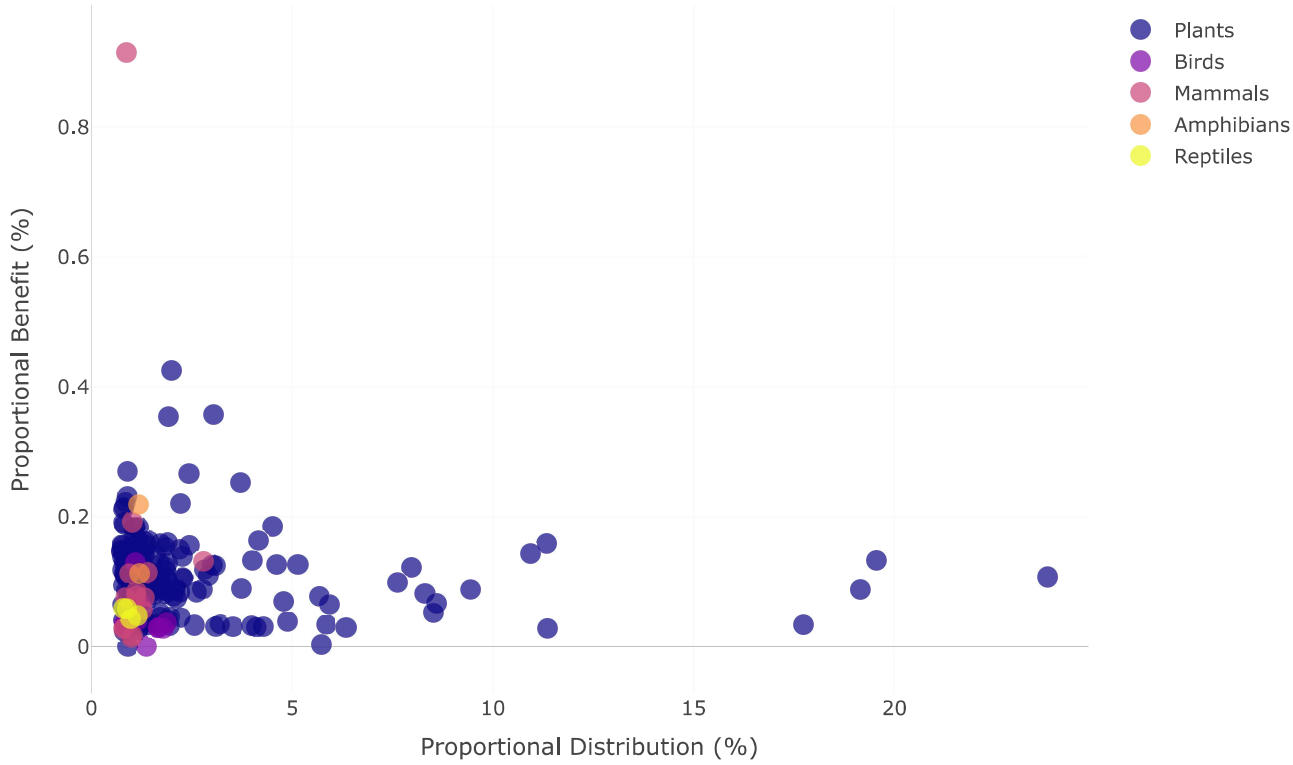


Benefit of Top 15% most cost-effective actions, per species

The scatterplot below shows the benefit each species would receive from the Top 15% most cost-effective actions in the Summary Area (**Proportional Benefit**), relative to the proportion of each species' state-wide distribution within the Summary Area (**Proportional Distribution**).

The y-axis shows the expected Change in Suitable Habitat (CSH) within the Summary Area, expressed as the proportional increase in suitable habitat from undertaking the Top 15% most cost-effective actions, relative to the suitable habitat without any management action. For example, a value of 0.5 on the y-axis indicates that, over the 50-year time scale of SMP, undertaking a cost-effective biodiversity management regime would yield a 50% increase in suitable habitat within the Summary Area, relative to taking no action.

Each dot in the scatterplot represents a different species in the Summary Area. Hover over a dot to reveal more information about the species and the benefit values of individual and integrated actions. Hover over the top right of the plot to reveal the toolbar menu, and click on the taxonomic groups in the legend to toggle them on or off.



Use this scatterplot to see cost-effective combinations of actions that collectively benefit as many species as possible, especially those species with restricted or depleted distributions. Species on the right-side of the plot have a higher proportion of their state-wide distribution within the Summary Area and are therefore more dependent on management within the Summary Area for their long-term persistence.

Species in the top right quadrant have high proportional distribution and are expected to benefit significantly from the cost-effective set of actions modelled in SMP. Species in the lower right quadrant of the plot have high proportional distribution but are not expected to benefit significantly from the landscape-scale actions modelled in SMP. These species may need further consideration or a Specific Needs Assessment. Visit Choosing actions for nature (https://www.environment.vic.gov.au/biodiversity/choosing-actions-for-nature) on the DEECA website for more information on the Specific Needs approach.

Species in the top left of the plot can be thought of as getting collateral benefits from the cost-effective actions modelled in SMP. These species benefit from, but were not the primary reason for, the selection of those actions. A maximum of 200 species with the highest proportional distributions in the Summary Area are included in the scatterplot.

Benefits of action, per individual species

The table below shows the benefit-of-action values and distributional data for each individual species within the Summary Area. This includes the proportion of each species' state-wide distribution contained within the Summary Area (**Proportional Distribution**), the proportion of the Summary Area that is within the species' distribution (**Habitat Extent**), the **Proportion of VBA Records** for a species in the Summary Area relative to the total number of VBA records state-wide, and the **Total Benefit** for each species if all actions are undertaken, measured in Change in Suitable Habitat (CSH).

Use this table to see the benefit of actions for species of interest, measured as CSH, and to see which species have the highest proportion of their state-wide distribution in this Summary Area.

Click on a column heading to sort the rows according to the highest or lowest values in that column. Use the search bar above the table to search for a species of interest. Use the **Column Visibility** button to toggle different columns on and off, and use the page numbers at the bottom of the table to look through the whole table. Use the **.csv** button to download a copy of the table data for further analysis.

Column visibility ▾ CSV **Search:**

Common_Name	Species_Name	Taxonomic Group	FFG Status	Proportional Distribution (%)	Habitat_Extent (% of polygon)	Proportion of VBA Records*	To
Satinwood	Nematolepis squamea subsp. squamea	Plants	Vulnerable	23.82	47.96	0.07	
Satinwood	Nematolepis squamea	Plants		19.55	48.52	0.10	
Hybrid Pittosporum	Pittosporum undulatum subsp. X emmettii	Plants		19.16	13.97	0.00	
Ground Spleenwort	Asplenium appendiculatum subsp. appendiculatum	Plants	Critically Endangered	17.73	23.98	0.00	
Beech Finger-fern	Notogrammitis angustifolia subsp. nothofageti	Plants	Endangered	11.36	20.5	0.00	
Nunniong Everlasting	Ozothamnus rogersianus	Plants	Endangered	11.34	20.71	0.00	
Grey Correa	Correa reflexa (Western Otways)	Plants		10.94	0.4	0.00	
Brooker's Gum	Eucalyptus brookeriana	Plants	Endangered	9.45	48.48	0.04	
Otway Wattle	Acacia leprosa var. magna	Plants		8.6	5.13	0.10	
Dwarf Silver Wattle	Acacia nano-dealbata	Plants	Vulnerable	8.52	48.56	0.09	

Showing 1 to 10 of 1,848 entries

Previous 1 2 3 4 5 … 185 Next

**VBA records considered here include only observations since 1980 and with nominal spatial accuracy of 500m or less. There may be older and/or less accurate VBA records for some species within this polygon.*

Benefits of stopping native timber harvesting, reducing burn frequency, and permanent protection, for FFG-listed species

The table below lists the number of species in each taxa group and the individual FFG listed species which receive their highest benefit in the Summary Area from stopping native timber harvesting, reducing the frequency of fuel reduction burns, and permanent protection.

To see how much benefit the individual species receive from these actions and their proportional distribution in the Summary Area, use the table of benefits of action per individual species (above). Download the .csv file, sort by taxonomic group, and explore the data for the relevant taxonomic group and species, or plot your own charts to find species that receive the highest benefit from these actions.

Action	Number per Taxa Group	FFG listed Species
Stop Native Timber Harvesting		
Reduce Burn Frequency	1 Amphibians, 36 Birds, 11 Mammals, 164 Plants, 2 Reptiles	Powerful Owl, Masked Owl, Red-tailed Black-Cockatoo, White-throated Needletail, Grey-headed Flying-fox, Asplenium appendiculatum subsp. appendiculatum, Astelia australiana, Cyathea cunninghamii, Lastreopsis hispida, Orthrosanthus multiflorus, Thomasia petalocalyx, Westringia glabra, Monotoca glauca, Pellaea nana, Nematolepis squamea subsp. squamea, Hakea decurrens subsp. platytaenia, Sticherus tener s.s., Centipeda crateriformis subsp. crateriformis
Permanent Protection	3 Amphibians, 16 Birds, 9 Fish, 1 Mammals, 38 Plants, 2 Reptiles	Black Falcon, Australian Grayling, Flat-headed Galaxias, Murray-Darling Rainbowfish, Murray Cod, Macquarie Perch, Yarra Pygmy Perch, Asperula ambleia, Juncus psammophilus, Oxalis rubens, Acacia verticillata subsp. ruscifolia, Common Bent-wing Bat (southern ssp.)

Indicative annual costs of actions

The table below shows the estimated **annual indicative cost** of individual and integrated actions in SMP, reflecting the 'net present' cost over 50 years. Indicative costs are not intended to be the same as actual project costs. SMP uses a standardised set of cost parameters, including travel costs, opportunity costs, labour costs, and equipment costs, to enable comparison of the relative cost of different actions at the same location, or the same action across different locations. View the Cost models (yellow/orange) of individual actions in NatureKit. For more information on how costs are modelled in SMP, visit Choosing actions for nature (https://www.environment.vic.gov.au/biodiversity/choosing-actions-for-nature) on the DEECA website.

Action	Total indicative annual cost ($)	Annual indicative cost per Ha ($)	Annual indicative cost for Top 15% of actions ($)
Control All Weeds	853945	20	21260
Control Cats	1755976	49	77910
Control Cats Foxes	1687958	47	118205
Control Cats Foxes Goats	9266	72	360
Control Cats Foxes Pigs	2495954	72	116712
Control Cats Foxes Rabbits	31567	77	1001

Action	Total indicative annual cost ($)	Annual indicative cost per Ha ($)	Annual indicative cost for Top 15% of actions ($)
Permanent Protection	3316770	259	13986
Control Deer	78594	2	16182
Control Non-Woody Weeds	441049	12	15168
Control Foxes	1903380	45	79605
Control Goats	311	2	160
Control Domestic Stock	4216214	209	86108
Control Overabundant Kangaroos	26551	3	2691
Control Pigs	67280	2	75526
Control Rabbits	17838	12	7632
Control Woody Weeds	763634	18	1674

Note: Revegetation and Permanent Protection are relatively expensive actions because the costs include opportunity costs from changed land use, preparation and set-up costs, and costs of managing the site against other threats. For example, the cost of ongoing weed and animal management is included to ensure the biodiversity value of the habitat is achieved and maintained over 50 years.

Glossary of Terms

Term	Definition
Benefit of CE actions relative to most beneficial action in polygon	The ratio of benefit a species would receive from the set of cost-effective actions in a polygon, relative to the estimated benefit from the most beneficial action set for that species in the polygon. A value of one or greater suggests that most beneficial action for that species is included in the set of cost-efficient actions in the polygon. A value less than one suggests that the cost-efficient actions in that polygon are different to the most beneficial action for that species.
Change in Suitable Habitat (CSH)	A measure of the predicted increase in suitable habitat for a species as a result of a sustained management regime, relative to no management actions being conducted. The measure considers the type, extent and configuration of habitat for a species, and the factors that might influence how much a species can make use of that habitat.
Cost-effectiveness	The expected net benefit of an action, or set of actions, per unit cost. In SMP, net benefit is estimated as the expected change in summed 50-year persistence probabilities across all species associated with an action. Persistence probabilities are approximated as species-specific functions of the total area of suitable habitat (or expected area of occupancy) for each species.
Cost-effective actions (CE actions)	The set of actions that are expected to have the greatest net biodiversity benefit per unit cost. The most cost-effective actions are those within the Top 15% of cost-effectiveness rank values (see below).
Cost-effectiveness Rank	The cost-effectiveness of a management action in a particular location, ranked against the cost-effectiveness of all other actions at all other locations. The rank is expressed as a percentile from 1 (lowest) to 100 (highest).
FFG	Victorian Government Flora and Fauna Guarantee Act 1988

Term	Definition
Indicative Cost	Relative costs of each action at each location based on standardised cost estimates (e.g. travel time, labour, accommodation, terrain, site accessibility, transaction costs, equipment and material costs, project administration) to enable comparison between actions.
Summary Area / Polygon	The defined area of interest for which the report is generated
Proportional Benefit	A measure of the proportional increase in suitable habitat a species is expected to receive under the most cost-effective action, or set of actions, in the polygon of interest, relative to no management actions being done.
Proportional Distribution	The proportion of a species state-wide range contained within the polygon of interest.
Total benefit (all actions)	The amount of benefit a species would receive, measured in Change in Suitable Habitat, if all actions were conducted in a polygon.
Total benefit of cost-effective actions	The amount of benefit a species would receive, measured in Change in Suitable Habitat, from the most cost-effective actions in a polygon.

Appendix A-5

Flora species list

Key to table

Legislation

EPBC Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

FFG Victorian *Flora and Fauna Guarantee Act 1988*

Status of species

FFG:

RU Restricted Use (Protected)

vu Vulnerable

Weeds

Environmental Weed Advisory list of Environment Weeds in Victoria[5]

CALP Act Declared noxious weeds listed under the *Catchment and Land Protection Act 1994*

WONS Weeds of National Significance

Scientific name	Common name	Status
Native		
Acacia leprosa var. *magna*	Otway Wattle	RU
Acacia melanoxylon	Blackwood	
Acacia verticillata subsp. *verticillata*	Prickly Moses	RU
Acaena novae-zelandiae	Bidgee-widgee	
Amyema pendula	Drooping Mistletoe	
Asplenium gracillimum	Mother Spleenwort	RU
Bedfordia arborescens	Blanket Leaf	
Blechnum chambersii	Lance Water-fern	RU
Blechnum wattsii	Hard Water-fern	RU
Carex austrotenella	Delicate Hook-sedge	
Cassinia aculeata subsp. *aculeata*	Common Cassinia	
Clematis aristata	Mountain Clematis	
Coprosma quadrifida	Prickly Currant-bush	
Correa lawrenceana	Mountain Correa	RU
Cyathea australis	Rough Tree-fern	RU
Cynoglossum australe	Australian Hound's-tongue	
Dichondra repens	Kidney-weed	
Dicksonia antarctica	Soft Tree-fern	RU
Eucalyptus obliqua	Messmate Stringybark	
Eucalyptus regnans	Mountain Ash	
Eucalyptus viminalis subsp. *viminalis*	Manna Gum	
Euchiton japonicus s.s.	Creeping Cudweed	
Geranium spp.	Crane's Bill	
Goodenia ovata	Hop Goodenia	

[5] **https://www.ari.vic.gov.au/__data/assets/pdf_file/0027/125919/ARI-Technical-Report-287-Advisory-list-of-environmental-weeds-in-Victoria.pdf**

Scientific name	Common name	Status
Hackelia latifolia	Forest Hound's-tongue	
Hedycarya angustifolia	Austral Mulberry	
Histiopteris incisa	Bat's Wing Fern	RU
Hydrocotyle hirta	Hairy Pennywort	
Juncus spp.	Rush	
Lepidosperma elatius var. *ensiforme*	Tall Sword-sedge	
Microsorum pustulatum subsp. *pustulatum*	Kangaroo Fern	RU
Nematolepis squamea subsp. *squamea*	Satinwood	vu
Notelaea ligustrina	Privet Mock-olive	
Olearia argophylla	Musk Daisy-bush	RU
Olearia lirata	Snowy Daisy-bush	RU
Pimelea axiflora	Bootlace Bush	
Pittosporum bicolor	Banyalla	
Polystichum proliferum	Mother Shield-fern	RU
Pomaderris aspera	Hazel Pomaderris	
Prostanthera lasianthos	Victorian Christmas-bush	RU
Pteridium esculentum subsp. *esculentum*	Austral Bracken	
Senecio spp.	Groundsel	
Stellaria flaccida	Forest Starwort	
Tetrarrhena juncea	Forest Wire-grass	
Urtica incisa	Scrub Nettle	
Viola spp.	Ivy-leaf Violet	
Introduced		
Aira spp.	Hair Grass	Environmental Weed
Anthoxanthum odoratum	Sweet Vernal-grass	
Centaurium erythraea	Common Centaury	Environmental Weed
Cirsium vulgare	Spear Thistle	Environmental Weed, CALP
Dactylis glomerata	Cocksfoot	
Holcus lanatus	Yorkshire Fog	
Hypochaeris radicata	Flatweed	Environmental Weed
Lysimachia arvensis	Pimpernel	
Plantago lanceolata	Ribwort	
Poa annua s.l.	Annual Meadow-grass	Environmental Weed
Rubus fruticosus spp. agg.	Blackberry	Environmental Weed, CALP, WoNS

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The Power of Commitment

Appendix B

Offset site 2 – 245 Distillery Creek Road, Aireys Inlet – Survey Report

Proposed Offset Site 245 Distillery Creek Road Aireys Inlet

Targeted fauna and vegetation survey report

Barwon Water

9 June 2023

Project name		Colac Pipeline Upgrade						
Document title		Proposed Offset Site 245 Distillery Creek Road Aireys Inlet | Targeted fauna and vegetation survey report						
Project number		3137032						
File name		3137032-REP_Colac Pipeline Upgrade - Proposed Offset Site 245 Distillery Creek Road - Targeted fauna and vegetation survey report						
Status Code	**Revision**	**Author**	**Reviewer**		**Approved for issue**			
			Name	**Signature**	**Name**	**Signature**	**Date**	
S4	0	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	09/06/2023	
[Status code]								
[Status code]								

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[redacted]

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Executive summary

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.2 and the assumptions and qualifications contained throughout the Report.

Scope and methods

GHD was engaged by Barwon Water to complete a targeted fauna and habitat survey for the proposed offset property: 245 Distillery Creek Road, Aireys Inlet. Targeted surveys for the vulnerable Long-nosed Potoroo (*Potorous tridactylus trisulcatus*) were completed to understand the value of the site and its potential to meet offset requirements under the EPBC Act offset policy. The targeted assessment included camera trapping and habitat assessments during March 2023 to determine the presence and potential distribution of the Long-nosed Potoroo in the offset site.

Key survey findings

During the survey, 75 fauna species were identified at the site from a combination of targeted and opportunistic surveys, including 68 native species (14 mammals, 49 birds, three amphibian and two reptiles) and six non-native species.

The Long-nosed Potoroo was recorded using camera traps from five sites and 360 images over the course of 24 of the 25 survey days (all sites combined). Based on the distance between each camera location and time/date of the images, at least three, possibly four, Long-nosed Potoroo individuals were recorded within the proposed offset site. Activity patterns of the species were examined and it was revealed that the species was most active during the night and interestingly also active to a lesser extent during the hours before sunset and after sunrise. Given the number and frequency of records it appears that one or more of the individuals recorded are resident within the offset site.

The habitat present within the proposed offset site also provides habitat to other species including Long-nosed Bandicoot (*Perameles nasuta*), Rufous Bristlebird (*Dasyornis broadbenti caryochorus)* and Gang-gang Cockatoo (*Callocephalon fimbriatum)*.

Three EVC/ habitat types are present within the proposed offset site, providing high quality habitat for the species, including largely continuous moderate to dense understorey / shrublayer. There are no major barriers preventing the movement of the fauna within the offset site or in and out of the proposed offset site. A small section of the proposed offset site boundary shared with the water reclamation plant is fenced (approximately 600 m) which restricts the north-south movement of fauna, however the area is otherwise surrounded by reserve or vegetated area, apart from Distillery Creek Road.

Distillery Creek Road is frequently used by locals travelling between Aireys Inlet and Anglesea and is used for commuting and recreation. Although only 4-5 m wide and well vegetated in the road reserve for its length, it may provide a full or partial barrier to the movement of ground mammals (e.g. cleared gap to cross, with risk of vehicle strike and risk of predation); however, this is not considered significant for the potoroo, which is larger and can cross the gap quickly, if necessary.

Four feral animals were recorded within or nearby the offset site (Cat, Deer, Fox and Rabbit) and six weed species were recorded, including Boneseed and Bluebell Creeper. The pathogen *Phytophthora cinnamomi* was recorded in the offset site in the form of grass-tree dieback.

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Appendices

1. Introduction

The Colac Pipeline Upgrade project covers the proposed replacement of five sections (Sections 19, 20, 21, 23 and 25i) (approximately 5 kilometres in length) of the existing Colac Pipeline that are considered to be at high risk of future failure. The existing main transfers water from the West Gellibrand and Olangolah Reservoirs in the Otway Range to supply the township of Colac, in south-western Victoria. The existing pipeline is approximately 28 km long in total and is located in the Great Otway National Park, Otway Forest State Park, road reserves and private property. This scope of works forms part of a larger Barwon Water remediation program to replace the existing pipeline, which is duplicate or triplicate in certain sections and prone to failure, with a single 600 millimetre (mm) main (nominal) to maintain water security for Colac.

An assessment of the potential impacts on Matters of National Environmental Significance (MNES) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was undertaken in 2022 and determined that there may be significant residual impacts on three listed species: Gang-gang Cockatoo (*Callocephalon fimbriatum*), Yellow-bellied Glider (*Petaurus australis australis*) and Long-nosed Potoroo (*Potorous tridactylus trisulcatus*).

If residual impacts are likely to be significant, then details of an offset package to compensate for residual impacts on MNES must be provided to DCCEEW. This should consist of an offset proposal (Offset Strategy) and key commitments and management actions for delivering and implementing a proposed offset (i.e. an Offset Management Plan).

GHD was engaged by Barwon Water to complete targeted fauna surveys for the Long-nosed Potoroo and a habitat and vegetation survey of the proposed offset site at 245 Distillery Creek Road, Aireys Inlet. The offset requirements for the Yellow-bellied Glider and Gang-gang Cockatoo are addressed in a separate report.

1.1 Purpose and scope of this report

The purpose of this report is to present the methods and results for the targeted fauna and habitat survey for the proposed offset property 245 Distillery Creek Road, Aireys Inlet. Habitat assessments and targeted fauna surveys were completed for the Long-nosed Potoroo (*Potorous tridactylus trisulcatus*), which is listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The assessment was undertaken to understand the value of the site and its potential to meet offset requirements under the EPBC Act offset policy. The assessment was undertaken to understand the value of the site and its potential to meet offset requirements under the EPBC Act offset policy. The scope includes:

- A description of the offset site, including location, size, condition and environmental values
- Desktop review of records for the Long-nosed Potoroo within the study area
- Field investigation using targeted and opportunistic survey methods to understand the presence and distribution of the Long-nosed Potoroo and its habitats within the offset site, providing details of the surveys to show that they were undertaken in accordance with survey guidelines where available
- Field survey to document the quality and extent of native vegetation using vegetation quality assessment (VQA) methods within the offset site
- Details of on-going threats to the Long-nosed Potoroo at the offset site
- A report (this document) detailing the desktop review, methods and results of the targeted survey

1.2 Limitations and assumptions

This report has been prepared by GHD for Barwon Water and may only be used and relied on by Barwon Water for the purpose agreed between GHD and Barwon Water as set out in section 1.1 of this report. GHD otherwise disclaims responsibility to any person other than Barwon Water arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

This report provides the survey methods and results, however does not provide an analysis of offset obligations in regards to the proposed project, nor does it constitute an Offset Management Plan. 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 services undertaken by GHD in connection with preparing this report include the following:

– The field assessment was limited to an ecological assessment of vascular plant species (ferns, conifers and flowering plants) and terrestrial vertebrate fauna. Invertebrate fauna were recorded opportunistically. Fauna survey techniques and limitations are listed in section 2.2. The field assessment did not include any non-vascular flora (e.g. mosses, liverworts, lichens), fungi, or terrestrial invertebrates, except where listed threatened species are known or are suspected to occur.
– Included a field investigation for flora species during autumn, which is not an optimal time of year for conducting botanical assessments in the Otway Plain Bioregion, as many native flora are difficult or impossible to locate or identify at this time of year, due to a lack of reproductive material and/or the seasonal nature of some species (in particular, native orchids and forbs that may flower for limited periods during spring or flower at other times of the year). Additional native species may be recorded at the site at other times of the year. Therefore, it is considered possible that threatened flora may be present, but were not detected during the survey because of the timing of the survey (e.g. threatened species that emerge in spring/early summer would not have been detected).
– Did not involve targeted surveys for threatened flora, however did include identification of flora that were fertile and/or flowering at the time of the field investigations. Additional native species may be recorded at the site at other times of the year. Therefore, it is considered possible that threatened flora may be present, but were not detected during the survey because of the timing of the survey.
– Involved the use of Collector for ArcGIS mapping application to record site information. This mapping tool was accurate to within ten metres on site.
– The opinions, conclusions and any recommendations in this report are based on conditions encountered, observations made and information reviewed up to the date of preparation of the report. As GHD was only present on specific dates and certain time periods, this report is only indicative (and not definitive) of flora, fauna and communities present on the site. Flora, fauna and communities (whether in type or quantity) can also change at different times throughout the year (due to factors including seasonal changes, external events or third party intervention), and it is generally not possible to observe such changes where only a discrete site visit has taken place. 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.

1.3 Proposed offset site

The proposed **offset site** is located within the Barwon Water managed land at 245 Distillery Creek Road, Aireys Inlet 3230, approximately 125 km south-west of Melbourne. The site is located to the east of Colac, approximately 2.5 km north of Aireys Inlet and 45 km east of the Colac pipeline project site. The property is surrounded by the Great Otway National Park, with Distillery Creek Road forming one boundary. The proposed offset property sits within a larger property managed by Barwon Water, which includes the Aireys Inlet Water Reclamation Plant facility with three open pondages and a small Blue Gum plantation on the opposite side of Distillery Creek Road (Figure 1 and Figure 2). The facility is currently operational and the ponds are in use. Most of the pipes and disturbance in the larger property are confined to the ponds in the south-west corner of the site. There are also various tracks and irrigated tree lots in another BW landholding on the south side of Distillery Creek Road.

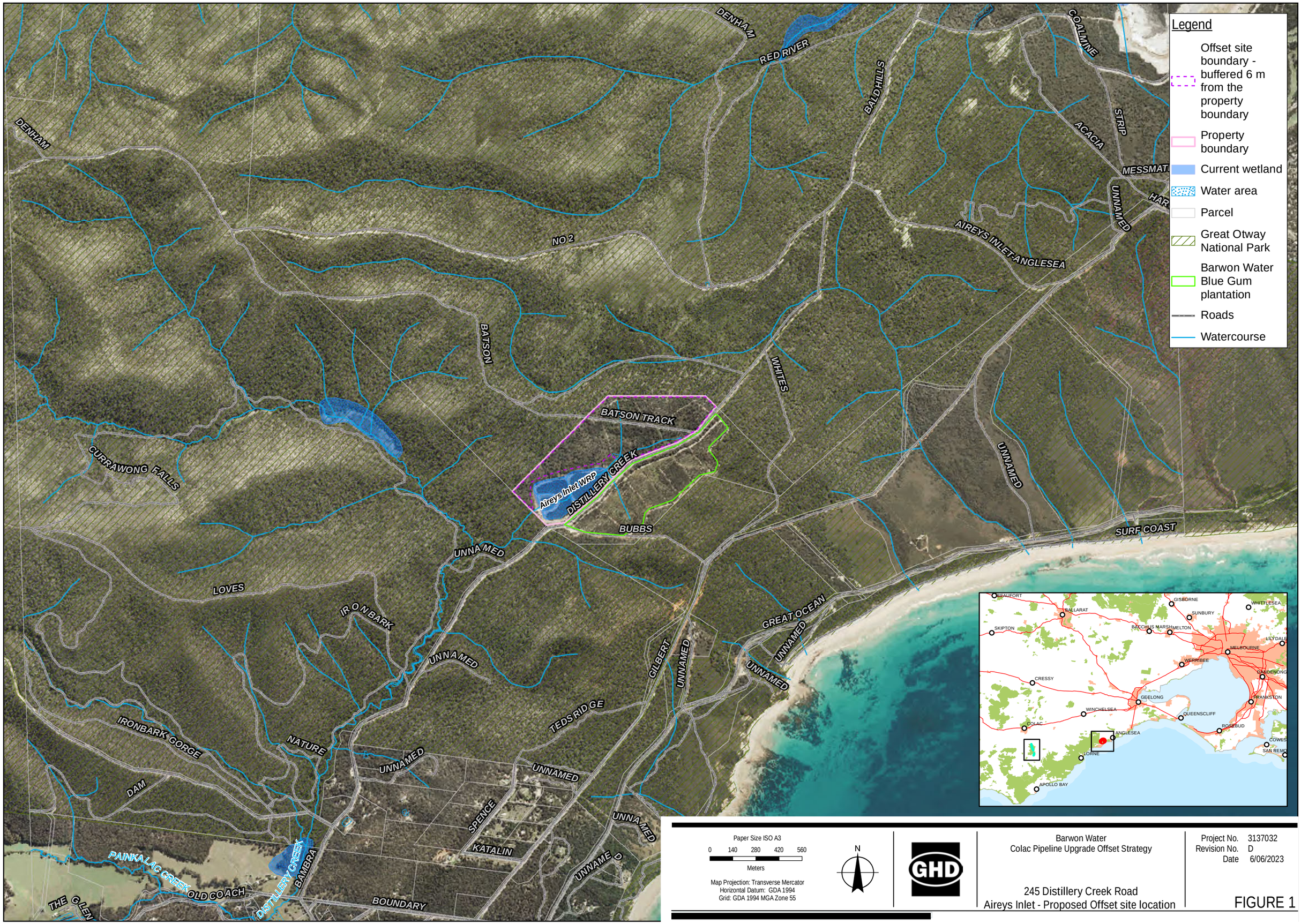
The property is 31.4 ha (excluding the pondages) and the proposed offset site within that property is approximately 29.68 ha (excluding the 6 m buffer area). The proposed offset site incorporates several named (Batson Track) and unnamed and unsealed vehicle access tracks used by Barwon Water and Parks Victoria. The following portions of the property are not included within the proposed offset site (refer Figure 2):

– Pondages and area bounded by concrete walls east of the pondages – buffered by 6 m
– 6 m buffer from property boundary in to property

The site is located on an undulating southerly facing slope. The steepest point is along the northern boundary of the site at approximately 80 m above sea level. From the high sections in the north, the elevation falls south toward the lowest point at Distillery Creek Road at approximately 40 m above sea level (Figure 2). Several minor drainage lines intersect the site, including two that feed a small dam east of the pondages.

The term **study area** refers to a broader region surrounding the offset site and includes the offset site and a 10 km buffer. The additional information captured has been used to provide context to assess the significance of ecological features identified within the offset site (for example, whether they are part of a larger area). The broader study area was only assessed at a desktop level.

According to DEECA's NatureKit Map, the study area occurs within the Otway Plain (OtP) bioregion. The study area occurs wholly within the Surf Coast Shire Council region and the Corangamite Catchment Management Authority (CCMA) area.



Paper Size ISO A3

0 140 280 420 560

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

Barwon Water
Colac Pipeline Upgrade Offset Strategy

245 Distillery Creek Road
Aireys Inlet - Proposed Offset site location

Project No. 3137032
Revision No. D
Date 6/06/2023

FIGURE 1

Data source:DEECA 2023,VicMap,2023 ;Aerial Imagery: Vicmap Basemap- Vicgrid Basemap - VicGrid94 - Aerial Data Custodian, Data Set Name/Title, Version/Date. Created by [redacted]

Paper Size ISO A3

0 30 60 90 120

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

Barwon Water
Colac Pipeline Upgrade Offset Strategy

245 Distillery Creek Road Aireys Inlet
Proposed Offset site location topography

Project No. 3137032
Revision No. C
Date 6/06/2023

FIGURE 2

2. Methods

2.1 Desktop review

A desktop assessment of data base records and other information sources was undertaken to assist with planning for field surveys and understanding the historical occurrence of threatened species within the offset site. The following sources were reviewed:

- Commonwealth EPBC *Act 1999* Protected Matters Search Tool (PMST) (maintained by the Department of Climate Change, Energy, the Environment and Water - DCCEEW 2023), (10 km buffer of the offset site)
- Victorian Biodiversity Atlas (VBA) for the records of the Long-nosed Potoroo and other EPBC Act listed species and a list of all terrestrial flora and fauna species recorded within a 10 km buffer of the offset site DEECA (2023a)
- Commonwealth Atlas of Living Australia (ALA, 2023) – to identify additional records not included in the Victorian Biodiversity Atlas database within a 10 km buffer of the offset site for the Long-nosed Potoroo and other EPBC Act listed species. The ALA is a collaborative, digital and open infrastructure that aggregates biodiversity data from multiple sources throughout Australia, and includes records not contained within the VBA. The ALA receives support through the Australian Government's National Collaborative Infrastructure Strategy and is hosted by the Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- NatureKit Maps – which provides GIS mapping, maintained by DEECA, including modelled mapping of extant and pre-1750 Ecological Vegetation Classes (EVCs) and known threatened species records (DEECA 2023b)
- NVIM Maps – which provides the Location Map, the Current Wetland Layer, the Strategic Biodiversity Score and the Native Vegetation Condition Score for the offset site (DEECA 2023c)
- Department of Agriculture, Water and the Environment (2022) Conservation Advice for *Potorous tridactylus trisulcatus* (Southern Long-nosed Potoroo). Canberra: Department of Agriculture, Water and the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/86367-conservation-advice-02032022.pdf. In effect under the EPBC Act from 02-Mar-2022
- Department of Environment and Primary Industries (DEPI) (2013) Action Statement No. 254, Long-nosed Potoroo *Potorous tridactylus - Flora and Fauna Guarantee Act 1988*
- Barwon Water Alliance (2010). Ecological Assessment with preliminary Net Gain – Aireys Inlet WRP Southern Drain Upgrade. Unpublished report
- Ecology Australia (2003). Aireys Inlet Sewage Treatment Plant: Flora and Fauna Assessment. Unpublished report prepared for Barwon Water
- Palmer, G (2019). Wildlife of the Otways and Shipwreck Coast
- Aerial imagery of the offset site

2.2 Survey methods

2.2.1 Review of survey techniques

A review was undertaken of the Conservation Advice and Action Statements (and references within) and other sources for the Long-nosed Potoroo. The main aim of the review was to understand the most appropriate survey methods to detect the species and appropriate survey effort.

The following documents were also considered when determining appropriate survey techniques and effort:

- Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) (2011) Survey Guidelines for Australia's Threatened Mammals
- Department of Sustainability and Environment (DSE) Approved Survey Standards: Long-footed Potoroo Potorous longipes, Date: 2 May 2011. Version 1.0
- Frankham, Greta & Reed, Robert & Fletcher, Terry & Handasyde, Kathrine. (2011). Population ecology of the long-nosed potoroo (*Potorous tridactylus*) on French Island, Victoria. Australian Mammalogy. 33. 10.1071/AM10051

– Robley, A., Moloney, P.D. and Le Duc, E. (2022). Glenelg Ark—2020 monitoring and evaluation update. Arthur Rylah Institute for Environmental Research Technical Report Series No. 340. Department of Environment, Land, Water and Planning, Heidelberg, Victoria
– Robley, A., Moloney, P., Stringer, L. and Donald, S. (2020) Glenelg Ark 2005–2019: Long-term predator and native mammal response to predator control. Arthur Rylah Institute for Environmental Research Technical Report Series. Department of Environment and Primary Industries, Heidelberg, Victoria
– Robley, A., Gormley A., Triggs, B., Albert, R., Bowd, M., Hatfield. C., McDonald, R., Rowe, C., Scott, K., and Smith, A. (2014) Glenelg Ark 2005–2013: Evidence of the Benefits for Native Mammals of Sustained Fox Control. Arthur Rylah Institute for Environmental Research Technical Report Series. Department of Environment and Primary Industries, Heidelberg, Victoria
– Stevens, M., Rudolph, G., Christian, F., and Frey, S. (2010). Pilot survey for Long-nosed Potoroo and Southern Brown Bandicoot using remote camera in the Grampians National Park, February to April 2009. Field Report 3. Unpublished

The following sections outline the survey approach and targeted field survey methods used to detect Long-nosed Potoroo within the offset site.

2.2.2 Survey approach

Survey methods and effort were informed by information sources listed in section 2.2.1, but also required consideration of project timelines and safety requirements (e.g. bushfire risks for animal trapping). Consequently, the methods did not strictly follow all advice offered in the reviewed resources (e.g hair-tubes and trapping surveys for Long-nosed Potoroo were not used).

DEPI 2013 noted that numerous surveys (cited within DEPI 2013) have targeted Long-nosed Potoroos or employed techniques that will detect potoroos including predator scat analysis, remote camera, hair tube and live trapping techniques. Older techniques, such as live trapping and predator scat analysis, have been replaced or supplemented successively by newer less-intrusive methods such as hair-tubing and remote cameras. The latter appears to be especially effective at detecting Long-nosed Potoroos (DEPI 2013). Survey programs for the Long-nosed Potoroo including the Land Conservation Council Regional surveys, forest block surveys, pre-logging coupe surveys, the monitoring programs associated with the Ark projects including Glenelg Ark (Robley et al 2022) and Grampians Ark have all successfully used remote cameras and or/hair-tubing. Survey guidelines developed by the DSEWPC (2011) recommend the following techniques: daytime searches for potentially suitable habitat resources and signs of activity (e.g. diggings); collection of predator scats; soil plot surveys for tracks and baited cameras. However, observers are cautioned that Long-nosed Potoroo diggings are usually indistinguishable in the field from those of sympatric species like bandicoots, where the Long-nosed Potoroo occurs in sympatry with other potoroo, bandicoot or small wallaby species, and where tracks cannot be distinguished, or may be difficult to distinguish between species (DSEWPC 2011). This survey used a combination of baited motion-sensing cameras, opportunistic surveys for predator scat and survey sign (e.g. tracks and digs) to determine the species' occurrence within the offset site.

The survey was undertaken over two periods:

– GHD Senior Ecologist [redacted] and Barwon Water Project Manager [redacted] – 3 March 2023. Camera deployment and habitat assessment
– GHD Senior Ecologist [redacted] and GHD Senior Botanist [redacted] – 28 March 2023. Camera retrieval, habitat and vegetation assessment.

All work was completed under the following permits:

– *Wildlife Act 1975* Management and Research Authorisation (Permit #10009413)
– Parks Victoria permit (number 10009148)
– Animal Ethics Scientific Procedures Fieldwork Licence GHD SPFL20067

A summary of survey methods, timing and effort is presented in Table 1.

Table 1 Summary of survey methods, timing and effort

Method	Location - site number (Figure 3 reference)	Timing and effort	Survey adequacy
Camera trap	C 1- 9	8 sites for 25 consecutive days (3-28/03/2023)	Suitable survey technique for detecting the Long-nosed Potoroo (DEPI 2013, DEWHA 2011, Stevens et al 2010, Robley et al various dates). *Summary of survey effort outcomes for offset site* Camera location c1 – technical issues no fauna images captured 8 sites for 200 survey-nights/ approximately 1 camera per 3.7 ha Long-nosed Potoroo was recorded at 5 of the 9 sites and for 24 of the 25 survey days.
Habitat assessment	H 1 - 9	Nine sites –habitat assessment (2.2.5), corresponding with each camera location	Daytime searches for suitable habitat is an accepted method for all species (DEPI 2013, DEWHA 2011). *Summary of survey effort outcomes for offset site* Many diggings were recorded however were likely a combination of species including echidna wallaby and/or Long-nosed Potoroo. Searching for sign for the Long-nosed Potoroo (e.g. digs) can be problematic as diggings are usually indistinguishable from other similar species therefore should not be used as primary method or only method.
Vegetation Quality Assessment (VQA)	HZ 1 – 5	Five sites – flora and vegetation assessment (2.4). One Two representative assessment in each of the dominant Ecological Vegetation Classes (EVCs) and one representative assessment in the linear riparian EVC	Vegetation Quality Assessment (VQA) methods in accordance with the: *Native vegetation: sustaining a living landscape. Vegetation Quality Assessment Manual-Guidelines for applying the habitat hectares scoring method, Version 1.3* (DSE 2004).

2.2.3 Camera survey

Nine motion-activated camera traps were deployed for 25 days to target native ground mammals during March 2023. Cameras were attached to a log, branch or nearest tree at 100 cm – 150 cm above the ground (Plate 1). A lure of truffle infused olive oil, peanut butter and rolled oats was secured to the ground in a small, ventilated container and tea strainer 2-3 m in front of the camera. Additional oil was dripped onto the ground below the lure. Cameras were set to take three images and a 15 second video per trigger.

One infrared camera model was used (Best Guard IR). All cameras are weatherproof, encased in an integrated hard plastic cover. Each camera takes colour images by daylight, and automatically adjusts to take black and white images at night and in low light conditions. For images in darkness or low light, the camera has an infrared 10 m flash rather than white flash. Image resolution was 10-15 MB per image. Camera sensitivity was set to ‘moderate’ (not ‘high’, not ‘low’). The photographs and videos were downloaded from each camera and reviewed for the presence of target species.

Plate 1 Camera trap locations c10 (top photos) and c2 (bottom photos) within offset site. Note bait attached to log

2.2.4 Habitat assessment

The habitat assessment included:

– Field survey of the habitats within the offset site to determine extent and occurrence of habitat for the Long-nosed Potoroo including the documentation of sign (e.g. diggings) and suitable refuge and breeding habitat (e.g. dense understorey vegetation).
– Brief assessment of habitat type and quality at nearby 'off site' locations with historical records for the Long-nosed Potoroo.
– Brief assessment of habitat quality and extent for the Gang-gang Cockatoo and Yellow-bellied Glider including record of key habitat elements (e.g. tall trees, feed species (trees and shrubs) rough and smooth-barked Eucalyptus, hollow-bearing trees and connectivity of site.
– Review of existing vegetation mapping and alignment with the species' habitat requirements following field surveys.

The daytime field habitat assessment involved two ecologists walking along all tracks and traversing the bush (see track log Figure 4) to assess and map fauna habitat favourable for the target species. The assessment also assisted with identifying some of the potential locations to focus targeted camera survey effort.

This method was used so that habitat assessments were relatively standardised and repeatable, with the ability to extrapolate likelihood of species' presence in other areas of similar EVC and condition, particularly when the species was not detected following the use of targeted survey methods.

2.3 Flora and vegetation

The aim of the vegetation assessment was to determine the types and extent of native vegetation across the site and habitat condition in relation to the threatened fauna species, (Long-nosed Potoroo) and to identify threats to the vegetation quality of the site.

The flora assessment involved the evaluation of remnant patches of native vegetation, non-native vegetation and scattered trees in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP 2017). The assessment included undertaking a Vegetation Quality Assessment (VQA), mapping the extent and condition of native vegetation within the offset site, including:

– Defining and mapping the relevant EVCs
– Mapping and measuring Canopy Trees that meet the benchmark to be considered Large Trees
– Compiling an inventory of native and non-native flora, together with their conservation status and origin
– Identifying significant weed species including those declared under relevant state and national legislation, policy or strategy, e.g. *Catchment and Land Protection Act 1994* (CaLP Act) and National Weeds Strategy

The site was traversed on foot and the DEECA 2005 EVC layer was ground-truthed and the EVC boundaries across the site were updated. Due to the contiguous nature of the vegetation condition at the site, plots were established (between 0.35 and 0.56 ha in size) to undertake the Vegetation Quality Assessments that could be used to extrapolate out vegetation condition across the site. Five plots were surveyed across the site, within representative areas of Shrubby Foothill Forest (EVC 45), Lowland Forest (EVC 16) and Sedgy Riparian Woodland (EVC 198) (Figure 5).

2.4 Nomenclature and conservation status

2.4.1 Flora

Common and scientific names for plants follow the Victorian Biodiversity Atlas (VBA) (Version 3.2.8).

Conservation status was determined in accordance with the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act).

Native vegetation is defined in the Victoria Planning Provisions as 'plants that are indigenous to Victoria, including trees, shrubs, herbs and grasses'. For the purpose of the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP 2017), native vegetation is classified into two categories, a **Patch** of vegetation or a **Scattered Tree**:

– A **Patch** of native vegetation is either:
  - An area of native vegetation where at least 25% of the total perennial understorey plant cover is native
  - Any area with three or more native canopy trees where the drip line of each tree touches the drip line of at least one other tree, forming a continuous canopy
  - Any mapped wetland included in the Current wetlands map (available on DELWP online mapping tools)
– A **Scattered tree** is a native canopy tree that does not form part of a patch

Other forms of vegetation include:

– **Planted native vegetation**, i.e. includes non-indigenous native species and areas of revegetation
– **Scattered native plants**, i.e. patches of vegetation dominated by introduced species where less than 25% of the total perennial understorey plant cover is native
– **Non-native vegetation**, i.e. vegetation that comprises entirely introduced flora

2.4.2 Vegetation communities

Native vegetation in Victoria is mapped in units known as Ecological Vegetation Classes (EVCs). EVCs are described according to a combination of floristic, life form and ecological characteristics, and through an inferred fidelity to particular environmental attributes.

Each EVC occurs under a common regime of ecological processes within a given biogeographic range, and may contain multiple floristic communities.

Other vegetation types that may occur in Victoria include vegetation communities listed as threatened under the EPBC Act and/or the FFG Act. These have separate vegetation classification systems, each of which is also separate to the EVC classification system. As such, any single patch of native vegetation occurring within the subject site (or anywhere in Victoria) will be classifiable as a particular EVC, and may also be separately classified as a different threatened ecological community under the EPBC Act, and/or as another vegetation community under the FFG Act.

2.4.3 Fauna species and fauna communities

Unless otherwise noted, common and scientific names for fauna follow the VBA database (Version 3.2.8).

The conservation significance of fauna was determined in accordance with the EPBC Act and the Victorian FFG Act. The EPBC Act and the FFG Act list a number of threatened fauna communities, at a national or state scale, respectively. Fauna communities known or potentially occurring within the study area are only considered if they are listed under either of these Acts.

2.4.4 Weeds

The loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants is a listed key threatening process under the EPBC Act. In addition, *Invasion of native vegetation by 'environmental weeds'*, is a listed potentially threatening process under the FFG Act.

During the field survey, a list of all flora species observed within the offset site was created. This includes environmental weeds, noxious weeds listed under the *Catchment and Land Protection Act 1994* (CaLP Act) and Weeds of National Significance (WoNS). All such weed species are listed in Appendix B-3.

BATSON

BATSON TRACK

DISTILLERY CREEK

C1-H1

C2-H2

C3-H3

C9-H9

C6-H6

C8-H8

C7-H7

C5-H5

C4-H4

Aireys Inlet Water Reclamation Plant

Legend

- Roads
- Watercourse
- Offset site boundary - buffered 6 m from the property boundary
- Property boundary
- Current wetland
- Water area
- Parcel
- Great Otway National Park
- Barwon Water Blue Gum plantation
- Long-nosed Potoroo record
- Camera location

Pest animals

- Deer - unknown species
- Fox
- Fox or dog

Weed species

- Bluebell creeper
- Boneseed
- Pampas grass

Paper Size ISO A3

0 25 50 75 100

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

Barwon Water
Colac Pipeline Upgrade Offset Strategy

Fauna survey methods and results
Weeds and pest animals

Project No. 3137032
Revision No. C
Date 6/06/2023

FIGURE 3

3. Survey results

3.1 Offset site overview

The proposed offset site is on land owned by Barwon Water, part of which is an active sewage treatment plant. There is approximately 29.5 ha of native vegetation remaining intact within the proposed offset site (Plate 2 and Plate 3). The proposed offset site is surrounded by the Great Otway National Park with the exception of a small earth quarry and the Barwon Water 20 ha Blue Gum Plantations located to the south off Distillery Creek Road (Figures 1 and 2).

Records of bushfires in the area suggest the last major fire to affect the offset site was in 2019 where a fuel reduction burn was undertaken. Prior to this, a bushfire (wild fire) was recorded in 2010 across the site[1].

There are no major barriers preventing the movement of fauna within the offset site despite two unsealed vehicle access tracks used by Parks Victoria and Barwon Water for management. Batsons Track is open to the public during the drier months (between March and October) and is accessed from Distillery Creek Road to the south and from No.2 Road north of the offset site (Figure 1 and 2). There was evidence of use of the tracks by both mountain bike and trail bike riders. Trail bike riders have appeared to push access through the vegetation around both entrance points to Batsons Track.

There are no major barriers to the movement of fauna of any type including ground fauna in and out of the proposed offset site. A small section of the proposed offset site boundary shared with the water reclamation plant is fenced (approximately 600 m) which prevents the north-south movement of fauna, however the area is otherwise surrounded by reserve or vegetated area, apart from Distillery Creek Road.

Distillery Creek Road is frequently used by locals travelling between Aireys Inlet and Anglesea, and is a recreational road used mainly by mountain bikers, four-wheel drivers and trail bike riders to access other tracks in the area. Although only 4-5 m wide and well vegetated in the road reserve for its length, it may provide a barrier to the movement of some ground mammals (e.g. cleared gap to cross, with risk of vehicle strike and risk of predation).

Plate 2 Heathy Woodland (EVC48)

Plate 3 Lowland Forest (EVC 16)

[1] https://www.vvb.org.au/vvb_map.php

The Victorian Strategic Management Prospects (SMP)[2] is a spatially explicit tool that determines where and how cost-effective actions could make the biggest difference to the protection of Victorian species and communities. This SMP tool identifies the offset site as scoring 100 /100 for the benefit to Victorian biodiversity via permanent protection of the land. Through the use of modelled data, the SMP also identifies threats for an area; this offset site is at risk of Phytophthora, weeds, noisy miner, pig, deer, fox, cat and too frequent fire. The offset site is within the Victorian SMP Summary Area 669 – full details of the strategic opportunities and cost benefit analysis are shown within the Summary Area SMP Output Summary (Appendix B-2).

3.2 Desktop review summary

There are 41 records of the Long-nosed Potoroo within the study area (ALA and VBA 2022). The nearest historical record for the species is approximately 1.4 km south-west opposite the junction of Loves Track and Iron Bark Drive, off Distillery Creek Road from 2018. More recently Parks Victoria detected Long-nosed Potoroo approximately 4.5 km west of the site during spring of 2022 using camera traps near the entrance of Duck Ponds track, just off Bambra Road (pers comm [redacted], Ranger West Coast District, Parks Victoria). This record like all records within 5 kms of the offset site is within continuous habitat connect to the proposed offset site. Figure 4 displays VBA and ALA records for all fauna species of MNES and Long-nosed Potoroo within the study area.

The Long-nosed Potoroo (SE mainland) is listed as Vulnerable under the EPBC Act. The distribution of Long-nosed Potoroos (SE mainland) has been well documented through trapping surveys and observations. Throughout New South Wales and Victoria, land clearing for agriculture and urbanisation (especially near the coast) has caused the reduction and fragmentation of suitable habitat resulting in isolated populations of the southern long-nosed potoroo (Seebeck 1981; Johnston 2008; Woinarski *et al*. 2014, cited in DAWE 2022).

In Victoria the Long-nosed Potoroo (SE Mainland) occurs in six discrete regions (Seebeck 1981), including the South-western region, Grampians, Otways, Western Port, Wilsons Promontory and east Gippsland. The six populations occur within a range of habitats from dense heathy woodland and coastal woodland to open forests, typically dominated by eucalypts.

Within the Otways region, fossil records and remains indicate the Long-nosed Potoroo (SE Mainland) was originally distributed at Mount Hamilton, Swains Cave, Mount Porndon, Three Mile Beach, and south of Nullawarre. Modern distributions include Naringal East, Ecklin South, Glenfyne, Jancourt, Timboon, Peterborough, the Parker River inlet, Aire Valley, Turtons Track, Benwerrin, Barwon Downs, Hordern Vale, Gellibrand River, Charleys Creek, Lorne and Aireys Inlet. The species has been sighted also at Gervoc, Bullahaare, the Simpson Heytesbury district, Crayfish Bay, Blanket Bay and Moonlight Head.

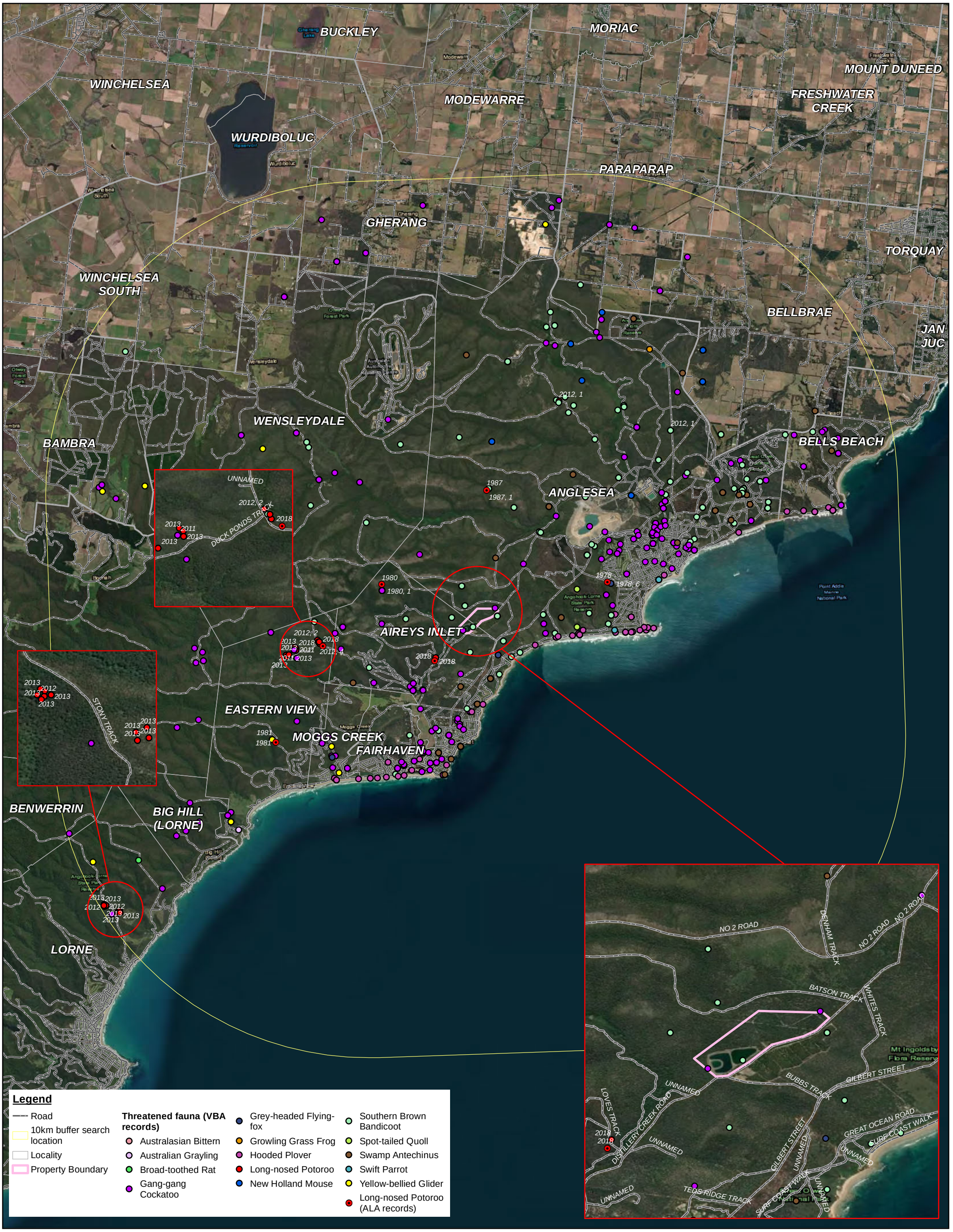
The species is omnivorous, with the most significant food source (30–90 percent of the diet) is sporocarps of hypogeal fungi (i.e. fruit bodies of underground fungi) (Claridge et al. 1993; Claridge & Cork 1994, cited in DAWE 2022). Other food sources include, feeding on fruits, seeds, leaves, roots and flowers, and invertebrates (Bennett & Baxter 1989, cited in DAWE 2022).

The species exhibits small home ranges (0.19 km^2 for females and 1 km^2 for males; Johnson 1987; Frankham et al. 2011; Woinarski et al. 2014; Lewis 2015; Gaborov 2017, cited in DAWE 2022). Habitat patch size is important. In Victoria, the southern long-nosed potoroo was present in habitat patches 0.1 km^2 in size and occurrence increased in larger patch sizes up to 1 km^2 (Bennett 1990ab, cited in DAWE 2022)

The limited dispersal capability (6–8 km for males) (Frankham *et al*. 2014, 2016) and the ongoing disappearance of small subpopulations progressively place the survival of the southern Long-nosed Potoroo subspecies at risk. In protected areas, properties may not change, but fragmentation within the habitat can still impact the southern Long-nosed Potoroo. The creation and maintenance of roads and tracks may also enhance access by predators (e.g., foxes) and result in road deaths (Martin & Temple-Smith 2012, cited in DAWE 2022).

[2] https://www.environment.vic.gov.au/biodiversity/choosing-actions-for-nature/how-to-use-strategic-management-prospects

Potoroids, as a group, have the highest percentage (61.9 percent) of extinct and threatened species of any family of mammals in Australia (Woinarski *et al*. 2014). Key threats include habitat loss and fragmentation; predation by invasive species, particularly European red foxes and feral cats; inappropriate fire regimes; and habitat degradation (due to, for example, forestry activities, livestock, feral herbivores, weeds). The species' preferred food source (underground fungi) is at risk from additional threats, including decreasing annual precipitation, consumption by native and feral species, and forest dieback from either *Phytophthora cinnamomi*, myrtle rust (*Austropuccinia psidii*) (DAWE 2022). Threats can operate synergistically and be cumulative, e.g., inappropriate fire management can result in loss of refugial habitats, loss of shallow subsurface food resources, and increased exposure to predation (Robley et al 2016).



Paper Size ISO A3

0 0.5 1 1.5 2 2.5 3

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

Barwon Water
Colac Pipeline
EPBC Self-Assessment

MNES within search area

Project No. 3137032
Revision No. C
Date 6/06/2023

FIGURE 4

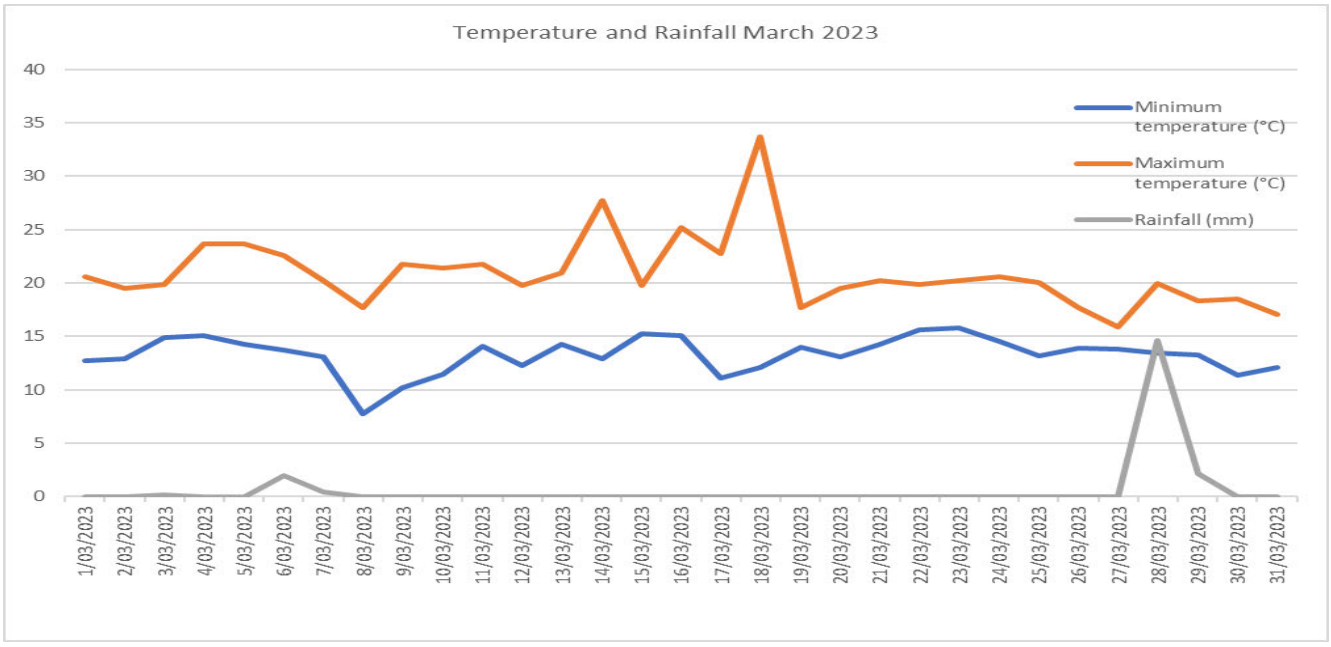
3.3 Fauna survey results

3.3.1 Summary of fauna species recorded and survey conditions

During the survey, 74 fauna species were identified at the site from a combination of targeted and opportunistic surveys, including 68 native species (14 mammals, 49 birds, three amphibian and two reptiles) and six non-native species (see Appendix B-1).

No significant or adverse weather was recorded during the survey period. A brief summary of the weather conditions taken from field observations and Bureau of Meteorology (Aireys Inlet March 2023 - Graph 1) is provided below:

– 3 March 2023 – mild to warm temperatures with occasional low to moderate wind gusts. Survey conditions generally suitable with no barriers to detection (e.g. heavy rainfall or wind) experienced.
– 28 March 2023 – mild to warm temperatures with occasional low to moderate wind gusts. Survey conditions generally suitable with no barriers to detection (e.g. heavy rainfall or wind) experienced. Heavy rainfall followed the recovery of cameras.



Graph 1 ***Temperature and Rainfall during survey period (source BOM, Aireys Inlet March 2023)***

3.3.2 Camera survey results

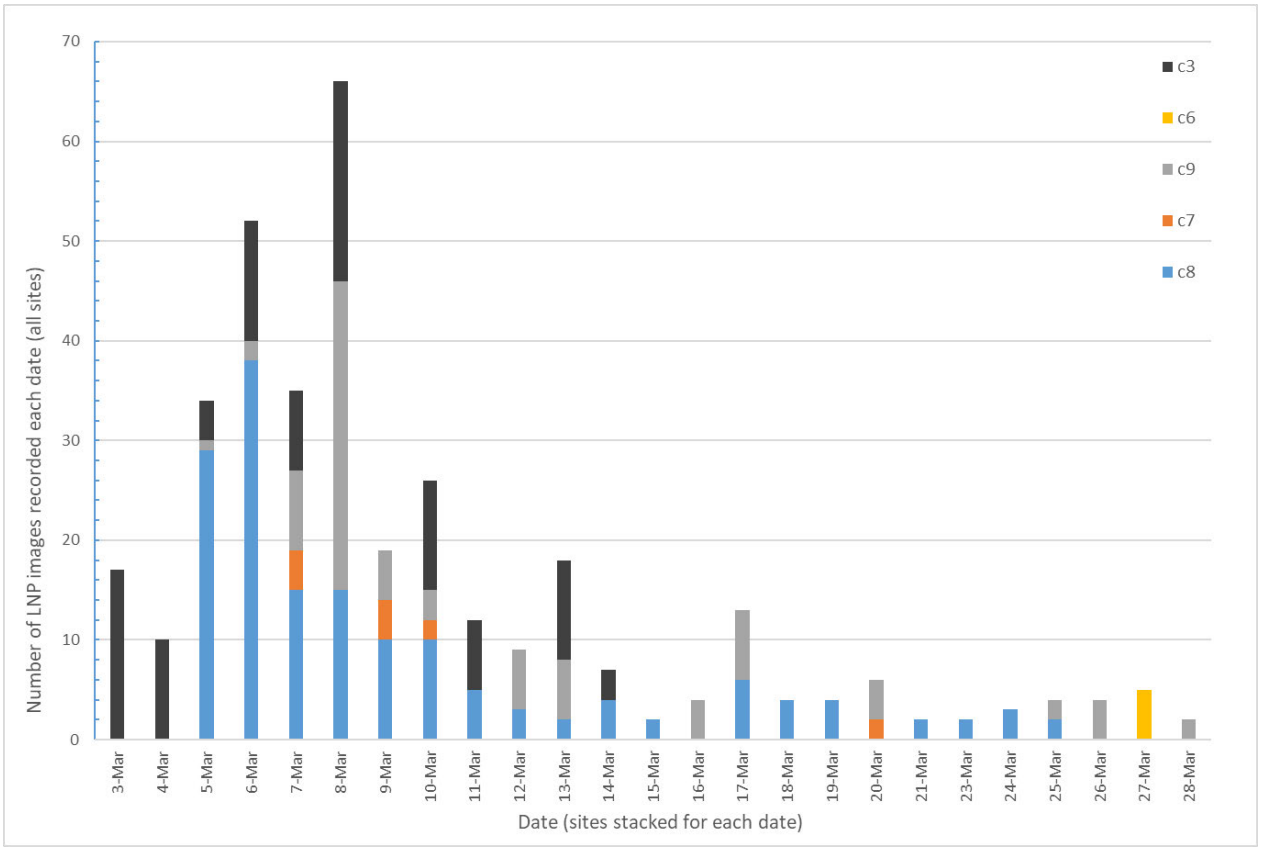
A total of 2875 images (still and video) were taken from cameras across the eight sites. The majority of the images (at least 88%; n= 2534) were confirmed to be triggered by fauna movements. All cameras apart from the one at location 5 performed well with no technical issues reported. Up to 21 fauna species were identified from camera images and video (Table 2) including seven birds, one reptile and up to 13 mammals. Most images of fauna could be identified to species. Small mammals (e.g. possible antechinus) were challenging, because of their small size and rapid movements, and not all individuals could be confidently identified to species. Figure 3 displays camera locations. Appendix B-4 displays images of fauna recorded during camera surveys within the offsets site.

The Long-nosed Potoroo was recorded at five sites and in 360 images (Table 2 and Graph 2). The species was recorded on 24 of the 25 survey dates (Graph 2). Based on the distance between each camera location, multiple individuals in some images and the time/date of the images, at least three and possibly four Long-nosed Potoroo individuals were recorded within the proposed offset site. Graph 3 displays the number of Long-nosed Potoroo images recorded for each hour of the day (all sites and dates combined) during the survey period. The species was most active during the night and interestingly also active (although to a lesser extent) during the hours before sunset and after sunrise. Plates 4 and 5 display images of the Long-nosed Potoroo captured from within the offset site during the survey.

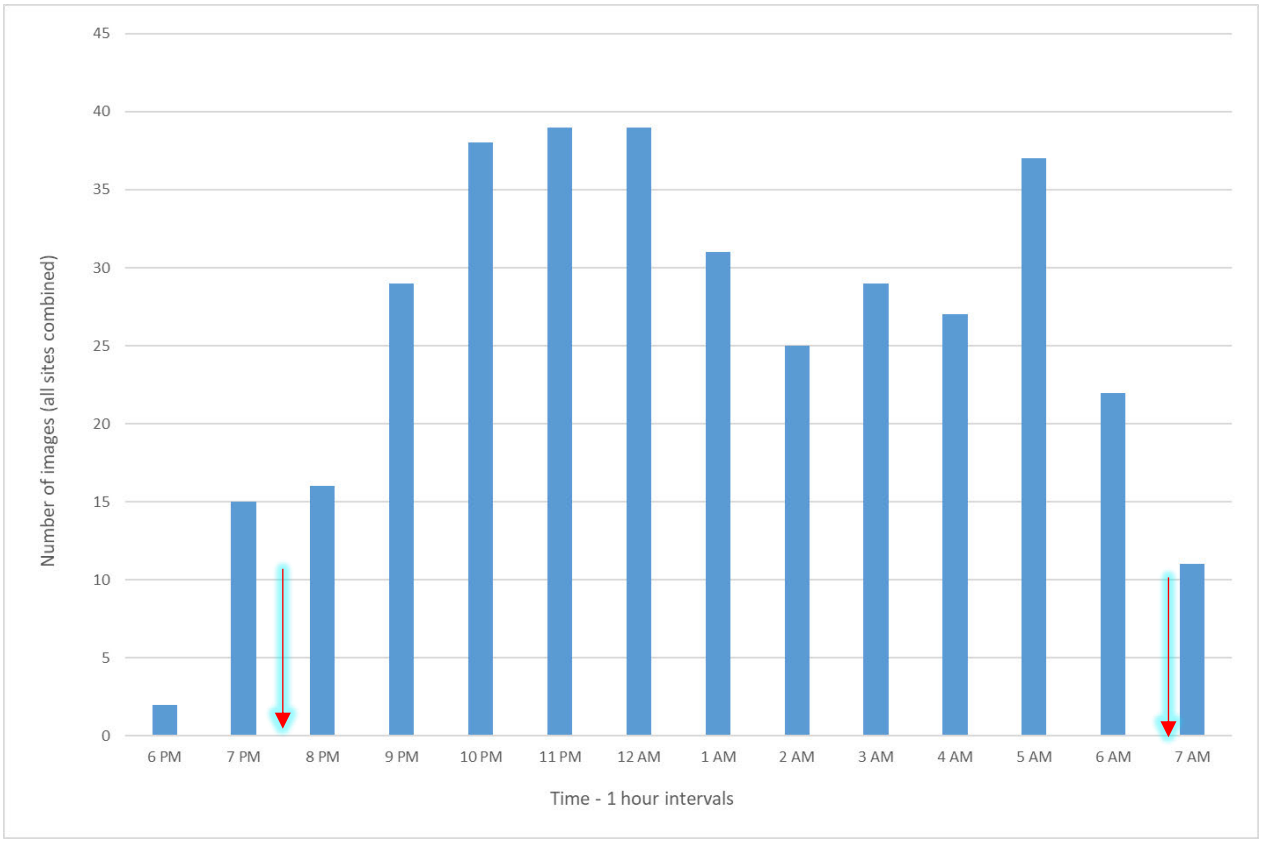
Table 2 Summary of camera image results for each site

Species/observations	c4	c7	c2	c9	c6	c5	c3	c8	Total
Agile Antechinus	3								3
Black Rat	7				6		4		17
Black Rat possible							7		7
Brown Thornbill						1	1		2
Bush Rat	32						23		55
Bush Rat possible	1						3		4
Cat	2	6					4		12
Common Bronzewing				1					1
Eastern Grey Kangaroo	8				2				10
Echidna		4	4	14	1		7	2	32
Echidna and Brown Thornbill (possible)							2		2
Echidna, Eastern Yellow Robin, Brown Thornbill (possible)							3		3
Grey Butcherbird			2						2
Grey Shrike-thrush	8			1					9
Long-nosed Bandicoot		2							2
Long-nosed Potoroo		**12**		**85**	**5**		**102**	**156**	**360**
Long-nosed Potoroo - possible				2					2
Pied Currawong					2				2
Red-necked Wallaby	1				24			9	34
Rodent species- possible	2						6		8
Skink sp.							1		1
Small mammal rodent/antechinus/dunnart sp.	4						2		6
Superb Fairy-wren								4	4
Swamp wallaby	81	322	147	205	98	499	180	417	1949
Wallaby species		2		1					3
Animal - indistinguishable	2					5	6		13
Total	151	348	153	309	138	505	351	588	2543

Table note * - introduced species. Location c1 – no data recorded.



Graph 2 Number of Long-nosed Potoroo images recorded each day of the survey each site. Note – no images of LNP recorded 22/3/23



Graph 3 Number of Long-nosed Potoroo images recorded within the offset site each hour for the duration of the survey (all sites combined) – red arrow indicates approximate sunset and sunrise time for survey period

Plate 4 Camera trap location c8 (top photo) and c3 (bottom still image) displaying two Long-nosed Potoroo - bottom image taken from video of two Long-nosed Potoroo foraging including digging around the base of the bait holder

Plate 5 Camera trap location c9 (top photo – 7:44 am 8/3/23) and c3 (bottom still image -7:26 pm 11/3/23) displaying Long-nosed Potoroo (bottom image taken from video of Long-nosed Potoroo foraging)

3.3.3 Observations of other fauna and fauna sign

Three locations with conical diggings (near C3, C7 and C9 – Figure 3) were recorded within the offset site during the survey. The diggings in this area could be made by the common Long-nosed Bandicoot (*Perameles nasuta*) or the endangered EPBC and FFG Act listed Southern Brown Bandicoot (*Isoodon obesulus obesulus*). The Long-nosed Bandicoot was recorded via camera trap during the survey.

The Rufous Bristlebird (*Dasyornis broadbenti caryochorus* - vulnerable FFG Act) was heard calling from a location to the north of Distillery Creek Road approximately 250 m east of the offset site during the survey (opposite White Track). It is possible that this species frequents the offsite site.

The Gang-Gang Cockatoo was heard off site during the survey calling from vegetation west of Loves Track, along Distillery Creek approximately 1.4 km west of the site. The species was also recorded opportunistically nearby the site outside the survey period during April 2023. A pair (male and female) were recorded flying along Distillery Creek Road near the junction of No 2 Road toward the site, and the species was also observed flying over the pondages west toward Distillery Creek (north of Distillery Creek Road) (pers comm [redacted] April 2023). There are approximately 240 historical records for the species within the study area including 24 records within 5 km and two records on site/or within 50 m of the site from 2011 and 2003 (VBA 2023 – refer Figure 4).

3.4 Vegetation and habitat assessment

3.4.1 Flora species

The VBA and PMST have records of 1570 flora from within the study area (10 km radius of the offset site). These records include 1146 native species, 385 introduced species, and 39 species that are native but non-indigenous to the area. During the field assessment, 82 flora species were identified, including 76 native species and six introduced species (Appendix B-3).

3.4.2 Habitat and Vegetation (EVC) types

Remnant native vegetation in the study area has been mapped by DEECA at a scale of 1:25,000. The 2005 EVC mapping indicates that three EVCs are modelled within the offset site:

– Sedgy Riparian Woodland (EVC 198), depleted in the OtP bioregion
– Heathy Woodland (EVC 48), least concern in the OtP bioregion
– Lowland Forest (EVC 16), depleted in the OtP bioregion

A high level vegetation survey was undertaken as part of this habitat assessment to identify the different types of vegetation present at the proposed offset site. During the field assessment, all three EVCs modelled as occurring by DEECA were identified at the offset site.

In areas mapped as Lowland Forest (EVC 16) during the field assessment, there were some characteristics of Heathy Woodland (EVC 48) present. Therefore, it is considered that the patches of Lowland Forest at the site display some ecotonal variance with Heathy Woodland. For the purpose, of this assessment of fauna habitat types, the area mapped as Lowland Forest (EVC 16) align predominantly with the DEECA modelled boundary for this EVC at the site, and patches of this EVC were assessed against the Lowland Forest benchmark for the Otway Plains Bioregion. A more detailed vegetation mapping assessment was undertaken by ABZECO for the preparation of the Offset Management Plan, the results of which are incorporated within that report (ABZECO 2023).

A description of each EVC as it occurred within the offset site is outlined below in Table 3. Figure 5 shows the location of each EVC mapped during the field assessment. The habitat hectare scores are provided within the Table 4.

Table 3 Vegetation type and description

Vegetation type and description	Key habitat characteristics for targeted species	Characteristic Photographs
Lowland Forest (EVC 16) **15.8 ha** The Habitat Zones 1 and 2 had a mature canopy of *Eucalyptus baxteri* (Brown Stringybark), *Eucalyptus obliqua* (Messmate Stringybark) to 16 m tall, which included large trees. The midstorey contained a range of shrubs and grass trees, including; *Acacia verticillata* subsp. *verticillata* (Prickly Moses), *Acacia suaveolens* (Sweet Wattle), *Banksia marginata* (Silver Banksia), *Leptospermum continentale* (Prickly Tea-tree) and *Xanthorrhoea australis (*Austral Grass-tree). The understorey included a variety of short and prostrate shrubs, herbs and grasses, *Amperea xiphoclada* var. *xiphoclada* (Broom Spurge), *Isopogon ceratophyllus* (Horny Cone-bush), *Lomandra filiformis* (Wattle Mat-rush), *Platylobium obtusangulum* (Common Flat-pea), *Pteridium esculentum* subsp. *esculentum* (Austral Bracken), *Tetratheca ciliata* (Pink-bells) and *Tetrarrhena distichophylla* (Hairy Rice-grass). Both Habitat Zone 1 and 2 had logs present, with Habitat Zone 2 having large logs present. Weed cover in both Habitat Zones was less than 5%.	***Long-nosed potoroo*** - This haitat type was associated with lower slopes, and along some drainage lines. Soils were sandy/loam - Species was recorded from one location within this habitat type - This habitat appeared longer unburnt (>3 years) than EVC 48 consisting of a moderate to desne understorey / shrub layer provides good cover for the species. - The habitat is continuous with other habitat types within the offset site and surrounding area ***Gang-gang Cockatoo*** - This habitat types includes known foarging species *E. obliqua and E. baxteri* and a variety of native shrubs including a variety of Acacia species - Predominantly moderate to moderately dense dense tree canopy - Potential hollows at suitable height above ground and entrance diameter were recorded (see Plates 6 and 7)	 

Vegetation type and description	Key habitat characteristics for targeted species	Characteristic Photographs
Heathy Woodland (EVC 48) **16 ha** The Habitat Zones 3 and 5 had a mature canopy of *Eucalyptus baxteri* (Brown Stringybark) and *Eucalyptus obliqua* (Messmate Stringybark) to 8 m tall, which included large trees. The midstorey was less diverse than Lowland Forest EVC 16 with only; *Acacia myrtifolia* (Myrtle Wattle), *Leptospermum scoparium* (Manuka) and *Xanthorrhoea australis (*Austral Grass-tree). The understorey included a high diversity of short and prostrate shrubs, herbs and grasses, *Amperea xiphoclada* var. *xiphoclada* (Broom Spurge), *Acrotriche serrulata* (Honey-pots), *Banksia marginata* (Silver Banksia), *Epacris impressa* (Common Heath), *Goodenia lanata* (Trailing Goodenia), *Gonocarpus tetragynus* (Common Raspwort), *Isopogon ceratophyllus* (Horny Cone-bush), *Lomandra filiformis* (Wattle Mat-rush), *Pimelea humilis* (Common Rice-flower), *Platylobium obtusangulum* (Common Flat-pea), *Rytidosperma setaceum* (Bristly Wallaby-grass), *Tetratheca ciliata* (Pink-bells) *Tetrarrhena distichophylla* (Hairy Rice-grass) and *Viola* sp. (Violet). Both Habitat Zone 3 and 5 had logs present, with Habitat Zone 3 having large logs present. Weed cover in both Habitat Zones was less than 5%.	***Long-nosed potoroo*** - This haitat type was associated with hill slope and hill top areas, generally of higher elevation that the other habitat types. Soils apperaed mostly sandy to sandy/loam - Species was recorded from three locations within this habitat type - The habitat displays recent signs of burn (2-3 years), particulalry the area around c6-h6 (Figure 3) however a sometimes sparse to predominantly moderate to dense understorey / shrub layer provides good cover for the species. - The habitat is continuous with other habitat types within the offset site and surrounding area ***Gang-gang Cockatoo*** - This habitat types includes known foarging species *E. obliqua and E. baxteri* and a variety of native shrubs including a variety of Acacia species - Sparse to predominantly moderately tree canopy - Potential hollows at suitable height above ground and entrance diameter were recorded (see Plates 6 and 7)	 

Vegetation type and description	Key habitat characteristics for targeted species	Characteristic Photographs
Sedgy Riparian Woodland (EVC 198) **0.7 ha** Habitat Zone 4 existed along drainage lines within the offset site. In some locations ephemeral wetlands were orbserved within the Sedgy Riparian Woodland EVC 198, with a canopy of *Eucalyptus baxter*i s.l. (Brown Stringybark) and *Eucalyptus obliqua (*Messmate Stringybark) along it's fringes. The midstorey was very dense and dominated by *Acacia verticillata* subsp. verticillata (Prickly Moses) and *Leptospermum continentale* (Prickly Tea-tree), with *Gahnia radula* (Thatch Saw-sedge), *Lepidosperma laterale* (Variable Sword-sedge) and *Persoonia juniperina* (Prickly Geebung). This habitat zone did not contain any large trees, or large logs, however small logs were present.. Weed cover was less than 5% across the EVC.	***Long-nosed potoroo*** - This haitat type was associated with low elevation and drainage lines. Soils were sandy/loam often with a higher organic content than other sites, possibly due to it being longer unburnt - Species was recorded from one location within this habitat type - This habitat appeared longer unburnt (>3 years) than the other EVCs possibly because it was located along a draiage line, hence allowed for faster regrowth or alternatively a less intense burn due to higher moisture in ground. - This EVC consist of a moderate to dense understorey / shrub layer provides good cover for the species. - The habitat is continuous with other habitat types within the offset site and surrounding area ***Gang-gang Cockatoo*** - This habitat types includes known foarging species *E. obliqua and E. baxteri* and a variety of native shrubs including a variety of Acacia species	

Table 4 Vegetation Quality Assessment for the EVCs present at the proposed offset site

Habitat Zone			HZ 1	HZ 2	HZ3	HZ4	HZ5
Bioregion			Otway Plain	Otway Plain	Otway Plain	Otway Plain	Otway Plain
EVC #			**16**	**16**	**48**	**198**	**48**
EVC Name			**Lowland Forest**	**Lowland Forest**	**Heathy Woodland**	**Sedgy Riparian Woodland**	**Heathy Woodland**
		Max Score	**Score**				
Site condition	Large Trees	10	9	8	10	0	3
	Tree Canopy Cover	5	5	5	5	4	5
	Lack of Weeds	15	15	15	15	15	15
	Understory	25	20	15	20	10	20
	Recruitment	10	10	6	6	3	6
	Organic Litter	5	5	5	5	5	5
	Logs	5	5	4	5	2	4
	Standardiser	1	1	1	1	1	1
	Total Site Score	75	69	58	66	39	58
Landscape value	Patch Size	10	8	8	8	8	8
	Neighbourhood	10	7	7	7	7	7
	Distance to Core	5	4	4	4	4	4
Habitat Score			**88**	**77**	**85**	**58**	**77**
Habitat points = #/100			**0.88**	**0.77**	**0.85**	**0.58**	**0.77**

3.4.3 Large trees

During the GHD field assessments for this report and the field assessments completed by ABZECO for the preparation of the Offset Management Plan a total of 50 large trees were recorded. These trees met the minimum diameter at breast height (DBH) as outlined in the respective EVC benchmark.

Large trees are shown in Figure 5 and photos of the examples of potential hollows recorded within the large trees are shown in Plate 6 and Plate 7.

Plate 6 Example of hollow-bearing trees recorded with site. Photo to left displays tree – photo to right displays zoomed in hollow. Top photos – E. baxteri or E. obliqua. Bottom photos historically burnt E. baxteri or E. obliqua. Note recent chew marks around rim of hollow indicating usage

Plate 7. Example of hollow-bearing E. baxteri or E. obliqua recorded with site. Photo to left displays tree – photo to right displays zoomed in hollow.

3.4.4 Threatened species and communities

Database searches for the study area identified that threated species and communities are known or likely to occur within the study area:

3.4.4.1 Species

Seventy- nine threatened species of flora have been previously recorded or are predicted to occur within the study area:

– A total of 19 species listed under the EPBC Act
– A total of 75 species listed as threatened under the FFG Act

Additional listed flora may occur within the study area for which there are currently no local records on the VBA or PMST databases. No threatened species were recorded within the offset site at the time of this assessment.

In addition to threatened flora, another 17 species listed as protected under the FFG Act were recorded during the field assessment (Appendix B-3). This includes species from the Protected families of *Asteraceae, Epacridaceae* and *Orchidaceae* along with genera from *Acacia, Stylidium,* and *Xanthorrhoea.*

3.4.4.2 Threatened ecological communities

EPBC Act-listed communities

The PMST predicted five EPBC Act Threatened Ecological Communities as may or likely to occur within the study area:

– *Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community* - Endangered
– *Subtropical and Temperate Coastal Saltmarsh* - Vulnerable
– *Giant Kelp Marine Forests of South East Australia* - Endangered
– *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* Critically - Endangered
– *Natural Damp Grassland of the Victorian Coastal Plains* Critically - Endangered

The offset site is not on the open coast or within a saltmarsh, therefore the potential presence of the first three TECs can be discounted at the proposed offset site.

The *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* can be synonymous with Valley Grassy Forest, Plains Grassy Woodland and Grassy Woodland EVCs which were not recorded on the offset site. Additionally, no key species required to meet the description *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* were recorded within the offset site.

Natural Damp Grassland of the Victorian Coastal Plains is defined as vegetation subsisting of a tussock forming grassland with a sparse coverage of trees and shrubs over 1 m tall. No patches of vegetation at the site were consistent with this vegetation type.

Therefore, no EPBC Act listed TEC were recorded or are likely to occur within the offset site.

FFG Act-listed communities

Under the FFG Act 42 vegetation and fauna habitat communities are listed as threatened. No threatened communities were recorded or are likely to occur within the offset site.

BATSON

DISTILLERY CREEK

BATSON TRACK

Aireys Inlet Water Reclamation Plant

DISTILLERY CREEK

DISTILLERY CREEK

UNNAMED

Legend

- Roads
- Watercourse
- Offset site boundary - buffered 6 m from the property boundary
- Property boundary
- Current wetland
- Water area
- Great Otway National Park
- Barwon Water Blue Gum plantation
- Parcel

EVCs

- 16 - Lowland Forest
- 48 - Heathy Woodland
- 198 - Sedgy Riparian Woodland
- Large tree

Paper Size ISO A3

0 30 60 90 120

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

Barwon Water
Colac Pipeline Upgrade Offset Strategy

Vegetation and habitat mapping

Project No. 3137032
Revision No. D
Date 6/06/2023

FIGURE 5

3.5 Threats

Threats to an offset site are usually physical, either from feral (pest) animals, invasive plant species, disease or from land clearing. However, all threats can result in a decrease of vegetation quality at the offset site that would negatively affect threatened species. Feral animals can cause land degradation by promoting soil erosion, stream turbidity and the spread of weeds, and can threaten the persistence of native plants and animals through competition, habitat destruction and predation. They also have the potential to act as reservoirs for diseases that affect native wildlife.

3.5.1 Feral animal species

Four feral animals were recorded within the offset property during the surveys (see Figure 3):

– Cat (*Felis catus*) – at least two individuals, possibly three recorded from locations c4, c7 and c3. See plate 8.

– European Red Fox (*Vulpes vulpes*) – recorded from tracks and scat within the offset site. A fox was also sighted crossing Distillery Creek Road whilst driving to the offset site.

– Deer - unknown deer species were recorded from tracks from within the offset site. Deer including Fallow are regularly sighted in the local area (pers comm [redacted]

– European Rabbit (*Oryctolagus cuniculus)* – observed along Distillery Creek Road and possible scat and digs recorded near boundary of the offset site.

Plate 8. Images of feral cats within offset site – camera locations clockwise c4, c7, c3 (c7 and c3 also recorded Long-nosed Potoroo)

3.5.2 Domestic animals

Dog tracks were recorded from within the offset site, indicating that people/dogs use the tracks within the offset site for walking/recreation. The tracks were identified as domestic dog given the size of the track (twice as large as a fox) and accompanying human footprints in parallel with the dog track indicating the dog was walking with the person.

3.5.3 Weeds and pathogens

Of the six species considered introduced, one (*Chrysanthemoides monilifera* Boneseed) is listed under the *Catchment and Land Protection Act 1985* (CALP Act) as a controlled weed and is also listed as a Weed of National Significance (WoNS).

Within the offset site, the transects determined that weeds were more common and abundant within proximity to the edge of the patch of native vegetation and along the tracks.

Weed infestations pose a significant threat to native vegetation, in particular the above species can easily smother recruitment and therefore decrease the ability of the EVC to recruit and sustain canopy cover. These species also outcompete many understorey species reducing the biodiversity and strata composition of the EVC. Many weeds can also provide habitat to pest animals.

Pathogens such as *Phytophthora cinnamomi* move through native vegetation and selectively affect species susceptible to the pathogen. *Phytophthora cinnamomi* was observed in the offset site at the time of this assessment (Plate 9 and Plate 10). *Phytophthora cinnamomi* is spread through soil, water or plant material movement. “Dieback caused by the root-rot fungus *Phytophthora cinnamomi’* is listed as a key threatening process under the EPBC Act. Detecting *Phytophthora cinnamomi* is difficult as it can lay dormant for long periods.

Plate 9 Phytophthora affected grass trees

Plate 10 Phytophthora affected grass tree

4. Summary of survey outcomes

Habitat assessments and targeted survey methods for the Long-nosed Potoroo were undertaken during March 2023 within the proposed offset site.

During the survey, 74 fauna species were identified at the site from a combination of targeted and opportunistic surveys, including 68 native species (14 mammals, 49 birds, three amphibian and two reptiles) and six non-native species.

The Long-nosed Potoroo was recorded using camera traps; 360 images were obtained across five sites on 24 of the 25 survey days (all sites combined). Based on the distance between each camera location and the time/date of the images, at least three and possibly four Long-nosed Potoroo individuals were recorded within the proposed offset site. The species was most active during the night and to a lesser extent during the hours before sunset and after sunrise. Given the number and frequency of records it appears that one or more of the individuals recorded are resident within the offset site.

Three EVC/ habitat types are present within the offset site, providing high quality habitat for the Long-nosed Potoroo, including largely continuous moderate to dense understorey / shrublayer. There are no major barriers preventing the movement of the fauna within the offset site or in and out of the proposed offset site. A small section of the proposed offset site boundary shared with the water reclamation plant is fenced (approximately 600 m) which prevents the north-south movement of fauna, however the area is otherwise surrounding by reserve or vegetated area, apart from Distillery Creek Road.

The habitat present within the proposed offset site also provides habitat to other species including Long-nosed Bandicoot (*Perameles nasuta*), Rufous Bristlebird (*Dasyornis broadbenti caryochorus)* and Gang-gang Cockatoo (*Callocephalon fimbriatum)*.

Distillery Creek Road is frequently used by locals travelling between Aireys Inlet and Anglesea and is used for commuting and recreation. Although only 4-5 m wide and well vegetated in the road reserve for its length, it may provide a barrier to the movement of some ground mammals (e.g. cleared gap to cross, with risk of vehicle strike and risk of predation); however, this is not considered significant for the Long-nosed Potoroo.

Four feral animals were recorded within or nearby the offset site (Cat, Deer, Fox and Rabbit) and six weed species were recorded, including Boneseed and Bluebell Creeper – both recognised as significant environmental weeds. Within the offset site, vegetation transects determined that weeds were more common and abundant within proximity to the edge of the patch of native vegetation and along the tracks. The pathogen *Phytophthora cinnamomi* was observed in the offset site within grass trees.

5. References

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Appendices

Appendix B-1

Fauna species list

GHD survey – X = observed during survey, s = scat, C = in situ camera, ho = heard only, os = offsite within 500 m of offset site, digs = obvious scratching, soil disturbance, e.g. conical digs (likely created by bandicoots), tracks = animal tracks, * = introduced

Legislation

EPBC Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

FFG Victorian *Flora and Fauna Guarantee Act 1988*

Status of species

CR Critically Endangered, EN Endangered, VU Vulnerable

Taxa	Common Name	Scientific Name	EPBC status	FFG status	Offsets site/property
Amphibian	Common Froglet	*Crinia signifera*			ho
Amphibian	Southern Brown Tree Frog	*Litoria ewingii*			ho
Amphibian	Striped Marsh Frog	*Limnodynastes peronii*			ho os
Bird	Australian Hobby	*Falco longipennis*			os
Bird	Australian King-Parrot	*Alisterus scapularis*			x
Bird	Australian Magpie	*Gymnorhina tibicen*			x, C
Bird	Australian Raven	*Corvus coronoides*			x
Bird	Australian Wood Duck	*Chenonetta jubata*			os ponds
Bird	Black Swan	*Cygnus atratus*			os ponds
Bird	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*			x
Bird	Brown Thornbill	*Acanthiza pusilla*			x
Bird	Brown-headed Honeyeater	*Melithreptus brevirostris*			x
Bird	Chestnut Teal	*Anas castanea*			os ponds
Bird	Common Blackbird	*Turdus merula**			x
Bird	Common Bronzewing	*Phaps chalcoptera*			x
Bird	Crimson Rosella	*Platycercus elegans*			x
Bird	Eastern Shrike-tit	*Falcunculus frontatus*			x
Bird	Eastern Spinebill	*Acanthorhynchus tenuirostris*			x
Bird	Eastern Yellow Robin	*Eopsaltria australis*			x, C
Bird	Eurasian Coot	*Fulica atra*			os ponds
Bird	Fan-tailed Cuckoo	*Cacomantis flabelliformis*			x
Bird	Forest Raven	*Corvus tasmanicus*			x
Bird	Galah	*Cacatua (Eolophus) roseicapilla*			x
Bird	Gang-gang Cockatoo	*Callocephalon fimbriatum*	EN		x
Bird	Golden Whistler	*Pachycephala pectoralis*			x
Bird	Grey Butcherbird	*Cracticus torquatus*			x, C
Bird	Grey Currawong	*Strepera versicolor*			OS
Bird	Grey Fantail	*Rhipidura albiscapa*			x
Bird	Grey Shrike-thrush	*Colluricincla harmonica*			x, C

Taxa	Common Name	Scientific Name	EPBC status	FFG status	Offsets site/property
Bird	Hoary-headed Grebe	*Poliocephalus poliocephalus*			os ponds
Bird	Laughing Kookaburra	*Dacelo novaeguineae*			x
Bird	Magpie-lark	*Grallina cyanoleuca*			x
Bird	Masked Lapwing	*Vanellus miles*			os
Bird	Mistletoebird	*Dicaeum hirundinaceum*			x
Bird	New Holland Honeyeater	*Phylidonyris novaehollandiae*			x
Bird	Olive Whistler	*Pachycephala olivacea*			x
Bird	Pacific Black Duck	*Anas superciliosa*			os ponds
Bird	Pied Currawong	*Strepera graculina*			x
Bird	Red Wattlebird	*Anthochaera carunculata*			x
Bird	Rufous Bristlebird	*Dasyornis broadbenti caryochorus*		vu	Ho os – approx 250 north-east off Distillery Creek Road
Bird	Sacred Kingfisher	*Todiramphus sanctus*			Ho os
Bird	Satin Bowerbird	*Ptilonorhynchus violaceus*			x
Bird	Silvereye	*Zosterops lateralis*			x
Bird	Striated Pardalote	*Pardalotus striatus*			x
Bird	Sulphur-crested Cockatoo	*Cacatua galerita*			x
Bird	Superb Fairy-wren	*Malurus cyaneus*			x
Bird	Welcome Swallow	*Hirundo neoxena*			x
Bird	White-browed Scrubwren	*Sericornis frontalis*			x
Bird	White-eared Honeyeater	*Nesoptilotis leucotis*			x
Bird	White-naped Honeyeater	*Melithreptus lunatus*			x
Bird	White-throated Treecreeper	*Cormobates leucophaea*			x
Bird	Willie Wagtail	*Rhipidura leucophrys*			x
Bird	Yellow-faced Honeyeater	*Caligavis chrysops*			x
Bird	Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*			x
Mammal	Agile Antechinus	*Antechinus agilus*			C
Mammal	Common Brush-tailed Possum	*Trichosurus vulpecula*			s, C
Mammal	Eastern Grey Kangaroo	*Macropus giganteus*			x, C, s
Mammal	Antechinus	*Antechinus sp*			C, s
Mammal	Bush Rat	*Rattus fuscipes*			C
Mammal	House Mouse	*Mus musculus*			C
Mammal	Black Wallaby	*Wallabia bicolor*			x, C, s
Mammal	Black Rat	*Rattus rattus**			C
Mammal	Cat	*Felis catus**			C
Mammal	Deer - unknown species	*			s
Mammal	European Rabbit	*Oryctolagus cuniculus**			os
Mammal	Long-nosed Bandicoot	*Perameles nasuta*			C, digs

Taxa	Common Name	Scientific Name	EPBC status	FFG status	Offsets site/property
Mammal	Long-nosed Potoroo	*Potorous tridactylus trisulcatus*	Vu	vu	C
Mammal	Red-necked Wallaby	*Notamacropus rufogriseus banksianus*			C
Mammal	Common Ringtail Possum	*Pseudocheirus peregrinus*			C
Mammal	Red Fox	*Vulpes vulpes**			x, s
Mammal	Short-beaked Echidna	*Tachyglossus aculeatus*			C, s
Reptile	Blotched Blue-tongued Skink	*Tiliqua nigrolutea*			x
Reptile	Grass Skink	*Lampropholis guichenoti*			x

Appendix B-2

Summary area SMP Output

Summary Area SMP Output Summaries

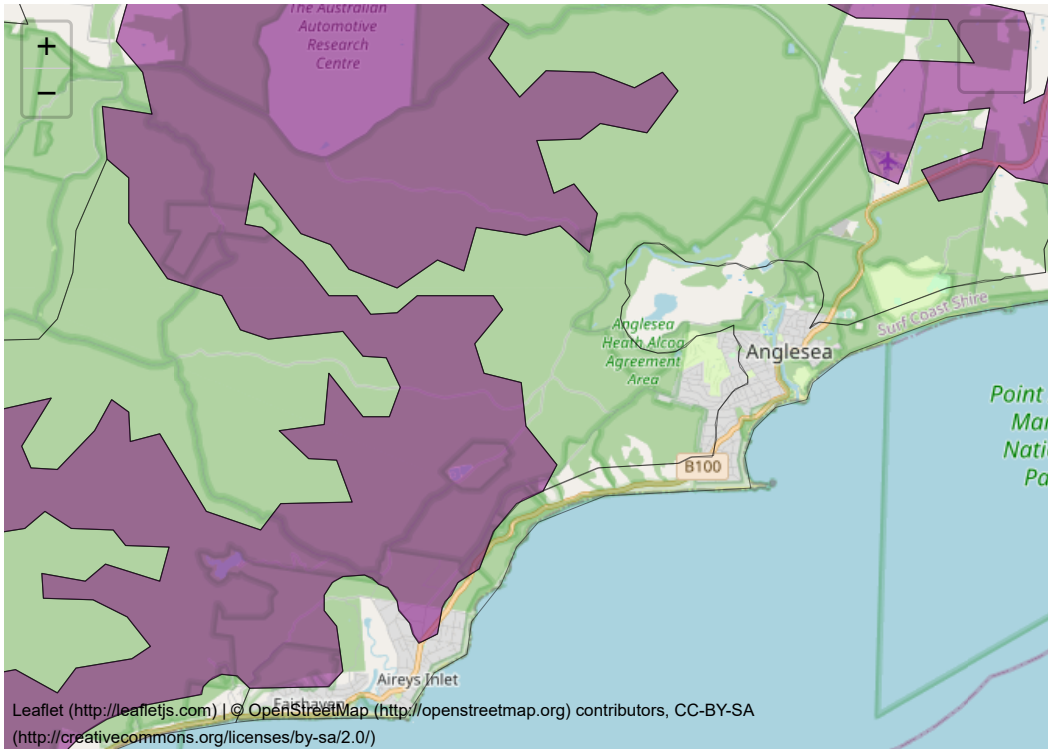
SMP v3.0 Report created on 17 October, 2021

Summary Area 669

This report shows the Strategic Management Prospects summary output for Summary Area 669. It is intended to be read in conjunction with the spatial NaturePrint outputs shown on NatureKit.

For more information, including further guides on how to interpret these outputs, head to the NaturePrint website: https://www.environment.vic.gov.au/biodiversity/natureprint (https://www.environment.vic.gov.au/biodiversity/natureprint). SMP layers, SMP Summary Area Reports and SMP Species Reports can be viewed live on NatureKit: https://naturekit.biodiversity.vic.gov.au/ (https://naturekit.biodiversity.vic.gov.au/)

Map of Summary Area



Summary Area information

This table provides some diagnostic information about the SMP Summary Area, including an overview of species that have potentially important habitat areas within the Summary Area polygon.

Polygon area	18969 Ha
Native veg. cover	66 %
Public land	57 %
Number of species with more than 5% of their Victorian range in polygon	0 Amphibians, 11 Plants, 0 Birds, 0 Mammals, 0 Reptiles
Species that have more than 50% of their Victorian range in polygon	
FFG listed species with more than 20% of their Victorian range in polygon	

Summary Area SMP Output Summaries

Action Cost-effectiveness and Benefit Ranks

Median and range of cost-effectiveness ranks and relative benefit ranks for actions within this Summary Area. Use this table to determine the most beneficial and most cost-effective actions in this Summary Area.

This table can also be viewed on NatureKit as a pop-up Results Table. To view the pop-up Results Table, click on the Summary Area to highlight it and then click on the first link in the Summary Area pop-up window.

The Integrated Cost-effectiveness (CE) Rank provides a state-wide comparison of the relative cost-effectiveness of different actions in specific locations. It can be used to identify actions that are expected to deliver relatively large net biodiversity benefits per unit cost. Biodiversity benefits are integrated across all species, with greater weight given to rare species and species with depleted populations or habitats. The Integrated CE Rank helps to identify actions that will collectively maximise the benefits to as many species as possible across the state, consistent with Protecting Victoria's Environment - Biodiversity 2037 (https://www.environment.vic.gov.au/biodiversity/biodiversity-plan (https://www.environment.vic.gov.au/biodiversity/biodiversity-plan)).

The Area in Top 20% and Top 5% of Integrated CE Ranks is the area (in hectares) within the Summary Area over which a particular action ranks among the top 20% or top 5% for cost-effectiveness across the state. These location-specific actions represent the most cost-effective actions to maximise biodiversity benefit across Victoria.

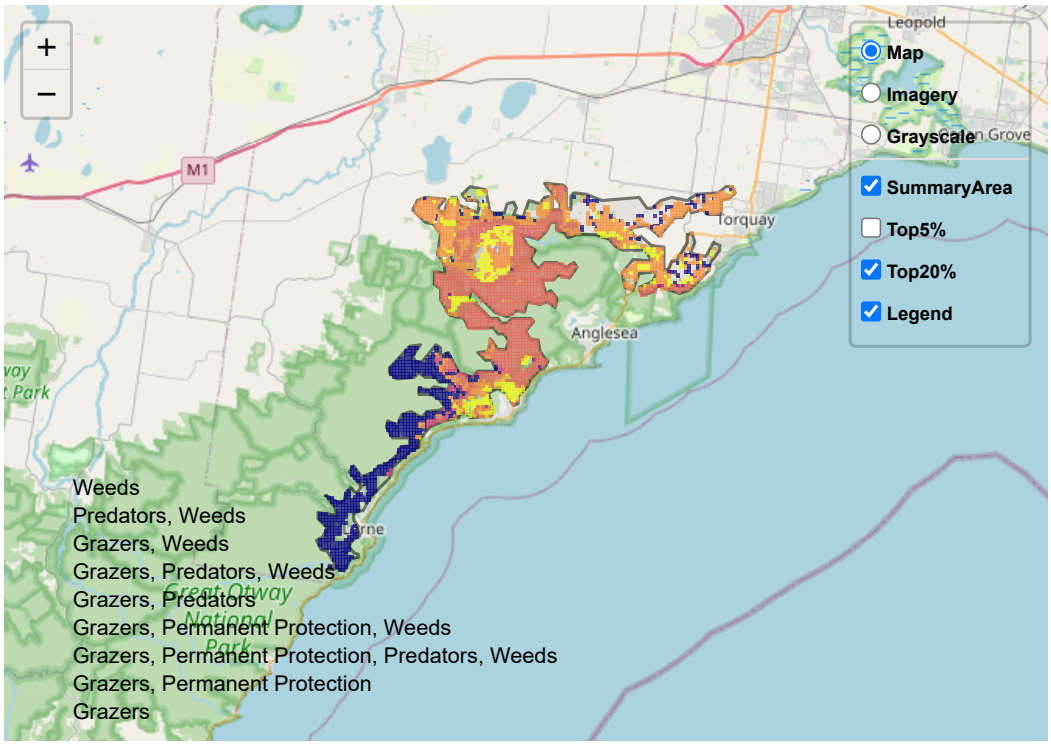
Column visibility | CSV

Action	Relevant Area	Median Cost-effectiveness Rank	Cost-effectiveness Range	Area in Top 5% (Ha)	Area in Top 20% (Ha)	Median Benefit Rank	Range of Benefits
Control Pigs	10277	99	1-100	9593	10272	94	1-100
Control Deer	10905	91	1-100	3463	8363	95	1-100
Control Weeds	18848	89	0-99	663	12464	93	0-100
Control Rabbits	5695	85	0-99	334	3716	55	0-100
Control Cats_Foxes_Pigs	10267	83	1-95	41	5690	96	1-100
Control Cats_Foxes	10895	77	0-95	30	4561	89	0-100
Control Cats_Foxes_Rabbits	248	73	48-94	0	71	90	40-100
Control Foxes	10905	69	0-94	0	2177	78	0-99
Control Cats	11978	68	0-94	0	2258	78	0-99
Control Pigs_Permanent Protection	238	61	13-96	10	30	92	54-99
Control Overabundant Kangaroos	7700	60	0-95	20	1387	63	0-100
Control Cats_Foxes_Pigs_Permanent Protection	238	58	15-86	0	15	95	46-100
Control Deer_Permanent Protection	294	57	13-90	0	20	94	48-99
Control Cats_Foxes_Permanent Protection	294	54	10-82	0	5	88	23-99
Control Grazing_Weeds	10626	51	0-99	101	1357	95	0-100
Control Foxes_Permanent Protection	294	49	9-74	0	0	78	15-98
Control Weeds_Permanent Protection	6703	47	0-90	0	61	93	0-100

Action	Relevant Area	Median Cost-effectiveness Rank	Cost-effectiveness Range	Area in Top 5% (Ha)	Area in Top 20% (Ha)	Median Benefit Rank	Range of Benefits
Control Grazing	10717	45	0-99	192	1276	88	0-100
Control Cats_Foxes_Rabbits_Permanent Protection	35	45	17-62	0	0	89	63-99
Control Grazing_Weeds_Permanent Protection	6703	41	0-87	0	35	96	0-100
Control Cats_Permanent Protection	1250	39	6-76	0	0	75	7-99
Control Grazing_Permanent Protection	6733	32	0-89	0	25	90	0-100
Control Rabbits_Permanent Protection	4065	27	0-84	0	5	64	0-100
Control Overabundant Kangaroos_Permanent Protection	4774	27	0-73	0	0	68	0-100
Ecological Burning	25	15	8-25	0	0	5	3-7
Ecological Burning_Permanent Protection	15	7	2-9	0	0	8	3-9

Integrated Cost-effective Actions Map

The map below shows where in the Summary Area the Integrated CE Actions are recommended. You can choose to show either the top 5% or 20% actions by checking the box in the top right corner. “Grazers” includes deer, domestic grazing, goats, horses, over-abundant kangaroos, pigs, rabbits and total grazing pressure. Hover over the coloured pixels on the map to see which actions and which specific grazers are relevant for each place. Use the purple SMP Individual Action Benefit-cost layers on NatureKit to see more detail about where to carry out the relevant actions in this Summary Area.

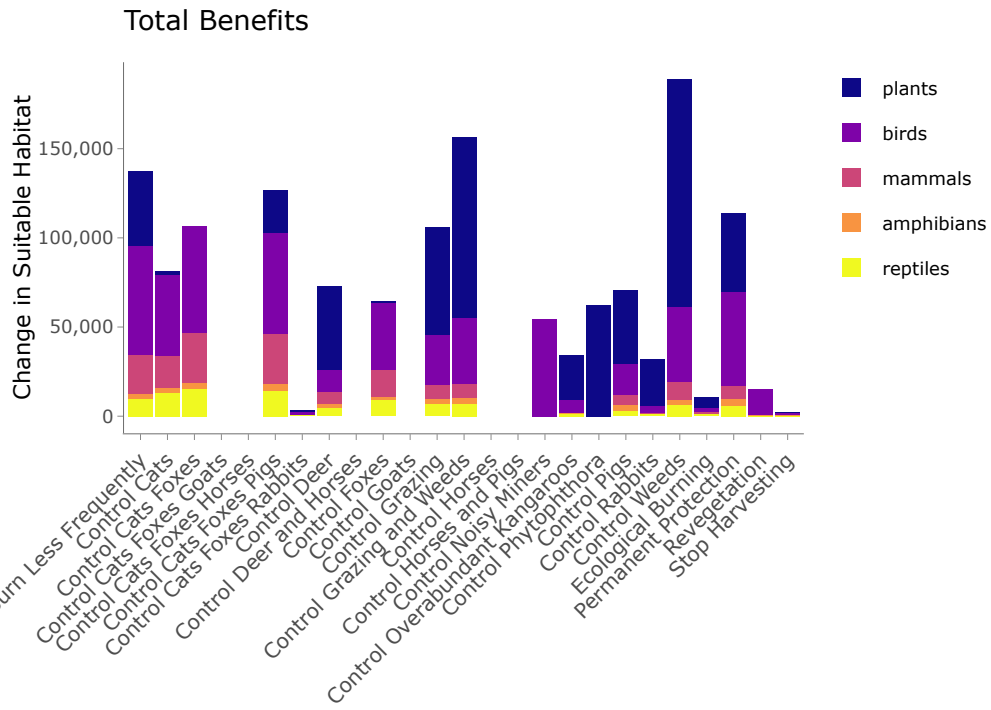


Total Benefits

Use the Total Benefits plot to see which actions will provide the highest relative biodiversity benefit for each taxonomic group in this Summary Area.

The plot shows how much benefit could be gained (summing over all species in the summary area) by undertaking each action. The benefit values (CSH) shown in the benefit bar plot assume that each action is undertaken wherever the corresponding threat is present within the polygon (or the action is relevant, e.g. all cleared areas are revegetated).

The x-axis of the benefit bar plot shows each of the actions in the SMP analysis, and the y-axis shows the Change in Suitable Habitat (CSH) available for each of the actions in the Summary Area. The y axis shows both the total benefit and how much each action benefits each taxonomic group.

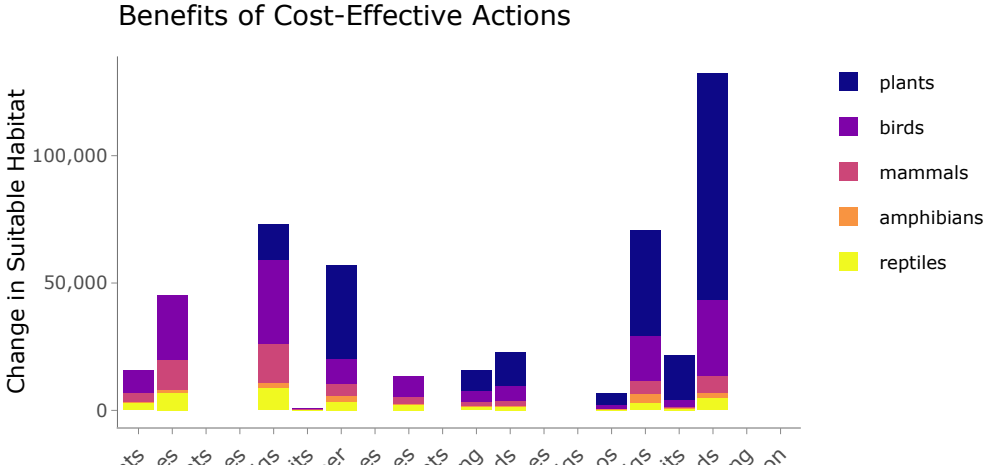


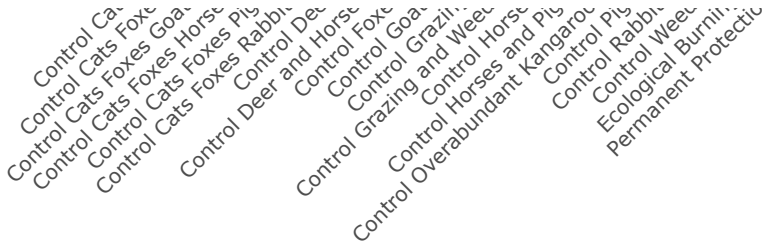
Benefits of the Top 20% of Cost-Effective Actions

Use the Benefits of Cost-Effective Actions plot to see which actions will provide the most cost-effective biodiversity benefits in this Summary Area.

The plot shows the potential amount of benefit from actions in this Summary Area that rank in the top 20% of cost-effective actions state-wide, which collectively benefit as many species as possible. The cost-effective action bar plot summarises the SMP Cost-effective Actions Maps. The benefit values (CSH) shown in this bar plot assume that the actions shown on the cost-effective actions map are undertaken in the locations specified.

The x-axis of the cost-effective actions bar plot shows each of the costed actions in the SMP analysis, and the y-axis shows the Change in Suitable Habitat (CSH) available for each of the actions in the Summary Area. The y axis shows both the total benefit and how much each action benefits each taxonomic group.





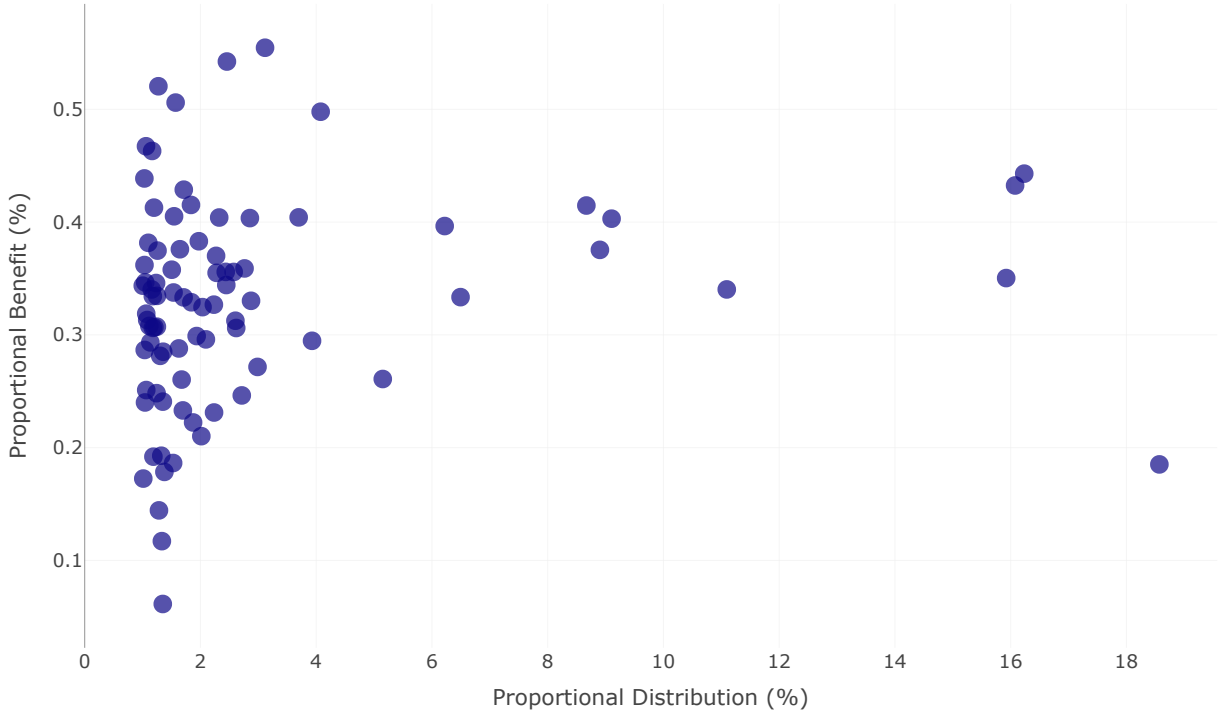
Scatterplot of Relative Benefit for Species of the most Cost-effective Actions in the Summary Area

This scatter plot provides a view of the relative benefit each species would receive from the most cost-effective actions in the polygon, plotted against the proportion of the species' state-wide distribution contained within the polygon (Proportional Distribution). Each dot represents a different species in the polygon. The y-axis shows the expected Change in Suitable Habitat (CSH) within the polygon, expressed as a proportion of the expected total suitable habitat in the polygon in the absence of any management action (i.e. the proportional increase in suitable habitat associated with the most cost-effective actions). For example, a value of 0.5 would suggest that, over time, the cost-effective management regime would yield a 50% increase in suitable habitat (a combination of extent and condition) within the polygon, relative to no biodiversity management regime.

Use this plot to check if any species that are important to this area are missing out on benefits from the landscape-scale actions in SMP. Species in the bottom right of the plot may need further consideration or a Specific Needs analysis (see the NaturePrint webpage for more information about the Specific Needs approach).

To use this interactive plot: Hover over each of the dots on the scatter plot to find out more information about the species and which action provides the most benefit for it. Hover over the top right of the plot to view the toolbar to help manipulate the graph, including to zoom in and out. Click and drag the graph to pan over it or zoom in on a section. You can also toggle on or off each of the taxonomic groups by clicking on them in the legend.

Species with a Proportional Distribution of less than 1% are not included in this plot.



The SMP analysis identifies cost-effective combinations of actions that collectively benefit as many species as possible, especially species with restricted or depleted distributions. Species to the right of the plot have a higher proportion of their state-wide distribution within the polygon area, and are therefore more dependent on management within the polygon for their long-term persistence. Ideally, all species with high Proportional Distributions would get large benefits (increases in net habitat suitability) from the cost-effective set of actions (top right quadrant). If a species with high proportional representation is not expected to benefit from the cost-effective actions (lower right quadrant), that species may need more relevant management actions (Specific Needs analysis). Species in the top left of the plot can be thought of as getting collateral benefits from the cost-effective actions: those species benefit from the cost-effective actions, but they were not the primary reason for the selection of those actions.

Frequent Fuel Reduction Burning, Timber Harvesting, and Land Clearing

The table below lists the number of species in each taxa group and the individual FFG listed species which receive their highest benefit in the Summary Area from preventing habitat clearing, timber harvesting, and reducing the frequency of fuel reduction burns.

To check how much benefit the individual species receive from these actions and their Proportional Distribution in the Summary Area, see the Individual Species Benefit Table at the end of this report. We suggest downloading the .csv file, and then sorting by taxonomic group, then exploring the data for the relevant taxonomic group and species from the table or by plotting your own charts to find those species which receive the highest benefit from these actions.

Threat	Number per Taxa Group	FFG listed Species
Timber harvesting	0 Amphibians, 0 Birds, 0 Mammals, 0 Plants, 0 Reptiles	
Fuel reduction burns	1 Amphibians, 43 Birds, 12 Mammals, 105 Plants, 4 Reptiles	Eastern Great Egret, Magpie Goose, Grey Goshawk, Square-tailed Kite, Powerful Owl, Masked Owl, Red-tailed Black-Cockatoo, White-throated Needletail, Grey-headed Flying-fox, Astelia australiana, Lastreopsis hispida, Monotoca glauca, Pellaea nana, Nematolepis squamea subsp. squamea, Sticherus tener s.s.
Habitat clearing	6 Amphibians, 57 Birds, 2 Mammals, 33 Plants, 4 Reptiles	Little Egret, Black Falcon, Diamond Firetail, Asperula ambleia, Oxalis rubens, Pneumatopteris pennigera, Heterozostera nigricaulis, Common Bent-wing Bat (southern ssp.)

Total Action Indicative Costs in Summary Area

The table below shows the estimated annual Indicative Costs of each action or action combination used in SMP (reflecting the ‘net present’ cost over 50 years). These modelled Indicative Costs are not intended to be the same as actual project costs. SMP uses a standardised set of cost parameters (travel cost, opportunity costs, labour costs, equipment costs, etc) to enable comparison of the relative cost of different actions at the same location; or the same action across different locations. See the cost models (yellow/orange) on NatureKit - SMP Rasters>Individual Action Layers>[Action]>Cost [Action]. For more details about how SMP costs are modelled, see the Strategic Management Prospects Inputs information sheet at https://www.environment.vic.gov.au/biodiversity/natureprint (https://www.environment.vic.gov.au/biodiversity/natureprint)

Action	Total indicative annual cost ($)	Annual indicative cost per Ha ($)	Annual indicative cost for Top 20% of actions ($)
Control Cats	520724	41	92578
Control Cats Foxes	457954	39	177879
Control Cats Foxes Pigs	660752	60	341400
Control Cats Foxes Rabbits	22164	61	4331
Control Deer	34111	3	25089
Control Foxes	440883	38	82726
Control Grazing	4006716	353	450428
Control Grazing and Weeds	4243722	375	508875
Control Overabundant Kangaroos	43613	5	6935
Ecological Burning	891	35	0
Control Pigs	20458	2	20544
Control Rabbits	58057	9	33444
Control Weeds	504205	27	336528

If your project costs are similar or slightly less than the SMP indicative costs, then your project will be similarly or more cost-effective compared to the SMP estimates. If the project costs are significantly lower than SMP Indicative Costs, this could be because the project is benefiting from volunteers or cost-efficiencies such as the use of free vehicles or equipment. Otherwise, check that you have fully considered factors such as site preparation and ongoing management and are undertaking ‘best practice’ management.

If your project costs are significantly greater than the SMP Indicative Costs, then the project is less cost-effective than SMP estimated at this location. If there are other actions with similar Integrated CE Rank at this location, then it could be useful to reconsider which action/s will be most cost-effective. Revegetation and Permanent Protection are relatively expensive actions because the costs include opportunity costs from changed land use, the preparation and set-up costs, and the costs of managing the site against other threats (for example, ongoing weed and animal management to ensure that the biodiversity value of the habitat is achieved and maintained over 50 years).

Individual Species Benefits in the Summary Area

The following table shows the benefits of each action to each species in this polygon, measured as the Change in Suitable Habitat (CSH). Use this table to find out which species have the highest proportion of their distribution in this Summary Area and need to be looked after here as they are less likely to be looked after elsewhere. You can also check the benefit of actions for species of interest.

Also shown is the proportion of each species state-wide range contained within the polygon (Proportional Distribution) and the proportion of the polygon that is within the species' range (Habitat Extent). The Proportion of VBA Records shows the number of pixels in the polygon with VBA records relative the the total number of pixels state-wide with VBA records. The Total Benefit column shows the total benefit for each species if all actions are undertaken, measured in CSH. Use the 'Column Visibility' button to toggle different columns on and off, and the page numbers at the bottom of the table to look through the whole table. The table can be sorted according to the highest or lowest values in each column. To do this, click the arrows next to each column heading. To search for a particular species of interest, type in the species' name in the search bar. Use the .csv button to download a copy.

You can also use the Scatterplot in this Report, and the individual SMP Species Reports (available on NatureKit) to see if any species of interest are missing out on benefits from the SMP Landscape-scale management actions and may need Specific Needs analysis (see the NaturePrint webpage for more information about the Specific Needs approach).

Column visibility CSV **Search:**

Common_Name	Species_Name	Taxonomic Group	FFG Status	Proportional Distribution (%)	Habitat_Extent (% of polygon)	Proportion of VBA Records	Total_ (all a
Swamp Pelican-orchid	Corybas fordhamii	Plants	Endangered	18.57	11.04	0.0000	
Anglesea Leek-orchid	Prasophyllum aff. odoratum E	Plants		16.23	8.14	0.0000	
Heath Leek-orchid	Prasophyllum aff. odoratum F	Plants		16.08	5.06	0.0000	
Top Bog-sedge	Schoenus turbinatus	Plants	Vulnerable	15.92	20.46	0.3077	
Angahook Pink-fingers	Caladenia maritima	Plants	Critically Endangered	11.09	8.43	0.6667	
Clustered Lily	Thelionema umbellatum	Plants	Vulnerable	9.1	7.64	0.0000	
Large Plume-orchid	Pterostylis sp. aff. plumosa (Anglesea)	Plants	Critically Endangered	8.9	7.12	0.3000	
Slender Twist-rush	Caustis restiacea	Plants		8.67	2.3	0.0000	
Anglesea Grevillea	Grevillea infecunda	Plants	Endangered	6.49	11.27	0.6929	
Spreading Brachyloma	Brachyloma depressum	Plants	Endangered	6.22	8.39	0.0000	

Showing 1 to 10 of 2,162 entries Previous 1 2 3 4 5 … 217 Next

Glossary of Terms

Term	Definition
Benefit of CE actions relative to most beneficial action across full species range	The ratio of the total benefit a species would receive from all cost-effective actions across its full range (including areas outside of polygon), relative to the total benefit it would receive from the most beneficial actions for that species across its entire range. A value near one suggests that the cost-effective actions align with the most beneficial actions for that species across its full range. A value less than one suggests that the cost-effective actions differ from the most benefit actions for that species across some or all of its range.
Benefit of CE actions relative to most beneficial action in polygon	The ratio of benefit a species would receive from the most cost-effective actions in a polygon, relative to the most beneficial action for that species in the polygon. A value near one suggests that the set of cost-efficient actions in the polygon align with the most beneficial action for that species. A value less than one suggests that the cost-efficient actions in that polygon are different to the most beneficial actions for that species.
Change in Suitable Habitat (CSH)	A measure of the predicted increase in suitable habitat for a species as a result of sustained management regime, relative to no management actions being conducted. The measure considers the type, extent and configuration of habitat for a species, and the factors that might influence how much a species can make use of that habitat.
Cost-effectiveness	The expected net benefit of an action, or set of actions, per unit cost. In SMP, net benefit is estimated as the expected change in summed 50 year persistence probabilities across all species associated with an action. Persistence probabilities are approximated as species-specific functions of the total area of suitable habitat (or expected area of occupancy) for each species.
Cost-effective actions (CE actions)	The set of actions that are expected to have the greatest net benefit relative to cost, in a polygon.
FFG	Victorian Government Flora and Fauna Guarantees Act 1988
Indicative Cost	Relative costs of each action at each locations based on standard cost attributes (e.g. travel time, labour, accommodation, terrain, site accessibility, transaction costs equipment and material costs, project administration) to enable comparison between actions.
Integrated Cost-effectiveness Rank	The cost-effectiveness of a given set of actions in a particular location, ranked against the cost-effectiveness of all other actions at all other locations. The rank is expressed as a percentile from 1 (lowest) to 100 (highest).
Polygon/Summary Area	The defined area of interest for which the report is generated
Proportional Benefit	A measure of the proportional increase in suitable habitat a species is expected to receive under the most cost-effective action, or set of actions, in the polygon of interest, relative to no management actions being done.
Proportional Distribution	The proportion of a species state-wide range contained within the polygon of interest.
Total benefit (all actions)	The amount of benefit a species would receive, measured in Change in Suitable Habitat, if all actions were conducted in a polygon.
Total benefit of cost-effective actions	The amount of benefit a species would receive, measured in Change in Suitable Habitat, from the most cost-effective actions in a polygon.

Appendix B-3

Flora species list

Scientific Name	Common Name	FFG Status	Conservation Status
Native species			
Acacia longifolia subsp. *sophorae*	Coast Wattle		#
Acacia myrtifolia	Myrtle Wattle		
Acacia suaveolens	Sweet Wattle		
Acacia verticillata subsp. *verticillata*	Prickly Moses		
Acrotriche serrulata	Honey-pots		
Allocasuarina littoralis	Black Sheoak		
Allocasuarina misera	Slender Sheoak		
Amperea xiphoclada var. *xiphoclada*	Broom Spurge		
Apium prostratum subsp. *prostratum*	Sea Celery		
Asteraceae spp.	Composite		
Austrostipa rudis	Veined Spear-grass		
Austrostipa spp.	Spear Grass		
Banksia marginata	Silver Banksia		
Billardiera scandens s.l.	Common Apple-berry		
Bossiaea prostrata	Creeping Bossiaea		
Brunonia australis	Blue Pincushion		
Burchardia umbellata	Milkmaids		
Caladenia sp.	Caladenia		
Carex appressa	Tall Sedge		
Cassytha glabella	Slender Dodder-laurel		
Caustis flexuosa	Curly Wig		
Daviesia brevifolia	Leafless Bitter-pea		
Dianella revoluta s.l.	Black-anther Flax-lily		
Dillwynia glaberrima	Smooth Parrot-pea		
Epacris impressa	Common Heath		
Eucalyptus aromaphloia	Scentbark		
Eucalyptus baxteri s.l.	Brown Stringybark		
Eucalyptus obliqua	Messmate Stringybark		
Eucalyptus ovata subsp. *ovata*	Swamp Gum		
Euchiton involucratus s.l.	Common Cudweed		
Gahnia radula	Thatch Saw-sedge		
Gonocarpus tetragynus	Common Raspwort		
Goodenia lanata	Trailing Goodenia		
Goodenia ovata	Hop Goodenia		
Hakea ulicina	Furze Hakea		
Hibbertia riparia	Erect Guinea-flower		
Hibbertia sericea s.l.	Silky Guinea-flower		
Hypolaena fastigiata	Tassel Rope-rush		
Isolepis spp.	Club Sedge		

Scientific Name	Common Name	FFG Status	Conservation Status
Isopogon ceratophyllus	Horny Cone-bush		
Juncus spp.	Rush		
Kennedia prostrata	Running Postman		
Lagenophora sp.	Bottle Daisy		
Lepidosperma gunnii	Slender Sword-sedge		
Lepidosperma laterale	Variable Sword-sedge		
Leptospermum continentale	Prickly Tea-tree		
Leptospermum scoparium	Manuka		
Leucopogon virgatus	Common Beard-heath		
Lindsaea linearis	Screw Fern		
Lobelia gibbosa var. *gibbosa*			
Lomandra filiformis	Wattle Mat-rush		
Lomandra longifolia subsp. *longifolia*	Spiny-headed Mat-rush		
Lomandra multiflora subsp. *multiflora*	Many-flowered Mat-rush		
Lomatia ilicifolia	Holly Lomatia		
Microlaena stipoides var. *stipoides*	Weeping Grass		
Monotoca scoparia	Prickly Broom-heath		
Opercularia varia	Variable Stinkweed		
Persoonia juniperina	Prickly Geebung		
Pimelea humilis	Common Rice-flower		
Platylobium obtusangulum	Common Flat-pea		
Platylobium triangulare	Ivy Flat-pea		
Poa sieberiana	Grey Tussock-grass		
Poa spp.	Tussock Grass		
Pomaderris ferruginea	Rusty Pomaderris		
Pteridium esculentum subsp. *esculentum*	Austral Bracken		
Pultenaea scabra	Rough Bush-pea		
Rytidosperma setaceum	Bristly Wallaby-grass		
Rytidosperma spp.	Wallaby Grass		
Schoenus spp.	Bog Sedge		
Senecio spp.	Groundsel		
Stylidium spp.	Trigger Plant		
Tetrarrhena distichophylla	Hairy Rice-grass		
Tetratheca ciliata	Pink-bells		
Viola spp.	Violet		
Xanthorrhoea australis	Austral Grass-tree	P	
Xanthosia dissecta s.l.	Cut-leaf Xanthosia		
Introduced species			
Billardiera heterophylla	Bluebell Creeper		*
Centaurium spp.	Centaury		*

Scientific Name	Common Name	FFG Status	Conservation Status
Chrysanthemoides monilifera	Boneseed		*
Cortaderia selloana subsp. *selloana*	Pampas Grass		*
Hypochaeris radicata	Flatweed		*
Plantago coronopus	Buck's-horn Plantain		*

Appendix B-4

Long-nosed Potoroo and other fauna images

Image	Location and species
	C2 Swamp Wallaby adult and juvenile
	C2 Echidna
	C3 Long-nosed Potoroo

	C3 Long-nosed Potoroo
	C3 Long-nosed Potoroo and rodent (possible Black Rat)
	C4 Red-necked Wallaby

	C5 Swamp Wallaby
	C6 Long-nosed Potoroo
	C7 Long-nosed Potoroo

	C7 Long-nosed Potoroo
	C7 Long-nosed Bandicoot
	C8 Long-nosed Potoroo

	C8 Long-nosed Potoroo
	C8 Long-nosed Potoroo
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	C9 Long-nosed Potoroo

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	C9 Long-nosed Potoroo

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The Power of Commitment

Appendix C

Native vegetation removal report

Native vegetation removal report

This report provides information to support an application to remove, destroy or lop native vegetation in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation*. The report **is not an assessment by DELWP** of the proposed native vegetation removal. Native vegetation information and offset requirements have been determined using spatial data provided by the applicant or their consultant.

Date of issue: **30/04/2021**
Time of issue: **12:30 pm**

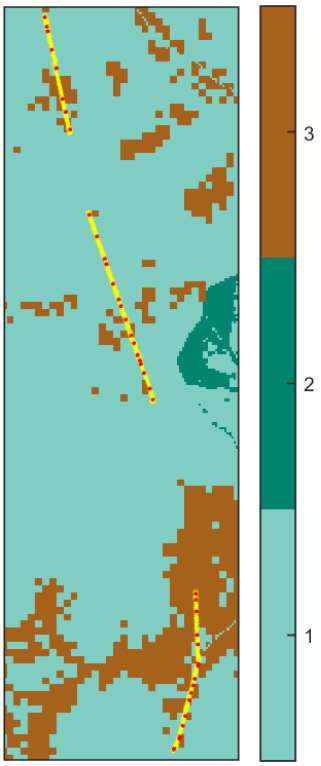
Report ID: GHD_2021_022_edit

Project ID	Colac_NVR_30Apr21

Assessment pathway

Assessment pathway	**Detailed Assessment Pathway**
Extent including past and proposed	9.012 ha
Extent of past removal	0.151 ha
Extent of proposed removal	8.860 ha
No. Large trees proposed to be removed	215
Location category of proposed removal	Location 3 The native vegetation is in an area where the removal of less than 0.5 hectares could have a significant impact on habitat for one or more rare or threatened species.

1. Location map



Total offset requirements if a permit is granted

Any approval granted will include a condition to obtain an offset that meets the following requirements:

Species offset amount[1]	6.083 species units of habitat for Spotted Hyacinth-orchid, *Dipodium pardalinum* 11.312 species units of habitat for Showy Lobelia, *Lobelia beaugleholei* 1.238 species units of habitat for Otway Bush-pea, *Pultenaea prolifera* 11.313 species units of habitat for Currant-wood, *Monotoca glauca* 3.091 species units of habitat for Scented Spider-orchid, *Caladenia fragrantissima* 11.312 species units of habitat for Small Sickle Greenhood, *Pterostylis lustra* 0.183 species units of habitat for Otways Cray, *Geocharax gracilis*
Large trees	215 trees

Offset requirements if a permit is granted: Stage 1

Any approval granted will include a condition to obtain an offset that meets the following requirements:

Species offset amount[1]	0.446 species units of habitat for Spotted Hyacinth-orchid, *Dipodium pardalinum* 5.679 species units of habitat for Showy Lobelia, *Lobelia beaugleholei* 1.238 species units of habitat for Otway Bush-pea, *Pultenaea prolifera* 5.680 species units of habitat for Currant-wood, *Monotoca glauca* 3.091 species units of habitat for Scented Spider-orchid, *Caladenia fragrantissima* 5.679 species units of habitat for Small Sickle Greenhood, *Pterostylis lustra*
Large trees	76 trees

Offset requirements if a permit is granted: Stage 2

Any approval granted will include a condition to obtain an offset that meets the following requirements:

Species offset amount[1]	5.637 species units of habitat for Spotted Hyacinth-orchid, *Dipodium pardalinum* 5.633 species units of habitat for Showy Lobelia, *Lobelia beaugleholei* 5.633 species units of habitat for Currant-wood, *Monotoca glauca* 5.633 species units of habitat for Small Sickle Greenhood, *Pterostylis lustra* 0.183 species units of habitat for Otways Cray, *Geocharax gracilis*
Large trees	139 trees

NB: values within tables in this document may not add to the totals shown above due to rounding

Appendix 1 includes information about the native vegetation to be removed

Appendix 2 includes information about the rare or threatened species mapped at the site.

Appendix 3 includes maps showing native vegetation to be removed and extracts of relevant species habitat importance maps

1 The species offset amount(s) required is the sum of all species habitat units in Appendix 1.

Next steps

Any proposal to remove native vegetation must meet the application requirements of the Detailed Assessment Pathway and it will be assessed under the Detailed Assessment Pathway.

If you wish to remove the mapped native vegetation you are required to apply for a permit from your local council. Council will refer your application to DELWP for assessment, as required. **This report is not a referral assessment by DELWP.**

This *Native vegetation removal report* must be submitted with your application for a permit to remove, destroy or lop native vegetation.

Refer to the *Guidelines for the removal, destruction or lopping of native* vegetation (the Guidelines) for a full list of application requirements This report provides information that meets the following application requirements:

- The assessment pathway and reason for the assessment pathway
- A description of the native vegetation to be removed (partly met)
- Maps showing the native vegetation and property (partly met)
- Information about the impacts on rare or threatened species.
- The offset requirements determined in accordance with section 5 of the Guidelines that apply if approval is granted to remove native vegetation.

Additional application requirements must be met including:

- Topographical and land information
- Recent dated photographs
- Details of past native vegetation removal
- An avoid and minimise statement
- A copy of any Property Vegetation Plan that applies
- A defendable space statement as applicable
- A statement about the Native Vegetation Precinct Plan as applicable
- A site assessment report including a habitat hectare assessment of any patches of native vegetation and details of trees
- An offset statement that explains that an offset has been identified and how it will be secured.

Authorised by the Victorian Government, 8 Nicholson Street, East Melbourne.

For more information contact the DELWP Customer Service Centre 136 186

www.delwp.vic.gov.au

Appendix 1: Description of native vegetation to be removed

The species-general offset test was applied to your proposal. This test determines if the proposed removal of native vegetation has a proportional impact on any rare or threatened species habitats above the species offset threshold. The threshold is set at 0.005 per cent of the mapped habitat value for a species. When the proportional impact is above the species offset threshold a species offset is required. This test is done for all species mapped at the site. Multiple species offsets will be required if the species offset threshold is exceeded for multiple species.

Where a zone requires species offset(s), the species habitat units for each species in that zone is calculated by the following equation in accordance with the Guidelines:

Species habitat units = extent x condition x species landscape factor x 2, where the species landscape factor = 0.5 + (habitat importance score/2)

The species offset amount(s) required is the sum of all species habitat units per zone

Where a zone does not require a species offset, the general habitat units in that zone is calculated by the following equation in accordance with the Guidelines:

General habitat units = extent x condition x general landscape factor x 1.5, where the general landscape factor = 0.5 + (strategic biodiversity value score/2)

The general offset amount required is the sum of all general habitat units per zone.

Native vegetation to be removed

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	**Type**	**BioEVC**	**BioEVC conservation status**	**Large tree(s)**	**Partial removal**	**Condition score**	**Polygon Extent**	**Extent without overlap**	**SBV score**	**HI score**	**Habitat units**	**Offset type**
77-B	Patch	otp_0016	Depleted	31	no	0.760	0.933	0.933	0.689	0.842	1.306	502733 Showy Lobelia *Lobelia beaugleholei*
										0.842	1.306	503859 Currant-wood *Monotoca glauca*
										0.273	1.305	504351 Scented Spider-orchid *Caladenia fragrantissima*
										0.273	1.305	504876 Small Sickle Greenhood *Pterostylis lustra*
78-B	Patch	otp_0048	Least Concern	5	no	0.600	0.425	0.425	0.610	0.836	0.468	502733 Showy Lobelia *Lobelia beaugleholei*
										0.836	0.468	503859 Currant-wood *Monotoca glauca*
										0.836	0.468	504351 Scented Spider-orchid *Caladenia fragrantissima*
										0.836	0.468	504876 Small Sickle Greenhood *Pterostylis lustra*
79-B	Patch	otp_0048	Least Concern	1	no	0.600	0.026	0.026	0.878	0.843	0.028	502733 Showy Lobelia *Lobelia beaugleholei*

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	**Type**	**BioEVC**	**BioEVC conservation status**	**Large tree(s)**	**Partial removal**	**Condition score**	**Polygon Extent**	**Extent without overlap**	**SBV score**	**HI score**	**Habitat units**	**Offset type**
										0.843	0.028	503859 Currant-wood *Monotoca glauca*
										0.843	0.028	504351 Scented Spider-orchid *Caladenia fragrantissima*
										0.843	0.028	504876 Small Sickle Greenhood *Pterostylis lustra*
80-B	Patch	otp_0008	Least Concern	0	no	0.761	0.032	0.032	0.910	0.840	0.044	502733 Showy Lobelia *Lobelia beaugleholei*
										0.840	0.044	503859 Currant-wood *Monotoca glauca*
										0.840	0.044	504351 Scented Spider-orchid *Caladenia fragrantissima*
										0.840	0.044	504876 Small Sickle Greenhood *Pterostylis lustra*
81-B	Patch	otp_0008	Least Concern	0	no	0.761	0.007	0.007	0.865	0.833	0.010	500324 Spotted Hyacinth-orchid *Dipodium pardalinum*
										0.833	0.010	502733 Showy Lobelia *Lobelia beaugleholei*
										0.833	0.010	503859 Currant-wood *Monotoca glauca*
										0.833	0.010	504351 Scented Spider-orchid *Caladenia fragrantissima*
										0.833	0.010	504876 Small Sickle Greenhood *Pterostylis lustra*
82-B	Patch	otp_0008	Least Concern	0	no	0.761	0.001	0.001	0.854	0.831	0.001	500324 Spotted Hyacinth-orchid *Dipodium pardalinum*
										0.831	0.001	502733 Showy Lobelia *Lobelia beaugleholei*
										0.831	0.001	503859 Currant-wood *Monotoca glauca*
										0.831	0.001	504351 Scented Spider-orchid *Caladenia fragrantissima*
										0.831	0.001	504876 Small Sickle Greenhood *Pterostylis lustra*

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	**Type**	**BioEVC**	**BioEVC conservation status**	**Large tree(s)**	**Partial removal**	**Condition score**	**Polygon Extent**	**Extent without overlap**	**SBV score**	**HI score**	**Habitat units**	**Offset type**
83-B	Patch	otp_0008	Least Concern	0	no	0.761	0.002	0.002	0.856	0.830	0.003	500324 Spotted Hyacinth-orchid *Dipodium pardalinum*
										0.831	0.003	502733 Showy Lobelia *Lobelia beaugleholei*
										0.067	0.003	502868 Otway Bush-pea *Pultenaea prolifera*
										0.831	0.003	503859 Currant-wood *Monotoca glauca*
										0.831	0.003	504351 Scented Spider-orchid *Caladenia fragrantissima*
										0.831	0.003	504876 Small Sickle Greenhood *Pterostylis lustra*
84-B	Patch	otp_0008	Least Concern	0	no	0.761	0.007	0.007	0.914	0.840	0.009	502733 Showy Lobelia *Lobelia beaugleholei*
										0.726	0.009	502868 Otway Bush-pea *Pultenaea prolifera*
										0.840	0.009	503859 Currant-wood *Monotoca glauca*
										0.840	0.009	504351 Scented Spider-orchid *Caladenia fragrantissima*
										0.840	0.009	504876 Small Sickle Greenhood *Pterostylis lustra*
85-B	Patch	otp_0008	Least Concern	0	no	0.761	0.006	0.006	0.903	0.840	0.009	502733 Showy Lobelia *Lobelia beaugleholei*
										0.654	0.009	502868 Otway Bush-pea *Pultenaea prolifera*
										0.840	0.009	503859 Currant-wood *Monotoca glauca*
										0.840	0.009	504351 Scented Spider-orchid *Caladenia fragrantissima*
										0.840	0.009	504876 Small Sickle Greenhood *Pterostylis lustra*
86-B	Patch	otp_0008	Least Concern	0	no	0.761	0.002	0.002	0.930	0.840	0.002	502733 Showy Lobelia *Lobelia beaugleholei*
										0.840	0.002	502868 Otway Bush-pea *Pultenaea prolifera*
										0.840	0.002	503859 Currant-wood *Monotoca glauca*

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	**Type**	**BioEVC**	**BioEVC conservation status**	**Large tree(s)**	**Partial removal**	**Condition score**	**Polygon Extent**	**Extent without overlap**	**SBV score**	**HI score**	**Habitat units**	**Offset type**
										0.840	0.002	504351 Scented Spider-orchid *Caladenia fragrantissima*
										0.840	0.002	504876 Small Sickle Greenhood *Pterostylis lustra*
87-B	Patch	otp_0008	Least Concern	1	no	0.761	0.309	0.309	0.885	0.835	0.431	500324 Spotted Hyacinth-orchid *Dipodium pardalinum*
										0.836	0.431	502733 Showy Lobelia *Lobelia beaugleholei*
										0.439	0.432	502868 Otway Bush-pea *Pultenaea prolifera*
										0.836	0.431	503859 Currant-wood *Monotoca glauca*
										0.836	0.431	504351 Scented Spider-orchid *Caladenia fragrantissima*
										0.836	0.431	504876 Small Sickle Greenhood *Pterostylis lustra*
88-B	Patch	otp_0048	Least Concern	13	no	0.600	0.702	0.702	0.680	0.859	0.783	502733 Showy Lobelia *Lobelia beaugleholei*
										0.581	0.783	502868 Otway Bush-pea *Pultenaea prolifera*
										0.859	0.783	503859 Currant-wood *Monotoca glauca*
										0.066	0.779	504351 Scented Spider-orchid *Caladenia fragrantissima*
										0.859	0.783	504876 Small Sickle Greenhood *Pterostylis lustra*
89-B	Patch	otp_0048	Least Concern	4	no	0.600	0.300	0.300	0.700	0.698	0.306	500324 Spotted Hyacinth-orchid *Dipodium pardalinum*
										0.698	0.306	502733 Showy Lobelia *Lobelia beaugleholei*
										0.698	0.306	503859 Currant-wood *Monotoca glauca*
										0.698	0.306	504876 Small Sickle Greenhood *Pterostylis lustra*
90-B	Patch	otp_0048	Least Concern	5	no	0.600	0.152	0.152	0.864	0.710	0.156	500324 Spotted Hyacinth-orchid *Dipodium pardalinum*

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
										0.792	0.164	502733 Showy Lobelia *Lobelia beaugleholei*
										0.792	0.164	503859 Currant-wood *Monotoca glauca*
										0.792	0.164	504876 Small Sickle Greenhood *Pterostylis lustra*
										0.297	0.183	1669 Otways Cray *Geocharax gracilis*
91-B	Patch	otp_0198	Depleted	16	no	0.690	0.499	0.499	0.852	0.800	0.620	500324 Spotted Hyacinth-orchid *Dipodium pardalinum*
										0.811	0.624	502733 Showy Lobelia *Lobelia beaugleholei*
										0.811	0.624	503859 Currant-wood *Monotoca glauca*
										0.811	0.624	504876 Small Sickle Greenhood *Pterostylis lustra*
92-B	Patch	otp_0016	Depleted	77	no	0.760	2.253	2.253	0.828	0.846	3.160	500324 Spotted Hyacinth-orchid *Dipodium pardalinum*
										0.836	3.144	502733 Showy Lobelia *Lobelia beaugleholei*
										0.836	3.144	503859 Currant-wood *Monotoca glauca*
										0.836	3.144	504876 Small Sickle Greenhood *Pterostylis lustra*
93-B	Patch	otp_0048	Least Concern	26	no	0.600	0.751	0.751	0.782	0.830	0.824	500324 Spotted Hyacinth-orchid *Dipodium pardalinum*
										0.827	0.823	502733 Showy Lobelia *Lobelia beaugleholei*
										0.827	0.823	503859 Currant-wood *Monotoca glauca*
										0.827	0.823	504876 Small Sickle Greenhood *Pterostylis lustra*
94-B	Patch	otp_0016	Depleted	11	no	0.760	0.410	0.410	0.845	0.833	0.571	500324 Spotted Hyacinth-orchid *Dipodium pardalinum*
										0.838	0.572	502733 Showy Lobelia *Lobelia beaugleholei*
										0.838	0.572	503859 Currant-wood *Monotoca glauca*

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	**Type**	**BioEVC**	**BioEVC conservation status**	**Large tree(s)**	**Partial removal**	**Condition score**	**Polygon Extent**	**Extent without overlap**	**SBV score**	**HI score**	**Habitat units**	**Offset type**
										0.838	0.572	504876 Small Sickle Greenhood *Pterostylis lustra*
95-B	Patch	otp_0016	Depleted	13	no	0.760	0.781	0.781	0.576	0.848	1.097	502733 Showy Lobelia *Lobelia beaugleholei*
										0.848	1.097	503859 Currant-wood *Monotoca glauca*
										0.848	1.097	504876 Small Sickle Greenhood *Pterostylis lustra*
96-B	Patch	otp_0083	Endangered	0	no	0.710	0.011	0.011	0.917	0.821	0.014	502733 Showy Lobelia *Lobelia beaugleholei*
										0.821	0.014	503859 Currant-wood *Monotoca glauca*
										0.821	0.014	504876 Small Sickle Greenhood *Pterostylis lustra*
97-B	Patch	otp_0083	Endangered	0	no	0.710	0.007	0.007	0.730	0.810	0.009	502733 Showy Lobelia *Lobelia beaugleholei*
										0.810	0.009	503859 Currant-wood *Monotoca glauca*
										0.810	0.009	504876 Small Sickle Greenhood *Pterostylis lustra*
98-B	Patch	otp_0083	Endangered	0	no	0.710	0.106	0.106	0.759	0.822	0.137	502733 Showy Lobelia *Lobelia beaugleholei*
										0.822	0.137	503859 Currant-wood *Monotoca glauca*
										0.822	0.137	504876 Small Sickle Greenhood *Pterostylis lustra*
99-B	Patch	otp_0048	Least Concern	0	no	0.600	0.182	0.182	0.763	0.813	0.198	502733 Showy Lobelia *Lobelia beaugleholei*
										0.813	0.198	503859 Currant-wood *Monotoca glauca*
										0.813	0.198	504876 Small Sickle Greenhood *Pterostylis lustra*
100-B	Patch	otp_0016	Depleted	2	no	0.760	0.260	0.260	0.830	0.828	0.362	502733 Showy Lobelia *Lobelia beaugleholei*
										0.828	0.362	503859 Currant-wood *Monotoca glauca*
										0.828	0.362	504876 Small Sickle Greenhood *Pterostylis lustra*

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	**Type**	**BioEVC**	**BioEVC conservation status**	**Large tree(s)**	**Partial removal**	**Condition score**	**Polygon Extent**	**Extent without overlap**	**SBV score**	**HI score**	**Habitat units**	**Offset type**
101-B	Patch	otp_0016	Depleted	0	no	0.760	0.001	0.001	0.550	0.850	0.002	502733 Showy Lobelia *Lobelia beaugleholei*
										0.850	0.002	503859 Currant-wood *Monotoca glauca*
										0.850	0.002	504876 Small Sickle Greenhood *Pterostylis lustra*
102-B	Patch	otp_0048	Least Concern	0	no	0.600	0.001	0.001	0.820	0.820	0.001	502733 Showy Lobelia *Lobelia beaugleholei*
										0.820	0.001	503859 Currant-wood *Monotoca glauca*
										0.820	0.001	504876 Small Sickle Greenhood *Pterostylis lustra*
103-B	Patch	otp_0048	Least Concern	10	no	0.600	0.556	0.556	0.712	0.833	0.612	502733 Showy Lobelia *Lobelia beaugleholei*
										0.833	0.612	503859 Currant-wood *Monotoca glauca*
										0.833	0.612	504876 Small Sickle Greenhood *Pterostylis lustra*
104-B	Patch	otp_0048	Least Concern	0	no	0.600	0.000	0.000	0.844	0.822	0.000	502733 Showy Lobelia *Lobelia beaugleholei*
										0.822	0.000	503859 Currant-wood *Monotoca glauca*
										0.822	0.000	504876 Small Sickle Greenhood *Pterostylis lustra*
105-B	Patch	otp_0048	Least Concern	0	no	0.600	0.001	0.001	0.940	0.830	0.001	502733 Showy Lobelia *Lobelia beaugleholei*
										0.830	0.001	503859 Currant-wood *Monotoca glauca*
										0.830	0.001	504876 Small Sickle Greenhood *Pterostylis lustra*
106-B	Patch	otp_0048	Least Concern	0	no	0.600	0.008	0.008	0.877	0.825	0.009	502733 Showy Lobelia *Lobelia beaugleholei*
										0.825	0.009	503859 Currant-wood *Monotoca glauca*

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	**Type**	**BioEVC**	**BioEVC conservation status**	**Large tree(s)**	**Partial removal**	**Condition score**	**Polygon Extent**	**Extent without overlap**	**SBV score**	**HI score**	**Habitat units**	**Offset type**
										0.825	0.009	504876 Small Sickle Greenhood *Pterostylis lustra*
107-B	Patch	otp_0048	Least Concern	0	no	0.600	0.129	0.129	0.922	0.828	0.142	502733 Showy Lobelia *Lobelia beaugleholei*
										0.828	0.142	503859 Currant-wood *Monotoca glauca*
										0.828	0.142	504876 Small Sickle Greenhood *Pterostylis lustra*
108-B	Patch	otp_0048	Least Concern	0	no	0.600	0.000	0.000	0.940	0.830	0.000	502733 Showy Lobelia *Lobelia beaugleholei*
										0.830	0.000	503859 Currant-wood *Monotoca glauca*
										0.830	0.000	504876 Small Sickle Greenhood *Pterostylis lustra*

Appendix 2: Information about impacts to rare or threatened species' habitats on site

This table lists all rare or threatened species' habitats mapped at the site.

Species common name	Species scientific name	Species number	Conservation status	Group	Habitat impacted	% habitat value affected
Otways Cray	*Geocharax gracilis*	1669	Endangered	Highly Localised Habitat	Habitat importance map ; special site	0.1600
Currant-wood	*Monotoca glauca*	503859	Rare	Dispersed	Top ranking map ; special site	0.0392
Otway Bush-pea	*Pultenaea prolifera*	502868	Rare	Dispersed	Top ranking map	0.0196
Showy Lobelia	*Lobelia beaugleholei*	502733	Rare	Dispersed	Top ranking map	0.0095
Small Sickle Greenhood	*Pterostylis lustra*	504876	Endangered	Dispersed	Top ranking map	0.0089
Spotted Hyacinth-orchid	*Dipodium pardalinum*	500324	Rare	Dispersed	Top ranking map	0.0087
Scented Spider-orchid	*Caladenia fragrantissima*	504351	Endangered	Dispersed	Top ranking map	0.0066
Otway Bush-pea	*Pultenaea prolifera*	502868	Rare	Dispersed	Habitat importance map	0.0056
Currant-wood	*Monotoca glauca*	503859	Rare	Dispersed	Habitat importance map ; special site	0.0029
Brooker's Gum	*Eucalyptus brookeriana*	501256	Rare	Dispersed	Habitat importance map	0.0029
Showy Lobelia	*Lobelia beaugleholei*	502733	Rare	Dispersed	Habitat importance map	0.0024
Small Sickle Greenhood	*Pterostylis lustra*	504876	Endangered	Dispersed	Habitat importance map	0.0022
Dwarf Silver Wattle	*Acacia nano-dealbata*	500064	Rare	Dispersed	Habitat importance map	0.0018
Scented Spider-orchid	*Caladenia fragrantissima*	504351	Endangered	Dispersed	Habitat importance map	0.0018
Swamp Diuris	*Diuris palustris*	501082	Vulnerable	Dispersed	Top ranking map	0.0017
Spotted Hyacinth-orchid	*Dipodium pardalinum*	500324	Rare	Dispersed	Habitat importance map	0.0017
Naked Sun-orchid	*Thelymitra circumsepta*	503383	Vulnerable	Dispersed	Habitat importance map	0.0016
Southern Toadlet	*Pseudophryne semimarmorata*	13125	Vulnerable	Dispersed	Habitat importance map	0.0015
Slender Pink-fingers	*Caladenia vulgaris*	504449	Rare	Dispersed	Habitat importance map	0.0014

Swamp Skink	*Lissolepis coventryi*	12407	Vulnerable	Dispersed	Habitat importance map	0.0014
Bog Gum	*Eucalyptus kitsoniana*	501290	Rare	Dispersed	Habitat importance map	0.0013
Swamp Flax-lily	*Dianella callicarpa*	505086	Rare	Dispersed	Habitat importance map	0.0012
Dwarf Boronia	*Boronia nana var. pubescens*	504278	Rare	Dispersed	Habitat importance map	0.0012
Wrinkled Buttons	*Leiocarpa gatesii*	501942	Vulnerable	Dispersed	Top ranking map	0.0012
Swamp Fireweed	*Senecio psilocarpus*	504659	Vulnerable	Dispersed	Habitat importance map	0.0011
Western Peppermint	*Eucalyptus falciformis*	505358	Rare	Dispersed	Habitat importance map	0.0011
Tufted Club-sedge	*Isolepis wakefieldiana*	501789	Rare	Dispersed	Habitat importance map	0.0011
Wiry Bossiaea	*Bossiaea cordigera*	500435	Rare	Dispersed	Habitat importance map	0.0010
Parsley Xanthosia	*Xanthosia leiophylla*	504562	Rare	Dispersed	Habitat importance map	0.0009
Rough Blown-grass	*Lachnagrostis rudis subsp. rudis*	500159	Endangered	Dispersed	Habitat importance map	0.0008
Blotched Sun-orchid	*Thelymitra benthamiana*	503369	Vulnerable	Dispersed	Habitat importance map	0.0006
Swamp Diuris	*Diuris palustris*	501082	Vulnerable	Dispersed	Habitat importance map	0.0006
Nunniong Everlasting	*Ozothamnus rogersianus*	501623	Rare	Dispersed	Habitat importance map	0.0006
Grey Goshawk	*Accipiter novaehollandiae novaehollandiae*	10220	Vulnerable	Dispersed	Habitat importance map	0.0006
Southern Xanthosia	*Xanthosia tasmanica*	504088	Rare	Dispersed	Habitat importance map	0.0005
Clover Glycine	*Glycine latrobeana*	501456	Vulnerable	Dispersed	Habitat importance map	0.0004
Masked Owl	*Tyto novaehollandiae novaehollandiae*	10250	Endangered	Dispersed	Habitat importance map	0.0003
Powerful Owl	*Ninox strenua*	10248	Vulnerable	Dispersed	Habitat importance map ; special site	0.0003
Spiral Sun-orchid	*Thelymitra matthewsii*	503378	Vulnerable	Dispersed	Habitat importance map	0.0002
Wrinkled Buttons	*Leiocarpa gatesii*	501942	Vulnerable	Dispersed	Habitat importance map	0.0002
White-throated Needletail	*Hirundapus caudacutus*	10334	Vulnerable	Dispersed	Habitat importance map	0.0002
Silky Golden-tip	*Goodia pubescens*	504600	Rare	Dispersed	Habitat importance map	0.0002

Wiry Bog-sedge	*Schoenus carsei*	503043	Rare	Dispersed	Habitat importance map	0.0001
Lewin's Rail	*Lewinia pectoralis pectoralis*	10045	Vulnerable	Dispersed	Habitat importance map	0.0001
Leafy Twig-sedge	*Cladium procerum*	500786	Rare	Dispersed	Habitat importance map	0.0001
Green-striped Greenhood	*Pterostylis chlorogramma*	504728	Vulnerable	Dispersed	Habitat importance map	0.0001
Australasian Bittern	*Botaurus poiciloptilus*	10197	Endangered	Dispersed	Habitat importance map	0.0001
Square-tailed Kite	*Lophoictinia isura*	10230	Vulnerable	Dispersed	Habitat importance map	0.0001
Baillon's Crake	*Porzana pusilla palustris*	10050	Vulnerable	Dispersed	Habitat importance map	0.0001
Forest Bitter-cress	*Cardamine papillata*	505034	Vulnerable	Dispersed	Habitat importance map	0.0001
Tremont Bundy	*Eucalyptus aff. goniocalyx (Dandenong Ranges)*	507008	Vulnerable	Dispersed	Habitat importance map	0.0001
Chestnut-rumped Heathwren	*Calamanthus pyrrhopygius*	10498	Vulnerable	Dispersed	Habitat importance map	0.0000
Australasian Shoveler	*Anas rhynchotis*	10212	Vulnerable	Dispersed	Habitat importance map	0.0000
Yarra Gum	*Eucalyptus yarraensis*	501326	Rare	Dispersed	Habitat importance map	0.0000
Hardhead	*Aythya australis*	10215	Vulnerable	Dispersed	Habitat importance map	0.0000
Dwarf Brooklime	*Gratiola pumilo*	503753	Rare	Dispersed	Habitat importance map	0.0000
Black Falcon	*Falco subniger*	10238	Vulnerable	Dispersed	Habitat importance map	0.0000
Large White Spider-orchid	*Caladenia venusta*	500533	Rare	Dispersed	Habitat importance map	0.0000

Habitat group

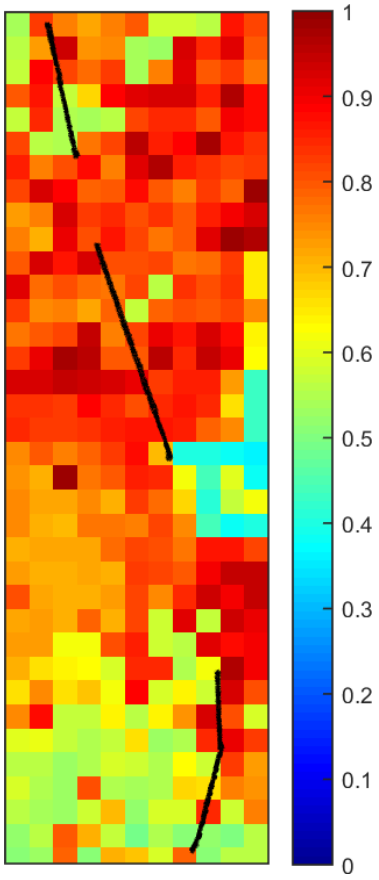
- Highly localised habitat means there is 2000 hectares or less mapped habitat for the species
- Dispersed habitat means there is more than 2000 hectares of mapped habitat for the species

Habitat impacted

- Habitat importance maps are the maps defined in the Guidelines that include all the mapped habitat for a rare or threatened species
- Top ranking maps are the maps defined in the Guidelines that depict the important areas of a dispersed species habitat, developed from the highest habitat importance scores in dispersed species habitat maps and selected VBA records
- Selected VBA record is an area in Victoria that represents a large population, roosting or breeding site etc.

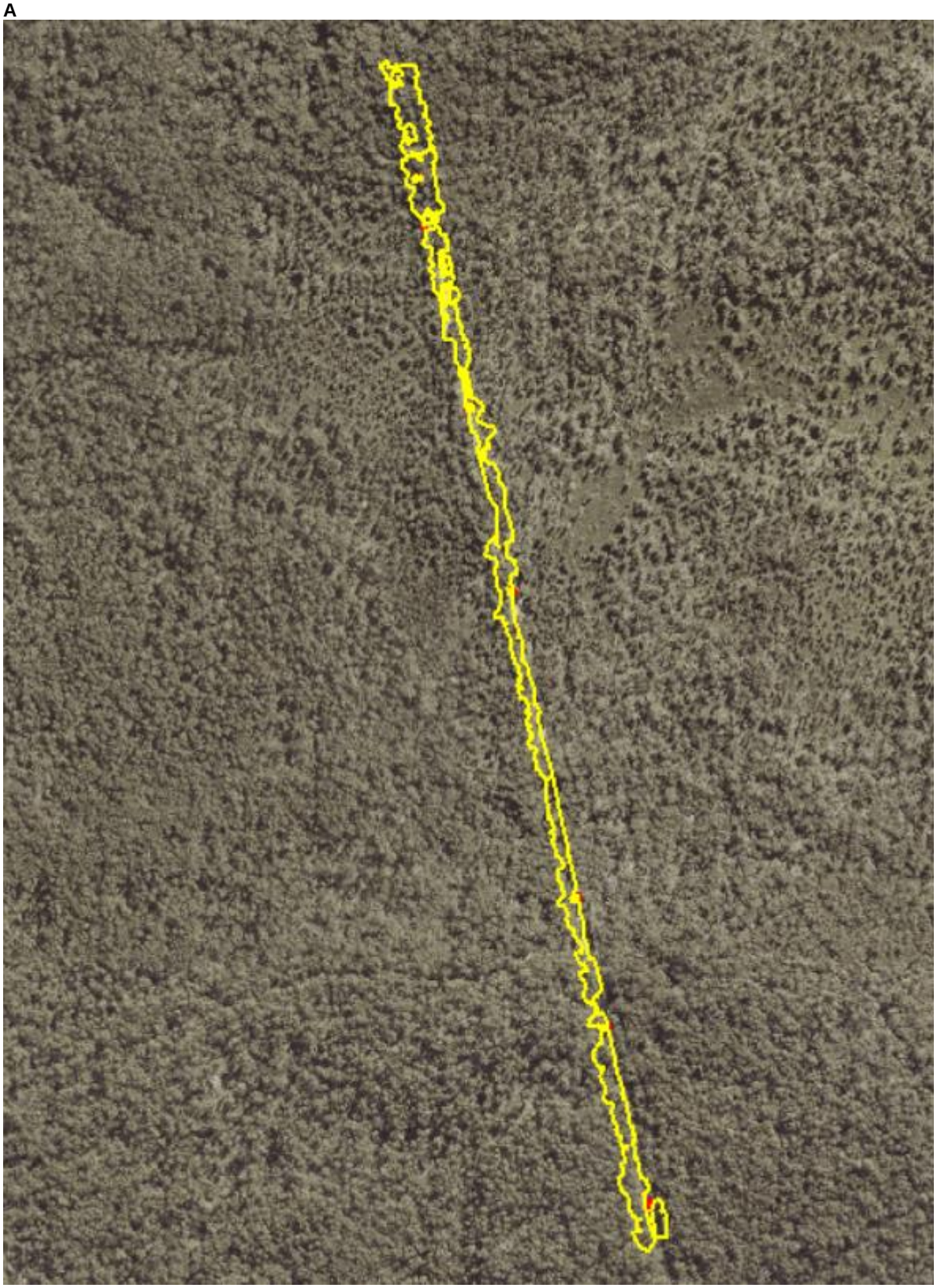
Appendix 3 – Images of mapped native vegetation

2. Strategic biodiversity values map

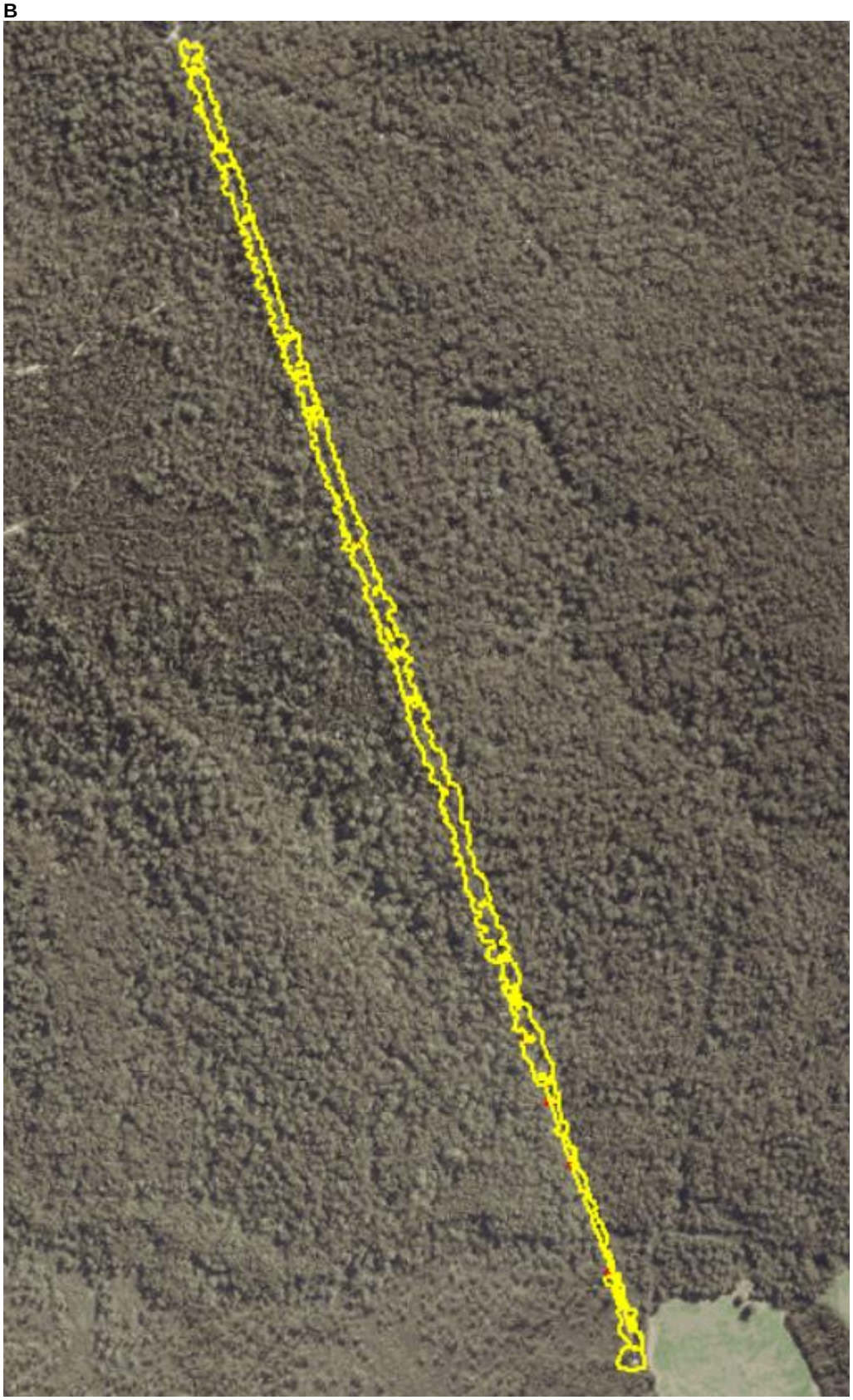


3. Aerial photograph showing mapped native vegetation

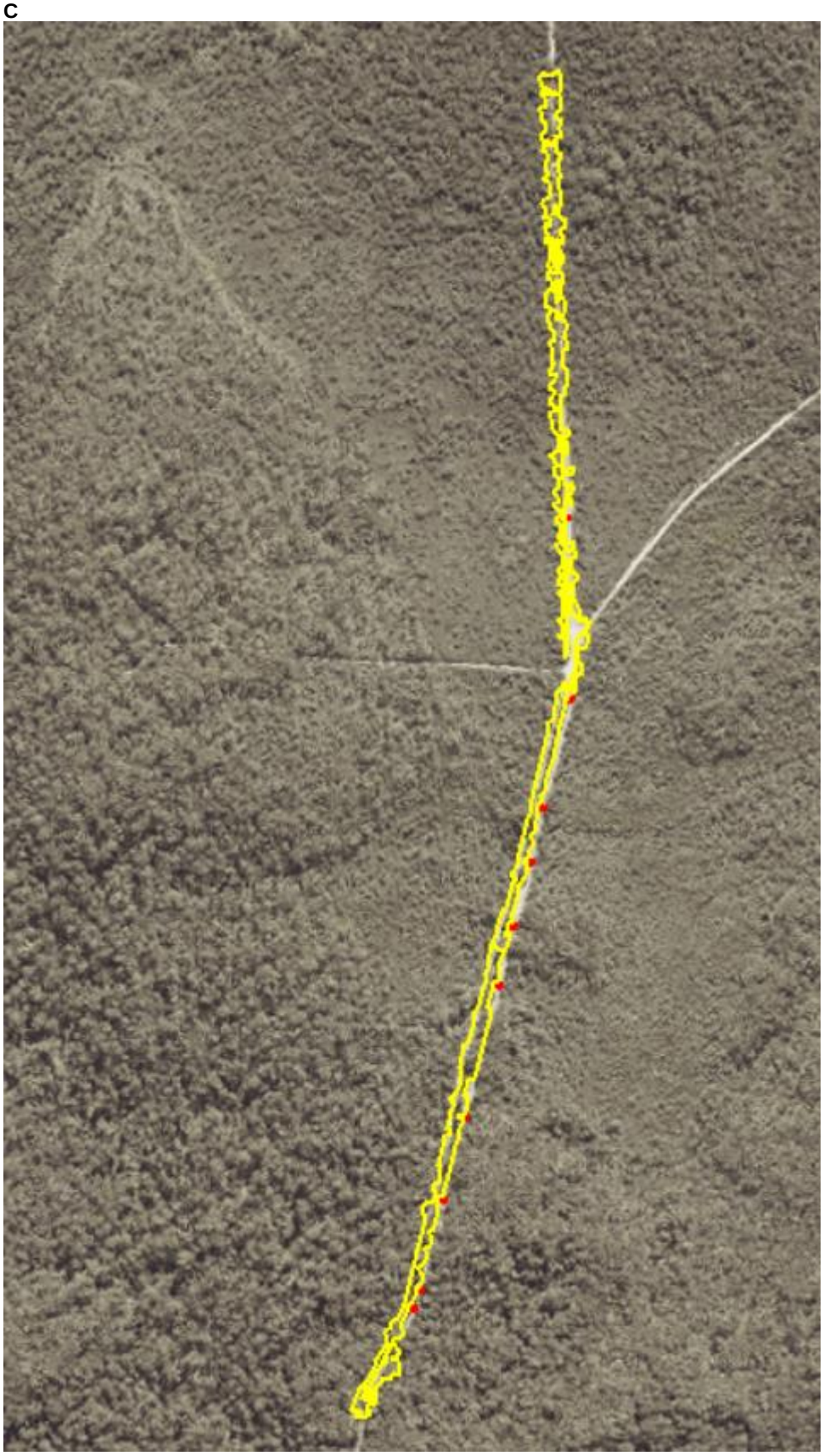
A



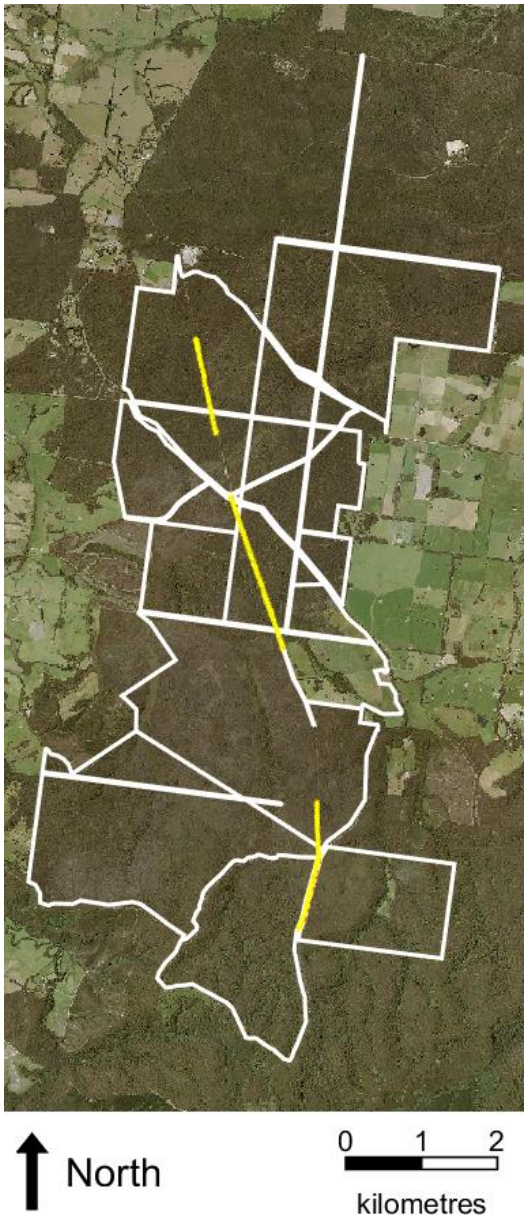
B



C



4. Map of the property in context



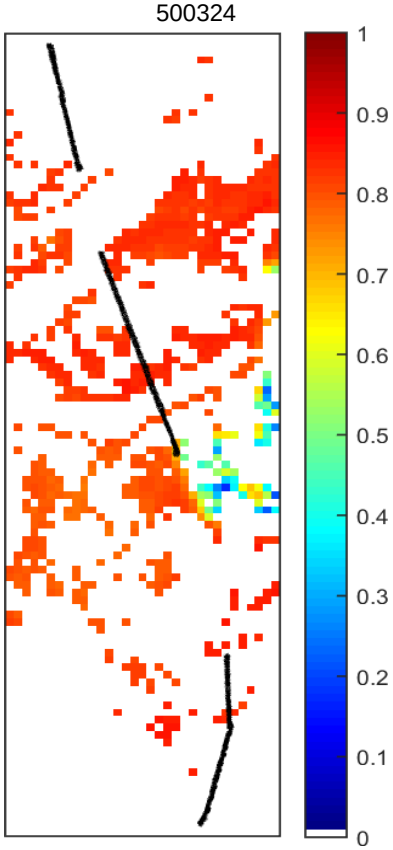
Yellow boundaries denote areas of proposed native vegetation removal.

Red boundaries denote areas of past removal.

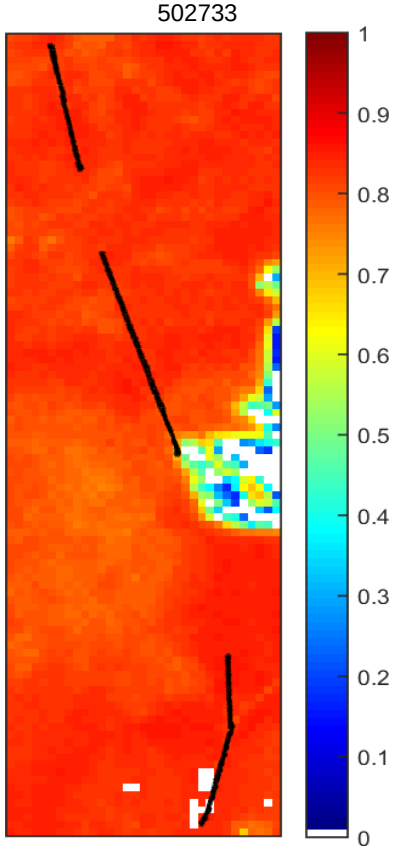
Blue boundaries denote zones of partial removal with a halved condition score.

4. Habitat importance maps

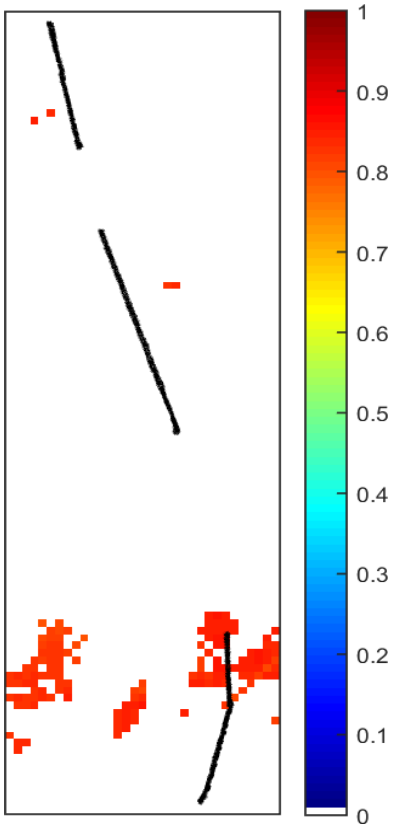
Spotted Hyacinth-orchid
Dipodium pardalinum
500324



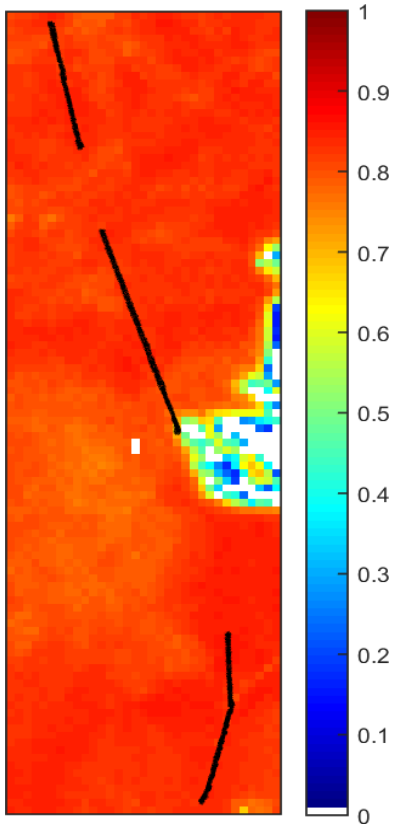
Showy Lobelia
Lobelia beaugleholei
502733



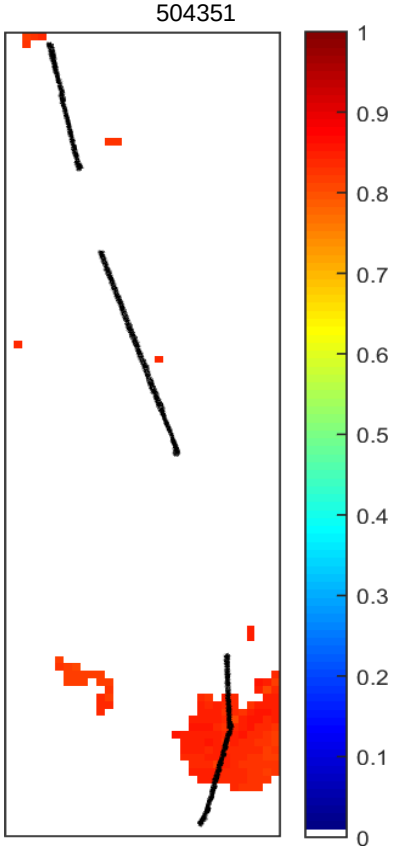
Otway Bush-pea
Pultenaea prolifera
502868



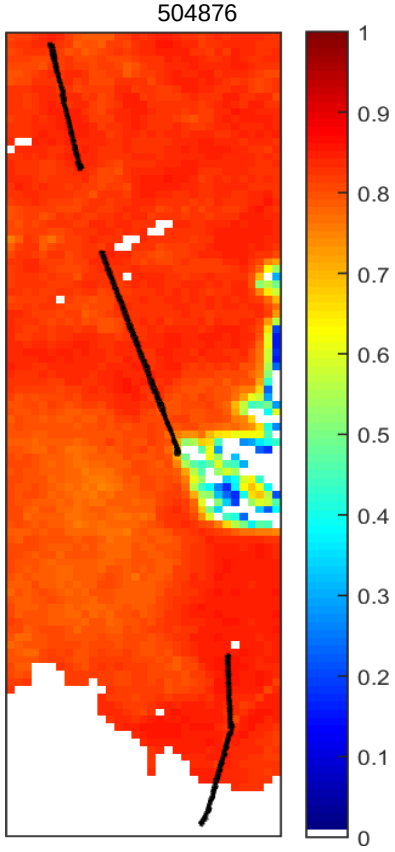
Currant-wood
Monotoca glauca
503859



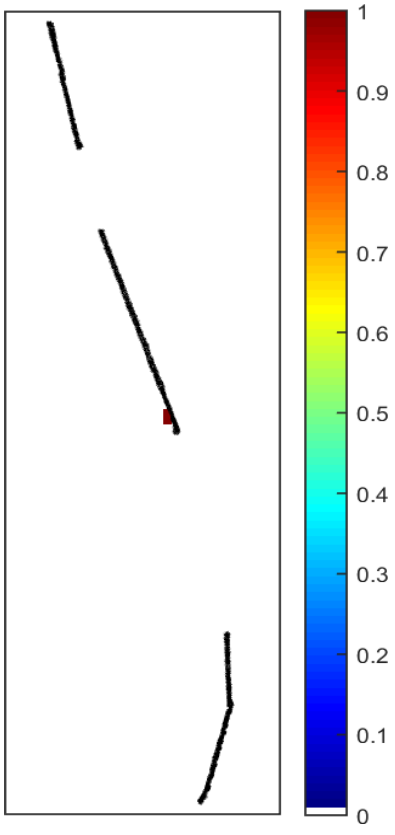
Scented Spider-orchid
Caladenia fragrantissima
504351



Small Sickle Greenhood
Pterostylis lustra
504876



Otways Cray
Geocharax gracilis
1669



Appendix D

Native Vegetation Credit Register – Allocated credit extracts

Department of Environment, Land, Water and Planning

Native Vegetation Credit Register

Allocated credit extract

Credit ID: 2022-0628

Credit owner: Barwon Region Water Corporation

Credits allocated to:

Planning approval type: Planning permit

Approval reference: PP259/2021-1

Clearing site location: Pipeline Track - Great Otway National Park and Otway State Forest (Colac Water Supply Pipeline Upgrade)

Responsible authority: Colac Otway Shire Council

Date of allocation: 23/08/2022

Credits allocated:

Large Trees 0

Taxon ID	*Scientific name*	Common name	Total Species Habitat Units	Site - Zone	SHU per Site
1669	*Geocharax gracilis*	Otways Cray	**0.183**	1-B	0.183

Credit site details:

Property identifier: BBA-0114

Catchment Management Authority: Corangamite

Local Governement Authority: Colac Otway Shire

Locality: Yeodene

Bioregion: Otway Plain

Ecological Vegetation Class: Swampy Riparian Woodland (0083)

Credit type: Remnant vegetation

Colac Otway SHIRE

PLANNING PERMIT NO.: PP259/2021-1
CONDITION NUMBER: 14 Endorsed Offset Evidence
ENDORSED PLAN: SHEET 1 of 5
ENDORSED DATE: 5/09/2022
ORIGINAL ISSUED DATE: 02/08/2022
AUTHORISED OFFICER: Ravi Teja Ayyagari

This extract provides evidence of an allocation of credits to a planning document with a condition requiring an offset. The specified credits can no longer be traded or allocated for another purpose.

Information Privacy Act 2000

The Department of Environment, Land, Water and Planning (DELWP) is committed to protecting information provided in accordance with the principles of the Information Privacy Act 2000. Information contained in your correspondence or any other response to this matter, will be stored and used by DELWP for the purposes of providing native vegetation offset services and supplying related information that may be of interest to you. This information may be disclosed to persons seeking native vegetation credits. If you wish to access information about you held by DELWP, please contact the Privacy Manager, PO Box 500, East Melbourne 3002.

VICTORIA State Government

Department of Environment, Land, Water and Planning

Native Vegetation Credit Register

Allocated credit extract

Credit ID: 2022-0656

Credit owner: Barwon Region Water Corporation

Credits allocated to:

Planning approval type: Planning permit

Approval reference: PP259/2021-1 (GHD_2021_022)

Clearing site location: Pipeline Road, Gerangamite (Colac Pipeline Upgrade Sections 19, 20, 23 and 25(i))

Responsible authority: Colac Otway Shire Council

Date of allocation: 24/08/2022

Credits allocated:

Large Trees 215

Taxon ID	*Scientific name*	Common name	Total Species Habitat Units	Site - Zone	SHU per Site
503859	*Monotoca glauca*	Currant-wood	**11.313**	30-A	11.313
502733	*Lobelia beaugleholei*	Showy Lobelia	**11.312**	30-A	11.312

Credit site details:

Property identifier: BBA-2337_06

Catchment Management Authority: Corangamite

Local Government Authority: Colac Otway Shire

Locality: Barramunga

Bioregion: Otway Ranges

Ecological Vegetation Class: Scrubby Wet Forest (0201)

Credit type: Remnant vegetation

Colac Otway SHIRE

PLANNING PERMIT NO.: PP259/2021-1
CONDITION NUMBER: 14 Endorsed Offset Evidence
ENDORSED PLAN: SHEET 2 of 5
ENDORSED DATE: 5/09/2022
ORIGINAL ISSUED DATE: 02/08/2022
AUTHORISED OFFICER: Ravi Teja Ayyagari

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VICTORIA State Government

Department of Environment, Land, Water and Planning

Native Vegetation Credit Register

Allocated credit extract

Credit ID: 2022-0657

Credit owner: Barwon Region Water Corporation

Credits allocated to:

Planning approval type: Planning permit

Approval reference: PP259/2021-1 (GHD_2021_022)

Clearing site location: Pipeline Road, Gerangamite (Colac Pipeline Upgrade Sections 19, 20, 23 and 25(i))

Responsible authority: Colac Otway Shire Council

Date of allocation: 24/08/2022

Credits allocated:

Large Trees 0

Taxon ID	*Scientific name*	Common name	Total Species Habitat Units	Site - Zone	SHU per Site
504876	*Pterostylis lustra*	Small Sickle Greenhood	**11.312**	1-A	11.312
500324	*Dipodium pardalinum*	Spotted Hyacinth-orchid	**6.083**	1-A	6.083

Credit site details:

Property identifier: BBA-3041

Catchment Management Authority: Glenelg Hopkins

Local Governement Authority: Moyne Shire

Locality: Macarthur

Bioregion: Victorian Volcanic Plain

Ecological Vegetation Class: Stony Rises Woodland (0203)

Credit type: Remnant vegetation

Colac Otway SHIRE

PLANNING PERMIT NO.: PP259/2021-1
CONDITION NUMBER: 14 Endorsed Offset Evidence
ENDORSED PLAN: SHEET 3 of 5
ENDORSED DATE: 5/09/2022
ORIGINAL ISSUED DATE: 02/08/2022
AUTHORISED OFFICER: Ravi Teja Ayyagari

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VICTORIA State Government

Department of Environment, Land, Water and Planning

Native Vegetation Credit Register

Allocated credit extract

Credit ID: 2022-0658

Credit owner: Barwon Region Water Corporation

Credits allocated to:

Planning approval type: Planning permit

Approval reference: PP259/2021-1 (GHD_2021_022)

Clearing site location: Pipeline Road, Gerangamite (Colac Pipeline Upgrade Sections 19, 20, 23 and 25(i))

Responsible authority: Colac Otway Shire Council

Date of allocation: 24/08/2022

Credits allocated:

Large Trees 0

Taxon ID	*Scientific name*	Common name	Total Species Habitat Units	Site - Zone	SHU per Site
504351	*Caladenia fragrantissima*	Scented Spider-orchid	**3.091**	1-A	3.091

Credit site details:

Property identifier: VC_CFL-3763_01

Catchment Management Authority: Glenelg Hopkins

Local Governement Authority: Glenelg Shire

Locality: Greenwald

Bioregion: Victorian Volcanic Plain

Ecological Vegetation Class: Heathy Woodland (0048)

Credit type: Remnant vegetation

Colac Otway SHIRE

PLANNING PERMIT NO.: PP259/2021-1
CONDITION NUMBER: 14 Endorsed Offset Evidence
ENDORSED PLAN: SHEET 4 of 5
ENDORSED DATE: 5/09/2022
ORIGINAL ISSUED DATE: 02/08/2022
AUTHORISED OFFICER: Ravi Teja Ayyagari

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VICTORIA State Government

Department of Environment, Land, Water and Planning

Native Vegetation Credit Register

Allocated credit extract

Credit ID: 2022-0659

Credit owner: Barwon Region Water Corporation

Credits allocated to:

Planning approval type: Planning permit

Approval reference: PP259/2021-1 (GHD_2021_022)

Clearing site location: Pipeline Road, Gerangamite (Colac Pipeline Upgrade Sections 19, 20, 23 and 25(i))

Responsible authority: Colac Otway Shire Council

Date of allocation: 24/08/2022

Credits allocated:

Large Trees 0

Taxon ID	*Scientific name*	Common name	Total Species Habitat Units	Site - Zone	SHU per Site
502868	*Pultenaea prolifera*	Otway Bush-pea	**1.238**	1-C	1.238

Credit site details:

Property identifier: VC_TFN-C2058_01

Catchment Management Authority: Corangamite

Local Governement Authority: Colac Otway Shire

Locality: Hordern Vale

Bioregion: Otway Ranges

Ecological Vegetation Class: Lowland Forest (0016)

Credit type: Remnant vegetation

Colac Otway SHIRE

PLANNING PERMIT NO.: PP259/2021-1
CONDITION NUMBER: 14 Endorsed Offset Evidence
ENDORSED PLAN: SHEET 5 of 5
ENDORSED DATE: 5/09/2022
ORIGINAL ISSUED DATE: 02/08/2022
AUTHORISED OFFICER: Ravi Teja Ayyagari

This extract provides evidence of an allocation of credits to a planning document with a condition requiring an offset. The specified credits can no longer be traded or allocated for another purpose.

Appendix E

EPBC offsets assessment calculations for Gang-Gang Cockatoo, Yellow-bellied Glider and Long-nosed Potoroo

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Gang-gang Cockatoo
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	Foraging, and potential roosting and breeding habitat	**Area**	7.31	Hectares	
			Quality	**7**	Scale 0-10	
			Total quantum of impact	5.12	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	5.12	Adjusted hectares	450 Morris Track	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	33.01	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	95%	0.00	0.00	5.57	108.79%	Yes	
									Future area without offset (adjusted hectares)	33.0	**Future area with offset (adjusted hectares)**	33.0								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**8**	**Future quality without offset (scale of 0-10)**	**7**	**Future quality with offset (scale of 0-10)**	**9**	2.00	95%	1.90	1.69				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	5.117	5.57	108.79%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Yellow-bellied Glider
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**	0		
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	known foraging and potential denning and breeding habitat	**Area**	5.07	Hectares	
			Quality	**7**	Scale 0-10	
			Total quantum of impact	3.55	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	3.55	Adjusted hectares	450 Morris Track	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	33.01	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	95%	0.00	0.00	6.15	173.23%	Yes	
									Future area without offset (adjusted hectares)	33.0	**Future area with offset (adjusted hectares)**	33.0								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**8**	**Future quality without offset (scale of 0-10)**	**7**	**Future quality with offset (scale of 0-10)**	**9**	2.00	95%	1.90	1.86				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	3.549	6.15	173.23%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Long-nosed Potoroo
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**	0		
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	Identified and potential habitat	**Area**	7.81	Hectares	
			Quality	**7**	Scale 0-10	
			Total quantum of impact	5.47	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	5.47	Adjusted hectares	245 Distillery Creek Road	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	29.4266	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	95%	0.00	0.00	5.48	100.25%	Yes	
									Future area without offset (adjusted hectares)	29.4	**Future area with offset (adjusted hectares)**	29.4								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**8**	**Future quality without offset (scale of 0-10)**	**7**	**Future quality with offset (scale of 0-10)**	**9**	2.00	95%	1.90	1.86				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	5.467	5.48	100.25%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**

Appendix F

Supporting information for Gang-gang Cockatoo, Yellow-bellied Glider and Long-nosed Potoroo – EPBC species offset calculations

Table F.1 Attribute values for Gang-gang Cockatoo – Action area and offset site (450 Morris Track, Lavers Hill)

Offset assessment guide attribute	Habitat	Justification
Impact calculator – Quantum of impact – Area	7.31 ha	Removal of known and potential habitat as detailed in the Preliminary Documentation response (GHD 2023a) and supporting technical report (GHD 2023b). Impact calculated based on the ecological surveys undertaken by GHD (2021) and target surveys for the species (GHD 2023b and c)
Impact Calculator – Quantum of impact – Quality	7/10	The habitat quality score (7 out of 10) was determined according to DCCEEW's assessment guide (DSEWPaC 2012b), which includes three attributes: 'site condition', 'site context' and 'species stocking rate'. Details of the weighting of these three attributes is described in section 2.2.2.3 and Table 4. Each characteristic was then scored based on the field assessment results presented within the ecology (GHD 2021) and targeted survey report (GHD 2023b). Adjusted quantum of impact: 7.31 x 7/10 = 5.12 ha
Offset calculator – Time horizon – Risk related time horizon	20 years	The proposed offset site would be managed in perpetuity under a legal covenant on title. 20 years is the maximum timeframe for averting loss in the EPBC Act offsets assessment guide.
Offset calculator – Time horizon – Time until ecological benefit	10 years	The existing habitat condition at the proposed offset site is expected to be improved over the 10-year active management period as detailed in the OMP. Potential management activities include: control of pest plants and animals. Ecological benefits arising from management would be assessed progressively over the 10-year period to understand that the management actions are effective and the species maintains its current population presence within the offset site. A tangible increase in site quality score with management or decrease because of ongoing threats would be expected after 10 years.
Offset calculator – Future area and quality without offset – Risk of loss without offset	0%	Risk of loss 0% as per recent DCCEEW guidance.
Offset calculator – Future area and quality with offset – Risk of loss with offset	0%	Risk of loss 0% as per recent DCCEEW guidance.
Confidence in result – Averted loss of offset	95%	Confidence in applied scores is high due to careful consideration of the offset site, condition and evidence of the landholder's capability to manage threats through agreement to the OMP. Further, DSEWPaC (2013) guidance and recent determinations by DCCEEW suggest that 95 per cent is a reasonable estimate of the confidence in the strength and effectiveness of the agreement at averting the risk of loss of habitat. The offset site will be secured under a Section 69 agreement in accordance with the *Conservation, Forests and Lands Act 1987*. The legally secured offset site will be managed by the landowner under a legal contract and site-specific OMP that will contain a risk assessment detailing relevant risk and mitigation measures for the offset site. The OMP enables land practices that promote positive outcomes on MNES.
Offset calculator – Start area and quality – Area	33.01 ha	The area of Gang-gang Cockatoo habitat was mapped based on targeted surveys completed by GHD (2023c). See Table 5 Section 2.2.2. The area exceeds the adjusted quantum of impact by x 6
Offset calculator – Start area and quality – Start quality	8/10	The quality of Gang-gang Cockatoo habitat was assessed based on targeted surveys completed by GHD (2023c). See Table 4 Section 2.2.2. The Gang-gang Cockatoo was recorded within the offset site during targeted surveys.

Offset assessment guide attribute	Habitat	Justification
Offset calculator - Future area and quality without offset – Future quality without offset (1-10)	7/10	Without protection and ongoing management as an offset site, there is a degree of uncertainty regarding the future condition of the land particularly from habitat degradation caused by pest animal and plant species (see GHD 2023b). The OMP provides measures for control of pest plants and animals, both of which left unchecked would be likely to negatively impact the habitats of the site. Key threats to the future habitat quality for Gang-gang Cockatoo without securing and management of the offset site include: – Invasion of weeds (woody weeds and understorey weeds). Weed species can outcompete native plants and reduce the quality of midstorey foraging habitat and recruitment of trees which could provide future breeding habitat. If weeds are permitted to invade the offset site and change the vegetation composition and structure this may result in increased fuel loads in the lower vegetation layers, which is likely to have negative implications for Gang-gang Cockatoo by increasing the risk of fire frequency and severity. More frequent and severe fires are known to cause direct mortality of Gang-gang Cockatoo and indirectly cause declines through the loss of foraging and breeding habitat. – Pest species, predation and competition which can reduce the quality of foraging habitat and likelihood of successful breeding of Gang-gang Cockatoo. Pest species, such as the European Rabbit and Deer can reduce the quality of foraging habitat for Gang-gang Cockatoo by browsing on and/or damaging recruiting/regenerating native plants (both understorey/midstorey vegetation and future canopy species) and disrupting soil health by digging, pugging, burrowing, creating game trails and spreading of weed seeds, thereby changing the vegetation composition and structure. Alteration of vegetation composition and structure is likely to favour species that are more tolerant of modified environments, such as the Sulphur-crested Cockatoo and Crimson Rosella, which are known to occur in altered or disturbed environments (i.e., suburban areas) and allow them to increase in numbers and outcompete the Gang-gang Cockatoo for resources (such as foraging resources and nest hollows). Predation by foxes and cats on Gang-gang Cockatoos is also possible, particularly when birds are foraging in the lower to midstorey vegetation or when birds are using waterways to drink. If allowed to increase in numbers, predatory species such as foxes and cats can also indirectly impact on Gang-gang Cockatoo habitat, by predating on native ground-mammals that are important for maintaining vegetation structure and soil health. – Inappropriate fire management is listed as a key threat to Gang-gang Cockatoo within the conservation advice (DAWE 2022a). Inappropriate fire regimes can result in the direct mortality of individuals, remove Gang-gang Cockatoo nesting sites, reduce the availability of quality foraging sites, and increase individuals' vulnerability to other threatening processes (such as predators or competitors). The offset site is long unburnt and failing to secure the offset site will increase the likelihood of inappropriate fire regimes occurring (i.e., due to unplanned ignitions as a result of public access to the site, or reduced ability to control fire and fuel load within the site, i.e., for planned burns). Fire can kill and destroy live (and dead) hollow bearing trees and if too frequent and or intense can reduce flora species diversity and cover over time. This would impact Gang-gang Cockatoo habitat by reducing nest sites and foraging resources. There would also be less shelter increasing the risk of predation from foxes and cats. – Disturbance and altered land use. The offset property is zoned Farming Zone (FZ) – there is a risk that some of the habitat will be lost to agricultural use (e.g., grazing) if not protected as an offset site, which could result in direct habitat removal and/or degradation of habitat for Gang-gang Cockatoo. Additionally, if not secured as an offset it is possible that public access to the site will persist or increase for recreational purposes (i.e., trail bikes, four-wheel driving) which could increase the spread of weeds and plant pathogens (i.e., *Phytopthora*) into the site via tyres, footwear and other equipment. Vehicles, foot traffic, illegal hunting and illegal firewood collection can also cause noise, damage to vegetation and soil and alter hydrology or quality of waterways which can degrade habitat for Gang-gang Cockatoo.

Offset assessment guide attribute	Habitat	Justification
		For Gang-gang Cockatoo, a score of 7/10 is expected to be achieved in the future without offset through either (or both) a decrease in the 'site condition' score as a result of high threats (such as weeds, pests, fire and disturbance) impacting on habitats within the site (i.e., from a '3' to a '2' – see section 2.2.2.3) and/or an decrease to the 'species stocking rate' score from a '2' to a '1'. Gang-gang Cockatoo use of the site may decrease as habitat quality declines (i.e., habitat use may become occasional as opposed to regular, with breeding less likely). Without protection of habitat and improved habitat condition through active management it is expected that overall habitat quality will decrease for Gang-gang Cockatoo.
Offset calculator -Future area and quality with offset – Future quality with offset (1-10)	9/10	There is a high level of confidence that the future quality of the offset site for Gang-gang Cockatoo will increase through the active implementation of the various actions outlined in the OMP. There is a high likelihood that the management actions provided in the OMP will lead to an increase the habitat quality of the site, particularly through management actions designed to minimise existing threats (pest plant and animal species). Actions will include but not be limited to weed control, pest control, preventing inappropriate fire management and preventing disturbance and altered land use. The following actions are expected to improve the future habitat quality for Gang-gang Cockatoo within the offset site: – Control of weeds (woody weeds and understorey weeds). Weed control is required to prevent weeds impacting Gang-gang Cockatoo habitat on site. All woody weeds on site must be eliminated and all high threat herbaceous and grassy weeds will be eliminated or reduced to < 1% cover after the 10 year-period. The following actions are expected to improve the quality of existing understorey and midstorey Gang-gang Cockatoo foraging habitat and allow recruitment/regeneration of canopy species that will provide future breeding habitat. – Control of pest animals (foxes, deer and rabbits). Fox baiting will be undertaken in accordance with the Parks Victoria fox baiting program used in parts of the surrounding Great Otway National Park. Fox dens, where present, will also be destroyed through fumigation and collapse. Fox control shooting will also be undertaken in conjunction with deer shooting and any rabbit shooting. Annual cat trapping is also proposed for the offset site. After the 10-year period, all fox dens and rabbit warrens on site have been hand collapsed and there is no increase in the abundance of pest animals, evidenced by declining numbers of pest animals reported by controllers and declining numbers of pest animals caught on camera traps. Decline in number of pest animals is expected to reduce direct mortality on Gang-gang Cockatoos and improve the quality of foraging habitat and future breeding habitat. – Preventing inappropriate fire management. Fire must be prevented from affecting the offset site where possible. Barwon Water will liaise with PV and DEECA each year at the commencement of the fire season to communicate the requirement to not burn the site if planned burns are going to be undertaken nearby in the future. DEECA have provided assurance that a wildfire would be suppressed as soon as possible after it is detected to protect natural assets. Barwon Water will liaise with Forest Fire Management Victoria (FFMV) regularly to reconfirm the importance of protecting the site from fire. If fire impacts the site, then intensive follow up weed and pest control must be undertaken until native vegetation has recovered sufficiently to suppress weeds and pests. Efforts to prevent fire from impacting on the offset site (and managing threats, if fire occurs) is expected to benefit Gang-gang Cockatoo, by maintaining and improving habitat that could otherwise be lost or degraded. – Preventing disturbance and altered land use. The availability and security of the offset site provides an important patch of local habitat linking adjacent habitats to the west (Great Otway National Park) and north, east and south (Otway Forest Park and freehold forested land), which further consolidates the value of habitat in the property. Monitoring of unauthorised site access (and implementation of measures to prevent unauthorised access, such as installation of gates and cameras, if required) is expected to reduce the risk of public access that may introduce key threats that could impact on habitat for Gang-gang Cockatoo.

Offset assessment guide attribute	Habitat	Justification
		For Gang-gang Cockatoo, a score of 9/10 is expected to be achieved in the future through either (or both) an increase in the 'site condition' score as a result of the management actions (i.e., from a '3' to a '4' – see section 2.2.2.3) and/or an increase to the 'species stocking rate' score from a '2' to a '3' with the likelihood of breeding increasing as potential breeding habitat is protected and managed. With protection of habitat and improved habitat condition through active management it is expected that overall habitat quality will increase for Gang-gang Cockatoo.
Confidence in result – Change in quality	95%	Confidence in applied scores is relatively high due to careful consideration of the offset site, condition and evidence of the landholder's capability to manage threats through agreement to the OMP. Barwon Water understands that management actions (i.e., weed control, pest control) are required to protect and improve habitat quality in the offset site. Professional experienced contractors will be inducted and trained to undertake the work effectively. The site is relatively weed free and accessible and so effective control of weeds on site is considered feasible and achievable. A detailed pest animal program for foxes, rabbits, deer and cats is included in the OMP (ABZECO 2024a) and Barwon Water have agreed to implement the program. Barwon Water understands that it is important that the site is not burnt to protect Gang-gang Cockatoo habitat. Barwon Water will liaise with PV and DEECA to protect the site from planned burns and with FFMV to highlight the importance of protection in the event of wildlife occurring within or near the offset site. Barwon Water understands that preventing unauthorised access is important to protecting the Gang-gang Cockatoo habitat in the offset site and have agreed to ensure the spur track remains closed. They have also agreed to undertake a range of measures including installing steel locked gates, signage, fake security cameras at either end of the spur track and fencing along Morris Track as required if unauthorised access occurs. All the above management actions are expected to contribute to long-term improvement in the quality of habitat for Gang-gang Cockatoo within the offset site. Management methods will be reviewed regularly to ensure they are achieving the desired management outcomes and adaptive management implemented. Regular contact with Parks Victoria (preferred contact advised by PV) will be maintained to coordinate management in adjoining habitats. Barwon Water is a government owned statutory authority under the *Water Act 1989* (Vic) and has a strong commitment to building a healthier environment, and, as a minimum, delivering on all environmental commitments and conditions of approval. Barwon Water has experience with the management of offset requirements under the EPBC Act. The Melbourne Geelong Interconnection Pipeline Project (EPBC Number: 2010/5380) generated the requirement for substantial offsets that were identified and managed through Barwon Water in cooperation with Trust for Nature. Barwon Water has also managed a number of smaller projects not requiring offsets, such as the Refurbishment of the Wurdee Buloc Inlet Channel (EPBC Number: 2012/6266), which required extensive on-ground management actions. The site will be protected through a Section 69 Agreement of the Conservation, Forests and Lands Act 1987 – DELWP (DEECA) is responsible for security agreements under this Act. DEECA undertakes a quality assurance process for all offset sites to ensure the landowner agreements address the management commitments in the plan.
Percentage of impact offset	**108.79%**	Exceeds minimum 90% direct offset requirement

Table F.2 Attribute values for Yellow-bellied Glider – Action area and offset site (450 Morris Track, Lavers Hill)

Offset assessment guide attribute	Habitat	Justification
Impact calculator – Quantum of impact – Area	5.07	Removal of known and potential habitat as detailed in the Preliminary Documentation response (GHD 2023a) and supporting technical report (GHD 2023b). Impact calculated based on the ecological surveys undertaken by GHD (2021) and target surveys for the species (GHD 2023b).
Impact Calculator – Quantum of impact – Quality	7/10	The habitat quality score (7 out of 10) was determined according to DCCEEWs assessment guide (DSEWPaC 2012b), which includes three attributes: 'site condition', 'site context' and 'species stocking rate'. Details of the weighting of these three attributes is described in section 2.2.3.2 and Table 5. Each characteristic was then scored based on the field assessment results presented within the ecology (GHD 2021) and targeted survey report (GHD 2023b). Adjusted quantum of impact: 5.07 x 7/10 = 3.55 ha
Offset calculator – Time horizon – Risk related time horizon	20 years	The proposed offset site would be managed in perpetuity under a legal covenant on title. 20 years is the maximum timeframe for averting loss in the EPBC Act offsets assessment guide.
Offset calculator – Time horizon – Time until ecological benefit	10 years	The existing habitat condition at the proposed offset site is expected to be improved over the 10-year active management schedule as detailed in the OMP. Potential management activities may include, but are not limited to control of pest plants and animals. Ecological benefits arising from management would be assessed progressively over the 10-year period to understand that the management actions are effective and the species maintains its current population presence within the offset site. A tangible increase in site quality score with management or decrease because of ongoing threats would be expected after 10 years.
Offset calculator -Future area and quality without offset – Risk of loss without offset	0%	Risk of loss 0% as per recent DCCEEW guidance
Offset calculator -Future area and quality with offset – Risk of loss with offset	0%	Risk of loss 0% as per recent DCCEEW guidance
Confidence in result – Averted loss of offset	95%	Confidence in applied scores is relatively high due to careful consideration of the offset site, condition and evidence of the landholder's capability to manage threats through agreement to the OMP. Further, DSEWPaC (2013) guidance and recent determinations by DCCEEW suggest that 95 per cent is a reasonable estimate of the confidence in the strength and effectiveness of the agreement at averting the risk of loss of habitat. The offset site will be secured under a Section 69 agreement in accordance with the *Conservation, Forests and Lands Act 1987*. The legally secured offset site will be managed by the landowner under a legal contract and site-specific OMP that will contain a risk assessment detailing relevant risk and mitigation measures for the offset site. The OMP enables land practices that promote positive outcomes on MNES.
Offset calculator – Start area and quality – Area	33.01 ha	The area of Yellow-bellied Glider habitat was mapped based on targeted surveys completed by GHD (2023c). See Table 5 Section 2.2.2. The area exceeds the adjusted quantum of impact by x 9
Offset calculator – Start area and quality – Start quality	8/10	The quality of habitat was assessed based on targeted surveys completed by GHD (2023c). See Table 5 Section 2.2.2. The Yellow-bellied Glider was recorded within the offset site during targeted surveys. The quality score is the same as the impact area.

Offset assessment guide attribute	Habitat	Justification
Offset calculator – Future area and quality without offset – Future quality without offset (1-10)	7/10	Without protection and ongoing management as an offset site, there is a degree of uncertainty regarding the future condition of the land particularly from habitat degradation caused by pest animal and plant species (see GHD 2023b). The OMP provides measures for control of pest plants and animals, both of which left unchecked would be likely to negatively impact the habitats of the site. Key threats to the future habitat quality for Yellow-bellied Glider without securing and management of the offset site include: – Invasion of weeds (woody weeds and understorey weeds). Weed species can outcompete native plants and reduce the quality of midstorey foraging habitat and recruitment of trees which could provide future breeding habitat. If weeds are permitted to invade the offset site and change the vegetation composition and structure this may result in increased fuel loads in the lower vegetation layers, which is likely to have negative implications for Yellow-bellied Glider by increasing the risk of fire frequency and severity. More frequent and severe fires are known to cause direct mortality of Yellow-bellied Glider and indirectly cause declines through the loss of foraging habitat (i.e., loss of sap trees) and breeding habitat (loss of live hollow-bearing trees). – Pest species and predation which can reduce the quality of foraging habitat and likelihood of successful breeding of Yellow-bellied Glider. Pest species, such as the European Rabbit and Deer can reduce the quality of foraging habitat for Yellow-bellied Glider (listed as a key threat within the conservation advice DAWE 2022b) by browsing on and/or damaging recruiting/regenerating native plants (both understorey/midstorey vegetation and future canopy species) and disrupting soil health by digging, pugging, burrowing, creating game trails and spreading of weed seeds, thereby changing the vegetation composition and structure. Predation by foxes and cats on Yellow-bellied Glider are listed as key threats in the conservation advice (DAWE 2022b). The Red Fox is known to climb trees and have been recorded predating on Yellow-bellied Gliders (DAWE 2022b). Although Cat predation on Yellow-bellied Gliders has not been confirmed, they are known to predate on the similar Greater Glider and have been observed climbing Yellow-bellied Glider feed trees (DAWE 2022b). If allowed to increase in numbers within the offset site, foxes and cats are expected to reduce the numbers of Yellow-bellied Gliders within the site through direct mortality and may also indirectly impact the species through stress and behavioural alteration. Foxes and cats may also indirectly impact on Yellow-bellied Glider habitat, by predating on native ground-mammals that are important for maintaining vegetation structure and soil health. – Fire (including extensive severe bushfires and prescribed burns) is listed as a key threat to Yellow-bellied Glider within the conservation advice (DAWE 2022b). Bushfires or prescribed burns can result in the direct mortality of individuals through lethal heating or sublethal inhalation of smoke however, indirect mortality occurs due to the loss of important habitat features and resources such as sap feeding trees and live hollow - bearing trees (DAWE 2022b). Fire may also increase individuals' vulnerability to other threatening processes (such as exposure to foxes and cats). The offset site is long unburnt and failing to secure the offset site will increase the likelihood of inappropriate fire regimes occurring (i.e., due to unplanned ignitions of bushfires as a result of public access to the site, or reduced ability to control fire and fuel load within the site, i.e., for planned burns). Fire can kill and destroy live (and dead) hollow bearing trees and if too frequent and or intense can reduce flora species diversity and cover over time. This would impact Yellow-bellied Glider habitat by reducing nest sites and foraging resources. There would also be less shelter increasing the risk of predation from foxes and cats. – Disturbance and altered land use. The offset property is zoned Farming Zone (FZ) – there is a risk that some of the habitat will be lost to agricultural use (e.g., grazing) if not protected as an offset site, which could result in direct habitat removal and/or degradation of habitat for Yellow-bellied Glider. Additionally, if not secured as an offset it is possible that public access to the site will persist or increase for recreational purposes (i.e., trail bikes, four-wheel driving) which could increase the spread of weeds and plant pathogens (i.e., *Phytopthora*) into the site via tyres, footwear and other equipment. Vehicles, foot traffic, illegal hunting

Offset assessment guide attribute	Habitat	Justification
		and illegal firewood collection can also cause noise, damage to vegetation and soil and alter hydrology or quality of waterways which can degrade habitat for Yellow-bellied Glider. For Yellow-bellied Glider, a score of 7/10 is expected to be achieved in the future without offset through either (or both) a decrease in the 'site condition' score as a result of high threats (such as weeds, pests, fire and disturbance) impacting on habitats within the site (i.e., from a '3' to a '2' – see section 2.2.3.2) and/or an decrease to the 'species stocking rate' score from a '2' to a '1'. Yellow-bellied Glider use of the site may decrease as habitat quality declines (i.e., habitat use may become occasional or transitory as opposed to regular use or breeding habitat). Without protection of habitat and improved habitat condition through active management it is expected that overall habitat quality will decrease for Yellow-bellied Glider.
Offset calculator – Future area and quality with offset – Future quality with offset (1-10)	9/10	There is a high level of confidence that the future quality of the offset site for Yellow-bellied Glider will increase through the active implementation of the various actions outlined in the OMP. There is a high likelihood that the management actions provided in the OMP will lead to an increase the habitat quality of the site, particularly through management actions designed to minimise existing threats (pest plant and animal species). Actions will include but not be limited to weed control, pest control, preventing inappropriate fire management and preventing disturbance and altered land use. The following actions are expected to improve the future habitat quality for Yellow-bellied Glider within the offset site: – Control of weeds (woody weeds and understorey weeds). Weed control is required to prevent weeds impacting Yellow-bellied Glider habitat on site. All woody weeds on site must be eliminated and all high threat herbaceous and grassy weeds will be eliminated or reduced to < 1% cover after the 10 year-period. The following actions are expected to improve the quality of existing understorey and midstorey Yellow-bellied Glider foraging habitat and allow recruitment/regeneration of canopy species that will provide foraging habitat (sap feed trees) and future breeding habitat. – Control of pest animals (foxes, deer and rabbits). Fox baiting will be undertaken in accordance with the Parks Victoria fox baiting program used in parts of the surrounding Great Otway National Park. Fox dens, where present, will also be destroyed through fumigation and collapse. Fox control shooting will also be undertaken in conjunction with deer shooting and any rabbit shooting. Annual cat trapping is also proposed for the offset site. After the 10-year period, all fox dens and rabbit warrens on site have been hand collapsed and there is no increase in the abundance of pest animals, evidenced by declining numbers of pest animals reported by controllers and declining numbers of pest animals caught on camera traps. Decline in number of pest animals is expected to reduce direct mortality on Yellow-bellied Glider and improve the quality of foraging habitat and future breeding habitat. – Preventing inappropriate fire management. Fire must be prevented from affecting the offset site where possible. Barwon Water will liaise with PV and DEECA each year at the commencement of the fire season to communicate the requirement to not burn the site if planned burns are going to be undertaken nearby in the future. DEECA have provided assurance that a wildfire would be suppressed as soon as possible after it is detected to protect natural assets. Barwon Water will liaise with Forest Fire Management Victoria (FFMV) regularly to reconfirm the importance of protecting the site from fire. If fire impacts the site, then intensive follow up weed and pest control must be undertaken until native vegetation has recovered sufficiently to suppress weeds and pests. Efforts to prevent fire from impacting on the offset site (and managing threats, if fire occurs) is expected to benefit Yellow-bellied Glider, by maintaining and improving habitat that could otherwise be lost or degraded. – Preventing disturbance and altered land use. The availability and security of the offset site provides an important patch of local habitat linking adjacent habitats to the west (Great Otway National Park) and north, east and south (Otway Forest Park and freehold forested land), which further consolidates the value of habitat in the property. Monitoring of

Offset assessment guide attribute	Habitat	Justification
		unauthorised site access (and implementation of measures to prevent unauthorised access, such as installation of gates and cameras, if required) is expected to reduce the risk of public access that may introduce key threats that could impact on habitat for Yellow-bellied Glider. For Yellow-bellied Glider, a score of 9/10 is expected to be achieved in the future through either (or both) an increase in the 'site condition' score as a result of the management actions (i.e., from a '3' to a '4' – see section 2.2.3.2) and/or an increase to the 'species stocking rate' score from a '2' to a '3' with the likelihood of breeding increasing as potential breeding habitat is protected and managed. With protection of habitat and improved habitat condition through active management it is expected that overall habitat quality will increase for Yellow-bellied Glider.
Confidence in result – Change in quality	95%	Confidence in applied scores is relatively high due to careful consideration of the offset site, condition and evidence of the landholder's capability to manage threats through agreement to the OMP. Barwon Water understands that management actions (i.e., weed control, pest control) are required to protect and improve habitat quality in the offset site. Professional experienced contractors will be inducted and trained to undertake the work effectively. The site is relatively weed free and accessible and so effective control of weeds on site is considered feasible and achievable. A detailed pest animal program for foxes, rabbits, deer and cats is included in the OMP (ABZECO 2024a) and Barwon Water have agreed to implement the program. Barwon Water understands that it is important that the site is not burnt to protect Yellow-bellied Glider habitat. Barwon Water will liaise with PV and DEECA to protect the site from planned burns and with FFMV to highlight the importance of protection in the event of wildlife occurring within or near the offset site. Barwon Water understands that preventing unauthorised access is important to protecting Yellow-bellied Glider habitat in the offset site and have agreed to ensure the spur track remains closed. They have also agreed to undertake a range of measures including installing steel locked gates, signage, fake security cameras at either end of the spur track and fencing along Morris Track as required if unauthorised access occurs. All the above management actions are expected to contribute to long-term improvement in the quality of habitat for Yellow-bellied Glider within the offset site. Management methods will be reviewed regularly to ensure they are achieving the desired management outcomes and adaptive management implemented. Regular contact with Parks Victoria (preferred contact advised by PV) will be maintained to coordinate management in adjoining habitats. Barwon Water is a government owned statutory authority under the *Water Act 1989* (Vic) and has a strong commitment to building a healthier environment, and, as a minimum, delivering on all environmental commitments and conditions of approval. Barwon Water has experience with the management of offset requirements under the EPBC Act. The Melbourne Geelong Interconnection Pipeline Project (EPBC Number: 2010/5380) generated the requirement for substantial offsets that were identified and managed through Barwon Water in cooperation with Trust for Nature. Barwon Water has also managed a number of smaller projects not requiring offsets, such as the Refurbishment of the Wurdee Buloc Inlet Channel (EPBC Number: 2012/6266), which required extensive on-ground management actions. The site will be protected through a Section 69 Agreement of the Conservation, Forests and Lands Act 1987 – DELWP (DEECA) is responsible for security agreements under this Act. DEECA undertakes a quality assurance process for all offset sites to ensure the landowner agreements address the management commitments in the plan.
Percentage of impact offset	**173.23%**	Greatly exceeds minimum 90% direct offset requirement

Table F.3 Attribute values for Long-nosed Potoroo – 245 Distillery Creek Road

Offset assessment guide attribute	Habitat	Justification
Impact calculator – Quantum of impact – Area	7.81 ha	The extent of removal of known and potential habitat is detailed in the Preliminary Documentation response (GHD 2023a) and supporting technical report (GHD 2023b and c). Impact calculated based on the ecological surveys undertaken by GHD (2021) and target surveys for the species (GHD 2023c).
Impact Calculator – Quantum of impact – Quality	7/10	The habitat quality score (7 out of 10) was determined according to DCCEEWs assessment guide (DSEWPaC 2012b), which includes three attributes: 'site condition', 'site context' and 'species stocking rate'. Details of the weighting of these three attributes is described in section 2.2.4.6 and Table 6. Each characteristic was then scored based on the field assessment results presented within the ecology (GHD 2021) and targeted survey report (GHD 2023b). Adjusted quantum of impact: 7.81 x 7/10 = 5.47 ha
Offset calculator – Time horizon – Risk related time horizon	20 years	The proposed offset site would be managed in perpetuity under a legal covenant on title. 20 years is the maximum timeframe for averting loss in the EPBC Act offsets assessment guide.
Offset calculator – Time horizon – Time until ecological benefit	10 years	The existing habitat condition at the proposed offset site is expected to be improved over the 10-year active management period as detailed in the OMP. Potential management activities include: control of pest plants and animals. Ecological benefits arising from management would be assessed progressively over the 10-year period to understand that the management actions are effective and the species maintains its current population presence within the offset site. A tangible increase in site quality score with management or decrease because of ongoing threats would be expected after 10 years.
Offset calculator – Future area and quality without offset – Risk of loss without offset	0%	Risk of loss 0% as per recent DCCEEW guidance
Offset calculator – Future area and quality with offset – Risk of loss with offset	0%	Risk of loss 0% as per recent DCCEEW guidance
Confidence in result – Averted loss of offset	95%	Confidence in applied scores is high due to careful consideration of the offset site, condition and evidence of the landholder's capability to manage threats through agreement to the OMP. Further, DSEWPaC (2013) guidance and recent determinations by DCCEEW suggest that 95 per cent is a reasonable estimate of the confidence in the strength and effectiveness of the agreement at averting the risk of loss of habitat. The offset site will be secured under a Section 69 agreement in accordance with the *Conservation, Forests and Lands Act 1987*. The legally secured offset site will be managed by the landowner under a legal contract and site-specific OMP that will contain a risk assessment detailing relevant risk and mitigation measures for the offset site. The OMP enables land practices that promote positive outcomes on MNES.
Offset calculator – Start area and quality – Area	29.43 ha	The area of Long-nosed Potoroo habitat was mapped based on targeted surveys completed by GHD (2023c). See Table 6 Section 2.2.2. The area exceeds the adjusted quantum of impact by x 5
Offset calculator – Start area and quality – Start quality	8/10	The quality of Long-nosed Potoroo habitat was assessed based on targeted surveys completed by GHD (2023c). See Table 6 Section 2.2.2. The Long-nosed Potoroo was recorded within the offsite during targeted surveys.

Offset assessment guide attribute	Habitat	Justification
Offset calculator – Future area and quality without offset – Future quality without offset (1-10)	7/10	Without protection and ongoing management as an offset site, there is a degree of uncertainty regarding the future condition of the land particularly from habitat degradation caused by pest animal and plant species (see GHD 2023c). The OMP provides measures for control of pest plants and animals, both of which left unchecked would be likely to negatively impact the habitats of the site. Key threats to the future habitat quality for Long-nosed Potoroo without securing and management of the offset site include: – Invasion of weeds. Weed species can invade, establish and outcompete native plants and reduce the quality of habitat. Weeds are listed as a key threat to Long-nosed Potoroo and if weeds are permitted to invade the offset site they could directly impact food availability by changing the vegetation composition and structure (DAWE 2022c). Fuel loads in the lower vegetation layers may also increase, which is likely to have negative implications for Long-nosed Potoroo by increasing the risk of fire frequency and severity. – Predation by foxes and cats on Long-nosed Potoroo is listed as a key threat in the conservation advice (DAWE 2022c) and both foxes and cats were recorded within the offset property during the surveys (Appendix B). If allowed to increase in numbers within the offset site, foxes and cats are expected to reduce the numbers of Long-nosed Potoroo within the site through direct mortality and may also indirectly impact the species through stress and behavioural alteration. Foxes and cats may also indirectly impact on Long-nosed Potoroo habitat, by predating on other native ground-mammals that are important for maintaining vegetation structure and soil health. – Feral herbivores, such as the European Rabbit and deer that were recorded within the offset property during the surveys (Appendix B), can reduce the quality of foraging habitat for Long-nosed Potoroo (listed as a threat within the conservation advice DAWE 2022c) by browsing on and/or damaging recruiting/regenerating native plants and disrupting soil health by digging, pugging, burrowing, creating game trails and spreading of weed seeds, thereby changing the vegetation composition and structure. – Inappropriate fire regime is listed as a threat to Long-nosed Potoroo within the conservation advice (DAWE 2022c). High frequency fires can result in changed habitat structure and fires that coincide with breeding can potentially decrease breeding success. Fire may also increase individuals' vulnerability to other threatening processes (such as exposure to foxes and cats). – Disturbance and altered land use. The offset property is zoned Public Use (PU) so there is a risk that some of the habitat will be lost to future use/development of the site (e.g., expansion of Water Treatment Plant or other utility use) if not secured as an offset. For Long-nosed Potoroo, a score of 7/10 is expected to be achieved in the future without offset through either (or both) a decrease in the 'site condition' score as a result of high threats (such as weeds, pests, fire and disturbance) impacting on habitats within the site (i.e., from a '3' to a '2' – see section 2.2.4.2) and/or an decrease to the 'species stocking rate' score from a '3' to a '2'. Long-nosed Potoroo use of the site may decrease as habitat quality declines. Without protection of habitat and improved habitat condition through active management it is expected that overall habitat quality will decrease for Long-nosed Potoroo.

Offset assessment guide attribute	Habitat	Justification
Offset calculator – Future area and quality with offset – Future quality with offset (1-10)	9/10	There is a high level of confidence that the future quality of the offset site will increase through the active implementation of the various actions outlined in the OMP. There is a high likelihood that the management actions provided in the OMP will lead to an increase in the habitat quality of the site, particularly through management actions designed to minimise existing threats (pest plant and animal species). Actions will include but not be limited to weed control, pest control, preventing inappropriate fire management and preventing disturbance and altered land use. The following actions are expected to improve the future habitat quality for Long-nosed Potoroo within the offset site: – Control of weeds to prevent weeds impacting Long-nosed Potoroo habitat on site. All woody weeds on site must be eliminated and all high threat herbaceous and grassy weeds will be eliminated or reduced to < 1% cover after the 10 year-period. – Control of pest animals (foxes, deer, cats and rabbits) to protect the population of Long-nosed Potoroo from predation and habitat quality. Fox baiting will be undertaken in accordance with the Parks Victoria fox baiting program used in parts of the surrounding Great Otway National Park and Anglesea Heath. Fox dens, where present, will also be destroyed through fumigation and collapse. Deer control shooting is proposed and potentially fox shooting and rabbit shooting. Cat trapping is also proposed for the offset site. Decline in number of pest animals is expected to reduce direct mortality on Long-nosed Potoroo and improve the quality of foraging habitat and future breeding habitat. – Preventing inappropriate fire management. Barwon Water will engage with Parks Victoria to assist with maintaining most of the site in an unburnt condition for over 20 years. After 20 years of being unburnt, ecological mosaic burning is proposed to be undertaken. If fire impacts the site, then intensive follow up pest control must be undertaken and supplementary planting if vegetation is not recovering post fire. Efforts to prevent fire from impacting on the offset site (and managing threats, if fire occurs) is expected to benefit Long-nosed Potoroo, by maintaining and improving habitat that could otherwise be lost or degraded by fire. – Other ongoing management commitments include: • Control all high threats • Control rubbish dumping • Undertake track remediation including prevention and repair of erosion and revegetation • Protect the site from being readily accessible by persons (i.e., exclude persons, other than those required for management or monitoring) • Monitor threats throughout the year (at least once per quarter) • Retain all standing trees (dead or alive) • Retain all logs, fallen timber and leaf litter • Exclude stock For Long-nosed Potoroo, a score of 9/10 is expected to be achieved in the future through either (or both) an increase in the 'site condition' score as a result of the management actions (i.e., from a '3' to a '4' – see section 2.2.4.2). With protection of habitat and improved habitat condition through active management it is expected that overall habitat quality will increase for Long-nosed Potoroo. Further, the availability and security of the offset site provides and important patch of local habitat for the species, expanding upon the protected reserve system (Great Otway National Park).

Offset assessment guide attribute	Habitat	Justification
Confidence in result – Change in quality	95%	Confidence in applied scores is relatively high due to careful consideration of the offset site, condition and evidence of the landholder's capability to manage threats through agreement to the OMP. Barwon Water understands that management actions (i.e., weed control, pest control) are required to protect and improve habitat quality in the offset site. Professional experienced contractors will be inducted and trained to undertake the work effectively. Barwon Water is a government owned statutory authority under the *Water Act 1989* (Vic) and has a strong commitment to building a healthier environment, and, as a minimum, delivering on all environmental commitments and conditions of approval. Barwon Water has experience with the management of offset requirements under the EPBC Act. The Melbourne Geelong Interconnection Pipeline Project (EPBC Number: 2010/5380) generated the requirement for substantial offsets that were identified and managed through Barwon Water in cooperation with Trust for Nature. Barwon Water has also managed a number of smaller projects not requiring offsets, such as the Refurbishment of the Wurdee Buloc Inlet Channel (EPBC Number: 2012/6266), which required extensive on-ground management actions. Management methods will be reviewed regularly to ensure they are achieving the desired management outcomes and adaptive management implemented. Regular contact with Parks Victoria (preferred contact advised by PV) will be maintained to coordinate management in adjoining habitats. The site will be protected through a Section 69 Agreement of the Conservation, Forests and Lands Act 1987 – DELWP (DEECA) is responsible for security agreements under this Act. DEECA undertakes a quality assurance process for all offset sites to ensure the landowner agreements address the management commitments in the plan.
Percentage of impact offset	**100.25%**	Exceeds minimum 90% direct offset requirement

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