Olive Downs

Stage 2 Offset Area Management Plan

Prepared for Pembroke Resources

May 2024

Olive Downs

Stage 2 Offset Area Management Plan

Pembroke Resources

E220619 RP#1

May 2024

Version	Date	Prepared by	Reviewed by	Comments
V1	16 April 2024	Elliot Leach	Sandra Walters	Draft for client review
V2	23 May 2024	Andrew Jensen	Berlinda Ezzy	Final
V3	06 May 2025	Rebecca Simpson	Ann Stray	Addressed feedback from DCCEEW

Approved by

Berlinda Ezzy
Associate Director
23 May 2024

Level 1 87 Wickham Terrace
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Declaration of accuracy

I declare that:

1. To the best of my knowledge, all the information contained in, or accompanying this Offset Area Management Plan is complete, current and correct.
2. I am the designated proponent or the approval holder for this action.
3. I am aware that:
    a. Section 490 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence for an approval holder to provide information in response to an approval condition where the person is reckless as to whether the information is false or misleading.
    b. Section 491 of the EPBC Act makes it an offence for a person to provide information or documents to specified persons who are known by the person to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth) where the person knows the information or document is false or misleading.
    c. The above offences are punishable on conviction by imprisonment, a fine or both.

Signed

Name

Organisation

Date

Glossary of terms

Table G1 Glossary of terms

Terms/acronyms	Definition
EIS	Environmental Impact Statement
EMM	EMM Consulting Pty Ltd
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
MNES	Matter of National Environmental Significance
MSES	Matter of State Environmental Significance
NC Act	*Nature Conservation Act 1992*
OAMP	Offset Area Management Plan
Pembroke	Pembroke Olive Downs Pty Ltd
The Project	Olive Downs Coking Coal Project
RE	Regional Ecosystem

Executive summary

The Olive Downs Coking Coal Project is a greenfield metallurgical coal mine within the Bowen Basin, located approximately 40 kilometres (km) south-east of Moranbah, Queensland. The proponent is Pembroke Olive Downs Pty Ltd (Pembroke).

All referrals for the Project were assessed under the bilateral agreement between the Commonwealth and the State of Queensland, via an Environmental Impact Statement (EIS). All four referrals (EPBC 2017/7867, 2017/7868, 2017/7869, 2017/7870) have now received approvals, with conditions, under the EPBC Act, with the last approval being that associated with the mine site and access road dated 14 May 2020.

Due to design modifications, the commencement of Stage 2 is proposed to be brought forward, with construction to commence in 2024. Consequently, an EPBC Approval amendment was lodged with DCCEEW in early 2024, to allow the earlier commencement of Stage 2 (Pembroke 2024). Stage 2 will occur over an estimated 8 years and predominantly involves the development of mine pits and the construction of supporting infrastructure.

Approval conditions require Pembroke to compensate for the clearance of listed threatened species' habitat through provision of environmental offsets that are consistent with the EPBC Act *Environmental Offsets Policy* (DSEWPC 2012a).

Pembroke has undertaken extensive ecological surveys and impact assessments as part of preparing the EIS for the Project, evaluating the potential for significant impacts to occur to both matters of state and national environmental significance (MSES and MNES). Four MNES will be impacted in Stage 2:

- Ornamental Snake (*Denisonia maculata*).
- Squatter Pigeon (southern) (*Geophaps scripta scripta*).
- Greater Glider (*Petauroides volans sensu lato*).
- Koala (*Phascolarctos cinereus*).

The purpose of this Stage 2 OAMP is to describe the offset area, the performance outcomes to be achieved for each MNES, the management actions to be implemented to achieve the set outcomes, the risks to achieving those outcomes and appropriate corrective actions, and the associated monitoring and reporting program.

This plan outlines key strategies to improve the habitat quality for the target threatened species across the offset area. These strategies include natural resource management (fire, feral animal and weed control), targeted biodiversity surveys, and deliberate measures to regenerate habitat (e.g. grazing control, selective planting, exclusion fencing). The plan includes completion criteria, action triggers and corrective actions to ensure goals are achieved.

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1 Introduction

1.1 Background

Pembroke Olive Downs Pty Ltd (Pembroke) is the proponent for the Olive Downs Coking Coal Project (herein referred to as the Project). The Project is a greenfield metallurgical coal mine within the Bowen Basin, located approximately 40 kilometres (km) south-east of Moranbah, Queensland. The coal resource will be mined by conventional open cut mining methods, with product coal to be transported by rail to the Dalrymple Bay Coal Terminal.

The Project, discussed in the draft EIS (Pembroke 2019) comprises four separate components being:

- the mine and access road
- a rail spur connecting the mine site to the Norwich Park Branch Railway
- a water pipeline connecting to the Eungella pipeline network
- an electricity transmission line (ETL).

The Project components were approved to be delivered in four stages, which are shown in Figure 1.1. Stage 2 of the Project is primarily concerned with the construction of secondary elements of the mine and was included in the referral to the Commonwealth Department of Agriculture, Water and the Environment (DAWE) in 2019. This referral (Olive Downs Mine Site and Access Road (EPBC 2017/7867)) was subsequently determined to be a 'controlled action' requiring assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The referral was assessed under the bilateral agreement between the Commonwealth and the State of Queensland, via an Environmental Impact Statement (EIS) (see Pembroke 2019), and was approved under the EPBC Act on 14 May 2020.

Due to design modifications, the commencement of Stage 2 is proposed to be brought forward, with construction to commence in 2024. Consequently, an EPBC Approval amendment was lodged with DCCEEW in early 2024, to allow the earlier commencement of Stage 2 (Pembroke 2024). Stage 2 will occur over an estimated 8 years and predominantly involves the development of mine pits and the construction of their supporting infrastructure.

The EIS identified that significant impacts are likely to occur to matters of national environmental significance (MNES) as a result of Stage 2 activities, and that environmental offsets will be required for those matters. Offsets required for Stage 2 works are summarised in Table 1.1.

The required offsets are proposed to be delivered predominantly as direct, land-based offsets and Pembroke has identified the Stage 2 offset area for approval. Pembroke has commissioned detailed ecological surveys across the Stage 2 Offset Area to confirm the area supports, or has the potential to support, the required MNES. Evidence to support the suitability of the proposed offset for Stage 2 impacts is provided in this Offset Area Management Plan (OAMP) and the Stage 2 Offset Area Supporting Report (EMM 2024).

Table 1.1 Stage 2 significant residual impacts to be offset

MNES	Stage 2 impact (ha)*
Ornamental Snake (*Denisonia maculata*) important habitat	1374
Squatter Pigeon (southern)† (*Geophaps scripta scripta*) breeding habitat	439
Squatter Pigeon (southern) (*Geophaps scripta scripta*) foraging habitat	255
Greater Glider (*Petauroides volans sensu lato*)‡ habitat	741
Koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT) habitat	724

* Stage 2 impact areas are derived from EPBC approval amendment.

† Hereafter referred to as 'Squatter Pigeon'.

‡ Note that due to the current taxonomic uncertainty regarding Greater Gliders (*Petauroides* spp.) (see McGregor et al 2020 and TSSC 2021 for a summary), we will hereafter refer to the central Queensland population as 'Greater Glider', accepting that future taxonomic work may lead to a change in the species' name and/or status in the region.

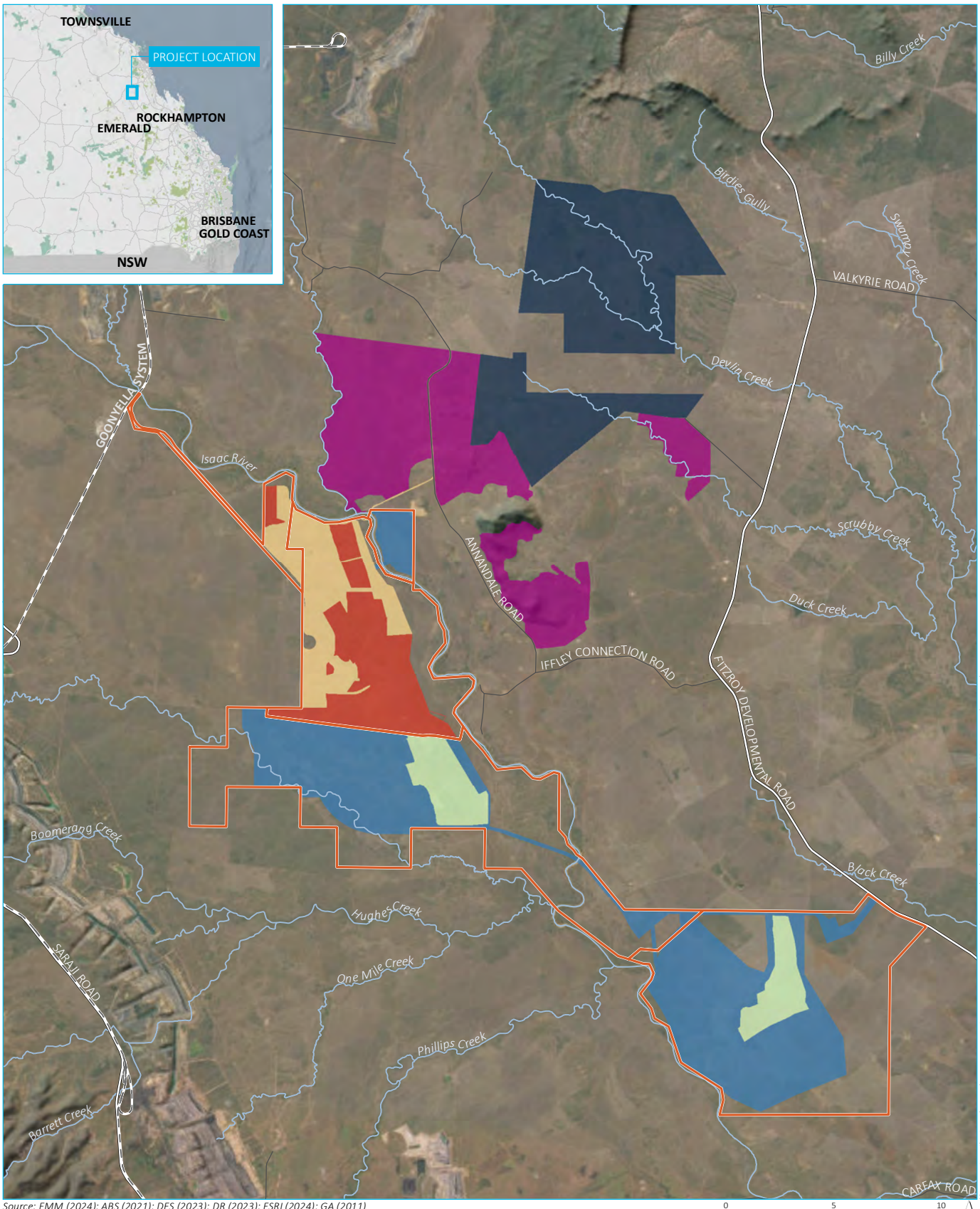
1.2 Purpose and scope

The purpose of this Stage 2 OAMP is to describe the offset area, the performance outcomes to be achieved for each MNES, the management actions to be implemented to achieve the set outcomes, the risks to achieving those outcomes and appropriate corrective actions, and the associated monitoring and reporting program.

Approval conditions require Pembroke to compensate for the clearance of listed threatened species habitat through provision of environmental offsets that are consistent with the EPBC Act *Environmental Offsets Policy* (DSEWPC 2012a).

Conditions of approval pertaining to environmental offsets and the Stage 2 OAMP are summarised in Table 1.2, including references to the relevant sections where they are addressed within the OAMP. These conditions are currently being varied with DCCEEW as part of an amendment to EPBC 2017/7867, and the proposed draft conditions are provided in Table 1.2.

Figure 1.1 Location of Olive Downs Mine Project and proposed Stage 2 Offset Area



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Source: EMM (2024); ABS (2021); DES (2023); DR (2023); ESRI (2024); GA (2011)

0 5 10 km

GDA 1994 MGA Zone 55

N

KEY

- Mining lease boundary
- Offset area
  - Stage 1
  - Proposed Stage 2
- Mine impact stage
  - Stage 1
  - Stage 2
  - Stage 3
  - Stage 4
- Existing environment
  - Rail line
  - Major road
  - Minor road
  - Named watercourse
- INSET KEY
  - Major road
  - National park/nature reserve
  - State forest

Location of Olive Downs Mine Project and proposed Stage 2 Offset Area

Olive Downs Stage 2
Offset Area Management Plan
Figure 1.1

EMM creating opportunities

Table 1.2 Conditions of approval pertaining to offsets – Mine Site & Access Road (EPBC 2017/7867)

Condition number	Requirements	Section of report addressed	Key commitments
2.	During each stage of the action, the approval holder must not clear more than the areas (in hectares) of habitat for each listed threatened species and community as specified in the following table:	NA; noted.	During each stage of the action, Pembroke agrees to clear no more than the agreed areas of habitat for each listed threatened species.
3.	To compensate for the clearance of habitat for listed threatened species and community for Stage 2 up to the limits as specified in condition 2, the approval holder must provide an environmental offset consistent with the Environmental Offsets Policy.	Compliance with Environmental Offsets Policy is addressed in Section 2.3 on page 8. Offset calculator outputs are provided in Stage 2	NA

MNES	Stage 1	Stage 2	Stage 3	Stage 4
Ornamental Snake (*Denisonia maculata*) important habitat	973.9	1,373.5	4,174.12	1,221.23
Squatter Pigeon (Southern) (*Geophaps scripta scripta*) breeding habitat	810.45	439.41	2,907.43	322
Squatter Pigeon (Southern) (*Geophaps scripta scripta*) foraging habitat	133.76	255.16	471.08	6.5
Greater Glider (*Petauroides volans*) habitat	932.81	741.43	3,532.33	389
Australian Painted Snipe (*Rostratula australis*) breeding habitat	16	0	73	25
Koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT) habitat	1,099	724	3,582	354
Brigalow TEC	0	0	13	0

Table 1.2 Conditions of approval pertaining to offsets – Mine Site & Access Road (EPBC 2017/7867)

Condition number	Requirements	Section of report addressed	Key commitments
		OAMP Supporting Report.	
12.	The environmental offset to compensate for the clearance of 741.43 ha of Greater Glider (*Petauroides volans*) habitat for Stage 2 must result in a measured increase in Greater Glider (*Petauroides volans*) habitat connectivity in the riparian zones within the Stage 2 environmental offset.	Increase in Greater Glider habitat connectivity is addressed in Section 4.2.1 on page 53.	- revegetation of riparian habitat - augmentation of habitat with nest boxes - active management of threats (weeds, fire, feral animals).
13.	At least 6 months prior to the commencement of Stage 2, the approval holder must submit a Stage 2 OAMP prepared by a suitably qualified ecologist for the written approval of the Minister. The approval holder must not commence Stage 2 until the Stage 2 OAMP has been approved in writing by the Minister. The approved Stage 2 OAMP must be implemented.	This OAMP addresses Condition 13. Demonstration of 'suitably qualified ecologist' is provided in Section 2.4 on page 12.	
14.	The Stage 2 OAMP must include the offset information to compensate for the clearance of habitat for each listed threatened species and community as provided for in condition 2 in accordance with the principles of the Environmental Offsets Policy.	Values for each MNES within the offset are addressed in Section 3.3 on page 34.	- management of known threats for each MNES - improvement in habitat quality for breeding, shelter and foraging for each MNES -improvement of habitat connectivity for each MNES
15.	To assess the effectiveness of the management actions in the Stage 2 OAMP to increase Greater Glider (*Petauroides volans*) habitat connectivity in the riparian zones within the Stage 2 environmental offset, the approval holder must engage an independent suitably qualified expert to undertake an assessment every 5 years from the implementation date of the approved Stage 2 OAMP until the approved Stage 2 OAMP offset completion criteria are achieved.	The 5-yearly independent report is addressed in Section 7.4 on page 105.	- independent suitably qualified expert will review effectiveness of

Table 1.2 Conditions of approval pertaining to offsets – Mine Site & Access Road (EPBC 2017/7867)

Condition number	Requirements	Section of report addressed	Key commitments
			management actions every 5 years.
16.	The approval holder must ensure each assessment of the effectiveness of the management actions in the Stage 2 OAMP is: • subject to a peer-review completed within 6 months of the completion each such assessment; and • published on its website with the findings of the peer-review within 6 months of the completion of the peer-review and for the duration of this approval.	Peer-review and reporting is addressed in Section 7.4 on page 105.	- independent review will be published on Pembroke's website within 6 months of completion.
17.	The approval holder must legally secure the Stage 2 environmental offset within 2 years from the date that the Stage 2 OAMP is approved by the Minister in writing. The approved Stage 2 OAMP must be attached to the legal mechanism used to legally secure the Stage 2 environmental offset.	Legal security of the offset is addressed in Section 4.2.10 on page 75.	-offset will be legally secured within 2 years of approval of OAMP
18.	The approval holder must notify the Department within 5 business days of the mechanism to legally secure the Stage 2 environmental offset being executed.	Legal security of the offset is addressed in Section 4.2.10 on page 75.	- notification will be provided within 5 business days

2 Legal framework

A summary of key legislation and policies pertaining to the design and implementation of the Stage 2 Offset Area is provided in the following sections.

2.1 EPBC Act

Under the EPBC Act approvals for the Project, Pembroke is required to offset the significant, residual impacts to MNES. Delivery of the offsets in stages has been approved by DCCEEW with the Stage 1 OAMP already approved by the Minister prior to the Project commencement. For Stages 2 to 4 of the Project, a biodiversity offset will be provided and an applicable OAMP approved by the Minister before the commencement of each stage.

The Stage 2 Offset Area is designed to be consistent with the EPBC Act Environmental Offsets Policy and compensate for residual impacts associated with the construction of Stage 2 of the mine site and access road (hereafter referred to as Stage 2). A summary of the residual impacts to MNES required be offset in Stage 2 is provided in Table 1.1.

The OAMP is required to be prepared by a suitably qualified ecologist and submitted for the written approval of the Minister. The approved OAMP must be implemented.

Applicable conditions of approval associated with the Stage 2 offsets, and where these requirements have been addressed, are summarised in Section 1.2.

2.2 Environmental Offsets Policy

The proposed environmental offsets have been assessed using the framework under the EPBC Act *Environmental Offsets Policy* (DSEWPC 2012a) (the Policy). Offset assessment methodologies have applied the criteria within the *How to use the offsets assessment guide* (DSEWPC 2012b) which supports the Policy.

The key components of the guide are the Impact Calculator and Offset Calculator (refer Plate 2.1). Once the inputs have been provided for the Impact Calculator and Offset Calculator, the Offset Assessment Guide provides the results as a percentage of impact offset, where a score greater than 100% indicates that all of the impact has been compensated for through a direct offset.

The habitat quality scores on both impact site and offset site were determined by applying the Queensland *Guide to Determining Terrestrial Habitat Quality v 1.3* (DES 2020), which is an endorsed method of deriving a habitat quality score for ecological communities and species listed under the EPBC Act. Habitat Quality scoring for the impact areas and proposed offset areas as well as relevant EPBC Act offset calculator scores and justification of calculator inputs have been provided separately to this OAMP in supporting documentation (see EMM 2024).

Details of ecological surveys of the proposed offset area including habitat mapping for each MNES species and habitat quality assessments are provided in the *Olive Downs Stage 2 Offset Area Supporting Report* dated April 2024 (EMM 2024). Calculator inputs are in accordance with the EPBC Act Offset Assessment Guide (DSEWPC 2012b) whereby multiple attributes are assessed for each impacted matter; these attributes have been refined for the purposes of finalising this OAMP. Offset calculator inputs for each MNES are detailed in EMM (2024). These include assessments of predicted time to ecological benefits of the offset, projected habitat quality as a result of the offset management actions, and projected habitat quality without the implementation of the proposed Stage 2 offset management actions.

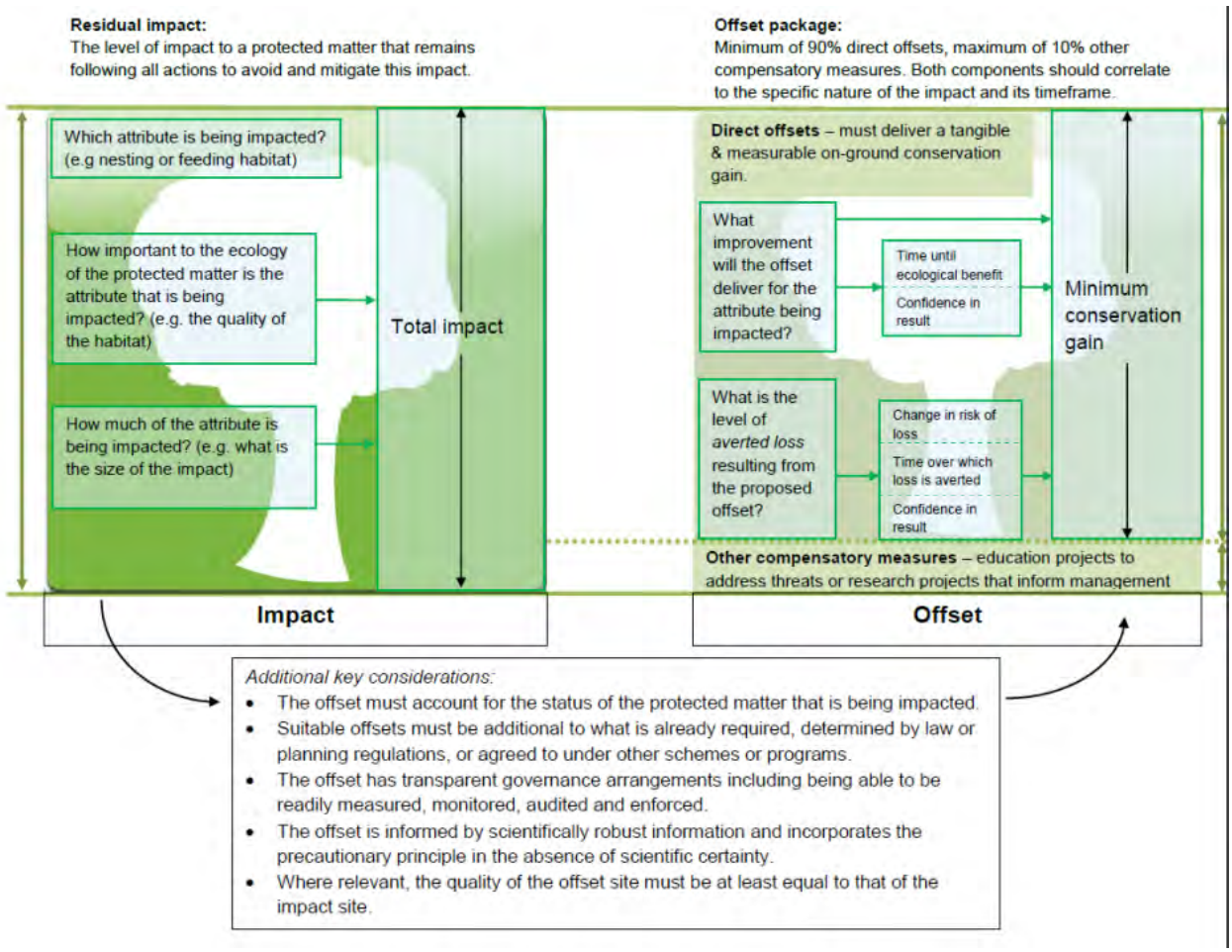


Plate 2.1 Determining suitable offsets under the EPBC Act

2.3 Compliance with Environmental Offsets Policy

The key principles that underpin the Environmental Offsets Policy have been addressed in the selection of the Stage 2 Offset Area, management actions proposed, and overarching governance framework as summarised in this OAMP. Key offset principles and how they have been addressed in this OAMP are summarised in Table 2.1.

Table 2.1 Overarching principles to determine offset suitability

Suitable offsets must	Section of report addressed
1. Deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environmental law and affected by the proposed action	• Each impacted MNES for Stage 2 has a direct land-based offset area proposed (Section 3 and Table 3.3) that currently provides suitable habitat for the species, and/or contains areas that will be restored and rehabilitated to improve habitat quality for the species. • Restoration techniques are detailed in Section 4.2. Monitoring and interim targets regarding how those habitat quality gains will be achieved are summarised in Section 4 and 6. • Overall viability of each MNES will be increased as recognised threats to each MNES (including pest animals, weeds, fire and loss of connectivity) will be mitigated, controlled or improved in the offset area. • All proposed land based offset areas will be actively managed to improve habitat quality over the specified timeframe, and habitat quality gains are set out for each MNES. How these gains will be achieved is addressed in Section 4 and Section 6.3. • The Stage 2 Offset Area will be legally secured in perpetuity, and actively managed over the life of Project to increase MNES habitat extent, increase habitat quality and reduce threats to improve the species viability.

Table 2.1 Overarching principles to determine offset suitability

Suitable offsets must	Section of report addressed
	• All impacted MNES have been confirmed to occur on the proposed Stage 2 Offset Area (refer EMM 2024) and habitat suitability has been demonstrated in Section 3.3. As such the identified matters are known to utilise the Stage 2 Offset Area. • Habitats of the Stage 2 Offset Area will be available to the impacted matters permanently rather than over the period of the proposed action alone. • Management and mitigation actions will be designed and implemented to support the ecological characteristics and functions required for each MNES. For example, the offset will result in an overall increase in the number of Koala food trees, increased extent of habitat, reduced threats from feral predators and improved connectivity to adjacent habitats. Specific outcomes for each MNES are detailed in Table 6.3.
2. Be built around direct offsets but may include other compensatory measures	• The proposed offsets deliver 100% of the offset requirement through land-based offsets for each MNES except Ornamental Snake. Ornamental Snake offsets will be delivered as 93% direct offset and 7% indirect offset. • The Indirect Offset Plan (Appendix B) which delivers 7% of the Ornamental Snake offset requirements forms part of the proposed stage 2 offset delivery and will consist of 6 year research program to help better understand Ornamental Snake dispersal patterns in wet and dry seasons, their biology and home ranges and how factors such as prey abundance and grazing regimes may impact or alter dispersal. • Each impacted MNES in Stage 2 has a direct land-based offset area (Table 3.3) proposed that currently provides suitable habitat for the species, or will be restored and rehabilitated to provide suitable habitat for the species. The direct, land-based offsets for Stage 2 will meet 100% of offset policy requirements (except for Ornamental Snake, as described above) and conservation gains for each impacted matter will be measured through detailed field assessments and reporting of habitat quality. The results of progressive habitat quality reports will also be reviewed by a suitable third party. • Key threats to be addressed by the offset proposal include threats specified in conservation/listing advice and recovery plans for each MNES species (e.g. prevention of clearing, fire protection, pest animal control, weed control and removal/reduction of grazing pressure). • In addition to these direct offsets Pembroke also propose to undertake some supplementary research and monitoring programs as part of the offset delivery for Stage 2. This includes a supplementary nest box research and monitoring program to determine use by Greater Gliders and most effective nest box design. Details are provided in Section 4.2.7; this research is ongoing at the time of writing.
3. Be in proportion to the level of statutory protection that applies to the protected matter	• The land-based offsets proposed have been assessed in accordance with the *EPBC Environmental Offsets Policy* and the *Offsets Assessment Guide* which consider the status of each impacted matter. • The proposed offset areas, management actions and prescribed outcomes are in proportion to the status of MNES impacted and meet the policy requirements.
4. Be of a size and scale proportionate to the residual impacts on the protected matter	• The land-based offsets proposed have been assessed in accordance with the *EPBC Environmental Offsets Policy* and *Offsets Assessment Guide*. This included the quantification of baseline (i.e. starting) Habitat Quality and the predicted final Habitat Quality associated with each impacted matter in the offset area. Impact area Habitat Quality scores were also assessed. A summary of Habitat Quality scoring for impact and offset areas is provided in supporting documentation (EMM 2024). • Habitat Quality scores were developed applying the *Guide to Determining Terrestrial Habitat Quality v 1.3* (DES 2020) using specific habitat attributes for each impacted matter. The Habitat Quality scoring results across different areas were derived for each MNES and input into the EPBC offsets calculator to determine size and scale requirements. Information regarding individual survey sites and Habitat Quality scoring is summarised in supporting documentation (EMM 2024). • Offset calculator results have been provided in supporting documentation including offset calculator inputs and justification (EMM 2024).

Table 2.1 Overarching principles to determine offset suitability

Suitable offsets must	Section of report addressed
	• The scoring process also identified size requirements for the Stage 2 Offset Area. The total offset areas to be legally secured and actively managed are of a larger size than those impacted, are situated near the impacted areas and the offset areas will also enhance patch size of habitats and connectivity for the impacted species.
5. Effectively account for and manage the risks of the offset not succeeding	• Threats to the offset area will be managed through the implementation of the management measures discussed in Section 5 and 6. • Risks to the offset failing have been identified and assessed. The risk matrix from the *Environmental Management Plan Guidelines* (DoE 2014a) has been applied and risks have been scored separately both with and without offset management actions. The risk assessment matrix is provided in Table 5.4. • Relevant actions to manage risk include: – legally securing the offset area on title – restricting access – weed monitoring and control – grazing management – pest fauna management – fuel load management and fire management – habitat restoration through managing natural regeneration and other active techniques such as direct seeding and revegetation. • The risk assessment (Table 5.4) identifies potential risks, management measures to reduce risk probability, and proposed timeframes for corrective actions to be undertaken. • If the proposed Stage 2 Offset Area fails to meet interim targets, corrective actions will be implemented. This includes implementing further management actions in the Stage 2 Offset Area such as additional soil preparations and direct seeding, additional weed control, changes to grazing regime etc. If it is found that these additional corrective actions have not been successful, Pembroke will consider seeking out supplementary offset areas for those habitat restoration areas that are not on track to meet performance outcomes in Table 6.3. Options for alternate offsets include those currently identified for subsequent offset areas associated with later stages of the Project. Risks and mitigation measures are described in Section 5, Table 5.4 and corrective actions associated with management activities are outlined in Section 4.
6. Be additional to what is already required, determined by law or planning regulations or agreed to under schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action, see section 7.6 of offsets policy)	• The land-based offsets and supplementary research and funding that are to be delivered by Pembroke provide significant 'additionality' to what is required by law or planning regulation. The additional actions include installation of nest boxes targeting Greater Glider as summarised in Section 4.2.7, the monitoring of Greater Glider use of nest boxes and revegetation areas as summarised in Section 6.3 and ongoing monitoring of threatened fauna populations across the offset area. Additionality of proposed management actions is further discussed in supporting documentation as part of the offset calculator inputs (see EMM 2024). • Currently, the proposed offset properties are being grazed and regrowth areas have been actively managed for this purpose (e.g. re-cleared lawfully). Non-remnant areas that are MNES habitat (especially gilgai habitat for Ornamental Snake) would likely continue to be degraded by livestock or ploughed and cropped if not protected as an offset. • Grazing and agricultural activities would continue, preventing further regeneration of native vegetation communities which provide habitat for the MNES species. • In Queensland there are no existing land management obligations that prescribe or exclude fire. An inappropriate fire regime has the potential to degrade and destroy MNES habitat values including hollow-bearing trees and regenerating woodland. • Removing cattle and reducing grazing levels, actively improving condition of the remnant vegetation, promoting regeneration and restoration of vegetation communities, undertaking supplementary tree planting and installing nest boxes are all 'additional' actions to be implemented.

Table 2.1 Overarching principles to determine offset suitability

Suitable offsets must	Section of report addressed
7. Be efficient, effective, timely, transparent, scientifically robust and reasonable	• The proposed offsets and governance framework are efficient, effective, timely, scientifically robust and transparent in their design. Justification is provided in Sections 6 and 7. • Efficient/effective/reasonable. The offset proposal is a cost-effective approach to providing a direct offset, achieved through implementing widely applied and verified management strategies that are consistent with Conservation Advice statements regarding threats that require intervention. • Timely. The offset outcomes will be delivered progressively over 20 years, and maintained for at least the period of effective approval (i.e. until 4 December 2123). Legal security of the Stage 2 Offset Area will occur within 2 years of the OAMP being approved. Management outcomes are described in Section 4.3, Table 4.6 and interim milestones to be reached over 20 years are outlined in Table 6.3. • Transparent/scientifically robust. Implementation of the OAMP will be monitored and reported in annual compliance reports. Management actions are based on known threats to each MNES, which has been informed by scientifically robust, peer-reviewed research. Management of the offset will be undertaken by appropriately qualified persons with experience in land restoration and species conservation to ensure management activities are appropriate. Management actions are set out in Section 4, monitoring is outlined in Section 6 and reporting is discussed in Section 7. • There will be annual monitoring and reviews of the offset activities and an annual report prepared. More detailed five yearly performance reviews will be undertaken to assess progress towards performance outcomes which include a requirement (Condition 15 and 16; EPBC 2017/7867) to ensure each assessment of the effectiveness of the management actions in the Stage 2 OAMP is: a) Subject to a peer-review completed within 6 months of the completion of each interim assessment. b) Published on its website with the findings of the peer-review within 6 months of the completion of the peer-review and for the duration of this approval.
8. Have transparent governance arrangements including being able to be readily measured monitored, audited and enforced.	• Extensive monitoring and reporting is proposed, to ensure the offset is successful. Monitoring will occur every year and at other key intervals as specified in Section 6. All annual monitoring reports will be made available to DCCEEW upon request. • Condition 15 (EPBC 2017/7867) of the mine approval requires some additional auditing as below: – To assess the effectiveness of the management actions in the Stage 2 OAMP to increase Greater Glider (*Petauroides volans*) habitat connectivity in the riparian zones within the Stage 2 environmental offset, the approval holder must engage an independent suitably qualified expert to undertake an assessment every 5 years from the implementation date of the approved Stage 2 OAMP until the approved Stage 2 OAMP offset completion criteria are achieved. – Condition 16 (EPBC 2017/7867) also requires ensuring each 5 yearly assessment of the effectiveness of the management actions in the Stage 2 OAMP is: a) Subject to a peer-review completed within 6 months of the completion of each such assessment. b) Published on its website with the findings of the peer-review within 6 months of the completion of the peer-review and for the duration of this approval. • Monitoring methods follow QLD and Commonwealth guidelines, which are standardised and repeatable. Transparency arrangements for reporting (e.g. reporting is regular, peer-reviewed and publicly available on Pembroke's website) ensures that the progressive trajectory of the offset is readily auditable.

2.4 Suitably qualified ecologists

It is a requirement that the approval holder submits a Stage 2 OAMP prepared by a 'suitably qualified ecologist' for the written approval of the Minister (Condition 13 under EPBC 2017/7867). A 'suitably qualified ecologist' is defined under EPBC Act approval as "a person who has professional qualifications and at least 3 years of work experience designing and implementing surveys for the listed threatened species and community and their habitat, and can give an authoritative assessment and advice on the presence and habitat requirements of the listed threatened species and community using relevant protocols, standards, methods and/or literature".

Pembroke commissioned EMM Consulting Pty Ltd (EMM) to prepare this OAMP. EMM compiled a skilled team of ecologists and support personnel to undertake assessments to identify a suitable offset for the Olive Downs Stage 2 impacts. The credentials of the survey team and their roles in the project are summarised in *Olive Downs Stage 2 Offset Area Supporting Report* (EMM 2024). Details of the key contributors to this OAMP, and how they satisfy the 'suitably qualified ecologist' condition is provided in the following sections. Curricula vitae are provided in the Supporting Report.

i Sandra Walters

Sandra Walters was technical lead in the preparation of this OAMP, which included Project Management, field surveys of the Stage 2 Impact Area and proposed Stage 2 Offset Area (reconnaissance surveys, 'BioCondition' flora surveys and targeted fauna surveys for Greater Glider, Koala, Squatter Pigeon and Ornamental Snake), and contribution to, and technical oversight of, all reporting elements. Sandra has 23 years' experience in terrestrial ecology, having worked in environmental consultancy for 13 years after roles in state government and private not-for-profit conservation. She holds a Bachelor of Environmental Science (Management), with a major in conservation ecology, awarded 'with Distinction'. Sandra has extensive experience in fauna and flora survey techniques, design and implementation of threatened species surveys, landscape-scale conservation land management (i.e. fire, feral animal and weed management, soil conservation and biodiversity monitoring), and more recently, delivery of land-based offsets under state and federal mechanisms.

Sandra has developed and implemented several landscape-scale fire, weed and pest animal management programs in the Brigalow Belt Bioregion. She contributed to the management of a privately-owned 59,000-hectare conservation reserve in the Brigalow Belt for 4 years, which contained all threatened species that are the subject of this assessment. As a consultant, Sandra has led or contributed to more than 150 projects involving threatened species survey and assessment, of which approximately 65 included at least one of the species that are the subject of this OAMP.

ii Elliot Leach

Elliot Leach prepared the text of the OAMP and supporting report for review by Sandra Walters. Additionally, Elliot conducted the literature review that informed habitat quality scoring for each MNES associated with the Project, and assisted Gus Daly with the habitat quality scoring process. Elliot has 11 years' experience in terrestrial ecology, having worked as an environmental consultant for the past six years after leaving academia.

Elliot completed a PhD on the community ecology of Australian rainforest birds in 2018, a research-based Honours (first class) on the foraging ecology of Nankeen Kestrels in 2013, and a Bachelor of Science (majoring in Ecology and Conservation Biology, with a GPA of 6.3) in 2012. He has authored (or co-authored) more than a dozen peer-reviewed scientific articles since 2013. Elliot has extensive experience with threatened species surveys in the Brigalow Belt, and has been involved with the Olive Downs Project since EMM was engaged by Pembroke.

iii Ann Stray

Ann Stray processed the BioCondition data and performed the habitat quality scoring and spatial data analysis associated with the Stage 2 Offset Area. Ann is a terrestrial ecologist with 10 years' experience, and has well developed skills in desktop ecology assessment, flora and fauna surveys (including regional ecosystem and protected plant surveys) and targeted threatened species surveys including trapping, spotlighting, and active searches. She holds a Bachelor of Science (majoring in Plant Sciences and Zoology) and completed a research-based Postgraduate Diploma of Science on the effects of fire on vegetation and soils. She is proficient in flora and fauna identification, with experience in the Brigalow Belt. Ann is skilled in the use of GIS software and the preparation of technical reports and impact assessments.

3 Biodiversity offset area

3.1 Regional context and location

The Stage 2 Offset Area, shown in Figure 3.1, is situated directly east of the Olive Downs Coal Project, on the eastern side of the Isaac River, and south-east of Moranbah within the Isaac Regional Council area. The offset area is situated on the Deverill property (Lot 18 on SP113322) and the Iffley property (Lot 11 on KL135) (Figure 3.1). Pembroke own these properties on freehold title.

The Stage 2 Offset Area is located in the Brigalow Belt North bioregion, and the Isaac-Comet Downs sub-region. It is located in the Isaac-Connors River catchment.

The Brigalow Belt North bioregion has a semi-arid to tropical climate with predominantly summer rainfall. The Moranbah Water Treatment Plant (weather station 034038) is the nearest weather station to the Project which provides long-term rainfall and temperature data (BOM 2023); the following descriptions of climate statistics are derived from data collected at that weather station between 1986 and 2022 (36 years). Maximum temperatures in the region during the summer months are generally around 34°C; in the winter months, maximum temperatures are approximately 10°C cooler (BOM 2023). Minimum temperatures in the summer months range between 21°C and 22°C; in the winter months, mean minimum temperatures are approximately 10°C cooler. Rainfall is typically highest in summer months, with the highest mean rainfalls recorded in December, January and February (Plate 3.1).

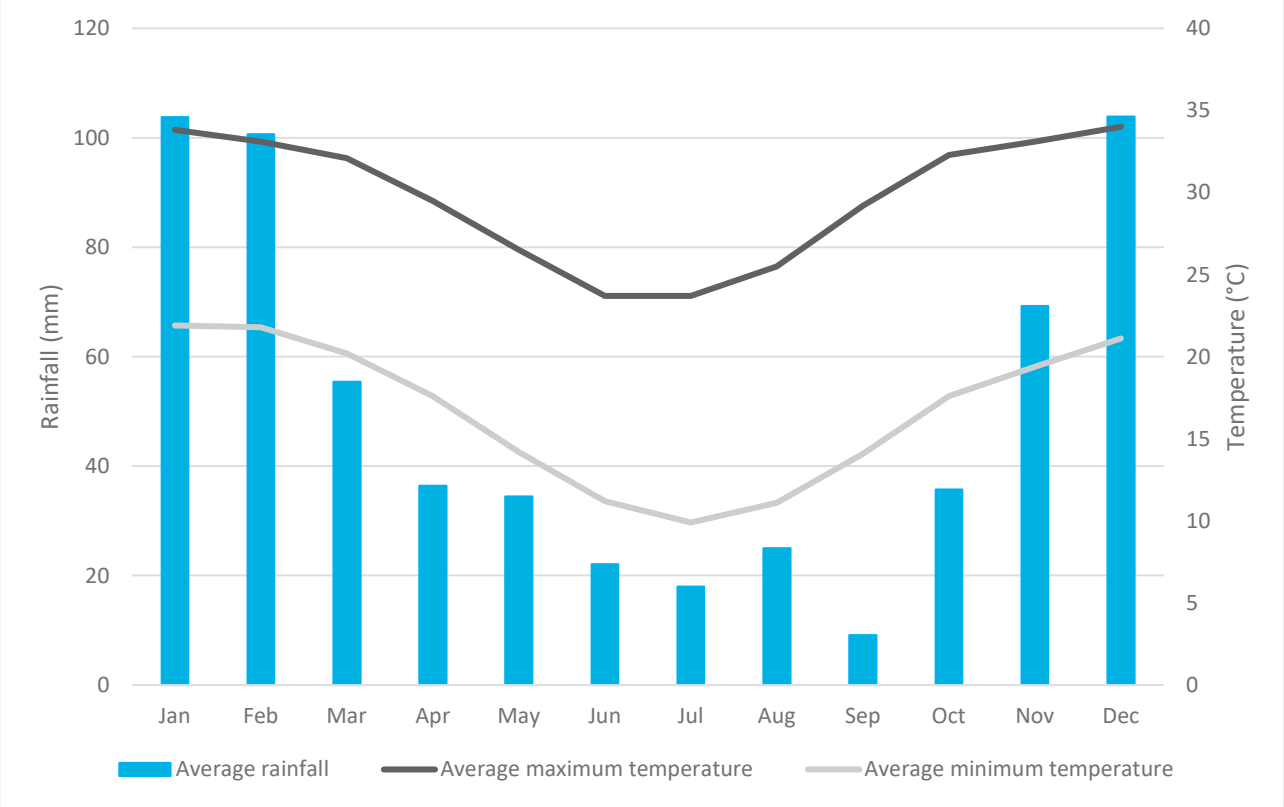


Plate 3.1 **Average weather conditions at Moranbah, Queensland. Data collected at Moranbah Water Treatment Plant between 1986 and 2022.**

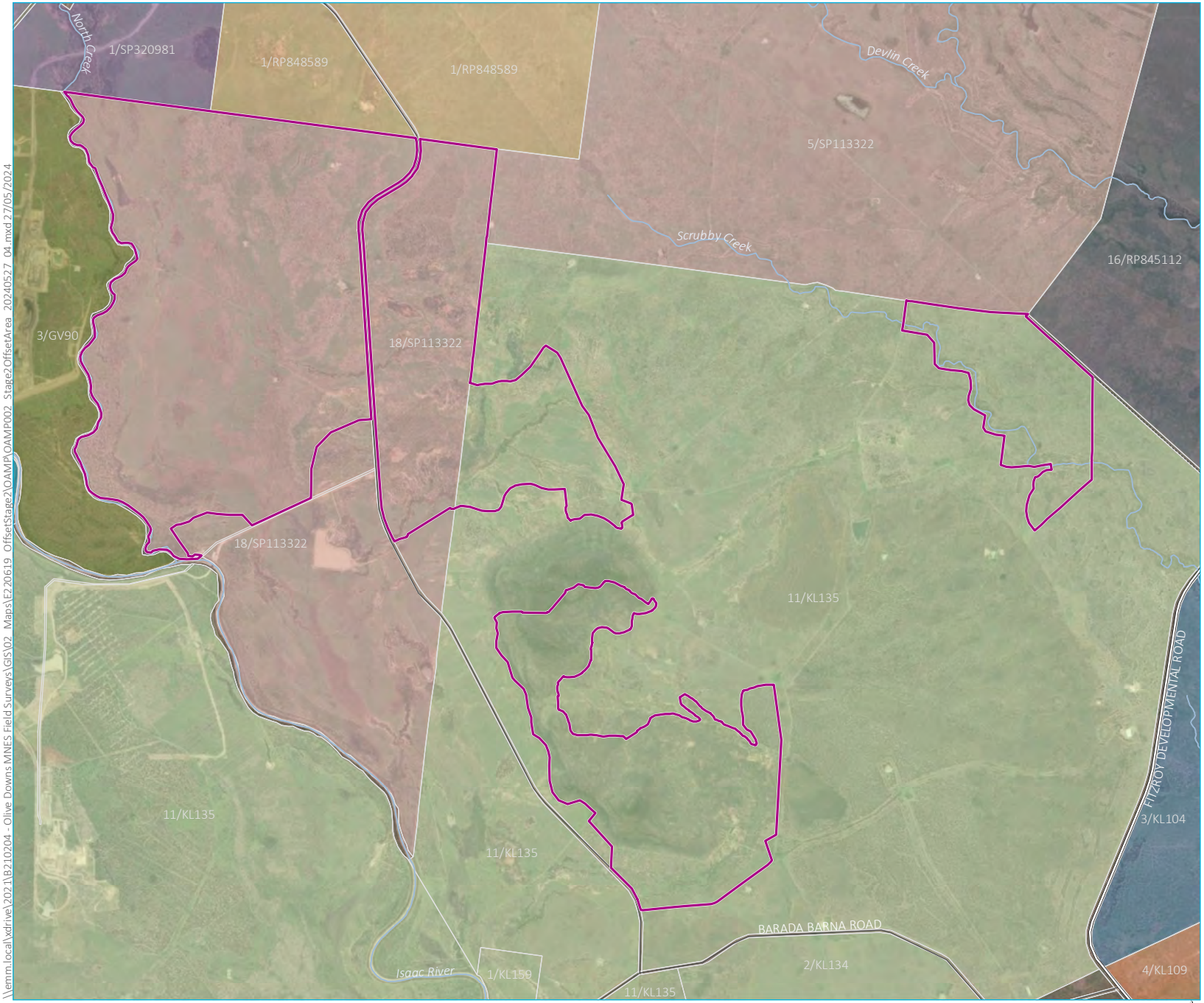
Surrounding land uses are predominantly comprised of agriculture and coal mining (Figure 3.2). Active mines in the area include Coppabella and Moorvale to the north, Daunia, Caval Ridge and Peak Downs to the west and south-west, and Lake Vermont mine to the south. Land directly to the north, north-east and south is grazing land, with areas supporting remnant vegetation. Dipperu (Scientific) National Park is situated approximately 20 km north-east of the offset area.

The Codrilla Mining Lease (ML70450) is situated approximately 1.5 km northeast of the Stage 2 Offset Area but is not developed (Figure 3.2). The Olive Downs South Special Purpose Lease (ML700036) is located adjacent to the Stage 2 Offset Area and is also not developed but is likely to be as part of Stage 3 impacts. There are no registered interests under the Qld Land Act 1994 (freehold land) on the offset properties. There are, however, a number of Potential Commercial Area (PCA) and Exploration Permits Coal (EPC) located on the offset properties. These exploration tenements do not have legal rights to undertake activities in the offset area without Pembroke's consent. Pembroke will not grant consent to undertake any exploration in the offset areas, and future development in adjacent areas will need to take into consideration the approved offset as an MSES value and MNES values in future approval processes.

Those tenements that overlap with the properties in which Stage 2 Offset Area is proposed are:

- EPC 952 (Fitzroy Coal Exploration Pty Ltd) – expiry 20 April 2026
- EPC 649 (Fitzroy Coal Exploration Pty Ltd) – expiry 20 April 2026
- EPC 676 (Peabody BB Interests Pty Ltd – expiry 30 March 2026
- PCA 141 (CH4 Pty Ltd) – expiry 14 September 2029
- PCA 151 (CH4 Pty Ltd) - expiry 20 August 2029
- PCA 152 (CH4 Pty Ltd) – expiry 20 August 2029
- PCA 259 (Arrow Energy Pty Ltd) – expiry 7 May 2027

Figure 3.1 Stage 2 Offset Area property detail



KEY

- Proposed stage 2 offset area

Property name

- Cattle Camp
- Codrilla
- Deverill
- Iffley
- Lake Lindsay
- Lake Vermont
- Lillianvale
- Moorvale
- Olive Downs

Existing environment

- Major road
- Minor road
- Vehicular track
- Named watercourse
- Cadastral boundary

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Source: EMM (2024); DES (2023); DR (2023); ESRI (2024); GA (2011)

0 2.5 5 km

GDA 1994 MGA Zone 55

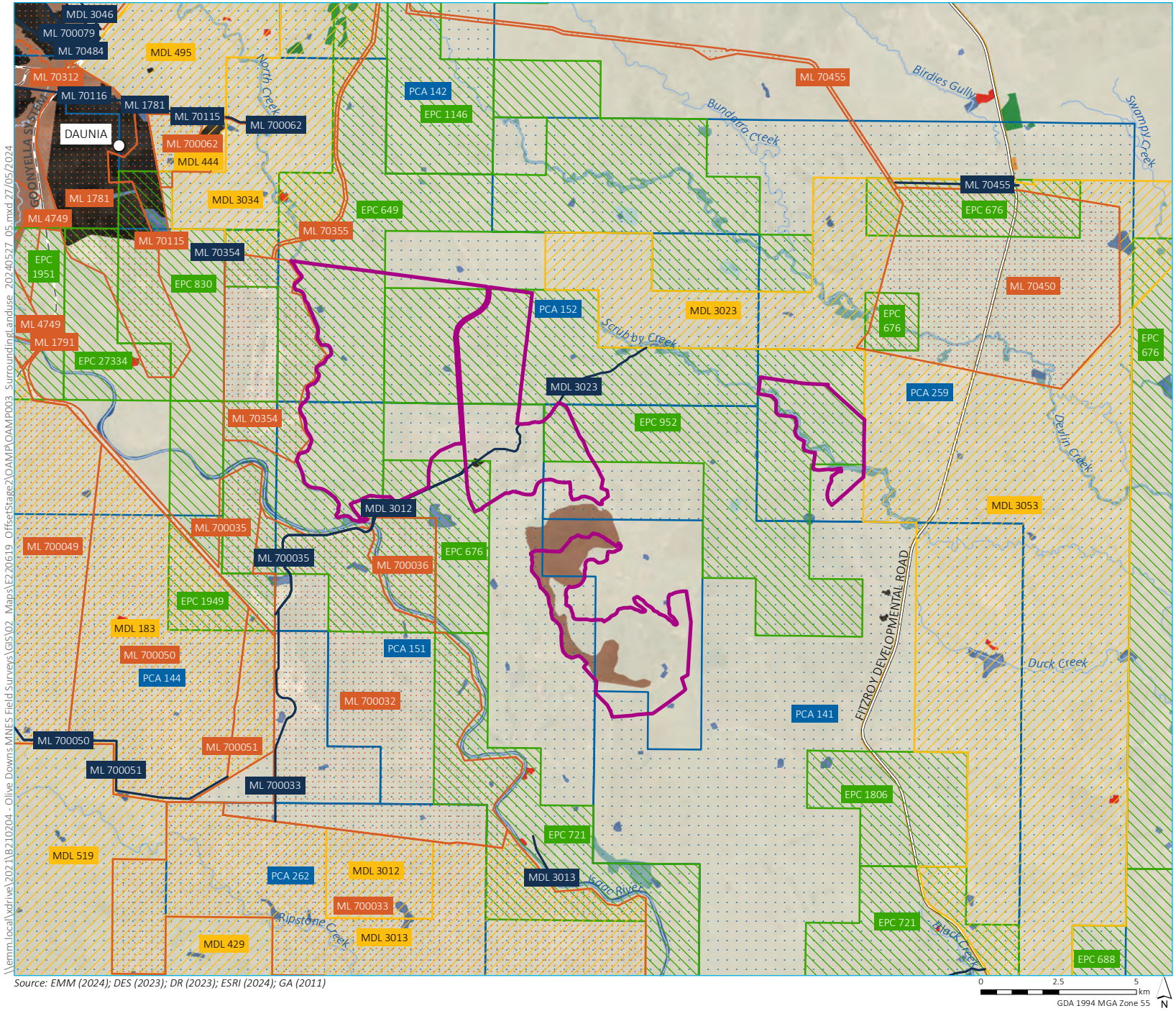
N

Stage 2 Offset Area property detail

Olive Downs Stage 2
Offset Area Management Plan
Figure 3.1

EMM
creating opportunities

Figure 3.2 Surrounding land use



KEY

- Proposed stage 2 offset area
- Mining lease
- Mineral development licence
- Exploration permits for coal
- Potential commercial area
- ML/MDL access
- Operating mine

Land use

- Other minimal use
- Grazing native vegetation
- Cropping
- Residential and farm infrastructure
- Services
- Transport and communication
- Mining
- Lake
- Reservoir/dam
- River
- Marsh/wetland

Existing environment

- Rail line
- Major road
- Named watercourse

0 2.5 5 km

GDA 1994 MGA Zone 55

N

Source: EMM (2024); DES (2023); DR (2023); ESRI (2024); GA (2011)

\\emm.local\xdrive\2021\B210204 - Olive Downs MNES Field Surveys\GIS\02 Maps\E220619 OffsetStage2\OAMP\OAMP003 SurroundingLanduse 20240527 05.mxd 27/05/2024

Surrounding land use

Olive Downs Stage 2
Offset Area Management Plan
Figure 3.2

EMM
creating opportunities

3.2 Offset area values

The Stage 2 Offset Area is 6,280.57 ha in size. It is comprised of three separate areas as shown in Figure 3.1, and is located on two properties - Deverill (Lot 18 on SP113322) and Iffley (Lot 11 on KL135). These areas were selected based on the identification of suitable habitats for target threatened fauna species (i.e. those MNES requiring offsets as a result of Stage 2 of the Project) on land owned by Pembroke. The delineation of the offset area was informed by the use of existing property boundaries, tracks and fence lines on this land. The presence of target MNES species and suitable habitat areas within the Stage 2 Offset Area was confirmed during on-ground ecological surveys conducted in 2022, 2023 and 2024 as described in the *Olive Downs Stage 2 Offset Area Supporting Report* (EMM 2024).

Field ecology surveys included:

- Vegetation community surveys in accordance with *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland Version 6.0* (Neldner et al 2022).
- BioCondition surveys, conducted in accordance with *BioCondition: A condition assessment framework for terrestrial biodiversity in Queensland, Assessment Manual version 2.2* (DES 2015), and applying *Guide to Determining Terrestrial Habitat Quality v 1.3* (DES 2020).
- Fauna surveys in accordance with applicable survey guidelines, being:
    a) *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland* (Eyre et al 2018).
    b) *EPBC Act survey guidelines for Australia's threatened mammals* (DSEWPC 2011a).
    c) *EPBC Act survey guidelines for Australia's threatened reptiles* (DSEWPC 2011b).
    d) *EPBC Act survey guidelines for Australia's threatened birds* (DEWHA 2010).
    e) *EPBC Act draft referral guidelines for the nationally listed Brigalow Belt reptiles* (DSEWPC 2011c).
    f) *Referral guidance for the Endangered Koala* (DCCEEW 2022a).

Detailed information on survey locations and methods are provided in the *Olive Downs Stage 2 Offset Area Supporting Report* (EMM 2024). Offset calculator assessments were undertaken to support finalisation of the Stage 2 Offset Area.

3.2.1 Habitat quality assessments (Biocondition)

The size of offset area required for each MNES species was determined through the application of the EPBC offset calculator. This included an analysis of start and end habitat quality for each species on the offset site, and a starting habitat quality on the impact site. Habitat quality scores were developed applying the *Guide to Determining Terrestrial Habitat Quality v 1.3* (DES 2020) and results for each survey site, as well as final scores for each MNES, are provided in the *Olive Downs Stage 2 Offset Area Supporting Report* (EMM 2024).

Habitat quality (HQ) assessments were completed at 22 survey sites across Stage 2 impact areas which were each within a mapped RE type and assessment unit, using the methodologies described in DES (2020). Within the Stage 2 Offset Area, 31 survey sites were completed in mapped RE types and assessment units (EMM 2024).

Habitat quality assessments included three elements: a site condition assessment, based on the BioCondition methodologies described in Eyre et al (2015); a site context assessment of vegetation patch size and connectivity (refer DES 2020); and a fauna species habitat index score based on methodologies described in DES (2020).

Further detail on habitat quality scoring is provided in the *Olive Downs Stage 2 Offset Area Supporting Report* (EMM 2024).

3.2.2 Current land use and areas excluded from Stage 2 Offset

Current land use on the Deverill and Iffley properties is primarily cattle grazing and managed by the Pembroke Pastoral Company which operates from Iffley Homestead (excluded from the Stage 2 Offset Area). This will continue once the Stage 2 Offset is established, however cattle grazing will be reduced in its extent and intensity with exclusion areas to apply. Further detail of grazing management on the Stage 2 Offset Area is provided in Section 4.2.4.

The Olive Downs mine access road runs east-west to the south of the western part of the Stage 2 Offset Area, with mine traffic moving through the area daily. This road is unsealed at the time of writing, and dust suppression activities occur on an ongoing basis. Dust suppression water is sourced from a dam south of the mine access road (named locally 'Ski Dam') covering approximately 35 ha, which will continue as required in the future. A solar farm is proposed to be constructed in the vicinity of Ski Dam, hence the dam and an adjoining area to be utilised for the solar farm has been excluded from the Stage 2 Offset Area. Nearby, an Electricity Transmission Line (ETL) corridor also crosses the Isaac River in the vicinity of the mine bridge crossing over the Isaac River.

Near the intersection of Barada Barna Road and Iffley Connection Road, a 200-bed camp will be constructed, which will accommodate Olive Downs mine personnel. An internal access road will be constructed, which will run immediately to the west of Barada Barna Road and connect the current mine access road with the proposed camp. The proposed camp and internal access road have been excluded from the Stage 2 Offset Area.

3.2.3 Connectivity values

Connectivity values have been assessed using the methods of the Biodiversity Planning Assessment (BPA) for the Brigalow Belt Bioregion (DES 2018). The published BPAs provide a consistent approach to mapping biodiversity values (using vegetation mapping) while incorporating various habitat related factors (such as patch size) to determine biodiversity significance at landscape scale. The outcome of the BPA method is a map displaying the biodiversity significance of remnant vegetation in specific bioregions and locations of terrestrial and riparian landscape corridors.

The designation of bioregional corridors in BPAs is primarily established to:

- distinguish and conserve ecological and evolutionary processes at a landscape scale
- maximize connectivity between remnant vegetation areas
- identify important areas for rehabilitation and offset opportunities.

State significant corridors have been defined across Queensland. These are designated by broad links between landscapes, connect protected areas and typically follow large tracts of remnant vegetation with identified biodiversity values. Regional biodiversity corridors also consist of connections between remnant vegetation areas, but can also include non-remnant vegetation areas recognised to have high rehabilitation potential for habitat restoration (DES 2018). Regional corridors often follow remnant vegetation along riparian zones. The state and regional corridors in proximity to the offset areas are shown in Figure 3.3. North Creek, which forms the western boundary of the offset north of the Isaac River, along with another unnamed tributary of the Isaac, are regionally-significant riparian biodiversity corridors within the Stage 2 Offset Area. These riparian corridors contain mature Eucalypt woodland (primarily RE 11.3.25), with stands of Queensland Blue Gum (*Eucalyptus tereticornis)* up to 30 metres in height, and a high density of hollows suitable for Greater Glider. Significant numbers of Greater Glider and Koala have been recorded on the Stage 2 Offset within these corridors (refer Figure 3.7 and EMM (2024)), verifying the importance to these MNES at a regional and state scale.

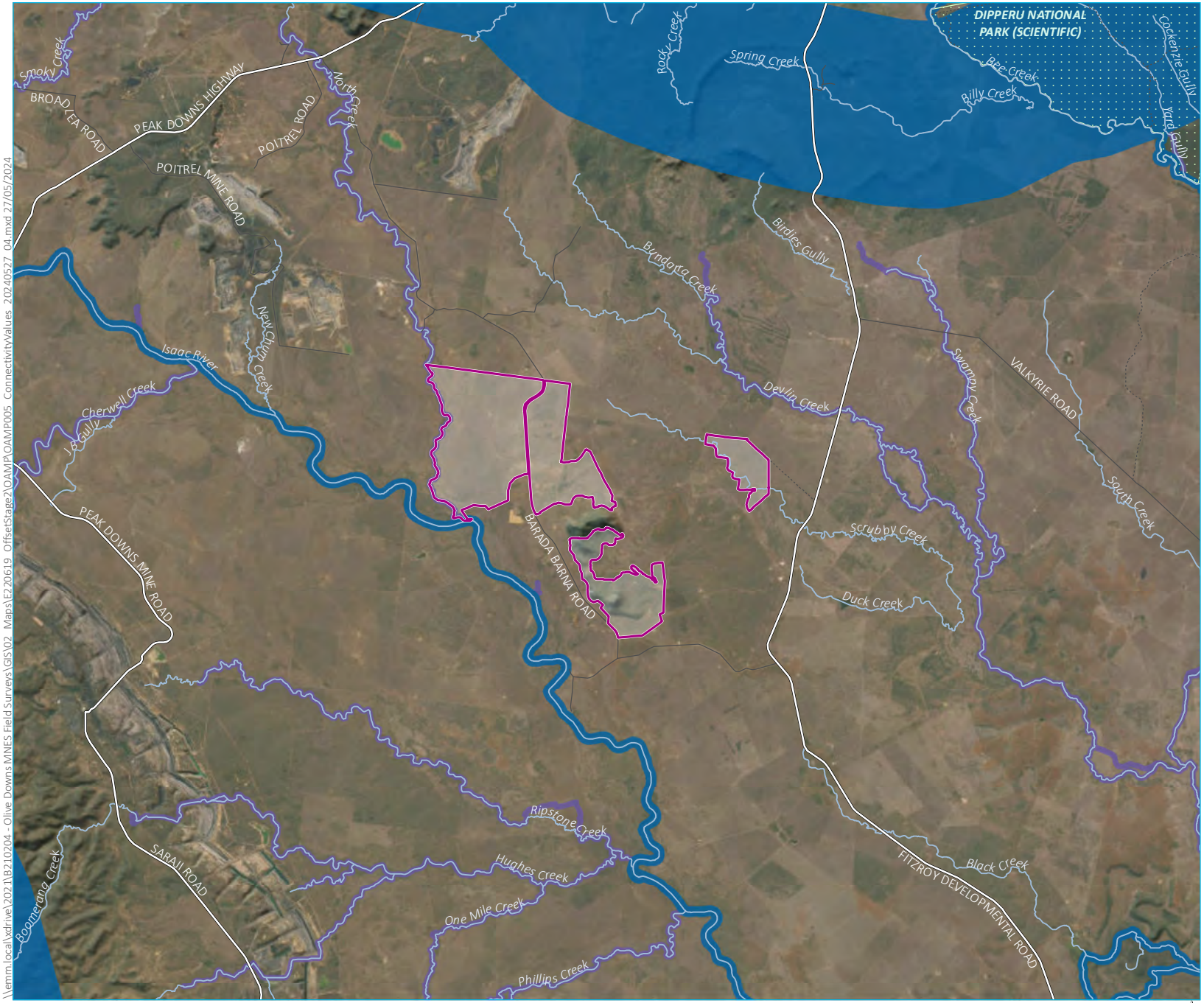
The alluvial plains of the Isaac River / North Creek corridor extend eastward for approximately 2 km and consist of remnant and advanced regrowth eucalypt woodlands dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*), Poplar Box (*E. populnea*), and mixed *Corymbia* species. Further east, remnant and regrowth eucalypt woodlands on sandy soil are interspersed with large tracts of regrowth Brigalow (*Acacia harpophylla*) woodland on cracking clays. In the south of the Stage 2 Offset Area, higher relief associated with Mt Coxendean contains remnant eucalypt woodland and areas of semi-evergreen vine thicket (SEVT). Drainage features at the southern end of Mt Coxendean are characterised by remnant and regrowth riparian woodland dominated by Queensland Blue Gum and/or Poplar Box, which provide connectivity beyond the Stage 2 Offset Area boundary to the Isaac River corridor.

The Stage 2 Offset Area (6,281 ha) is also directly connected with the approved Olive Downs Stage 1 Offset (5,421 ha) and will increase this total conservation area to 11,702 ha. Active conservation management will occur along North Creek, improving the quality of this biodiversity corridor; other management activities and natural revegetation will continue to improve habitat connectivity throughout the offset area for the life of the offset. Connectivity on a broader scale predominantly occurs through the Stage 1 Offset area to the north and east, into large tracts of vegetation (>20,000 ha in total) on private land classified as vegetation of state and regional biodiversity significance (Figure 3.3). These areas are connected to a large terrestrial State significant biodiversity corridor that intersects with Dipperu National Park to the east.

Pembroke's commitment to habitat restoration on the Stage 2 Offset Area will lead to an increase in the amount of habitat available to target MNES, improvement in the amount of foraging resources available, improvement in overall habitat quality and increased habitat connectivity at the local and landscape scales.

Connectivity values according to each MNES species are summarised below; see also Figure 3.3.

Figure 3.3 Connectivity values



KEY

- Proposed stage 2 offset area

Biodiversity corridor

- State
- Regional

Existing environment

- Major road
- Minor road
- Vehicular track
- Named watercourse
- Dipperu National Park

\\emm.local\xdrive\2021\B210204 - Olive Downs MNES Field Surveys\GIS\02 Maps\E220619 OffsetStage2\OAMP\OAMP005 ConnectivityValues 20240527 04.mxd 27/05/2024

Source: EMM (2024); DES (2023); DR (2023); ESRI (2024); GA (2011)

0 5 10 km

GDA 1994 MGA Zone 55

N

Connectivity values

Olive Downs Stage 2
Offset Area Management Plan
Figure 3.3

EMM creating opportunities

i Ornamental Snake

Large areas of Ornamental Snake habitat are present in the northern and eastern parts of the Stage 2 Offset Area, with connectivity through to similar suitable habitat in the southern part of the Stage 2 offset. The species has been recorded in most areas mapped as suitable within the Stage 2 Offset Area, as well as areas immediately adjacent (see Figure 3.8). All records were associated with gilgai depressions on cracking clay soils with Brigalow regrowth or remnant vegetation. At one location in the north of the Stage 2 Offset Area, three individual Ornamental Snakes were recorded within isolated patches of typical habitat (RE 11.4.9 Brigalow woodland on cracking clay soil with gilgai) that were contained wholly within a larger patch of nominally unsuitable habitat (RE 11.5.3 Poplar box woodland on sand plains) (EMM 2024). These small patches (0.1 – 0.2 ha) were separated from other suitable patches of habitat by up to 500 m, suggesting that dispersal does occur within at least these distances. This habitat has direct connectivity through to large areas of suitable habitat in the southern portion of the Stage 1 Offset. To the southeast of the eastern section of the Stage 2 Offset Area are additional large areas of gilgai that have potential to support the species and over time will provide dispersal opportunities for the species.

Although the species is not known for high dispersion traits, the numerous watercourses and interconnected gilgai offer suitable connective habitats, particularly during and after rainfall events. The improvement of gilgai habitats within the Stage 2 Offset Area will further increase the species' ability to disperse successfully.

ii Squatter Pigeon

Squatter Pigeon records exist within and adjacent to the Stage 2 Offset Area, as shown in Figure 3.9. Records are from both restoration areas (non-remnant) and remnant vegetation, in a variety of habitats and settings. Birds were seen along internal property tracks and on heavily trafficked roads such as the mine access road and Barada Barna Road. They were also observed at farm dams, naturally vegetated swamps and in proximity to the North Creek riparian corridor.

This species is known to utilise degraded habitats for both breeding and foraging, and dispersal habitat can be any area with sparse vegetation between foraging and breeding habitat or suitable waterbodies. Given Squatter Pigeons were recorded across the Stage 2 Offset Area, in both degraded and remnant habitat, and that large areas within the offset are within 1 km of permanent water (primarily farm dams), they are considered likely to utilise most habitats present.

Adjacent areas also support Squatter Pigeon habitat, including areas to north of the approved Stage 1 Offset Area and east and south of the Stage 2 Offset Area.

iii Greater Glider

Several Greater Glider have been recorded on the Stage 2 Offset Area within the North Creek corridor, as shown in Figure 3.10, verifying the importance of these riparian habitats to the species. Gliders have the ability to disperse from the North Creek corridor into adjacent eucalypt woodlands, however the absence of contemporary records in these areas is likely due to a paucity of large trees containing hollows. The improvement in condition of primary habitat along North Creek through weed control and native revegetation will increase the connectivity value of this habitat. Planned augmentation of habitat with nest boxes in remnant alluvial woodland and advanced regrowth will increase the area of breeding habitat available to the species. On the Stage 1 Offset area, Greater Gliders occupied nest boxes installed along major creeks and adjacent floodplains, within five months of installation (EMM unpublished data).

iv Koala

Koala habitat occurs along major watercourses through the Stage 2 Offset Area including North Creek and several minor unnamed tributaries associated with this creek line. Koala was recorded predominantly along riparian corridors as shown in Figure 3.11 and the species is known to move through the landscape along riparian corridors including through fragmented landscapes.

Koalas may move from Isaac River in the west (where a significant number of Koalas have been recorded) east through the offset area and north into larger tracts of remnant eucalypt woodlands. These Koala habitats consist of remnant eucalypt woodlands and advanced regrowth woodlands. There are also large tracts of woodlands with Koala food trees.

The improvement in condition of the riparian zones with revegetation and weed management will facilitate an increase in Koala habitat and greater opportunities for movement along existing corridors.

3.2.4 Summary of vegetation condition types

Vegetation across the Stage 2 Offset Area has been categorised into three broad condition types, namely:

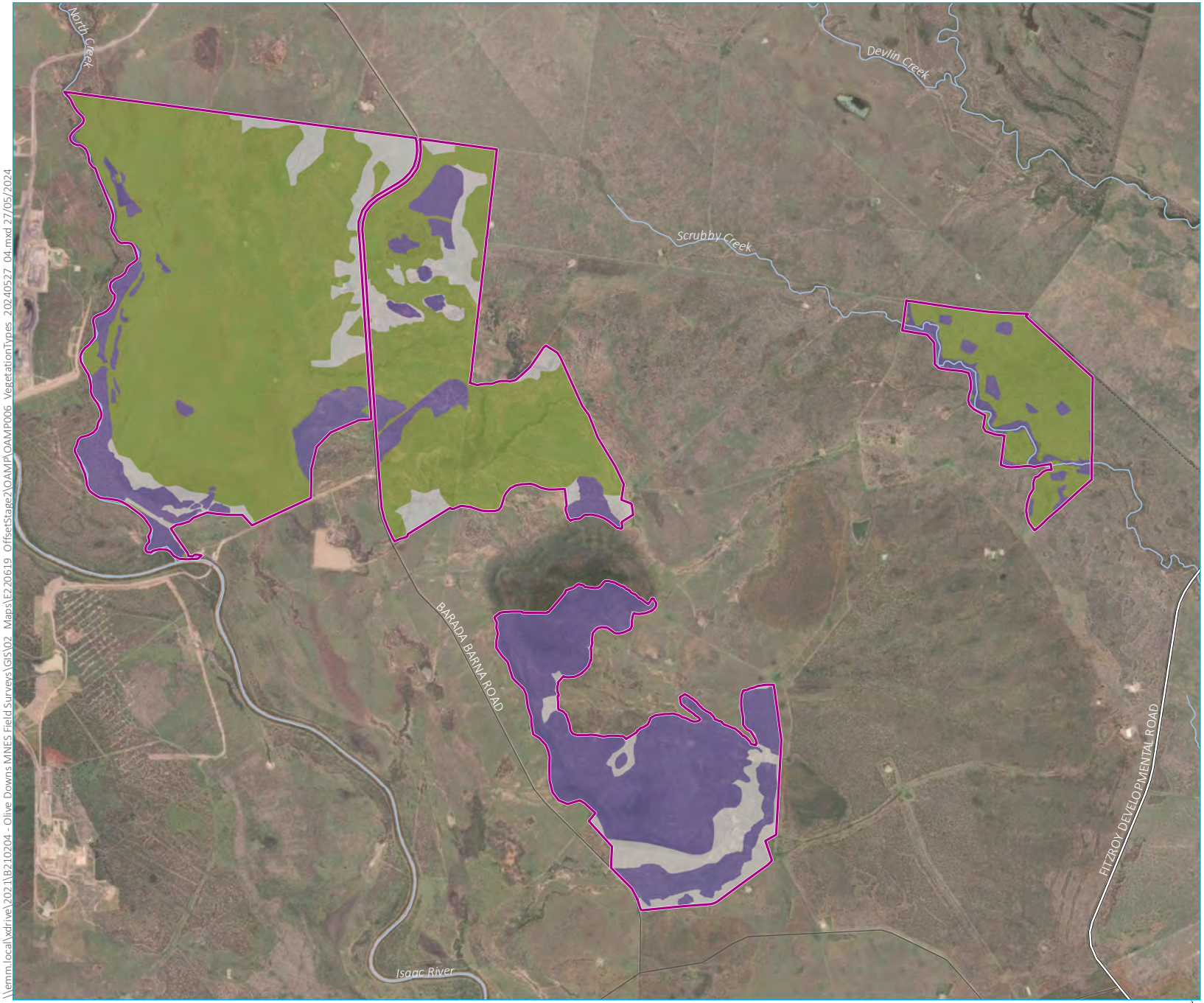
- remnant vegetation
- advanced regrowth woodlands
- non-remnant areas.

Vegetation types across the offset area are shown in Figure 3.4, and the extent of each condition type in hectares is provided in Table 3.1.

Table 3.1 Vegetation condition types across the offset area

Vegetation condition type	Area (ha)
Remnant vegetation	1,715
Advanced regrowth woodlands	4,566

Figure 3.4 Ground-truthed vegetation types



KEY

- Proposed stage 2 offset area

Ground-truthed vegetation type

- Remnant
- Advanced regrowth
- Non-remnant

Existing environment

- Major road
- Minor road
- Vehicular track
- Named watercourse

\\emm.local\xdrive\2021\B210204 - Olive Downs MNES Field Surveys\GIS\02 Maps\E220619 OffsetStage2\OAMP\OAMP006 VegetationTypes 20240527 04.mxd 27/05/2024

Source: EMM (2024); DES (2023); DR (2023); ESRI (2024); GA (2011)

0 2.5 5 km

GDA 1994 MGA Zone 55

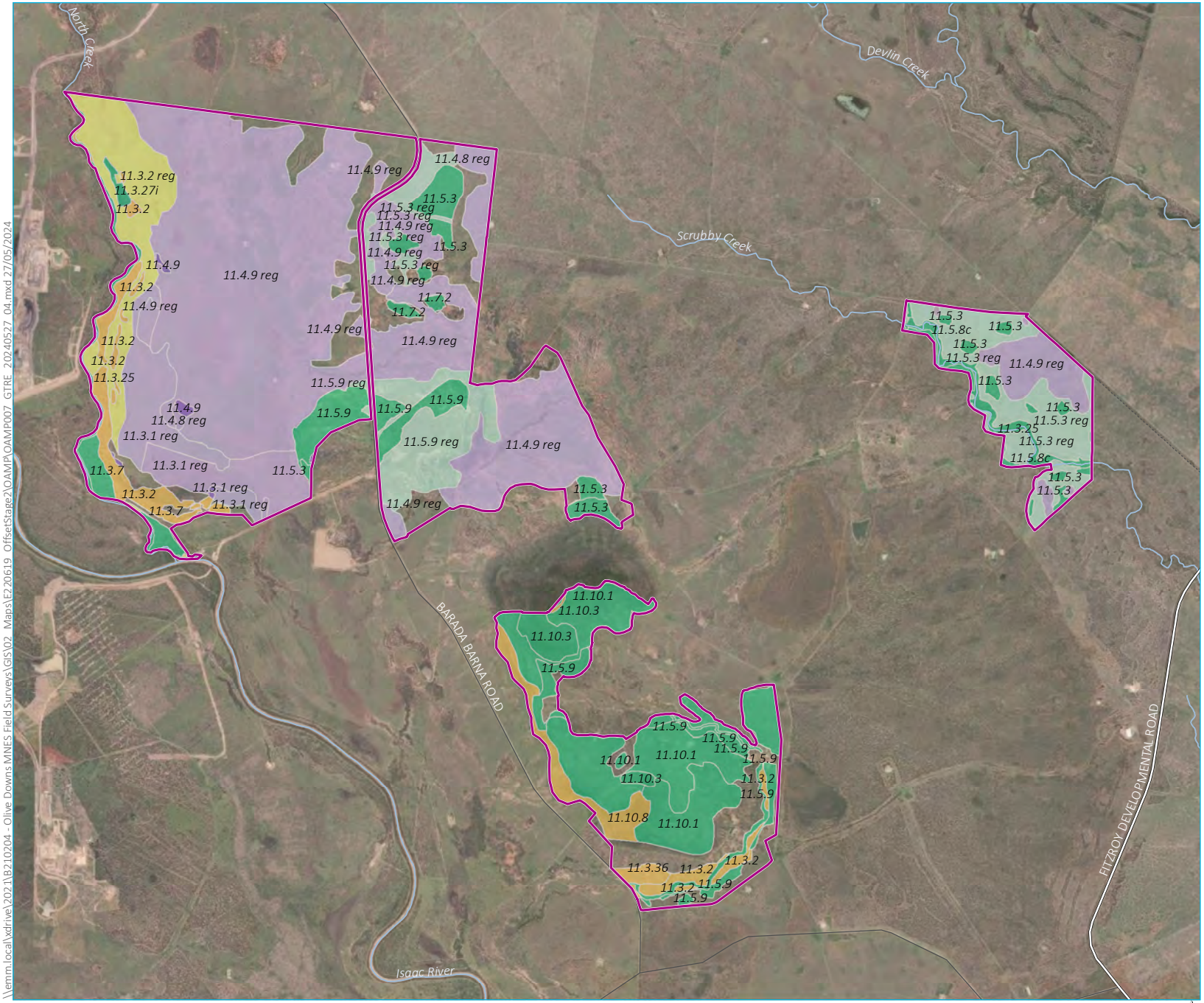
N

Ground-truthed vegetation types

Olive Downs Stage 2
Offset Area Management Plan
Figure 3.4

EMM creating opportunities

Figure 3.5 Ground-truthed Regional Ecosystems



KEY

- Proposed stage 2 offset area

Ground-truthed regional ecosystems (VM status)

- Remnant - endangered
- Regrowth - endangered
- Remnant - of concern
- Regrowth - of concern
- Remnant - least concern
- Regrowth - least concern

Existing environment

- Major road
- Minor road
- Vehicular track
- Named watercourse

Ground-truthed regional ecosystems

\\emm.local\xdrive\2021\B210204 - Olive Downs MNES Field Surveys\GIS\02 Maps\E220619 OffsetStage2\OAMP\OAMP007 GTRE 20240527 04.mxd 27/05/2024

Source: EMM (2024); DES (2023); DR (2023); ESRI (2024); GA (2011)

0 2.5 5 km

GDA 1994 MGA Zone 55

N

Olive Downs Stage 2
Offset Area Management Plan
Figure 3.5

EMM creating opportunities

3.2.5 Remnant woodlands

Within the Stage 2 Offset Area there are tracts of mature remnant woodland covering a total area of 1,715 ha. Remnant woodlands are typically located along watercourses and on adjacent alluvial flats, as well as on Mt Coxendean. The distribution of remnant vegetation is illustrated in Figure 3.4, and the ground-truthed Regional Ecosystem mapping is provided in Figure 3.5.

Remnant woodlands are generally in moderate condition, supporting vegetation that can be classified into fifteen regional ecosystems (REs), as shown in Table 3.2. A representative photograph of each Regional Ecosystem that is present on the Stage 2 Offset Area is provided in Photograph 3.1 to Photograph 3.11.

Table 3.2 Remnant Regional Ecosystems of the Stage 2 Offset Area

Regional Ecosystem	Short description	Reference photograph (below)
11.3.1	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains	Photograph 3.1
11.3.2	*Eucalyptus populnea* woodland on alluvial plains	Photograph 3.2
11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines.	Photograph 3.3
11.3.27i	Freshwater wetlands.	Photograph 3.4
11.3.36	*Eucalyptus crebra* and/or *E. populnea* and/or *E. melanophloia* on alluvial plains. Higher terraces.	Photograph 3.5
11.3.7	*Corymbia spp.* open woodland on alluvial plains.	Photograph 3.6
11.4.9	*Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains.	Photograph 3.7
11.5.3	*Eucalyptus populnea* +/- *E. melanophloia* +/- *Corymbia clarksoniana* woodland on Cainozoic sand plains and/or remnant surfaces.	Photograph 3.8
11.5.8c	*Eucalyptus platyphylla* woodland on white-yellow weathered sands, with grassy ground layer on Quaternary sediments.	Photograph 3.9
11.5.9	*Eucalyptus crebra* and other *Eucalyptus spp*. and *Corymbia spp*. woodland on Cainozoic sand plains and/or remnant surfaces.	Photograph 3.10
11.10.1	*Corymbia citriodora* woodland on coarse-grained sedimentary rocks.	Photograph 3.11

Photograph 3.1 **RE 11.3.1**

Photograph 3.2 **RE 11.3.2**

Photograph 3.3 **RE 11.3.25**

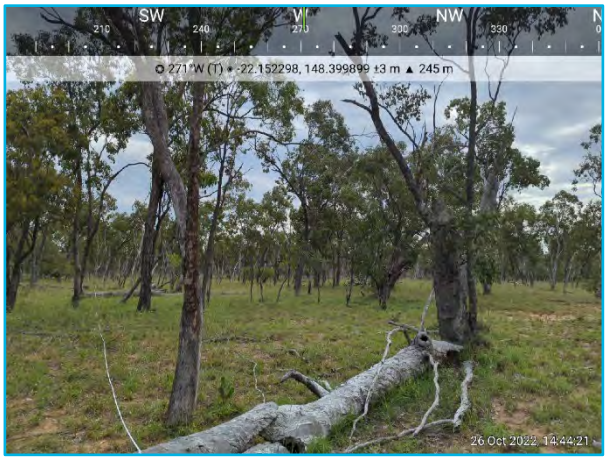
Photograph 3.4 **RE 11.3.27i**

Photograph 3.5 **RE 11.3.36**

Photograph 3.6 **RE 11.3.7**

Photograph 3.7 **RE 11.4.9 (regrowth)**

Photograph 3.8 **RE 11.5.3**



Photograph 3.9 **RE 11.5.8c**

Photograph 3.10 **RE 11.5.9**

Photograph 3.11 **RE 11.10.1**

3.2.6 Advanced regrowth woodlands

Advanced regrowth woodlands are present across the Stage 2 Offset Area, covering a total of 4566 ha. These woodlands are comprised of regenerating *Eucalyptus* and *Corymbia* species on alluvial soils (land zone 3) and sand plains (land zone 5), as well as extensive areas of *Acacia harpophylla* (Brigalow) on cracking clays. Historical aerial imagery indicates that clearing occurred in the majority of these woodlands between the late 1970s and '80s, with follow up clearing since that time. Eucalypt woodlands are typically 7-10 m tall with scattered larger trees (some containing hollows) that were retained. Brigalow regrowth is typically 4-6 m in height. An example of advanced regrowth eucalypt woodland is shown in Photograph 3.12 and typical Brigalow regrowth is shown in Photograph 3.13. Habitat restoration will occur in advanced regrowth woodlands, particularly where there is opportunity to improve connectivity for MNES species, such as along riparian corridors. Restoration methods adopted will include stock removal, weed control, and direct revegetation of nominated areas. See Section 4.2.1 for an in-depth discussion of restoration methods to be adopted on the offset site. The end goal of restoration is improvement in overall habitat quality for MNES across the Stage 2 Offset Area.

Photograph 3.12 Typical eucalypt regrowth woodland

Photograph 3.13 Typical Brigalow regrowth woodland

3.2.7 Biodiversity values

The Stage 2 Offset Area supports a number of significant biodiversity values at Commonwealth and State level. These include:

- Tracts of intact remnant vegetation.
- 'Endangered' and 'Of concern' REs.
- Breeding and foraging habitat for threatened fauna species.
- Watercourse vegetation and wetlands.
- State and regionally significant biodiversity corridors associated with the Isaac River and tributaries.

The Stage 2 Offset Area supports existing habitat for four threatened fauna species listed under the EPBC Act and impacted by the Project. All have been observed on the offset during targeted fauna surveys, namely:

- Ornamental Snake
- Squatter Pigeon
- Greater Glider
- Koala.

The extent of habitat available for threatened species across the Stage 2 Offset Area in hectares is summarised in Table 3.3.

Table 3.3 Stage 2 Offset Area – MNES values

MNES value	Description	Area (ha)
Ornamental Snake	Habitat	3,559
Squatter Pigeon	Breeding habitat	1,001
	Foraging habitat	1,832
Greater Glider	Habitat	2,833
Koala	Habitat	2,833

As offsets for MNES habitat are co-located, the Stage 2 Offset Area protects larger areas of MNES habitat than is required to be offset for Stage 2 impacts to Koala, Greater Glider and Squatter Pigeon foraging habitat, as shown in Table 3.4. The excess areas for these MNES will be used as advanced offsets for Stage 3 impacts. See EMM (2024) for further details.

Table 3.4 Advanced offsets for Stage 3 impacts provided in Stage 2

MNES value	Description	Offset area required for Stage 2 (ha)	Offset provided in Stage 2 (ha)	Percentage of S2 impact offset (%)	Advanced offset for Stage 3 (ha)
Ornamental Snake	Habitat	3445	3,559	93.05	0
Squatter Pigeon	Breeding habitat	978	1,001	102.39	23
	Foraging habitat	410	1,832	448.77	1422
Greater Glider	Habitat	2065	2,833	137.27	768
Koala	Habitat	1947	2,833	145.64	886

The habitat and ecosystem values for each species are discussed further in the following sections.

3.2.8 Habitat Quality

Habitat Quality assessments were undertaken in accordance with the *Guide to Determining Terrestrial Habitat Quality v1.3* (DES 2020); sites were designated within ground-truthed vegetation types (REs), and field data was compared to state government provided benchmarks specific to each RE. These benchmarks are representative of high quality, intact sites of each vegetation type. Location of habitat quality assessment transects (BioCondition surveys) are shown in Figure 3.6 and the results are summarised in EMM (2024).

Table 3.5 summarises the Habitat Quality scoring of each MNES across both the Stage 2 Impact and Offset Areas based on site condition (see EMM 2024 for further details).

Table 3.5 Habitat Quality scores (site condition)

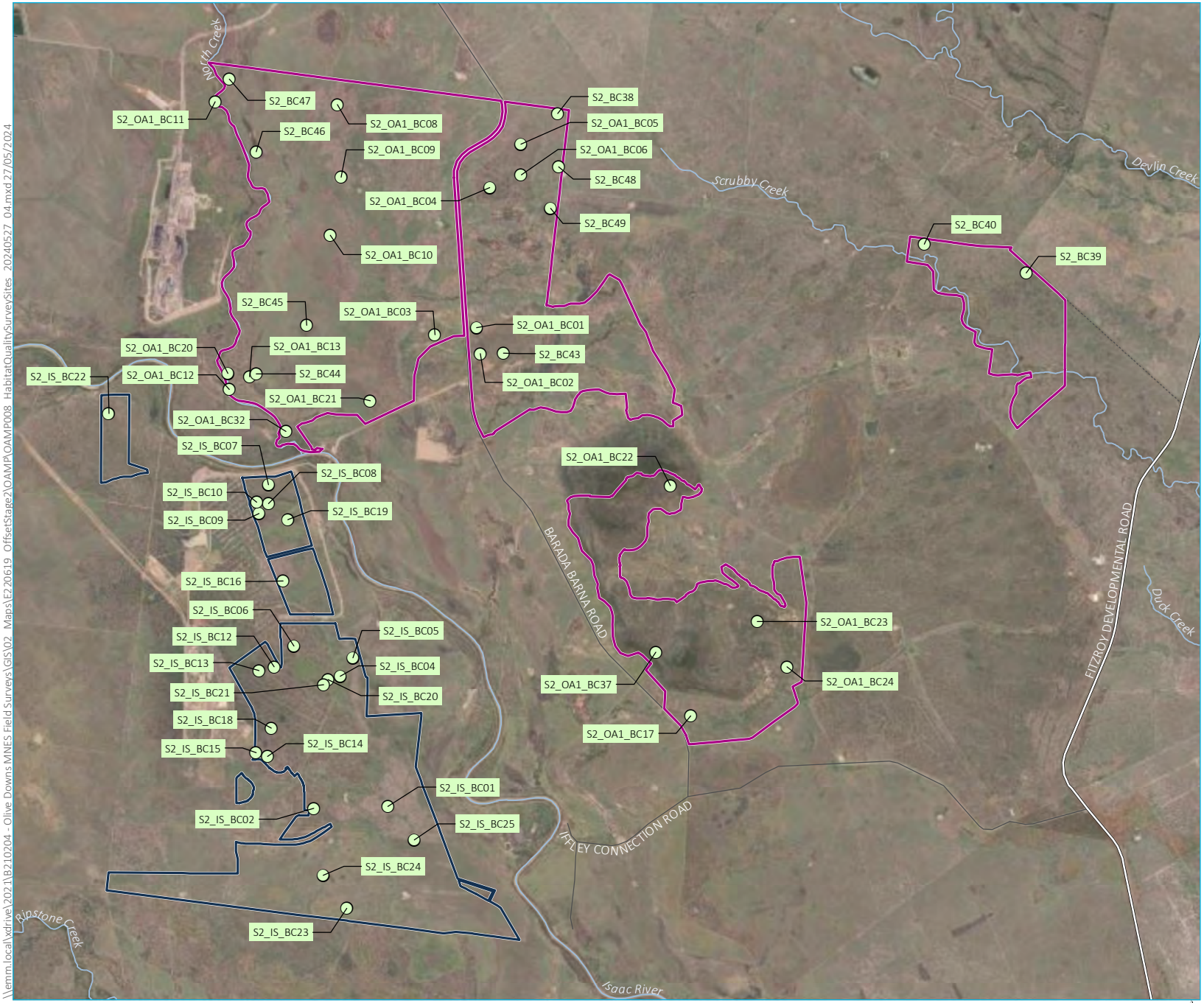
MNES value	Impact (Starting score)	Offset (Starting score)
Ornamental Snake	5	5
Squatter Pigeon (breeding)	8	5
Squatter Pigeon (foraging)	8	6
Greater Glider	8	6
Koala	8	6

Table 3.6 summarises the Habitat Quality scoring of each MNES across both the Stage 2 Impact and Offset Areas based on species habitat attributes (see EMM 2024 for further details). These scores also represent offset calculator inputs for starting habitat quality.

Table 3.6 Habitat Quality scores (species habitat attributes)

MNES value	Impact (Starting score)	Offset (Starting score)
Ornamental Snake	5	5
Squatter Pigeon (breeding)	4	5
Squatter Pigeon (foraging)	4	4
Greater Glider	5	4
Koala	5	6

Figure 3.6 Habitat quality survey sites



KEY

- Proposed stage 2 offset area
- Stage 2 impact area
- BioCondition survey site

Existing environment

- Major road
- Minor road
- Vehicular track
- Named watercourse

\\emm.local\xdrive\2021\B210204 - Olive Downs MNES Field Surveys\GIS\02 Maps\E220619 OffsetStage2\OAMP\OAMP008 HabitatQualitySurveySites 20240527 04.mxd 27/05/2024

Source: EMM (2024); DES (2023); DR (2023); ESRI (2024); GA (2011)

0 2.5 5 km

GDA 1994 MGA Zone 55

N

Habitat quality survey sites

Olive Downs Stage 2
Offset Area Management Plan
Figure 3.6

EMM creating opportunities

3.3 Values for MNES

3.3.1 Ornamental Snake

The Ornamental Snake is only known to occur within the drainage systems of the Fitzroy and Dawson rivers in central Queensland (DoE 2014b). Suitable habitat for the species is closely tied to the availability of their primary prey (frogs) and can include floodplains, undulating clay pans, the margins of swamps, lakes, gilgai and watercourses, as well as adjoining areas of elevated ground (DoE 2014b). Preferred habitat is represented by seasonally inundated wetlands with deep cracking clay soils (including gilgai), with or without the presence of *Acacia harpophylla* (Melzer 2012). Coarse woody debris, ground litter and deep clay cracks are important microhabitat features for Ornamental Snake, as they provide critical sheltering habitat. The Isaac River area supports some of the highest known population densities of the species (Melzer 2012).

Six records of Ornamental Snake have been made in suitable habitat (ephemeral wetlands, primarily gilgai) across the Stage 2 Offset Area, with individuals observed in the northwest area (Figure 3.8). A further record, of a juvenile in a patch of mature Brigalow, was observed in habitat near the eastern portion of the Stage 2 offset. Habitat areas for the species across the offset area are typically degraded as a result of:

- grazing pressure and 'pugging' within gilgai caused by cattle, feral pigs and Chital Deer
- the activities of feral pigs (wallowing and foraging) within gilgai, particularly after rainfall events
- reduction in water quality and increased turbidity through disturbance from cattle and feral pigs, reducing prey populations (primarily amphibians) and in turn foraging opportunities and carrying capacity for the species
- the loss of coarse woody debris and other shelter habitat due to landholder activities associated with cattle grazing (raking the ground to 'improve' pasture)
- increased weed cover, resulting in a reduction of native ground cover and native tree species recruitment
- unmanaged Cane Toad populations
- unmanaged feral cat populations.

Ornamental Snake habitat (3,559 ha) was mapped across the offset area based upon ground-truthed verification of satellite imagery depicting gilgai and other ephemeral wetlands, along with review of landzone mapping to identify potential areas of suitable clay soils. Ornamental Snake habitat mapping is shown in Figure 3.8. A photograph of typical Ornamental Snake habitat within the Stage 2 Offset Area is provided in Photograph 3.14, and a photograph of an Ornamental Snake that was seen while spotlighting is provided in Photograph 3.15.

Photograph 3.14 Typical Ornamental Snake habitat in the Stage 2 Offset Area

Photograph 3.15 Ornamental Snake seen while spotlighting in suitable habitat within Stage 2 Offset Area

3.3.2 Squatter Pigeon

The Squatter Pigeon is restricted to Queensland, where it occupies grassy woodlands and open forests that are dominated by eucalypts, generally on sandy soils in proximity to permanent water (Reis 2012). Within the Stage 2 Offset Area, all areas of eucalypt dry woodlands on inland depositional plains and eucalypt open forests to woodlands on floodplains are considered potential habitat for this species. Eight records of the species were made throughout the offset area by EMM ecologists, representing a total of 16 individuals.

Habitat quality for the species across the offset area is negatively impacted by:

- Grazing pressure from cattle, which continues to degrade the grassy woodlands through herbivory of native grass, impacts on native groundcover and reduction in tree recruitment (cattle grazing is specifically recognised as a threat to the species by Reis (2012)).
- Weed cover, including that of Buffel Grass (recognised as a threat to the species by Reis (2012)), which is extensive throughout the offset areas; without active management, weed cover will increase and reduce native ground cover and native tree species recruitment.
- The presence of feral predators, primarily feral cats, which directly predate the species.
- Reduction in water quality through disturbance from cattle and feral pigs, reducing access to clean water.

Potential habitat for Squatter Pigeon (stratified into breeding (1,001 ha) and foraging (1,832 ha) habitat), was mapped across the Stage 2 Offset Area (Figure 3.9) in accordance with the habitat definitions outlined in Table 3.7. A photograph of typical Squatter Pigeon habitat within the Stage 2 Offset Area is provided in Photograph 3.16, and an image of a Squatter Pigeon seen within the offset area is shown in Photograph 3.17.

Table 3.7 Squatter Pigeon habitat definitions

Habitat type	Maximum distance from nearest waterway	Restricted to	Characteristic Regional Ecosystems (REs) within the Stage 2 offset area
Breeding habitat	1 km	Land Zone 5 and selected areas on Land Zone 3	11.5.3, 11.5.9, 11.5.8c 11.3.1, 11.3.2, 11.3.25, and 11.3.27i,.
		<33% groundcover	
		Patchy native ground layer*	
Foraging habitat	3 km	Land Zone 5 and selected areas on Land Zone 3	11.5.3,, 11.5.8c, 11.5.9, 11.3.1, 11.3.2, 11.3.7, 11.3.25, 11.3.36 and 11.10.1.
		<33% groundcover	
		Patchy native ground layer*	

* either: patchy, native, perennial tussock grasses, or mixed-native perennial tussock grasses and low shrubs/forbs.

Photograph 3.16 Typical Squatter Pigeon habitat within Stage 2 Offset Area

Photograph 3.17 Squatter Pigeon observed within Stage 2 Offset Area

3.3.3 Greater Glider

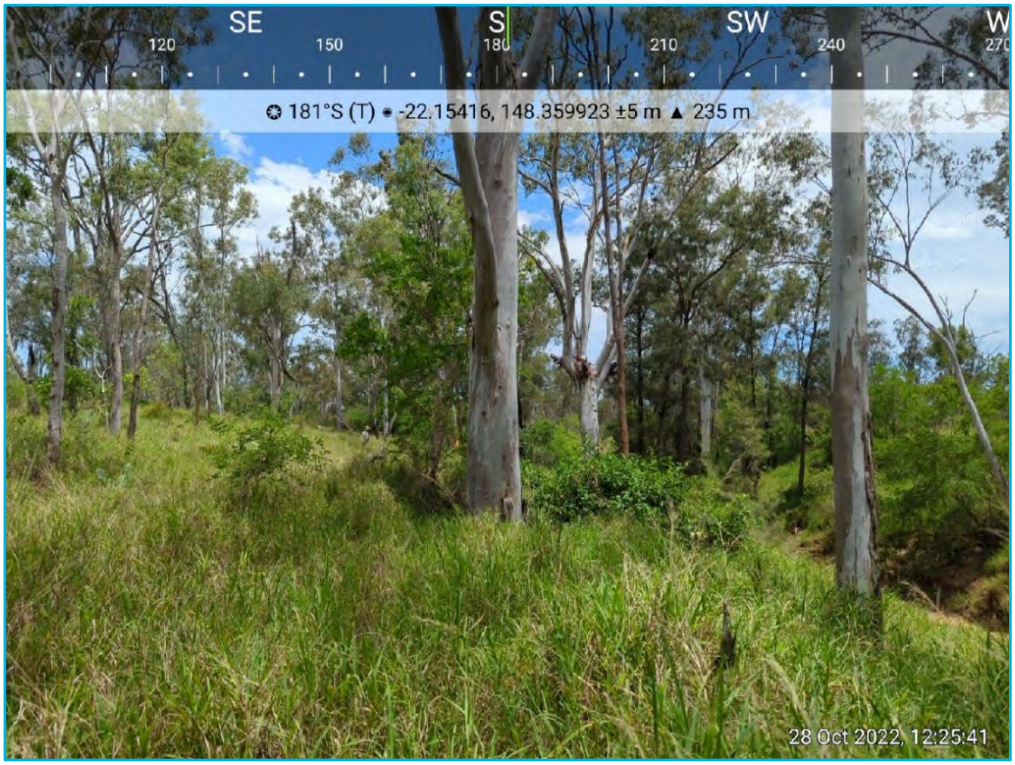
Greater Gliders occur in eastern Australia, in Eucalypt forests or woodlands that support large (i.e. >50 cm dbh) hollow bearing trees which are a critical habitat requirement for the species (DCCEEW 2022b, Eyre et al 2022). In both the impact and offset areas associated with the Project, Greater Gliders are primarily found in riparian zones that support suitable foraging and denning trees (EMM unpublished data). Potential habitat throughout the offset area is, consequently, dictated by the occurrence of large trees in remnant riparian vegetation, as well as in remnant woodland. EMM ecologists detected 10 Greater Gliders across the offset area (see Figure 3.10); all were in riparian areas and most were observed within in *Eucalyptus tereticornis*. Other trees utilised by Greater Gliders on site included *E. coolabah* and *E. populnea*.

Habitat quality for the species across the offset area has been reduced by historical broad-scale clearing and by the installation of kilometres of barbed wire fencing, which may entangle and kill Greater Gliders (TSSC 2021, WFF 2023a). Despite this, enough remnant habitat exists along and adjacent to the Isaac River / North Creek riparian corridors to support a (presumably) stable population of the species in the local area. Threats to the persistence of the species include:

- invasion of preferred habitat by weeds such as *Lantana camara*, which suppresses natural recruitment of canopy species
- erosion of riverbanks and riparian zones and reduced recruitment of canopy species as a result of unrestricted cattle grazing
- loss of habitat connectivity
- intense fires
- predation by feral predators, primarily feral cats
- entanglement in barbed wire fences.

Habitat for Greater Glider (3,289 total ha) was mapped across the Stage 2 Offset Area (Figure 3.10) and included all riparian zones and woodlands that supported large hollow-bearing trees suitable for denning (1,701 ha). Habitat restoration areas (1,132 ha) were strategically mapped in areas which enhanced connectivity between known areas of occupancy or improved landscape-scale connectivity in the broader sense. These areas typically contain advanced regrowth eucalypt communities considered capable of supporting a Greater Glider population within the life of the offset, provided restoration activities and habitat augmentation occurs. A photograph of typical Greater Glider habitat within the Stage 2 Offset Area is provided in Photograph 3.18, and an image of a Greater Glider seen within the offset area is shown in Photograph 3.19.

Photograph 3.18 Typical Greater Glider habitat within the Stage 2 Offset Area



Photograph 3.19 Greater Glider observed whilst spotlighting on the Stage 2 Offset Area

3.3.4 Koala

The Koala has one of the largest distributions of any terrestrial threatened species listed under the EPBC Act, occurring throughout the eastern seaboard of Australia south of the Wet Tropics. It occupies a variety of vegetation types across this large distribution, can move long distances and is variably affected by a range of threats (DAWE 2022). Due to this broad distribution, the definition of what is suitable habitat for Koala is necessarily vague. Koala habitat "includes both coastal and inland areas that are typically characterised by Eucalyptus forests and woodlands" (DAWE 2022). This can include remnant and non-remnant vegetation in natural, agricultural, urban and peri-urban environments. Koalas require areas of habitat that provide the resources necessary for individual foraging, growth, reproduction, movement and survival (including predator avoidance) (DAWE 2022). The amount of resources available, and how they are arranged at a landscape scale influences the viability of metapopulations and processes.

At the individual level, Koalas require sufficient forage and shelter trees to allow them to meet their daily energy requirements as well as facilitating their reproductive needs and predator avoidance behaviours (DAWE 2022). In practice, this means that suitable habitat for an individual Koala includes Eucalypt forests and woodlands as well as a safe ground matrix to support their ability to travel between trees. Patches of habitat must be sufficient in size to support foraging, shelter and reproduction, and have sufficient connectivity between patches of habitat to facilitate movement of and interaction between individuals within the broader landscape (DAWE 2022). At the population level similar habitat attributes apply, but with landscape-scale application (i.e. the population has sufficient resources available to remain viable, habitat connectivity is sufficient to allow gene-flow between subpopulations, drought refugia are accessible, etc) (DAWE 2022).

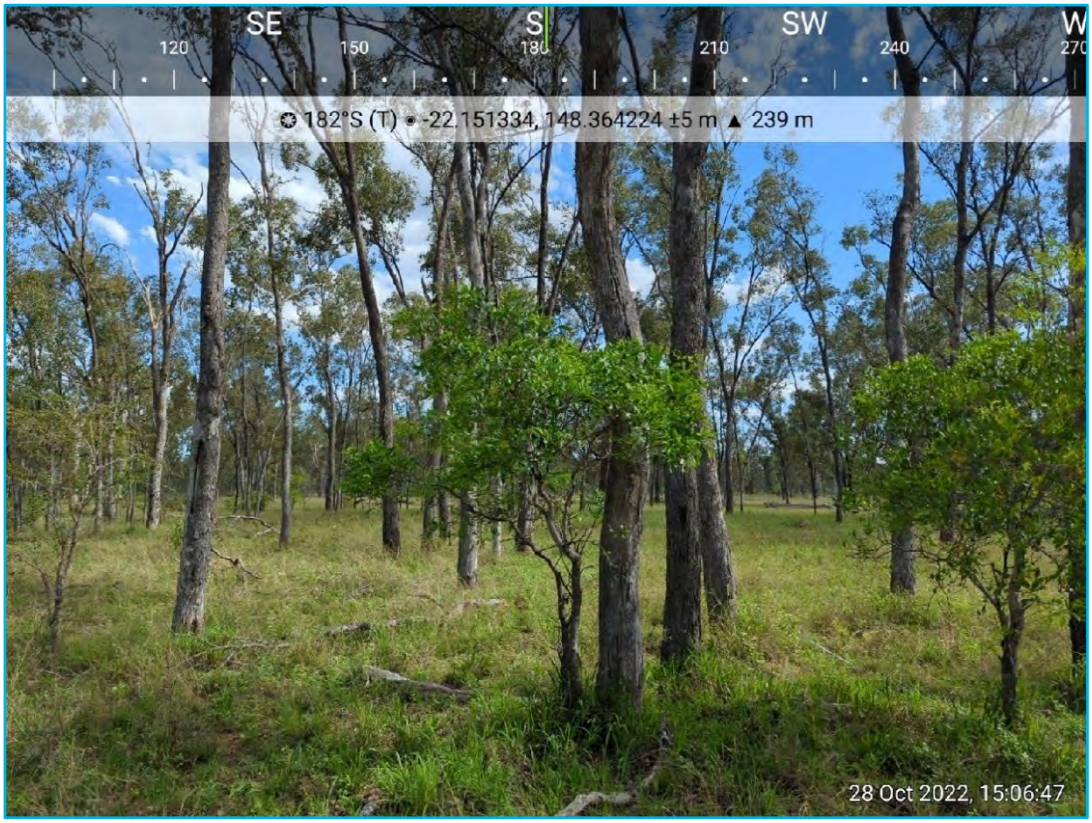
Two Koalas have been seen within the Stage 2 Offset Area by EMM ecologists to date (see Photograph 3.22), but ecologists tracking Koalas in the local area have also recorded individuals within the offset area (Ben Nottidge pers. comm.). The majority of survey effort targeting the species to date has been conducted within riparian zones (see Figure 3.11 for the locations of EMM Koala records).

Existing Koala habitat within the Stage 2 Offset Area (Figure 3.11) comprises remnant woodlands (1,701 ha; see Photograph 3.20) and suitable regrowth woodlands (1,132 ha; see Photograph 3.21).

Habitat areas for the Koala:

- include remnant vegetation along North Creek and tributaries
- include advanced regrowth along Devlin Creek, its tributaries and floodplain
- include regrowth areas where a combination of ground observations, aerial imagery and State pre-clear mapping suggest that Koala food trees are likely to regenerate or become established with suitable tree plantings
- exclude areas of cracking clays with gilgai, where Koala food trees are not likely to establish.

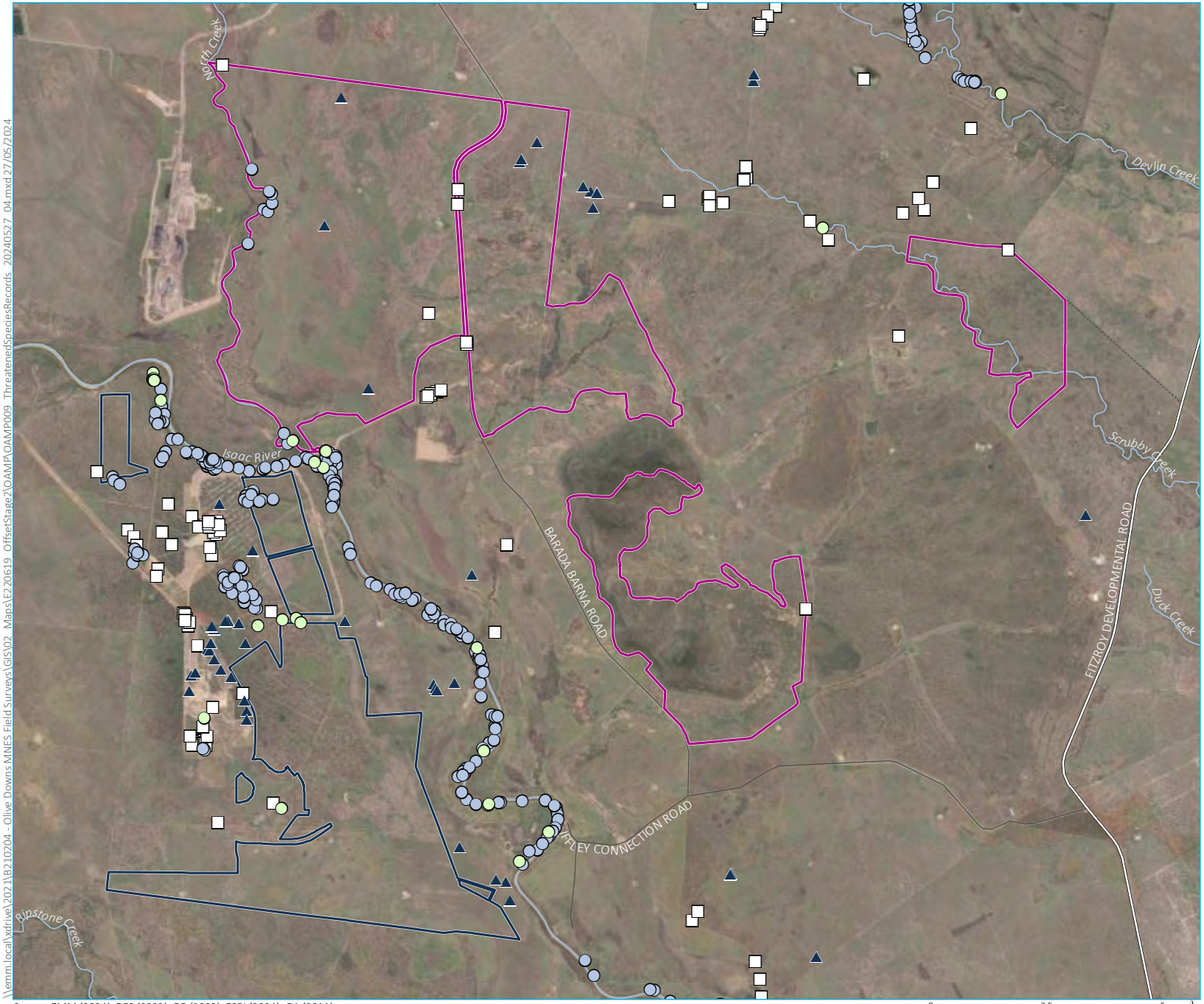
Photograph 3.20 Koala habitat within remnant eucalypt woodland



Photograph 3.21 Koala habitat within advanced regrowth eucalypt woodland

Photograph 3.22 Koala observed whilst spotlighting on Stage 2 Offset Area

Figure 3.7 Threatened species records across the Stage 2 Offset Area



KEY

- Proposed stage 2 offset area
- Stage 2 impact area

Threatened species records (EMM)

- Ornamental Snake
- Greater Glider
- Koala
- Squatter Pigeon

Existing environment

- Major road
- Minor road
- Vehicular track
- Named watercourse

\\emm.local\xdrive\2021\B210204 - Olive Downs MNES Field Surveys\GIS\02 Maps\E220619 OffsetStage2\OAMP\OAMP009 ThreatenedSpeciesRecords 20240527 04.mxd 27/05/2024

Source: EMM (2024); DES (2023); DR (2023); ESRI (2024); GA (2011)

0 2.5 5 km

GDA 1994 MGA Zone 55

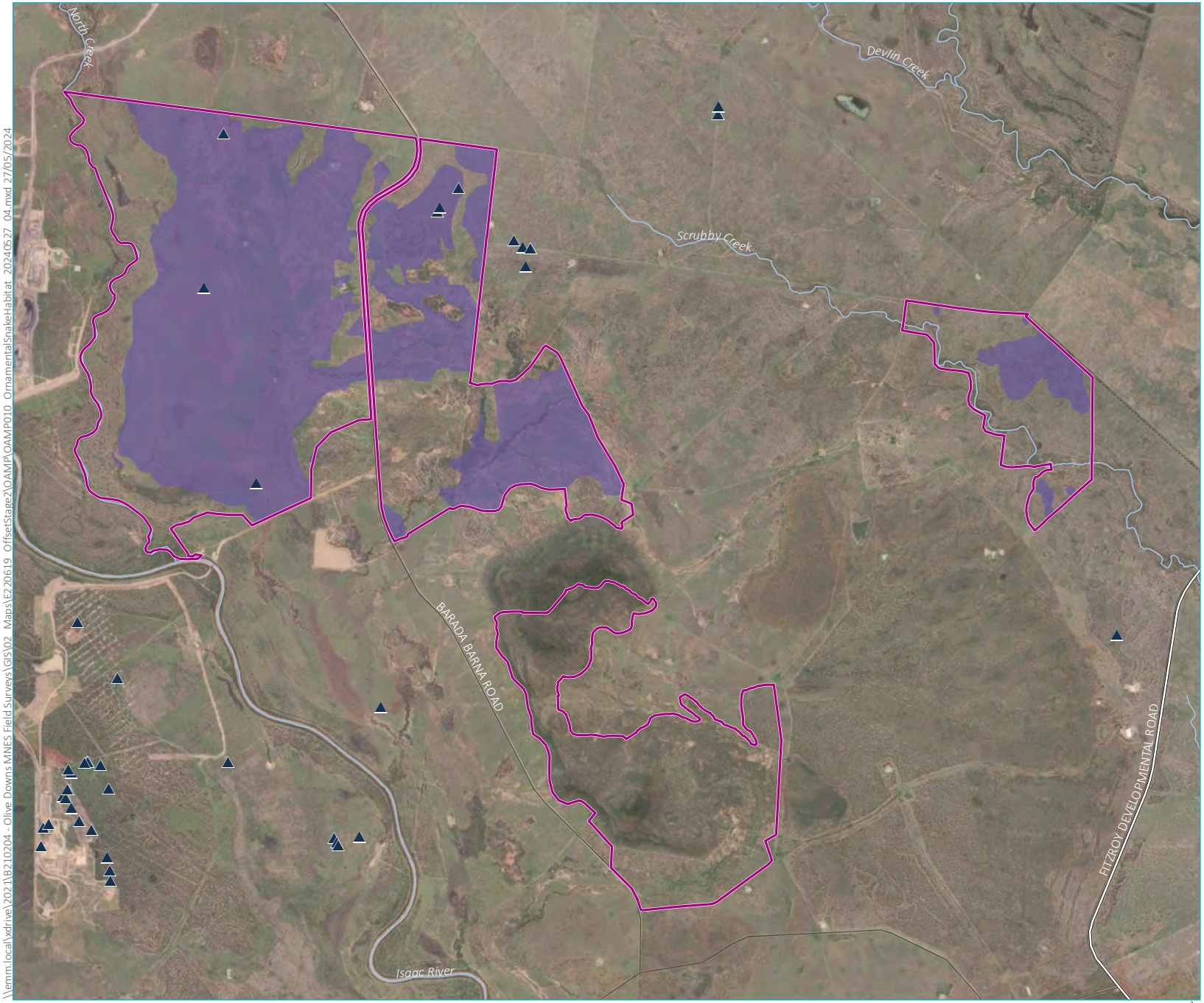
N

Threatened species records across the stage 2 offset area

Olive Downs Stage 2
Offset Area Management Plan
Figure 3.7

EMM creating opportunities

Figure 3.8 Ornamental Snake habitat mapping



KEY

- Proposed stage 2 offset area
- Ornamental Snake record (EMM)
- Ornamental Snake habitat

Existing environment

- Major road
- Minor road
- Vehicular track
- Named watercourse

\\emm.local\xdrive\2021\B210204 - Olive Downs MNES Field Surveys\GIS\02 Maps\E220619 OffsetStage2\OAMP\OAMP010 OrnamentalSnakeHabitat 20240527 04.mxd 27/05/2024

Source: EMM (2024); DES (2023); DR (2023); ESRI (2024); GA (2011)

0 2.5 5 km

GDA 1994 MGA Zone 55

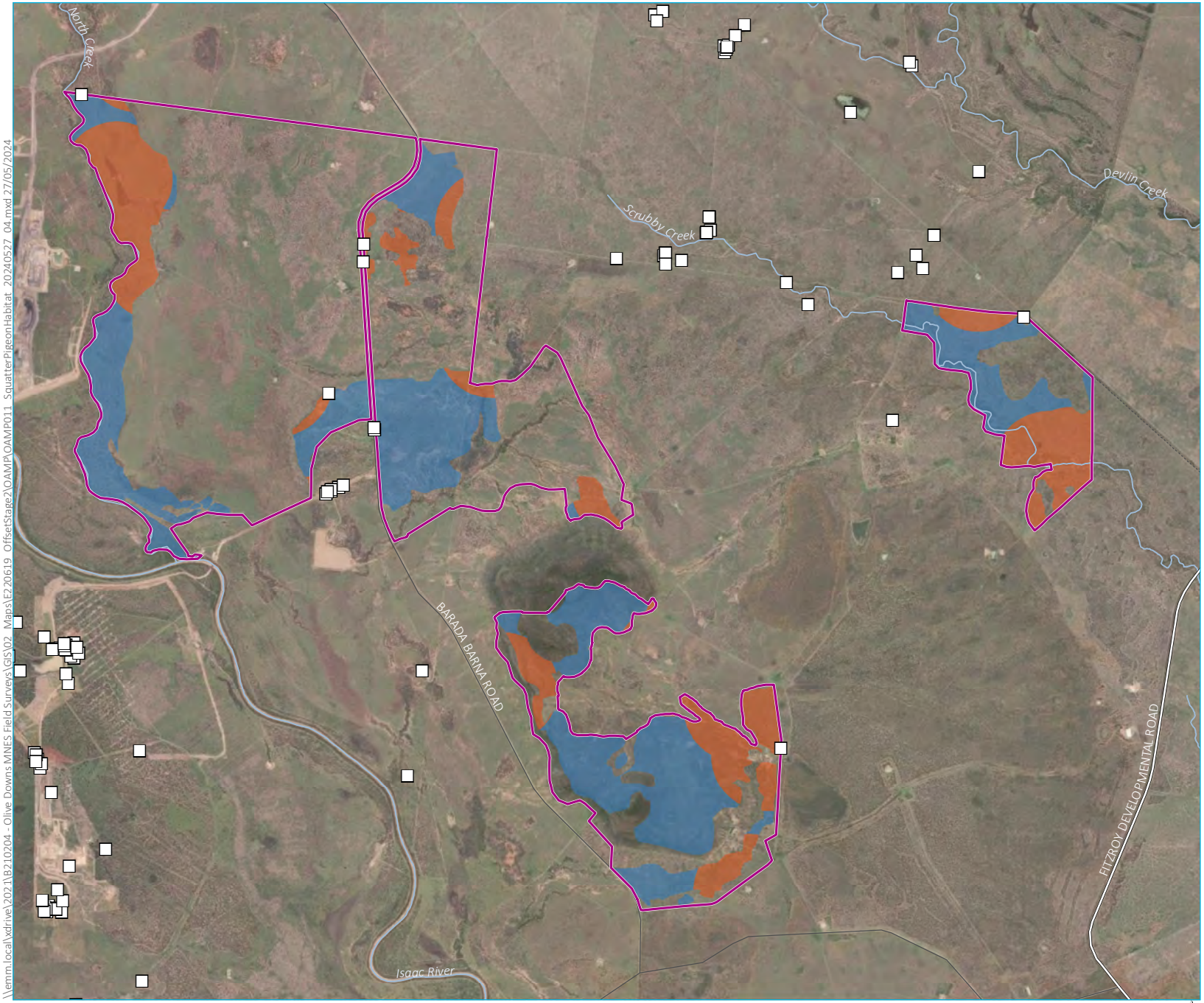
N

Ornamental Snake habitat mapping

Olive Downs Stage 2
Offset Area Management Plan
Figure 3.8

EMM creating opportunities

Figure 3.9 Squatter Pigeon habitat mapping



KEY

- Proposed stage 2 offset area
- Squatter Pigeon record (EMM)

Squatter Pigeon habitat

- Breeding
- Foraging

Existing environment

- Major road
- Minor road
- Vehicular track
- Named watercourse

\\emm.local\xdrive\2021\B210204 - Olive Downs MNES Field Surveys\GIS\02 Maps\E220619 OffsetStage2\OAMP\OAMP011 SquatterPigeonHabitat 20240527 04.mxd 27/05/2024

Source: EMM (2024); DES (2023); DR (2023); ESRI (2024); GA (2011)

0 2.5 5 km

GDA 1994 MGA Zone 55

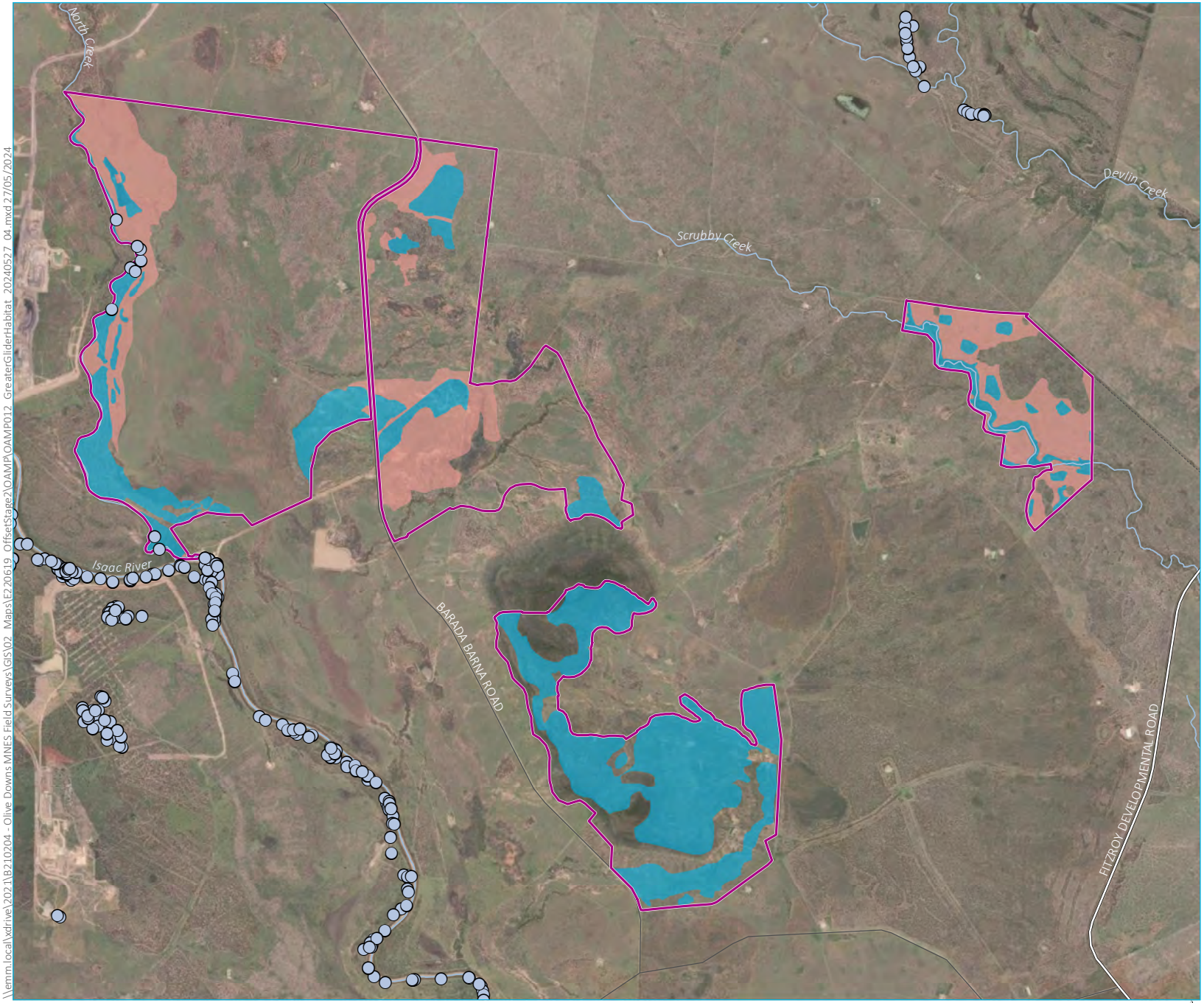
N

Squatter Pigeon habitat mapping

Olive Downs Stage 2
Offset Area Management Plan
Figure 3.9

EMM
creating opportunities

Figure 3.10 Greater Glider habitat mapping



KEY

- Proposed stage 2 offset area
- Greater Glider record (EMM)

Greater Glider habitat

- Habitat
- Future

Existing environment

- Major road
- Minor road
- Vehicular track
- Named watercourse

\\emm.local\xdrive\2021\B210204 - Olive Downs MNES Field Surveys\GIS\02 Maps\E220619_OffsetStage2\OAMP\OAMP012 GreaterGliderHabitat 20240527 04.mxd 27/05/2024

Source: EMM (2024); DES (2023); DR (2023); ESRI (2024); GA (2011)

0 2.5 5 km

GDA 1994 MGA Zone 55

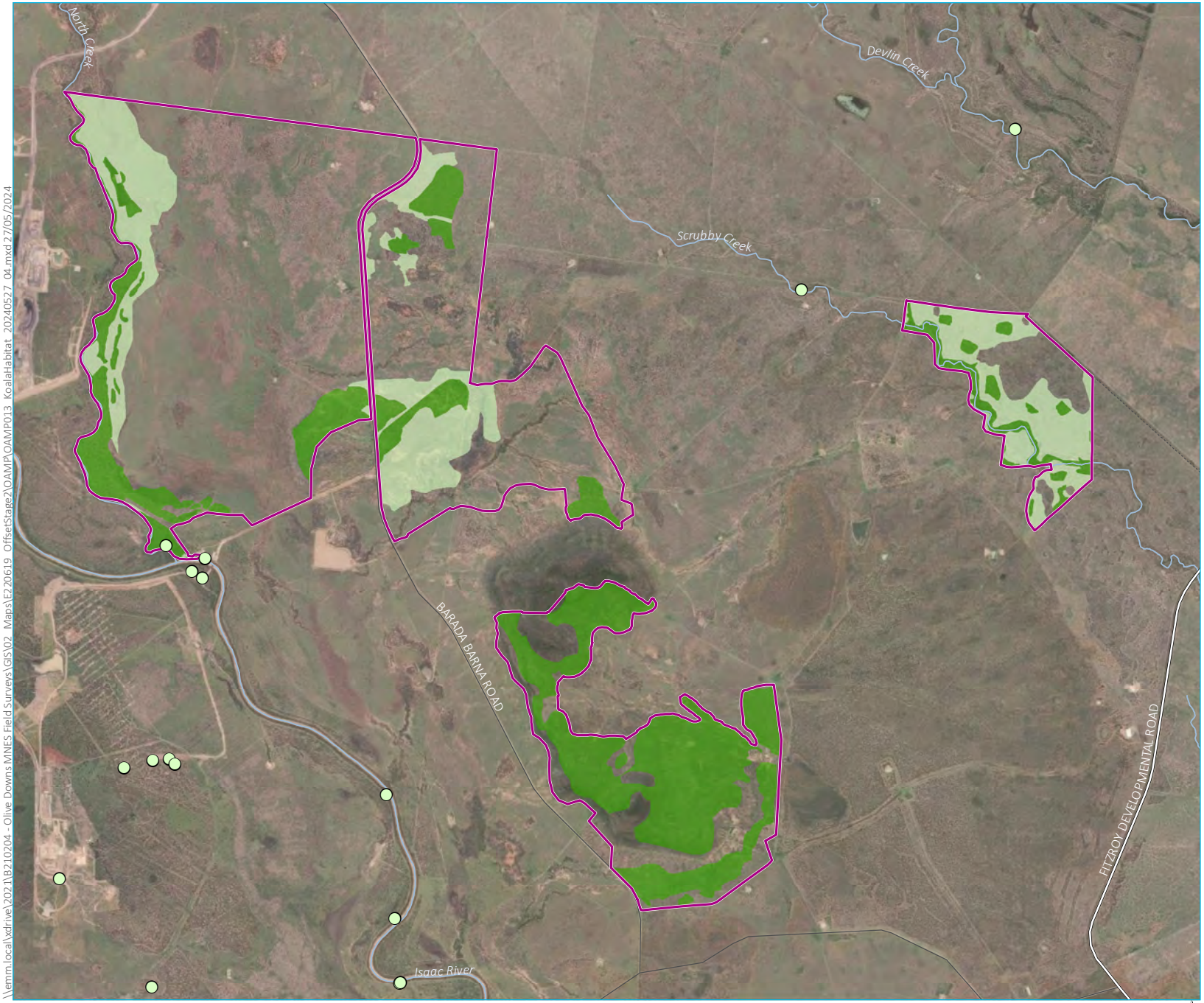
N

Greater Glider habitat mapping

Olive Downs Stage 2
Offset Area Management Plan
Figure 3.10

EMM creating opportunities

Figure 3.11 Koala habitat mapping



KEY

- Proposed stage 2 offset area
- Koala record (EMM)

Koala habitat

- Habitat
- Future

Existing environment

- Major road
- Minor road
- Vehicular track
- Named watercourse

\\emm.local\xdrive\2021\B210204 - Olive Downs MNES Field Surveys\GIS\02 Maps\E220619 OffsetStage2\OAMP\OAMP013 KoalaHabitat 20240527 04.mxd 27/05/2024

Source: EMM (2024); DES (2023); DR (2023); ESRI (2024); GA (2011)

0 2.5 5 km

GDA 1994 MGA Zone 55

N

Koala habitat mapping

Olive Downs Stage 2
Offset Area Management Plan
Figure 3.11

EMM creating opportunities

4 Management actions

4.1 Overall approach to management of Stage 2 Offset Area

This section describes the overarching management strategies that will be implemented, over a 20-year period, on the Stage 2 Offset Area in order to meet the final habitat quality scores for each MNES and satisfy the offset completion criteria (Section 6.3). Interim milestones (set at 5-yearly intervals) will assess the OAMP's ongoing progress and ability to achieve these performance outcomes; the milestones are described in Table 6.3. Failure to achieve interim milestones will result in a review of the OAMP, an evaluation of the management practises adopted and the determination (and subsequent implementation) of corrective actions in collaboration with DCCEEW. Management measures, as well as potential triggers for corrective actions, are described in Table 4.1. The implementation schedule for the Stage 2 OAMP is provided at Appendix A.1.

Section 4.2 outlines proposed management measures to be implemented across the entire Stage 2 Offset Area. These management measures will result in improvements in habitat quality for all MNES, reduce key threatening processes, and ensure that the overarching management objectives can be achieved. Species-specific management objectives are outlined in Section 4.3, demonstrating how the proposed management strategies and corrective actions are informed by relevant contemporary literature (including peer-reviewed and 'grey' scientific literature, Conservation Advice, Listing Advice and/or Recovery Plans (if available)).

The key threatening processes that need to be managed across the entire offset area are:

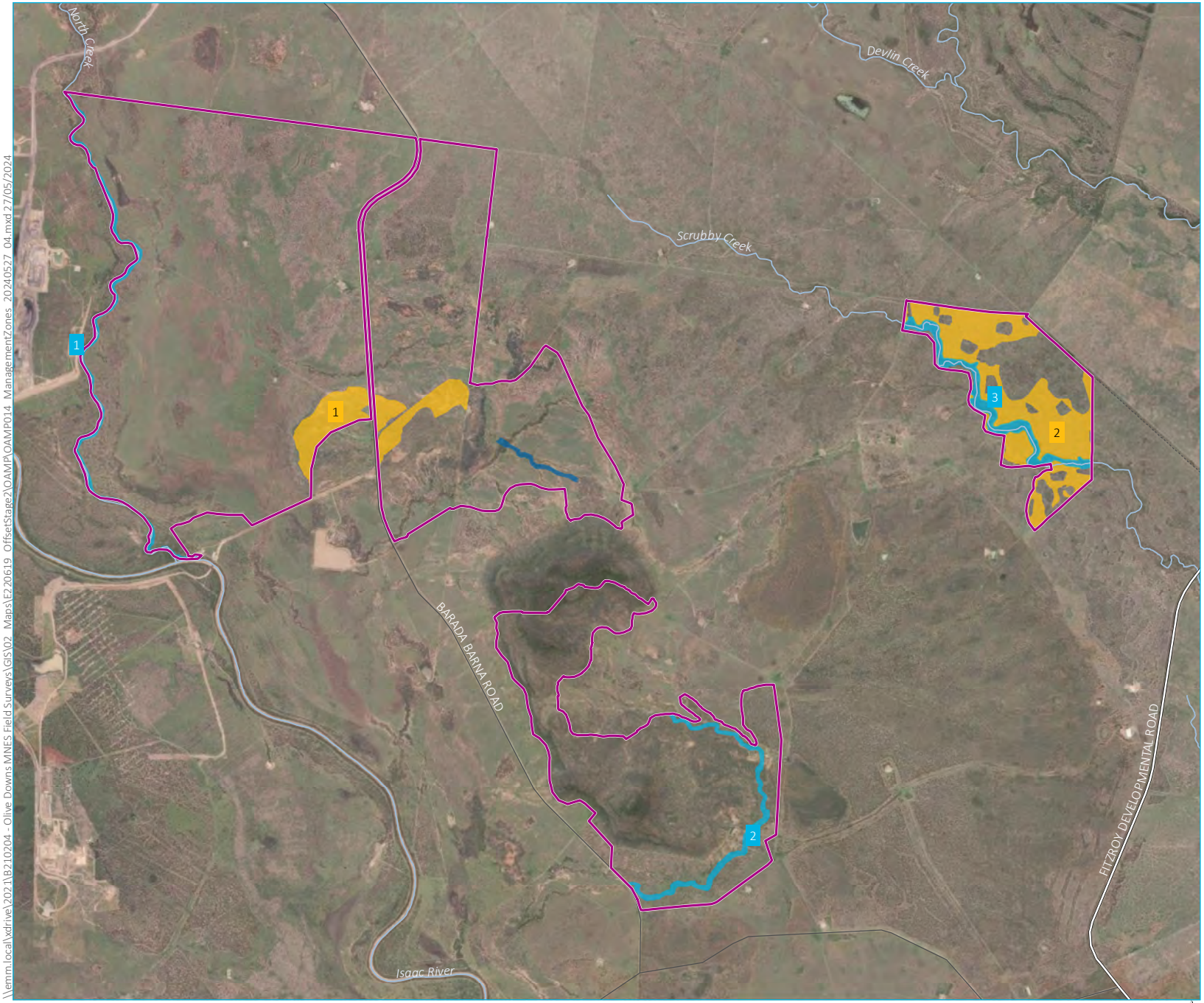
- inappropriate grazing and fire regimes
- the spread and occurrence of weeds and pest animal species
- land clearing and habitat fragmentation.

Year 1 of offset implementation will commence once this Stage 2 OAMP is approved.

4.2 Proposed management measures

The general management measures to be employed across the Stage 2 Offset Area, and anticipated benefits to MNES in accordance with available literature, are described in Table 4.1. A map showing management zones within the Stage 2 Offset Area is provided in Figure 4.1.

Figure 4.1 Management zones within Stage 2 Offset Area



KEY

- Proposed stage 2 offset area

Management zones

- Riparian habitat restoration
- Connectivity restoration
- Greater Glider nest box augmentation

Existing environment

- Major road
- Minor road
- Vehicular track
- Named watercourse

\\emm.local\xdrive\2021\B210204 - Olive Downs MNES Field Surveys\GIS\02 Maps\E220619 OffsetStage2\OAMP\OAMP014 ManagementZones 20240527 04.mxd 27/05/2024

Source: EMM (2024); DES (2023); DR (2023); ESRI (2024); GA (2011)

0 2.5 5 km

GDA 1994 MGA Zone 55

N

Management zones

Olive Downs Stage 2
Offset Area Management Plan
Figure 4.1

EMM creating opportunities

Table 4.1 Management measures and corrective actions

Management measure	Management implementation	Location	Timing	Responsible party	Trigger for corrective action	Corrective actions	Species benefiting
Regeneration of native vegetation communities	Active revegetation (seeding/planting) in identified revegetation areas, namely riparian habitat restoration in three areas (161 ha) and connectivity restoration in one area (8.3 ha) linking patches of habitat(Figure 4.1). Revegetation will be managed in accordance with the project's Revegetation Management Plan (RMP), which will be prepared in Year 2. The RMP will be prepared by Pembroke and a suitably qualified contractor identifying preparation works, planting methodology and monitoring. Assess soil health and suitability for successful regeneration. Improve existing habitat in remnant woodlands. Expand habitat in regrowth woodlands and cleared agricultural grasslands (restoration areas). Manage natural regeneration of woodlands in restoration areas.	Riparian corridors to improve connectivity. Areas where extensive weed management is undertaken.	Year 1 of offset implementation will commence once the OAMP is approved. RMP will be prepared in Year 2. Tree planting and seeding will commence within Year 3 of OAMP implementation and be completed by end of Year 6.	Suitably qualified person/s with appropriate experience in bush regeneration and revegetation.	Tree mortality >25%. Disease in trees and saplings. Weed species inhibiting native growth. Animal grazing on native growth. Natural regeneration not occurring at rates required to meet interim performance targets for restoration areas in Table 6.3.	Assess fencing structures to ensure there is no unauthorised access by stock or large numbers of native herbivores. Increased controls of pest flora and fauna species. Increase watering of planted tubestock. Dead trees to be replaced so average of 300 trees/ha is achieved in active revegetation areas. Additional direct seeding is undertaken across larger areas in the restoration habitats. Manage disease through application of suitable herbicides and/or pesticides.	Ornamental Snake - long term regeneration increases coarse woody debris, which is identified as a habitat resource for the species (Melzer 2012). Squatter Pigeon - vegetation clearing is identified as a threat to the species (TSSC 2015). Regeneration of open woodlands and native grasses increases areas of suitable habitat and food resources. Greater Glider - habitat loss is identified as a catastrophic threat to this species (DCCEEW 2022b). Regeneration and revegetation will increase foraging resources and connectivity between habitats in shorter term and denning resources in longer term. Koala - habitat loss is identified as a key threat to this species (DAWE 2022), with regeneration and revegetation resulting in increased availability of foraging resources and improved shelter and connectivity.
Weed control	Baseline weed mapping surveys. Weeds will be managed in accordance with the project's weed management plan, which will be developed post baseline surveys being completed in Year 1. The weed management plan will be prepared by Pembroke and a suitably qualified contractor identifying specific weed control methods, areas to be targeted and timing for each year. Targeted weed control measures (see Table 4.2 for further details).	Areas where weeds exist across all offset areas.	Weed mapping surveys to be undertaken in Year 1. Weed management plan completed by end of Year 1. Weed control at least annually. Species dependent (see Table 4.2 for further details).	Pembroke Land Manager or suitably qualified person/s with appropriate experience in weed management.	New areas of weed outbreaks have been noted from the baseline surveys. Increase in weed abundance. Average increase of 20% in non-native cover from previous baseline surveys at the HQ monitoring sites. New weed species identified.	Alter weed management strategy to target problematic species and/or outbreaks. Increase frequency of weed management events. Assess weed control methods and change methods if required. Review hygiene protocols to ensure they are effective in preventing vehicles and people spreading or introducing weeds across offset area.	Ornamental Snake - invasive weeds are identified as a key threat (DCCEEW 2022c). Squatter Pigeon – invasion by weed species that do not provide foraging resources is identified as a threat to the species (TSSC 2015). Greater Glider - Buffel Grass contributes to increased fuel loads, which in turn lead to increased burn severity during fire events (Miller et al 2010); this is a key threat to Greater Glider (DCCEEW 2022b). Koala - Buffel Grass contributes to increased fuel loads, which in turn lead to increased burn severity during fire events (Miller et al 2010); this is a key threat to Koala (DAWE 2022).

Table 4.1 Management measures and corrective actions

Management measure	Management implementation	Location	Timing	Responsible party	Trigger for corrective action	Corrective actions	Species benefiting
Biomass control and grazing management	Minimise fuel loads through prescribed (hazard reduction) burns and manual techniques such as slashing. Exclude grazing in certain areas. Grazing is excluded from major watercourses and adjacent riparian areas (at least 50 m either side of any major water source) will be fenced off. Off-stream watering points will be installed to ensure cattle have adequate access to water. Grazing will be excluded in mapped gilgai areas which are Ornamental snake habitat to ensure gilgai habitats are protected. Grazing will be excluded from Ornamental Snake and Squatter Pigeon habitats as shown on.Figure 4.2 all year round.	Riparian corridors. Gilgai landforms. Remnant woodland. Regrowth woodland. Cleared areas.	Dependent on location (see Table 4.3 for further details).	Pembroke Environmental Manager. Suitably qualified person/s with appropriate experience in grazing management.	Increase in weed abundance. Average increase of 20% in non-native cover from previous baseline surveys at the HQ monitoring sites. Fuel loads exceed specified thresholds. Evidence of livestock in exclusion areas.	Alter timing and frequency of selective grazing. Implement better exclusion mechanisms. Review prescribed burning regime. Provide alterations as required to assist manage fuel loads. Alter weed management strategy to target problematic species and/or outbreaks. Increase frequency of weed management events. Assess weed control methods and change methods if required. Review hygiene protocols to ensure they are effective in preventing vehicles and people spreading or introducing weeds across offset area.	Ornamental Snake - grazing has potential to degrade wetland/gilgai areas through pugging and compaction of soil cracks (Melzer 2012). Squatter Pigeon – the species does not inhabit areas with dense grass cover and requires bare ground for foraging (SPW 2011). Greater Glider - Buffel Grass contributes to increased fuel loads, which in turn lead to increased burn severity during fire events (Miller et al 2010); this is a key threat to Greater Glider (DCCEEW 2022b). Koala - Buffel Grass contributes to increased fuel loads, which in turn lead to increased burn severity during fire events (Miller et al 2010); this is a key threat to Koala (DAWE 2022).
Fire management	Fire will be managed in accordance with the project's Bushfire Management Plan (BMP), which will be developed after baseline surveys are completed in Year 1. The BMP will be prepared by Pembroke and a suitably qualified contractor identifying fire prescriptions for specific Fire Management Zones (FMZs) and requirements for fire management infrastructure (e.g. fire breaks). Create and maintain fire tracks (fire breaks) for fire control where necessary. Maintain fuel loads at appropriate levels (see Section 4.2.5). Hazard reduction burns. Mosaic burning.	Across offset areas.	Key fire tracks to be created within 12 months of the biodiversity offset commencing. Access tracks and fire breaks to be maintained at least every 12 months. Fuel load management dependent on location (see Table 4.3 for further details). Hazard reduction burns prior to the dry season (when necessary). Controlled and mosaic burning when necessary.	Pembroke Environmental Manager.	Fuel loads exceed specified thresholds. An unplanned bushfire occurs.	Review effectiveness of fuel load management and monitoring techniques. If controlled burning is implemented review effectiveness and monitor any changes post event.	Ornamental Snake - inappropriate fire regimes can result in loss of coarse woody debris. Squatter Pigeon - inappropriate fire regimes are identified as a threat to this species and may exacerbate other threats (TSSC 2015). Greater Glider - too intense or frequent fires are identified as a severe threat (DCCEEW 2022b). Koala - fire can be a significant threat to the Koala, with significant loss of habitat during recent bushfires across eastern Australia (DAWE 2022).
Pest fauna management	Baseline feral animal surveys in Year 1. Species specific management controls (see Table 4.5 for further detail). Pest fauna to be targeted include feral pigs, foxes, rabbits, feral cats, deer.	Across offset area, targeting areas where feral animals have been recorded during baseline surveys. Wetland areas with food sources for Ornamental Snake.	Species specific (see Table 4.5 for further details).	Suitably qualified person/s with appropriate experience and licences in pest fauna management.	Observed increase in incidental sightings of feral animals. Increase in 10% of feral animal abundance from previous monitoring event. Observation of any MNES species mortality from pest animals such as feral cat predation of Greater Glider. Evidence of pest animal degradation on MNES species habitats, such as feral pigs in gilgai.	Increase frequency of pest control events. Review and alter pest control methods. Adopt pest control across a broader area if it is likely pest animals are breeding in adjacent areas.	Ornamental Snake - impacts to wetland habitat from feral pigs and cattle is considered a threat, along with predation or poisoning by feral species (Melzer 2012, TSSC 2015) Squatter Pigeon - overgrazing by feral herbivores such as the rabbit, and/or predation by feral cats and foxes is identified as a threat (SPW 2011, Reis 2012). Greater Glider - Predation by feral cats is a known threat to the species (DCCEEW 2022b) and feral cats occur across the offset area, albeit in low numbers, potentially due to predation by Dingoes. Koala - predation, particularly by dogs, is identified as a threat in suburban and peri-urban areas (DAWE 2022).

Table 4.1 Management measures and corrective actions

Management measure	Management implementation	Location	Timing	Responsible party	Trigger for corrective action	Corrective actions	Species benefiting
Fencing	Fencing to be maintained to allow grazing to be managed in selected areas. Fences with barbed wire to be removed.	Existing fence lines To be maintained only within selected areas.	Existing barbed wire on internal fences to be removed within First year of the biodiversity offset commencing. Removal of top strand of barbed wire may not be possible for perimeter boundary fences due to neighbouring landowner requirements. Fences to be maintained annually.	Pembroke Environmental Manager.	Evidence of damage to fences. Livestock entering areas they are excluded from. Wildlife injury on any fences.	Repair damaged fencing. Remove livestock and repair fence. Change design of fence to minimise wildlife injuries.	Ornamental Snake - cattle contribute to the degradation of habitat for the species (Melzer 2012). Squatter Pigeon - it is likely that barbed wire fences pose a risk to this species (WFF 2023b). Koala - barbed wire fences may entangle Koalas or prohibit their movement through the landscape. Greater Glider - barbed wire fences are identified as a threat to the species (DCCEEW 2022b, WFF 2023a).

Further details of each management measure are provided below.

4.2.1 Improvement of Greater Glider connectivity in riparian zones

As per condition 12 of the approval (2017/7867), habitat connectivity within riparian zones of the Stage 2 Offset Area must increase. The riparian corridors are a mix of remnant vegetation and advanced regrowth areas. In accordance with condition 15, the increase in connectivity must be appropriately assessed with results and management actions to be peer-reviewed every 5 years to ensure improvements are achieved, or management short-comings are identified and corrected in due course. Assessments and reviews of Greater Glider habitat connectivity will be undertaken until completion criteria are achieved. Monitoring for Greater Glider including habitat connectivity is described in Section 6 and completion criteria are defined in Table 6.2.

Habitat connectivity will be improved for Greater Glider through protection and management of existing remnant vegetation along watercourses, reduction of threats such as weed management and preventing destructive bushfires, active revegetation to expand the existing riparian corridors, and managing natural regeneration of eucalypt woodlands across much broader areas identified as 'habitat restoration areas' (Figure 4.1). This will ensure important riparian corridors are maintained and widened over time, and edge effects minimised, to improve habitat connectivity.

Management actions to achieve improved habitat connectivity will include the following:

- Supplementary tree plantings and direct seeding in riparian corridors over approximately 161 ha, starting from Year 3 and will be completed by end of Year 6 (Figure 4.1) (refer Section 4.2.2).
- Installation of nest boxes in advanced regrowth vegetation and remnant vegetation where existing hollow-bearing trees are limited (ie less than 50% of the benchmark for large trees) to provide additional denning resources and encourage their movement through these areas in first five years. The suggested nest box density will be one per 3 hectares of habitat, as this is the approximate home range of the Greater Glider (Eyre et al 2022), and some hollow bearing trees will already be present. Findings from nest box installation on the Stage 1 Offset area to be incorporated.
- Installation of nest boxes in restoration habitat areas (including revegetation sites) when canopy trees are mature enough to hold a nest box and Greater Gliders start to utilise these areas to provide additional denning resources and support movement into these additional habitats.
- Control of weeds to increase natural recruitment.
- Reduction of fuel loads and active fire management to reduce intense fires.
- Management of grazing to ensure natural regeneration isn't impeded.
- Increase in canopy height and cover to improve glider ability to move through these habitat areas.
- Targeted management of feral cats as they are known to prey on Gliders.
- Removal of barbed wire fencing to avoid injury and/or mortality.

These management actions will allow the vegetation to regenerate and develop naturally with limited disturbance. This will enhance Glider habitat through increased food tree abundance as well as enhanced vegetative structural form for Glider mobility through increased canopy heights and cover. Nest boxes will also provide interim shelter and denning/breeding habitat until further natural hollows develop.

Field assessments to measure success will include the following methods:

- active spotlighting surveys to determine usage of Greater Glider and relative abundance across these main riparian corridors, including revegetated areas
- structural vegetation assessments including numbers of large trees, suitable hollows, median canopy heights and canopy cover

- monitoring of next box utilisation
- results from Habitat Quality assessments.

Restoration areas (Figure 4.1) would provide suitable habitat characteristics (hollows) over time with the implementation of appropriate management measures proposed to be implemented under this OAMP. These naturally regenerating areas will be actively managed so that over time they will provide additional foraging resources for Gliders. These areas are situated adjacent to remnant areas so this will increase patch size of Greater Glider habitats, making them more resilient to edge effects and will also improve connectivity between patches for Gliders. Once these restoration areas are maturing and canopy trees reach adequate size (estimated at 10-15 m height and DBH of at least 30 cm) additional nest boxes will be installed across these areas.

4.2.2 Regeneration works

Loss of habitat is identified as a key threatening process in the conservation and listing advice for all species to be managed within the Stage 2 Offset Area (Table 4.1). Regeneration works will provide long-term benefits for these species through improvements to existing habitat in remnant woodlands, expansion and improvement of habitat in regrowth woodlands and the restoration of cleared agricultural grasslands.

Active revegetation (seeding/planting of tubestock) will be implemented in remnant and non-remnant areas along riparian corridors to improve habitat connectivity, with a primary focus on habitat for Koalas and Greater Glider. Locations of the revegetation areas are highlighted in Figure 4.1. It is presently proposed that approximately 161 ha will be revegetated across these riparian areas commencing in Year 3 and being completed by end of Year 6. Target areas are typically in proximity to remnant or advanced regrowth. Some cleared creek banks will be revegetated to reduce erosion potential and improve connectivity between habitat patches.

The following actions will be implemented when undertaking active revegetation:

- A Revegetation Management Plan will be prepared in Year 2, which will include:
  - location and staging of works
  - species to be included in planting / direct seeding and their proportions and density
  - soil preparation works to be undertaken prior to planting
  - planting methodology (i.e. use of guards / watering / fertiliser)
  - requirements for ongoing management, monitoring and corrective actions.
- The ground-truthed REs identified near the revegetation areas includes RE 11.3.25 (Figure 3.5). Revegetation will include dominant canopy species from this REs such as *Eucalyptus tereticornis, Corymbia tessellaris, Eucalyptus coolabah* and *Casuarina cunninghamiana*, along with other *Eucalyptus* and *Corymbia* species to reflect the vegetation of surrounding areas.
- Preparation works will be undertaken including soil preparation, weed and biomass control. Preparation works are likely to commence in Year 2.
- Revegetation will include direct seeding and/or tubestock plantings. Overstorey species to be planted will be consistent with those found in nearby REs. Plantings will also include key feed species for Koala (Melzer et al 2012) and/or Greater Glider (Smith et al 2007).
- Trees will be planted at a density consistent with the applicable RE benchmarks, which contains an average basal area of 14 m^2/ha. This will be an average of 300 trees per hectare (factoring losses); trees will be protected with tree guards. Direct seeding will also be undertaken at a rate suitable to generate 300 canopy trees per hectare.
- Supplementary watering will be undertaken during and after planting.

- All regeneration works will be undertaken by a qualified bush regenerator.
- The revegetation works will be implemented from Year 3 and be completed by end of Year 6. Forty-five ha will be revegetated each year due to the large areas required, and to ensure planting occurs under the right seasonal conditions. By completing smaller areas per year, and immediately commencing maintenance, survivability of plantings will be maximised.
- Monitoring of revegetation works will commence immediately and continue for a minimum of 5 years after the area has been seeded and/or planted. Mortality greater than 25% will be replaced on an annual basis to maintain tree density.

Active revegetation will be implemented following extensive weed management (such as in areas of extensive Guinea Grass, Lantana or Buffel Grass control) to ensure other weed species do not establish. This will be determined during monitoring works. If required, active revegetation will be undertaken in accordance with the process outlined above, with additional planting of understorey and groundcover species endemic to the appropriate RE at a rate of 500 plants per hectare.

Triggers for corrective actions include:

- evidence of tubestock mortality (>25% of planted tubestock)
- evidence of disease in trees and saplings
- evidence of weed species inhibiting native growth
- evidence of pest animal predation on native growth.

Corrective actions to be implemented where natural regeneration success is low will include:

- assessments of fencing structures to ensure there is no unauthorised access by stock or large numbers of native herbivores (i.e. Eastern Grey Kangaroo) browsing on saplings
- implement increased controls of pest flora and fauna species
- increasing intensity of weed management where weeds are confirmed as key cause for lack of regeneration
- increase watering regime if conditions are unseasonably dry
- assess soil health and suitability for successful regeneration
- dead trees to be replaced with tube stock.

4.2.3 Weed control

Invasive weeds are identified as a key threat to the Ornamental Snake and Squatter Pigeon. Weed invasion is likely to lead to loss of habitat for the Ornamental Snake (DAWE 2020c, DoE 2014b) and Squatter Pigeon (DAWE 2020b, TSSC 2015), with invasion by Buffel Grass identified as a key threat for these species. Buffel Grass also contributes to increased fuel loads, which in turn leads to increased burn severity during fire events (Miller et al 2010); this is a key threat to Greater Glider (DCCEEW 2022b) and Koala (DAWE 2022).

Management of weeds will be a key management action to address ongoing loss and degradation of habitat for all species within the Stage 2 Offset Area.

Targeted surveys for weeds have not yet been completed on the Stage 2 Offset Area, however weeds were noted incidentally whilst completing BioCondition surveys (EMM 2024). These surveys identified four Weeds of National Significance (WONS) (*Lantana camara* (Lantana), *Opuntia tomentosa* (Velvety Tree Pear), *Parthenium hysterophorus* (Parthenium) and *Parkinsonia aculeata* (Parkinsonia)) and five which are listed under Qld's *Biosecurity Act 2014* (BS Act) as Category 3 restricted invasive plants (*Harrisia martini* (Harrisia cactus) plus the four WONS noted above). Category 3 plants must not be given away, sold, or released into the environment. The BS Act requires everyone to take all reasonable and practical steps to minimise the risks associated with invasive plants under their control. Two additional environmental weeds (*Cenchrus ciliaris* (Buffel Grass) and *Megathyrsus maximus* (Guinea Grass)) have been observed and are proposed to be actively managed due to their potential to degrade habitats and ecological condition of offset area.

Table 4.2 provides a summary of the weed species present in the in the Stage 2 Offset Area, the proposed control method, control period and intensity. All species will require a minimum of one control event per year, and most species will require follow-up treatment during the growing season. Active management and monitoring under this OAMP will continue for 20 years. For other species at least two control events will be undertaken yearly due to follow up weed control being required. It is expected that primary weed control would be undertaken in years 1 to 5, with secondary control in years 6 to 10 and follow up control in years 11 to 20. Pembroke will continue to undertake weed control and maintenance of the offset after this period until the remainder of the approval.

In Year 1, it is proposed that a comprehensive baseline weed survey will be completed. This will confirm weed species present, as well as their distribution and abundance across the offset area. Large infestations will be mapped and permanent photo monitoring points will be established at strategic locations, such as waterway crossings. Management outcomes for weed cover (regarding the reduction in cover being sought across the offset area) are prescribed in Table 6.3 for each 5-year interval. A more detailed weed management plan will be prepared after the baseline survey is completed. The weed management plan will apply to a 12-month period with specific detail regarding the weeds to be targeted, appropriate control methods and timing. Weed management will be implemented by suitably qualified persons. Weed mapping will be a key part of this baseline survey and will be detailed in an appendix to the refined OAMP that will be prepared after the first year of management.

Triggers for corrective actions will be based on data collected during the baseline survey, and include:

- new areas of weed outbreaks being identified (using distributions mapped during baseline surveys)
- weed abundance increasing by average of 20% from previous baseline surveys across HQ monitoring sites
- new weed species being identified.

Corrective actions to be implemented for weed control will include:

- altering weed management strategy to target problematic species and/or outbreaks
- increasing frequency of weed management events, which will focus on areas showing increase in weed outbreaks
- review of hygiene protocols to ensure weeds are not being introduced and/or spread by vehicles, people, etc
- changing weed control methods and evaluating if they are more effective in managing the particular weed species.

Table 4.2 Weed management

Species details	Presence on site	Control method (s)	Control period	Management outcomes	Threat to biodiversity
Bellyache Bush *Jatropha gossypiifolia* QLD Biosecurity Act: Cat 3 National Status: WONS	Not observed	*General controls* Mechanical control: For small infestations mechanical control will be used. As bellyache bush is shallow rooted, grubbing the plant by hand is effective. Grazing management: Pasture management to maintain ground cover post treatment significantly reduces seedlings survival through competition. Fire: If deemed suitable fire will be used to control larger infestations. Fire wouldn't be suitable along watercourses, but more if there is a larger infestation in an open grassland or open woodland. This would only occur as part of an approved fuel reduction burn. *Chemical control* Many herbicides are currently or about to be registered for bellyache bush. Below are just two examples of registered chemicals. In native pastures, apply Metasulfuron-methyl 600g/kg, at a rate of 10 g/100 L + penetrant. Thoroughly wet plants and apply when actively growing.	Annually. September to April* At least one control event per year. * As Bellyache bush flowers throughout the year when moisture is adequate control can also occur at these times. The proposed months are designed to maximise weed-control efficiency across the entire Stage 1 offset area.	No new weed infestations. Key focus is to reduce infestations along watercourses. Reduction in weed cover across offset area.	Dense infestations can occur on river flats and other areas of good loamy soil. It can take over these riparian areas reducing biodiversity values and prohibiting fauna use of the area. Fruits of bellyache bush are poisonous to humans and animals.
Brazilian Nightshade *Solanum seaforthianum* QLD Biosecurity Act: N/A National Status: N/A	Along watercourse and wetland areas. Scattered infestations.	*Chemical control* Cut and dab method followed by the Foliar spray method. Apply herbicide immediately to a stump that has been cut to within 15 cm of the ground. Cut-stump method. Spray herbicide to cover all leaves and stems, and ensure the area is not disturbed for 24 hours to allow herbicide uptake. *Mechanical control* For larger infestations mechanical control can be used including slashing. This will only be conducted where it won't impact on native vegetation communities.	Annually. September to April. At least one control event per year, if required.	This species will only be actively managed in specific areas identified in the baseline weed survey (i.e. where there is high risk to MNES habitat values). No new weed infestations. Reduction in weed cover at identified locations.	Species is classified as an environmental weed as it can take over bushland and riparian areas. Fruit and leaves are toxic to humans.
Buffel Grass *Cenchrus ciliaris* QLD Biosecurity Act: N/A National Status: N/A	Dominates many clearings.	*Strategy* Buffel Grass is a pervasive species that is drought tolerant and grows quickly after summer rainfall. Buffel Grass has proved useful for pasture and soil retention in a wide range of environments due to its drought tolerance, high biomass, deep roots, rapid response to summer rains, relative palatability and resistance to overgrazing. However, it can outcompete native grasses and trees regenerating and increase fuel loads substantially therefore increasing risk of hot fires occurring. Therefore, the approach will be to target the reduction of Buffel Grass where it occurs in riparian areas or where it is outcompeting regeneration of native grasses and trees. *Smaller outbreaks in forested areas* For small outbreaks physical removal or herbicide, or combined treatment will be undertaken. Follow-up treatment is essential. *Larger outbreaks in forested areas or regenerating areas* For mixed native-buffel pasture: manage fire to maintain diversity, e.g. allow native plants to recruit seedlings and set seed in good seasons. For cleared/improved pasture: manage seed production and minimise spread into adjacent areas, remove seedlings from outside planted area. Prevent fires spreading from pastures. Apply herbicide after heavy rain to impact both mature plants and seedlings. Plants must be actively growing. Plants may be flowering but must not be seeding. Herbicide should be applied to as much of the green leaf as possible. This is best achieved through spot spraying. Repeated treatment is often required. Slashing of old foliage followed by spraying after effective rainfall can be very effective. Slashed material will remain on the ground to protect the soil from erosive rainfall. Follow up with further spraying or grubbing of surviving plants and seedlings when actively growing. Slashing will only be done if native saplings are not impacted.	Two events per year. This is due to follow up treatment being required. Control most effective after summer rains when in growth phase.	Reduction in Buffel Grass extent in remnant bushland. Fuel loads are managed to specified levels to reduce risk of hot bushfires occurring.	Buffel Grass has spread well beyond planted areas and can dominate the ground layer in many native plant communities. It reduces native plant diversity and can affect vegetation structure by changing fire regimes. It has potential to outcompete regeneration of native grasses and trees and increase risk of hot bushfires.
Castor Oil Plant *Ricinus communis* QLD Bio Act: N/A National Status: N/A	Along watercourse and wetland areas. Scattered infestations.	*Manual control* Individual plants or small infestations will be removed by cut stump and foliar spray. *Chemical controls* Fluroxypyr 333 g/L (e.g. Starane Advanced) applied at a rate of 30 mL/10 L water. This requires PVMA permit PER11463; the permit expires 30/06/2023. Method: Foliar spray (backpack). Read permit and label carefully. Fluroxypyr is suitable for native and exotic areas (DoAF 2020a).	Annually. September to April. At least one control event per year.	This species will only be actively managed in specific areas identified in the baseline weed survey (i.e. where there is high risk to MNES habitat values). No new weed infestations. Reduction in weed cover at identified locations.	It is regarded as an environmental weed due to its ability to dominate understorey of bushland areas. In particular along watercourses.

Table 4.2 Weed management

Species details	Presence on site	Control method (s)	Control period	Management outcomes	Threat to biodiversity
Guinea Grass *Megathyrsus maximus* QLD Biosecurity Act: N/A National Status: N/A	Dominates many clearings.	*Strategy* Guinea Grass is a pervasive grass species that that can dominate understorey in bushland areas and riparian vegetation. Therefore, the approach will be to target the reduction of Guinea Grass where it occurs in riparian areas of Greater Glider and Koala habitat. *Mechanical control* Slashing / brush-cutting and/or hand pulling will be the preferred option for control, to reduce the risk of impacts to aquatic environments. *Chemical control* There are no products specifically registered for the control of guinea grass in Queensland. However, a permit held by the Department of Agriculture and Fisheries allows people generally to use some herbicide products to control guinea grass as an environmental weed in various situations. Any herbicide used in the riparian zone must be non-residual and approved by the Australian Pesticides & Veterinary Medicines Authority (APVMA) for use in aquatic environments. Herbicide must only be applied as a follow up to mechanical control (i.e. on resprouting plants).	Annually. September to April. At least one control event per year.	Reduction in Guinea Grass extent in remnant bushland and riparian vegetation.	Regarded as an environmental weed. It is common and widespread in bushland and riparian vegetation in the tropical, sub-tropical, warmer temperate and semi-arid regions of Australia.
Harrisia Cactus *Harrisia martini* QLD Biosecurity Act: Cat 3 National Status: N/A	Scattered, observed along fence lines.	Control of this plant is difficult as it has a deep underground tuberous root system and use of a combination of physical, biological and herbicide controls is recommended. *Manual control* Dig out plants completely and burn. Ensure all tubers are removed and destroyed. Spot spray with registered herbicide. *Biological control* Biological control includes two introduced insects: • a stem-boring longicorn beetle (*Alcidion cereicola*) • a mealybug (*Hypogeococcus festerianus*). Stem-boring beetle only attacks older woody stems. In Collinsville area, large beetle colonies developed and contributed to collapse of dense areas of cactus. Populations of *Alcidion cereicola* have declined with reduction in cactus in recent years. More successful biological control agent is mealybug *Hypogeococcus festerianus*, which is now present in most areas infested with harrisia cactus. Mealybug is considered more effective in more northern areas of central Queensland. *Herbicide* Triclopyr as tea 200 g/L + Picloram as tipa 100 g/L (e.g. Slasher) or Triclopyr as tea 200 g/L + Picloram as tipa 100 g/L + Aminopyralid 25 g/L (e.g. Tordon RegrowthMaster) (e.g. Tordon DSH®).	Annually. September–March (Herbicide). September–December (Biological).	This species will only be actively managed in specific areas identified in the baseline weed survey (i.e. where biological control agents are not active). No new weed infestations. Reduction in weed cover across offset area.	Highly invasive species. Produces large quantities of seed that is highly viable and easily spread by birds and other animals. Any broken-off portions of the plant will take root and grow.
Lantana *Lantana camara* QLD Biosecurity Act: Cat 3 National Status: WONS	Scattered throughout all areas particularly along drainage features, some dense infestations.	*Manual control* For single-stemmed lantana, basal bark spraying and cut-stump methods give good results at any time of year (but best when the plant is actively growing). For large Lantana infestations, treatment with herbicides by foliar spraying is usually not economically feasible. However, fire and slashing/cutting, can reduce dense infestations, making follow-up spot treatments with chemicals more economically viable. Lantana seed banks remain viable for at least four years, so follow-up control to kill seedlings before they mature is vital to ensure initial management efforts to control the parent bush are not wasted. *Herbicide control* On multi-stemmed varieties, best results by carefully applying herbicide to each stem. When treating actively growing plants less than 2-m tall, spray foliage overall to the point of run-off. Splatter gun techniques are effective and particularly useful in hard-to-access areas. This is best done in autumn, when sap-flows draw the poison down into the root stock, but before night temperatures get too cold. Any herbicide used in the riparian zone must be non-residual and approved by the APVMA for use in aquatic environments. Herbicide must only be applied as a follow up to mechanical control (i.e. on resprouting plants).	Annually Manual removal any time of year. March–May for herbicide control.	No new weed infestations. Reduction in weed cover across offset area.	It forms dense thickets that smother and kill native vegetation and are impenetrable to animals, people and vehicles. Research indicates more than 1400 native species are negatively affected by lantana invasion, including many endangered and threatened species. As lantana is a woody shrub that has thin, combustible canes, its presence can also create hotter bushfires, altering native vegetation communities and pastures.

Table 4.2 Weed management

Species details	Presence on site	Control method (s)	Control period	Management outcomes	Threat to biodiversity
Mimosa Bush *Acacia farnesiana* QLD Bio Act: N/A National Status: N/A	Scattered individuals.	*Chemical controls* Basal bark spray: For stems up to 15 cm diameter, carefully spray completely around base of plant to a height of 30 cm above ground level. Thoroughly spray into all crevices. Larger trees will be controlled by spraying to a greater height, up to 100 cm above ground level. The best time for treatment is during autumn when plants are actively growing, and soil moisture is good. Cut and dab treatment: At any time of year, cut stems off horizontally as close to the ground as possible. Immediately (within 15 seconds) swab cut surface with herbicide mixture.	Annually March–May for basal bark spray treatment. Any time of year for cut and dab treatment.	No new weed infestations. Reduction in weed cover across offset area	Mimosa Bush is an environmental weed. Seeds sprout readily and plants grow rapidly. Mimosa bush does well in dry localities and on loamy or sandy soils, forming thickets along watercourses.
Noogoora Burr *Xanthium orientalis* QLD Bio Act: N/A National Status: N/A	Along watercourse and wetland areas. Scattered infestations.	*Biological control* Some level of control has been achieved with biological control agents including stem-boring and stem-galling insects, and a rust fungus (Puccinia xanthii). This form of control has been more effective in tropical areas where temperatures and moisture conditions are favourable. *Mechanical control* Cultivation or hand pulling isolated plants is effective if performed before flowering or burr formation. *Chemical control* Few chemicals approved for use in native vegetation. Therefore, use chemical control as a last resort. Spraying with 2,4-D or MCPA before flowering will give favourable results. As plants mature, higher rates are necessary (DoAF 2020b).	Annually Any time of year for manual control. If chemical control to be done before flowering.	This species will only be actively managed in specific areas identified in the baseline weed survey (i.e. where there is high risk to MNES habitat values). No new weed infestations. Reduction in weed cover at identified locations.	Species is an environmental weed. It can be found along river and creek flats, on roadsides and in pastureland. Noogoora burr spreads by seed in burrs. Burrs are spread by attaching to animals, clothing and bags. Burrs can also float on water.
Parthenium *Parthenium hysterophorus* QLD Bio Act: Cat 3 National Status: WONS	Observed throughout all areas, some scattered patches and dense infestations, particularly in black soil areas.	*General controls* No manual method because of the health hazard from allergic reactions and the danger of mature seeds dropping and increasing the infestation area. *Chemical control* Spot spray with registered herbicide early before plants can set seed. Monitor treated areas for the life of the OAMP. Preferred method for smaller infestations. Treat small and/or isolated infestations immediately. Herbicide control will involve a knockdown herbicide to kill plants that are present and a residual herbicide to control future germinations. Repeated spraying will be applied to prevent further seed production. Extensive infestations will require herbicide treatment in conjunction with pasture management. Timing of spraying is critical so that parthenium is removed when plants are small and before seeding has occurred.	Two events per year. This is due to follow up treatment being required. Spray before seeding occurs.	Key focus is to reduce species cover in Ornamental Snake habitat (gilgai areas) and along access tracks to limit spread. Reduction in weed cover across offset area. No new weed infestations. Groundcover maintained to reduce spread.	Parthenium can colonise brigalow, gidgee and softwood scrub soils. It will take over pastures with sparse ground cover. Parthenium is also a health problem as contact with the plant or the pollen can cause serious allergic reactions such as dermatitis and hay fever.
Phasey Bean, Siratro *Macroptilium lathyroides* QLD Bio Act: N/A National Status: N/A	Throughout all areas, dense infestations in some wetland areas.	*Manual control* Phasey Bean can be hand pulled, chipped or mowed. Removing the whole crown by grubbing is the most effective manual/mechanical control method. Tangled growth will be cleared using a brush cutter. Cannot tolerate grazing. Manual removal suited to small infestations. *Chemical control* Two herbicides are currently registered for the control of Phasey Bean in non-crop situations in Queensland: 2,4-D amin and Glufosinate. Glufosinate ammonium is non-selective and needs to be used with care. Use the foliar spray method. Use chemical control as a last resort (DoAF 2020c).	Annually. Manual control any time of year.	This species will only be actively managed in specific areas identified in the baseline weed survey (i.e. where there is high risk to MNES habitat values). No new weed infestations. Reduction in weed cover at identified locations.	An environmental weed. Can dominate groundcover of open woodland and riparian areas.
Rubber Vine *Cryptostegia grandiflora* QLD Bio Act: Cat 3 National Status: WONS	Likely scattered along water courses.	Effective control of rubber vine can be achieved by a number of methods, alone or in combination depending on the situation and the severity of infestation. All areas treated must be periodically checked and any regrowth treated or the initial treatment efforts will be wasted. Any isolated plants located will be treated promptly. *Chemical control* Basal bark treatment - For single stem plants, thoroughly spray around the base of the plant to a height of 20–100 cm above ground level, spraying higher on larger plants. Cut stump treatment - This is the most successful method, but also the most labour intensive. The following should be followed carefully: Cut stems off horizontally as close to ground as possible and immediately swab or spray cut surface and stem with herbicide mixture. *Mechanical control* Scattered or medium-density infestations: Where possible, repeated slashing close to ground level is recommended. Slashing will only occur where native vegetation won't be impacted.	Two events per year. This is due to follow up treatment being required. Optimal when plant is actively growing in summer months.	No new weed infestations. Reduction in weed cover across offset area. Key focus is to reduce infestations along watercourses.	Rubber Vine generally invades waterways first, where the seeds germinate in moist silt layers after rain. The plant smothers riparian vegetation and forms dense, sometimes impenetrable, thickets. Prevents movement of animals within riparian corridors.

Table 4.2 Weed management

Species details	Presence on site	Control method (s)	Control period	Management outcomes	Threat to biodiversity
Velvety Tree Pear *Opuntia tomentosa* QLD Bio Act: Cat 3 National Status: WONS	Scattered throughout all areas.	*Chemical control* Spot spray with registered herbicide. *Biological control* Includes eight insects and the mite in Queensland. These species are: • Stem-boring moths: *Cactoblastis cactorum.* • Cochineal scale insects: *Dactylopius ceylonicus, D. opuntiae, D. confuses* and *D. austrinus.* • Cell-sucking bugs: *Chelinidea tabulate.* • Stem-boring moths: *Tucumania tapiacola.* • Stem-boring beetles: *Archlagocheirus funestus.* • Prickly pear red spider mites: *Tetranychus opuntiae.* • *Cactoblastis spp*. and *Dactylopius spp*. provide the most success.	Annually September–April.	This species will only be actively managed in specific areas identified in the baseline weed survey (i.e. where biological control agents are not active). No new weed infestations. Reduction in weed cover across offset area.	Dense infestations compete with native vegetation, limiting the growth of small shrubs and groundcover species. The plant's sharp spines or barbs can cause injury to stock and native animals.

4.2.4 Weed and fuel/biomass load management through grazing, slashing and fire

Weeds and/or increased biomass are identified as key threats for all threatened species occurring on the offset area (see Section 4.2.3 and Table 4.1). Weed infestations result in the loss and degradation of habitat, loss of foraging resources and an increased risk of severe fire. Undertaking weed and biomass control is a key action to be undertaken to provide benefits for the threatened species across the offset area.

Weed and fuel/biomass load will be managed through a combination of the following:

- crash grazing which involves high stocking density in an area for short durations, and excluding stock from the area once grass cover and fuel loads reach the required level slashing, which involves mowing areas along boundaries or in areas where grazing is not appropriate
- fire management including low intensity controlled burns at an appropriate time of year in suitable environmental conditions (e.g. low wind speed, adequate soil moisture, adequate fuel load to carry fire).

Land within the Stage 2 Offset Area has been used predominately for cattle grazing within the past 50 years or so, with large areas historically cleared through past agricultural practices (DPM 2018). However, some tracts of remnant vegetation and significant advanced regrowth occur across the site.

Weed and fuel/biomass load management will differ between the types of habitat available across the Stage 2 Offset Area to minimise harm to threatened species. Management strategies have been developed based on the following habitat types:

- riparian areas along major watercourses - including existing remnant riparian vegetation and regenerating riparian vegetation
- gilgai landforms including gilgai in cleared agricultural grasslands/shrublands, as they provide habitat for Ornamental Snake
- other remnant woodland areas
- advanced regrowth woodland areas.

Table 4.3 outlines the weed and fuel/biomass load management strategies to be implemented across each of these habitat types, including background information to inform the strategy, what strategy will be undertaken and triggers for grazing. See Figure 4.2 for grazing exclusion areas.

Table 4.3 Weed and fuel/biomass load management strategies

Grazing management area	Background information	Management strategy	Trigger for control
Riparian areas along watercourses	Riparian areas are considered sensitive habitats. Trees, shrubs and grasses are all important for the stability, productivity and filtration capacity of riparian and wetland areas. The grass layer slows the flow of water, reducing erosion and increasing infiltration as well as filtering soil and nutrients from the run-off. Trees and shrubs along a stream and within wetlands help cycle nutrients, provide shade and habitat, reinforce the banks by holding soil together and also dry out the soil helping to prevent soils from becoming saturated and slumping. The riparian areas in the Stage 2 Offset Area support critical habitat for Greater Glider, Koalas and other fauna species as well as provide important connectivity corridors. The objective is to improve the habitat quality of these riparian areas which includes allowing regeneration of native grasses, shrubs and trees. Control methods need to consider the sensitivity of these environments. For example, livestock cause stream bank erosion (particularly where there is a lack of vegetation), stir up sediments and cause pugging within the waterway which can reduce water quality.	*Grazing is excluded* To ensure creek banks are not degraded, existing riparian vegetation is retained and natural regeneration along riparian areas can occur, grazing will be excluded from these areas (shown in Figure 4.2). Major watercourses and adjacent riparian areas (at least 50 m either side of any major water source) will be fenced. If required, off-stream watering points will be installed to ensure cattle have adequate access to water. As riparian environments are susceptible to erosion, control utilising fire will be carefully timed to avoid periods when follow up heavy rain is likely (e.g. early wet season). *Slashing* Where control of fuel load/biomass is required, slashing / brush cutting will be employed. Slashing will need to ensure no native tree saplings are impacted.	For biomass control: Restricted to areas with biomass cover of exotic ground cover species of >50%. Slashing to be undertaken using manual brush cutters to a height of no less than 20 cm. Slashing to occur immediately prior to flowering and seeding period of key weed species to reduce seed set.
Gilgai landforms	Gilgai (otherwise referred to as melon holes) are known habitat for the threatened Ornamental Snake. Gilgai occur on deep cracking clay soils. In dry periods Ornamental Snake live within the soil cracks and are less susceptible to grazing impacts. However, after rain the clay soils swell, and gilgai fill up with water. When grazing occurs after rain, cattle, deer and feral pigs degrade the gilgai by compacting the ground and causing pugging, compromising soil structure. Habitat degradation through grazing by stock is identified as a threat to the Ornamental Snake (DCCEEW 2023a).	*Grazing is excluded in all Ornamental Snake habitat areas* Grazing will be excluded from Ornamental Snake habitats as shown on.Figure 4.2 all year round. Outside Ornamental Snake habitats grazing will be used to control biomass and/or weeds in line with the grazing strategy outlined below for remnant woodland, regrowth woodland and cleared agricultural grasslands. Grazing will be excluded from any areas with low levels of weed cover (<50%) or low biomass (<70%). *Cool mosaic burns to reduce biomass* Fire will be implemented to control fuel load/biomass in line with recommendations in Section 4.2.5 and in accordance with the Stage 2 Offset Area Bushfire Management Plan, which will be prepared in Year 1 of the offset.	Grazing will be excluded in gilgai areas to ensure gilgai habitats are protected. Outside gilgai areas where grazing is permitted in these areas for biomass control refer to triggers set out below based on type of vegetation.

Remnant woodland	Remnant woodlands within the Stage 2 Offset Area provide significant high-quality habitat for threatened species across eleven REs. These areas are generally in moderate to good condition. Weed cover ranges from minimal (5%) to high (>90%). These areas provide existing, high-quality habitat for all threatened species (dependent on predominant RE and/or overstorey species and/or groundcover). Grazing can provide a useful tool for managing weed loads and/or biomass in certain areas. Any grazing strategy will need to consider the underlying weed and biomass cover and species composition of these areas. Fire management will be an important element of integrated management of fuel and biomass load control, and is an appropriate, low-impact tool for use in conservation areas.	*Grazing permitted to reduce biomass* Crash grazing will be used to maintain native vegetation and grassy open woodland ecosystems. Crash grazing will be undertaken at specific times of year for short periods to control weed cover or control excessive grass biomass in above average growth seasons. Grazing will be undertaken at a time of year immediately prior to flowering of key weed species to reduce seed set, or as required to control biomass. Grazing will be excluded from any areas with low levels of weed cover (<50%) or low biomass (<70%). *Cool mosaic burns to reduce biomass* Fire will be implemented to control fuel load/biomass in line with recommendations in Section 4.2.5. Grazing will be excluded in Squatter Pigeon breeding habitat all year round to avoid impacting on species and their nests (shown in Figure 4.2).	For weed control: • Restricted to areas with weed cover of >50% or areas with high threat weed (WONS or Bio Act listed). • Grazing timed to occur immediately prior to flowering and seeding period of key weed species to reduce seed set. • Grazing undertaken for very short periods (time will be depending on paddock size, generally days). • Grazing removed once reduction in seed heads has occurred. For biomass control: • Restricted to areas with biomass cover of >70%. • Grazing undertaken within a grazing window, avoiding key growth period for native species. • Groundcover maintained at a minimum of 70%. • Sward heights of dominant grasses maintained at following minimum sward height: – Short grasses (<0.6 m): maintained at 5 cm bulk sward height. – Medium grasses (0.6 m to 1.2 m): maintained at 10 cm bulk sward height. – Large grasses (>1.2 m): maintained at 20 cm bulk sward height. Fire will be used to manage biomass, in line with recommendations in Section 4.2.5.

Table 4.3 Weed and fuel/biomass load management strategies

Grazing management area	Background information	Management strategy	Trigger for control
Regrowth areas	Regrowth woodlands occur across significant areas of the Stage 2 Offset Area. These areas are showing signs of natural regeneration of the overstorey, and support significant areas of native shrub layer with a moderate diversity of native ground cover/grasses. These areas currently provide suitable habitat for Ornamental Snake and Squatter Pigeon. They also provide existing and future potential habitat of the Koala and Greater Glider, subject to maturation of overstorey species. Grazing provides a useful tool for managing weed loads and/or biomass in certain areas. However, regrowth areas are highly susceptible to impacts from grazing, with livestock capable of trampling young vegetation. Fire will be an important tool for fuel load/biomass control.	*Grazing excluded from young saplings/planted tubestock* Areas of existing naturally regenerating native vegetation (i.e. naturally occurring areas of saplings or 'suckers') will be fenced off and grazing excluded. Grazing will not occur in these areas until the saplings are of a size to withstand grazing and browsing from stock (approximately 2–3 years). Grazing will be excluded from any areas with low levels of weed cover (<50%) or low biomass (<70%). After such time, crash grazing will be used to maintain native vegetation and grassy ecosystems. Crash grazing will be undertaken at specific times of year for short periods to control weed cover or control excessive grass biomass in above average growth seasons. Grazing will be undertaken at a time of year immediately prior to flowering of key weed species to reduce seed set, or as required to control biomass. *Cool mosaic burns to reduce biomass* Fire will be implemented to control fuel load/biomass in line with recommendations in Section 4.2.5. Grazing will be excluded in Squatter Pigeon breeding habitat all year round to avoid impacting on Squatter Pigeon and their nests (shown in Figure 4.2).	Exclude all grazing in naturally regenerating areas until saplings are capable of withstanding impacts from livestock (approximately 2–3 years). For weed control: • Restricted to areas with weed cover of >50% or areas with high threat weed (WONS or Bio Act listed). • Grazing timed to occur immediately prior to flowering and seeding period of key weed species to reduce seed set. • Grazing undertaken for very short periods (time will be depending on paddock size, generally days). • Grazing removed once reduction in seed heads has occurred. For biomass control: • Restricted to areas with biomass cover of >70%. • Grazing undertaken within a grazing window, avoiding key growth period for native species. • Groundcover maintained at a minimum of 70%. • Sward heights of dominant grasses maintained at following minimum sward height: – Short grasses (<0.6 m): maintained at 5 cm bulk sward height.

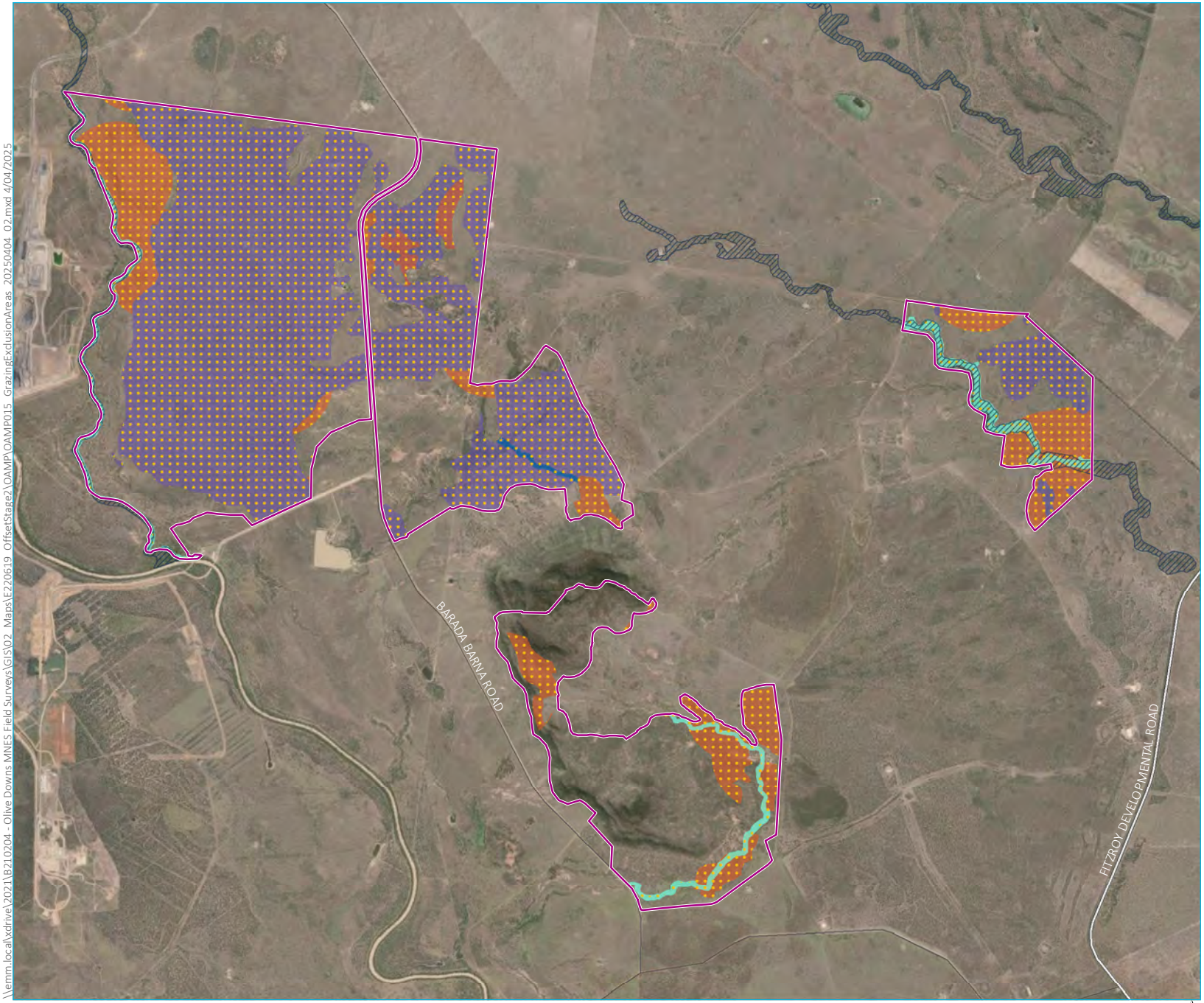
Table 4.3 Weed and fuel/biomass load management strategies

Grazing management area	Background information	Management strategy	Trigger for control
			– Medium grasses (0.6 m to 1.2 m): maintained at 10 cm bulk sward height. – Large grasses (>1.2 m): maintained at 20 cm bulk sward height. Fire will be used to manage biomass, in line with recommendations in Section 4.2.5
Non-remnant areas	Historically cleared agricultural grasslands occur across the Stage 2 Offset Area, representing 23% of the total area. These areas occur in various condition states, with some dominated by weeds (>90% cover) while others a contain a reasonable mix of native grasses. These areas have potential to provide significant areas of future potential habitat for all threatened species, subject to suitable management. Grazing will form part of an integrated management approach to controlling weeds and biomass in these areas. Fire will be utilised in association with grazing, as a primary tool for reducing fuel loads, with grazing employed to manage regenerating weedy grasses (especially Buffel Grass) that are promoted by fire.	*Grazing permitted to reduce biomass* Crash grazing will be used to maintain native vegetation and grassy ecosystems. Crash grazing will be undertaken at specific times of year for short periods to control weed cover or control excessive grass biomass in above average growth seasons. Grazing will be excluded in Squatter Pigeon breeding habitat all year round to avoid impacts on Squatter Pigeon and their nests (shown in Figure 4.2). Grazing will be undertaken at a time of year immediately prior to flowering of key weed species to reduce seed set, or as required to control biomass. Grazing will be excluded from any areas with low levels of weed cover (<50%) or low biomass (<70%). Once evidence of natural regeneration is occurring, the grazing management strategy for regrowth woodlands outlined above will be applied. *Cool mosaic burns to reduce biomass* Fire will be implemented to control fuel load/biomass in line with recommendations in Section 4.2.5.	For weed control: • Restricted to areas with weed cover of >50% or areas with high threat weed (WONS or Bio Act listed). • Grazing timed to occur immediately prior to flowering and seeding period of key weed species to reduce seed set. • Grazing undertaken for very short periods (time will be depending on paddock size, generally days). • Grazing removed once reduction in seed heads has occurred. For biomass control: • Restricted to areas with biomass cover of >70%. • Grazing undertaken within a grazing window, avoiding key growth period for native species. • Groundcover maintained at a minimum of 70%.

Table 4.3 Weed and fuel/biomass load management strategies

Grazing management area	Background information	Management strategy	Trigger for control
			• Sward heights of dominant grasses maintained at following minimum sward height: – Short grasses (<0.6 m): maintained at 5 cm bulk sward height. – Medium grasses (0.6 m to 1.2 m): maintained at 10 cm bulk sward height. – Large grasses (>1.2 m): maintained at 20 cm bulk sward height. • Fire will be used to manage biomass, in line with recommendations in Section 4.2.5. Once regeneration is evident, exclude all grazing in naturally regenerating areas until saplings are capable of withstanding impacts from livestock (approximately 2-3 years).

Figure 4.2 Grazing exclusion areas



Proposed stage 2 offset area
Grazing exclusion area
Wetland area

Ornamental Snake habitat
Squatter Pigeon breeding habitat

Management
Connectivity restoration
Riparian habitat restoration

Existing
Major road
Minor road
Vehicular track

\\emm.local\xdrive\2021\B210204 - Olive Downs MNES Field Surveys\GIS\02 Maps\E220619 OffsetStage2\OAMP\OAMP015 GrazingExclusionAreas 20250404 02.mxd 4/04/2025

Source: EMM (2025); DES (2024); DR (2023); ESRI (2024); GA (2011)

0 2.5 5 km
GDA 1994 MGA Zone 55
N

Grazing exclusion areas

Grazing exclusion areas
Offset Area Management Plan
Figure 4.2

EMM
creating opportunities

4.2.5 Fire management

Management of fire regime in the Stage 2 Offset Area (and surrounds on adjacent land owned by Pembroke) will reduce the likelihood of threatened species mortality and habitat degradation due to uncontrolled bushfire. Fire management will also be used as a method to control biomass of native and invasive species and will form part of an integrated management approach for key weed species (e.g. Buffel Grass).

Bushfire preventative measures will include:

- Educating employees and contractors on general fire awareness and response procedures.
- Creation and maintenance of fire tracks (fire breaks) for fire control where necessary.
- Ground fuel loads will be monitored and, where required, reduced through crash grazing, with exception of grazing exclusion areas to prevent thick grass biomass from accumulating over time (see Section 4.2.4). Reducing the fuel load will minimise the impact of uncontrolled fires (e.g. from lightning strike). When necessary, fuel management (e.g. hazard reduction burns prior to the dry season) will be undertaken in consultation with the Qld Rural Fire Service.
- Local fire wardens will be consulted, and fire permits will be obtained prior to hazard reduction burns.
- Mosaic burning for certain species at appropriate intervals to promote regeneration and germination of native vegetation communities and species will be undertaken.

A Bushfire Management Plan (BMP) will be prepared by a suitably qualified person in the first year of the Stage 2 Offset Area. The Stage 2 Offset Area BMP will include, as a minimum:

- An overview of the fire history, fire weather conditions and fire risk of the property, including in the context of surrounding land uses.
- Maps which delineate fire management zones according to vegetation present, and values to MNES species.
- Identification of appropriate fire prescriptions (e.g. time of year to burn, how often, targets for fuel reduction) based on Regional Ecosystem and the ecology of each MNES species, or for non-remnant and regrowth areas, vegetation characteristics.
- Maps which show the location of firebreaks and buffers and a description of the standard of maintenance for these (e.g. width, treatment – i.e. whether slashed or chemical break).
- Firefighting requirements including infrastructure, and response procedures in the event of an unplanned fire.
- Procedures to follow when preparing for, implementing and monitoring prescribed burns.
- The location of fuel load assessment sites.
- BMP to be reviewed and updated at least once every 3 years.

The creation of key fire management tracks will occur in the first 12 months of the Stage 2 Offset Area commencing and will be maintained each year thereafter. Other essential fire tracks will be added in following years if required. Hazard reduction burns prior to the dry season will be undertaken each year as directed by the Stage 2 Offset Area BMP and when environmental conditions are appropriate.

Pembroke will undertake annual pre-dry season inspections of fire tracks and will ensure they are maintained. Pembroke will monitor ground fuel loads in both grazed and ungrazed areas and adjust grazing activities according to fuel load targets. The overall objective is to prevent uncontrolled fires late in the dry season (e.g. August to November) from occurring, and to maintain a fire regime that promotes diversity within MNES habitats.

Fuel loads across the Stage 2 Offset Area will be monitored via simple, rapid fuel load assessments, which will be based on the Overall Fuel Hazard Assessment Guide (DSE 2010). Total fuel load is comprised of the components shown in Table 4.4. This can be used to quickly estimate fuel load over an area in the immediate vicinity. The location of fuel load assessment sites will be included in the BMP to be developed by a suitably qualified practitioner.

Table 4.4 Rapid fuel load assessment (after DSE 2010)

Fuel type	Description	Contribution to total fuel load
Surface fuel	Leaves, twigs, bark lying on the ground, predominantly horizontal. Include fine surface fuel less than 6mm diameter.	Each 20% cover with depth of 100 mm adds 1 t/ha (so 100% cover, 100 mm depth = 5 t/ha; 20% cover at 200 mm depth = 2 t/ha)
Near surface	Live and dead fuel in touch with ground, but not lying on it, mix of vertical and horizontal. Estimate % cover of fuel up to knee height.	Each 20% of cover in this layer adds 1 t/ha
Elevated – knee to waist	Live and dead fuel, knee to waist height. Estimate % cover.	Each 20% of cover in this layer adds 1 t/ha
Elevated – waist to shoulder	Live and dead fuel, waist to shoulder height. Estimate % cover.	Each 20% of cover in this layer adds 1 t/ha

Triggers for corrective actions include:

- fuel loads exceed specified thresholds
- the occurrence of an uncontrolled bushfire
- decline in BioCondition metrics such as recruitment of canopy species, ground and shrub cover diversity, and percentage cover of non-native species.

Corrective actions to be implemented for fire management will include:

- review effectiveness of fuel load management and monitoring techniques as thresholds will need to be reduced if fuel loads are consistently high
- review effectiveness of prescribed burn program against the objectives of the BMP. Ensure any learnings are adopted for next round.

4.2.6 Pest fauna management

Pest animal species represent key threats to a number of threatened species to be managed within the Stage 2 Offset Area. Dingoes have been present in the Australian landscape for at least 3000 years (Balme et al 2018) and, as such, are not considered a 'pest' within the confines of the Stage 2 Offset Area. This view is supported by recent research indicating that, contrary to popular belief, the occurrence of Dingo x domestic dog hybrids across the continent is very rare (Cairns et al 2021). All MNES threatened species within the Stage 2 Offset Area have ecological experience of the Dingo as a top-order predator and the benefits of Dingo presence within the offset area (i.e. '24/7' control of feral cats, a key threat to Ornamental Snake, Squatter Pigeon and Greater Glider) outweigh the possible benefits of their removal. As such, feral cats, cattle, Chital Deer, rabbits, hares and feral pigs are the main pest vertebrate species found on the Stage 2 Offset Area that have the potential to damage or destroy native flora and fauna or their habitat.

Feral pigs and deer degrade habitat for the Ornamental Snake (DAWE 2020c), while feral herbivores such as the rabbit and hare result in degradation of habitat for the Squatter Pigeon (TSSC 2015). Predation by species such as feral cats and foxes is considered a key threat to the Ornamental Snake (DoE 2014b), Squatter Pigeon (TSSC 2015,

DAWE 2020b), Greater Glider (Ben Nottidge pers. comm.) and Koala (DSEWPC 2012b). Additionally, Ornamental Snake may be poisoned through ingestion of Cane Toads (though direct evidence for this is lacking, circumstantial evidence is strong (DCCEEW 2023a)). However, as Cane Toads are ubiquitous in the landscape, and Ornamental Snake populations are high in the region (in other words, they co-exist successfully with Cane Toads), active control of Cane Toads is not considered necessary.

Any efforts to reduce numbers through trapping tadpoles in dams will be completely undone during the wet season when the watercourses flow and move adults downstream, and the gilgai fill and become wetlands for Cane Toads to deposit their eggs in.

Females can lay 8,000–30,000 eggs per clutch, and two clutches per year. Cane Toad eggs hatch in 2-3 days and the tadpole stage lasts 4-8 weeks, with toadlets reaching adult size within a year (DEWHA 2010). Currently it is possible to control Cane Toads in a small area such as a pond but not at a broader scale such as the offset area (DEWHA 2010). As such, trapping in an area the size of the Stage 2 Offset Area is futile and will offer no significant ecological benefits. The complete eradication of fauna pest species within the Stage 2 Offset Area is considered unfeasible, due to the cost of erecting and maintaining a pest-proof fence around the entire area. Significant effort could be expended to eradicate pests in the offset area, but they are likely to re-enter from adjoining properties. Therefore, the objective will be to reduce pest fauna populations which will in turn reduce threats on MNES species and their habitats.

Control of pest fauna within the Stage 2 Offset Area will be undertaken via several methods that are:

- species specific (wherever possible)
- not harmful to the natural environment
- are humane
- meet relevant Work, Health, Safety and Environment regulatory requirements.

Triggers for corrective actions include:

- An observed increase in incidental sightings of feral animals.
- Greater than 10% increase in a pest animal abundance from previous baseline survey. Baseline surveys will be completed for feral cats, Chital Deer, rabbits, hares and pigs.
- Observations of any MNES species mortality from pest animals such as feral cat predation on Greater Glider.
- Evidence of pest animal degradation on MNES species habitats, including through Habitat Quality scoring.

Corrective actions to be implemented for pest fauna management will include:

- increase frequency of pest control events
- change pest control methods as required in consultation with experienced professionals
- adopt pest control across a broader area if it is likely pest animals are breeding in adjacent areas
- review effectiveness of pest fauna exclusion fencing in ecologically sensitive areas (e.g. gilgai) if feral pigs, Chital Deer or feral cattle ('cleanskins' that have escaped recent mustering) are causing significant damage).

All pest fauna management will be undertaken by suitably qualified and experienced contractors.

Pest fauna specific control methods, timing, monitoring and corrective actions are outlined in Table 4.5.

Table 4.5 Pest fauna management

Pest species	Control method	Frequency and timing
Feral cat	The control of feral cat numbers within the Stage 2 Offset Area will be achieved through several methods, including: • Trapping - cage traps, focusing on territorial markers. Attractants, such as Tuna oil, will be used as required to attract feral cats. • Shooting - night shooting programs over the Stage 2 Offset Area. • Baiting - Baiting will be undertaken throughout the Stage 2 Offset Area in conjunction with other programs as a part of an integrated control program and will use species-specific strategies to avoid potential impacts on Dingoes. • The utility of "Felixer" units (Moseby et al 2020) for use across the Stage 2 Offset Area will be explored in Year 1. Feral cat control will be undertaken across all habitat types within the Stage 2 Offset Area.	Feral cat control will be undertaken on an annual basis in late autumn, prior to breeding occurring. Control using shooting will be undertaken over a minimum of three days and nights. Baiting will be undertaken for a month, with baits laid out and collected to determine take.
Chital Deer	The control of Chital Deer numbers within the Stage 2 Offset Area will be achieved through shooting. Chital Deer control will be undertaken across all habitat types within the Stage 2 Offset Area.	Control using shooting will be undertaken over a minimum of three days and nights.
European Fox	Foxes have not been recorded to date on either the impact areas or offset areas associated with the Project. A single record of the species exists some 30 km to the north-east; it is possible that Dingoes competitively exclude foxes in the local area. If foxes are recorded on the Stage 2 Offset Area, the following control methods will be employed: • Trapping - rubber-jawed leg-hold trapping and/or snare trapping will be undertaken in conjunction with other programs as a part of an integrated control program. • Shooting - daytime and night-time shooting will be used for opportunistic control where appropriate. Fox control will be undertaken across all habitat types within the Stage 1 offset area.	If required, Fox control will be undertaken on an annual basis in late autumn, immediately prior to breeding occurring. Control using trapping or shooting will be undertaken over a minimum of three days and nights.

Table 4.5 Pest fauna management

Pest species	Control method	Frequency and timing
Feral pig	The control of feral pig numbers within the Stage 2 Offset Area will be achieved though several methods, including: • Poisoning - 1080 targeted baiting programs will be undertaken throughout the Stage 2 Offset Area as the primary control method. Pre-feeding is an important step in success of this control measure. To maximise effectiveness, feral pigs must be free fed with non-poisoned bait for several days before laying poisoned baits. Pig-specific feeding stations (e.g. Hoghopper) will help reduce access to bait by non-target species. • Shooting - daytime and night-time shooting will be used for opportunistic control where appropriate, e.g. isolated males, in conjunction with other programs. • Trapping – permanent traps will be utilised in strategic locations across the Stage 2 Offset Area, in conjunction with monitoring cameras wherever possible. Feral pig control will be undertaken across the Stage 2 Offset Area with a focus on wetland areas and gilgai habitats where feral pigs are most likely to be active.	Feral pig control will be undertaken on an annual basis in conjunction with other control programs. Pre-feeding before annual baiting efforts will be carried out for a minimum of three days prior. Control via shooting will be opportunistic and occur in conjunction with other control programs.
European Rabbit and European Hare	An integrated control approach, combining different control methods with land management practices will be undertaken for rabbits and hares. Control methods to be implemented include: • Warren ripping - a tractor will be used with tined (sharp-pronged) implement, one tine or many, that rips through warren and collapses it. All warrens within 1 km of permanent water will be ripped. • Poisoning - targeted baiting programs using 1080 or Pindone will be undertaken throughout the Stage 2 Offset Area. Pre-feeding can increase bait uptake and prove more effective and will be undertaken at least three times over a one-week period prior to baiting. • Trapping – trapping undertaken via cage and barrel traps can be labour intensive so it will be used as an additional method following warren ripping and poisoning. • Shooting - daytime and night-time shooting will be used to ‘mop up’ after other control methods have been enforced.	Harbour destruction will be undertaken in the first year of the implementation of this OAMP and largely as a one-off program. Warren ripping will be undertaken on an as needs basis when warrens are identified. Trapping and shooting will be undertaken opportunistically to mop up following harbour destruction and/or warren ripping. Poisoning will be undertaken on an annual basis in conjunction with other control programs. Poisoning will occur when green pick is low to ensure uptake and when rabbits are not breeding.

4.2.7 Nest box research program (Greater Glider)

It is recognised that the offset areas for Greater Glider which are classified as 'restoration areas' (see Figure 4.1) will not result in an increase in the amount of naturally formed hollows within a 20-year timeframe. Hollow formation is dependent on a tree's history, its species and location. Generally, small hollows with narrow entrances suitable for animals such as the Krefft's Glider (*Petaurus notatus*) take about 100 years to form. Hollows of a medium size, suitable for animals such Greater Glider, can take up to 200 years to form (NPWS 1999). In general, trees capable of supporting hollows suitable for the species will have a DBH ≥46 cm (DES 2022), corresponding to an age of ~175 years (Ngugi et al 2015). As they are secured in perpetuity, trees in the Stage 2 Offset Area are on a trajectory towards developing hollows in the future as they continue to mature beyond the 20 years of this OAMP and life of Project management.

In the near-term, however, a supplementary nest box program is proposed that will supplement denning and breeding habitat for the Greater Glider. Research will be undertaken to evaluate the success of these nest boxes for the species. For clarity the nest box program and research conducted within this plan are discrete from other research programs being conducted by Pembroke, including the Koala and Greater Glider Conservation Program and its related research activities. It will take approximately five to eight years for tree plantings within the 'restoration areas' to reach a size to support Greater Glider foraging activities. Therefore, in the first five years of management, supplementary nest boxes will be installed into existing adjacent remnant and regrowth habitat with low hollow availability to allow Greater Gliders to exploit the new foraging resource. See EMM (2020) for implementation details of the nest box monitoring programme across the Stage 1 Offset Area, which will directly inform the implementation of the research program across Stage 2. Suitable areas for habitat augmentation with nest boxes are shown in Figure 4.1 and total 179.77 ha and 364.87 ha respectively.

4.2.8 Other general management measures

i Fencing design

Fencing is an integral part of land management. Fences delineate legal boundaries and control access, restrict stock movements, and often provide access routes for land managers with tracks along fence lines. However, fences can restrict the movement of native wildlife, and can cause serious injury and deaths. Barbed wire is a major hazard for wildlife: more than 75 wildlife species have been identified in Australia as occasional or regular victims of barbed wire fences, especially nocturnal animals such as bats, gliders and owls (WFF 2023c). Many species fail to see the fence or cannot clear the height under windy conditions; Greater Gliders, Little Red Flying-fox and Tawny Frogmouths have been found dead as a result of barbed wire entanglement on the impact site (EMM unpublished data). Most animals found entangled and subsequently rescued are too severely injured to return to the wild. Most entanglements (86% of entanglements) occur on the top strand of wire, with 95% of all entanglements involving the top two strands (WFF 2023c). Barbed wire fences are specifically identified as a threat to the Greater Glider (TSSC 2021, DCCEEW 2022b).

Internal fences without specific purpose across the offset area will be removed. Fences that are unable to be removed, such as those surrounding wetlands, or those on the border with other properties, will have the top two strands of barbed wire replaced with plain or PVC-coated borderline wire unless requirements of neighbouring landowners necessitate use of barbed wire. Barbed wire removal can significantly reduce the risk of wildlife entanglement and subsequent fatality (WFF 2023c). Reflectors will be placed on the top wire to increase detectability at night by wildlife in areas of habitat (e.g. riparian corridors or movement corridors between patches of vegetation).

Design parameters for new fencing will consider animals moving beneath the fence by leaving a minimum of 40 cm between the ground and the bottom wire, as well as the risk of fauna entanglement in barbed wire (WFF 2023c); plain, high-tensile fencing wire or PVC-coated borderline wire will be used for the top two strands, and reflectors will be placed along the top strand to improve visibility in areas of habitat where this is considered to be valuable (e.g. riparian corridors or movement corridors between patches of vegetation).

ii Track establishment and maintenance

A number of access tracks, to enable management fire control, will be established as a part of the Stage 2 Offset Area. Largely, these management tracks will use the existing track network. Annual maintenance of access tracks will be undertaken, including grading and erosion control measures, using graders and road base materials where required. Access tracks/fire breaks will generally be no wider than 3 metres unless there is a specific requirement for greater width. Fire breaks will be a width suitable for the vegetation and infrastructure present in line with the Bushfire Management Plan in development for the site (to be completed in Year 1).

iii Erosion management

Erosion will be limited across the offset area through the exclusion of stock in certain areas/at certain times of year, ongoing rehabilitation and maintenance of existing riparian vegetation and groundcover, and the management of feral pigs and Chital Deer. Where those controls are not adequate, appropriate erosion-control measures will be implemented, such as the installation of temporary sandbags and further tree plantings where appropriate.

4.2.9 Prohibited activities

The following activities are not permitted to occur under this OAMP unless express written permission is received from Pembroke and DCCEEW:

- No clearing of native woody vegetation is permitted within the offset area unless it is required for maintaining 3 m wide fence lines and fire breaks. Clearing of large trees will be avoided to the greatest extent possible.
- No clearance of hollow-bearing trees will be permitted.
- Important habitat, connecting habitat or adjacent patches of suitable habitat for threatened species will not be cleared, unless this is essential for management purposes (e.g. fire breaks).
- The following practices will be prohibited in the Stage 2 Offset Area:
    a) ploughing
    b) fertiliser application, unless for promotion of tubestock growth in habitat restoration zones
    c) aerial application of pesticide from planes or helicopters
    d) continuous grazing
    e) use of livestock feed
    f) littering or dumping of foreign waste
    g) removal of firewood, native plants or animals
    h) removal of rocks, sand or gravel
    i) logging
    j) hunting
    k) trapping or shooting (unless approved under this OAMP for controlling pest animals)
    l) keeping of European beehives, domestic cats and/or dogs.

4.2.10 Securing the offset areas through a legally binding mechanism

The Stage 2 Offset Area is required to be legally secured in perpetuity.

Pembroke, who currently own the proposed offsets, recommend that the Stage 2 Offset Area will initially be legally secured through a Voluntary Declaration under the Vegetation Management Act 1999 (VM Act). This will occur within 12 months of the OAMP being approved by DCCEEW, consistent with conditions of approval. This will protect the vegetation on the title, and require land management to be undertaken in accordance with the OAMP. This declaration is legally binding on current and future landowners.

Pembroke then propose to commence discussions with Queensland DES regarding protecting the Stage 2 Offset Area, and possibly future biodiversity offset stages for Olive Downs, under a Nature Refuge Agreement under Nature Conservation Act 1992 (NC Act). The Nature Refuges Program is the Queensland Government's primary voluntary conservation covenanting program. Key aspects of the program are that:

- Each nature refuge is negotiated directly with the landholder through a nature refuge agreement.
- it can apply to a whole property or a portion of the property, depending on the conservation values and the landholder's wishes.
- The refuge is perpetual, registrable on title and binds successive owners or lessees of the land. A nature refuge is the best way landholders can ensure the good land management practices and conservation works they have initiated will be continued when future generations or new owners take over. So, if a property changes hands, responsibility for the nature refuge rests with the new owners or lessees.
- When a landholder signs a nature refuge agreement, they are supported by nature refuge officers located in key locations across the state. These officers support landholders through one-on-one specialist advice on how to best protect the conservation values on their nature refuge.
- A nature refuge is a Category C Environmentally Sensitive Area under *Environmental Protection Act 1992* and a Matter of State Environmental Significance (MSES) which provides greater protection to the offset.

Nature refuge declarations can take over 12 months to finalise hence the need to use a Voluntary Declaration to initially secure the offset.

4.3 Threatened fauna management objectives

The management measures outlined above have been informed by key threats, recovery actions and management priorities from each species listing advice, conservation advice, recovery plan and/or threat abatement plan (if available).

Table 4.6 provides a summary of how the proposed management measures address key threats and will provide a positive conservation outcome for MNES species across the offset area.

It demonstrates how the proposed Stage 2 Offset Area will compensate for the clearance of listed threatened species habitat at the Olive Downs Coking Coal project.

Table 4.6 Summary of threatened fauna management objectives

Key threats	Management outcome	Management action/s to address key threats
Ornamental Snake		
Habitat loss and fragmentation	Overall improvement in existing Ornamental Snake habitat quality.	Past and ongoing clearing of habitat for the Ornamental Snake, particularly broad-scale land clearing, has had significant negative effects on the species: restricted dispersal, isolated populations, genetic fragmentation and increased habitat degradation from edge effects (DSEWPC 2011c, DCCEEW 2023a).

Table 4.6 Summary of threatened fauna management objectives

Key threats	Management outcome	Management action/s to address key threats
	Increase in Ornamental Snake habitat through natural regeneration or active restoration. Increase in available shelter through increases in coarse woody debris.	A total of 3,559 ha of known important habitat for the Ornamental Snake will be protected and managed within the Stage 2 Offset Area. Weed control works and weed and fuel/biomass control will be implemented in the Stage 2 Offset Area resulting in a net improvement in habitat condition. Reduced weed cover and improved recruitment of native vegetation will result in a long-term increase in the availability of coarse woody debris which provides shelter for this species. Livestock will be excluded from Ornamental Snake habitat at certain times of year to ensure gilgai and other ephemeral wetlands are not further degraded. These measures, combined, address a key threat of habitat loss and will have a long-term benefit for the species.
Habitat degradation resulting from grazing leading to soil compaction and compromising of soil structure	Reduce habitat degradation resulting from stock grazing.	Grazing by stock has resulted in degradation of habitat for the Ornamental Snake, particularly in sensitive wetland and gilgai habitats (DCCEEW 2023a). Grazing leads to soil compaction, which reduces the availability of refugia for the species. This, in turn, reduces habitat quality and function leading to reduced resilience of populations to adverse environmental change (DSEWPC 2011c). Livestock will be excluded all year round from Ornamental Snake and Squatter Pigeon breeding habitats (as shown in Figure 4.2). These measures are anticipated to result in all impacts to key habitat from grazing being removed from the site, with resultant increases in habitat quality across the Stage 2 Offset Area.
Destruction of wetland habitat by feral pigs, cattle and Chital Deer	Reduce the likelihood of habitat degradation by feral pigs, cattle and Chital Deer.	Destruction of wetland habitats, including gilgai, by feral pigs is highlighted as a key threat to the species and is likely to result in ongoing habitat loss and degradation, as well as direct mortality (DoE 2014b). Other ungulates found on the offset area (i.e. cattle and Chital Deer) are almost certain to have similar impacts. The presence of ungulates in wetland habitats is also likely to reduce the suitability of this habitat for key prey species for the Ornamental Snake (frogs), further exacerbating impacts. Control of feral pigs will be undertaken across the Stage 2 Offset Area using a combination of baiting (for broad control) and shooting (for opportunistic control). Feral pig control will focus on ephemeral wetlands and gilgai where feral pigs are most likely to be active. Cattle will be excluded from all wetland areas. Chital Deer will be controlled via shooting. Ongoing control of ungulates will result in reduced degradation of known important habitat, addressing habitat loss and increasing availability of prey items.
Predation by feral species	Reduce the likelihood of predation by feral cats and feral pigs.	The Ornamental Snake has undergone a decline in abundance in the past few decades due to a number of impacts on the species, one of which is predation by feral species (DCCEEW 2023a). Predator control works will be undertaken across the Stage 2 Offset Area using a variety of methods such as trapping and shooting programs (Table 4.5). Predator control works will be undertaken on an annual basis across the Stage 2 Offset Area.
Invasion by weeds	Reduce invasion of weed species (Buffel Grass).	The degradation of habitat by invasive weeds, such as Buffel Grass, is considered a potential contributing factor to the decline of the Ornamental Snake (DCCEEW 2023a). Weed control will be undertaken across the Stage 2 Offset Area using a variety of methods (Table 4.3). Methods of removal and control for Buffel Grass include the strategic use of fire and grazing. Fire management will occur annually according to the Stage 2 Offset Area BMP.
Squatter Pigeon		
Habitat and resource loss	Reduce competition of food source by cattle and rabbits.	Overgrazing of habitat and competition for food sources by livestock and feral herbivores such as rabbits is a threat to the Squatter Pigeon (TSSC 2015). A total of 1,001 ha of Squatter Pigeon breeding habitat and 1,832 ha of Squatter Pigeon foraging habitat will be protected and managed within the Stage 2 Offset

Table 4.6 Summary of threatened fauna management objectives

Key threats	Management outcome	Management action/s to address key threats
	Improve Squatter Pigeon habitat extent and connectivity.	Area. Weed control works and weed and fuel/biomass control will be implemented in the Stage 2 Offset Area resulting in a net improvement in habitat condition. Reduced weed cover and improved recruitment of native vegetation will result in a long-term increase in habitat quality for this species. Pest fauna management controls for rabbits will be undertaken across the Stage 2 Offset Area using a variety of methods such as warren ripping, harbour destruction, baiting, trapping and shooting. Warren ripping and harbour destruction will occur opportunistically (i.e. when identified). Trapping, baiting and shooting programs will occur annually. Reduction in feral herbivores, particularly rabbits, will reduce pressures from competition of food source, providing positive benefits for the local Squatter Pigeon population.
Habitat degradation resulting from grazing leading to soil compaction and compromising of soil structure	Reduce habitat degradation resulting from stock grazing.	The degradation of Squatter Pigeon habitat through overgrazing by stock has contributed to the decline of the species (DAWE 2020b). Within Queensland much of the species original habitat has been replaced with improved pasture for cattle-grazing (TSSC 2015). Grazing will largely be removed from site with crash grazing (short-term) undertaken to control weeds and fuel load/biomass. Riparian vegetation, existing and future habitat will be protected from grazing using fencing. Planted areas will be fenced off and excluded from grazing within the first 2 to 3 years. Further detail on planting is outlined in Section 4.2.1. Squatter Pigeon breeding habitat will be excluded from grazing These measures are anticipated to result in all impacts to key habitat from grazing being removed from the site, with resultant increases in habitat quality across the Stage 2 Offset Area. Rotation of livestock will occur during years with sufficient rainfall, dependent on seasonal conditions and fuel load assessments.
Invasion by weeds	Reduce invasion of weed species (Buffel Grass).	The degradation of habitat by invasive weeds, such as Buffel Grass, is one of the main threats to the Squatter Pigeon (DCCEEW 2023b). Weed control will be undertaken across the Stage 1 offset area using a variety of methods (Table 4.2). Methods of control for Buffel Grass include integrated management of prescribed fire and grazing. Other weed species will be managed via chemical and/or mechanical control. Weed control events will be completed at least once a year from October to April.
Predation by feral cats	Reduce likelihood of predation by feral cats	Predation, particularly by feral cats and foxes, is identified as having the greatest impact upon the Squatter Pigeon (southern) population (DCCEEW 2023b). As foxes have not yet been recorded on the Project area, predator control works focusing on feral cats will be undertaken across the Stage 2 Offset Area using a variety of methods such as trapping and shooting programs. Predator control works will be undertaken on an annual basis across the Stage 2 Offset Area.
Climate change and drought	Enhancing drought-resistant habitat.	Higher temperatures due to climate change may cause heat stress to Squatter Pigeon and reduce the availability of foraging habitat.
	Create water stations for fauna.	The offset area will enhance drought-resistance and connectivity to known drought refugia, such as riparian woodlands, to increase the resilience of Squatter Pigeon populations across the area. Water stations placed out for Koalas may also be utilised by Squatter Pigeons.
Mortality and injury from wildfires	Reduce frequency and intensity of fires within Squatter Pigeon habitat. Increased survival of extreme fire events.	It is suggested that drought and bushfires may exacerbate the impacts of other threatening processes and contribute to the decline of the species (DCCEEW 2023b). Weed and fuel/biomass control will be undertaken across the Stage 2 Offset Area to reduce fuel loads and risk of high intensity to catastrophic fires. Further, these measures are designed to ensure they do not have negative impact on other

Table 4.6 Summary of threatened fauna management objectives

Key threats	Management outcome	Management action/s to address key threats
		habitat features such as regeneration. Hazard reduction burns will be undertaken in consultation with the Queensland Rural Fire Service to further reduce this risk. These measures will provide an increased level of protection for the Squatter Pigeon within the Stage 2 Offset Area, reducing the risk of both mortality and habitat loss because of fire. This will provide benefits for local populations as well the regional population through ensuring an available source population should fires have detrimental impact on regional populations.
Mortality and injury from collisions with barbed wire	Reduced likelihood of collision with barbed wire and subsequent injury or mortality.	Across the Project area, barbed wire fencing is common, as both the impact site and offset site have historically been used for cattle grazing. Many species of birds, including pigeons, have died as a result of entanglement in barbed wire fencing (WFF 2023b); it is likely that Squatter Pigeons, which often fly close to the ground, are also impacted. Existing barbed wire fencing across the offset area will be removed. Fences unable to be removed (such as those on the border with neighbouring properties) will have the top two strands replaced with plain wire or with PVC-coated borderline within the first year of the offset commencing, unless requirements of neighbouring landowners necessitate use of barbed wire. The top strand will also have reflectors added in areas of habitat where this is considered to be valuable (e.g. riparian corridors or movement corridors between patches of vegetation). New fencing will not use barbed wire and will be designed to allow fauna to safely move underneath the fence, leaving a gap of 40 cm between the ground and the bottom strand.
Greater Glider		
Habitat loss, fragmentation and/or degradation	Overall improvement in Greater Glider habitat quality. Increase in Greater Glider habitat through natural regeneration and/or revegetation. Increased denning habitat for the Greater Glider, including through installation of nest boxes. Increased Greater Glider habitat connectivity in riparian areas including through revegetation.	Habitat loss and fragmentation is identified as a key threat to the Greater Glider (TSSC 2021, DCCEEW 2022b). A total of 3,289 ha of habitat for the Greater Glider will be protected and managed within the Stage 2 Offset Area. The exclusion of cattle from Greater Glider habitat will support natural regeneration across the site, with active revegetation proposed in nominated riparian areas. Existing hollow-bearing trees will be retained across the offset area and new hollows will continue to develop naturally. Regrowth vegetation in non-remnant areas will further develop, improving habitat quality for the species. Supplementary nest boxes will be installed within remnant and advanced regrowth woodlands and over time will be installed into regeneration/revegetated areas. This will provide more denning opportunities for the species and improve their connectivity through these habitats. Section 4.2.7 includes further details of the nest box installation and research program. Weed control works and weed and fuel/biomass control will be implemented across the Stage 2 Offset Area, resulting in a net improvement in condition through reduction of weeds and control of biomass contributing to the ongoing growth and recruitment of Greater Glider feed trees and den trees. Feral Cats (a known predator) will be actively controlled across the Stage 2 Offset Area via a combination of management techniques (see Section 4.2.6), reducing predation pressure. Greater Glider habitat connectivity in riparian areas will be improved by increasing the height and cover of remnant vegetation and regrowth vegetation along riparian corridors. Up to 161 ha will be revegetated by the end of Year 6 to enhance Glider connectivity through riparian zones. Revegetated areas will be appropriately fenced where required to protect young saplings from grazing pressures and feral animals.
Climate change and drought	Enhancing drought-resistant habitat.	Increasing maximum temperatures as a result of ongoing climatic change may cause heat stress to Greater Gliders and reduce the availability of foraging habitat (TSSC 2021).

Table 4.6 Summary of threatened fauna management objectives

Key threats	Management outcome	Management action/s to address key threats
		The offset area will enhance drought-resistance and enhance connectivity to known drought refugia, such as riparian woodlands, to increase the resilience of Greater Glider populations across the area.
Mortality and injury from wildfires	Reduce frequency and intensity of fires within Greater Glider habitat. Increased survival of extreme fire events.	The Greater Glider is sensitive to wildfire and is slow to recover following major disturbance (DCCEEW 2022b). High intensity fires are considered a serious threat to the species (DCCEEW 2022b). Weed and fuel/biomass control will be undertaken across the Stage 2 Offset Area to reduce fuel loads and risk of high intensity to catastrophic fires. Further, these measures will be designed to ensure they do not have negative impacts on other habitat features such as regeneration. Hazard reduction burns and/or cool burns will be undertaken in consultation with the Queensland Rural Fire Service to further reduce this risk. These measures will provide an increased level of protection for the Greater Glider within the Stage 2 Offset Area, reducing the risk of both mortality and habitat loss because of fire. This will provide benefits for local populations as well the regional population through ensuring an available source population should fires have detrimental impact on regional populations.
Mortality and injury from collisions with barbed wire	Reduced likelihood of collision with barbed wire and subsequent injury or mortality.	Across the Project area, barbed wire fencing is common, as both the impact site and offset site have historically been used for cattle grazing. Greater Gliders are known to become tangled in fences, particularly in those made from barbed wire (DCCEEW 2022b, WFF 2023a); an observation of a dead Greater Glider caught on the top strand of a barbed wire fence along Barada Barna Rd was made by EMM ecologists in 2022. Existing barbed wire fencing across the offset area will be removed. Fences unable to be removed (such as those on the border with neighbouring properties) will have the top two strands replaced with plain wire or with PVC-coated borderline within the first year of the offset commencing, unless requirements of neighbouring landowners necessitate use of barbed wire. The top strand will also have reflectors added in areas of habitat where this is considered to be valuable (e.g. riparian corridors or movement corridors between patches of vegetation). New fencing will not use barbed wire and will be designed to allow fauna to safely move underneath the fence, leaving a gap of 40 cm between the ground and the bottom strand.
Koala		
Habitat loss, fragmentation and/or degradation	Overall improvement in Koala habitat quality. Increase in Koala habitat extent through natural regeneration and active revegetation. Increased Koala habitat connectivity in riparian areas including through revegetation.	Habitat loss is identified as a key threat to the Koala (DAWE 2022). A total of 2,833 ha of existing and future Koala habitat will be protected and managed within the Stage 2 Offset Area. Existing grazing practices will be reduced and managed across the site, allowing natural regeneration to occur across the site, with some active revegetation in riparian areas. Active revegetation is detailed in Section 4.2.1. Weed control works and weed and fuel/biomass control will be implemented across all habitat for the species, resulting in a net improvement in habitat condition; reduction of weeds and control of biomass (along with active revegetation) will support ongoing growth and recruitment of Koala feed trees and resting trees in these areas and lead to a net increase in availability of Koala habitat across the offset area. Koala habitat connectivity in riparian areas will be improved by increasing the height and cover of remnant vegetation and regrowth vegetation along riparian corridors. Up to 161 ha will be revegetated by end of Year 6 in order to enhance Koala movement through riparian zones. Non-remnant areas will then start to develop in their regrowth vegetation making these riparian corridors larger and providing improved foraging resources for the species. These measures, combined, address a key threat of habitat loss and have the capacity to result in Koala population increases at a local and regional scale.

Table 4.6 Summary of threatened fauna management objectives

Key threats	Management outcome	Management action/s to address key threats
Predation by Dingoes or domestic dogs	Reduced likelihood of predation by Dingoes or domestic dogs	Predation, particularly by dogs, has been identified as a threat to the Koala and may lead to localised declines (DAWE 2022). Much of the available data is from urban and peri-urban environments, though Dingoes are known to prey on Koalas in rural and regional settings. Predator control works will be undertaken across the Stage 2 Offset Area using a variety of methods (Table 4.5). Predator control works will be undertaken on an annual basis across the Stage 2 Offset Area. Reductions in predator numbers will reduce overall population pressure, providing positive benefits for the local Koala population.
Climate change and drought	Enhancing drought-resistant habitat. Create water stations for fauna.	Drought and incidences of extreme heat are identified as a threat to the Koala and may cause significant mortality in populations (DAWE 2022). Seabrook et al (2012) identified that drought significantly reduced populations in south-east Queensland and Koalas contracted to critical riparian habitats. The offset area will enhance drought-resistance and connectivity to known drought refugia, such as riparian woodlands, to increase the resilience of koala populations in the local area. Water stations (Tree Troffs - www.nvi.com.au/story/6898187) will be investigated for potential use in the offset area as water supplementation was found to be critical to the species during periods of drought (Mella et al 2019).
Mortality and injury from wildfires	Reduce frequency and intensity of fires within Koala habitat. Increased survival of extreme fire events.	Climate change and resultant increased risk of fire is identified as an increasing threat to the Koala, resulting in mortality and range reductions (DAWE 2022). The recent 2019/2020 bushfire 'black summer' resulted in significant losses of Koala habitat. Weed and fuel/biomass control will be undertaken across the Stage 2 Offset Area to reduce fuel loads and the risk of 'high intensity' to 'catastrophic fires'. Further, these measures are designed to ensure they do not have negative impact on other habitat features such as regeneration. Hazard reduction burns will be undertaken in consultation with the Qld Rural Fire Service to further reduce this risk when necessary. These measures will provide an increased level of protection for the Koala within the Stage 2 Offset Area, reducing the risk of both mortality and habitat loss because of fire. This will provide benefits for local populations as well the regional population by facilitating the survival of a source population should fires have detrimental impacts on regional populations outside the offset area.

5 Risk assessment

This section of the OAMP performs a risk analysis and a risk management and mitigation strategy for the successful implementation of the OAMP and timely achievement of the offset management outcomes. It includes a rating of all initial and post-mitigation residual risks in accordance with the risk assessment matrix provided by DCCEEW.

The key risks have been assessed using qualitative likelihood (Table 5.1) and qualitative consequence ratings (Table 5.2) with the interaction of likelihood and consequence determining the overall residual risk. The risk assessment matrix is presented as Table 5.3.

Table 5.1 Qualitative measure of likelihood

Score	Definition / rationale
Highly Likely (L5)	Is expected to occur in most circumstances
Likely (L4)	Will probably occur during the life of the project
Possible (L3)	Might occur during the life of the project
Unlikely (L2)	Could occur but considered unlikely or doubtful
Rare (L1)	May occur in exceptional circumstances

Notes: Likelihood is defined by how likely is it that this event/circumstances will occur after management activities are implemented

Table 5.2 Qualitative measure of consequence

Score	Definition / rationale
Minor (C1)	Minor risk of failure to achieve the plan's objectives. Minor incident of environmental damage that can be reversed. Results in short-term delays to achieving plan objectives, implementing low-cost, well-characterised corrective actions.
Moderate (C2)	Moderate risk of failure to achieve the plan's objectives. Isolated but substantial instances of environmental damage that could be reversed with intensive efforts. Results in short-term delays to achieving plan objectives, implementing well-characterised, high-cost/effort corrective actions.
High (C3)	High risk of failure to achieve the plan's objectives. Substantial instances of environmental damage that could be reversed with intensive efforts. Results in medium-long term delays to achieving objectives, implementing uncertain, high-cost/effort corrective actions.
Major (C4)	The plan's objectives are unlikely to be achieved, with significant legislative, technical, ecological and/or administrative barriers to attainment that have no evidenced mitigation strategies. Major loss of environmental amenity and real danger of continuing.
Critical (C5)	The plan's objectives are unable to be achieved, with no evidenced mitigation strategies. Severe widespread loss of environmental amenity and irrecoverable environmental damage

Table 5.3 Risk assessment matrix

Risk Assessment		Consequence				
		Minor (C1)	Moderate (C2)	High (C3)	Major (C4)	Critical (C5)
Likelihood	Highly likely (L5)	Medium	High	High	Severe	Severe
	Likely (L4)	Low	Medium	High	High	Severe
	Possible (L3)	Low	Medium	Medium	High	Severe
	Unlikely (L2)	Low	Low	Medium	High	High
	Rare (L1)	Low	Low	Low	Medium	High

Table 5.4 outlines the key identified risks which will influence the ability of the offset to achieve the final completion criteria set at the end of the OAMP, as well as the likelihood of the identified management actions achieving the set management objectives. It outlines feasible mitigation measures to reduce the overall risk and failure of the offset.

The ratings assume that the risks are untreated, i.e. have not been addressed by specific risk mitigation measures other than routine design and operational practice. The residual risk resulting from corrective actions applied to each risk event is then applied.

Table 5.4 Risk Assessment

Management objective/desired outcome	Event or circumstance	Relevant management actions/measures	Residual risk			Trigger detection and monitoring activities	Feasible/effective corrective actions
			L	C	RL		
Offset site values including MNES are protected from conflicting land uses and approval condition 17 (legal security) of 2017/7867 are met.	Impacts to the offset from resource tenements and/or future development. • The Stage 2 Offset Area is not constrained by any mining leases. Mining Leases to the west of the offset are owned by Pembroke and will not affect the offset. and resource holders will have agreements in place to ensure future development activities do not impact on offset values. • The offset is proposed on land that is freehold tenure, owned by Pembroke, and not encumbered by easements or other interests under Qld Land Act.	Legally secure Stage 2 Offset Area through declaration as a reserve under NC Act declaration or legally binding covenant. A Voluntary Declaration under the Vegetation Management Act (1999) will be the initial securement mechanism, until the reserve is declared. This will remain on the title binding future owners and constrain future development. Fencing the offset boundary will occur to ensure the offset land is clearly delineated from the mining tenement and there is no unauthorised access.	L1	C4	Medium	Trigger detection includes: • The Stage 2 Offset Area has not been legally secured within 12 months from the date that the OAMP is approved by the minister in writing. • Pembroke sells the offset land once performance outcomes are achieved. • Future mining or development is proposed over the offset area.	Corrective actions and adaptive management will be applied over the life of the offset. • Follow up progress of legally securing Stage 2 Offset Area at 12 months (must be secured within 2 years). • The offset protection mechanism is legally binding and new owners will need to comply with the accompanying conservation agreement. • New development proponent would need to offset the offset and submit a referral under EPBC Act for impacts to MNES.
	Impacts to the offset from unauthorised access. Unauthorised access and activities have potential to degrade the ecological values of the offset. These activities include: • 4WD access - degrade wetlands and gilgai, erode tracks particularly after rain, introduce weed species and/or spread weeds. • Shooting/hunting. • Timber harvesting. • Release of cattle/horses for grazing. • Dumping of rubbish. • Poaching of wildlife.	The property is currently appropriately fenced, with gates installed. Gates will be locked within the first year of offset management commencing. Only the landholder and approved contractors will be granted access. Property regularly monitored and patrolled for unauthorised access.	L2	C2	Low	Property regularly monitored and patrolled for unauthorised access. Triggers for detection include: • Broken/tampered fences, gates or locks. • Evidence of identified unauthorised activities.	Corrective actions and adaptive management will be applied over the life of the offset. • If access restrictions are not successful, implementation of camera monitoring to identify perpetrators. • Notification to police and DCCEEW if suspected/substantiated unlawful access.
Expanding available habitat and increasing Habitat Quality	Woodland regeneration and habitat quality scores are not achieved in timeframes set.	Natural regeneration is proposed to be actively managed to increase extent of remnant woodland and habitats across the offset site. Natural regeneration is preferred method due to the size of areas containing regrowth and non-remnant areas. Natural regeneration will be encouraged through reduced grazing pressure, reducing weed cover, pest animal management and active fire management. Up to 161 ha of woodland is proposed to be revegetated within riparian corridors. Revegetation areas will be maintained for five years and losses will be replaced to maintain 300 canopy trees/ha. The plantings will be staggered over four years (commencing in Year 3 and being completed by end of Year 6) and maintenance will include watering, weeding, removing grazing and pest animals. Other management actions are also proposed to improve habitat quality including weed management, fire management, grazing management and pest animal control. Revegetating 161 ha and managing natural regeneration through other habitat quality management measures such as weed control will be the focus in the first six years. Additional intervention may then be undertaken from Year 7 such as ripping, further direct seeding and increased intensity of weed control.	L3	C2	Medium	Monitoring of the progress of the offset and habitat quality benchmarks will occur and every five years the outcomes will be formally assessed against interim targets for each MNES. If natural regeneration is not shown to be progressing to set targets, additional intervention will be undertaken. Trigger detection includes: • Tree mortality >25%. • Disease in trees and saplings. • Weed species inhibiting native growth. • Animal herbivory on native growth. • Natural regeneration not occurring at rates required to meet interim performance targets for restoration areas in Table 6.3.	Corrective actions and adaptive management will be applied over the life of the offset. • Assess fencing structures to ensure there is no unauthorised access by stock or large numbers of native herbivores. • Increased controls of pest flora and fauna species. • Assess soil health and suitability for successful regeneration. • Increase watering of planted tubestock. • Dead trees to be replaced so average of 300 trees/ha is achieved in active revegetation areas. • Additional ripping, direct seeding and supplementary planting of tubestock is undertaken across larger areas in the restoration habitats. • Increasing weed control efforts and managing disease through application of suitable herbicides.

Table 5.4 Risk Assessment

Management objective/desired outcome	Event or circumstance	Relevant management actions/measures	Residual risk			Trigger detection and monitoring activities	Feasible/effective corrective actions
			L	C	RL		
	Micro habitat features for target MNES species do not develop appropriately during OAMP life. • Coarse woody debris (CWD) is insufficient relative to RE benchmarks to provide micro-habitat for Ornamental Snake. • Squatter Pigeon require adequate foraging resources and native grass species diversity. • Greater Gliders require tree hollows for breeding.	If CWD is not developing based on set benchmarks investigate introducing CWD salvaged from impact site into Ornamental Snake habitats. If native grass species are not regenerating investigate increasing weed control and/or aerial seeding of native grass stock, as weeds may be outcompeting native grasses, and reducing or remove grazing. Cool burns may also encourage native grass regeneration. Deployment of supplementary nest boxes for Greater Glider will be undertaken. This recognises the fact some habitats will take a long time to develop naturally forming hollows. Trials of using salvaged tree hollows from impact site will be undertaken as well as monitoring to determine if Greater Gliders are using nest boxes. Undertake feral pig / Chital Deer management to reduce impacts on wetland and gilgai areas.	L3	C2	Medium	Monitoring will occur annually to evaluate effectiveness of management actions, and track progress of habitat quality objectives.	Corrective actions and adaptive management will be applied over the life of the offset. • If CWD is not developing based on set benchmarks investigate introducing CWD salvaged from impact site into Ornamental Snake habitats. • If native grass species are not regenerating investigate increasing weed control as weeds may be outcompeting native grasses. Cool burns may also encourage native grass regeneration. • Nest boxes will augment Greater Glider habitat.
	Wetland and riparian habitat regeneration fails. • Wetlands and riparian areas are important habitats for the target MNES species (e.g. Ornamental Snake utilises wetlands and gilgai and key habitat for Greater Gliders and Koalas is found along watercourses). • Increased activity by site personnel, unauthorised access, stock access or feral animals (pigs) can suppress natural regeneration and erode creek banks.	Measures to reduce/eliminate access and impacts to these areas will include: • Contractor management plans restricting access of contractors to certain areas. • Keeping vehicles to designated access tracks. • Stock being fenced out of riparian areas with off-stream watering points. • Restrictions on unauthorised access (4WD and hunting). • Pest animals (active reduction in feral pig numbers through active management). Livestock to be excluded from wetland habitats. • All riparian areas will be fenced to prevent unauthorised access.	L3	C1	Low	Monitoring will occur annually to evaluate effectiveness of management actions, and track progress of habitat quality objectives. Trigger detection includes: • Evidence of increased erosion around creek banks • Natural regeneration not occurring at rates required to meet interim performance targets for restoration areas in Table 6.3	Corrective actions and adaptive management will be applied over the life of the offset. • Assess fencing structures to ensure there is no unauthorised access by stock or large numbers of native herbivores. • Increased controls of pest flora and fauna species. • Revise weed management program in riparian and wetland areas. • Assess soil health and suitability for successful regeneration. • Implement better exclusion mechanisms.
Weed management	Introduction, establishment and spread of weeds as a result of access to offset. Weed populations increase or do not reduce. • Weeds carried on vehicles, plant, machinery and equipment may be introduced/further spread and subsequently colonise disturbed ground, leading to increased risk of competition with regenerating native plants / increased biomass resulting in heightened bushfire risk. • Weeds may outcompete regenerating native grasses and tree species. • Weeds can reduce fauna movement through the offset area.	Baseline weed survey will occur in Year 1 across Stage 2 Offset Area. The survey will clearly document weed species present, distribution and any larger infestations. Weed control will be undertaken annually as a minimum. The following actions will also reduce risks associated with weeds and increase effectiveness of management: • Access only to authorised personnel. • Mapping infestations and areas of exclusions (weed baseline). • Weed treatment schedule addressing method of control, pesticides, location and timing of treatments. • Develop hygiene control program including vehicle washdown – machinery to arrive and depart from site in a clean condition (general biosecurity obligation), free from seed or mud. • Any introduced mulch, soil or plants are to be weed free and disease free. • Weed control to be implemented by suitably qualified and appropriately permitted pest control personnel.	L3	C2	Medium	Monitoring will occur annually to evaluate effectiveness of management actions, and track progress of weed populations and reduction in distribution. Trigger detection includes: • New areas of weed outbreaks have been noted from the baseline surveys. • Increase in weed abundance. Average increase in 20% of non-native cover from previous baseline surveys at the HQ monitoring sites. • New weed species identified.	Corrective actions and adaptive management will be applied over the life of the offset. • Alter weed management strategy to target problematic species and/or outbreaks. • Increase frequency of weed management events. • Assess weed control methods and change methods if required. • Review hygiene protocols to ensure they are effective in preventing vehicles and people spreading or introducing weeds across offset area.

Table 5.4 Risk Assessment

Management objective/desired outcome	Event or circumstance	Relevant management actions/measures	Residual risk			Trigger detection and monitoring activities	Feasible/effective corrective actions
			L	C	RL		
		• Ongoing monitoring conducted for weed species and location. • If weed populations are not decreasing or new weed species have been introduced a review of measures will be undertaken. Different control methods will be trialled and weed control effort will be increased.					
Biomass control	Biomass increases, thus increasing likelihood of destructive fires occurring. Hot fires can remove habitat features such as CWD, tree hollows and kill native vegetation, as well as threatened species. Too frequent fires can also reduce CWD, reduce regeneration of saplings and increase certain weed species.	Biomass (i.e. fuel load) is proposed to be managed through a combination of control methods, such as grazing, cool/mosaic burns, and weed control. In areas where grazing isn't appropriate cool burns or manual slashing can be used to reduce fuel load. Fire breaks will also be put in place and maintained to reduce likelihood of uncontrolled fires spreading and improve access around offset for fire management activities.	L2	C2	Low	Monitoring will occur throughout the year to identify when grazing can and can't occur based on biomass levels. A formal annual monitoring program (Section 6) will also be completed to evaluate effectiveness of management actions, and track progress of weed populations and reduction in distribution. Fire management will be used across the Stage 2 Offset Area to manage fuel loads. Trigger detection includes: • Increase in weed abundance. • Average increase in 20% of non-native cover from previous baseline surveys at the HQ monitoring sites. • Fuel loads exceed specified thresholds. • Evidence of livestock in exclusion areas.	Corrective actions and adaptive management will be applied over the life of the offset. • Alter timing and frequency of selective grazing. • Implement better exclusion mechanisms. • Alter weed management strategy to target problematic species and/or outbreaks. • Increase frequency of weed management events. • Assess weed control methods and change methods if required. • Review hygiene protocols to ensure they are effective in preventing vehicles and people spreading or introducing weeds across offset area.
	Loss of Squatter Pigeon habitat due to increase in ground cover percentage, and exotic grasses and weeds outcompeting native grass regeneration. • Utility of potential breeding and foraging habitat for Squatter Pigeon decreases when ground cover exceeds >33%. The species requires bare ground for foraging and dust bathing. • Weed establishment / expansion in potential habitats, especially by Buffel Grass, is a significant threat.	Implement biomass control activities including prescribed burning and grazing. Implement the Squatter Pigeon monitoring plan (Table 6.2) to track habitat quality improvements are being achieved including increase in native grass species diversity. Weed control will be undertaken to reduce competition with native grass species recruitment.	L2	C2	Low	Monitoring will occur throughout the year to identify when grazing can and can't occur based on biomass levels. A formal annual monitoring program (Section 6) will also be completed to evaluate effectiveness of management actions, and track progress of weed populations and reduction in distribution. Trigger detection includes: • Increase in weed abundance. • Average increase in 20% of non-native cover from previous baseline surveys at the HQ monitoring sites. • Fuel loads exceed specified thresholds.	Corrective actions and adaptive management will be applied over the life of the offset. • Alter timing and frequency of selective grazing. • Implement better exclusion mechanisms. • Alter weed management strategy to target problematic species and/or outbreaks. • Increase frequency of weed management events. • Assess weed control methods and change methods if required. • Review hygiene protocols to ensure they are effective in preventing vehicles and people spreading or introducing weeds across offset area.
Pest animal management	Uncontrolled or increasing feral pig / Chital Deer activity which degrades Ornamental habitat. • Impacts to wetland habitat from feral pigs, Chital Deer, and cattle is considered a threat to wetland and habitat values for Ornamental Snake.	Feral pig and Chital Deer control to be undertaken annually to reduce feral pig numbers and ecological impacts. If monitoring is showing feral pig / Chital Deer populations are not decreasing, or wetland impacts are increasing, feral pig / Chital Deer control will be increased. Feral pig / Chital Deer control in adjacent properties will be undertaken. Management must consider humane measures to destroy pigs, and in the case of poisoned baits, consider poisoning of target animal. Exclusion of livestock from wetland areas.	L2	C2	Low	A formal annual monitoring program (Section 6) will be completed to evaluate effectiveness of management actions, and track reduction in feral pig / Chital Deer populations. Trigger detection includes: • Observed increase in incidental sightings of feral animals. Increase in 10% of feral animal abundance from previous monitoring event. • Evidence of pest animal / livestock degradation of MNES species habitats, such as feral pigs, Chital Deer or cattle signs in gilgai.	Corrective actions and adaptive management will be applied over the life of the offset. • Increase frequency of pest control events. • Review and alter pest control methods. • Adopt pest control across a broader area if it is likely pest animals are breeding in adjacent areas.
	Uncontrolled feral animal activity. • Feral predators (primarily cats) pose a serious threat to native fauna (including MNES species). Uncontrolled,	Feral animal control to be undertaken annually to reduce feral animal numbers and impacts on MNES.	L2	C2	Low	A formal annual monitoring program (Section 6) will be completed to evaluate effectiveness of management actions, and track reduction in feral animal populations.	Corrective actions and adaptive management will be applied over the life of the offset.

Table 5.4 Risk Assessment

Management objective/desired outcome	Event or circumstance	Relevant management actions/measures	Residual risk			Trigger detection and monitoring activities	Feasible/effective corrective actions
			L	C	RL		
	these predators pose a serious threat to native animals in the offset. For example, feral cats are known to predate Squatter Pigeon and Greater Glider.	Measures must consider humane measures of destruction, and in the case of poisoned baits, consider poisoning of target animals.				Trigger detection includes: • Observed increase in incidental sightings of feral animals. Increase in 10% of feral animal abundance from previous monitoring event. • Observation of any MNES species mortality from pest animals such as cat predation of Greater Glider. • Evidence of pest animal degradation on MNES species habitats, such as feral pigs in gilgai.	• Increase frequency of pest control events. • Review and alter pest control methods. • Adopt pest control across a broader area if it is likely pest animals are breeding in adjacent areas.
Fire management	Increasing intensity, duration or frequency of fires. Hot fires can remove habitat features such as coarse woody debris (CWD), tree hollows and kill native vegetation, as well as threatened species. Too frequent fires can also reduce CWD, reduce regeneration of saplings and increase certain weed species. • Excessive/uncontrolled establishment of exotic weeds (e.g. Buffel Grass, Guinea Grass) create fire risks through increased fuel loads. These often result in fires of greater intensity and duration and impact upon natural regenerative processes affecting structural and floristic change to habitats. A drying climate can also stimulate greater frequency (and intensity) of fire.	Fire management activities will be undertaken on an annual basis. This will include establishment of fire breaks and fuel load reduction. Prescribed fire will be used to manage fuel loads (in combination with light grazing in some areas) and promote diversity in MNES habitats. Fire prescriptions will take into account the vegetation community type, maturity and ecological requirements of the regenerating areas. Appropriate burn times including cool burns to influence a variety of ecological responses that do not favour any one species.	L3	C2	Medium	Fire breaks and fuel loads will be regularly monitored throughout the year. A formal annual monitoring program (Section 6) will be completed to evaluate effectiveness of management actions, including reducing risk of hot bushfires occurring. Trigger detection includes: • Fuel loads exceed specified thresholds. • An unplanned bushfire occurs.	Corrective actions and adaptive management will be applied over the life of the offset. • Review effectiveness of fuel load management and monitoring techniques. • Review effectiveness of prescribed burn program and adjust where appropriate.
Fencing	Death or injury of native animals due to barbed wire fencing. • Most existing fencing has barbed wire on the top strand for livestock control. • Barbed wire poses a significant threat to native fauna especially bats, owls, birds and gliders (i.e. Greater Gliders in this instance) (WFF 2023a). Such animals become entangled, usually on top wires in the case of gliders, and are seriously injured and perish. • Ground fauna can be injured when fleeing predators or other threats, e.g. wallabies trying to cross the fence.	Existing barbed wire fencing across the offset area will be removed. Fences unable to be removed (such as those on the border with neighbouring properties) will have the top two strands replaced with plain wire or with PVC-coated borderline within the first year of the offset commencing, unless requirements of neighbouring landowners necessitate use of barbed wire. The top strand will also have reflectors added in areas of habitat where this is considered to be valuable (e.g. riparian corridors or movement corridors between patches of vegetation). New fencing will be designed to allow fauna to safely move underneath leaving a gap of 40 cm between ground and bottom wire. Electric fencing can be used with caution. Electric fencing has shown to be effective in keeping cattle out and not injuring wildlife. The hot wire will be at least 40 cm above the ground to allow for small animals to pass under with ease.	L4	C1	Low	Fences will be regularly monitored and maintained throughout the year to ensure they are not damaged and keeping livestock out of certain areas. Trigger detection includes: • Evidence of damage to fences. • Livestock entering areas they are excluded from. • Wildlife injury on any fences.	Corrective actions and adaptive management will be applied over the life of the offset. • Repair damaged fencing. • Change design of fence to minimise wildlife injuries. • Install additional fencing to further restrict access by pest fauna, e.g. feral pigs in gilgai or rabbits in revegetation areas.
Legal security of offset	Legislative reform prejudices proposed tenure arrangements for offset properties.	The offset will be legally secured in perpetuity.	L1	C1	Low	• Any new lease applications affecting the offset will not be granted access.	• The offset protection mechanism is legally binding and new owners will need to comply with the accompanying conservation agreement.
Actions of adjacent landowners do not compromise offset outcomes.	Landowner-approval holder agreements fail to adequately address management commitments in the offset plan	The Stage 2 Offset Area is located on land owned and managed by Pembroke, so no landowner-approval holder agreements will be required.	L1	C1	Low	• NA	• NA
	Adjacent/regional landowner's land management practices fail to support attainment of offset outcomes.	Fire management on adjacent properties may be inconsistent with proposed objectives of offset.	L3	C2	Medium	• Unplanned fire events originate from outside of offset.	• Review effectiveness of boundary treatments (fire breaks, weed treatments)

Table 5.4 Risk Assessment

Management objective/desired outcome	Event or circumstance	Relevant management actions/measures	Residual risk			Trigger detection and monitoring activities	Feasible/effective corrective actions
			L	C	RL		
		Bushfire management plan will include adequate fire breaks, actions and planning to protect against unplanned fire entering or leaving the offset. Neighbouring properties will be consulted during the preparation and implementation of the S2 OAMP BMP.				• Increase in pest animal activity, despite concerted management actions. • Encroachment of weeds from boundaries.	• Escalate efforts in communication with adjacent landowners to achieve mutually satisfactory land management outcomes
Offset is adequately funded	Insufficient funds provided by approval holder to implement the plan.	Committed actions in this OAMP have been fully costed and funds committed to the ongoing management of the offset for the life of the approval.	L1	C2	Low	• Annual offset budgets are met / not met.	• Review management activities / contractor procurement processes if annual budgets are exceeded • Review appropriateness of offset management budgets /funding
Offset achieves interim performance targets and completion criteria for MNES	Stochastic events (wildfire/drought/flood) prejudice attainment of interim performance targets and/or completion criteria for MNES.	Fire management planning will account for worst case scenario, using future climate modelling inputs. Weed and pest animal management will be adaptive and adjusted based on annual monitoring results. Annual monitoring will include a review of performance against completion criteria so that corrective actions are timely.	L2	C2	Low	• Unplanned fire impacts offset. • Annual monitoring activities detects decline in MNES species distribution or abundance. • Changes in weed distribution and abundance as a result of flood events	• Consider installation of supplementary measures (e.g. Tree Troffs). • Revise weed management plan to focus efforts in affected areas (e.g. riparian / floodplain zones. • Review effectiveness of Bushfire Management Plan and/or fuel load management monitoring frequency.

6 Monitoring program

6.1 Monitoring program objectives

Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced. The monitoring program is designed to facilitate operational decision-making, in particular to:

- Inform and report 'early-control', i.e. to demonstrate that management actions are effective in achieving interim performance targets, and, in time, completion criteria.
- support an 'early warning' function, i.e. to inform timely decisions on corrective actions to ensure performance and completion criteria are achieved and maintained.

The monitoring program will:

- confirm all prescribed management actions have been completed in timeframes set for that 12-month period (refer to Section 7.1)
- identify trends and areas for improvement through early control and early warning functions
- assess effectiveness of environmental controls
- where necessary, identify modifications required to the monitoring program and methods
- assess vegetation community growth, condition and extent
- assess habitat quality for each MNES, including evaluating whether interim performance outcomes are being achieved
- determine that the final habitat quality is achievable
- assess presence, abundance and habitat utilisation by target MNES species
- confirm performance objectives have been met at end of 20-year management period (reduced management will continue for the duration of the Project approval).

Habitat quality (BioCondition) assessments will be undertaken in the early stages of the monitoring program at both new and previously established sites to ensure baseline data is sufficient to inform ongoing offset management strategies and allow measurement of temporal changes in habitat quality from the onset of the monitoring program.

Existing and additional BioCondition sites are summarised in Table 6.1 according to vegetation community and offset value. Existing BioCondition sites are illustrated in Figure 3.6.

Table 6.1 Habitat Quality assessment sites

Assessment unit and Regional ecosystem	Existing BioCondition sites	Additional BioCondition sites to be completed in Year One	Associated MNES species habitat
AU 1 - RE 11.3.1 Remnant	BC44	None (contiguous condition).	Ornamental Snake
AU 2 - RE 11.3.1 Regrowth	BC21	Three.	Ornamental Snake
AU 3 - RE 11.3.2 Remnant	BC13	Three.	Squatter Pigeon (breeding), Squatter Pigeon (foraging), Greater Glider, Koala
AU 4 - RE 11.3.2 Regrowth	BC47	Three.	Squatter Pigeon (breeding), Squatter Pigeon (foraging), Greater Glider, Koala
AU 5 - RE 11.3.25 Remnant	BC11, BC12	Two.	Squatter Pigeon (breeding), Squatter Pigeon (foraging), Greater Glider, Koala
AU 6 - RE 11.3.27i Remnant	BC46	One.	Squatter Pigeon (foraging), Greater Glider, Koala
AU 7 - RE 11.3.36 Remnant	BC17	One.	Squatter Pigeon (foraging), Greater Glider, Koala
AU 8 - RE 11.3.7 Remnant	BC20, BC32	One.	Squatter Pigeon (foraging), Greater Glider, Koala
AU 9 - RE 11.4.8 Regrowth	BC38, BC48, BC49	None (contiguous condition).	Ornamental Snake
AU 10 - RE 11.4.9 Remnant	BC45	One.	Ornamental Snake
AU 11 - RE 11.4.9 Regrowth	BC08, BC09, BC10	None (contiguous condition).	Ornamental Snake
AU 12 - RE 11.5.3 Remnant	BC04, BC05, BC06	One.	Squatter Pigeon (breeding), Squatter Pigeon (foraging), Greater Glider, Koala
AU 13 - RE 11.5.3 Regrowth	BC40	Four.	Squatter Pigeon (breeding), Squatter Pigeon (foraging), Greater Glider, Koala
AU 14 - RE 11.5.8c Remnant	BC41	Four.	Squatter Pigeon (breeding), Squatter Pigeon (foraging), Greater Glider, Koala
AU 15 - RE 11.5.9 Remnant	BC01, BC02, BC03	One.	Squatter Pigeon (breeding), Squatter Pigeon (foraging), Greater Glider, Koala
AU 16 - RE 11.5.9 Regrowth	BC43	Three.	Squatter Pigeon (foraging), Greater Glider, Koala
AU 17 - RE 11.10.1 Remnant	BC22, BC23, BC37	Two.	Squatter Pigeon (breeding), Squatter Pigeon (foraging), Greater Glider, Koala

6.2 Monitoring methods

Specific monitoring methods and timings sufficient to address the Monitoring Program objectives detailed in Section 6.2 are summarised in Table 6.2. The implementation schedule for each of the management measures and monitoring methods is outlined in Table 6.3.

Table 6.2 Monitoring for threatened species and offset effectiveness

Monitoring activity	Management needs/questions addressed	Parameter/s measured	Survey/monitoring guidelines	Where	When	Reliability
Offset Administration						
1. Confirm all prescribed management actions have been completed in timeframes set for that 12-month period.	Ensure committed actions are implemented as designed.	All set management actions in each 12-month period will be evaluated to confirm they have been completed. These are outlined in further detail below including: • weed management • fire management • fence and access track maintenance • fuel load and grazing management.	A suitably qualified person will be engaged by Pembroke Resources to inspect the offset area and confirm work has been completed. The appointed person will consult with applicable parties engaged to do the work and seek evidence tasks were completed in accordance with the approved OAMP. This may be Pembroke employees, grazing manager or suitably qualified contractors. A report will be prepared summarising the audit completed and findings. Report will be issued to Pembroke.	Across Stage 2 Offset Area	Audit will occur annually (estimated around April). Report will be finalised at least one month prior to the Annual Report being due on 30 June.	High. Report will provided as required. Supporting information (e.g. contractor/consultant reports, invoices and other evidence) will be available.
2. Assess effectiveness of environmental controls implemented.	Management actions deliver the desired outcomes.	Following each monitoring event the results will be evaluated and measured against the specific management outcomes for that particular matter, and habitat quality objectives set out in Table 6.3.	A range of monitoring methods will be implemented. These are outlined in this table from monitoring activities 5 to 13.	Across Stage 2 Offset Area	Effectiveness of management actions and any corrective actions put in place will be assessed annually. This will be as part of the Annual Report process described in Section 7.1.	High. Report will be provided as required. Supporting information (e.g. contractor/consultant reports, invoices and other evidence) will be available.
		All management actions	The approval holder must ensure each assessment of the effectiveness of the management actions in the Stage 2 OAMP is: a. subject to a peer-review completed within 6 months of the completion of each such assessment; and b. published on its website with the findings of the peer-review within 6 months of the completion of the peer-review and for the duration of this approval.		Every five years.	
3. Timing of corrective actions and evaluation of effectiveness.	Poor performance of any management measure is detected and corrected in a timely manner.	All management actions	The monitoring actions from monitoring activities 5 to 14 will be implemented to confirm if the management actions are effective.	Across Stage 2 Offset Area.	Implement corrective actions within three months of identifying a corrective action is required (refer Section 4).	High. Reporting of corrective actions will be included in Annual Report. Supporting information which evaluates effectiveness of each management measure (e.g. habitat quality and threatened species monitoring, annual fire, feral, weed management) will be available.
4. Identify modifications required to the monitoring program and methods.	Poor performance of any monitoring measure is detected and corrected in a timely manner.	All management actions	Pembroke will undertake a review of the monitoring program. The review will consider: • Are the monitoring methods effective and providing the information required? • Are the monitoring frequencies suitable? • Is the monitoring program efficient or are there improvements that could be made? • What changes may be justified and why?	Across Stage 2 Offset Area.	At the end of the first 5 years (and every 5 years after) a review of the monitoring program will occur. As per the approval conditions for 2017/7867, a report summarising key findings and any recommendations for refinement will be prepared. The report will also be submitted to DCCEEW for review. If changes are proposed and agreed the OAMP will be updated and new revision approved.	High. The reporting and monitoring schedules outlined in this table ensure transparent and timely treatment of items requiring modification.

Table 6.2 Monitoring for threatened species and offset effectiveness

Monitoring activity	Management needs/questions addressed	Parameter/s measured	Survey/monitoring guidelines	Where	When	Reliability
Ecosystem Health						
5. Weeds	Ensure weed management is appropriate to ecology of each MNES. Ensure weed management reduces threats to MNES by reducing abundance and impacts of weeds.	Weed species present. Weed species abundance. Weed species distribution.	Undertake weed baseline survey across offset area. Document weed species present, locations observed, map larger infestations, provide abundance scores for all occurrences. Map results. Establish permanent weed monitoring photo points at strategic locations (e.g. drainage crossings) to document extent and abundance. Weed cover will also be measured and monitored at established HQ monitoring sites. Weed Management Plan to be prepared in Year 1 and reviewed and updated every 3 years. Weed treatment activities will be reported annually by implementation contractor and independently audited in the field, at the end of each treatment round. Annual reports of weed distribution and abundance will be prepared. A targeted annual weed treatment program will be prepared prior to the growing season.	Across Stage 2 Offset Area, including critical locations: - Within riparian and connectivity restoration zones - along internal access tracks - HQ monitoring and permanent photo monitoring sites	Weed baseline survey will occur in Year 1. Preparation of Weed Management Plan in Year 1. Weed treatment program to be prepared annually, prior to growing season. Weed treatments to occur annually, and be independently audited post-treatment each year. Weed monitoring surveys to occur annually Year 2–20. Pembroke will continue to undertake weed control and maintenance for the duration of the approval. Post-20 years, this will include reduced general maintenance and management including weed control.	High. Collection of high-quality spatial data will ensure weeds are accurately tracked over time. Independent monitoring of management actions, annual treatment and regular revision of Weed Management Plan will ensure management is effective and adaptive.
6. Feral animals	Ensure pest animal management is appropriate to ecology of each MNES. Ensure pest animal management reduces threats to MNES by reducing abundance and impacts of pest animals.	Feral animal species present. Feral animal abundance. Feral animal distribution.	Undertake feral animal baseline survey across offset area. The survey will confirm presence of feral animal species, their abundance, distribution and document evidence of impacts. The baseline survey will establish an abundance of each target species namely feral cats, Chital Deer, rabbits, hares and feral pigs. The survey will be replicated to compare changes in abundance and extent of impacts. Establish baited camera trap locations and assessment sites to determine their presence e.g. wetland and gilgai areas for feral pigs. The same camera trap locations will be repeated each monitoring event to gauge presence of feral animal species and any change in abundance. A minimum of 20 cameras will be deployed at each monitoring event. The baited camera traps will be set up across the offset area in particular key habitats. Camera traps will be left out for four weeks. Spotlighting for presence of feral animals will also be undertaken. This will coincide with spotlighting being undertaken, Ornamental Snake, Greater Glider and Koalas.	Within mapped MNES habitat areas and other strategic pest management locations.	Feral animal baseline survey will occur in Year 1. Feral animal surveys will occur annually between Years 2–Year 5. Then every 2 years from Years 6–20. Feral animal surveys (independent of contractor completing control activities) will be undertaken after annual treatment programs are complete.	High. Collection of high-quality spatial data will ensure pest animals are accurately tracked over time. Independent monitoring of management actions and annual treatment will ensure management is effective and adaptive.
7. Fire	Ensure fire management is appropriate to ecology of each MNES. Ensure fire management reduces threats to MNES by reducing fuel loads.	Fire track maintenance. Fuel loads. Fire history.	Property Bushfire Management Plan (BMP) will be prepared in Year 1 of offset. Annual burn plans will be prepared prior to commencement of fire danger season. All fire tracks will be surveyed to confirm they are adequately maintained. Monitor fuel loads and seasonal conditions. Fuel reduction burns will be applied in accordance with BMP. Annual fire management planning and monitoring will include mapping of previous fires (fire history) and extent of prescribed burns (fire scar mapping) to inform future management.	In each Fire Management Zone, identified in Stage 2 Offset BMP. Property boundaries and internal tracks. Fuel load monitoring across property.	Survey fire tracks annually, prior to start of fire danger season. Implement fire track maintenance (e.g. slashing) as per annual program, prior to start of fire danger season. Monitor fuel load at end of wet season (prior to dry season). Low intensity fires will be applied at intervals prescribed in BMP. Map fire scars at end of fire season. Prepare annual burn plan prior to commencement of fire danger season. Review and re-issue BMP every 3 years.	High. Assessment of fire history and fire modelling will utilise CSIRO data and conservative Representative Concentration Pathway (RCP) climate modelling. Analysis of fire scars and fire history will utilise data supplied by reliable sources (e.g. NAFI, Geoscience Australia, TERN). Regular monitoring of fuel loads, preparation of annual burn programs, independent auditing of fire management activities and regular review of the BMP will ensure management is effective and adaptive.

Table 6.2 Monitoring for threatened species and offset effectiveness

Monitoring activity	Management needs/questions addressed	Parameter/s measured	Survey/monitoring guidelines	Where	When	Reliability
8. Grazing	Ensure grazing is only applied, to reduce fuel loads when trigger levels are reached.	Fuel loads. Fence maintenance. Evaluate stock numbers, timing of grazing and impact on fuel load.	Monitor fuel loads via rapid fuel load assessment method. Survey fences and confirm they are adequately maintained. Assess grazed areas for effectiveness in managing fuel load and that no degradation to environmental values is occurring. Report to be provided by grazing manager that will include: • Seasonal conditions. • Grazing intensity and stock rotation. • Fuel load levels at commencement and completion of grazing and duration including photos taken from permanent monitoring plot locations. General property maintenance activities such as fencing, access track maintenance.	At fuel load assessment sites determined in the BMP	Survey fences and access tracks every year. Assess grazed areas and evaluate effectiveness of rotational grazing every year.	High. Fuel load assessments will be based on accepted, reliable methods of fuel hazard estimation. Annual reporting and independent review will ensure grazing is sustainable and used for the intended purpose (fuel load management, not productivity).
Habitat Quality						
9. Track changes in habitat quality scores for each MNES. Confirm they are on track to achieve interim milestones and final milestone. Refer to supporting documentation for further detail on MNES Habitat Quality Scores and Table 6.3 for habitat quality improvements being sought.	Ensure habitat quality scores are tracking towards outcomes identified in Table 6.3.	Complete Habitat Quality Assessments. This will include measuring: • Canopy species • Canopy height • Canopy cover • Number of large trees • Groundcover species • Total tree species richness • Grass species richness • Weed species and cover • Litter cover • Coarse woody debris • Recruitment of woody perennial species • Photo points • Patch size • Connectivity Hollow bearing trees and size of hollows (to be added to all BioCondition).	Baseline BioCondition transects will be established in Year 1 across the offset areas. 48 BioCondition (BC) transects have been established to date, and a review will determine if further BC sites are required, including in remnant, regrowth and non-remnant areas. This will ensure adequate representation of vegetation communities and habitat types. Refer Section 3.2.1 and Supporting Report (EMM 2024). In Year 3 BioCondition transects will be re-assessed and habitat quality scores prepared for each MNES species. An analysis of changes will be undertaken including those elements tracking well, and any that haven't improved or worsened. Results will be assessed against interim habitat quality scores set out in Table 6.3 for each MNES species. The BioCondition transects and habitat quality scores will be repeated every 2-3 years to track progress against habitat quality objectives, and identify if corrective actions need to be taken. Permanent photo point monitoring will occur at each BioCondition site.	Established Habitat Quality (BioCondition) monitoring sites	All baseline BioCondition transects will be finalised in Year 1. BioCondition assessments and habitat quality scoring will then occur in the following years to ensure regular progress is evaluated, and to coincide with the 5 yearly milestones: Years 3, 5, 7, 10, 12, 15, 17 and 20. Once completion criteria are achieved Pembroke will manage the offset for duration of Project approval. This will be general maintenance activities such as weed control, fire management, grazing management and pest control to maintain habitat quality.	High. The BioCondition methodology is an established method of monitoring condition, developed by the Queensland Herbarium. Monitoring reports will be reviewed by an independent expert every 5 years.
Target MNES species presence, abundance and habitat utilisation						
10. Ornamental Snake	Ensure habitat quality scores are tracking towards outcomes identified in Table 6.3. Ensure management actions identified in Table 4.1 are being implemented, and are successful.	Condition of gilgai (through BioCondition assessment, weed surveys and feral animal surveys).	Habitat assessments to evaluate gilgai ecological condition, considering presence of cracking clays, grass cover, woody debris, weeds, etc. Baseline BioCondition transects will be established in Year 1 across the offset areas. 48 BioCondition (BC) transects have been established to date, and a review will determine if further BC sites are required, including in remnant, regrowth and non-remnant areas. This will ensure adequate representation of vegetation communities and habitat types. Refer Section 3.2.1 and Supporting Report (EMM 2024). In Year 3 BioCondition transects will be re-assessed and habitat quality scores prepared for each MNES species. An analysis of changes will be undertaken including those elements tracking well, and any that haven't improved or worsened. Results will be assessed against interim habitat quality scores set out in Table 6.3 for each MNES species. Photo monitoring points in gilgai. Assess presence of feral pigs in gilgai, and evaluate any negative impacts being caused.	Habitat Quality sites (BioCondition) within mapped Ornamental Snake habitat.	All baseline BioCondition transects will be finalised in Year 1. BioCondition assessments and habitat quality scoring will then occur in the following years to ensure regular progress is evaluated, and to coincide with the 5 yearly milestones (refer Section 4 and Table 4.1for corrective actions). Years 3, 5, 7, 10, 12, 15, 17 and 20. Feral animal baseline survey will occur in Year 1. Feral animal surveys will occur annually between Years 2–Year 5. Then every 2 years from Years 6−20.	High. The BioCondition methodology is an established method of monitoring condition, developed by the Queensland Herbarium. Monitoring reports will be reviewed by an independent expert every 5 years.

Table 6.2 Monitoring for threatened species and offset effectiveness

Monitoring activity	Management needs/questions addressed	Parameter/s measured	Survey/monitoring guidelines	Where	When	Reliability
	Ensure the offset continues to support populations of Ornamental Snake.	Species presence and abundance	Spotlighting in warmer months is the most effective survey method to identify the species. Spotlighting will be completed by suitably qualified ecologist/s. Spotlighting will be completed across representative areas of the Ornamental Snake habitats to confirm presence of Ornamental Snake. Spotlighting will target gilgai, wetlands and riparian habitats. Those areas where species has historically been recorded will be resurveyed (See Stage 2 OAMP Supporting Report (EMM 2024)). Permanent transects will be established across the habitat areas. These will be surveyed at each survey period to support an estimate of population numbers, and how these are changing over time. Each spotlighting survey will be at least 5 consecutive nights for a team of four ecologists, being a minimum of 200 person-hours. These will be planned to be undertaken following rain events to coincide with increased amphibian activity. Data analysis will include counts of occupancy per km and abundance per km, with statistical analysis of significance.	Permanent survey transects within mapped Ornamental Snake habitat.	The first targeted surveys for Ornamental Snake are proposed to occur in Year 2 between late September through to late March when weather conditions are warm, not too dry and maximum temperatures are greater than 25°C on most survey days (Brigalow Belt Reptile Guideline). This is to allow BioCondition transects to be established in Year 1 and suitable locations for Ornamental Snake spotlighting and transects can be assessed. The targeted Ornamental Snake surveys will then be completed every second year being Years 4, 6, 8 and 10. Then targeted Ornamental Snake surveys would be undertaken in Years 13, 16 and 19 as habitat areas will be more established and less change is occurring.	High. Survey methodology will be in accordance with approved guidelines for the target species, published under the EPBC Act. Data will employ robust models of statistical analysis and report on all assumptions and limitations associated with the data used.
	Ensure the offset continues to support populations of Ornamental Snake.	Habitat utilisation and dispersal	Based on spotlighting survey results an evaluation of habitats the species are found in, and their location, will be undertaken. This is to gain a greater understanding of the habitats they are occurring in including remnant, regrowth and non-remnant, condition and any other relevant factors such as climatic conditions. Habitat quality will be monitored through implementation of habitat quality scoring (refer Section 3.2.8). It will also support an understanding of the species distribution across the offset area.		As part of above surveys.	
11. Squatter Pigeon	Ensure habitat quality scores are tracking towards outcomes identified in Table 6.3.	Condition of Squatter Pigeon habitat including foraging resources.	Baseline BioCondition transects will be established in Year 1 across the offset areas. 48 BioCondition (BC) transects have been established to date, and a review will determine if further BC sites are required, including in remnant, regrowth and non-remnant areas. This will ensure adequate representation of vegetation communities and habitat types. Refer Section 3.2.1 and Supporting Report (EMM 2024). In Year 3 BioCondition transects will be re-assessed and habitat quality scores prepared for each MNES species. An analysis of changes will be undertaken including those elements tracking well, and any that haven't improved or worsened. Results will be assessed against interim habitat quality scores set out in Table 6.3 for each MNES species. Photo monitoring points in Squatter Pigeon habitat. Weed surveys will be conducted to determine weed species presence, abundance and distribution.	Habitat Quality sites (BioCondition) within mapped Squatter Pigeon habitat.	All baseline BioCondition transects will be finalised in Year 1. BioCondition assessments and habitat quality scoring will then occur in the following years to ensure regular progress is evaluated, and to coincide with the 5 yearly milestones: Years 3, 5, 7, 10, 12, 15, 17 and 20. Feral animal baseline survey will occur in Year 1. Feral animal surveys will occur annually between Years 2–Year 5. Then every 2 years from Years 6–20. Weed baseline survey will occur in Year 1. Weed monitoring surveys will then occur annually Year 2–Year 10. Weed monitoring will then occur every 2 years from Year 11–Year 20.	High. The BioCondition methodology is an established method of monitoring condition, developed by the Queensland Herbarium. Monitoring reports will be reviewed by an independent expert every 5 years. Collection of high-quality spatial data will ensure weeds and pest animal are accurately tracked over time. Independent monitoring of management actions, annual treatment and regular revision of Weed Management Plan will ensure management is effective and adaptive.
	Ensure the offset continues to support populations of Squatter Pigeon.	Species presence and abundance.	Complete targeted surveys to determine the presence of the species within the offset area. Squatter Pigeon surveys will include: • Diurnal bird surveys between sunrise and 0900 and between 1530 and sunset over minimum of four days. • Camera traps (set up near waterbodies and left out for minimum of 4 weeks). • Driving surveys along dirt tracks.	At the locations established during baseline surveys (see EMM 2024).	The first targeted survey for Squatter Pigeon is proposed to occur in Year 2 between May to October when the species is most actively foraging for grass seed. Squatter Pigeon targeted surveys will occur annually between Years 3 and 5, then every two years for the following 5 years. Then in Years 10, 15 and 20.	High. Survey methodology will be in accordance with approved guidelines for the target species, published under the EPBC Act. Data will employ robust models of statistical analysis and report on all assumptions and limitations associated with the data used.

Table 6.2 Monitoring for threatened species and offset effectiveness

Monitoring activity	Management needs/questions addressed	Parameter/s measured	Survey/monitoring guidelines	Where	When	Reliability
	Ensure the offset continues to support populations of Squatter Pigeon.	Habitat utilisation and dispersal.	Based on targeted survey results an evaluation of habitats the species are found in will be undertaken and their location. This is to gain a greater understanding of the habitats they are occurring in including remnant, regrowth and non-remnant, condition and any other relevant factors such as proximity to water, land zone and other climatic conditions. Habitat quality will be monitored through implementation of habitat quality scoring (refer Section 3.2.8). It will also support an understanding of the species distribution across the offset area. The field surveys will confirm presence of Squatter Pigeon within breeding and foraging habitats.	Within mapped Squatter Pigeon habitat.		High. Survey methodology will be in accordance with approved guidelines for the target species, published under the EPBC Act. Data will employ robust models of statistical analysis and report on all assumptions and limitations associated with the data used.
12. Greater Glider	Ensure habitat quality scores are tracking towards outcomes identified in Table 6.3.	Condition of Greater Glider habitats (through BioCondition assessment, weed surveys, feral animal surveys).	Baseline BioCondition transects will be established in Year 1 across the offset areas. 48 BioCondition (BC) transects have been established to date, and a review will determine if further BC sites are required, including in remnant, regrowth and non-remnant areas. This will ensure adequate representation of vegetation communities and habitat types. Refer Section 3.2.1 and Supporting Report (EMM 2024). In Year 3 BioCondition transects will be re-assessed and habitat quality scores prepared for each MNES species. An analysis of changes will be undertaken including those elements tracking well, and any that haven't improved or worsened. Results will be assessed against interim habitat quality scores set out in Table 6.3 for each MNES species. Photo monitoring points in Greater Glider habitats including representation of remnant, advanced regrowth and cleared areas. Weed surveys will be conducted to determine weed species present, abundance and distribution. Feral animal surveys will be completed to monitor the distribution and abundance of Feral Cats.	Habitat Quality sites (BioCondition) within mapped Greater Glider habitat.	All baseline BioCondition transects will be finalised in Year 1. BioCondition assessments and habitat quality scoring will then occur in the following years to ensure regular progress is evaluated, and to coincide with the 5 yearly milestones: Years 3, 5, 7, 10, 12, 15, 17 and 20. Weed baseline survey will occur in Year 1. Weed monitoring surveys will then occur annually Year 2–Year 10. Weed monitoring will then occur every 2 years from Year 11–Year 20. Feral animal baseline survey will occur in Year 1. Feral animal surveys will occur annually between Years 2–Year 5. Then every 2 years from Years 6−20.	High. The BioCondition methodology is an established method of monitoring condition, developed by the Queensland Herbarium. Monitoring reports will be reviewed by an independent expert every 5 years.
	Effectiveness of actions to improve Greater Glider habitat connectivity are independently audited.	Greater Glider connectivity.	To assess the effectiveness of the management actions in the Stage 2 OAMP to increase Greater Glider *(Petauroides volans)* habitat connectivity in the riparian zones within the Stage 2 environmental offset, the approval holder must engage an independent suitably qualified expert to undertake an assessment every 5 years from the implementation date of the approved Stage 2 OAMP until the approved Stage 2 OAMP offset completion criteria are achieved (refer Section 6.3).	NA	Every 5 years from the implementation date of the approved Stage 2 OAMP an independent expert will be engaged to review the offset outcomes and confirm if connectivity has been improved for Greater Glider. This will occur until the approved Stage 2 OAMP offset completion criteria are achieved.	High. Appointed expert will be suitably qualified and independent of the project.
	Measure increase in Greater Glider habitat connectivity. along riparian corridors.	Monitor revegetation areas: - progress of plantings - utilisation by Gliders - nest box monitoring	Monitoring of the revegetation areas will occur to assess the progress and condition of the revegetated species. This will involve suitable transects to measure increase in canopy cover, canopy height, groundcover, percentage mortality and photo monitoring to show progress of plantings and woodland maturing. Any threats to revegetated species, such as pest animals, weed species, and inappropriate fire will be monitored and any losses of tubestocks will be recorded. Revegetation monitoring will be augmented by monitoring of Greater Glider use of these revegetation areas through establishment of permanent transects. Linear transects will be established that are 500 m long in representative sections of the planting areas. At least 6 permanent transects will be established. Transects will be surveyed via spotlighting with or without supplementary use of camera traps to determine presence of Greater Glider. Transects will be completed before and after planting. The permanent linear transects will be surveyed at the same time each year to determine presence of Greater Glider. To supplement riparian connectivity nest boxes are also proposed to be installed as outlined in Section 4.2.7. Nest box usage will also be monitored – see below.	Within 'riparian habitat restoration' zone, 'connectivity restoration' zone and 'nest box augmentation' zone – see Figure 4.1.	Monitoring of revegetation areas will occur annually for five years. This will be from the time the area is planted. Eg, if an area is planted in Year 4, annual monitoring will occur for another 5 years (through to Year 9). This is to ensure the trees are self-sustaining at this time. The spotlighting transects in revegetation areas will occur at same frequency as other Greater Glider population monitoring. The first targeted surveys for Greater Glider are proposed to occur in Year 2. The targeted Greater Glider surveys will then be completed every 2 years being Years 4, 6, 8 and 10. Surveys will then go to Years 13, 16 and 19. Timing would be around start of Spring.	High. Survey methodology will be in accordance with approved guidelines for the target species, published under the EPBC Act. Data will employ robust models of statistical analysis and report on all assumptions and limitations associated with the data used. Data will be independently reviewed by a suitably qualified expert. Revegetated areas will be planned, implemented and monitored in accordance with the *National standards for the practice of ecological restoration in Australia* (SER Australia 2018).

Table 6.2 Monitoring for threatened species and offset effectiveness

Monitoring activity	Management needs/questions addressed	Parameter/s measured	Survey/monitoring guidelines	Where	When	Reliability
	Ensure the offset continues to support populations of Greater Glider.	Species presence and abundance.	Complete targeted surveys to determine the presence of the species within the offset area. Greater Glider surveys will be primarily focused on spotlighting as this is the most effective survey technique. All habitat types will be surveyed, in particular riparian communities that support hollows. Locations where the species have been previously recorded will be surveyed as shown in Figure 3.7, as well as additional areas of remnant and advanced regrowth areas. Each spotlighting survey will be at least 5 consecutive nights for a team of four ecologists, being a minimum of 200 person-hours.	Within mapped Greater Glider habitat.	The first targeted survey for Greater Glider is proposed to occur in Year 2. This is to allow BioCondition transects to be established in Year 1 and suitable Greater Glider habitat survey locations to be evaluated. The targeted Greater Glider surveys will then be completed every 2 years being Years 4, 6, 8 and 10. Then targeted Greater Glider surveys would be undertaken in Years 13, 16 and 19. Timing would be around start of Spring.	High. Survey methodology will be in accordance with approved guidelines for the target species, published under the EPBC Act.
	Ensure the offset continues to support populations of Greater Glider.	Habitat utilisation and dispersal.	When Greater Gliders are detected their location and trees in which they are present will be recorded. This will assist to assess habitat utilisation and dispersal across the offset site.	Within mapped Greater Glider habitat.	During Greater Glider surveys.	High. Surveys will be conducted by suitably qualified ecologists with experience in Greater Glider ecology and habitat utilisation (e.g. tree species identification).
	Measure increase in Greater Glider habitat connectivity along riparian corridors.	Nest box usage.	Cameras will be used to determine if Greater Gliders are using nest boxes, or if other species are competing for nest boxes. Direct observations will also be used as a survey method using extended poles with cameras, as well as watching hollows at dusk for animals to emerge from nest boxes.	Within Greater Glider nest box augmentation zone.	Monitoring by suitably qualified persons will include quarterly inspections during the first year which will enable occupation timing to be documented. Following the first year, monitoring of installed nest boxes will occur annually in spring and winter for the next two years, and will then be reduced to biennial monitoring (every 2 years) following a review of the monitoring results. Refer Section 4.2.7 for details on nest box installation and monitoring program.	High. Surveys will be conducted by suitably qualified ecologists with experience in Greater Glider ecology and habitat utilisation (e.g. tree species identification).
13. Koala	Ensure habitat quality scores are tracking towards outcomes identified in Table 6.3. Ensure management actions identified in Table 4.1 are being implemented, and are successful.	Condition of Koala habitats (through BioCondition assessment, weed surveys).	Baseline BioCondition transects will be established in Year 1 across the offset areas. 48 BioCondition (BC) transects have been established to date, and a review will determine if further BC sites are required, including in remnant, regrowth and non-remnant areas. This will ensure adequate representation of vegetation communities and habitat types. Refer Section 3.2.1 and Supporting Report (EMM 2024). In Year 3 BioCondition transects will be re-assessed and habitat quality scores prepared for each MNES species. An analysis of changes will be undertaken including those elements tracking well, and any that have not improved or worsened. Results will be assessed against interim habitat quality scores set out in Table 6.3 for each MNES species. Photo monitoring points in Koala habitats including representation of remnant, advanced regrowth and cleared areas. Weed surveys will be conducted to determine weed species present, abundance and distribution.	Habitat Quality sites (BioCondition) within mapped Koala habitat.	All baseline BioCondition transects will be finalised in Year 1. BioCondition assessments and habitat quality scoring will then occur in the following years to ensure regular progress is evaluated, and to coincide with the 5 yearly milestones: Years 3, 5, 7, 10, 12, 15, 17 and 20. Weed baseline survey will occur in Year 1. Weed monitoring surveys will then occur annually Year 2–Year 10. Weed monitoring will then occur every 2 years from Year 11–Year 20.	High. The BioCondition methodology is an established method of monitoring condition, developed by the Queensland Herbarium. Monitoring reports will be reviewed by an independent expert every 5 years.
	Ensure the offset continues to support populations of Koala.	Species presence and abundance.	Complete Koala surveys to determine the presence of the species within the offset area. Koala surveys will include: • Thermal drone detection surveys • Indirect survey methods such as looking for scratches and scats (particularly focused along riparian corridors) • Spotlighting (sampling all habitat types) • Call playback (performed during spotlighting)	Within mapped Koala habitat.	The first targeted survey for Koalas is proposed to occur in Year 2 between August and January when Koala activity is at its peak. This is to allow BioCondition transects to be established in Year 1 and suitable Koala habitat survey locations to be evaluated. The targeted Koala surveys will then be	High. Survey methodology will be in accordance with approved guidelines for the target species, published under the EPBC Act.

Table 6.2 Monitoring for threatened species and offset effectiveness

Monitoring activity	Management needs/questions addressed	Parameter/s measured	Survey/monitoring guidelines	Where	When	Reliability
			• Koala detection dogs (will trial this survey method to confirm presence of individuals)		completed every 2 years being Years 4, 6, 8 and 10. Koala monitoring surveys will occur between August and January. Then targeted Koala surveys would then be undertaken in Years 13, 16 and 19. Feral animal baseline survey will occur in Year 1. Feral animal surveys will occur annually between Years 2–Year 5. Then every 2 years from Years 6–20.	
	Ensure the offset continues to support populations of Koala.	Population numbers and health.	Where koalas are detected on site assessments of individual health will be carried out. This will include size, estimated age, sex, colouring, any young present, health such as any signs of chlamydia. Results of koala surveys will be used to assist in determining population numbers and changes over time on the offset site and their dispersal across the offset.			High. Survey methodology will be in accordance with approved guidelines for the target species, published under the EPBC Act. Data will employ robust models of statistical analysis and report on all assumptions and limitations associated with the data used.
	Ensure the offset continues to support populations of Koala.	Habitat utilisation and dispersal.	When Koalas are detected, their location and trees they are present in will be recorded. This will assist in assessing habitat utilisation and dispersal across the offset site.	Within mapped Koala habitat.		High. Surveys will be conducted by suitably qualified ecologists with experience in Koala ecology and habitat utilisation (e.g. tree species identification)
	Measure increase in Koala habitat connectivity along riparian corridors.	Increase habitat connectivity along riparian corridors.	Monitoring of the revegetation areas will occur to assess the health and growth of the revegetated species. This will involve suitable transects to measure increase in canopy cover, canopy height, groundcover, tree health and photo monitoring to show progress of plantings and woodland maturing. Any threats to revegetated species, such as pest animals, weed species, cattle, will be monitored and any losses of tubestocks will be recorded.	Within 'riparian habitat restoration' zone, 'connectivity restoration' zone – see Figure 4.1.	Monitoring of revegetation areas will occur annually for five years. This will be from the time the area is planted. So if an area is planted in Year 4, annual monitoring will occur for another 5 years post that. This is to ensure the trees are self-sustaining at this time.	High. Revegetated areas will be planned, implemented and monitored in accordance with the *National standards for the practice of ecological restoration in Australia* (SER Australia 2018).
	Ensure management actions identified in Table 4.1 are being implemented, and are successful.	Evidence of predation.	During Koala surveys any deceased koalas will be noted. Signs of dog attack will be recorded. Feral animal surveys will also note any wild dogs observed. Feral animal monitoring will occur through deployment of baited camera traps to determine their presence, e.g. wetland and gilgai areas for feral pigs. The same camera trap locations will be repeated each monitoring event to gauge presence of feral animal species and any change in numbers. Minimum of 20 cameras would be deployed. The baited camera traps will be set up across the offset area in particular key habitats. Camera traps will be left out for four weeks. Spotlighting for presence of feral animals will also be undertaken.	Within mapped Koala habitat.	During above Koala surveys and feral animal surveys.	High. Survey methodology will be in accordance with approved guidelines for the target species, published under the EPBC Act. Data will employ robust models of statistical analysis and report on all assumptions and limitations associated with the data used.

6.3 Completion criteria and interim milestones

Table 6.3 provides a summary of the targeted habitat quality score increases for each MNES species over the 20-year management timeframe of the Stage 2 Offset Area. The first 20 years of the Project will involve intensive on-ground management of the offset area; Pembroke will continue to monitor habitat quality for the duration of the Project approval, and it is anticipated that reduced general maintenance and management will be required after 20 years.

Table 6.3 includes interim milestones, relevant to each species, to measure the progress of ongoing management. Interim scores will be calculated (applying BioCondition methods) in five-year intervals to determine where (and how) further gains in habitat quality can be achieved. Note that general improvement across the spectrum of site-based attributes is expected, and interim milestone scores may be exceeded. For example, an increase in native perennial grass cover percentage (an interim milestone for Squatter Pigeon) is likely to lead to a corresponding increase in native grass species richness, and therefore an increase in the habitat quality score. Details regarding the starting scores for habitat quality can be found in the supporting documentation provided to DCCEEW (EMM 2024).

Note that species-specific habitat quality scores were utilised in the EPBC offset calculators to demonstrate the appropriateness of the Stage 2 Offset Area to offset residual impacts to MNES associated with Stage 2 of the Olive Downs mine. Refer to the Stage 2 Offset Area Management Plan Supporting Report (EMM 2024) for further information.

Table 6.3 Habitat quality milestones

Species	Habitat quality scores				
	0 years (starting score)	5 years	10 years	15 years	20 years (final score)
Ornamental Snake	4.6	5.2 • Increase in the amount of coarse woody debris available to provide sheltering habitat for the species, or their preferred prey; target score in relevant AUs is 2. • Reduction in non-native plant cover percentage; high percentage cover of non-native plants may negatively impact the species or their preferred prey. Target score in relevant AUs is 3. • Increase in the amount of organic litter cover available to provide sheltering habitat for the species or their preferred prey; target score in relevant AUs is 3. • Evidence of Ornamental Snake utilising mapped habitats. • Reduction in feral cat populations by 10% from established baseline. • Reduction in pugging and soil compaction in gilgai habitats due to livestock exclusion at certain times of year.	5.8 • Continued increase in / maintenance of the amount of coarse woody debris; target score in relevant AUs is 2. • Continued reduction in / maintenance of non-native plant cover percentage; target score in relevant AUs is 5. • Continued increase in / maintenance of the amount of organic litter cover; target score in relevant AUs is 3. • Evidence of Ornamental Snake utilising mapped habitats. Ornamental Snake utilisation (i.e. number of individuals observed) has increased 5% from baseline survey. • Reduction in feral cat populations by 20% from established baseline. • Continued reduction of disturbance in gilgai habitats leads to an increase in the availability of soil crack refugia.	6.1 • Continued increase in / maintenance of the amount of coarse woody debris to provide sheltering habitat for the species; target score in relevant AUs is 5. • Continued reduction in / maintenance of non-native plant cover percentage; target score in relevant AUs is 5. • Continued increase in / maintenance of the amount of organic litter; target score in relevant AUs is 5. • Evidence of Ornamental Snake utilising mapped habitats. Ornamental Snake utilisation (i.e. number of individuals observed) has increased 10% from baseline survey. • Reduction in feral cat populations by 30% from established baseline. • Ongoing increase in the availability of soil crack refugia due to ungulate exclusion from gilgai habitats at certain times of year.	6.4 • Continued increase in / maintenance of the amount of coarse woody debris to provide sheltering habitat for the species; target score in relevant AUs is 5. • Continued reduction in / maintenance of non-native plant cover percentage; target score in relevant AUs is 10. • Continued increase in / maintenance of the amount of organic litter cover; target score in relevant AUs is 5. • Evidence of Ornamental Snake utilising mapped habitats. Ornamental Snake utilisation (i.e. number of individuals observed) has increased 15% from baseline survey. • Reduction in feral cat populations by 50% from established baseline. • Ongoing increase in the availability of soil crack refugia due to ungulate exclusion from gilgai habitats at certain times of year.
Squatter Pigeon (breeding)*	4.7	5.2 • Increase in native shrub cover percentage, providing shelter and foraging opportunities for the species; target score in relevant AUs is 3. • Increase in native perennial grass cover percentage, providing shelter and foraging opportunities for the species; target score in relevant AUs is 1. • Reduction in non-native plant cover percentage, particularly that of Buffel Grass, which may negatively impact the species; target score in relevant AUs is 3. • Reduction in feral cat populations by 10% from established baseline. • Maintenance of water resources and water quality by excluding livestock from watercourses. Dams will be maintained to provide additional water sources. • Evidence of Squatter Pigeon utilising mapped habitats during monitoring surveys.	5.6 • Continued increase in / maintenance of native shrub cover; target score in relevant AUs is 5. • Continued increase in / maintenance of native perennial grass cover; target score in relevant AUs is 3. • Continued reduction in / maintenance of non-native plant cover; target score in relevant AUs is 5. • Reduction in feral cat populations by 20% from established baseline • Ongoing maintenance of water resources and water quality. • Evidence of Squatter Pigeon utilising mapped habitats. Squatter Pigeon utilisation (i.e. number of individuals observed) has increased 10% from baseline survey.	5.8 • Continued increase in / maintenance of native shrub cover; target score in relevant AUs is 5. • Continued increase in / maintenance of native perennial grass cover; target score in relevant AUs is 5. • Continued reduction in / maintenance of non-native plant cover; target score in relevant AUs is 5. • Reduction in feral cat populations by 30% from established baseline. • Ongoing maintenance of water resources and water quality. • Evidence of Squatter Pigeon utilising mapped habitats. Squatter Pigeon utilisation (i.e. number of individuals observed) has increased 15% from baseline survey.	6.4 • Continued increase in / maintenance of native shrub cover; target score in relevant AUs is 5. • Continued increase in / maintenance of native perennial grass cover; target score in relevant AUs is 5. • Continued reduction in / maintenance of non-native plant cover; target score in relevant AUs is 10. • Reduction in feral cat populations by 50% from established baseline. • Ongoing maintenance of water resources and water quality. • Evidence of Squatter Pigeon utilising mapped habitats. Squatter Pigeon utilisation (i.e. number of individuals observed) has increased 20% from baseline survey.
Squatter Pigeon (foraging)	4.4	4.9 • Increase in native shrub cover percentage, providing increased shelter and foraging opportunities for the species; target score in relevant AUs is 3. • Increase in native perennial grass cover percentage, providing increased shelter and foraging opportunities for the species; target score in relevant AUs is 1. • Reduction in non-native plant cover percentage, particularly that of Buffel Grass, which may negatively impact the species; target score in relevant AUs is 3. • Reduction in feral cat populations by 10% from established baseline. • Maintenance of water resources and water quality by excluding livestock from watercourses. Dams will be maintained to provide additional water sources. • Evidence of Squatter Pigeon utilising mapped habitats during monitoring surveys.	5.3 • Continued increase in / maintenance of native shrub cover; target score in relevant AUs is 5. • Continued increase in / maintenance of native perennial grass cover; target score in relevant AUs is 3. • Continued reduction in / maintenance of non-native plant cover; target score in relevant AUs is 5. • Reduction in feral cat populations by 20% from established baseline. • Ongoing maintenance of water resources and water quality. • Evidence of Squatter Pigeon utilising mapped habitats. Squatter Pigeon utilisation (i.e. number of individuals observed) has increased 10% from baseline survey.	5.5 • Continued increase in / maintenance of native shrub cover; target score in relevant AUs is 5. • Continued increase in / maintenance of native perennial grass cover; target score in relevant AUs is 5. • Continued reduction in / maintenance of non-native plant cover; target score in relevant AUs is 5. • Reduction in feral cat populations by 30% from established baseline. • Ongoing maintenance of water resources and water quality. • Evidence of Squatter Pigeon utilising mapped habitats. Squatter Pigeon utilisation (i.e. number of individuals observed) has increased 15% from baseline survey.	6.1 • Continued increase in / maintenance of native shrub cover; target score in relevant AUs is 5. • Continued increase in / maintenance of native perennial grass cover; target score in relevant AUs is 5. • Continued reduction in / maintenance of non-native plant cover; target score in relevant AUs is 10. • Reduction in feral cat populations by 50% from established baseline. • Ongoing maintenance of water resources and water quality. • Evidence of Squatter Pigeon utilising mapped habitats. Squatter Pigeon utilisation (i.e. number of individuals observed) has increased 20% from baseline survey.

Table 6.3 Habitat quality milestones

Species	Habitat quality scores				
	0 years (starting score)	5 years	10 years	15 years	20 years (final score)
Greater Glider	4.4	5.0 • Increase in tree canopy height, providing increased shelter and foraging opportunities for the species; target score in relevant AUs is 3. • Increase in tree canopy cover percentage, providing increased shelter and foraging opportunities for the species; target score in relevant AUs is 2. • Increase in native shrub cover percentage, providing increased shelter and foraging opportunities for the species; target score in relevant AUs is 3. • Reduction in non-native plant cover percentage, particularly that of Buffel Grass, which may negatively impact the species through increased likelihood of hot fires; target score in relevant AUs is 3. • Reduction in feral cat populations by 10% from established baseline. • Evidence of Greater Glider utilising mapped habitats during monitoring surveys.	5.4 • Continued increase in / maintenance of tree canopy height; target score in relevant AUs is 3. • Continued increase in / maintenance of tree canopy cover percentage; target score in relevant AUs is 2. • Continued increase in / maintenance of native shrub cover; target score in relevant AUs is 5. • Continued reduction in / maintenance of non-native plant cover; target score in relevant AUs is 5. • Reduction in feral cat populations by 20% from established baseline. • Evidence of Greater Gliders utilising mapped habitats. Greater Glider utilisation (i.e. the number of individuals observed) has increased 10% from baseline survey.	5.8 • Continued increase in / maintenance of tree canopy height; target score in relevant AUs is 5. • Continued increase in / maintenance of tree canopy cover percentage; target score in relevant AUs is 5. • Continued increase in / maintenance of native shrub cover; target score in relevant AUs is 5. • Continued reduction in / maintenance of non-native plant cover; target score in relevant AUs is 5. • Reduction in feral cat populations by 30% from established baseline. • Evidence of Greater Gliders utilising mapped habitats. Greater Glider utilisation (i.e. the number of individuals observed) has increased 15% from baseline survey.	6.4 • Continued increase in / maintenance of tree canopy height; target score in relevant AUs is 5. • Continued increase in / maintenance of tree canopy cover percentage; target score in relevant AUs is 5. • Continued increase in / maintenance of native shrub cover; target score in relevant AUs is 5. • Continued reduction in / maintenance of non-native plant cover; target score in relevant AUs is 10. • Reduction in feral cat populations by 50% from established baseline. • Evidence of Greater Gliders utilising mapped habitats. Greater Glider utilisation (i.e. the number of individuals observed) has increased 20% from baseline survey.
Koala	5.5	6.0 • Increase in tree canopy height, providing increased shelter and foraging opportunities for the species; target score in relevant AUs is 3. • Increase in tree canopy cover percentage, providing increased shelter and foraging opportunities for the species; target score in relevant AUs is 2. • Increase in native shrub cover percentage, providing increased shelter and foraging opportunities for the species; target score in relevant AUs is 3. • Reduction in non-native plant cover percentage, particularly that of Buffel Grass, which may negatively impact the species through increased likelihood of hot fires; target score in relevant AUs is 3. • Evidence of Koalas utilising mapped habitats during monitoring surveys. This may be through detection of scats or scratches or by observing individuals.	6.4 • Continued increase in / maintenance of tree canopy height; target score in relevant AUs is 3. • Continued increase in / maintenance of tree canopy cover percentage; target score in relevant AUs is 2. • Continued increase in / maintenance of native shrub cover; target score in relevant AUs is 5. • Continued reduction in / maintenance of non-native plant cover; target score in relevant AUs is 5. • Evidence of Koalas utilising mapped habitats. Koala utilisation (i.e. the amount of evidence of the species observed) has increased 10% from baseline survey.	6.8 • Continued increase in / maintenance of tree canopy height; target score in relevant AUs is 5. • Continued increase in / maintenance of tree canopy cover percentage; target score in relevant AUs is 5. • Continued increase in / maintenance of native shrub cover; target score in relevant AUs is 5. • Continued reduction in / maintenance of non-native plant cover; target score in relevant AUs is 5. • Evidence of Koalas utilising mapped habitats. Koala utilisation (i.e. the amount of evidence of the species observed) has increased 15% from baseline survey.	7.4 • Continued increase in / maintenance of tree canopy height; target score in relevant AUs is 5. • Continued increase in / maintenance of tree canopy cover percentage; target score in relevant AUs is 5. • Continued increase in / maintenance of native shrub cover; target score in relevant AUs is 5. • Continued reduction in / maintenance of non-native plant cover; target score in relevant AUs is 10. • Evidence of Koalas utilising mapped habitats. Koala utilisation (i.e. the amount of evidence of the species observed) has increased 10% from baseline survey.

* Note that the only difference in habitat quality scoring for the two habitat types associated with the Squatter Pigeon is 'distance to permanent water' (which will not be altered by potential management actions); as such, the habitat quality scores are very similar.

7 Roles and responsibilities

The responsibility for the satisfaction of this OAMP belongs to Pembroke.

Pembroke will ultimately be responsible for the management of the Offset Areas in accordance with this OAMP.

Pembroke will engage the following specialists person/s as required in accordance with this OAMP.

- Suitably qualified person/s (SQP) to undertake baseline and monitoring surveys
- SQP planting to undertake regeneration programs
- Weed control SQPsto undertake weed management programs
- SQP to implement grazing management programs
- Pest animal control SQPs to implement pest control
- SQPs for maintenance or installation activities, such as fencing
- SQP with appropriate licences to undertake fire management activities including controlled burns.

It will be the responsibility of these contractors to undertake their operations in accordance with this OAMP, as applicable and as directed by Pembroke.

8 Reporting

8.1 Annual reporting

Environmental offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced. To support transparent governance arrangements, and demonstrate compliance with the OAMP, regular compliance and monitoring reporting is proposed to occur as per approval conditions for EPBC 2017/7867 and conditions 4i-k (EPBC 2017/7868, 2017/7896 and 2017/7870).

An Annual Report will be prepared and submitted to DCCEEW for their information.

The Annual Report is proposed to be submitted by 30 June each year. This date is to allow for the main monitoring periods in late Summer – early Autumn each year to be completed, and adequate time for report preparation to occur.

The Annual Report will be prepared by suitably qualified personnel with experience in offset management and threatened species, and will be signed off by Pembroke.

The Annual Report will include:

- description of all management actions that have been completed in that 12-month period
- description of grazing management activities that were completed and results including a report prepared by the grazing manager as outlined in Table 6.2
- description of pest management activities that were completed and results
- description of the monitoring activities that were completed and results (Approval conditions for 2017/7867)
- habitat quality scores, using the *Guide to Determining Terrestrial Habitat Quality v 1.3* (DES 2020), (for those years when they are required) for each MNES species and how they are tracking against relevant interim 5-yearly goals (refer Section 3.2.8 and Table 6.3; see also Appendix A)
- identification of any constraints to monitoring and management actions over that timeframe (e.g. inability to access offset area due to flooding, etc)
- how any risks or threats have impacted on the area (e.g. drought period therefore lack of growth)
- photos from photo monitoring points
- identification of any risks or potential threats to the offset and offset values that have become apparent and how they will be addressed
- any corrective actions implemented during the 12-month period
- any learnings from implementation of the OAMP and monitoring
- any proposed changes to the OAMP and justification.

8.2 Reporting non-compliance

Non-compliances with the actions in this OAMP, or the conditions of approval, will be reported to DCCEEW in writing in accordance with the conditions of approval.

A non-compliance will be reported as soon as possible and no later than 30 business days after becoming aware of the non-compliance.

8.3 Adaptive management

An adaptive implementation program will be used to ensure uncertainty is reduced over time, and that completion criteria are attained and maintained over the period of approval. As more information becomes available following ongoing performance monitoring, the management and monitoring regime will be reviewed and revised to maximise the likelihood of attaining and maintaining the outcomes to be achieved by implementing the OAMP. The review and updated management actions will occur as part of the annual review process for the stage 2 offset area.

Any updates to the OAMP which do not result in a material change to the environmental outcomes or completion criteria will be made by Pembroke without the requirement of informing DCCEEW. If material amendments are determined as likely to alter the environmental outcomes, or performance and completion criteria they will be proposed to the OAMP. The recommended material amendments and justification for the contingency measures will be provided to DCCEEW in writing for their review and approval within three months of the annual review period

An example of adaptive management will be revisions to the OAMP to include information following the baseline monitoring surveys proposed for Year 1 of offset implementation. The following types of information may be updated in the OAMP as part of an annual review:

- Figures showing types and locations of features to be targeted for management, with the aim of achieving the ecological outcomes (such as weed infestations to be targeted, areas to be revegetated/regenerated, access restrictions, infrastructure such as fences and tracks to be maintained or removed, disturbances/threats to be managed, additional records or sightings)
- Figures showing monitoring sites
- Update of management measures as appropriate and for site-specific requirements
- Update of MNES species information and utilisation of habitats.

Adaptive management may also allow for:

- assimilation of new data or information - such as, updates to conservation advice or new threat abatement plans
- new information that becomes available on survey techniques or management actions.

8.4 Baseline data reporting

Pembroke will ensure that all baseline monitoring is completed in the given timeframe outlined in this OAMP. Baseline data will be used to track progress of management measures outlined in this OAMP. Following the completion of baseline monitoring, all baseline data will be provided to DCCEEW. This will include results from field validated surveys, and quantifiable ecological data on habitat quality and other supporting evidence that documents the presence of each listed threatened species and the quality of each listed threatened species habitat within the offset area

8.5 Management plan reporting

8.5.1 Weed Management Plan

The weed management plan will be prepared following baseline monitoring in year 1 and updated every three years. Pembroke will provide this plan to DCCEEW upon completion. The weed management plan will provide specific detail regarding the weeds to be targeted, appropriate control methods and timing.

8.5.2 Revegetation Management Plan

The revegetation management plan will be prepared in year 2. Pembroke will provide the revegetation management plan to DCCEEW upon completion. The revegetation management plan will be prepared by Pembroke and a suitably qualified person identifying preparation works, planting methodology and monitoring.

8.5.3 Bushfire Management plan

The bushfire management plan will be prepared in year 1 and will be maintained each year thereafter. Pembroke will provide the bushfire management plan to DCCEEW upon completion or as supplementary information to the annual report. The bushfire management plan will be prepared by a suitably qualified person to plan for bushfire prevention.

8.6 Data management

Pembroke will ensure that all data collected as part of the OAMP implementation is managed and stored appropriately. A data management framework will be established to ensure proper data quality assurance, storage and protection occurs.

Key features of the data management will be:

- Spatial data collection proformas for use in the field to ensure robust data is collected, and in a consistent manner.
- Establishment of a geodatabase for management of spatial data.
- Standardised data collection methods by qualified personnel, particularly for monitoring so that it is completed consistently each year to enable comparison of results.
- Quality assurance review process by suitably qualified persons.
- Version control of data and reports.
- Appropriately stored information for future use and reference.

8.7 Audits

In addition to any audit required under EPBC conditions of approval, self-auditing will be undertaken over the life of the offset to verify OAMP implementation is occurring, and progress towards the management outcomes and completion criteria are being achieved. Pembroke will commission this self-auditing to occur as part of the ongoing monitoring program (as detailed in Section 6) and every five years as part of a more formal review of the success of management actions and effectiveness of the OAMP. This is to meet Condition 15 (EPBC 2017/7867) for monitoring reporting. Corrective actions will be undertaken if standards are not met (Section 4 and Table 4.1).

Systems for recording management action implementation and performance will be auditable, and include details of who, what, where and how implementation and performance were identified and/or assessed. This will include Pembroke keeping records of information such as:

- Contractors' expense claims for chemicals and materials for actions such as weed management, fence construction and maintenance, pest animal control, establishing and maintaining fire breaks.
- Engagement of contractors to complete particular tasks such as feral animal control, direct seeding and tree planting, fire management and associated invoices.
- Engagement of contractors to undertake ecological monitoring, spatial data and associated reports.
- Any internal staff conducting an internal audit and inspection of the offset site and key findings.

8.8 Five yearly report

At the completion of every five years a report will be prepared to assess how the offset is tracking for each MNES against the completion criteria set out in Table 6.3. The report will include recommendations and justification for any changes to the OAMP that are required. This will include discussion on progress against set interim milestones, any corrective actions implemented, and adaptive management changes that are justified.

To meet conditions of approval (2017/7867 – conditions 15 and 16) the following will be undertaken and included as part of the 5 yearly reports:

1. To assess the effectiveness of the management actions in the Stage 2 OAMP to increase Greater Glider (*Petauroides volans*) habitat connectivity in the riparian zones within the Stage 2 environmental offset, the approval holder must engage an independent suitably qualified expert to undertake an assessment every 5 years from the implementation date of the approved Stage 2 OAMP until the approved Stage 2 OAMP offset completion criteria are achieved.

2. The approval holder must ensure each assessment of the effectiveness of the management actions in the Stage 2 OAMP is:

    a) Subject to a peer-review completed within 6 months of the completion of each such assessment.

    b) Published on its website with the findings of the peer-review within 6 months of the completion of the peer-review and for the duration of this approval.

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Appendix A
Implementation schedule

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A.1 Implementation schedule

Table A.1 Implementation schedule

Activity	Management actions	Management years																				Timing	Related monitoring
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Post 20 years - Remainder of Project duration	
Offset admin	Audits of management actions	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		April. Annual report due June.	Assess tasks have been completed with the approved OAMP Annual report prepared See Table 6.2 monitoring activity 1
	Corrective actions	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		Within 3 months of identifying corrective action is required.	Implement corrective actions when required See Table 6.2 monitoring activity 2 and 3
	Assess effectiveness of environmental controls implemented					✓					✓					✓					✓		End of each 5 years. Formal review of OAMP.	Review of monitoring programs See Table 6.2 monitoring activity 2 and 4
	Legally binding mechanism to secure offset	✓		✓																			Voluntary Declaration (Vegetation Management Act 1999) within 12 months of approval Nature Refuge Agreement (Nature Conservation Act 1992) within 3 years	See Section 4.2.10
Weed management	Weed baseline survey	✓																					During Year 1	Establish permanent weed monitoring transects and photo points. See Table 6.2 activity 5
	Weed monitoring surveys		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Annually Year 2-20. Post year 20 weed mg't will continue and surveys will be done every second year.	
	Weed management plan	✓			✓			✓			✓			✓			✓			✓			Prepared in Year 1 and reviewed and updated every 3 years	See Table 6.2 activity 5
	Weed treatment activities	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		Weed treatment activities reported annually	See Table 6.2 activity 5
Feral animal management	Feral animal baseline survey	✓																					During Year 1	Establish baited camera traps Spotlighting in conjunction with Ornamental Snake and Koala monitoring See Table 6.2 activity 6
	Feral animal surveys		✓	✓	✓	✓	✓		✓		✓		✓		✓		✓		✓		✓	✓	Annually Years 2-5. Every second year 6-20. Post year 20 feral animal mg't will continue.	
Fire management	Monitor fuel loads	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Monitor fuel loads at end of wet season (prior to dry season) will continue as per OAMP.	Fuel reduction burns as required by BMP See Table 6.2 activity 7
	Assess firebreaks (fences and tracks)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Annually, prior to fire danger season	
	Cool/mosaic burning	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	As required (annual burn plans will indicate when these take place)	
	Bushfire management plan	✓			✓			✓			✓			✓			✓			✓			Prepared in Year 1. Review and reissue every 3 years	
Grazing management	Monitor fuel loads	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Annually	Monitor fuel loads, survey fences and assess grazed areas for effectiveness See Table 6.2 activity 8
	Maintaining fences	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Annually	
	Assess grazed areas	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	As required	

Table A.1 Implementation schedule

Activity	Management actions	Management years																				Timing	Related monitoring
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Post 20 years - Remainder of Project duration	
Habitat quality	Habitat quality assessments (Permanent BioCondition transects)	✓		✓		✓		✓			✓		✓			✓		✓			✓		Baselines to be established in Year 1. Habitat quality/BioCondition to be scored Years 3, 5, 7, 10, 12, 15, 17 and 20 and to coincide with the 5 yearly milestones.	BioCondition assessments and habitat quality scoring. Habitat assessment for each MNES See Table 6.2 activity 9
Ornamental Snake surveys	Targeted surveys		✓		✓		✓		✓		✓			✓			✓			✓			The first targeted surveys for Ornamental Snake are proposed to occur in Year 2, then be completed years 4, 6, 8 10, 13, 16 and 19 Between late September to late March	Spotlighting along permanent transects See Table 6.2 activity 10
Koala surveys	Targeted surveys		✓		✓		✓		✓		✓			✓			✓			✓			The first targeted survey for Koalas is proposed to occur in Year 2. Then Years 4, 6, 8, 10, 13, 16 and 19. Between August and January	SAT surveys (permanent transects are chosen and replicated) Thermal drone detection surveys Indirect survey methods such as looking for scratches and scats (particularly focused along riparian corridors) Spotlighting (sampling all habitat types) Call playback (done during spotlighting) Health assessments and location assessments See Table 6.2 activity 13
	Measure increase in Koala habitat connectivity along riparian corridors.				✓	✓	✓	✓	✓	✓	✓	✓											Annually for five years post plantings. This will be from the time the area is planted.	
Squatter Pigeon surveys	Targeted surveys	✓	✓	✓	✓		✓		✓	✓						✓					✓		The first targeted survey for Squatter Pigeon is proposed to occur in Year 2, annually between Years 3 and 5, then every two years for the following 5 years. Then in Years 10, 15 and 20. Between May and October	Diurnal surveys and camera traps See Table 6.2 activity 11
Greater Glider surveys	Targeted glider surveys	✓		✓		✓		✓		✓				✓			✓			✓			The first targeted surveys for Greater Glider are proposed to occur in Year 2. The targeted Greater Glider surveys will then be completed every 2 years being Years 4, 6, 8 and 10. Surveys will then go to Years 13, 16 and 19. Timing would be around start of Spring.	Spotlighting Nest box monitoring See Table 6.2 activity 12
	Effectiveness of actions to improve Greater Glider habitat connectivity are independently audited.					✓					✓					✓					✓	✓	Every 5 years from the implementation date of the approved Stage 2. This will occur until the approved Stage 2 OAMP offset completion criteria are achieved.	
	Measure increase in Greater Glider habitat connectivity. along riparian corridors.				✓	✓	✓	✓	✓	✓	✓	✓											Annually for five years post plantings. This will be from the time the area is planted.	
	Survey of Greater Glider connectivity in revegetation areas				✓		✓		✓		✓			✓			✓			✓			Linear spotlighting transects. Every second year up to Year 10. Then every 3 years to Year 20.	

Table A.1 Implementation schedule

Activity	Management actions	Management years																				Timing	Related monitoring
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Post 20 years - Remainder of Project duration	
	Nest boxes	✓	✓	✓		✓		✓		✓		✓		✓		✓		✓		✓			Quarterly during Year 1, then in Spring and Winter for Years 2 and 3. Then every two years in Spring.	
Reporting	Annual Report	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		By June 30 each year	Section 7.1
	5 Yearly Reports (includes peer reviews)					✓					✓					✓					✓		Every 5 years	Section 7.4

Appendix B
Indirect Offsets Plan

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Indirect Offset Plan

Olive Downs (Stage 2)

Prepared for Pembroke Olive Downs Pty Ltd

May 2024

Indirect Offset Plan

Olive Downs (Stage 2)

Pembroke Olive Downs Pty Ltd

E220619 RP#13

May 2024

Version	Date	Prepared by	Reviewed by	Comments
1	16/04/2024	Berlinda Ezzy Lindsay Wickson	Sandra Walters	Draft for client review
2	27/05/2024	Berlinda Ezzy	Andrew Jensen	Final
3	06/02/2025	Rebecca Simpson	Ann Stray	Addressed feedback from DCCEEW
4	05/04/2025	Client	Client	Final updates based upon DCCEEW feedback

Approved by

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1 Introduction

The development of the coal mining precinct in the northern Bowen Basin has resulted in the procurement and management of compensatory Ornamental Snake (*Denisonia maculata*) habitat to offset impacts on the species. The effectiveness of direct offsets, and land management techniques, would be benefited by an improvement in our understanding of the species' biology and ecology. This lack of knowledge highlights the importance of ongoing research and monitoring efforts to inform effective management strategies and realise actual conservation outcomes.

1.1 Purpose

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Environmental Offsets Policy (EOP), a suitable offset must deliver an overall conservation outcome that improves or maintains the viability of matters of national environmental significance (MNES) affected by a proposed action. These offsets must be built around direct offsets but may include compensatory measures (DSEWPC 2012).

The Olive Downs Coking Coal Project (herein referred to as 'the Project'), in accordance with the conditions of its EPBC Approval (EPBC 2017/7867), is required to offset its significant residual impact (SRI) on six MNES. Of the six matters, five are proposed to be entirely (i.e. 100%) acquitted via direct, land-based offsets, while the offset requirements for one MNES, the Ornamental Snake (*Denisonia maculata*), is proposed to be met through a combination of direct and indirect compensatory measures.

The objective of this Indirect Offset Plan (IOP) is to demonstrate the suitability of the proposed compensatory measures and describe the overall conservation outcomes to be achieved through their implementation that indirectly benefit Ornamental Snake and Ornamental Snake habitat.

1.2 Project background

Pembroke Olive Downs Pty Ltd (Pembroke) are the proponent of the Project and are in the process of developing an environmental offset package for the second stage of a four-stage mine development plan. This Stage 2 offset package must be approved by the Australian Government Environment Minister (the Minister) prior to the commencement of Stage 2 construction.

The development of Stage 2 is expected to impact 1,373.50 ha of Ornamental Snake habitat. A total of 3,558.84 ha is proposed to be directly offset within a designated Stage 2 offset area located adjacent the Project (Figure 1.1). The direct, land-based offset equates to 93.05 % of the requisite offset. The remaining offset requirement (i.e. 6.95 %) is proposed to be met through indirect offset measures (i.e. compensatory measures).

Table 1.1 Summary of Ornamental Snake impacts and offsets

	Value
Stage 2 Ornamental Snake impact	1,373.50 ha
Area required to directly offset 100% of the Stage 2 Ornamental Snake impact (EPBC offset calculator)	3,825 ha
Ornamental snake habitat within the Stage 2 offset area	3,558.84 ha
Percentage of requisite offset able to be mitigated directly (i.e. land-based)	93.05 %
Percentage of requisite offset mitigated indirectly	10 %

1.3 Relevant legislation

1.3.1 EPBC Act Environmental Offsets Policy

In accordance with the EOP, a minimum of 90% of the offset requirements must be met through direct offsets. Deviation from the 90% per cent direct offset requirement will only be considered where:

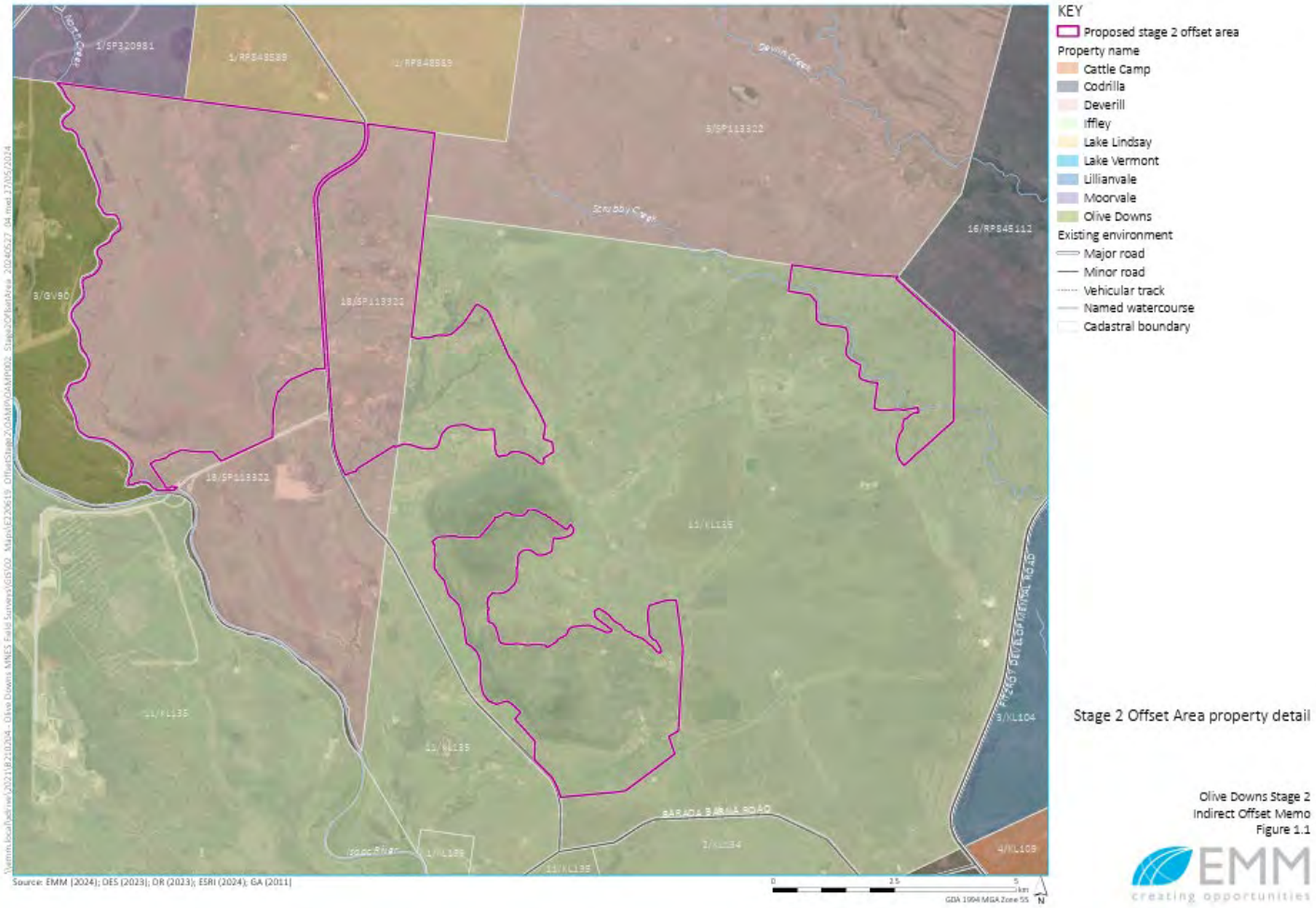
- it can be demonstrated that a greater benefit to the protected matter is likely to be achieved through increasing the proportion of other compensatory measures in an offsets package; or
- scientific uncertainty is so high that it isn't possible to determine a direct offset that is likely to benefit the protected matter. For example, this can be the case in some poorly understood ecosystems in the Commonwealth marine environment (DSEWPC 2012).

1.3.2 Compensatory measures

The EOP defines 'other compensatory measures' as those actions that do not directly offset the impacts on the protected matter but are anticipated to lead to benefits for the impacted protected matter, for example funding for research or educational programs. Appendix A of the EOP provides further guidance on criteria for research and educational programs such as:

- endeavour to improve the viability of the impacted protected matter
- be targeted toward key research/education activities as identified in the relevant Commonwealth approved recovery plan, threat abatement plan, conservation advice, ecological character description, management plan or listing document
- be undertaken in a transparent, scientifically robust and timely manner
- be undertaken by a suitably qualified individual or organisation in a manner approved by the department
- consider best practice research approaches
- ensure that funds are managed appropriately and that auditable financial records are kept and maintained
- apply a 'no-surprises' policy to the publication, whereby research publications and outputs are provided to the department at least five working days before release.

Figure 1.1 Proposed Stage 2 land based offset area



2. Knowledge Gaps

It is widely recognised there are many knowledge gaps for the Ornamental Snake, including its biology and habitat utilisation. Ornamental snake are habitat specialists, closely associated with gilgai and cracking clay soils within acacia-dominant communities such as brigalow (*Acacia harpophylla*) and/or gidgee (*Acacia cambagei*). The species is listed as vulnerable under the EPBC Act and Queensland *Nature Conservation Act 1992* (NC Act). The Ornamental Snake is known only from within the drainage system of the Fitzroy and Dawson Rivers in the Brigalow Belt bioregion of Queensland, it is sparsely distributed across its geographic range, and the population size is unknown (DoE 2014).

Photograph 2.1 Ornamental snake observed in Stage 2 offset area

1.4 Condition class

Ornamental Snakes have been observed in remnant, regrowth and non-remnant communities, including buffel grass-dominated paddocks, suggesting that the condition class may not be as valuable in determining habitat suitability for the species as the condition of the gilgai and presence of cracking soils. However, the prevailing theory suggests that remnant vegetation communities are of higher quality to the species that inhabit them. As such, offset strategies are often directed towards enhancing habitat quality by achieving remnant status over the life of the offset – often at the cost of grazing which is typically incompatible with the restoration of native woody species. The correlation between condition class of vegetation communities and Ornamental Snake habitat quality is currently unknown. The influence of condition class on Ornamental Snake habitat may be low, with microhabitat features such as gilgai relief, soil crack presence and condition, and shelter in the form of coarse woody debris (CWD) potentially exerting a greater influence.

Studies have shown the presence of microhabitat features such as gilgai, cracking soils and presence of prey are of higher importance for the species (Veary 2011).

1.5 Coarse woody debris

Buffel paddocks and other non-remnant communities typically have less CWD than remnant stands, apart from ripped brigalow left in situ, but the contribution of CWD to the habitat quality for Ornamental Snake is unknown. Veary (2011) found Ornamental Snake continued to reside in soil cracks when available, but once inundated, individuals sought refuge within adjacent CWD and tussock bases. The value of CWD to survival of the species and its habitat utilisation has implications for offset management and habitat quality scoring.

1.6 Diversity of gilgai

Gilgai are a known essential microhabitat feature, but the abundance and size of gilgai required to support a self-sustaining population of Ornamental Snake is unknown. Understanding the minimum viable area has benefits in understanding if the species is likely to be present, in habitat mapping, as well as understanding the consequences of habitat fragmentation.

A knowledge gap is also the species' ability to move between patches of gilgai. Habitat connectivity between gilgai and other suitable habitats is recognised as important under the draft *Referral Guidelines for nationally listed Brigalow Belt reptiles* (DSEWPC 2011b), but information is not known on what these connecting habitats are, and relevant distances that could be used between gilgai.

Veary (2011) suggests that Ornamental Snake reside at relatively shallow depths, typically less than 15 cm deep, which has implications in terms of the ability to avoid or mitigate (e.g fauna spotter catcher) impacts, with any process that disturbs the topsoil having the potential to impact Ornamental Snakes.

1.7 Home range

Existing literature including the conservation advice does not specify a home range for the species. However, analysis of GPS data in Veary (2011) for three snakes, calculated home ranges of 317 m^2 ,2,982 m^2 and 702 m^2.

The draft referral guidelines for nationally listed Brigalow Belt reptiles identifies clearing of two or more hectares of important habitat is likely to have a significant impact and Agnew 2010 pers. comm in DCCEEW (2023) suggests that habitat patches are typically greater than 10 hectares in area and are within, or connected to, larger areas of remnant vegetation (DCCEEW 2023).

The radio tracking study for Ornamental Snake by Veary (2011) identifies that the species does not have a large dispersal range, with two individuals moving less than 100 m between tracking events. The maximum home range of three snakes tracked was estimated to be in the vicinity of 2,981.5 m^2 or 0.2 ha, with the minimum being 317 m^2. Therefore, it could be assumed the species doesn't require large habitat patches to sustain a viable population, but this is not verified due to the small number of individuals studied. The importance of connectivity between habitats is also poorly understood. It is currently not known whether a population can survive in a small area of gilgai where there is sufficient access to prey, or whether the species needs to disperse across larger areas in drier conditions to find prey.

In December 2022, during targeted spotlighting surveys of the proposed Stage 2 Olive Downs offset, EMM ecologists recorded three small patches of Brigalow habitat with gilgai, measuring 3,048 m^2, 1,895 m^2 and 1,652 m^2. These gilgai patches were entirely land-locked within a much larger patch (59 hectares, or 594, 97 m^2) of remnant Poplar Box woodland on sandy soil, which is considered unsuitable habitat for Ornamental Snake. A single Ornamental Snake was observed to be active within each Brigalow patch, despite conditions being dry at the time. The patches were separated by 47 m and 433 m. These patch sizes are consistent with the reported home range of the species, and for the two closer patches, within the reported limits of movement. However, the distance between the third and more isolated patch (433 m) is greater than the distance Ornamental Snake are known to move, which raises important questions about population viability in small, isolated patches, the

importance of dispersal habitat, particularly across otherwise unsuitable habitats, and whether these isolated patches contain source or sink populations for other areas.

Understanding the minimum patch size for the species, and whether the home range size varies across dry and wet seasons would assist in mapping of habitats and assessing impacts that could reduce the habitat patch size or connectivity.

1.8 Movement patterns

The data on the movement or dispersal pattern of Ornamental Snakes is largely insufficient. Veary (2011) recorded relatively short movements, with instances of less than 100 m between individual tracking events for three snakes tracked), with a maximum distance of 91 m. These movements were observed during both the wet season, when gilgai were flooded and prey (predominately frogs) was plentiful, and the dry season. Ornamental snakes were not observed to undergo complete aestivation during the dry season and were found to engage in sporadic, brief movements.

Understanding the species' movement patterns informs habitat mapping such as whether areas between gilgai should be mapped as dispersal habitat and the relevant distance, but also the significance of impacts if barriers to movement are created such as installation of a road between gilgai.

1.9 Threats

Based on literature it is known that Ornamental Snake are susceptible to several direct mortality threats:

- past broadscale land clearing and current habitat loss
- destruction of wetlands by feral pigs
- trampling by livestock during wet season in gilgai areas
- any disturbance of the soil and cracks within gilgai mound and depression habitats at all times
- mortality by machinery during clearing, grading or ploughing
- ingesting cane toads (DoE 2014 and Veary 2011).

2 Recommended Research & Recovery Actions

The recommended priority research and conservation actions (DoE 2014; DCCEEW 2023) for the species are as follows:

- More precisely assess population size, distribution, ecological requirements and the relative impacts of threatening processes.
- Design and implement a monitoring program in key habitat and priority conservation areas.
- Monitor known populations to identify key threats.
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.
- Identify populations of high conservation priority.
- Investigate formal conservation arrangements, management agreements and covenants on private land, and for crown and private land investigate inclusion in reserve tenure if possible.
- Minimise adverse impacts from land use at known sites.
- Control introduced pests such as pigs to manage threats at known sites.
- Develop and implement a management plan for the control of Cane Toads in the region.
- Raise awareness of the Ornamental Snake and other reptiles found in the Brigalow Belt Bioregion within the local community.

Recovery actions in the species profile on the Queensland Department of Environment, Science and Innovation (DESI) website, are listed below. Those relevant to the IOP (in that the IOP is consistent with these recovery actions) are underlined.

- Encourage involvement, provide incentives and adopt a collaborative approach with government agencies, NRM regional bodies, the Indigenous community, key industry stakeholders and local governments to deliver region-specific information and implement sustained, effective recovery actions.
- Identify research priorities: develop and support the implementation of research projects undertaken by tertiary and research institutions.
- Inspect and identify suitable habitat for conservation of the Ornamental Snake.
- Identify key threats and develop management guidelines to protect key habitat.
- Maximise the establishment of appropriate reserves to protect Ornamental Snake habitat and landscape connectivity over the long term, e.g. on stock route networks, road reserves and private lands.
- Ensure Ornamental Snake conservation is incorporated into appropriate land management decisions made by all levels of government and industry.
- Develop and provide land-management guidelines and incentives for landowners to reduce the impact of current land use practices on the species outside reserves, e.g. restricting the use and spread of agricultural weeds, such as Buffel Grass.

- Negotiate management agreements and voluntary conservation agreements with landholders, on whose land the Ornamental Snake occurs, in line with the recommended management guidelines.
- Facilitate on-ground projects to manage and protect habitats on a range of land tenures in line with recommended management guidelines, e.g. in integrated weed and feral predator management programs.
- Develop community awareness within the species' known range through media campaigns and education material and provide incentives for wider community involvement, e.g. local governments and schools participating in reptile educational programs and adopting a local reptile species as their shire and/or school icon.
- Implement recommended fire management guidelines in property and reserve designs.
- Work with landholders and key stakeholders to undertake monitoring programs on selected sites.
- Monitor and evaluate recovery actions applying an adaptive management approach.

3 Indirect Offset Project Outline

Table 4.1 is a summary of three proposed activities that will make up the compensatory measures for Stage 2, and associated conservation outcomes for the Ornamental Snake. These activities will be conducted in collaboration with a Tertiary institution to ensure the program provides scientifically rigorous results that will contribute broadly to conservation of the species. A robust and transparent process for selection of the Tertiary Institution will be applied to ensure that a suitable partner for this program is engaged. Reporting upon this process will be provided to DCCEEW at the time of the first reporting event for this program. The appointed Tertiary Institution will support and deliver academic research associated with the program; this may be via a Higher Degree Research program with support from Pembroke.

This is a general outline of what is proposed and further scoping for each activity will be prepared by a suitably qualified person appointed by Pembroke in conjunction with the appointed Tertiary Institution. Detailed Budgets will also be developed at this stage, however, for transparency an indicative budget is provided within Section 5.

The resultant research plan will be provided to DCCEEW and the subsequent detailed activity plans will be submitted to DCCEEW in the first year of Stage 2 commencing, and prior to implementation of each activity.

Table 4.1 Indirect offset activities and program of delivery

Year	Task	Completed by	Expected Outcome	Relevant Recovery /Mgt Action
ACTIVITY 1 – Implement a radio tracking study to better understand Ornamental Snake dispersal patterns in wet and dry seasons, their biology and home ranges and how factors such as prey abundance and grazing regimes may impact or alter dispersal.				
Year 1	Define the radio tracking research study, provide agreed research plan to DCCEEW and seek Qld Animal Ethics approval. Submit radio tracking study plan to DCCEEW before end of year 1 for their information. Ornamental snakes from Offset Area 1 and Offset Area 2 will be used in this study.	Work will be conducted in conjunction with a tertiary institution who may work in conjunction with a suitably qualified person (SQP) engaged by Pembroke.	• Approved radio tracking study by Animal Ethics. • Tertiary institution engaged.	Outcomes of the radio tracking study are consistent with knowledge gaps that are recognised for the species. The conservation advice identifies research priorities to assess species distribution, ecological requirements and to implement a monitoring program in key habitats. Tracking individuals will provide key information about habitat patch sizes, dispersal and connectivity between gilgai, threats and land management influences on species' survival. Regular surveys (e.g. camera traps, pitfall traps) to determine prey species abundance will be conducted to provide data on seasonal fluctuations in prey abundance affecting dispersal. Assessments are to be taken on grazing regimes (e.g. heavily grazed, moderately grazed or ungrazed) within the study area which may impact the vegetation structure and cover and microhabitat availability for the species.

Table 4.1 Indirect offset activities and program of delivery

Year	Task	Completed by	Expected Outcome	Relevant Recovery /Mgt Action
				Prey abundance assessments will also be taken in response to grazing pressure.
Years 2 and 3	Implement radio tracking study. Study is expected to include: • Radio tracking of a number of individuals over two years to gain data on dispersal across various seasons, and habitat types. • Number of individuals tracked in Year 2 will be informed by ethics permits gained. Number of individuals tracked in year 3 will be informed by data collected during Year 2 tracking. • Tracking to potentially determine the habitat conditions they are found in, distance of dispersal, habitats they will disperse across, how dispersal may change in different seasonal conditions and home ranges • Targeting patches of suitable habitat that are isolated in a matrix of unsuitable habitat to understand whether they are source or sink populations. • Use of innovative tracking technology such as satellite transmitters.	Pembroke SQP and researcher/s	• Tracking of Ornamental Snakes. • Habitat assessments • Progress reports at end of each 12-month period.	As above

Table 4.1 Indirect offset activities and program of delivery

Year	Task	Completed by	Expected Outcome	Relevant Recovery /Mgt Action
Year 4	Write up results of the radio tracking study. Submit to DCCEEW. Develop academic research paper for submission to facilitate formal publication to a reputable journal in the relevant field for publication.	Pembroke SQP and researcher/s	• Identification of habitats and condition thresholds. • Refined detail of dispersal patterns and changes with seasonal conditions. • Refined understanding of home ranges. • Refined understanding of how to identify, map and manage core and dispersal habitat.	As above
ACTIVITY 2: Land use management – monitor changes in habitat quality and presence of Ornamental Snake based on land management techniques				
Year 1	Develop a monitoring program to evaluate effectiveness of management techniques to conserve Ornamental Snake and their associated habitat including the use of a range of grazing and stocking regimes on pastoral land on which Ornamental Snake habitat occurs. Different management regimes may be: • Grazing only in dry season and exclusion of livestock in wet • Grazing at various stocking rates • No grazing exclusion in control site • Complete grazing exclusion at another control site • Feral pig control • Weed control Sites will be established where monitoring will occur. Permanent transects would be established in these different management zones where habitat quality condition data will be collected.	Pembroke will appoint an SQP to develop and implement the monitoring program.	Completion of monitoring program plan and associated costings.	Conservation advice identifies that designing and implementing a monitoring program in key habitat areas is a priority. It also identifies that minimising adverse impacts from land use is a priority. The monitoring program will be looking to evaluate effectiveness of different controls such as grazing exclusion and feral pig eradication. Control introduced pests such as pigs to manage threats at known sites is a recommended regional priority. Monitoring the effectiveness of management actions and the need to adapt them if necessary is also identified for research priorities.

Table 4.1 Indirect offset activities and program of delivery

Year	Task	Completed by	Expected Outcome	Relevant Recovery /Mgt Action
	Ornamental Snake surveys will also occur to identify any changes in use of areas by species based on management regimes. Provide monitoring plan to DCCEEW for their information.			
Years 2 to 4	Implement the monitoring program over Years 2, 3 and 4.	Pembroke SQP	Implement monitoring program. Progress reports at end of each 12-month period	As above
Year 5	Write up results. Submit final report to DCCEEW.	Pembroke SQP		As above
Year 6	Write an Information Sheet and Habitat Guideline to improve knowledge of this species, to support identification of Ornamental Snake habitats and what are appropriate land management actions. Guideline will be targeted to rural landholders, mine site managers and local government in Brigalow Belt.	Pembroke SQP and researcher/s		Conservation advice identifies that raising awareness of the Ornamental Snake in the Brigalow Belt Bioregion within the local community is a priority. Recovery actions described by DESI include; Encourage involvement, provide incentives and adopt a collaborative approach with government agencies, NRM regional bodies, the Indigenous community, key industry stakeholders and local governments to deliver region-specific information and implement sustained, effective recovery actions.
ACTIVITY 3: Education and raise awareness				
Year 6	• Develop academic research paper, based upon results of radio tracking research study for submission to facilitate formal publication to a reputable journal in the relevant field for publication. • Present information on species and land management guideline to Brigalow Belt local	Pembroke SQP and researcher/s	A wider awareness and understanding of the importance of this species. How to identify its habitats and manage those habitats for their conservation. How to avoid and minimise threats.	Recovery actions recommended by DESI include; Develop community awareness within the species' known range through media campaigns and education material and provide incentives for wider community involvement.

Table 4.1 Indirect offset activities and program of delivery

Year	Task	Completed by	Expected Outcome	Relevant Recovery /Mgt Action
	governments, NRM groups and landholder groups to identify land management to support conservation of species and their habitat. • Present findings through EIANZ, and potentially relevant industry forums to environmental scientists and consultants.			

4 Proposed Funding

Pembroke will govern and fund the activities identified in Table 4.1. Pembroke will also be responsible for implementation and progress reporting of these activities.

The budgets will be finalised during the scoping phase of each activity and on engagement of suitably qualified contractors to deliver the work. The distribution of funding will be as per the final agreed research program and supporting plan. Funds will be paid out by Pembroke to relevant parties at agreed milestones and as per contractual arrangements and the Commonwealth provisions for Higher Degree Research.

The indicative budget considerations are as follows:

- Across the program the average spend is anticipated to be approximately AUD $100,000 per annum for equipment and specific tasks over the 6-year period, totalling AUD $600,000.
- The allocated annualised budget will be indexed in line with CPI for each to be equal to the value of $100,000 on the date of commencement of stage 2.
- This budget is additional to pre-existing Pembroke personnel and suppliers that are or will be engaged as part of our broader program works, current software and technology and broader business support available within the organisation.
- Clear delineation in Pembroke's financial statements and associated record keeping will occur to ensure that there is auditability and transparency regarding the ongoing investment in this program.

Progress reports will include the finalised budgets and funds paid from Pembroke's annual audited calendar year financial statements relevant to the period of reporting.

Progress reports in keeping with the listed timings within Table 4.1 will be submitted to DCCEEW for their information.

5 Communication of Outcomes

5.1 Reporting

Pembroke will submit an annual progress report to DCCEEW with budget tracking and proof of expenditure as well addressing works completed and preliminary results of each of the activities.

At the end of the six-year period, a detailed IOP outcome document will be prepared to report on all of the above activities, their outcomes and implications for recovery actions for the Ornamental Snake.

This final IOP report will be issued to DCCEEW and made publicly available on the Pembroke website.

5.2 Peer-reviewed scientific paper

The outcomes of the radio tracking research study in conjunction with the appointed Tertiary Institution will be submitted to a reputable journal in the relevant field for publication. Therefore, results will be publicly available, and findings can be more broadly taken up by the community, government agencies and environmental professionals.

6 References

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