

Indirect Offset Plan

Olive Downs (Stage 2)

Prepared for Pembroke Olive Downs Pty Ltd

May 2024

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Pembroke Olive Downs Pty Ltd

E220619 RP#13

May 2024

Version	Date	Prepared by	Reviewed by	Comments
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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

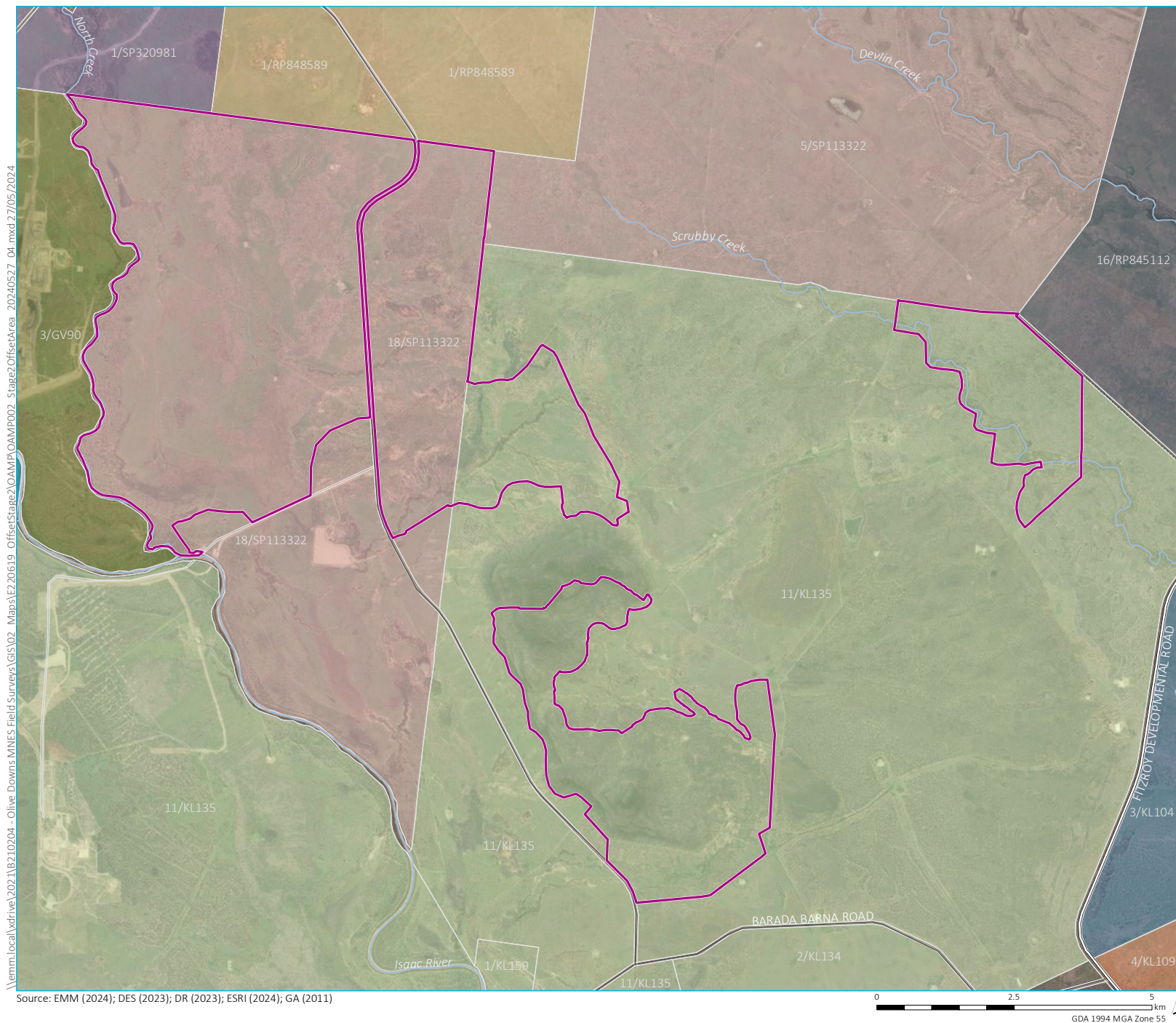
In accordance with the EOP, a minimum of 90% of the offset requirements must be met through direct offsets. Deviation from the 90% per cent direct offset requirement will only be considered where:

- 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.



- 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

Stage 2 Offset Area property detail

Olive Downs Stage 2
Indirect Offset Memo
Figure 1.1

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

2.1 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).

2.2 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.

2.3 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.

2.4 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 m², 2,982 m² and 702 m².

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 m² or 0.2 ha, with the minimum being 317 m². 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 m², 1,895 m² and 1,652 m². These gilgai patches were entirely land-locked within a much larger patch (59 hectares, or 594, 97 m²) 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.

2.5 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.

2.6 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).

3 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.

4 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. 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. Budgets will also be developed at this stage.

These more 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				
Year 1	<p>Define the radio tracking research study and seek Qld Animal Ethics approval.</p> <p>Submit radio tracking study plan to DCCEEW before end of year 1 for their information.</p> <p>Ornamental snakes from Offset Area 1 and Offset Area 2 will be used in this study.</p>	<p>Pembroke will award this work to a suitably qualified contractor.</p> <p>Potential to work with a tertiary institution to support delivery, such as a PhD student.</p>	<ul style="list-style-type: none"> Approved radio tracking study by Animal Ethics. Contractor engaged. 	<p>Outcomes of the radio tracking study are consistent with knowledge gaps that are recognised for the species.</p> <p>The conservation advice identifies research priorities to assess species distribution, ecological requirements and to implement a monitoring program in key habitats.</p> <p>By tracking individuals it will provide key information about habitat patch sizes, dispersal and connectivity between gilgai, threats and land management influences on species' survival.</p>
Years 2 and 3	<p>Implement radio tracking study.</p> <p>Study is expected to include:</p> <ul style="list-style-type: none"> 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 	<p>Pembroke and Appointed contractor</p>	<ul style="list-style-type: none"> 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
	<p>will disperse across, how dispersal may change in different seasonal conditions and home ranges</p> <ul style="list-style-type: none"> 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. 			
Year 4	<p>Write up results of the radio tracking study. Submit to DCCEEW.</p>	Pembroke and Appointed contractor	<ul style="list-style-type: none"> 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	<p>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.</p> <p>Different management regimes may be:</p> <ul style="list-style-type: none"> Grazing only in dry season and exclusion of livestock in wet Grazing at various stocking rates 	Pembroke will appoint a suitably qualified contractor to develop and implement the monitoring program.	Completion of monitoring program plan and associated costings.	<p>Conservation advice identifies that designing and implementing a monitoring program in key habitat areas is a priority.</p> <p>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.</p> <p>Control introduced pests such as pigs to manage threats at known sites is a recommended regional priority.</p> <p>Monitoring the effectiveness of management actions and the need to adapt them if</p>

Table 4.1 Indirect offset activities and program of delivery

Year	Task	Completed by	Expected Outcome	Relevant Recovery /Mgt Action
	<ul style="list-style-type: none"> No grazing exclusion in control site Complete grazing exclusion at another control site Feral pig control Weed control <p>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.</p> <p>Ornamental Snake surveys will also occur to identify any changes in use of areas by species based on management regimes.</p> <p>Provide monitoring plan to DCCEEW for their information.</p>			necessary is also identified for research priorities.
Years 2 to 4	Implement the monitoring program over Years 2, 3 and 4.	Pembroke and Suitably qualified contractor	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 and Suitably qualified contractor		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 and Suitably qualified contractor		<p>Conservation advice identifies that raising awareness of the Ornamental Snake in the Brigalow Belt Bioregion within the local community is a priority.</p> <p>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.</p>

Table 4.1 **Indirect offset activities and program of delivery**

Year	Task	Completed by	Expected Outcome	Relevant Recovery /Mgt Action
ACTIVITY 3: Education and raise awareness				
Year 6	<ul style="list-style-type: none"> • Publish results of radio tracking research study in a scientific journal. • Present information on species and land management guideline to Brigalow Belt local governments, NRM groups and landholder groups to identify land management to support conservation of species and their habitat • Present findings through EIANZ to environmental scientists and consultants. 	Pembroke	<p>A wider awareness and understanding of the importance of this species.</p> <p>How to identify its habitats and manage those habitats for their conservation.</p> <p>How to avoid and minimise threats.</p>	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.

5 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. Funds will be paid out by Pembroke to relevant parties at agreed milestones and as per contractual arrangements.

Progress reports will include the finalised budgets and funds paid over that period of reporting.

Progress reports will be submitted to DCCEEW for their information.

6 Communication of Outcomes

6.1 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.

6.2 Peer-reviewed scientific paper

The radio tracking research study is intended to be published in a peer-reviewed scientific journal. Therefore, the outcomes will be publicly available and can be more broadly taken up by the community, government agencies and environmental professionals.

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