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Surat Gas Project (SGP) Stage 2 Offset Strategy

arrow energy go further

Contents

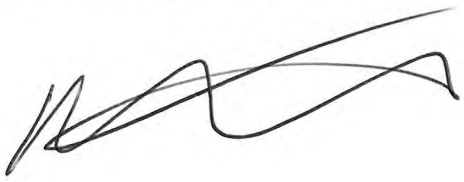
Declaration

I declare that to the best of my knowledge, all the information contained in, or accompanying this document is complete, current and correct. I am duly authorised to sign this declaration on behalf of the proponent/approval holder. I am aware that

a. *Section 490 of the Environmental Protection and Biodiversity Conservation Act 1999 (Cwth) (EPBC Act) makes it an offence for an approval holder to provide information in response to an approval condition where a 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 Environment Protection and Biodiversity Conservation Regulations 2000 (Cwth) 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: 

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Organisation	Arrow Energy Pty Ltd
EPBC Referral Number:	EPBC 2010/5344
Date:	30 April 2025

Executive Summary

Arrow Energy Pty Ltd (Arrow) has been operating a strong domestic gas supply business since 2004 and are expanding coal seam gas (CSG) operations in the Surat Basin through the Surat Gas Project (SGP; the Project). Arrow lodged a referral to the Australian Government under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (the Act) for the SGP on 27 January 2010 (EPBC 2010/5344). An Environmental Impact Statement (EIS) and Supplementary Report to the EIS (SREIS) were completed in March 2012 and June 2013, respectively. The SGP was granted approval from the Queensland Government in October 2013. The Minister for the Environment of the Australian Government (the Minister) granted approval for the SGP on 19 December 2013 (the Approval).

The SGP comprises up to 6,500 coal seam gas production wells and associated infrastructure within a tenure are covering approximately 5,385 km^2, extending from the township of Wandoan in the north towards Millmerran in the south. Land uses within the Surat Basin are dominated by agriculture and cattle grazing with remnant vegetation existing largely within State Forests and road reserves.

There have been six variations made to the Approval by the Minister (dated 29 March 2017, 29 May 2018, 31 October 2018, 2 July 2019, 29 March 2022 and 27 February 2025).

The Approval specifies 'Whole of Project' and 'Stage 1' maximum disturbance limits to core habitat for specified Matters of National Environmental Significance (MNES). To compensate for these significant residual impacts to MNES, the Approval requires offsets to be provided. The Approval allows for these offsets to be delivered in staged manner, aligned to the development stages of the SGP, and subject to a range of obligations and definitions.

Stage 1 commenced on 22 October 2020 and is defined within the Approval as *all activities, including the installation of gas wells and associated gathering lines, access tracks and gas and water aggregation and transmission infrastructure, from the date of commencement until 350 gas wells have been installed*.

Stage 2 planning is well progressed and scheduled to commence in August 2025. Stage 2 is defined within the Approval as *all activities following Stage 1, including the installation of gas wells and associated gathering lines, access tracks and gas and water aggregation and transmission infrastructure until 710 gas wells have been installed*.

The purpose of this document is to satisfy the Staged Offsets Conditions within the SGP EPBC Approval 2010/5344, whereby Arrow is submitting and committing to implement a Stage 2 Offset Strategy for approval by the Minister at least 3 months prior to Stage 2 commencement which is scheduled for August 2025.

This Stage 2 Offset Strategy follows on from approval by the Minister of both the Stage 1 Offset Strategy on 7 July 2019 and revised State 1 Offset Strategy on 27 March 2025. The Stage 1 Offsets Area Management Plan has been submitted and is currently under assessment by the department.

In accordance with the Stage 1 OAMP, offsets for the residual significant impacts to the EPBC listed species and threatened ecological communities for Stage 1 has been secured through direct land-based offsets on a property known as Killara, located 93 km north-east of Kogan. The property comprises four Lot on Plans (Lot 36 BO175 and Lots 15, 16 and 19 BO94) and has been legally secured in accordance with conditions of the Approval. This was achieved through the use of a Declared Area as defined under the Vegetation Management Act 1999 (Queensland).

Following implementation of the Stage 1 OAMP, offsets for two EPBC values has been secured in excess of Stage 1 impacts. These comprise 12.2 ha of Brigalow Threatened Ecological Community and 918.8 ha of South-eastern Long-eared Bat core habitat. Arrow proposes to carry these offsets over into Stage 2.

The process and key elements of this SGP Stage 2 Offset Strategy, including field survey methods, habitat mapping for listed threatened species, risk assessment and strategies to identify and secure offsets are consistent with those used within the approved Stage 1 Offset Strategy. The strategy to secure the offsets proposed for the residual significant impacts to the EPBC listed species and listed threatened ecological communities for Stage 2 comprises:

- Applying offsets secured in excess of Stage 1 impacts
- Applying additional areas (and associated EPBC values) of the Killara property presented in the Stage 1 Offset Area Management Plan to Stage 2
- Seeking to secure the smallest feasible number of additional properties where offsets for residual significant impacts to MNES are not sufficient on the existing property.
- Providing offsets in general accordance with the EPBC Act Offsets Policy, whereby a minimum of 90 per cent will be met through direct land-based offsets and the balance (<10 per cent) by other compensatory measures.

Since investigations began in 2015 into potential offset properties, Arrow has identified a significant number of potentially suitable properties to deliver offsets for the SGP. Arrow has also entered commercial in confidence discussions with offset brokers to assist. Through this process Arrow has identified a single additional strategic property with strong connectivity in the landscape, and combination of remnant and regrowth vegetation and that will provide the necessary offset values for Stage 2. This property also provided good connectivity with an adjacent conservation area. Suitably qualified ecologists have undertaken habitat assessments and negotiations are progressing with the landholder.

The Surat Gas Project Species Impact Management Plan (SIMP) details the measures that Arrow will take to avoid, mitigate and manage impacts to EPBC listed threatened species and their habitat during the construction, operation and decommissioning phases of the action, and how the success of these measures will be monitored. The SIMP was approved by the Minister on 14 December 2018.

A summary of conditions relevant to this Stage 2 Offset Strategy including how they have or are to be met is presented in **Table ES1**.

The approved Whole of Project Disturbance Limits and total Stage 1 and Stage 2 Actual and Proposed Disturbance to core habitat are summarised in **Table ES2**.

Table ES1 - Cross-reference table for information requirements of the Stage 2 Offset Strategy

Condition Number	Condition requirement	Section	Summary of how the condition has been met
8A	If the approval holder has provided an offset in respect of impacts to protected matters predicted for a development stage of the project which subsequently are not realised, such parts of the offset in excess of the obligation for that development stage can be applied towards offsets required for the impacts to protected matters of subsequent development stages.	Section 2	Arrow has provided offsets that are in excess of the realised impacts to protected matters for Stage 1. In accordance with Condition 8A, Arrow proposes to apply excess offsets from Stage 1 towards the Stage 2 offset requirements.
8B	The Offset Strategy may be prepared and submitted to the Minister for approval in stages. Each stage of the Offset Strategy must provide information in respect of the subsequent development stage to commence and all earlier development stages. A development stage must not commence until an Offset Strategy addressing offset obligations for that development stage has been approved by the Minister.	Section 3	A Stage 1 Offset Strategy was approved by the Minister on 7 July 2019. A revised Stage 1 Offset Strategy was subsequently approved by the Minister on 27 March 2025. This Offset Strategy has been developed for Stage 2 of the SGP as the subsequent development stage. This Offset Strategy provides information in respect to the predicted residual significant impacts to MNES for Stage 2. It also provides the relevant information on the earlier development stage (Stage 1). Arrow is submitting this revised Offset Strategy for the subsequent development stage (Stage 2) for approval by the Minister prior to commencement.
8C	The Offset Strategy must:		
8C(a)	Include a strategy to secure the offsets proposed for the residual significant impacts to the EPBC listed threatened species and EPBC communities for the subsequent development stage.	Section 4	A strategy to secure the offsets proposed for the residual significant impacts to the EPBC listed threatened species and EPBC communities for Stage 2 has been provided. This comprises: • Applying offsets in excess of Stage 1 • Applying additional areas (and associated MNES values) of the (existing) Killara property to Stage 2. This is the same property presented in the Stage 1 Offset Area Management Plan.

Condition Number	Condition requirement	Section	Summary of how the condition has been met
			• Seeking to secure the smallest feasible number of additional properties where offsets for residual significant impacts to MNES are not sufficient on the existing property. • Providing offsets in general accordance with the EPBC Act Offsets Policy, whereby a minimum of 90 per cent will be met through direct land-based offsets and the balance (<10 per cent) by other compensatory measures. Out of a pool of potentially suitable properties, Arrow has identified a single strategic property that, when combined with the additional remaining areas of the Killara property, would provide the necessary offset values for Stage 2. This additional property would also provide excellent connectivity with an adjacent conservation area (National Park). Suitably qualified ecologists have undertaken habitat assessments and negotiations are progressing with the landholder.
8C(b)	include a map of the location of each EPBC listed threatened species and its habitat and EPBC community in relation to infrastructure for the subsequent development stage.	Section 5	Arrow has provided maps to illustrate the location of each relevant MNES value in relation to the proposed Stage 2 development infrastructure.
8C(c)	describe potential risks to the successful implementation of the Offset Strategy, and the contingency measures that would be implemented to mitigate against these risks.	Section 6	**Table 6.1** describes potential risks to the successful implementation of this Stage 2 Offset Strategy. This includes a description of relevant contingency measures that would be implemented to mitigate against these risks.
8C(d)	detail how the approval holder will address any residual significant impacts to any EPBC listed threatened species and its habitat and/or EPBC communities not identified in Table 1, in accordance with the EPBC Act Offsets Policy.	Section 7	In accordance with Condition 7A, Arrow has a Species Impact Management Plan (SIMP) that has been approved by the Minister. In accordance with Condition 7A and the SIMP, Arrow uses suitably qualified ecologists to undertake pre-clearance surveys for ground disturbance activities. These surveys will identify and manage the risk of potential impact to EPBC listed species and EPBC communities not listed in Table 1 of the Approval. Arrow will offset residual significant impacts on these MNES values in accordance approval conditions and the EPBC Act Offsets Policy.

Condition Number	Condition requirement	Section	Summary of how the condition has been met
8C(e)	specify the proposed legal mechanism and timeframe for securing the offset(s).	Section 8	In accordance with Condition 10A and consistent with the legal mechanism for legally securing Phase 1 offsets, Phase 2 offsets will be legally secured in accordance with Queensland legislation. This will be achieved using a Declared Area as defined under the *Vegetation Management Act 1999* (VM Act) (Qld). In accordance with conditions, offset areas will be legally secured prior to commencement of the subsequent development stage.
8D	The approval holder must not commence the action until the Offset Strategy for Stage 1 has been approved by the Minister in writing. The approved Offset Strategy must be implemented by the approval holder.	Section 9	The Stage 1 Offset Strategy was approved by the Minister on 7 July 2019. Stage 1 commenced on 22 October 2020. A revised Stage 1 Offset Strategy was subsequently approved by the Minister on 27 March 2025. The Stage 1 Offset Strategy is being implemented. In accordance with Condition 10B, a Stage 1 Offset Area Management Plan (OAMP) was developed and submitted to the Minister for approval and is currently under assessment.
9A	At least 3 months prior to the commencement of any development stage after Stage 1, the approval holder must submit a revised Offset Strategy for approval by the Minister. The updated Offset Strategy must include:	Section 10	This Stage 2 Offset Strategy has been submitted at least 3 months prior to commencement of Phase 2 for approval by the Minister. Stage 2 is forecast to commence in August 2025. Arrow commits to implementation of this Stage 2 Offset Strategy following approval by the Minister.
9A (a)	a strategy to secure the minimum offsets proposed for the residual significant impacts to the EPBC listed threatened species and EPBC communities for the subsequent development stage	Section 11	A strategy to secure the offsets proposed for the residual significant impacts to the EPBC listed threatened species and EPBC communities for Stage 2 have been provided. In summary this comprises: • Applying offsets in excess of Phase 1 • Applying additional areas (and associated MNES values) of the (existing) Killara property presented in the Phase 1 Offset Area Management Plan • Seeking to secure an additional property(ies) where offsets residual significant impacts are not sufficient on the existing properties.

Condition Number	Condition requirement	Section	Summary of how the condition has been met
9A (b)	a map of the location of each EPBC listed threatened species and its habitat and EPBC community in relation to infrastructure for the subsequent development stage	Section 12	Maps have been provided to illustrate the location of each relevant MNES value in relation to the proposed Stage 2 development infrastructure.
9A (c)	the information required for the Offset Strategy at conditions 8C(a) to 8C(e) for the subsequent development stage	Section 13	The information required for the Offset Strategy conditions 8C(a) to 8C(e) for the subsequent development stage have been provided in Section 4 through to Section 8 of this Strategy.
9A (d)	demonstration of how any proposed offset builds on offsets already secured and will contribute to a larger strategic offset for whole of project impacts	Section 14	The strategy to secure the offsets for the predicted residual significant impacts to the EPBC listed threatened species and EPBC communities for Stage 2 comprises: • Applying offsets in excess of Stage 1 • Applying additional areas (and associated MNES values) of the (existing) properties presented in the Phase 1 Offset Area Management Plan to Stage 2 • Seeking to secure an additional property(ies) where offsets residual significant impacts are not sufficient on the existing property(ies). Co-locating the offset obligations on same large offset property or smallest number of properties to the extent technically feasible will improve the biodiversity value of each offset individually and strengthen other values such as connectivity and resilience. Optimal management for each offset will be achieved where the management actions, reporting timeframes and monitoring, can be aligned, where appropriate. This will achieve efficiencies in managing many aspects of the cumulative offset area, for aspects such as weeds, feral animals, fire and monitoring. This approach will ensure that a larger, more strategic offset is achieved by co-locating offsets for subsequent development stages where feasible for whole of project impacts.
9A (e)	performance and completion criteria for evaluating the management of offset areas	Section 15	

Condition Number	Condition requirement	Section	Summary of how the condition has been met
9A (f)	reconciliation of impacts predicted in the subsequent development stage and actual disturbance in preceding development stages against the maximum disturbance limits	Section 16	A reconciliation of impacts predicted in the Stage development stage and actual disturbance in Stage 1 against the maximum disturbance limits has been presented in **Table 16.1**.
10A	10A. Offsets for development stages must be provided in accordance with the mechanism identified in the approved Offset Strategy and must be registered and legally secured in accordance with Queensland legislation prior to commencement of any subsequent development stage.	Section 17	In accordance with this condition and the approved Stage 1 OAMP, offsets for Stage 1 were legally secured in accordance with Queensland legislation and achieved by using a Declared Area as defined under the *Vegetation Management Act 1999* (VM Act) (Qld) Consistent Stage 1 offsets, Phase 2 offsets will also be legally secured in accordance with Queensland legislation and achieved by using a Declared Area as defined under the *Vegetation Management Act 1999* (VM Act) (Qld). In accordance with conditions, Stage 2 offset areas will be legally secured prior to commencement of the Stage 2 development stage.
10B	Within 12 months of project commencement or the Minister approving the Offset Strategy for a subsequent development stage, the approval holder must submit for the approval of the Minister an Offset Area Management Plan	Section 18	Arrow commits to submitting a Stage 2 Offset Area Management Plan within 12 months of the Minister approving the Stage 2 Offset Strategy.

Table ES2 – Surat Gas Project Whole of Project Disturbance Limits to Core Habitat – Stage 1 and Stage 2

EPBC Species / Threatened Ecological Community	Whole of Project Disturbance Limits to Core Habitat (ha)	Total Actual and Proposed Stage 1 & Stage 2 Disturbance to Core Habitat (ha)	Whole of Project Disturbance Limit to Core Habitat Remaining at completion of Stage 1 & 2 (ha)
Brigalow TEC	106	8.0	98
Coolibah – Black Box	8	0	8
Dunmall's Snake	4400	855.9	3544
South-eastern Long-eared bat	4080	834.8	3245
Five-clawed worm-skink	560	0	560
Squatter pigeon (southern)	3261	0	3261
Regent honeyeater	20	0	20
Collared delma	90	0	90
Yakka skink	310	0	310
Australian Painted Snipe	5	0	5
Weeping Myall Woodlands	1	0	1
Natural Grasslands on basalt and fine-textured alluvial plains	No disturbance	No disturbance	No disturbance
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland	No disturbance	No disturbance	No disturbance
Semi-evergreen vine thickets	No disturbance	No disturbance	No disturbance
Curly-bark Wattle	1210	0	1210
Hando's Wattle	1210	0	1210
Belson's Panic,	140	0	140
Prostanthera sp Dunmore	380	0	380
Small-leaved Denhamia	50	0	50
Calytrix gurulmundensis	1210	0	1210
Ooline	No disturbance	No disturbance	No disturbance
Austral Toadflax	160	0	160

EPBC Species / Threatened Ecological Community	Whole of Project Disturbance Limits to Core Habitat (ha)	Total Actual and Proposed Stage 1 & Stage 2 Disturbance to Core Habitat (ha)	Whole of Project Disturbance Limit to Core Habitat Remaining at completion of Stage 1 & 2 (ha)
Acacia lauta	990	0	990
Xerothamnella herbacea	110	0	110
Hawkweed, Picris evae	120	0	120
Austral Cornflower	160	0	160
Eucalyptus virens	170	0	170
King Blue-grass	160	0	160
Queensland White-gum	10	0	10
Macrozamia machinii	No disturbance	No disturbance	No disturbance

Acronyms

The following table provides a list of acronyms used throughout this report.

Term	Definition
ANZMEC	Australian and New Zealand Minerals and Energy Council
CSG	Coal Seam Gas
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Australia)
EA	Environmental Authority
DES	Queensland Department of Environment & Science (now DETSI)
DEHP	Queensland Department of Environment & Heritage Protection (now DETSI)
DETSI	Queensland Department of Environment, Tourism, Science & Innovation (Queensland)
EIS	Environmental Impact Statement
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
FEED	Front End Engineering Design
GIS	Geographic Information System
ha	Hectare (100 metres by 100 metres)
km^2	Square kilometre (1000 metres by 1000 metres) – equivalent to 100 hectares
MNES	Matters of National Environmental Significance
MSES	Matters of State Environmental Significance
OAMP	Offset Area Management Plan
RE	Regional Ecosystem
SREIS	Supplementary Report to the Environmental Impact Statement
SGP	Surat Gas Project
SIMP	Species Impact Management Plan
TEC	Threatened Ecological Community
VM Act	*Vegetation Management Act 1999* (Queensland)

1. Introduction

Arrow Energy is a Queensland based subsidiary of Arrow Energy Holdings Pty Ltd (Arrow), a 50:50 joint venture between Royal Dutch Shell (Shell) and PetroChina Company Ltd (PetroChina). Arrow is currently developing coal seam gas (CSG) resources in Queensland, including in the Surat Basin.

The Surat Gas Project (SGP; the Project) Environmental Impact Statement (EIS) for up to 6,500 CSG production wells and associated infrastructure was granted approval from the Queensland Government in October 2013 under the State Development and Public Organisations Act 1971. Approval from the Australian Government was received in December 2013 (the Approval) under the Environmental Protection and Biodiversity Act 1999 (EPBC 2010/5344).

The SGP covers an area of approximately 5,385 km^2, extending from the township of Wandoan in the north, towards Millmerran in the south (**Figure 1.1**).

Arrow proposes to undertake the SGP in stages, with the Approval defining these stages as:

- **Stage 1**: means all activities, including the installation of gas wells and associated gathering lines, access tracks and gas and water aggregation and transmission infrastructure, from the date of commencement until 350 gas wells have been installed

- **Stage 2**: means all activities following Stage 1, including the installation of gas wells and associated gathering lines, access tracks and gas and water aggregation and transmission infrastructure until 710 gas wells have been installed

- **Stage 3**: means all activities following Stage 2, including the installation of gas wells and associated gathering, access tracks and gas and water aggregation and transmission infrastructure until 1175 gas wells have been installed

- **Stage 4**: means all activities following Stage 3, include the installation of gas wells and associated gathering lines, access tracks and gas and water aggregation and transmission infrastructure until 2276 gas wells have been installed.

- **Stage 5**: means all activities following Stage 4, including installation of gas wells and associated gathering lines, access tracks and gas and water aggregation and transmission infrastructure until the completion of the Action.

To protect EPBC listed threatened species and threatened ecological communities within the project area, maximum disturbance limits have been imposed with the Approval and include:

    - **Condition 5**: 'Whole of Project' maximum disturbance limits to core habitat for specified Matters of National Environmental Significance (MNES).

    - **Condition 6**: Phase 1 maximum disturbance limits to core habitat for specified MNES.

The Approval defines core habitat as *'means core habitat known and core habitat possible as defined in the rules for habitat mapping for each individual species in the Supplementary Report to the Surat Gas Project EIS (March 2012), Attachment 1 – Matters of National Environmental Significance'.*

To compensate for the residual significant impacts to MNES, the Approval requires offsets to be provided. The conditions impose obligations regarding the development of Offset Strategies and Offset Area Management Plans for Approval by the Minister, as well as the legal securing of offsets. The conditions also allow for the carry-over or "banking" of excess offsets from one phase to the next. These offset conditions include:

- **Condition 8A**: If the approval holder has provided an offset in respect of impacts to protected matters predicted for a development stage of the project which subsequently are not realised, such parts of the offset in excess of the obligation for that development stage can be applied towards offsets required for the impacts to protected matters of subsequent development stages.

- **Condition 8B**: The Offset Strategy may be prepared and submitted to the Minister for approval in stages. Each stage of the Offset Strategy must provide information in respect of the subsequent development stage to commence and all earlier development stages. A development stage must not commence until an Offset Strategy addressing offset obligations for that development stage has been approved by the Minister.

- **Condition 8C**: The Offset Strategy must:

    - include a strategy to secure the offsets proposed for the residual significant impacts to the EPBC listed threatened species and EPBC communities for the subsequent development stage
    - include a map of the location of each EPBC listed threatened species and its habitat and EPBC community in relation to infrastructure for the subsequent development stage
    - describe potential risks to the successful implementation of the Offset Strategy, and the contingency measures that would be implemented to mitigate against these risks
    - detail how the approval holder will address any residual significant impacts to any EPBC listed threatened species and its habitat and/or EPBC communities not identified in Table 1, in accordance with the EPBC Act Offsets Policy, and
    - specify the proposed legal mechanism and timeframe for securing the offset(s).

- **Condition 9A**: At least 3 months prior to the commencement of any development stage after Stage 1, the approval holder must submit a revised Offset Strategy for approval by the Minister. The updated Offset Strategy must include:

    - a strategy to secure the minimum offsets proposed for the residual significant impacts to the EPBC listed threatened species and EPBC communities for the subsequent development stage
    - a map of the location of each EPBC listed threatened species and its habitat and EPBC community in relation to infrastructure for the subsequent development stage
    - the information required for the Offset Strategy at conditions 8Ca to 8Ce for the subsequent development stage
    - demonstration of how any proposed offset builds on offsets already secured and will contribute to a larger strategic offset for whole of project impacts

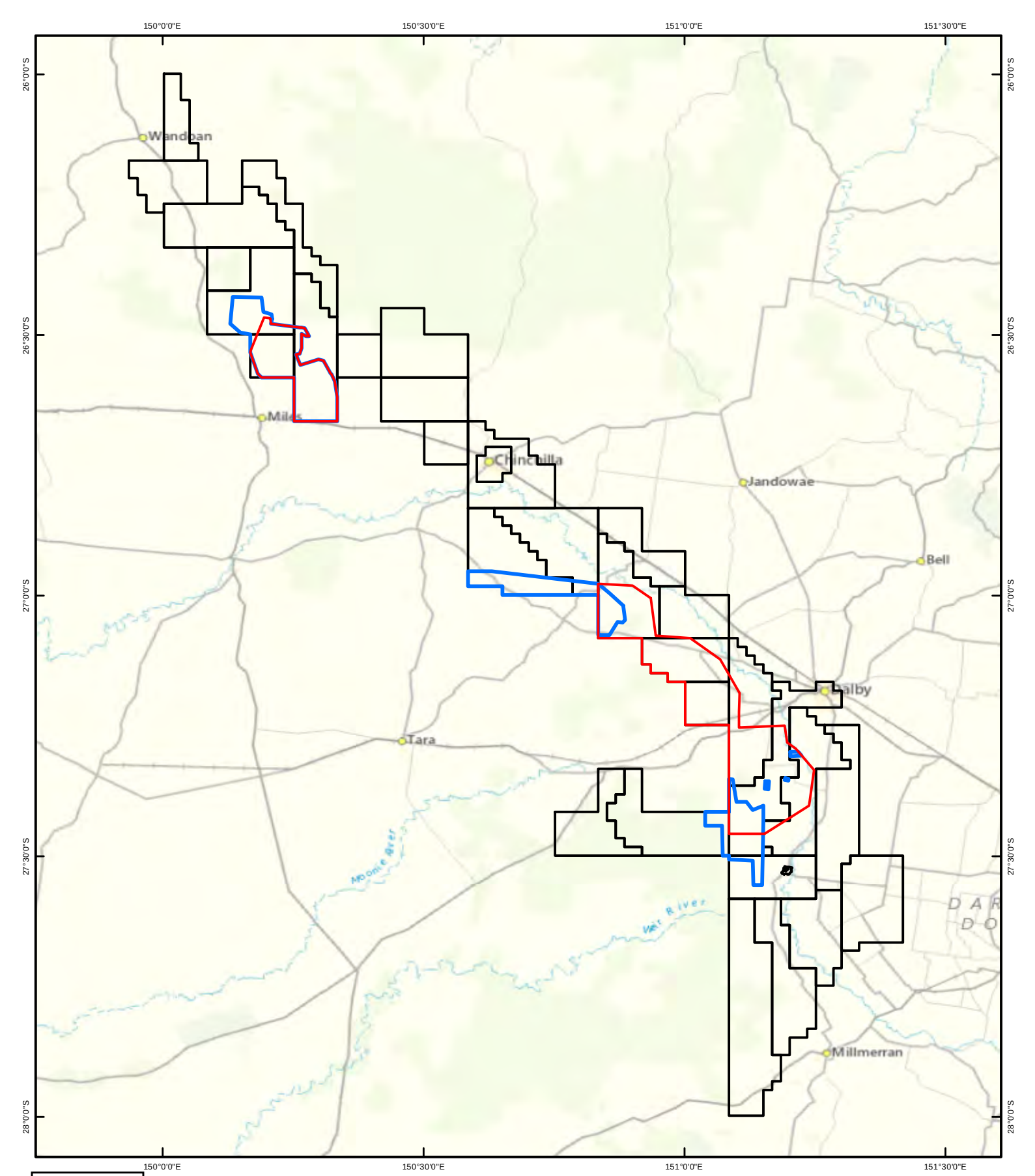
  - performance and completion criteria for evaluating the management of offset areas
  - reconciliation of impacts predicted in the subsequent development stage and actual disturbance in preceding development stages against the maximum disturbance limits.

- **Condition 10A**: Offsets for development stages must be provided in accordance with the mechanism identified in the approved Offset Strategy and must be registered and legally secured in accordance with Queensland legislation prior to commencement of any subsequent development stage.

This Offset Strategy applies to the SGP Stage 2 and addresses each of the conditions described above (as relevant).

The processes and key elements of the Surat Gas Project Stage 2 Offset Strategy, including field survey methods, habitat mapping for listed threatened species, risk assessment and strategies to identify and secure offsets are consistent with those used within the approved Stage 1 Offset Strategy.

Figure 1.1 shows the location of the SGP Stage 1 activities and the proposed Stage 2 activities. The final activity and infrastructure locations for Stage 2 will dependent upon the outcomes of pre-clearance surveys, obligations within the Significant Species Management Plan and relevant approval conditions.



Issued To: J Burkhardt
Author: tstringer

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Source:
Arrow Energy Limited, Geosciences Australia
Dept. Envir. and Resource Mgmt.

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Coordinate System: GDA2020

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Figure 1.1
Surat Gas Project
Location in the Regional Context

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2. Excess Offsets

Condition 8A: If the approval holder has provided an offset in respect of impacts to protected matters predicted for a development stage of the project which subsequently are not realised, such parts of the offset in excess of the obligation for that development stage can be applied towards offsets required for the impacts to protected matters of subsequent development stages.

In Accordance with Condition 8A, Arrow seeks to carry over the following secured offsets in excess of Stage 1 impacts to Stage 2:

- 12.2 ha of Brigalow Threatened Ecological Community
- 918.8 ha South-eastern Long-ear bat core habitat

Details regarding the reconciliation of Stage 1 offsets, and calculation of offsets in excess of Stage 1 is provided in **Table 1**.

Table 2.1 – Calculation of Stage 1 Offsets in Excess of Stage 1 Disturbance

EPBC Species/Community	Total Stage 1 Impact Area (ha)	Stage 1 Approval Limit (ha)	Stage 1 OAMP Impact Area Approved (ha)	Impact Area Remaining – in Excess of Stage 1 OAMP (ha)	Calculated Potential Offset Area Required for Stage 2 (ha)
Brigalow TEC	0.28	39.0	4.6	4.4	13.0
Coolibah – Black Box	0	8.0	0	0	0
Dunmall's Snake	150.0	300.0	150	0	296.4
South-eastern Long-eared bat	156.6	485.52	485.52	382.94	1356.1
Five-clawed worm-skink	0	2.0	0	0	0
Squatter pigeon (southern)	0	203.0	0	0	0
Regent honeyeater	0	1.0	0	0	0
Collared delma	0	11.0	0	0	0
Yakka skink	0	19.0	0	0	0

3. Staged Offsets

Condition 8B: The Offset Strategy may be prepared and submitted to the Minister for approval in stages. Each stage of the Offset Strategy must provide information in respect of the subsequent development stage to commence and all earlier development stages. A development stage must not commence until an Offset Strategy addressing offset obligations for that development stage has been approved by the Minister.

Arrow proposes to undertake the SGP in stages, with the EPBC Act approval defining these stages as:

- **Stage 1**: means all activities, including the installation of gas wells and associated gathering lines, access tracks and gas and water aggregation and transmission infrastructure, from the date of commencement until 350 gas wells have been installed
- **Stage 2**: means all activities following Stage 1, including the installation of gas wells and associated gathering lines, access tracks and gas and water aggregation and transmission infrastructure until 710 gas wells have been installed
- **Stage 3**: means all activities following Stage 2, including the installation of gas wells and associated gathering, access tracks and gas and water aggregation and transmission infrastructure until 1175 gas wells have been installed
- **Stage 4**: means all activities following Stage 3, include the installation of gas wells and associated gathering lines, access tracks and gas and water aggregation and transmission infrastructure until 2276 gas wells have been installed.
- **Stage 5**: means all activities following Stage 4, including installation of gas wells and associated gathering lines, access tracks and gas and water aggregation and transmission infrastructure until the completion of the Action.

To protect EPBC listed threatened species and EPBC communities within the project area, maximum disturbance limits have been imposed with the EPBC Act approval and include:

- **Condition 5**: 'Whole of Project' maximum disturbance limits to core habitat for specified Matters of National Environmental Significance (MNES).
- **Condition 6**: Phase 1 maximum disturbance limits to core habitat for specified MNES.

The approval defines core habitat as *'means core habitat known and core habitat possible as defined in the rules for habitat mapping for each individual species in the Supplementary Report to the Surat Gas Project EIS (March 2012), Attachment 1 – Matters of National Environmental Significance'.*

An Offset Strategy to address the residual significant impacts to MNES predicted for Stage 1 was approved by a Delegate for the Minister on 7 July 2019. A revision of the Offset Strategy for Phase 1 was subsequently approved by a Delegate for the Minister on 27 March 2025.

This Offset Strategy has been developed to address the residual significant impacts to MNES predicted for Stage 2 of the SGP. In accordance with Condition 8B, Stage 2 will not commence until this Offset Strategy has been approved by the Minister.

The location of Stage 1 development and Stage 2 development is provided in Figure 1.

A reconciliation of Stage 1 development impacts is provided in in Table 1.

The predicted impacts to listed EPBC species and threatened ecological communities for Stage 2 is provided in **Table 2.2**.

Table 2.2 – Predicted Impact to EPBC Species and Threatened Ecological Communities

EPBC Species/Community	Total Proposed Impact Area Stage 2 (ha)
Brigalow TEC	7.8
Coolibah – Black Box	0
Dunmall's Snake	705.9
South-eastern Long-eared bat	678.2
Five-clawed worm-skink	0
Squatter pigeon (southern)	0
Regent honeyeater	0
Collared delma	0
Yakka skink	0

Arrow will submit a revised Offset Strategy for each subsequent stage of development to Stage 2 (i.e. Stage 3 to Stage 5).

Arrow will not commence a subsequent development stage until the Offset Strategy for that stage has been approved by the Minister in accordance with conditions of the Approval.

4. Strategy to secure offsets

Condition 8C(a): The Offset Strategy must: include a strategy to secure the offsets proposed for the residual significant impacts to the EPBC listed threatened species and EPBC communities for the subsequent development stage.

Arrow's Strategy to secure offsets for the residual significant impacts to the EPBC listed species and EPBC communities for the SGP is through a combination of direct land-based offsets and indirect offsets (i.e. other compensatory measures) in accordance with the EPBC Act Offsets Policy. As per the policy:

- A minimum of 90 per cent of the offset requirements for any given impact will be met through direct offsets.
- The balance of the offset requirements (10 per cent or less), will be secured by other compensatory measures that will lead to benefits to the impacted matter.

Details are provided in the below.

Direct Offsets

Since investigations began in 2015 into potential offset properties, Arrow has identified a significant number potentially suitable properties to deliver offsets for the SGP. Arrow has also entered commercial in confidence discussions with offset brokers to assist in narrowing down opportunities and progressing offset delivery.

In identifying offset properties, Arrow has the following objectives for potentially suitable offsets:

- Property criteria align with EPBC Act Offsets Policy
- On-ground confirmation of offset values for selected option
- Wherever feasible, connected in the landscape to adjacent tracts of remnant vegetation and/or riparian corridors
- Contain the required offset values with sufficient area to meet offset requirements for that stage, with preference to have surplus offset areas available for the subsequent development stages where feasible
- Property management aligned with principle of reduction in threats, and an increase in or maintenance of ecological condition.

Responsible parties for the management and monitoring of secured offset properties will be determined and documented in the offset agreement with the landholder. A plan/agreement will be prepared confirming the above requirements to which the landholder, Arrow and any required contractors will be agreed through contractual obligations and arrangements.

Arrow will work with the Department during the development of the Stage OAMPs to ensure that the proposed offset property(ies) meet the objectives of the EPBC Act Offsets Policy. To align with the EPBC Act Offsets Policy, the offsets delivered will:

- Deliver an overall conservation outcome that improves or maintains the viability of the protected matter

- Be built around direct offsets but may include other compensatory measures. The proportion of direct and compensatory measures will be tailored to each MNES in accordance with the EPBC Act Offsets Policy, and set out in the OAMP
- Be in proportion to the level of statutory protection that applies to the protected matter
- Be of a size and scale proportionate to the impacts on the protected matter
- Effectively account for and manage the risks of the offset not succeeding
- Be additional to what is already required, determined by law or planning regulations, or agreed to under other schemes or programs
- Be efficient, effective, timely, transparent, scientifically robust and reasonable
- Have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.

Arrow's selection of direct offsets will be aligned with the conservation gain being able to:

- Improve existing habitat for the protected matter; and/or
- Create new habitat for the protected matter; and/or
- Reduce threats to the protected matter; and/or
- Avert the loss of a protected matter and its habitat that is under imminent threat of complete and continuing loss (if the risk of loss is avoided as a result of securing an offset for conservation purposes which will protect the protected matter and its habitat).

Arrow's preference for direct land-based offsets is to secure as few properties as possible to meet offset for staged offset requirements. This provides the advantage of securing a large offset property(ies) and thus reducing edge effects and improving connectivity and the efficiency of maintenance and management activities. The offset areas be legally secured in accordance with Queensland legislation, using a Declared Area mechanism as defined under the Vegetation Management Act 1999 (Queensland).

Indirect Offsets

Indirect offsets, referred to as 'other compensatory measures' in the EPBC Act Offsets Policy, will be proposed for the project where Arrow demonstrates to the Department's satisfaction that direct offsets are not physically available on leasehold or public lands, or leasehold landowners or public land managers will not reach agreement with Arrow to manage available offsets.

If Arrow needs to submit an indirect offset proposal to the Department, we will:

- nominate the percentage contribution to the total offset provided by the other compensatory measures
- describe, consistent with the EPBC Offsets Policy and Offset Assessment Guide, the basis on which the financial contribution to those measures has been derived

- describe the measures, timeframes, key outputs, pathway to delivering the conservation benefit and the confidence of achieving the desired outcomes for the protected matter.

Further to the above, Arrow will continue to explore indirect options for the species as per Section 4.2.3 and Appendix A of the Offsets Policy. Should they be required, options would be progressed in consultation with the DCCEEW and could include activities such as the establishment of a research program, and / or implementation of management actions to contribute to existing knowledge regarding conservation of the species.

Stage 2 Offset Strategy

Arrow is confident that all the required offsets for development Stage 2 can be delivered by securing land-based direct offsets. Section 6 of this Offset Strategy presents the risks to the successful implementation of this strategy. The calculated potential impact for Stage 2 and quantity of offsets required is presented in **Table 2.2**.

Details regarding the offset properties and values are provided below.

Killara Property: Arrow identified a single strategic property with strong connectivity in the landscape and the combination of remnant and regrowth vegetation that provided the necessary offset values for Stage 1. This property is known as Killara and is located approximately 93 km north-east of Kogan. The property comprises four Lot on Plans (Lot 36 BO175 and Lots 15, 16 and 19 BO94). The ecological assessment of this property is provided in **Appendix A**.

The Stage 1 offsets areas for this property were identified in the Stage 1 OAMP and these offset areas have been legally secured in accordance with Queensland legislation and conditions of the Approval. This was achieved using a Declared Area as defined under the Vegetation Management Act 1999 (Queensland).

This property has significant areas of additional values suitable for offsetting the potential significant residual impacts to core habitats of EPBC listed species and Threatened Ecological Communities for Stage 2 development.

This area includes:

- 4.35 ha Brigalow Threatened Ecological Community
- 1212 ha Dunmall's Snake
- 328.9 ha South-eastern Long-eared Bat

Additional Strategic Property (commercial in-confidence): Arrow has identified another single strategic property with strong connectivity in the landscape, and a combination of remnant and regrowth vegetation that will provide the necessary remaining offset values and area for Stage 2 (i.e. not able to be delivered on the Killara Property). This property also provides good connectivity with an adjacent conservation area and associated areas of remnant native vegetation.

Suitably qualified ecologists have undertaken habitat assessments and negotiations are progressing with the landholder.

The potential offset areas include:

- 2022 ha of Dunmall's Snake habitat
- 2835 ha of South-eastern Long-eared Bat habitat.

5. Maps of species locations and habitats

Condition 8C(b): The Offset Strategy must: include a map of the location of each EPBC listed threatened species and its habitat and EPBC community in relation to infrastructure for the subsequent development stage.

There is habitat for three EPBC listed threatened species and one EPBC ecological community within the area of the proposed Stage 2 activities. Figure 1 provides a regional context to the location of the proposed Stage 2 activities.

The actual disturbance area will be finalised during the detailed design phase based on the outcomes of SIMP and relevant conditions of the Approval.

Maps have been provided for each of the relevant EPBC listed threatened species and one EPBC ecological community within the area of the proposed Stage 2 activities, with each map showing:

- Conservative potential habitat: which for the purpose of this document is defined as the vegetation types (i.e. Queensland Regional Ecosystems) that correlate with the EPBC Species Profiles and Threats (SPRAT) Database habitat descriptions for each MNES (this area can be considered more broadly as 'potential habitat' and it provides a very conservative appreciation of the maximum extent of habitat that each species may utilise)

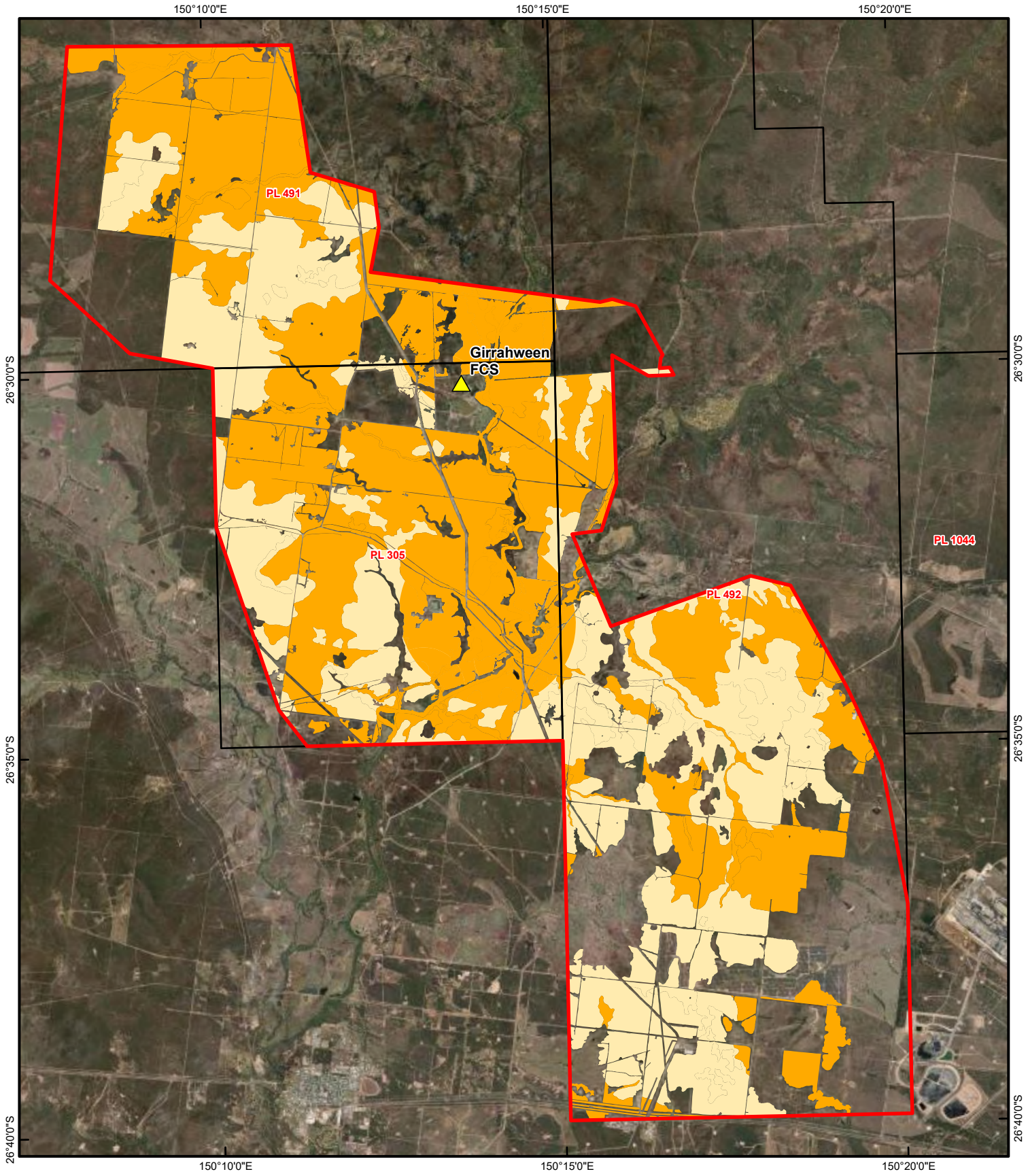
- Core habitat: which for the purpose of this document is a combination of core habitat known and core habitat possible for each MNES as defined in the rules for habitat mapping for each individual species provided in the Surat Gas Project Terrestrial Ecology Report.

The maps are as follows:

- Figure 5.1(a), Figure 5.1(b) and Figure 5.1(c): South-eastern Long-Eared Bat (*Nyctophilus corbeni)*

- Figure 5.2(a), Figure 5.2(b) and Figure 5.2(c): Dunmall's Snake (*Furina dunmalli*)

- Figure 5.3(a), Figure 5.3(b) and Figure 5.3(c): Brigalow (*Acacia harpophylla* dominant and co- dominant).



FCS
Stage 2 Area
Tenure

South-eastern long-eared Bat (Nyctophilus corbeni)

Core habitat
Overly conservative potential habitat

Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no warranty is given that the information contained on this map is free from error or omission. Any reliance placed on such information shall be at the sole risk of the user. Please verify the accuracy of all information prior to using it.

Source:
Arrow Energy Limited, Geosciences Australia
Dept. Envir. and Resource Mgmt.

N

Coordinate System: GDA2020 MGA Zone 56

0 1 2 4
km

Figures 5.1(a):
South-eastern Long-Eared Bat (Nyctophilus corbeni)

arrow energy
go further

Date: 24/04/2025

Issued To: J Burckhardt
Author: tstringer

Document: R:\GIS\Geomatics_Team\WORK_REQUESTS\Environment\250211_RITM0638046_SGPOffsetStrategy_JB\OffsetStrategyMapsStage2.aprx

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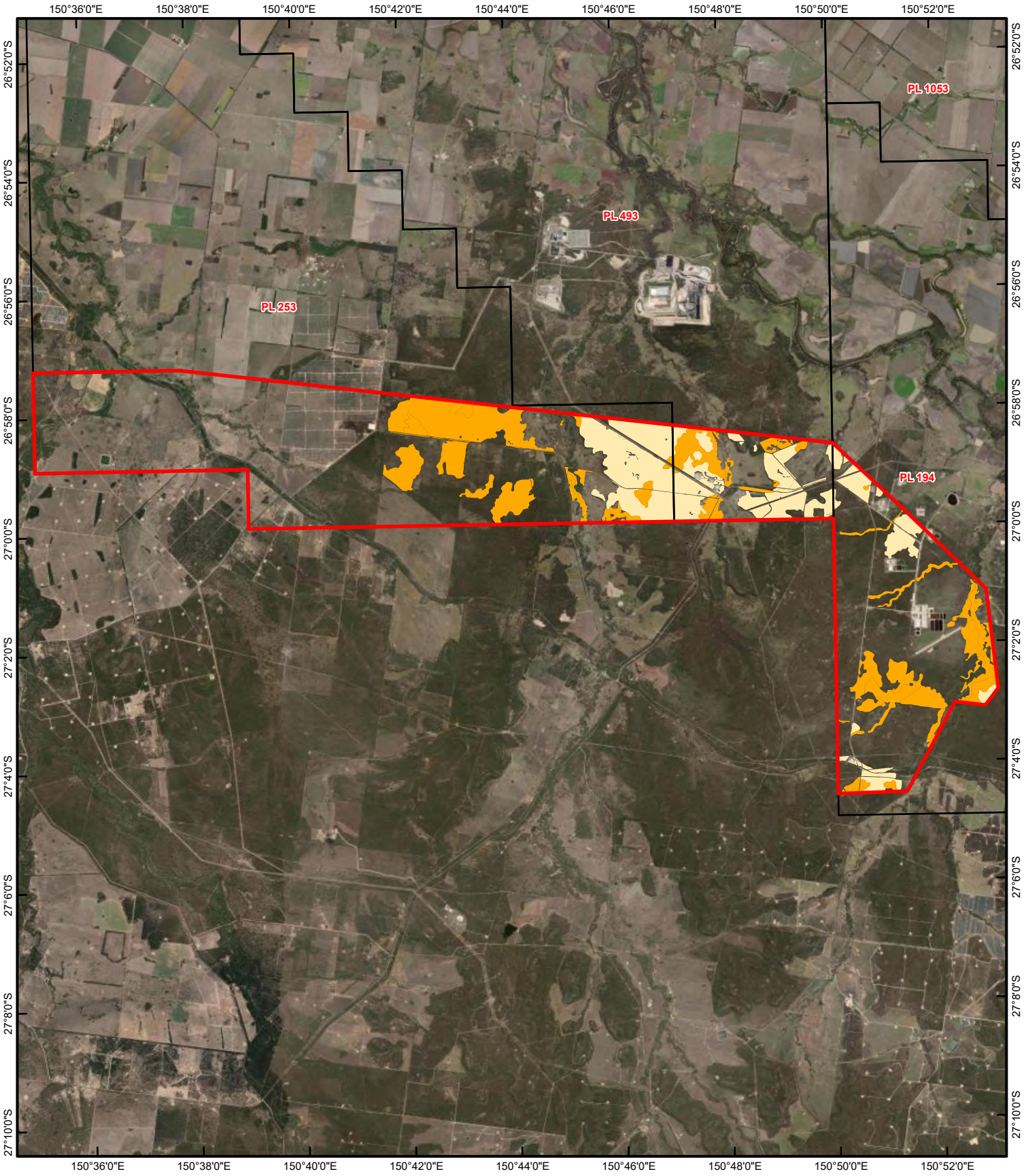

Stage 2 Area
Tenure

South-eastern long-eared Bat (Nyctophilus corbeni)

Core habitat
Overly conservative potential habitat

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Arrow Energy Limited, Geosciences Australia
Dept. Envir. and Resource Mgmt.

N

Coordinate System: GDA2020 MGA Zone 56

0 1.25 2.5 5
km

Figures 5.1(b):
South-eastern Long-Eared Bat (Nyctophilus corbeni)

arrow energy
go further

Date: 24/04/2025

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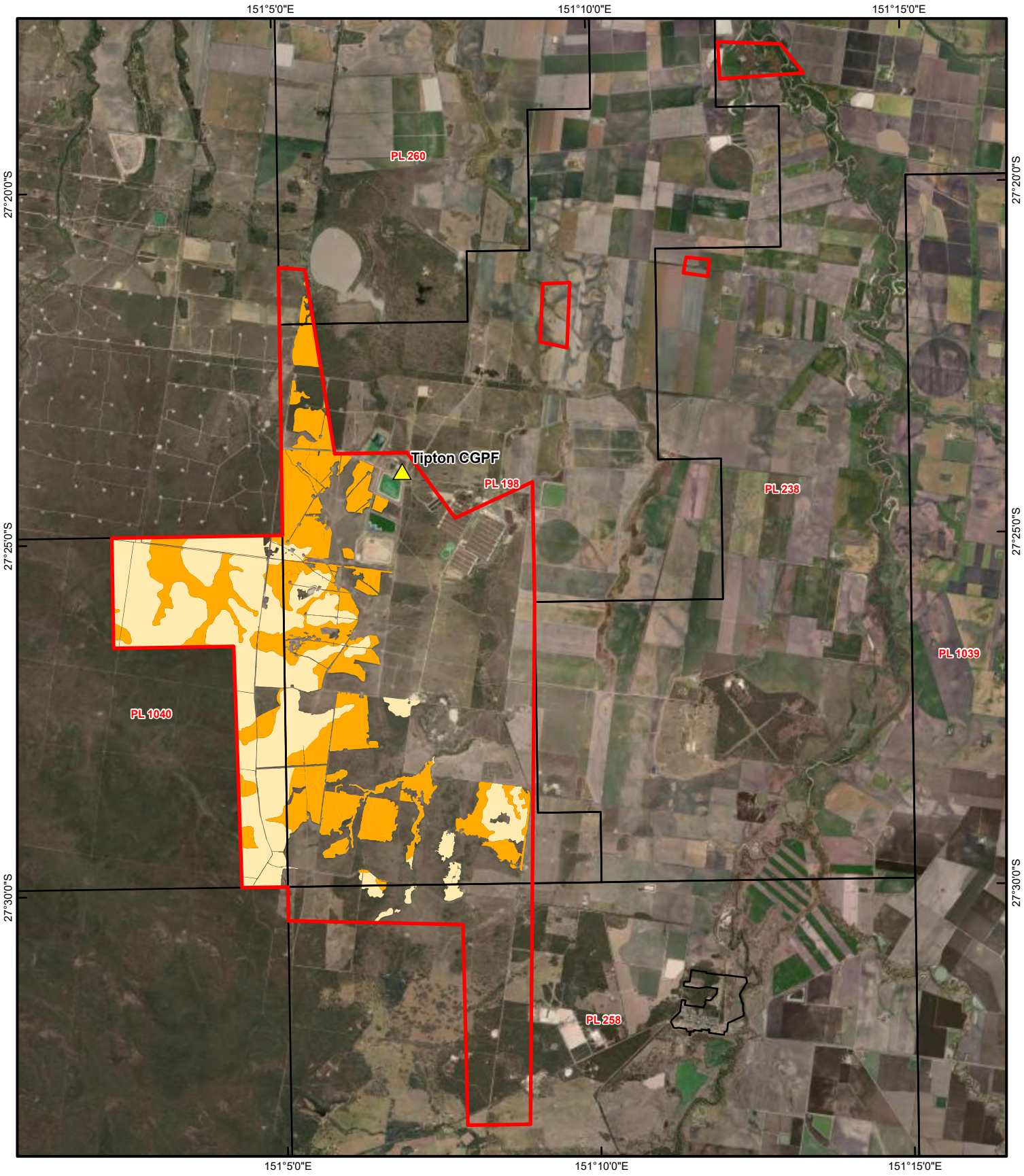

CGPF
Stage 2 Area
Tenure

South-eastern long-eared Bat (Nyctophilus corbeni)

Core habitat
Overly conservative potential habitat

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Dept. Envir. and Resource Mgmt.

N

Coordinate System: GDA2020 MGA Zone 56

0 1.25 2.5 5
km

Figures 5.1(c):
South-eastern Long-Eared Bat (Nyctophilus corbeni)

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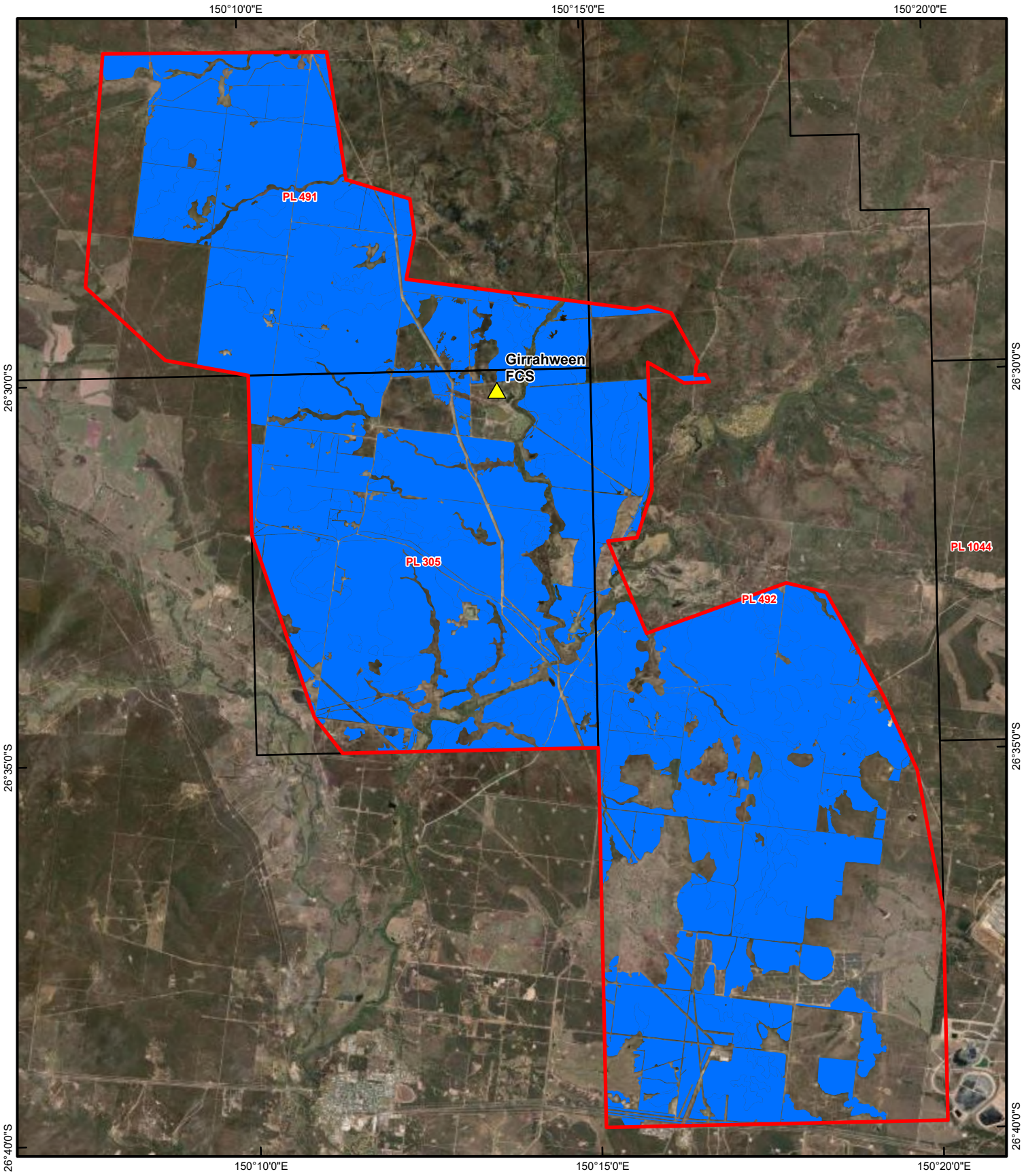

Source:
Arrow Energy Limited, Geosciences Australia
Dept. Envir. and Resource Mgmt.

N

Coordinate System: GDA2020 MGA Zone 56

0 1.25 2.5 5
km

Figure 5.2(a):
Dunmall's Snake (Furina dunmalli)

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Date: 24/04/2025

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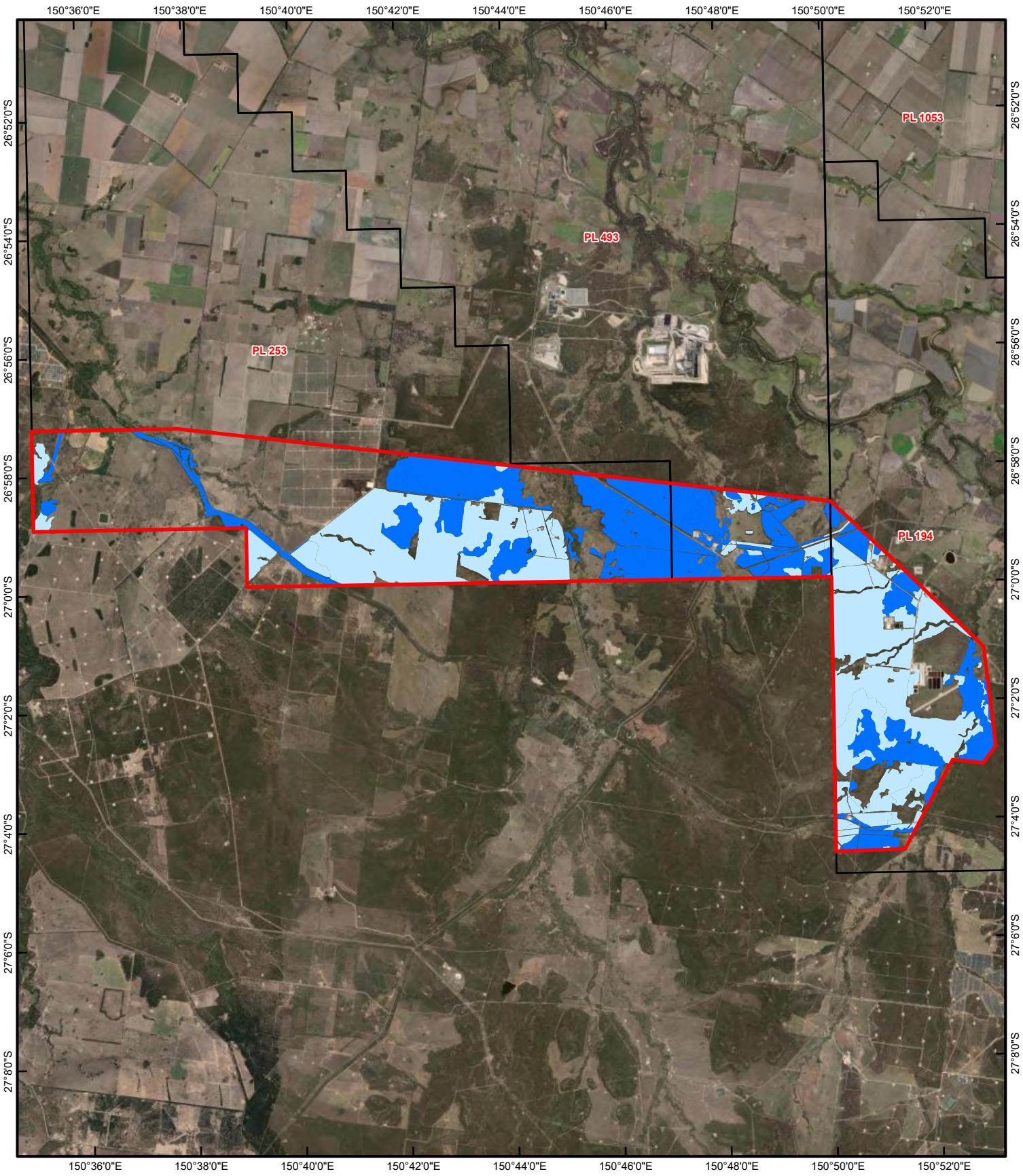

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Note: The information shown on this map is a copyright of Arrow Energy Limited and, where applicable, its affiliates and co-venturers.

Source:
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Dept. Envir. and Resource Mgmt.

N

Coordinate System: GDA2020 MGA Zone 56

0 1.25 2.5 5
km

Figures 5.2(b):
Dunmall's Snake (Furina dunmalli)

arrow energy
go further

Date: 24/04/2025

Document: R:\GIS\Geomatics_Team\WORK_REQUESTS\Environment\250211_RITM0638046_SGPOffsetStrategy_JB\OffsetStrategyMapsStage2.aprx

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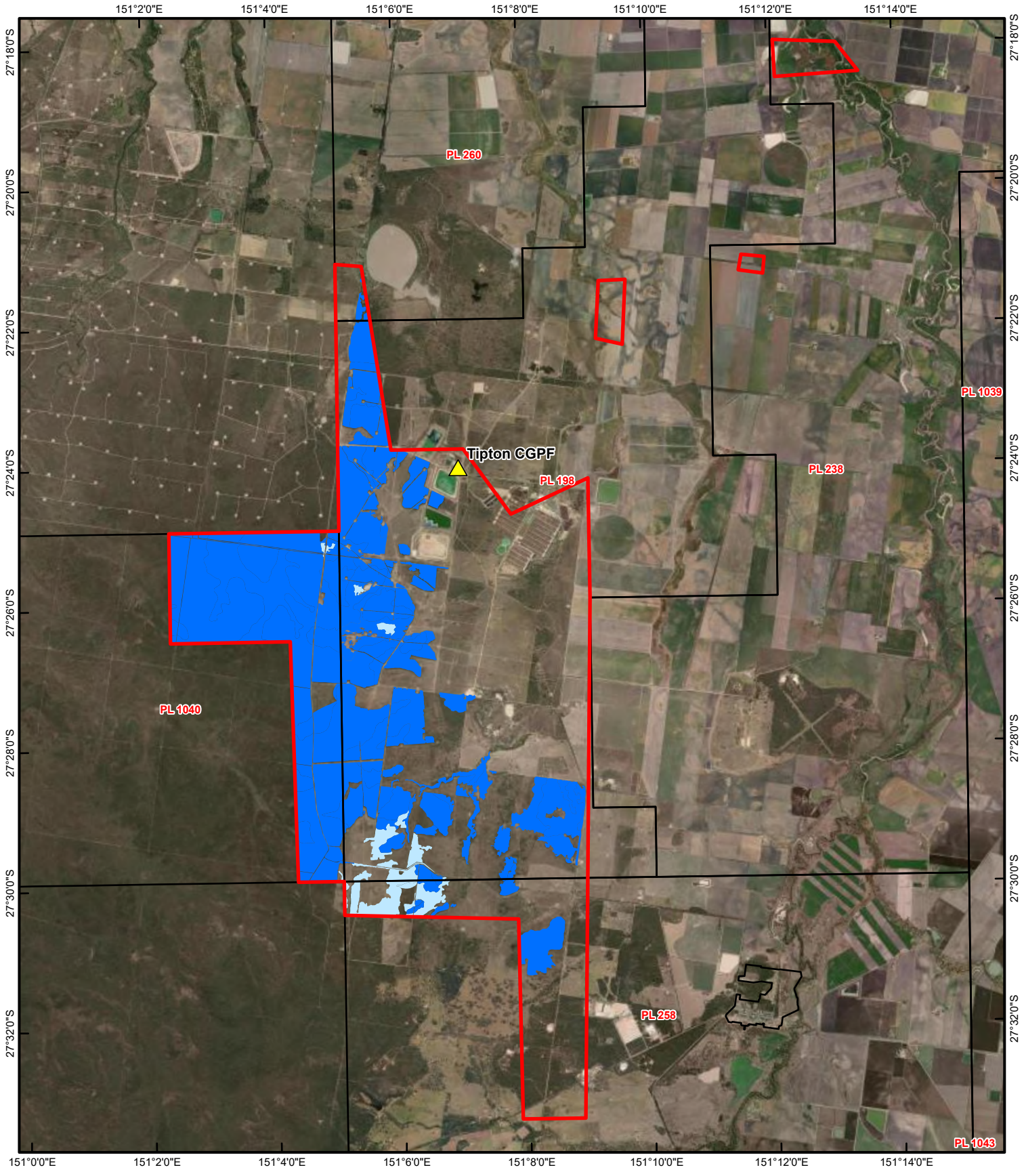

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0 1 2 4
km

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Dunmall's Snake (Furina dunmalli)

arrow energy
go further

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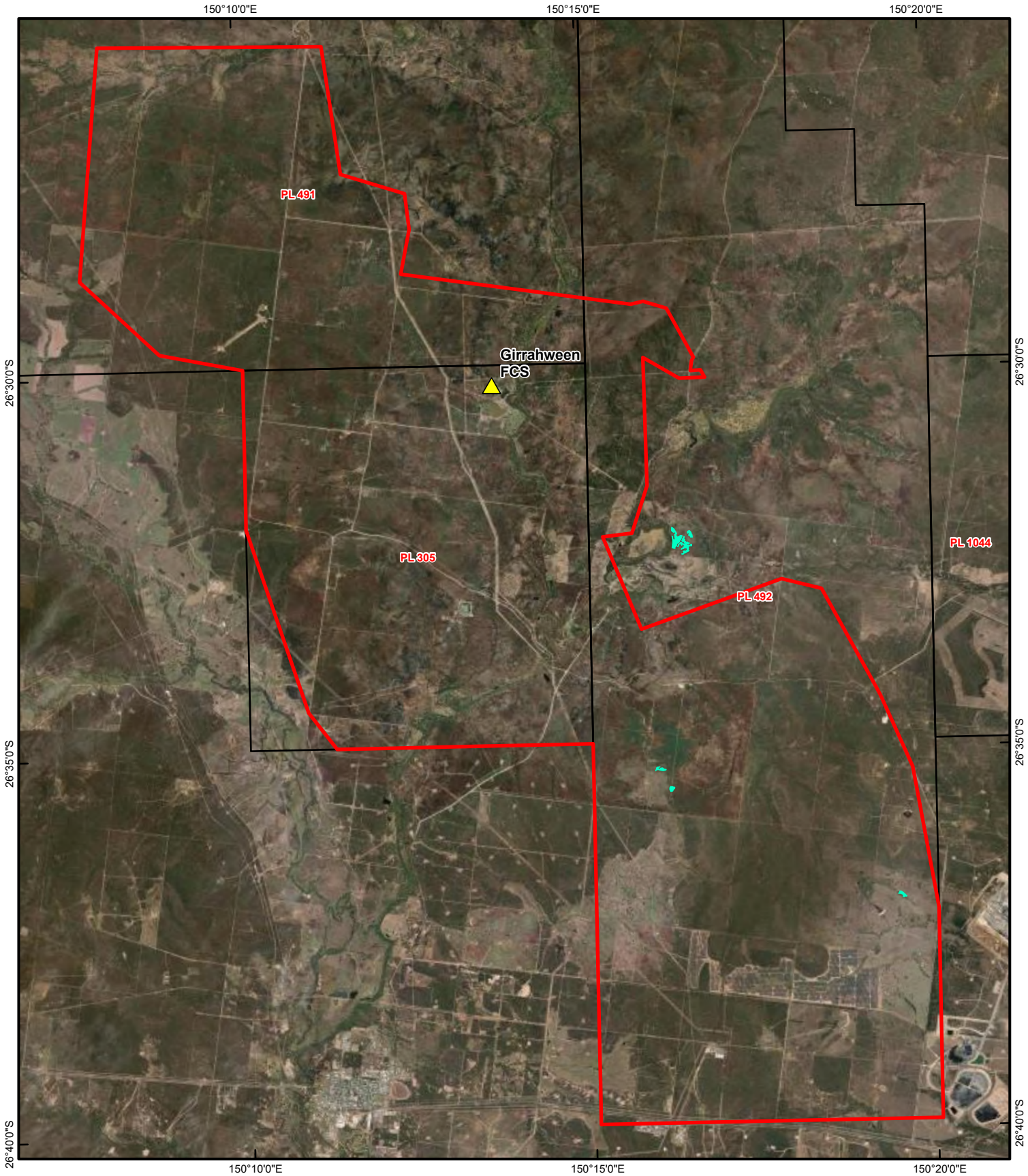

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N

Coordinate System: GDA2020 MGA Zone 56

0 1.25 2.5 5
km

Figure 5.3(a):
Brigalow (Acacia harpophylla dominant and co-dominant)

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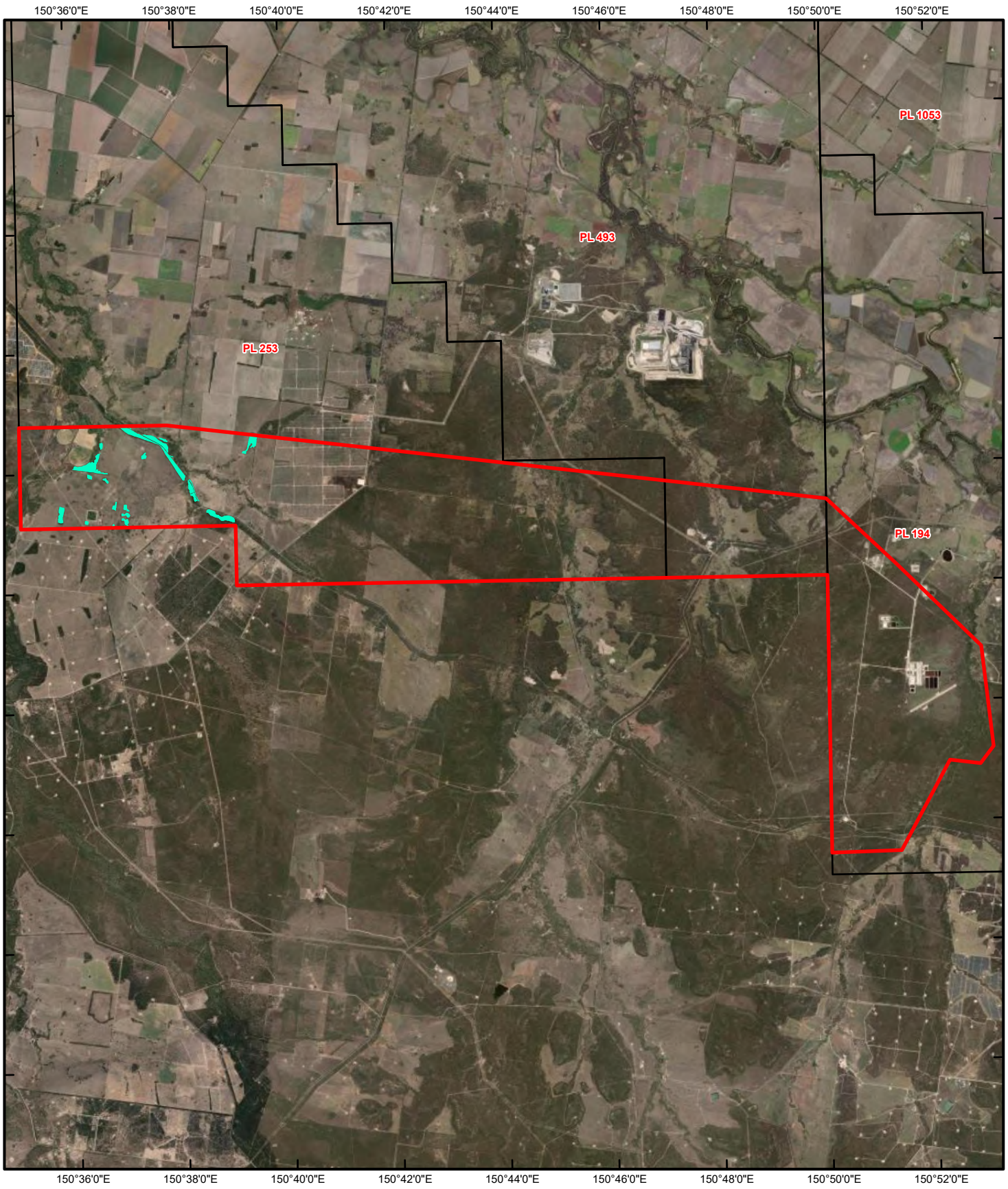
Author: tstringer

Date: 24/04/2025

Document: R:\GIS\Geomatics_Team\WORK_REQUESTS\Environment\250211_RITM0638046_SGPOffsetStrategy_JB\OffsetStrategyMapsStage2.aprx



Stage 2 Area
Tenure
Brigalow (Acacia harpophylla dominant and co-dominant)
Core habitat

Source:
Arrow Energy Limited, Geosciences Australia
Dept. Envir. and Resource Mgmt.

N

Coordinate System: GDA2020 MGA Zone 56

0 1.25 2.5 5
km

Figures 5.3(b):
Brigalow (Acacia harpophylla dominant and co-dominant)

arrow energy
go further

Date: 24/04/2025

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Author: tstringer

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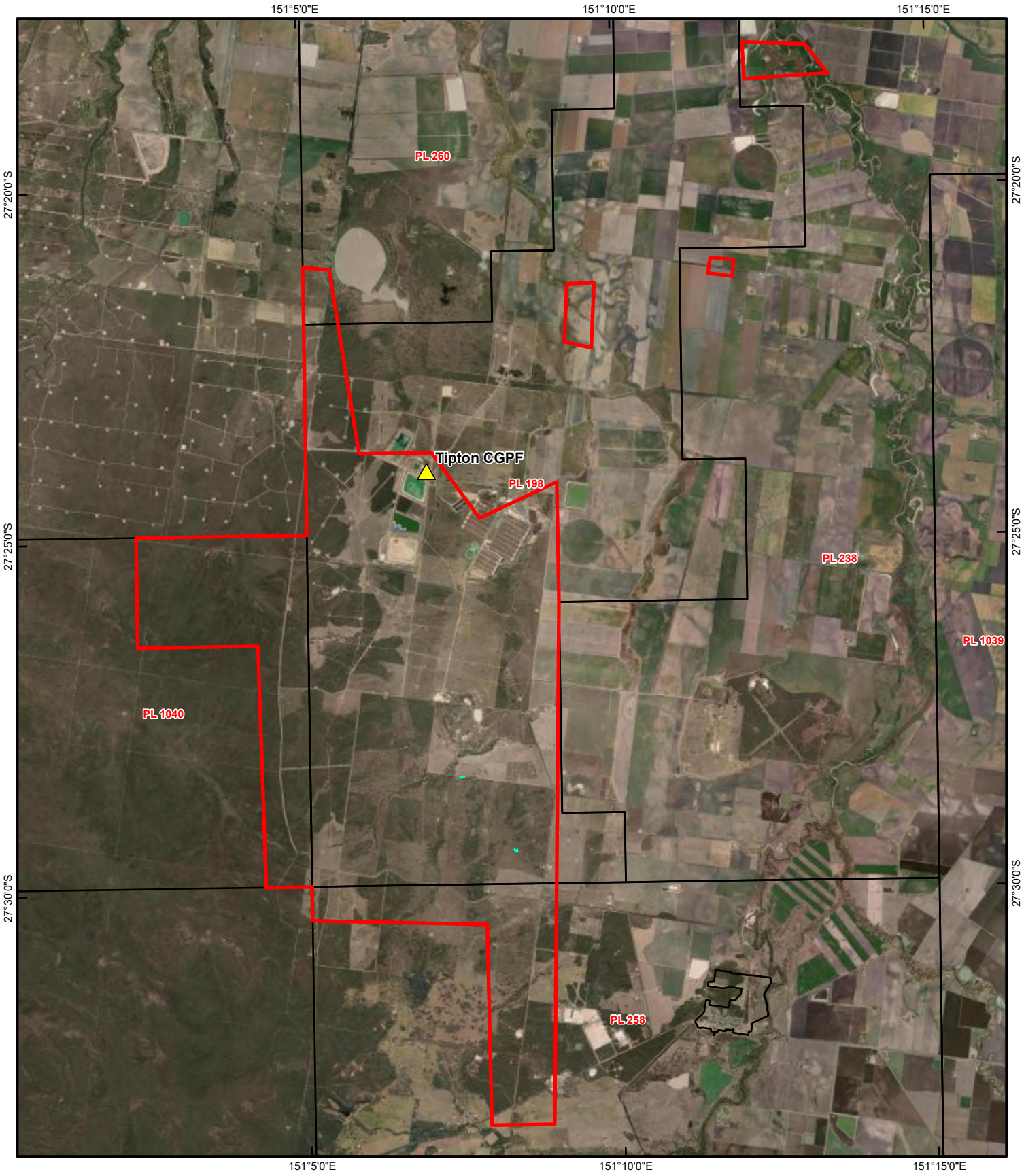

CGPF

Stage 2 Area

Tenure

Brigalow (Acacia harpophylla dominant and co-dominant)

Core habitat

Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no warranty is given that the information contained on this map is free from error or omission. Any reliance placed on such information shall be at the sole risk of the user. Please verify the accuracy of all information prior to using it.

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0 1.25 2.5 5
km

Figures 5.3(c):
Brigalow (Acacia harpophylla dominant and co-dominant)

arrow energy
go further

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6. Risks to successful implementation of this Strategy

Condition 8C(c): The Offset Strategy must: describe potential risks to the successful implementation of the Offset Strategy, and the contingency measures that would be implemented to mitigate against these risks.

For offsets in excess of Stage 1 to be carried over to Stage 2, there are no additional risks identified as the offset areas have already been legally secured and delivered in accordance with the Stage 1 OAMP. The Stage 1 OAMP is being implemented.

For the additional offset areas proposed for the Killara property and the additional property(ies), the risks, management controls, risk rating, triggers and contingency measures that would be implemented if the trigger was realised are described in **Table 6.1**.

Table 6.1 - Risks to the successful implementation of this Stage 2 Offset Strategy

Risk description	Existing controls	Risk Rating	Trigger that will be monitored	Contingency measure
Arrow does not implement the Offset Strategy	• Arrow commitment to implementing the SGP Stage 2 Offset Strategy.	Low	Annual report, including accurate records substantiating impacts to MNES and demonstrating compliance with this Strategy, will be made available on Arrow's website within 3 months of every 12-month anniversary of project commencement.	Arrow will notify the DCCEEW of the non-compliance and either rectify within 3 months or seek an alternative arrangement with DCCEEW.
Insufficient resources are assigned to implementing the Strategy	• Arrow is committed to implementing our Health Safety and Environment Policy, which specifically states, 'Arrow will fully support the implementation of this Policy by providing sufficient resources, systems and training to effectively manage HSE risks.' • Arrow is sufficiently resourced to implement this Strategy.	Low	Compliant Annual report as per above.	Assign sufficient resources to implement this Strategy and deliver a compliant Annual report or rectify as per above.
The Offset Area Management Plan (OAMP) is not submitted within 12 months of project commencement	• Arrow has already commissioned offset specialists and an offset broker to assist in the search for suitable offset properties. These consultants are also experienced in preparing and having OAMPs approved by DCCEEW. • Arrow is well underway with the search for proposed offset property(ies) and will commence preparation of the OAMP before the actual commencement of the SGP.	Low	In-principle, agreement on the quantification of offsets (i.e. inputs to the offset calculator) will be reached with DCCEEW within 9 months of project commencement.	Meet with DCCEEW within 9 months of the next development stage commencement to discuss the quantification of offsets. Provide the OAMP for Stage 2 in accordance with conditions of the Approval.

Risk description	Existing controls	Risk Rating	Trigger that will be monitored	Contingency measure
Arrow does not legally secure the required offset areas	• Arrow has already acquired the offset property, ecology assessments are complete and offset areas identified for Stage 1. • Offsets in excess of Stage 1 are to be legally secured. • Upon approval of this Stage 2 Strategy Arrow will commence the process of legally securing the additional offset areas on additional Offset sites via the Declared Area mechanism in accordance with Queensland legislation.	Low	The request for a declared area will be submitted to the Queensland Government within 3 months of the approval of the Stage 2 OAMP by the Minister	The next stage of development will not commence until the previous Stage's offset areas are legally secured in accordance with Queensland legislation and conditions of the Approval.
Arrow is unable to legally secure the required offset property(ies)	• As noted above, Arrow is well advanced in the search and commercial negotiations for suitable offset properties. • Offset areas have been identified and an offset agreement has been presented to the landholder in executable form. Upon execution of the agreement Arrow will commence the process of legally securing the offset via the declared area process.	Low	The request for a declared area will be submitted to the Queensland Government within sufficient time to legally secure the offset area before the start of the next development stage.	The next stage of development will not commence until the previous Stage's offset areas are legally secured in accordance with Queensland legislation and conditions of the Approval.
Failure to detect impacts to other MNES not addressed in this Strategy	• Arrow has completed seasonal field surveys across the SGP to identify the MNES that may potentially occur. • This information has been included on our GIS mapping layers that are interrogated when assessing the implications of any new disturbance • Pre-clearance surveys are conducted by suitably qualified ecologists prior to new disturbance in vegetated areas and bio-condition assessments will be undertaken in areas requiring clearing of MNES habitat.	Low	Post-clearing GPS records of impacts to MNES will be reviewed to detect any clearing of MNES not addressed in this Strategy.	The process and measures described in Section 7 will be implemented.

Risk description	Existing controls	Risk Rating	Trigger that will be monitored	Contingency measure
Arrow shortlists offset properties that do not meet the offset requirements	• Arrow will use the EPBC Offsets Assessment Guide, using conservative assumptions, to identify suitable offset areas. • Arrow will submit the draft OAMP to DCCEEW within 12 months of project commencement.	Low	DCCEEW assessment of the OAMP (including the offset calculators).	Arrow will aim to secure offsets beyond those required for Stage 2 where feasible.
The offsets do not address the principles of the EPBC Offset Policy	• Arrow has engaged external parties experienced in delivering EPBC offsets. • Arrow will continue to seek DCCEEW advice on compliance with the principles of the EPBC Act Offsets Policy.	Low	An approved OAMP for the subsequent development stage and compliant Annual report.	. Provide the OAMP for Stage 2 for approval in accordance with conditions of the Approval.

7. Residual Significant Impacts to other MNES

Condition 8C(d): The Offset Strategy must: detail how the approval holder will address any residual significant impacts to any EPBC listed threatened species and its habitat and/or EPBC communities not identified in Table 1, in accordance with the EPBC Act Offsets Policy.

Arrow has processes in place to identify EPBC Listed threatened species and its habitat and EPBC communities during field development planning and prior to disturbance. Arrow also has processes in place that will follow should an unavoidable residual significant impact to a MNES not included in Table 1 of the SGP EPBC approval be required. Sections below describes the process that will be followed prior to and during activities within areas proposed for ground disturbance.

Planning for disturbance activities

The following process will be implemented by Arrow prior to land disturbance:

- Pre-clearance surveys will be undertaken by suitably qualified ecologist and will include:
    - field inspection of the proposed disturbance footprint identified during detailed design will be undertaken by a suitably qualified ecologist (typically two to six months prior to planned disturbance activities) and the presence, absence and extent of MNES values will be verified and mapped in the field via GIS
    - where MNES (or State) values are confirmed, a ‘framing trade-offs’ session will be held with the project engineers, planners and ecologist to determine if the location of the activities can be changed to avoid and/or reduce the impact to the identified values
    - for habitat areas of MNES required to be impacted, Arrow will complete a Habitat Quality Assessment in accordance with the DCCEEW Offsets Assessment Guide (How to Use the Offsets Assessment Guide) and the Queensland Government Department of Environment and Heritage Protection’s Guide to determining terrestrial habitat quality – A toolkit for assessing land-based offsets under the Queensland Environmental Offsets Policy (2017). For habitat assessments undertaken post 2019 the Guide to determining terrestrial habitat quality (DES, 2020) has been utilised. This assessment will lead to a determination as to whether an MNES not listed in Table 1 of the Approval is to be impacted and a habitat quality score out of 10 for the impacted habitat based on the following indicators (as per the EPBC Offset Assessment Guide):
        - site condition: a general condition assessment of vegetation compared to a benchmark
        - site context: an analysis of the site in relation to the surrounding environment

    - species stocking rate: an analysis of the usage and/or density of a species at a particular site.

- A fauna spotter-catcher(s) will be present during clearing. The spotter-catcher will be a suitably qualified ecologist as per the definition provided in the Approval: *means a person who has professional qualifications, training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis to performance relative to the subject matter using relevant protocols, standards, methods and literature*.

- The coordinates and total area of disturbed EPBC listed habitats and communities will be recorded and tracked against the Whole of Project core habitat disturbance limits and used for annual compliance reporting. Offsets will be provided for MNES in accordance with the Stage 2 OAMP once submitted and approved in accordance with conditions of the Approval.

Process followed to address residual significant impacts to any EPBC listed threatened species and its habitat and/or EPBC communities not identified in Table 1.

If the abovementioned pre-clearance survey, framing trade-offs session and habitat quality assessment identifies the potential for a residual significant impact to a threatened species or EPBC community that was listed under the EPBC Act at the time of the approval but not listed in Table 1 of the EPBC approval, the following process would be implemented:

- Residual significant impacts to a EPBC listed threatened species and / or a EPBC community that was listed under the EPBC Act at the time of the approval but not identified in Table 1 of the Approval will be offset in accordance with the EPBC Act Offsets Policy.

- Arrow plans to offset residual significant impacts to the EPBC listed species and EPBC communities through a combination of direct land-based offsets and indirect offsets (i.e. other compensatory measures) in accordance with the EPBC Act Offsets Policy. As per the policy:

    - A minimum of 90 per cent of the offset requirements for any given impact will be met through direct offsets.

    - The balance of the offset requirements (10 per cent or less), will be secured by other compensatory measures that will lead to benefits to the impacted matter

- Arrow would address the requirement for the offset for the residual significant impact within the Stage 2 OAMP for approval by the Minister or if already approved, seek a subsequent variation approval.

Ecological surveys conducted post EIS approval and in accordance with above processes have recorded the presence of three recently listed EPBC Act species (i.e. post SGP Approval) within the SGP Project Area. These species comprise Koala (*Phascolarctos cinereus*), Greater Glider (*Petauroides volans*) and Painted Honeyeater (*Grantiella picta*) which were listed in February 2022, May 2016 and July 2015 respectively. In accordance with Queensland legislation, the potential for significant impacts to these species will be assessed as Matters of State Environmental Significance (MSES). Offsets for residual significant impact are being provided in accordance with the Queensland Government's

Offset Policy and Environmental Authority (EA) Conditions granted under the Environment Protection Act 1994 as imposed by the Department of the Environment, Tourism, Science & Innovation (DETSI).

8. Securing offsets

Condition 8C(e): The Offset Strategy must: specify the proposed legal mechanism and timeframe for securing the offset(s).

Legal mechanism

In accordance with Condition 10a of the Approval, offsets will be legally secured and registered in accordance with Queensland legislation. It is proposed that the offset areas be registered and legally secured through the use of a Declared Area as defined under the *Vegetation Management Act 1999* (VM Act) (Qld).

The Declared Area process provides a legislative pathway for landholders to voluntarily protect native vegetation on their land. The declared area provides a permanent, registered, binding mechanism linked to the property title, with direct reference to the approved offset plan that includes information on the area protected as the offset and requirements that must be met.

The use of this legal mechanism is consistent with the mechanism proposed in the Stage 1 Offset Strategy. This mechanism has been subsequently used by Arrow to legally secure and register Stage 1 offsets in accordance with the approved Stage 1 OAMP.

Timeline for securing offsets

Offsets in excess of Stage 1 on the Killara property are available for Stage 2 and are already legally secured.

Arrow commits to the following timelines relevant to securing the additional offsets:

- Any remaining habitat quality assessments on the Killara property will be undertaken and presented in the Stage 2 OAMP
- Arrow will continue discussions with the landholder of the additional offset property and undertake habitat quality assessments for presentation in the Stage 2 OAMP
- The Stage 2 OAMP will be submitted to the Department as required by Condition 10B). The OAMP will include the details of the offset package including, for direct offsets, each of the requirements specified in condition 10B
- The process for Declared Area under the VM Act will commence with the Queensland Government at least 3 months before the start of Stage 2.
- Arrow will legally secure the Stage 2 offsets prior to the commencement of the next development stage.

9. Implementation of Stage 1 Offset Strategy

Condition 8D: The approval holder must not commence the action until the Offset Strategy for Stage 1 has been approved by the Minister in writing. The approved Offset Strategy must be implemented by the approval holder.

The Stage 1 Offset Strategy was approved by the Minister on 7 July 2019 and subsequent amendments approved on 27 March 2025. Stage 1 commenced on 22 October 2020.

10. Prior to Commencement of Development Stage

Condition 9A: At least 3 months prior to the commencement of any development stage after Stage 1, the approval holder must submit a revised Offset Strategy for approval by the Minister.

This Stage 2 Offset Strategy has been submitted at least 3 months prior to commencement of Phase 2 for approval by the Minister. Stage 2 is forecast to commence in August 2025.

Arrow commits to implementation of this Stage 2 Offset Strategy following approval by the Minister.

11. Strategy to Secure Offsets

Condition 9A(a) a strategy to secure the minimum offsets proposed for the residual significant impacts to the EPBC listed threatened species and EPBC communities for the subsequent development stage.

A strategy to secure the minimum offsets proposed for the residual significant impacts to the EPBC listed threatened species and EPBC communities for Stage 2 has been provided in **Section 4**.

12. Location of EPBC Species and Communities

Condition 9A(b) a map of the location of each EPBC listed threatened species and its habitat and EPBC community in relation to infrastructure for the subsequent development stage.

Maps showing the location of each EPBC listed threatened species and its habitat and EPBC community in relation to infrastructure for the subsequent development stage are presented in **Section 5**. This is a duplication obligation of Condition 8C(b).

13. Information Required

Condition 9A(C) the information required for the Offset Strategy at conditions 8C(a) to 8C(e) for the subsequent development stage.

This information required for the Offset Strategy at conditions 8C(a) to 8C(e) for Stage 2 are provided in the following sections:

- 8C(a) – **Section 4**
- 8C(b) – **Section 5**
- 8C(c) – **Section 6**
- 8C(d) – **Section 7**
- 8C(e) – **Section 8.**

14. Larger Strategic Offset

Condition 9A(D) demonstration of how any proposed offset builds on offsets already secured and will contribute to a larger strategic offset for whole of project impacts.

Co-locating the offset obligations on the same large offset property or smallest number of properties to the extent technically feasible will improve the biodiversity value of each offset individually and strengthen other values such as connectivity and resilience.

Optimal management for each offset will be achieved where the management actions, reporting timeframes and monitoring, can be aligned, where appropriate. This will achieve efficiencies in managing many aspects of the cumulative offset area, for aspects such as weeds, feral animals, fire and monitoring.

This approach will ensure that a larger, or a small number of larger more strategic offsets is achieved by co-locating offset obligation for subsequent development stages where technically feasible for whole of project impacts.

15. Performance and Completion Criteria

Condition 9A(E) performance and completion criteria for evaluating the management of offset areas

Offset completion criteria have been determined based on an understanding of the specific habitat, connectivity, and other ecological values for the relevant MNES. These criteria were initially derived from detailed ecology survey information of both the impact and offset areas utilising an approach specified in the Guide to determining terrestrial habitat quality (DEHP, 2017 and DES 2020). The targeted habitat quality meet guidelines published by Australian and New Zealand Minerals and Energy Council (ANZMEC,2000) stating completion criteria should be:

- Specific enough to reflect a unique set of environmental, social and economic circumstances
- Flexible enough to adapt to changing circumstances without compromising objectives

- Include environmental indicators suitable to demonstrate that rehabilitation trends are heading in the right direction
- Undergo periodic review, modifying if required due to changed circumstances or improved knowledge
- Based on targeted research, resulting in more informed decisions.

A set number of interim performance completion criteria will be proposed during the management period to track the trajectory of habitat quality towards the desired final completion criteria. The timing of the interim targets will correspond with the targeted species surveys and detailed ecological condition monitoring. The interim performance completion criteria and timing of the interim targets would be provided in the Stage 2 OAMP.

Interim targets would be derived by identifying the attributes expected to increase over the period of the approval. The values were determined by differentiating between specific, longer-term metrics (e.g., species richness, tree canopy cover, number of large trees) and those where an initial benefit could be realised early (e.g., recruitment of woody species, non-native plant cover).

Completing management actions identified will enable the offset area to attain the completion criteria identified and maintaining the stated completion criteria for the duration of the Approval.

Annual reporting (that includes monitoring reports for the offset site) would provide transparency regarding how the site management actions are being implemented. The reports will be prepared after the anniversary of the implementation of the offset site or will be consistent with other offset site reporting dates, as it is planned that other offset sites will be established on the same property(ies).

Where relevant, the report will identify events impacting the offset area, trigger levels reached, corrective actions implemented as a result and the efficacy and success of those actions, and non-compliances with the management plan and subsequent corrective actions taken.

16. Reconciliation of Impacts

Condition 9A(f) reconciliation of impacts predicted in the subsequent development stage and actual disturbance in preceding development stages against the maximum disturbance limits.

A reconciliation of impacts predicted in the subsequent development stage and actual disturbance in preceding development stages against the maximum disturbance limits is provided in the **Table 16.1**, **Table 16.2** and **Table 16.3**.

Table 16.1 – Stage 1 Actual Impact vs Stage 1 OAMP Offset Areas

EPBC Species/Community	Total Stage 1 Impact Area (ha)	Stage 1 Approval Limit (ha)	Stage 1 OAMP Impact Area Approved (ha)	Impact Area Remaining – in Excess of Stage 1 OAMP (ha)	Calculated Potential Offset Area Required for Stage 2 (ha)
Brigalow TEC	0.28	39.0	4.6	4.4	13.0
Coolibah – Black Box	0	8.0	0	0	0
Dunmall's Snake	150.0	300.0	150	0	296.4
South-eastern Long-eared bat	156.6	485.52	485.52	382.94	1356.1
Five-clawed worm-skink	0	2.0	0	0	0
Squatter pigeon (southern)	0	203.0	0	0	0
Regent honeyeater	0	1.0	0	0	0
Collared delma	0	11.0	0	0	0
Yakka skink	0	19.0	0	0	0

Table 16.2 - Stage 2 Proposed Impact Area and Potential Offset Areas

EPBC Species/Community	Total Proposed Impact Area Stage 2 (ha)	Calculated Potential Offset Area Required for Stage 2 (ha)
Brigalow TEC	7.8	22.1
Coolibah – Black Box	0	0
Dunmall's Snake	705.9	2160.0
South-eastern Long-eared bat	678.2	2943.5
Five-clawed worm-skink	0	0
Squatter pigeon (southern)	0	0
Regent honeyeater	0	0
Collared delma	0	0
Yakka skink	0	0

Table 16.3 - Whole of Project Disturbance Limits to Core Habitat – Stage 1 & Stage 2

EPBC Species/Community	Whole of Project Disturbance Limit to Core Habitat (ha)	Total Actual and Proposed Stage 1 & Stage 2 Disturbance to Core Habitat (ha)	Disturbance Limit to Core Habitat Remaining at Completion of Stage 1 & 2 (ha)
Brigalow TEC	106	8.0	98.0
Coolibah – Black Box	8	0.0	8.0
Dunmall's Snake	4400	855.9	3544.1
South-eastern Long-eared bat	4080	834.8	3245.2
Five-clawed worm-skink	560	0.0	560.0
Squatter pigeon (southern)	3261	0.0	3261.0
Regent honeyeater	20	0.0	20.0
Collared delma	90	0.0	90.0
Yakka skink	310	0.0	310.0
Australian Painted Snipe	5	0.0	5.0
Weeping Myall Woodlands	1	0.0	1.0
Natural Grasslands on basalt & fine textured alluvial plains	No Disturbance	No Disturbance	No Disturbance
White Box-Yellow Box-Blakely's Red Gum Grassy Woodlands	No Disturbance	No Disturbance	No Disturbance
Semi-evergreen vine thickets	No Disturbance	No Disturbance	No Disturbance
Curley-bark Wattle	1210	0.0	1210.0
Hando's Wattle	1210	0.0	1210.0
Belson's Panic	140	0.0	140.0
Prostanthera sp Dunmore	380	0.0	380.0
Small-leaved Denhamia	50	0.0	50.0
Calytrix gurulmundensis	1210	0.0	1210.0
Ooline	No Disturbance	No disturbance	No disturbance
Austral Toadflax	160	0.0	160.0
Acacia Lauta	990	0.0	990.0
Xerothamnella herbacea	110	0.0	110.0
Hawkweed, Picris evae	120	0.0	120.0
Austral Cornflower	160	0.0	160.0
Eucalyptus virens	170	0.0	170.0
King Blue-grass	160	0.0	160.0
Queensland White-gum	10	0.0	10.0
Macrozamia machinii	No disturbance	No Disturbance	No Disturbance

17. Mechanism for Legal Security

Condition 10A: Offsets for development stages must be provided in accordance with the mechanism identified in the approved Offset Strategy and must be registered and legally secured in accordance with Queensland legislation prior to commencement of any subsequent development stage.

In accordance with Condition 10A of the Approval, offsets will be legally secured and registered in accordance with Queensland legislation. It is proposed that the offset areas be registered and legally secured through the use of a Declared Area as defined under the *Vegetation Management Act 1999* (VM Act) (Qld).

The Declared Area process provides a legislative pathway for landholders to voluntarily protect native vegetation on their land. The declared area provides a permanent, registered, binding mechanism linked to the property title, with direct reference to the approved offset plan that includes information on the area protected as the offset and requirements that must be met.

The use of this legal mechanism is consistent with the mechanism proposed in the Stage 1 Offset Strategy. This mechanism has been used by Arrow to legally secure and register Stage 1 offsets in accordance with the approved Stage 1 OAMP.

18. Stage 2 Offset Area Management Plan

Condition 10B: Within 12 months of project commencement or the Minister approving the Offset Strategy for a subsequent development stage, the approval holder must submit for the approval of the Minister an Offset Area Management Plan

Arrow commits to submitting a Stage 2 Offset Area Management Plan within 12 months of the Minister approving the Stage 2 Offset Strategy.

19. References

Arrow Energy. (2018). *Species Impact Management Plan.*

Arrow Energy. (2012). *Surat Gas Project Environmental Impact Statement*.

Arrow Energy. (2013). *Supplementary Report to the Surat Gas Project Environmental Impact Statement*.

Arrow Energy. (2019). *Surat Gas Project Stage 1 Offset Strategy*.

Arrow Energy. (2020). *Surat Gas Project Stage 1 Offset Area Management Plan*.

Australian Government. (2012). *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy.*

ANZMEC (2000) Australian and New Zealand Minerals and Energy Council (ANZMEC). 2000. Strategic Framework for Mine Closure. (http://www.dist.gov.au).

DEHP 2017. *Guide to Determining Terrestrial Habitat Quality: A toolkit for assessing land-based offsets under the Queensland Environmental Offset Policy.*

DES 2020. *Guide to Determining Terrestrial Habitat Quality: Methods for assessing habitat quality under the Queensland Environmental Offsets Policy.*

Appendix A – Killara Property Ecology Report

HABITAT QUALITY ASSESSMENT REPORT

Killara Offset Area

PREPARED FOR ARROW ENERGY PTY LTD
Version 1.2, March 2025

Killara Offset Area

Habitat Quality Assessment Report

March 2025

ECOSMART ECOLOGY
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INTENDED USE: EcoSmart Ecology has prepared this report at the request of Arrow Energy Pty Ltd. Information and recommendations contain herein are purpose and project specific and EcoSmart Ecology accepts no liability for the use or interpretation of any information contained in this report for any other purposes other than intended.

The report should be read in its entirety. No responsibility is accepted for portions of text taken out of context. This report does not provide legal advice. Legal advice should only be sort from qualified practitioners.

DOCUMENT CONTROL

Name of Project:	Killara Offset Area Habitat Quality Assessment
Project Number:	ARW_2401
Project Manager:	Mark Sanders
Document Author(s):	Mark Sanders
Name of Document:	ESE (2024)_Killara Habitat Quality Assessment Report
File Name:	ESE (2024)_Killara HQS report_Mar 25_v1.2.docx
Version:	Version 1.2

CONTENTS

FIGURES

1.0 INTRODUCTION

1.1 BACKGROUND

Arrow Energy (Arrow) is securing land-based offsets for their Surat Gas Project (SGP) located in the southern Brigalow Belt. To demonstrate ecological equivalence Arrow requires Regional Ecosystems (REs) within proposed offsets to have their 'habitat condition' evaluated for (i) Matters of National Environmental Significance (MNES) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act or EPBC) and (ii) Matters of State Environmental Significance (MSES) listed under the *Nature Conservation Act 1992* (NC Act or NCA).

'Killara', consisting of Lot 36 BO175 and Lots 15, 16 and 19 of BO94, is one of Arrows land-based offset properties. These lots, located approximately 65 km north-west of Kingaroy in south-east Queensland (Figure 1.1), were secured with the intent to provide offsets for Arrows off-tenure impacts (e.g., pipelines). They have been the subject of previous assessment resulting in 220 ha being set aside for offset (Umwelt 2020a). The balance of the properties, 1,756 ha, remains available to offset on-tenure impacts.

Matters of National Environmental Significance and MSES flora and fauna species which might be impacted by on-tenure activities has been identified in EcoSmart Ecology (2023) and includes information on the types of habitat in which they could occur. The report classes Regional Ecosystems (REs) as 'core' habitat or 'general' habitat. Core habitat areas reflect those REs which are likely to be regularly inhabited by, or of 'high importance' to, the species. Such areas include high amenity habitat which could include important resources such as roosting and nesting sites or food resources. General habitats are 'those REs that may be used less regularly by fauna' and has lower amenity habitat. These definitions roughly match the definitions of 'Core Habitat Possible' and 'General Habitat Possible' in (DES 2020b). The mapping is used by Arrow to calculate offset requirements based on the extent of Core Habitat Known and Core Habitat Possible.

This report assesses the offset value of the balance area (Figure 1.2) for MNES and MSES values potentially impacted by on-tenure activities.

1.2 SCOPE OF WORKS

EcoSmart Ecology has been engaged by Arrow Energy to calculate HQS for MNES and MSES values which have potential to occur at Killara. These species are listed in Table 1.1.

To be consistent and comparable with HQS calculated for on-tenure impacts, these scores should be derived using attributes, criteria and the methodology used in previous works (EcoSmart Ecology 2021; EcoSmart Ecology 2022). These historic works were initially developed to comply with federal conditions and used a method similar to the *Guide to determining terrestrial habitat quality v1.3* (DES 2020a) but with some variation.

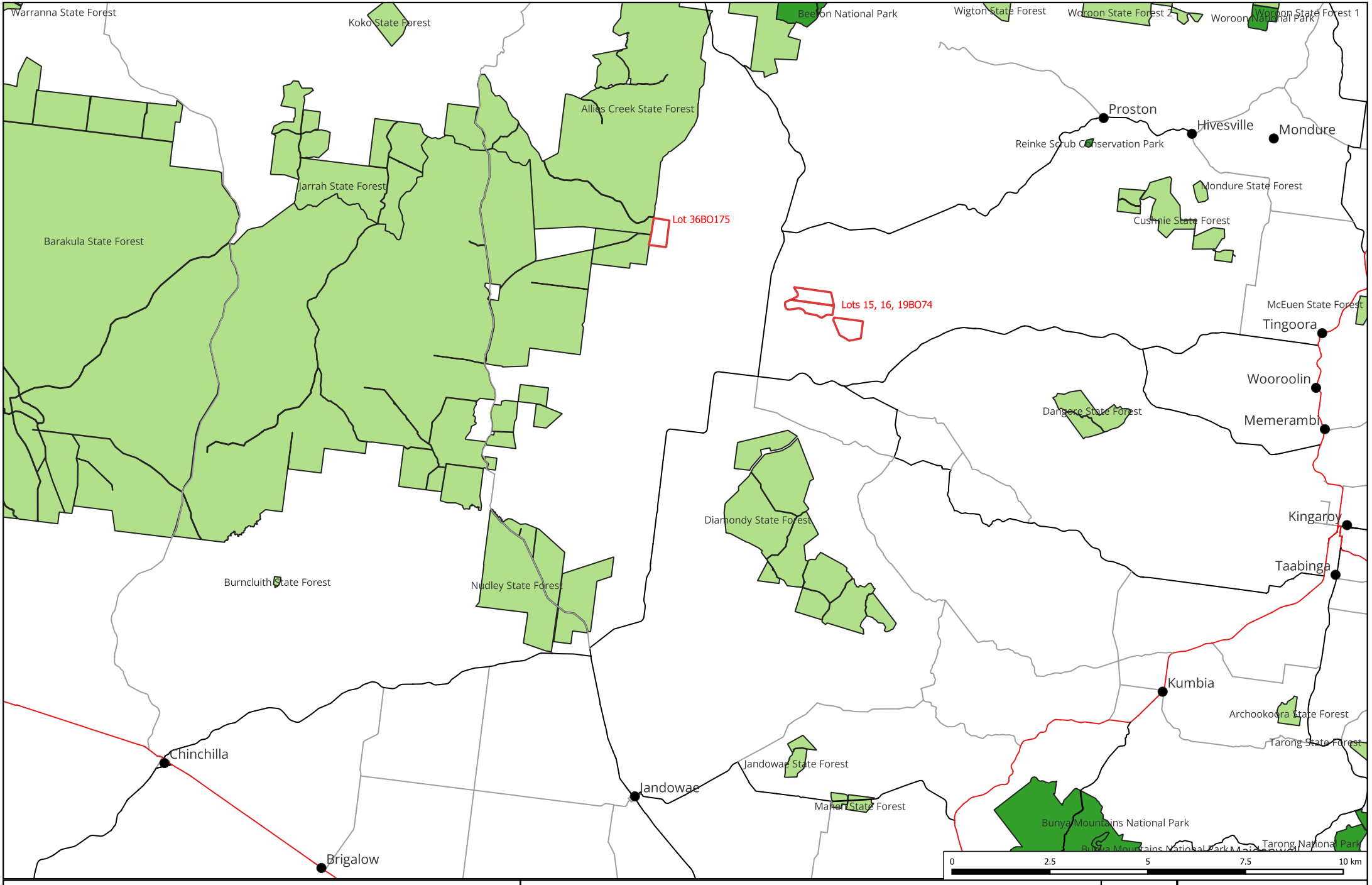

Figure 1.1
Regional location of the Killara properties

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Project: Killara Offset Habitat Quality Assessment

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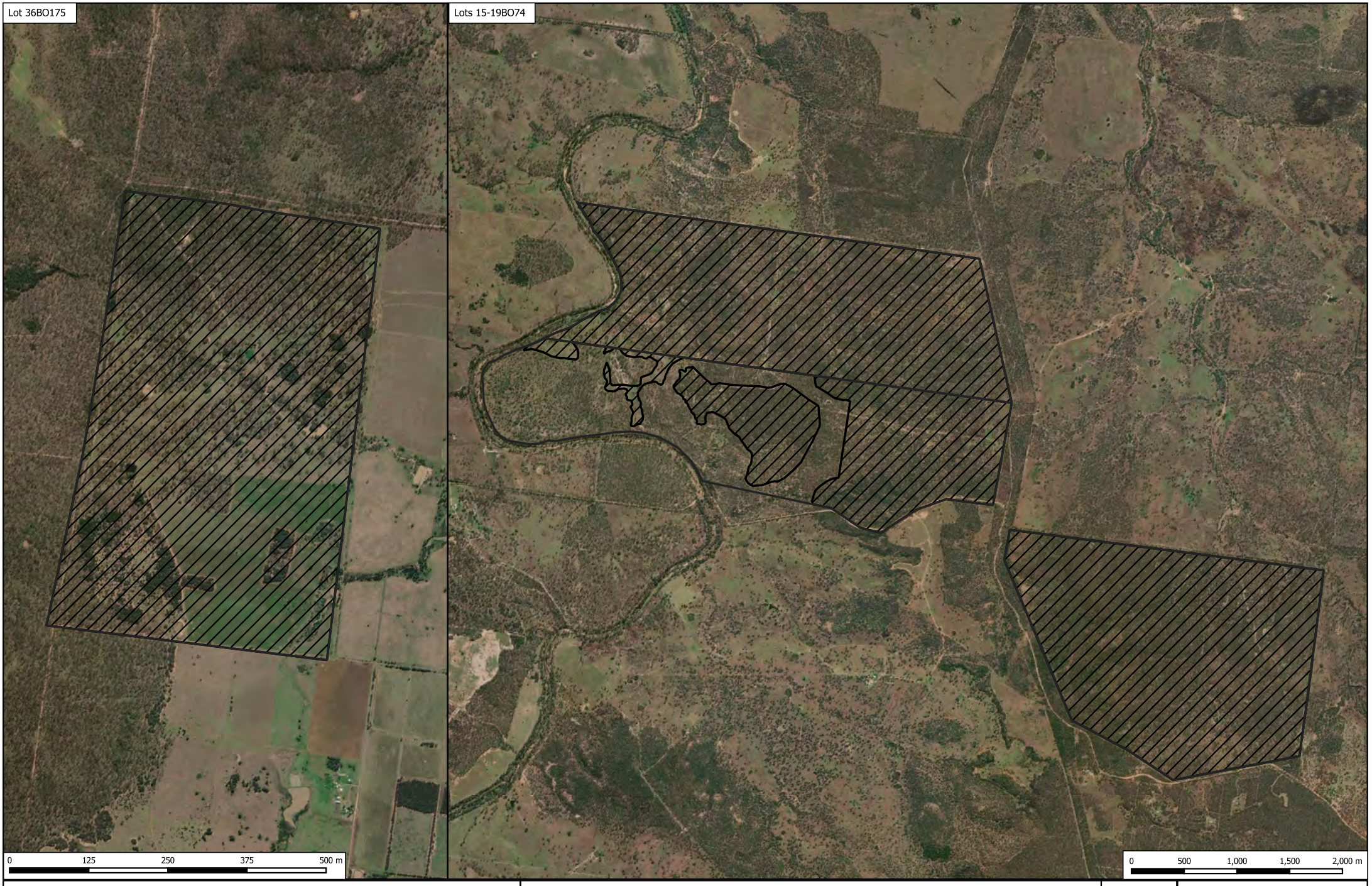

Figure 1.2
The Killara balance area subject to this assessment

Client: Arrow Energy
Project: Killara Offset Habitat Quality Assessment

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Table 1.1. MNES and MSES values known or with some possibility of occurring at Killara

Common Name	*Scientific Name*	Status*	
		EPBC	QLD
VEGETATION			
Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community (TEC)		End	-
RE 11.3.1 - *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains		-	End
RE 11.3.2 - *Eucalyptus populnea* woodland on alluvial plains		-	OC
RE 11.4.3 - *Acacia harpophylla* and/or *C. cristata* shrubby open forest on Cainozoic clay plains		-	End
Waterway corridor vegetation (stream orders 1, 2,3 and 6)		-	-
FLORA SPECIES			
Belson's Panic	*Homopholis belsonii*	Vul	End
	Fimbristylis vagans		End
	Solanum stenopterum		End
Austral Toadflax	*Thesium australe*	Vul	Vul
	Xerothamnella herbacea	End	End
INVERTEBRATE SPECIES			
Brigalow Woodland Snail	*Adclarkia cameronii*	End	Vul
Pale Imperial Hairstreak	*Jalmneus eubulus*	-	Vul
VERTEBRATE SPECIES			
Common Death Adder	*Acanthophis antarcticus*	-	Vul
Dunmall's Snake	*Glyphodon dunmalli*	Vul	Vul
Grey Snake	*Hemiaspis signata*	End	End
Yakka Skink	*Egernia rugosa*	Vul	Vul
Squatter Pigeon	*Geophaps scripta scripta*	Vul	Vul
Glossy Black Cockatoo	*Calyptorhynchus lathami lathami*	Vul	Vul
Painted Honeyeater	*Grantiella picta*	Vul	Vul
Short-beaked Echidna	*Tachyglossus aculeatus*	-	SLC
South-eastern Long-eared Bat	*Nyctophilus corbeni*	Vul	Vul
Greater Glider	*Petauroides volans sensu lato*	End	End
Yellow-bellied Glider	*Petaurus australis australis*	Vul	Vul
Koala	*Phascolarctos cinereus*	End	End

* Status under the federal EPBC Act and Queensland state NC Act or Vegetation Management Act. Categories include End = Endangered; Vul = Vulnerable = SLC = Special Least Concern; OC = Of Concern

2.0 Study Methods

2.1 Data Sources

Relevant Literature and Databases

Throughout this project scientific literature was reviewed on all target values to determining their ecological requirements and habits. This included relevant government conservation advice, recovery plans and related information. For fauna, this allowed the identification of indicators for measuring *Species Habitat Index* attributes and also aided in the likelihood assessment.

The Atlas of Living Australia was inspected for the target species based on a 50 km buffer. To ensure this information was up-to-date, location data was also downloaded for each species from the Queensland Department of Environment, Science and Innovation (DESI) website.

Site-specific Data

Historic site-specific datasets were used to source relevant information on the type of vegetation present and previous locations of significant species. The bulk of habitat quality data was gained from these sources. Relevant works include:

- A five-day survey (16th and 19th April 2018) by AECOM (AECOM 2018). The survey collected habitat quality data from 12 biocondition sites.
- A seven-day survey (16th-22nd June 2020) by Umwelt (Umwelt 2020a). The survey collected habitat quality data from 28 biocondition sites.
- Based on data collected in the previous two works, HQS were calculated for a number of MNES and MSES on or possibly occurring at Killara (Umwelt 2020a; Umwelt 2021)
- Two targeted fauna surveys (16th-19th June and 13th-20th Oct 2020) by Umwelt (Umwelt 2020b) which confirmed the presence of Greater Glider (on 36BO175) and Koala (on 15-19BO94).
- A three day survey targeting *Homopholis belsonii* (10-12th Jan 2024) by Attexo (Attexo 2024) which failed to locate the species.

Data from these works was supplemented by additional field studies by EcoSmart Ecology (see Section 2.2 below).

2.2 Additional Field Surveys

Most data used in this assessment was collected in previous works (see Section 2.1), though some fauna habitat attributes were not sampled resulting in the need for additional field survey. This additional work, which was undertaken between the 19th and 24th February inclusive, revisited the historic sites and collected the following density (per ha) data: hollow-bearing trees, mistletoe clumps, stages (dead trees) and Eucalypts (subcanopy and canopy). *Allocasuarina* (sub-canopy and canopy) cover was also recorded. Two sites which had been previously surveyed, but for which there was no data, were also resampled.

Analysis of the historic data found several Assessment Units (AUs) had been under sampled. To comply with DES (2020a), further work was undertaken between the 27th and 29th February

(inclusive) resulting in the establishment of nine new HQS sites (B41-B49). All AUs have at least two HQS sites, with the exception of 11.3.1 which is minor in extent and under flood during survey preventing sampling.

All surveys both historic and present measure relevant attributes within a standard biocondition site consisting of a 100x50m area and containing various sub-plots, as detailed in Eyre *et al.* (2015).

2.3 Site Stratification

Vegetation within the Killara properties has been previously assessed and mapped by Umwelt (2020a). Eleven different Regional Ecosystems (REs) are recognised (Table 2.1) and stratified into 16 Assessment Units (AU) for the purpose of offset evaluation (as per DES 2020a).

EcoSmart Ecology field surveys noted the extent of 11.3.1 in polygon 3 had been over-estimated and was subsequently split to creating a new polygon (36) of 11.3.2. This reduces the extent of 11.3.1 available for offset.

The spatial distribution of these AUs is shown in Figure 2.1 and Table 2.2 documents the extent available for offsetting on-tenure impacts.

Table 2.1. Regional Ecosystems within the balance area of the Killara properties available for offsetting on-tenure impacts

RE	BVG (1M)	Short Description	Extent (ha)*
11.3.1	25a	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains	9.8
11.3.2	17a	*Eucalyptus populnea* woodland on alluvial plains	13.4
11.3.25	16a	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	22.1
11.4.3	25a	*Acacia harpophylla* and/or *Casuarina cristata* shrubby open forest on Cainozoic clay plains	48.1
11.5.1	18b	*Eucalyptus crebra* and/or *E. populnea, Callitris glaucophylla, Angophora leiocarpa, Allocasuarina luehmannii* woodland on Cainozoic sand plains and/or remnant surfaces	54.3
11.5.1a	17a	*Eucalyptus populnea* woodland with *Allocasuarina luehmannii* low tree layer. Occurs on flat to gently undulating plains formed from weathered sandstones. Duplex soils with sandy surfaces.	0.6
11.5.20	13d	*Eucalyptus moluccana* and/or *E. microcarpa* and/or *E. woollsiana* +/- *E. crebra* woodland on Cainozoic sand plains	49.1
11.7.6	10a	*Corymbia citriodora* or *Eucalyptus crebra* woodland on Cainozoic lateritic duricrust	120.5
11.12.1a	13c	*Eucalyptus crebra* +/- *E. exserta* woodland. Occurs on undulating (igneous) rises.	1111.3
11.12.3	13c	*Eucalyptus crebra, E. tereticornis, Angophora leiocarpa* woodland on igneous rocks especially granite	101.4
11.12.6b	20a	*Eucalyptus crebra +/- Corymbia citriodora* and/or *E. acmenoides* +/- *Lophostemon suaveolens* woodland to open forest. Occurs on gently undulating lower slopes of igneous rocks	34.4
		TOTAL	1,565.0

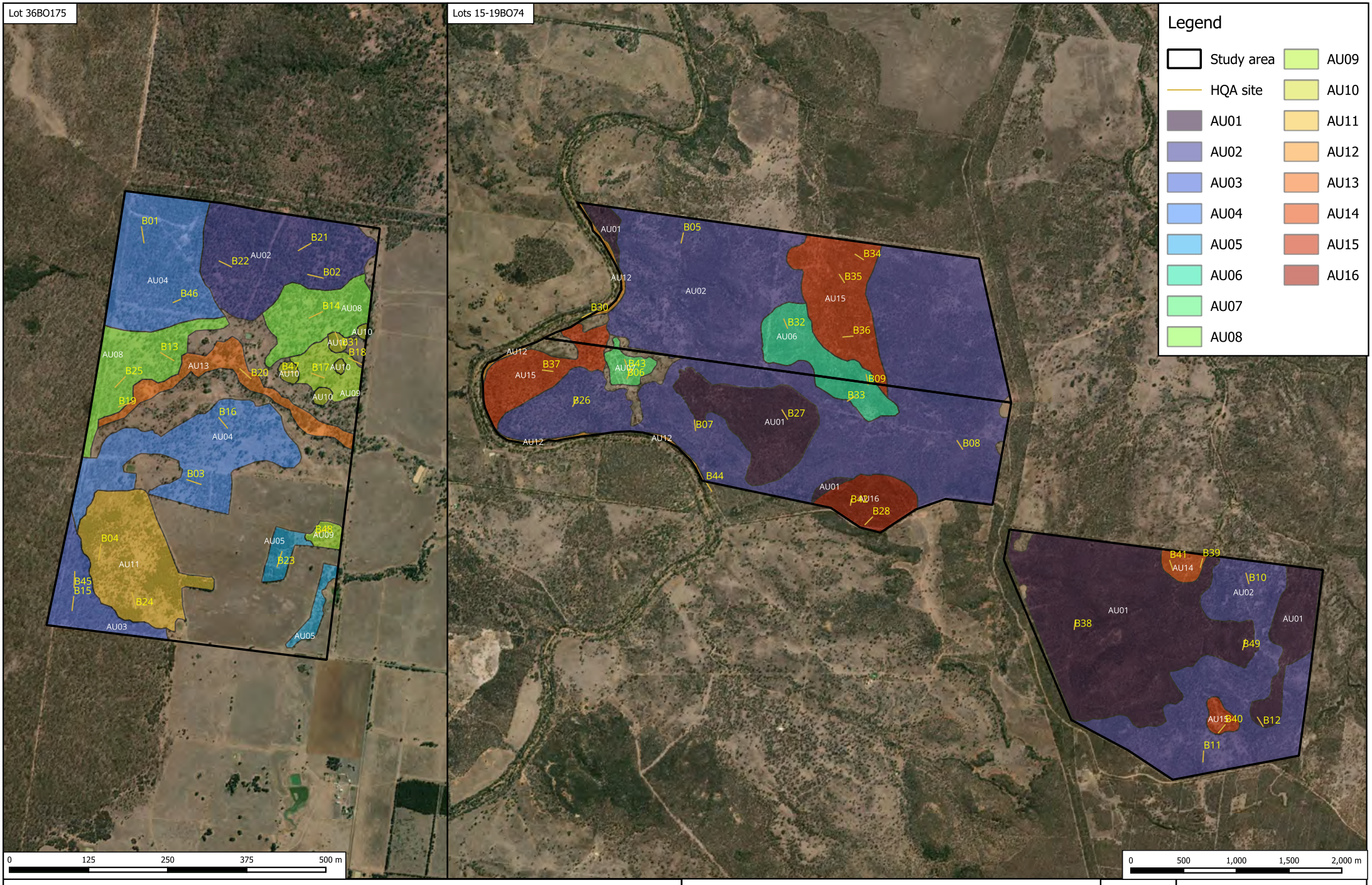

Figure 2.1
Spatial distribution of Assessment Units (AU) and location of HQS sites within the Killara property

Client: Arrow Energy
Project: Killara Offset Habitat Quality Assessment

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Table 2.2. Assessment Units within the Killara property available for offsetting on-tenure impacts

Assessment Unit	Polygon Number	Extent (ha)		RE	Form	Biocondition sites
		Polygon	Total for AU			
AU01	17	8.5	384.5	11.12.1a	Remnant	B12, B27, B38, B49
	24	2.8				
	25	74.7				
	30	258.1				
	32	40.4				
AU02	1	54.2	726.8	11.12.1a	Regrowth	B02, B05, B07, B08, B10, B11, B21, B22, B26
	18	489.6				
	31	183.0				
AU03	14	18.7	18.7	11.7.6	Remnant	B15, B45
AU04	15	53.3	101.8	11.7.6	Regrowth	B01, B03, B16, B46
	16	48.5				
AU05	2	5.5	9.8	11.3.1	Regrowth	B23
	3	4.3				
AU06	22	54.3	54.3	11.5.1	Regrowth	B09, B32, B33
AU07	23	0.6	0.6	11.5.1a	Regrowth	B06, B43
AU08	12	23.1	49.1	11.5.20	Regrowth	B13, B14, B25
	13	26				
AU09	4	10.3	13.4	11.3.2	Regrowth	B17, B18, B48
	36	3.1				
AU10	7	1.4	4.7	11.4.3	Remnant	B31, B47
	8	1.1				
	9	0.5				
	10	0.5				
	11	1.2				
AU11	6	43.4	43.4	11.4.3	Regrowth	B04, B24
AU12	21	4.5	4.6	11.3.25	Remnant	B30, B44
	27	0.1				
AU13	5	17.5	17.5	11.3.25	Regrowth	B19, B20
AU14	33	10.2	10.2	11.12.3	Remnant	B39, B4
AU15	19	77.3	91.2	11.12.3	Regrowth	B34, B35, B36, B37, B4
	20	6.6				
	34	7.3				
AU16	26	34.4	34.4	11.12.6b	Remnant	B28, B42

2.4 Watercourse Vegetation

Watercourse vegetation, as defined under the Vegetation Management Act 1999 (VM Act), was identified using QGIS consistent with the Queensland Environmental Offset Policy 2024. This uses the buffers applicable to the Brigalow Belt Bioregion as prescribed in Table 2.3.

Table 2.3. Defining distance for watercourse vegetation

Stream Order	Distance from defining bank (m)
1 or 2	25
3 or 4	50
5 or greater	100

2.5 Confirmed Threatened Species

Surveys have identified several threatened species within or adjacent the property including:

- Greater Glider (*Petaroides volans* sensu lato). Most commonly noted around 36BO175 adjacent Barakula State Forest with a single record from along the Boyne River adjacent 15-19BO74.
- Koala (*Phascolarctos cinereus*). Recorded numerous times within and surrounding 15-19BO74. Not yet recorded adjacent or near 36BO175 but likely to occur with records in the adjacent Barakula State Forest.
- Golden-tailed Gecko (*Strophurus taenicauda*) (Near-threatened, QLD). Recorded twice within 36BO175.

The locations of threatened species observations are shown in Figure 2.2.

2.6 Habitat Quality Assessment

For each target species habitat condition was evaluated using methods similar to those within the *Guide to determining terrestrial habitat quality v1.3* (DES 2020a). Habitat quality is scored using the three following features, and is only need for sites which occur in AUs suitable for supporting the target-value:

- *Site condition*: evaluates general vegetation condition compared to an undisturbed reference site with most of its natural values intact (a BioCondition benchmark). It provides a maximum score 80 for wooded communities.
- *Site context*: evaluates the landscape position of the site and the influence this has on the site's quality. It provides a maximum score of 20.
- *Species habitat index*: evaluates the ability of the site to support a particular species based on that species' specific habitat requirements. It provides a maximum score of 100.

For plant taxa, site condition is the only relevant feature and scaled to provide a total HQS out of 10. For fauna, each of the above three features are scaled to a maximum of 3, 3 and 4 respectively and then summed to provide a score out of 10 with 10 representing a fully intact and highly suitable habitat for the species. These final few steps are different from DES (2020a) but repeated for consistency with the SGP impact calculations. The approach has been ratified by relevant regulatory authorities.

Using these three features the habitat quality is averaged for relevant AUs, weighted according to the AU extent, and summed to provide an overall habitat score for the species. An overview of the calculation process is provided in Figure 2.3 and described in more detail below.

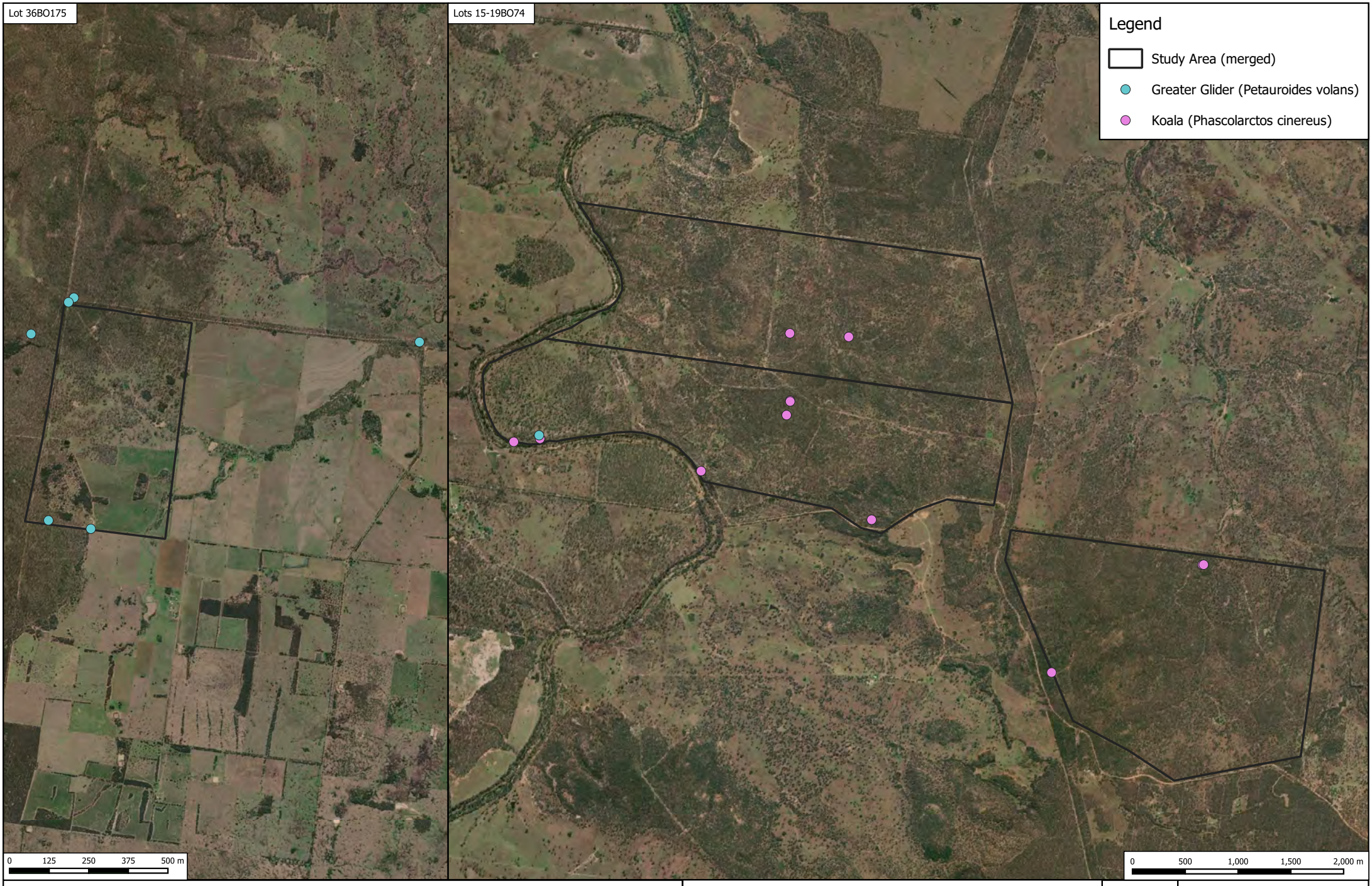
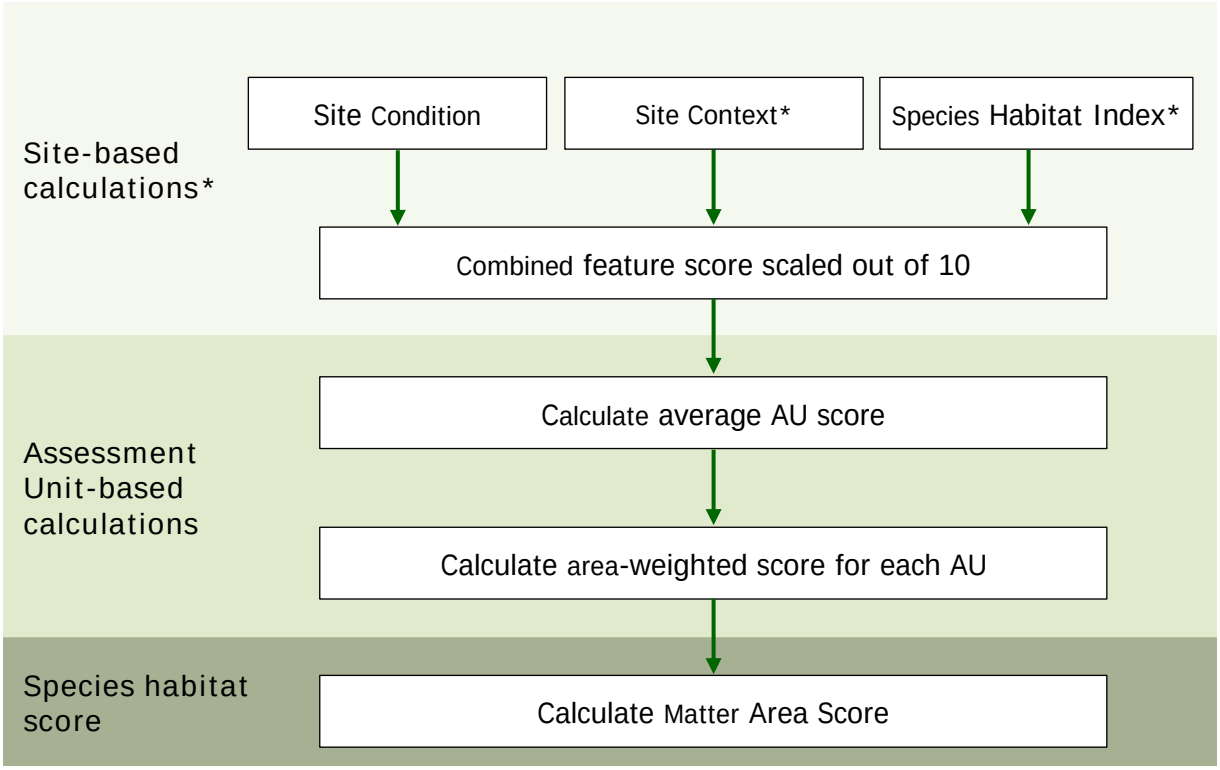


Figure 2.2
Locations of threatened species observations

Client: Arrow Energy
Project: Killara Offset Habitat Quality Assessment

ecosmart ECOLOGY



* Site context and species habitat index used only for fauna

Figure 2.3. The process of calculating target species habitat scores

2.6.1 Site-based Features

Site Condition

Site condition is measured for every BioCondition site by sampling the attributes in Table 2.4 and scored against a 'BioCondition Benchmark' for each RE provided by the Queensland Herbarium (v3.4, 2023). In this study v3.4 benchmark scores were available for all sampled REs except 11.12.1a which used 11.12.1 as a surrogate.

Table 2.4. Site Condition Attributes

Attribute	Maximum Score
Recruitment of woody perennial species in ecological dominant layer (EDL) (%)	5
Native plant species richness - trees	5
Native plant species richness - shrubs	5
Native plant species richness - grasses	5
Native plant species richness - forbes and other	5
Tree canopy - median height	5
Tree canopy - cover	5
Native shrub cover (%)	5
Native perennial grass cover (%)	5
Organic litter cover (%)	5
Large trees (euc plus non-euc)	15
Coarse woody debris (m/ha)	5
Non-native plant cover (%)	10
Maximum Total Score	80

Site Context

Site context attributes (Table 2.5) are evaluated for every biocondition site and scored against predefined thresholds for a fragmented landscape (Eyre *et al* 2015).

Table 2.5. Site Context Attributes

Attribute	Maximum Score
Size of patch	10
Context	5
Connectivity	5
Maximum Total Score	20

Species Habitat Index (Fauna)

For fauna the ability of the site to support a species is scored according to the attributes in Table 2.6. This is only calculated for relevant AUs, it is not calculated for AUs which are considered unsuitable for the species.

Table 2.6. Species Habitat Index Attributes

Attribute	Maximum Score
Quality and availability of food and habitat required for foraging	25
Quality and availability of habitat required for sheltering and breeding	25
Quality and availability of habitat required for mobility	25
Absence of threats	25
Maximum Total Score	100

For each of the habitat attributes, measurable biotic or abiotic indicator(s) reflecting the species requirements have been previously identified and justified (EcoSmart Ecology 2021; EcoSmart Ecology 2022). These are repeated in this work for consistency and to ensure the scores are comparable.

Score scaling

For relevant AUs a score for each biocondition site scaled out of ten. For flora this is achieved using site condition scores only, which provide a maximum possible score out of 80. For fauna, a score out of 10 is calculated using all three measured features as per below.

$$scaled\ site\ score = \left(\frac{site\ condition}{80} x\ 3\right) + \left(\frac{site\ context}{20} x\ 3\right) + \left(\frac{species\ habitat}{100} x\ 4\right)$$

2.6.2 Assessment Unit-based Calculations

For relevant AUs – those able to support the target species - the average score for each AU is calculated based on the applicable biocondition sites. This average is used to calculate the area-weighted score for each AU as follows:

$$WBC_{AUx} = \frac{BC_{AUx} \times A}{T}$$

Where:

WBC_{AUx} = Area-weighted score for the assessment unit

BC_{AUx} = average site score for the AU

A = Area (in hectares) of the AU

T = Total area (in hectares) of the matter area

2.6.3 Species Habitat Score

The final species habitat score for the matter area is calculated by summing relevant area-weighted scores.

2.7 Project Limitations

The following limitations of this work are noted:

- Habitat Quality Score (HQS) does not accurately reflect the possibility of a species occurring as other factors may affect their presence or absence (e.g., historic land use, historic stochastic events etc).
- This work used v3.4 benchmark scores (Apr 2023) which had values for all REs at Killara except 11.12.1a. For this RE data applicable to 11.12.1 was used as a surrogate.
- Flooding of vegetation within some areas of 11.3.1 prevented duplicate sampling of this relatively small (< 10ha) AU.

3.0 HABITAT QUALITY SCORES

3.1 VEGETATION

Habitat Quality Scores for offset opportunities of vegetation at Killara are provided in Table 3.1 below. The spatial location of these vegetation types are illustrated in Figure 2.1.

Table 3.1. Habitat quality scores for vegetation at Killara

Abbreviated Community Description	Relevant AUs	Extent (ha)	HQS
Brigalow (*A. harpophylla* dominant and co-dominant) TEC	5, 10, 11	57.9	5.6
RE 11.3.1 – *A. harpophylla* and/or *C. cristata* open forest	05	9.8	6.56
RE 11.3.2 – *E. populnea* woodland	09	13.4	6.65
RE 11.3.25 - *E. tereticornis* or *E. camaldulensis* woodland	12, 13	22.1	6.76
RE 11.4.3 - *A. harpophylla* and/or *C. cristata* shrubby open forest	10, 11	48.1	5.38
RE 11.5.1 - *E. crebra* and/or *E. populnea, C. glaucophylla, A. leiocarpa, A. luehmannii* woodland	06	54.3	6.92
RE 11.5.1a - *E. populnea* woodland with *A. luehmannii* low tree layer.	07	0.6	5.59
RE 11.5.20 - *E. moluccana* and/or *E. microcarpa* and/or *E. woollsiana* +/- *E. crebra* woodland	08	49.1	6.69
RE 11.7.6 – *C. citriodora* or *E. crebra* woodland	03, 04	120.5	5.89
RE 11.12.1a - *E. crebra* +/- *E. exserta* woodland	01, 02	1111.3	6.78
RE 11.12.3 - *E. crebra, E. tereticornis, A. leiocarpa* woodland	14, 15	101.4	6.14
RE 11.12.6b - *E. crebra* +/- *C. citriodora* and/or *E. acmenoides* +/- *L. suaveolens* woodland	16	34.4	6.47
Waterway corridor vegetation (stream orders 1, 2,3 and 6)	Various	137.1	6.7

3.2 FLORA SPECIES

Habitat quality scores for possible flora species are detailed in the sections below.

3.2.1 **Belson's Panic (***Homopholis belsonii***)**

Potential Occurrence at Killara

Targeted surveys have failed to locate Belson's Panic within the Killara properties. High amenity habitat is restricted to REs 11.3.1, 11.3.2 and 11.4.3 on 36BO175, though it might also occur in 11.7.6 on the same property. The species is not expected to occur on 15-19BO94 which has more gravely soils.

Habitat Quality Scores

Total extent of suitable habitat for Belson's Panic within the balance area of Killara is 191.8 ha and provides a HQS of 5.9/10. A summary of these scores is provided in Table 3.2 and detailed site scoring is provided in the associated data package.

Table 3.2. Habitat quality scores for Belson's Panic

Assessment Units	AU03	AU04	AU05	AU09	AU10	AU11	Total/Average
No. Sites Sampled	2	4	1	3	2	2	
Extent (ha)	18.7	101.8	9.8	13.4	4.7	43.4	**191.8**
% of matter area	9.7%	53.1%	5.1%	7.0%	2.5%	22.6%	-
Average HQS for AU (out of 10)	6.97	5.56	6.56	6.65	7.78	5.56	-
Weighted AU Score	0.68	2.95	0.34	0.46	0.19	1.26	**5.9**

3.2.2 Fimbristylis vagans

Potential Occurrence at Killara

This species of grass has not been located within the Killara properties. It is associated with shallow water at the edge of natural lagoons and waterways. The closest records are from the edge of Barakulla SF, approximately 30 km to the south-west of 36BO175. Potentially suitable habitat is present in areas of 11.3.1 and 11.3.25 and is more likely on 36BO175.

Habitat Quality Scores

Based on the extent of suitable REs, suitable habitat for this species at Killara is 34.9 ha. However, as it grows close to water suitable areas are likely more limited. Based on RE scores, the HQS for this species is 6.8/10. A summary of these scores is provided in Table 3.3 and detailed site scoring is provided in the associated data package.

Table 3.3. Habitat quality scores for *Fimbristylis vagans*

Assessment Units	AU05	AU12	AU13	Total/Average
No. Sites Sampled	1	2	2	
Extent (ha)	9.8	4.6	17.5	**34.9**
% of matter area	30.7%	14.4%	54.9%	-
Average HQS for AU (out of 10)	6.56	5.63	7.22	-
Weighted AU Score	2.02	0.81	3.96	**6.8**

3.2.3 Solanum stenopterum

Potential Occurrence at Killara

This species has not been located within the Killara properties. The closest collection records are from approximately 50 km to the south-west and north-west of 36BO175. It is known to occur in poplar box and belah woodland, and occasionally in paddocks. Suitable RE's include 11.3.1 and 11.3.2.

Habitat Quality Scores

Based on the extent of suitable REs, suitable habitat for this species at Killara is 23.2 ha and provides a HQS of 6.6/10. A summary of these scores is provided in Table 3.4 and detailed site scoring is provided in the associated data package.

Table 3.4. Habitat quality scores for *Solanum stenopterum*

Assessment Units	AU05	AU09	Total/Average
No. Sites Sampled	1	3	
Extent (ha)	9.8	13.4	**23.2**
% of matter area	42.2%	57.8%	-
Average HQS for AU (out of 10)	6.56	6.65	-
Weighted AU Score	2.77	3.84	**6.6**

3.2.4 Austral Toadflax (*Thesium australe*)

Potential Occurrence at Killara

This species has not been located within the Killara properties. It is known some 30 km from the Killara properties from grassland on basalt soil. It is known to occur in *Eucalyptus populnea* woodland on heavy alluvial soils. It has a low likelihood of occurring in 11.3.2.

Habitat Quality Scores

Total extent of suitable habitat for the Austral Toadflax at Killara is 13.4 ha and has a HQS of 6.7/10. A summary of these scores is provided in Table 3.5 and detailed site scoring is provided in the associated data package.

Table 3.5. Habitat quality scores for the Austral Toadflax (*Thesium australe*)

Assessment Units	AU09	Total/Average
No. Sites Sampled	3	
Extent (ha)	13.4	**13.4**
% of matter area	100.0%	-
Average HQS for AU (out of 10)	6.65	-
Weighted AU Score	6.65	**6.7**

3.2.5 Xerothamnella herbacea

Potential Occurrence at Killara

This species has not been located within the Killara properties. It is associated with brigalow communities and has been recorded ~4.6 km to the east of 36BO175. Suitable RE's at Killara includes 11.3.1 and 11.4.3. It is not expected to occur in 15-19BO94.

Habitat Quality Scores

Total extent of suitable habitat for *X. herbacea* at Killara is 57.9 ha and has a HQS of 5.9/10. A summary of these scores is provided in Table 3.6 and detailed site scoring is provided in the associated data package.

Table 3.6. Habitat quality scores for *Xerothamnella herbacea*

Assessment Units	AU05	AU10	AU11	Total/Average
No. Sites Sampled	1	2	2	
Extent (ha)	9.8	4.7	43.4	**57.9**
% of matter area	16.9%	8.1%	75.0%	-
Average HQS for AU (out of 10)	6.56	7.78	5.56	-
Weighted AU Score	1.11	0.63	4.17	**5.9**

3.3 Invertebrate Species

Habitat quality scores for possible invertebrate species at Killara are detailed in the sections below.

3.3.1 Brigalow Woodland Snail (*Adclarkia cameroni*)

Potential Occurrence at Killara

This species has not been confirmed at Killara but has not been the subject of target survey effort. Suitable habitat is present within areas of 11.3.1, 11.3.2, 11.3.25, and 11.4.3 on 36BO175. However, this property is at the limit of this species modelled distribution with only some of the property falling into the area where they could 'possibly' occur (DCCEEW 2024). It is not expected to occur on 15-19BO94. It should be assumed absent if not detected in future targeted surveys.

Fauna Habitat Attribute Scoring Method

The Brigalow Woodland Snail requires litter debris and fallen timber to retain moisture and provide habitat. Both are more likely in remnant vegetation with a canopy though this is not needed when fallen timber is abundant (TSSC 2016a; TSSC 2016b).

Fauna habitat attribute scoring for these species uses *BioCondition* scores derived by comparing benchmark data for coarse woody debris, organic litter cover and tree canopy cover. These are scaled by dividing the BioCondition score by its maximum value and multiplied by 25; when multiple variables are used their BioCondition scores are summed, divided by their combined maximum BioCondition score, and multiplied by 25.

Table 3.7 Relevant habitat attribute variables and scoring for the Brigalow Woodland Snail

Attribute	
Variable	Site scoring method*
Quality and availability of food and habitat required for foraging	
Coarse woody debris (BioCondition score)	1. Sum CWD and OLC BC scores, 2. Scale out of 25 (sum/10*25)
Organic litter cover (BioCondition score)	
Quality and availability of habitat required for shelter and breeding	
Coarse woody debris (BioCondition score)	(CWD BC score/5) x 25
Quality and availability of habitat required for mobility	
Coarse woody debris (BioCondition score)	1. Sum CWD and TCC BC scores, 2. Scale out of 25 (sum/10*25)
Tree canopy cover (BioCondition score)	

* CWD - course woody debris; OLC – organic litter cover; TCC – tree canopy cover; BC - BioCondition

Habitat Quality Scores

Total extent of suitable habitat at Killara is 93.4 ha and has a combined HQS of 4.6/10. A summary of the score results is provided in Table 3.8 below.

Table 3.8. Area-weighted scores for the Brigalow Woodland Snail

Assessment Units	AU05	AU09	AU10	AU11	AU12	AU13	Total/Average
No. Sites Sampled	1	3	2	2	2	2	
Extent (ha)	9.8	13.4	4.7	43.4	4.6	17.5	**93.4**
% of matter area	10.5%	14.3%	5.0%	46.5%	4.9%	18.7%	-
Average HQS for AU (out of 10)	3.93	5.08	6.88	3.81	4.69	6.07	-
Weighted AU Score	0.41	0.73	0.35	1.77	0.23	1.14	**4.6**

3.3.2 Pale Imperial Hairstreak (*Jalmenus eubulus*)

Potential Occurrence at Killara

The Pale Imperial Hairstreak has not been confirmed at Killara but has not been the subject of targeted survey. Suitable habitat is present within areas of 11.3.1 and 11.4.3 on 36BO175. It is not expected to occur on 15-19BO94. As the species is quite mobile and 36BO175 is within its range, the species has a reasonable probability of occurring. However, this butterfly is most often associated with remnant Brigalow and it may take time for current regrowth to attract individuals.

Fauna Habitat Attribute Scoring Method

The Pale Imperial Hairstreak is restricted to old-growth Brigalow-dominated woodlands and forests and does not appear to breed in regrowth or disturbed areas (Breitfuss and Hill, C. J. 2003; Eastwood *et al.* 2008; Taylor 2014). The larvae feed exclusively on Brigalow and eggs are laid on stem nodes, stem scars and stem axils. Limited observations suggest eggs are preferentially laid on younger plants and larvae seem to be associated with host plants less than 5 m in height (Breitfuss and Hill, C. J. 2003; Taylor 2014). The species is highly mobile and, based on comparison with similar species, likely to be able to traverse modified landscapes.

Habitat index scoring for the Pale Imperial Hairstreak uses *BioCondition* scores for recruitment of dominant canopy species, tree canopy cover, tree canopy height and shrub cover. These are scaled by dividing the BioCondition score by its maximum value and multiplied by 25; when multiple variables are used their BioCondition scores are summed, divided by their combined maximum BioCondition score, and multiplied by 25. As the species is highly mobile no offset actions are likely to improve its opportunity for mobility which is set at 25.

Table 3.9 Relevant habitat attribute variables and scoring for Pale Imperial Hairstreak

Attribute	
Variable	Site scoring method*
Quality and availability of food and habitat required for foraging	
Recruitment of dominant canopy species (BioCondition score)	1. Sum RDC, TCH and TCC BC scores, 2. Scale out of 25 (sum/15*25)
Tree canopy height (BioCondition score)	
Tree canopy cover (BioCondition score)	
Quality and availability of habitat required for shelter and breeding	
Recruitment of woody perennial species (BioCondition score)	1. Sum RDC and SCC BC scores, 2. Scale out of 25 (sum/15*25)
Shrub canopy cover (BioCondition score)	
Quality and availability of habitat required for mobility	
NA, set at 25	25

* RDC - recruitment of dominant canopy species; TCH – Tree Canopy Height; TCC – tree canopy cover; SCC – shrub canopy cover; BC – BioCondition

Habitat Quality Scores

Total extent of suitable or potential habitat for the Pale Imperial Hairstreak at Killara is 57.9 ha and has a combined HQS of 5.6/10. A summary of the score results is provided in Table 3.10 below, with individual site scores provided in the associated data package.

Table 3.10. Area-weighted scores for the Pale Imperial Hairstreak

Assessment Units	AU05	AU10	AU11	**Total/Average**
No. Sites Sampled	1	2	2	
Extent (ha)	9.8	4.7	43.4	**57.9**
% of matter area	16.9%	8.1%	75.0%	-
Average HQS for AU (out of 10)	4.40	5.97	5.81	-
Weighted AU Score	0.74	0.48	4.35	**5.6**

3.4 Vertebrate Species

Habitat quality scores for possible vertebrate species present at Killara are detailed in the sections below.

3.4.1 Yakka Skink (*Egernia rugosa*)

Potential Occurrence at Killara

This species has not been confirmed at Killara and records in the surrounding region are scarce. Modelled suitable habitat and records of this species are concentrated in the western portion of the Brigalow Belt bioregion (Johnson *et al.* 2017). These patterns suggest that, while some habitat is present, the likelihood of this species occurring is quite low. Other factors are likely affecting the species presence. Similarly, the Yakka Skink is not expected to occur within the SGP and no core habitat has been mapped (EcoSmart Ecology 2023).

Previous HQS assessments of Killara listed regional ecosystems 11.3.1, 11.4.3 and three REs on landzone 12 as suitable habitat for the species (Umwelt 2021). However, we can find no precedent for this species inhabiting vegetation on landzone 12, nor any documentation of them possibly occurring on this landzone (e.g. Kerswell *et al.* 2020). Similarly, there appears to be little evidence to support 11.3.1 or 11.4.3 as being high amenity habitat.

While the presence of this species on Killara is dubious, the following RE's are known or likely to be suitable habitat further west in the species distribution: 11.3.2, 11.5.1, 11.5.1a, 11.5.20 and 11.7.6. Habitat Quality Scores for Killara are based on these REs.

Fauna Habitat Attribute Scoring Method

In a research project to identify important habitat features for Yakka Skink in the south-east Brigalow Belt, Johnson *et al.* (2017) concluded that these lizards require woodlands and open forests with a soil structure suitable for burrowing (loam and sandy loams, not clay or silt soils), prefer a canopy height of <16.5 m and woody debris exceeding 37 m^3/ha[1]. However, the species can persist where log volume fell below this threshold if canopy cover was <11%. Yakka Skink habitat index scoring uses raw data for tree canopy height, tree canopy cover and coarse woody debris.

The foraging habitat attribute is evaluated using a matrix combining the raw values for canopy height and canopy cover as per below.

		Tree canopy height (m)				
		<10	10-13	13-16	16-19	>19 m
Tree Canopy cover (%)	0-8	25	25	25	20	10
	>8-11	25	20	20	15	5
	>11-15	20	15	15	10	5
	>15-19	15	15	10	5	0
	>19	10	10	10	5	0

Yakka Skink shelter/breeding and mobility habitat attributes are scaled out of 25 based on coarse woody debris length (m/ha) as per below. This may can be increased if the site contains abundant rabbit burrows (active or abandoned), suitable building waste/debris or rock structures which are considered suitable for Yakka Skink use or burrow creation.

	Score					
Variable	0	5	10	15	20	25
Coarse woody debris (m/ha)	0-100	>100-200	>200-300	>300-400	>400-500	>500

[1] Woody debris volume is disproportionately increased by larger logs which provide better habitat for Yakka Skink. This is therefore a better measurement for assessing shelter amenity than total length. However, there is no BioCondition measure of woody debris volume.

Habitat Quality Scores

The HQS for the Yakka Skink has been evaluated based on sites within REs 11.3.2, 11.5.1, 11.5.1a, 11.5.20 and 11.7.6. The total extent of potential habitat is 237.9 ha and has a combined HQS of 5.2. A summary of the score results is provided in Table 3.11 below.

Table 3.11. Area-weighted scores for the Yakka Skink at Killara

Assessment Units	AU03	AU04	AU06	AU07	AU08	AU09	Total/Average
No. Sites Sampled	2	4	3	2	3	3	
Extent (ha)	18.7	101.8	54.3	0.6	49.1	10.3	**237.9**
% of matter area	8.0%	43.4%	23.1%	0.3%	20.9%	4.4%	-
Average HQS for AU (out of 10)	5.91	5.28	4.97	3.45	5.09	4.15	-
Weighted AU Score	0.47	2.29	1.15	0.01	1.06	0.18	**5.2**

3.4.2 Common Death Adder (Acanthophis antarcticus)

Potential Occurrence at Killara

Once abundant in the Brigalow Belt, the Common Death Adder is now rarely observed and in the southern Brigalow belt seems to associate with large contiguous tracts of vegetation. For example, records are more abundant with the state forests around Inglewood and Southwood National Park. These areas may represent strongholds and often retain a complex and healthy ground strata (and in particular ground debris) (EPA 2008). Interestingly, it has never been recorded from Chinchilla State Forest, despite its sizable track of remnant vegetation.

Considering how infrequently this species is encountered within the southern brigalow belt, it seems the probability of the species occurring at Killara is relatively low but, certainly not unlikely.

Death Adders are found in a wide variety of habitats, including rainforest, open woodland, shrubland and heath (Ehmann 1992; Wilson and Swan 2020). They are typically not associated with grasslands or very open woodlands as these lack complex ground strata layers and abundant debris. Within the Killara properties it is possible in all types of vegetation.

Fauna Habitat Attribute Scoring Method

Coarse woody debris plays an important role in providing sheltering and refuge opportunity for Common Death Adder, and provides habitat for their prey (terrestrial vertebrates, especially lizards). Habitats with limited ground disturbance and intact shrub and leaf littler layers are thought to have higher amenity for the species (Wilson and Swan 2020; DES 2024). Common Death Adder occurrence in the Brigalow Belt appears to be influenced by patch size (Shine *et al.* 2014; Wilson 2022; DES 2024).

Habitat quality scores for the Common Death Adder are based on data for coarse woody debris, litter/debris ground cover, native grass cover and non-native grass cover.

The foraging habitat attribute is evaluated using a matrix combining the raw values for coarse woody debris (m/ha) and percentage ground cover of litter/debris.

		Coarse woody debris (m/ha)					
		0-100	>100-200	>200-300	>300-400	>400-500	>500
Littler/debris cover (%)	0-10	5	10	15	15	20	20
	>10-20	10	10	15	20	20	25
	>20-30	10	15	20	20	25	25
	>30-40	15	20	20	25	25	25
	>40-50	15	20	25	25	25	25
	>50	20	25	25	25	25	25

The shelter/breeding habitat attribute is scaled out of 25 based on coarse woody debris length (m/ha) as per below.

Mobility habitat is evaluated based on total grass cover. This combines native grass cover (%) and non-native grass cover (%) as evaluated in the 1 x 1 m quadrats. Once combined the value is scaled out of 25 based on the below.

Variable	Score					
	0	5	10	15	20	25
Coarse woody debris (m/ha)	0-100	>100-200	>200-300	>300-400	>400-500	>500
Total grass cover (native + non-native) (%)	>90	>70-90	>60-70	>45-60	>30-45	0-30

Habitat Quality Scores

Habitat quality scores for the Common Death Adder have been evaluated based on data collected at all sites in Killara. A summary of the score results is provided in Table 3.12 below. The final Habitat Quality Score for the Common Death Adder at Killara is 6.0.

Table 3.12. Area-weighted scores for the Common Death Adder at Killara

Assessment Units	AU01	AU02	AU03	AU04	AU05	AU06	AU07	AU08	AU09
No. Sites Sampled	4	9	2	4	1	3	2	3	3
Extent (ha)	384.5	726.8	18.7	101.8	9.8	54.3	0.6	49.1	13.4
% of matter area	24.6%	46.4%	1.2%	6.5%	0.6%	3.5%	0.0%	3.1%	0.9%
Average HQS for AU (of 10)	6.70	5.76	6.71	5.23	4.63	6.11	4.04	6.16	4.48
Weighted AU Score	1.65	2.68	0.08	0.34	0.03	0.21	0.00	0.19	0.04
Assessment Units	AU10	AU11	AU12	AU13	AU14	AU15	AU16	**Total/Averag**	
No. Sites Sampled	2	2	2	2	2	5	2		
Extent (ha)	4.7	43.4	4.6	17.5	10.2	91.2	34.4	**1,565.0**	
% of matter area	0.3%	2.8%	0.3%	1.1%	0.7%	6%	2%	-	
Average HQS for AU (of 10)	7.20	4.84	5.16	5.79	7.74	5.42	6.21	-	
Weighted AU Score	0.02	0.13	0.02	0.06	0.05	0.32	0.14	**6.0**	

3.4.3 **Dunmall's Snake** (*Glyphodon dumnalli*)

Potential Occurrence at Killara

Dunmall's Snake (*Glyphodon dunmalli,* previously *Furina dunmalli*) is confined to the Brigalow Belt bioregion of south-eastern Queensland and north-eastern New South Wales, occurring north to Clermont and near Rockhampton. Most records are from the Dalby-Tara area of the Darling Downs (Hobson 2012). The species is very rarely encountered, even in areas of known habitat, and has been described as 'extremely secretive, rarely encountered, possibly genuinely scarce' (Wilson 2022). Considering how infrequently this species is encountered within the southern brigalow belt, it seems the probability of it occurring at Killara is relatively low.

Regional Ecosystems which have been mapped as core habitat for Dunmall's Snake within the SGP that also occur at Killara include 11.3.1, 11.3.2, 11.4.3, 11.5.1, 11.5.1a, 11.5.20, and 11.7.6. In addition to these REs, the Dunmall's Snake has been recorded within the Broad Vegetation Group (BVG) 13c, which corresponds to 11.12.1a and 11.12.3 at Killara. These REs have been used to calculate HQS.

Fauna Habitat Attribute Scoring Method

Modelling completed by Johnson *et al.* (2017) failed to find any reliable attributes for predicting suitable habitat for this species. The Dunmall's Snake diet is thought to consist of small terrestrial reptiles with abundant populations potentially providing better foraging habitat; many of these reptiles shelter under fallen woody debris. Where these snakes shelter largely remains a mystery but is presumed beneath fallen debris similar to other snakes. However, few have been located when not active; one has been located under a log while a second approximately two metres off the ground under bark on a large dead tree (EcoSmart Ecology 2021). The lack of sheltering observations has led some to believe they may be partially subterranean in habit, possibly sheltering down deep soil cracks.

Habitat quality scores for the Dunmall's Snake is based on raw data for coarse woody debris. All three attributes (foraging, shelter/breeding and mobility) are derived from the coarse woody debris (m/ha) as per below.

	Score					
Variable	0	5	10	15	20	25
Coarse woody debris (m/ha)	0-100	>100-200	>200-300	>300-400	>400-500	>500

Habitat Quality Scores

Total extent of suitable habitat for the Dunmall's Snake at Killara is 1,509.0 ha and has a combined HQS of 5.6/10. A summary of these scores is provided in Table 3.13 and detailed site scoring is provided in the associated data package.

Table 3.13. Area-weighted scores for the Dumnall's Snake at Killara

Assessment Units	AU01	AU02	AU03	AU04	AU05	AU06	AU07
No. Sites Sampled	4	9	2	4	1	3	2
Extent (ha)	384.5	726.8	18.7	101.8	9.8	54.3	0.6
% of matter area	25.5%	48.2%	1.2%	6.7%	0.6%	3.6%	0.0%
Average HQS for AU (out of 10)	6.05	5.72	6.31	5.53	3.03	4.84	3.34
Weighted AU Score	1.54	2.76	0.08	0.37	0.02	0.17	0.00
Assessment Units	AU08	AU09	AU10	AU11	AU14	**Total/Average**	
No. Sites Sampled	3	3	2	2	2		
Extent (ha)	49.1	13.4	4.7	43.4	10.2	**1,509.0**	
% of matter area	3.3%	0.9%	0.3%	2.9%	0.7%	-	
Average HQS for AU (out of 10)	4.80	4.08	6.98	3.56	7.44	-	
Weighted AU Score	0.16	0.04	0.02	0.10	0.05	**5.6**	

3.4.4 Grey Snake (*Hemiaspis damelii*)

Potential Occurrence at Killara

Grey snakes occur throughout the Brigalow Belt, from coastal districts near Rockhampton, south-east to the Lockyer Valley in South East Queensland (Wilson and Swan 2020; Wilson 2022). They inhabit dry eucalypt forest and occasionally pasture favouring cracking, flood-prone soils along floodplains and near watercourses (Hobson 2002; Rowland 2012; Covacevich and Wilson 2020; Wilson 2022). Most records are not associated with large river channels, rather they inhabit the adjacent floodplains with ephemeral ponds or wetlands.

There are three mid-1980s records and one undated record <5 km from the Killara properties. Suitable habitats on Killara include any REs on Landzone 3 and 4 as well as non-remnant grassland (grazing land) on landzone 4 (i.e., RE 11.3.1, 11.3.2, 11.3.25 and 11.4.3). Higher amenity habitat is likely on 35BO175 which has broad areas of landzone 4 and some creekelines. The properties to the east (15-19BO94) are located higher in the landscape and have coarser well, drained soils (i.e., sand and gravel). If present the species is perhaps more likely restricted to waterways on this property.

Fauna Habitat Attribute Scoring Method

Grey Snakes inhabit dry eucalypt forest and pasture, favouring cracking, flood-prone soils along floodplains and near watercourses (Hobson 2012; Eyre *et al.* 2015). They feed on frogs and forage habitat amenity will be influenced by frog the abundance. Measuring frog abundance directly outside of rainfall events is difficult, if not impossible, nor are there obvious indirect measures to overcome this limitation. Scoring therefore, uses habitat features that can be measured such as the abundance of woody debris.

Grey Snake habitat quality scores are based on raw data for coarse woody debris. All three habitat attributes (foraging, shelter/breeding and mobility) are derived from the coarse woody debris (m/ha) as per below.

	Score					
Variable	0	5	10	15	20	25
Coarse woody debris (m/ha)	0-100	>100-200	>200-300	>300-400	>400-500	>500

Habitat Quality Scores

Total extent of suitable Grey Snake habitat at Killara is 93.4 ha and has a combined HQS of 4.1/10. A summary of these scores is provided in Table 3.14 and detailed site scoring is provided in the associated data package.

Table 3.14. Area-weighted scores for the Grey Snake at Killara

Assessment Units	AU05	AU09	AU10	AU11	AU12	AU13	Total/Average
No. Sites Sampled	1	3	2	2	2	2	
Extent (ha)	9.8	13.4	4.7	43.4	4.6	17.5	**93.4**
% of matter area	10.5%	14.3%	5.0%	46.5%	4.9%	18.7%	-
Average HQS for AU (out of 10)	3.03	4.08	6.98	3.56	4.56	5.19	-
Weighted AU Score	0.32	0.59	0.35	1.65	0.22	0.97	**4.1**

3.4.5 Squatter Pigeon (*Geophaps scripta scripta*)

Potential Occurrence at Killara

Based on database records, the Squatter Pigeon is reasonably well represented in the region around Killara, especially a little further north closer to Mundubbera. Habitat within Killara is consistent with areas where they are frequently encountered and, combined, these factors suggest the species as a good probability of occurring. However, based on the lack of current records it is dubious that the species is resident and breeding. Suitable habitats at Killara include all vegetation communities except those on landzone 12 for which there appears to be few records (Kerswell *et al.* 2020).

Fauna Habitat Attribute Scoring Method

Squatter Pigeons spend most of their life-cycle in similar habitats for foraging, sheltering, breeding, and movement. They are typically located in open forests with a sparse to patchy ground cover and within proximity to water. Nests are positioned on the ground with eggs laid in a slight depression lined with grasses and sheltered by tussock grass, shrubs, or debris (Frith 1982; Beruldsen 2004).

Habitat quality scores for Squatter Pigeon is based on the collected data for litter/debris cover (%), bare ground cover (%), tree canopy cover (%) and distance to water (km).

For the foraging habitat attribute, the average percentage cover of litter/debris and bare ground sampled in the five 1 x 1 m quadrates is combined and then scored according to below.

Variable	Score		
	0	15	25
Leaf/debris + bare ground cover (%)	<60	≥60-70	≥70

Shelter and breeding habitat is scored based on tree canopy cover (%) as per below.

Mobility habitat is measured based on a desktop assessment to ascertain distance to nearby permanent water (under average rainfall conditions). This is then converted to a score based on the below.

Variable	Score					
	0	5	10	15	20	25
Tree canopy cover (%)	0-30	>30-50	>50-60	>60-70	>70-80	>80
Distance to water (km)	>8	>4-8	>3-4	>2-3	>1-2	0-1

Habitat Quality Scores

The extent of estimated suitable Squatter Pigeon habitat at Killara is 317.9 ha and has a combined HWS of 5.9/10. A summary of these scores is provided in Table 3.15 and detailed site scoring is provided in the associated data package.

Table 3.15. Area-weighted scores for the Squatter Pigeon at Killara

Assessment Units	AU03	AU04	AU05	AU06	AU07	AU08	AU09
No. Sites Sampled	2	4	1	3	2	3	3
Extent (ha)	18.7	101.8	9.8	54.3	0.6	49.1	13.4
% of matter area	5.9%	32%	3%	17%	0%	15%	4%
Average HQS for AU (out of 10)	6.81	5.23	5.43	6.84	4.74	6.49	5.08
Weighted AU Score	0.40	1.67	0.17	1.17	0.01	1.00	0.21
Assessment Units	AU10	AU11	AU12	AU13	**Total/Average**		
No. Sites Sampled	2	2	2	2			
Extent (ha)	4.7	43.4	4.6	17.5	**317.9**		
% of matter area	1%	14%	1%	6%	-		
Average HQS for AU (out of 10)	5.80	5.64	5.46	5.89	-		
Weighted AU Score	0.09	0.77	0.08	0.32	**5.9**		

3.4.6 Glossy Black Cockatoo (*Calyptorhynchus lathami*)

Potential Occurrence at Killara

The Glossy Black Cockatoo is well known from the local area and there are numerous records in Barakula State Forest. The species is often recorded in 11.3.1 and 11.4.3 where they feed on *Allocasuarina cristata*. Both these REs occur at Killara. The species can also be located in 11.5.20 if *A. inophloia* is present. These REs have been used to calculate habitat lost within the SGP and are used again here to calculate habitat value at Killara. However, the lack of *Allocasuarina* in 11.5.20 at Killara suggest this RE as limited amenity for the species.

Fauna Habitat Attribute Scoring Method

Glossy Black-Cockatoos are dietary specialists feeding exclusively on the seeds of *Allocasuarina* and, less often, *Casuarina* spp. Belah (*Casuarina cristata*) is an important food source within the southern Brigalow Belt and, while poorly documented, occasionally *A. inophloia* in and around the Kumbarilla to Inglewood area (M. Sanders pers. obs.). They do not feed on Bulloak (*Allocasuarina luehmannii*). Nests are located in a large vertical hollow extending one or two metres deep.

Habitat quality scores for Glossy Black Cockatoo are based on Allocasuarina cover (excluding *A. luehmannii*) and hollow-bearing tree abundance (No./ha). As the species is highly mobile no on-ground features affect mobility which is set at 25.

For the foraging habitat attribute, the combined cover of Allocasuarina (excluding *A. luehmannii*) in the emergent, canopy (including emergent) and sub-canopy layers are scored as per below.

Shelter and breeding habitat is scored based on the number of hollow-bearing trees (per hectare) as per below.

Variable	Score					
	0	5	10	15	20	25
Emergent, canopy and subcanopy cover of *Allocasuarina* (exc. *A. luehmannii*) (%)	0	1-5	>5-15	>15-30	>30-50	50+
Hollow-bearing tree abundance (trees containing hollows ≥ 20cm in diameter) (No./ha)	0	1-3	4-5	6-7	8-9	>9

Habitat Quality Scores

Habitat quality scores for Glossy Black Cockatoo have been evaluated using REs 11.3.1, 11.4.3 and 11.5.20. The total extent of these habitats at Killara is 107.0 ha and has a combined HQS of 4.8/10. A summary of scores for each RE is provided in Table 3.16.

Table 3.16. Area-weighted scores for Glossy Black Cockatoo at Killara

Assessment Units	AU05	AU08	AU10	AU11	Total/Average
No. Sites Sampled	1	3	2	2	
Extent (ha)	9.8	49.1	4.7	43.4	**107.0**
% of matter area	9.2%	45.9%	4.4%	40.6%	-
Average HQS for AU (out of 10)	4.23	5.02	5.08	4.56	-
Weighted AU Score	0.39	2.30	0.22	1.85	**4.8**

3.4.7 Painted Honeyeater (*Grantiella picta*)

Potential Occurrence at Killara

Painted Honeyeaters are mistletoe specialists and their diet is dominated by mistletoe fruit and, at certain times of the year, mistletoe nectar (Oliver *et al.* 2003). Invertebrates can also be occasionally taken (Higgins *et al.* 2001). Nests are located in the outer foliage of trees, especially eucalypts and casuarinas, and mistletoes which have pendulous foliage (Higgins *et al.* 2001; Barea 2008). Studies have found that nest-site selection is primarily driven by mistletoe abundance and proximity to mistletoe clumps, although habitat structure also plays a role (Barea 2012).

Within the southern Brigalow belt vegetation which supports abundant Needle-leaved (*Amyema cambagei*) and Grey Mistletoe (*A. quandang*) are particularly favoured. Needle-leaved Mistletoe is associated with *Casuarina cunninghamiana* and *Casuarina cristata,* while Grey Mistletoe is associated with larger *Acacia* species (especially *A. harpophylla*). While it has been recorded using *A. pendula* in Victoria, this mistletoe is less frequently used in the southern Brigalow Belt. For the purpose of offset calculations and to be consistent with the SGP, data from RE 11.3.1 and 11.4.3 is used.

Fauna Habitat Attribute Scoring Method

Painted Honeyeaters inhabit open dry woodlands and forests which have abundant Mistletoe (Higgins *et al.* 2001). They are mistletoe specialists and their diet is dominated by mistletoe fruit and, at certain times of the year, mistletoe nectar (Oliver *et al.* 2003). Invertebrates can also be occasionally taken (Higgins *et al.* 2001). Nests are located in the outer foliage of trees, especially eucalypts and casuarinas, and mistletoes which have pendulous foliage (Higgins *et al.* 2001; Barea 2008). Studies have found that nest-site selection is primarily driven by mistletoe abundance and proximity to mistletoe clumps, although habitat structure also plays a role (Barea 2012). Based on a study in northern NSW, Painted Honeyeaters inhabit sites where mistletoe density averages 260 mistletoe clumps per hectare, though mistletoe density may range from five to 1,505 clumps per hectare (Oliver *et al.* 2003).

The Painted Honeyeater habitat quality scores are based on a per hectare estimate of Mistletoe abundance in the emergent, canopy and subcanopy layers. As the species is highly mobile no on-ground features affect mobility which is set at 25.

Foraging and breeding/shelter habitat attributes are scored based on mistletoe abundance as per below per below.

Variable	Score					
	0	5	10	15	20	25
Mistletoe abundance (per ha) in the emergent, canopy and subcanopy (clumps/ha)	0-50	51-100	101-150	151-200	201-250	251+

Habitat Quality Scores

The extent of high amenity Painted Honeyeater habitat at Killara is 57.9 ha and has a combined HWS of 4.5/10. A summary of these scores is provided in Table 3.17.

Table 3.17. Area-weighted scores for Painted Honeyeater at Killara

Assessment Units	AU05	AU10	AU11	**Total/Average**
No. Sites Sampled	1	2	2	
Extent (ha)	9.8	4.7	43.4	**57.9**
% of matter area	16.9%	8.1%	75.0%	-
HQS for AU (out of 10)	3.43	5.78	4.56	-
Weighted AU Score	0.58	0.47	3.42	**4.5**

3.4.8 Short-beaked Echidna (*Tachyglossus aculeatus*)

Potential Occurrence at Killara

The Short-beaked Echidna is a common species which can be seen throughout a variety of habitats including, occasionally, grazing lands with regrowth and woody debris. It is less common in wet habitats where its primary prey, termites, are in low abundance. All vegetation at Killara is suitable habitat for the species.

Fauna Habitat Attribute Scoring Method

While a highly adaptable species, Short-beaked Echidnas show a preference for intact native vegetation that provides sufficient resources to support its invertebrate prey – primarily ants and termites (Abensperg-Traun 1991; Wilkinson *et al.* 1998). No direct measure of ant and/or termite abundance is captured in the BioCondition framework, but a classification based on coarse woody debris seems appropriate given the reliance on dead wood by both ants and termites.

Habitat quality scores for the Short-beaked Echidna are based on coarse woody debris (m/ha) and percentage ground cover of litter/debris. All three habitat attributes (foraging, breeding/shelter and mobility) are scored similarly, using the matrix table below.

		Coarse woody debris (m/ha)					
		0-100	>100-200	>200-300	>300-400	>400-500	>500
Littler/debris cover (%)	0-10	5	10	15	15	20	20
	>10-20	10	10	15	20	20	25
	>20-30	10	15	20	20	25	25
	>30-40	15	20	20	25	25	25
	>40-50	15	20	25	25	25	25
	>50	20	25	25	25	25	25

Habitat Quality Scores

The extent of suitable habitat for the Short-beaked Echidna in the balance areas of Killara is 1,565.0 ha and has a combined HWS of 6.5/10. A summary of these scores is provided in Table 3.18.

Table 3.18. Area-weighted scores for Short-beaked Echidna at Killara

Assessment Units	AU01	AU02	AU03	AU04	AU05	AU06	AU07	AU08	AU09
No. Sites Sampled	4	9	2	4	1	3	2	3	3
Extent (ha)	384.5	726.8	18.7	101.8	9.8	54.3	0.6	49.1	13.4
% of matter area	24.6%	46%	1%	7%	1%	3%	0%	3%	1%
Average HQS for AU (of 10)	7.10	6.32	6.91	5.83	5.43	6.64	4.54	6.82	4.88
Weighted AU Score	1.75	2.93	0.08	0.38	0.03	0.23	0.00	0.21	0.04
Assessment Units	AU10	AU11	AU12	AU13	AU14	AU15	AU16	**Total/Averag**	
No. Sites Sampled	2	2	2	2	2	5	2		
Extent (ha)	4.7	43.4	4.6	17.5	10.2	91.2	34.4	**1,565.0**	
% of matter area	0%	3%	0%	1%	1%	6%	2%	-	
Average HQS for AU (of 10)	7.30	4.58	5.76	6.09	8.04	6.06	6.61	-	
Weighted AU Score	0.02	0.13	0.02	0.07	0.05	0.35	0.15	**6.5**	

3.4.9 South-eastern Long-eared Bat (*Nyctophilus corbeni*)

Potential Occurrence at Killara

In Queensland the South-easter Long-eared Bat is mainly recorded in the south of the Brigalow Belt (Reardon 2012) and from large tracts of vegetation, approximately 5000+ ha in size (e.g., Southwood National Park), although the species can be recorded from smaller tracts of 600 ha (e.g., Erringibba National Park) (EPA 2008). A similar association for large continuous vegetation has been noted in NSW (Turbill and Ellis 2006). Landscape context is therefore important consideration when assessing habitat amenity for this species.

The species is common in box/ironbark/cypress pine woodland and vegetation dominated by Buloke (*Allocasuarina luehmannii*) on sandy soils, though it can also occur in Brigalow (*Acacia harpophylla*) and Belah (*Casuarina cristata*) communities, dry sclerophyll forests with *Corymbia citriodora*, and semi-evergreen vine thickets (Turbill and Ellis 2006; Churchill 2008; Baker and Gynther 2023). The species prefers areas with a distinct overlapping canopy and a dense understorey (Churchill 2008; Law *et al.* 2016).

Regional ecosystems on Killara consistent with those mapped as high amenity habitat for this bat within the SGP include 11.3.1, 11.4.3, 11.5.1 and 11.5.1a. These are again used here for calculating HQS although, at Killara, RE 11.5.1 and 11.5.1a lacks a dense overlapping mid/understorey and has low amenity for the species. In addition to these REs, 11.12.1a, 11.12.3 and 11.12.6b, have been included in the calculations.

Fauna Habitat Attribute Scoring Method

Within its distribution the species tends to be absent from smaller remnants of vegetation and this may indicate a requirement for larger more continuous intact vegetation (Turbill and Ellis 2006). The species rarely uses areas of post wild-fire regrowth or open habitats (Law *et al.* 2016). In general, *N. corbeni* appears most abundant where the vegetation has a distinct canopy and a dense, cluttered understorey layer.

The diet of Southern Long-eared Bats is not well understood with some studies suggesting a diverse range of invertebrate prey but possible seasonal preferences (Law *et al.* 2016) while others a predominantly Lepidopteran (moth) diet (Vestjens and Hall 1977). The species possesses specialised ecological traits which favour slow, manoeuvrable flight and prey detection in dense vegetation (Denzinger and Schnitzler 2013; Law *et al.* 2016).

Nyctophilus corbeni roosts most frequently in dead eucalypts, followed by Bulloak (*Allocasuarina luehmannii*), dead cypress (*Callitris sp.*) and other unknown dead trees (Law *et al.* 2016; Law *et al.* 2018). Roost trees are more frequently located in comparatively dense vegetation, but roost preference seems to be influenced by hollow availability rather than a preference for any particular tree species (Law *et al.* 2016). Most roost trees are < 40cm DBH and, despite being common in the landscape.

Habitat attribute scoring for the South-eastern Long-eared Bat uses tree sub-canopy cover, shrub cover and stag abundance.

Foraging habitat amenity evaluated by combining the tree subcanopy cover and the native shrub cover (%) and then scoring the total as in the table below.

Stag abundance (No./ha) is used to score shelter and breeding habitat amenity as per below.

Variable	Score					
	0	5	10	15	20	25
Combined tree subcanopy and shrub cover (%)	0-30	>30-40	>40-50	>50-60	>60-70	>70
Stag density (No./ha)	<40	40-50	>50-60	>60-70	>70-80	>80

Mobility habitat amenity is not calculated using raw data. The average of the foraging habitat score and shelter/breeding habitat score (as individually calculated above) is initially calculated. This is then used with the landscape connectivity score (as per the section 6 of the *Biocondition Assessment Manual*) in the below matrix.

		Connectivity Score*			
		0	2	4	5
'Forage' and 'shelter/breeding' amenity (average)	<5	0	0	5	10
	5-10	0	5	10	15
	<10-15	5	5	10	15
	<15-20	5	10	15	20
	>20	10	15	20	25

* As assessed and scored using the *BioCondition Assessment Methodology*

Habitat Quality Scores

The extent of suitable habitat for the South-eastern Long-eared Bat in the balance areas of Killara is 1,359.9 ha and has a combined HWS of 5.4/10. A summary of these scores is provided in Table 3.19.

Table 3.19. Area-weighted scores for the South-eastern Long-eared Bat at Killara

Assessment Units	AU01	AU02	AU05	AU06	AU07	AU10
No. Sites Sampled	4	9	1	3	2	2
Extent (ha)	384.5	726.8	9.8	54.3	0.6	4.7
% of matter area	28.3%	53.4%	0.7%	4.0%	0.0%	0.3%
Average HQS for AU (out of 10)	6.35	4.71	2.38	7.67	1.42	14.57
Weighted AU Score	1.80	2.52	0.02	0.31	0.00	0.05
Assessment Units	AU11	AU14	AU15	AU16	**Total/Average**	
No. Sites Sampled	2	2	5	2		
Extent (ha)	43.4	10.2	91.2	34.4	**1,359.0**	
% of matter area	3.2%	0.8%	6.7%	2.5%	-	
Average HQS for AU (out of 10)	6.47	6.22	4.01	7.98	-	
Weighted AU Score	0.21	0.05	0.27	0.20	**5.4**	

3.4.10 Greater Glider (*Petauroides volans sensu lato*)

Recent genetic research (McGregor *et al.* 2020) suggests *P. volans* may be paraphyletic, consisting of three closely related taxa. Some agencies and jurisdictions have accepted this work and recognise *P. armillatus* (Central Greater Glider) as a separate species. However no formal description of the new taxa has been published, their distributions are poorly understood, and taxonomic change has not been formally recognised by the Australian Mammal Taxonomic Consortium (AMTC 2022). Nor has the new taxonomy been recognised in the recently published Mammals of Australia (Baker and Gynther 2023). In the interests of taxonomic stability, we retain *P. volans* (southern and central populations) as a single species here (*sensu lato*) but recognise this may change in the future. Irrespective of the taxonomic uncertainty, both southern and central Greater Glider are currently listed under state and federal legislation as Endangered.

Potential Occurrence at Killara

The Greater Glider (*sensu lato*) is predominately restricted to eucalypt forests and woodlands, and are most common in taller, montane, moist eucalypt forests with larger, relatively old trees and abundant hollows (Andrews *et al.* 1994; Kavanagh 2000; Eyre 2004; van der Ree *et al.* 2004; Vanderduys *et al.* 2012). In areas west of the Great Dividing Range they are found in low woodlands (McKay 2008).

Dietary selection in the southern Brigalow Belt is poorly understood with a single study finding foraging animals most often in *E. moluccana, E. fibrosa* and *Corymbia citriodora* (Smith *et al.* 2007; Eyre *et al.* 2022). A study of Greater Gliders across the broader southeast Queensland region (including the Brigalow Belt Bioregion) also identified *E. tereticornis* associated with Greater Glider presence in drier forests (Eyre 2006).

Greater Gliders require large old-growth trees with abundant large hollows for denning and its abundance is linked to hollow density (Kehl and Borsboom 1984; Lindenmayer *et al.* 1991; Andrews *et al.* 1994; Smith *et al.* 2007; Goldingay 2011). Both live and dead trees can be used but most dens are located in living trees (Kavanagh and Wheeler 2004).

Surveys of Killara have located the species within, or immediately adjacent, the property boundaries and it is likely the species will utilised remnant areas of 11.3.25, 11.5.1 and 11.5.1a, 11.5.20, 11.7.6, 11.12.1a, 11.12.3 and 11.12.6b. Data and scores from both regrowth and remnant vegetation has been used to calculate the Greater Glider HQS, though based on current condition, the species is unlikely to frequent regrowth due to the lack of denning opportunities.

Fauna Habitat Attribute Scoring Method

Greater Gliders are described as having a strictly 'eucalyptus' diet but will also occasionally take flowers and rarely *Acacia* phyllodes and Mistletoe leaves (Kavanagh and Wheeler 2004; Woinarski *et al.* 2014). Many studies have identified tree size as being important for Greater Gliders (Kavanagh and Lambert 1990; Eyre 2006). Smith *et al.* (2007), for example, found gliders only in trees with a DBH of > 20 cm and most in trees 30-70 cm in size; use of trees < 30 cm were frequented less than expected based on tree availability.

Hollows in both live and dead trees are used for denning but most den trees are living (Kavanagh and Wheeler 2004). Hollow entrance size is poorly documented but likely around 18 cm (Goldingay 2011). In south-east Queensland the Greater Glider is often absent from sites supporting less than six hollow-bearing trees per hectare (Lindenmayer 2002). Studies in Barakula State Forest found female Greater Gliders inhabited areas with, on average, 3.8 den trees per hectare while male home ranges had far fewer, on average 0.9 den trees per hectare (Smith *et al.* 2007).

Three variables are used to evaluate the habitat index for Greater Glider: percentage of large Eucalypts compared to the relevant benchmark (%), hollow-bearing tree abundance (No./ha) and combined tree emergent and canopy cover (%).

Quality of foraging habitat is scored as per below using the number of large Eucalypts compared to the benchmark as a percentage.

Shelter and breeding habitat quality is scored using the combined abundance of hollow-bearing trees and stags (No./ha) as per below.

Quality of habitat for mobility is scored as per below based on combined emergent and canopy cover (%).

	Score					
Variable	0	5	10	15	20	25
Percentage of large eucalypts* compared to benchmark (%)	≤10	>10-30	>30-50	>50-70	>70-90	≥90
Hollow-bearing tree+stag abundance (No./ha)	0	1-3	4-5	6-7	8-9	>9
Tree emergent and canopy cover (%)	0-39	40-49	50-59	60-69	70-79	80+

* As assessed using the BioCondition Assessment Methodology. Includes *Eucalyptus*, *Corymbia* and *Angophora* spp.

Habitat Quality Scores

Total extent of suitable or potential habitat for the Greater Glider at Killara is 1,493.7 ha and has a combined HQS of 4.3/10. A summary of the score results is provided in Table 3.20 below, with individual site scores provided in the associated data package.

Table 3.20. Area-weighted scores for Greater Glider at Killara

Assessment Units	AU01	AU02	AU03	AU04	AU06	AU07	AU08
No. Sites Sampled	4	9	2	4	3	2	3
Extent (ha)	384.5	726.8	18.7	101.8	54.3	0.6	49.1
% of matter area	25.7%	48.7%	1.3%	6.8%	3.6%	0.0%	3.3%
Average HQS for AU (out of 10)	4.87	4.06	6.11	3.38	4.00	3.34	4.16
Weighted AU Score	1.25	1.98	0.08	0.23	0.15	0.00	0.14
Assessment Units	AU12	AU13	AU14	AU15	AU16	**Total/Average**	
No. Sites Sampled	2	2	2	5	2		
Extent (ha)	4.6	17.5	10.2	91.2	34.4	**1,493.7**	
% of matter area	0.3%	1.2%	0.7%	6.1%	2.3%	-	
Average HQS for AU (out of 10)	4.96	4.29	5.86	3.98	5.11	-	
Weighted AU Score	0.02	0.05	0.0	0.2	0.1	**4.3**	

3.4.11 Yellow-bellied Glider (*Petaurus australis australis*)

Potential Occurrence at Killara

The Yellow-bellied Glider typically restricted to large contiguous or near contiguous forest patches, with areas less than 18,000ha (180 km^2) unlikely to support viable populations (Goldingay and Possingham 1995; TSSC 2022). The species is well represented in nearby Barakula and Gurulmundi State Forests but has not been located within the Killara properties.

In northern and central Australia they are associated with dry Eucalypt-dominated forest, especially vegetation with smooth- and gum-barked trees with deep, narrow and high hollows (Craig 1985; Goldingay 1987; Kavanagh 1987; Eyre 2007; Kambouris *et al.* 2013; Goldingay *et al.* 2018; Bilney *et al.* 2022). Winter-flowering trees are important in some areas (Irish and Kavanagh 2011).

Within the property suitable habitats are likely to include remnant areas of 11.3.25, 11.5.1, 11.5.1a, 11.5.20, 11.7.6, 11.12.1a, 11.12.3 and 11.12.6b. While data from both remnant and regrowth vegetation has been used to calculate the HQS, based on current condition it is unlikely the species will occur in regrowth vegetation (including HVR) due to the lack of denning opportunities.

Fauna Habitat Attribute Scoring Method

Yellow-bellied Gliders feed on pollen, nectar and invertebrates, though tree sap from selected tree species is extremely important. Within their home ranges individuals only feed on tree exudates from a subset of eucalypt species and a small number of individual trees. Typically these trees are smooth- and gum-barked with high, deep hollows and a large (>40 cm) DBH (Craig 1985; Kavanagh 1987; Goldingay and Quin 2004; Kambouris *et al.* 2013; Jessup *et al.* 2020). Specific tree preference varies by location though *Corymbia citriodora* is often recorded (Eyre and Goldingay 2005).

Yellow-bellied gliders den in hollows of living trees, and family groups may use eight or more den trees within a home range (Craig 1985). Thresholds or correlations between hollow abundance and Yellow-bellied Glider abundance is poorly understood.

The Yellow-bellied Glider is a highly mobile species capable of gliding >100 m, though average glide distances are much smaller 25-39 m (Goldingay 2014).

Fauna habitat attribute scoring for the Yellow-bellied Glider is based on three variables: the number of eucalypt trees in the emergent and canopy layers (No./ha), abundance of large eucalypts (No./ha) and emergent and canopy cover (%).

Quality of foraging habitat is scored as per below using the per hectare estimate of all eucalypts trees in the emergent and canopy layers (No./ha).

Breeding and sheltering habitat quality is scored as per below using the estimated number of large eucalypts per hectare (No./ha). A large eucalypt is any eucalyptus tree with a DBH at or exceeding the relevant benchmark data for the Regional Ecosystem.

Quality of habitat for mobility is scored as per below based on combined emergent and canopy cover (%).

Variable	Score					
	0	5	10	15	20	25
Eucalypt emergent and canopy abundance (No./ha)	0-20	>20-40	>40-60	>60-80	>80-100	>100
Large eucalypt* tree abundance (No./ha)	≤10	>10-30	>30-50	>50-70	>70-90	≥90
Combined emergent and canopy cover (%)	0-20	>20-30	>30-40	>40-50	>50-60	>60

* As assessed using the BioCondition Assessment Methodology. Includes Eucalyptus, Corymbia and Angophora spp.

Habitat Quality Scores

Total extent of suitable or potential habitat for the Yellow-bellied Glider at Killara is 1,493.7 ha and has a combined HQS of 5.4/10. A summary of the score results is provided in Table 3.21 below.

Table 3.21. Area-weighted scores for the Yellow-bellied Glider at Killara

Assessment Units	AU01	AU02	AU03	AU04	AU06	AU07	AU08
No. Sites Sampled	4	9	2	4	3	2	3
Extent (ha)	384.5	726.8	18.7	101.8	54.3	0.6	49.1
% of matter area	25.7%	48.7%	1.3%	6.8%	3.6%	0.0%	3.3%
Average HQS for AU (out of 10)	6.37	5.17	7.01	4.23	4.60	3.34	5.02
Weighted AU Score	1.64	2.52	0.09	0.29	0.17	0.00	0.17
Assessment Units	AU12	AU13	AU14	AU15	AU16	**Total/Average**	
No. Sites Sampled	2	2	2	5	2		
Extent (ha)	4.6	17.5	10.2	91.2	34.4	**1,493.7**	
% of matter area	0.3%	1.2%	0.7%	6.1%	2.3%	-	
Average HQS for AU (out of 10)	5.46	5.29	7.26	4.38	5.31	-	
Weighted AU Score	0.02	0.06	0.05	0.27	0.12	**5.4**	

3.4.12 Koala (*Phascolarctos cinereus*)

Potential Occurrence at Killara

Surveys have located on Killara within 15-19BO74 and it is also probable to the west in 36BO175.

Koalas feed on eucalyptus trees but show dietary preference based on geographical region and the types of tree species present. In the Brigalow Belt Koalas have at least 24 species of Eucalyptus upon which they preferentially forage (ANU 2021). Of these tree species the following have been recorded within Killara: *Corymbia tessellaris, C. citriodora, Eucalyptus, E. crebra, E. exserta, E. melanophloia, E. moluccana, E. populnea,* and *E. tereticornis*. These trees are scattered throughout all remnant and regrowth communities and, as such, all areas of vegetation are suitable Koala habitat.

Fauna Habitat Attribute Scoring Method

The Koala forages, shelters and breeds in the same habitat, and high value habitat is largely predicated on eucalypt density; however, not all eucalypts are of equal value, with some species favoured over others. In the southern Brigalow Belt, favoured tree species include *Eucalyptus melanophloia, E. orgadophylla, E. tereticornis, E. crebra, E. coolabah, E. chloroclada*

and *E. populnea*, with several other *Eucalyptus* spp as well as juvenile trees utilised at lower frequencies. A select few *Corymbia* spp. have been recorded as feed trees in the Brigalow Belt; however, the frequency of these trees in the diet is low, typically no more than 4.2% of scats. Koalas have not been reported feeding on *Angophora* spp. from this region (Melzer *et al.* 2014).

Koalas are largely sedentary and tend to confine movements to a small number of nearby trees within a day. Home ranges in low amenity habitats are much larger than in those containing high quality vegetation. Dispersing individuals, mostly young males, can cover large distances with studies finding movements from natal grounds can be as much as 16 km (DAWE 2021 and references therein). This can include crossing several kilometres of land with little vegetation.

All Koala habitat attributes are based on a combined estimate of the number of eucalypts ≥ 10 cm DBH in the emergent, canopy and sub-canopy (No./ha). This is scored as below.

Variable	Score					
	0	5	10	15	20	25
Combined abundance of emergent, canopy and sub-canopy eucalypt trees (No./ha)	0	1-50	51-100	101-150	151-200	200+

Habitat Quality Scores

All vegetation within the balance area of Killara is Koala habitat (1,565 ha). The species has a HQS of 6.5/10. A summary of the score results is provided in Table 3.22 below.

Table 3.22. Area-weighted scores for Koala at Killara

Assessment Units	AU01	AU02	AU03	AU04	AU05	AU06	AU07	AU08	AU09
No. Sites Sampled	4	9	2	4	1	3	2	3	3
Extent (ha)	384.5	726.8	18.7	101.8	9.8	54.3	0.6	49.1	13.4
% of matter area	24.6%	46%	1%	7%	1%	3%	0%	3%	1%
Average HQS for AU (of 10)	7.36	6.36	7.43	6.26	3.63	5.44	4.24	6.20	4.88
Weighted AU Score	1.81	2.95	0.09	0.41	0.02	0.19	0.00	0.19	0.04
Assessment Units	AU10	AU11	AU12	AU13	AU14	AU15	AU16	**Total/Averag**	
No. Sites Sampled	2	2	2	2	2	5	2		
Extent (ha)	4.7	43.4	4.6	17.5	10.2	91.2	34.4	**1,565.0**	
% of matter area	0%	3%	0%	1%	1%	6%	2%	-	
Average HQS for AU (of 10)	4.30	3.56	5.16	6.39	7.66	6.42	6.31	-	
Weighted AU Score	0.01	0.10	0.02	0.07	0.05	0.37	0.14	**6.5**	

4.0 SUMMARY OF HQS FOR KILLARA

Habitat Quality Scores for Killara ranged between 4.1 and 6.8 out of ten. Scores for each value are provided in Table 4.1.

Table 4.1. Summary of HQS for MNES and MSES values at Killara

Value/Common Name	*Scientific Name*	Potential Habitat (ha)	HQS
VEGETATION			
Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community (TEC)		57.9	5.6
RE 11.3.1 - Acacia harpophylla and/or Casuarina cristata open forest on alluvial plains		9.8	6.6
RE 11.3.2 - Eucalyptus populnea woodland on alluvial plains		13.4	6.6
RE 11.3.25 - *E. tereticornis* or *E. camaldulensis* woodland		22.1	6.76
RE 11.4.3 - Acacia harpophylla and/or C. cristata shrubby open forest on Cainozoic clay plains		48.1	5.4
RE 11.5.1 - *E. crebra* and/or *E. populnea, C. glaucophylla, A. leiocarpa, A. luehmannii* woodland		54.3	6.92
RE 11.5.1a - *E. populnea* woodland with *A. luehmannii* low tree layer.		0.6	5.59
RE 11.5.20 - *E. moluccana* and/or *E. microcarpa* and/or *E. woollsiana* +/- *E. crebra* woodland		49.1	6.69
RE 11.7.6 – *C. citriodora* or *E. crebra* woodland		120.5	5.89
RE 11.12.1a - *E. crebra* +/- *E. exserta* woodland		1111.3	6.78
RE 11.12.3 - *E. crebra, E. tereticornis, A. leiocarpa* woodland		101.4	6.14
RE 11.12.6b - *E. crebra +/- C. citriodora* and/or *E. acmenoides* +/- *L. suaveolens* woodland		34.4	6.47
Waterway corridor vegetation (stream orders 1, 2,3 and 6)		137.1	6.7
FLORA SPECIES			
Belson's Panic	*Homopholis belsonii*	191.8	5.9
	Fimbristylis vagans	31.9	6.8
	Solanum stenopterum	23.2	6.6
Austral Toadflax	*Thesium australe*	13.4	6.6
	Xerothamnella herbacea	57.9	5.9
INVERTEBRATE SPECIES			
Brigalow Woodland Snail	*Adclarkia cameronii*	93.4	4.6
Pale Imperial Hairstreak	*Jalmneus eubulus*	57.9	5.6
VERTEBRATE SPECIES			
Common Death Adder	*Acanthophis antarcticus*	1,565.0	6.0
Dunmall's Snake	*Glyphodon dunmalli*	1,508.5	5.6
Grey Snake	*Hemiaspis signata*	93.4	4.1
Yakka Skink	*Egernia rugosa*	237.9	5.2
Squatter Pigeon	*Geophaps scripta scripta*	317.9	5.9
Glossy Black Cockatoo	*Calyptorhynchus lathami lathami*	107.0	4.8
Painted Honeyeater	*Grantiella picta*	57.9	4.5
Short-beaked Echidna	*Tachyglossus aculeatus*	1,565.0	6.4
South-eastern Long-eared Bat	*Nyctophilus corbeni*	1,359.9	5.4

Value/Common Name	*Scientific Name*	Potential Habitat (ha)	HQS
Greater Glider	*Petauroides volans sensu lato*	1,493.7	4.3
Yellow-bellied Glider	*Petaurus australis australis*	1,493.7	5.4
Koala	*Phascolarctos cinereus*	1,565.0	6.5

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Appendix A: Maps

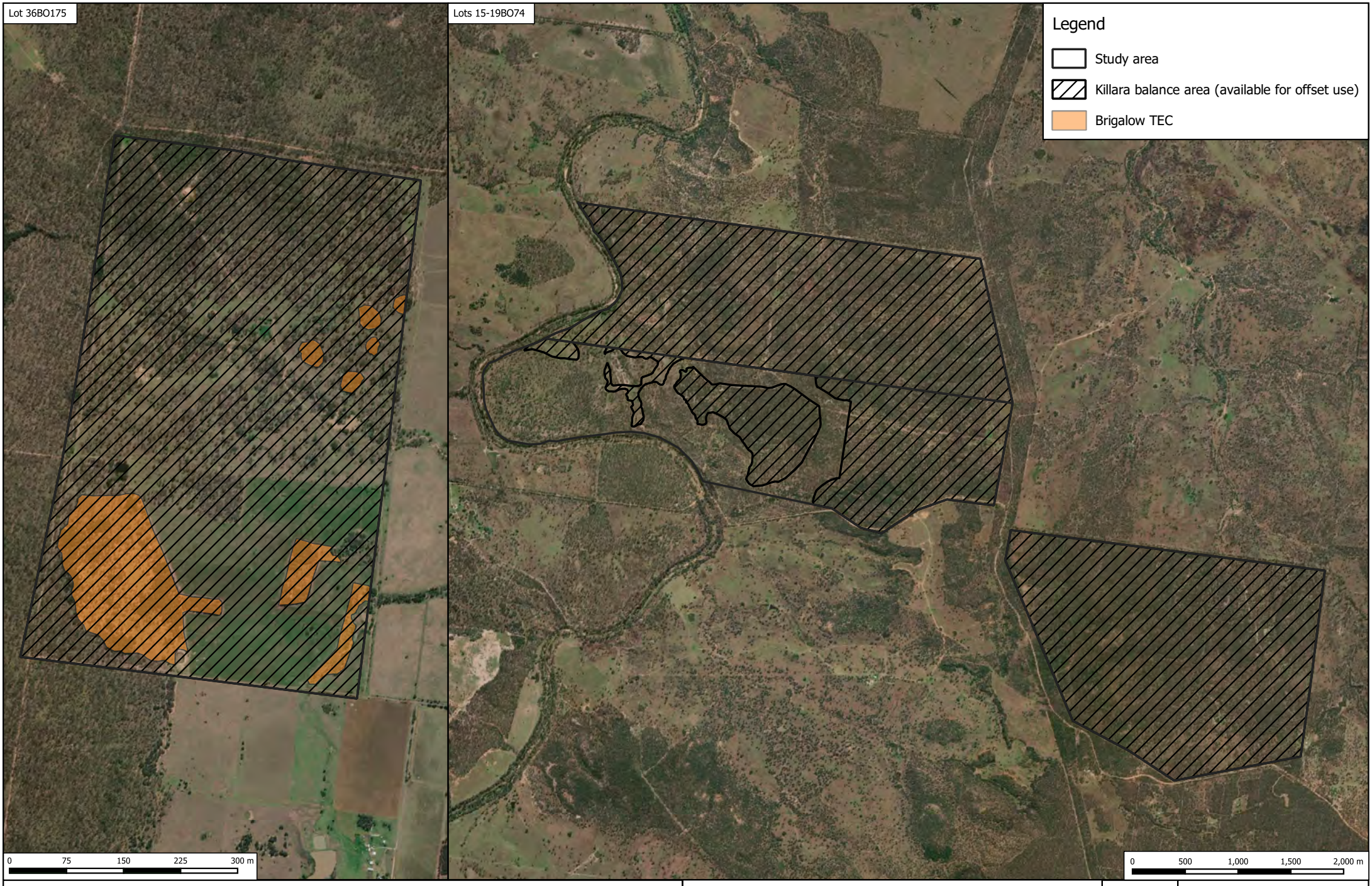

Figure A1
Brigalow TEC

Client: Arrow Energy
Project: Killara Offset Habitat Quality Assessment

ecosmart ECOLOGY

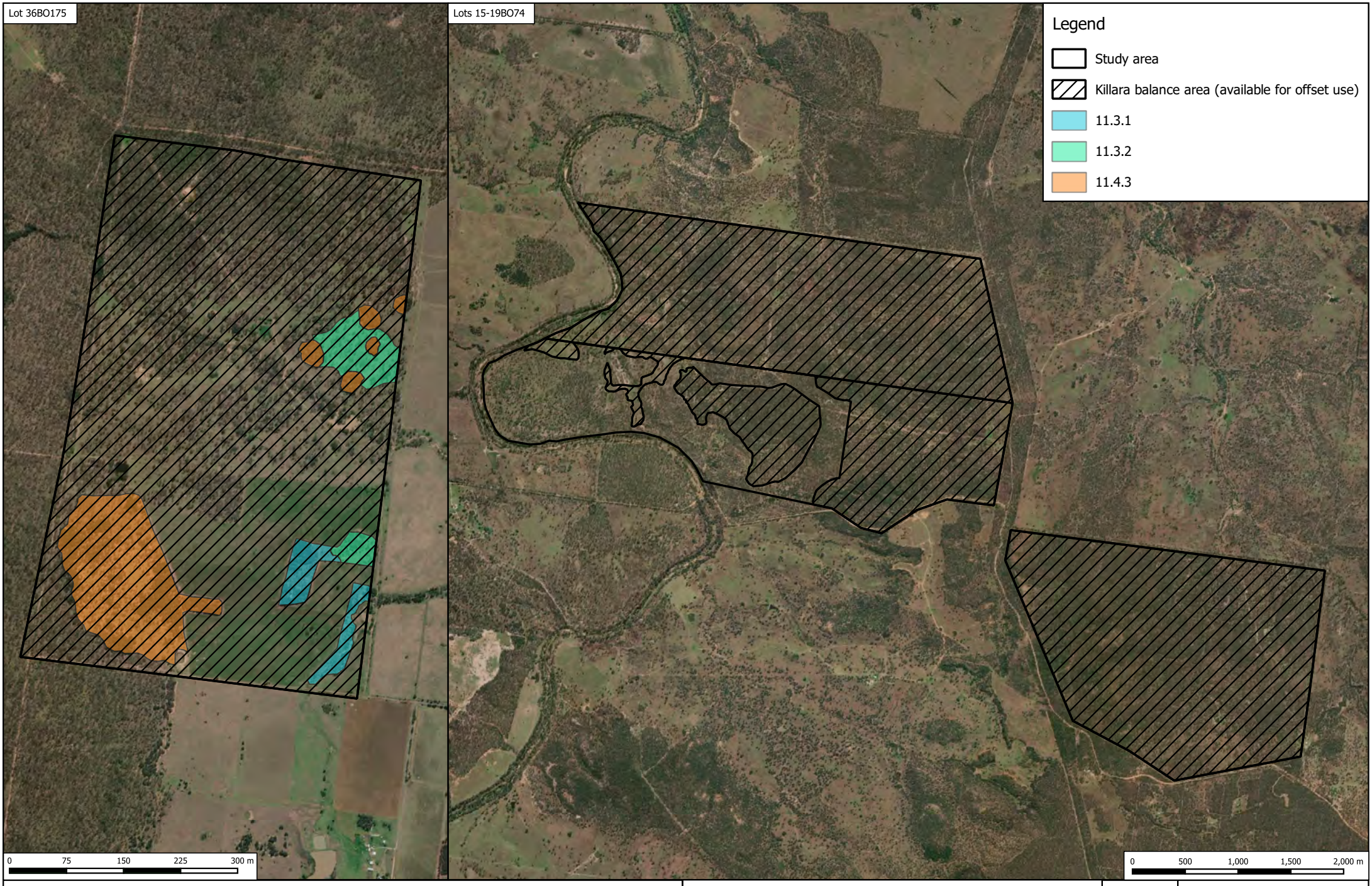

Figure A2
MSES Regional Ecosystems 11.3.1 (End), 11.3.2 (OC) and 11.4.3 (End)

Client: Arrow Energy
Project: Killara Offset Habitat Quality Assessment

ecosmart ECOLOGY

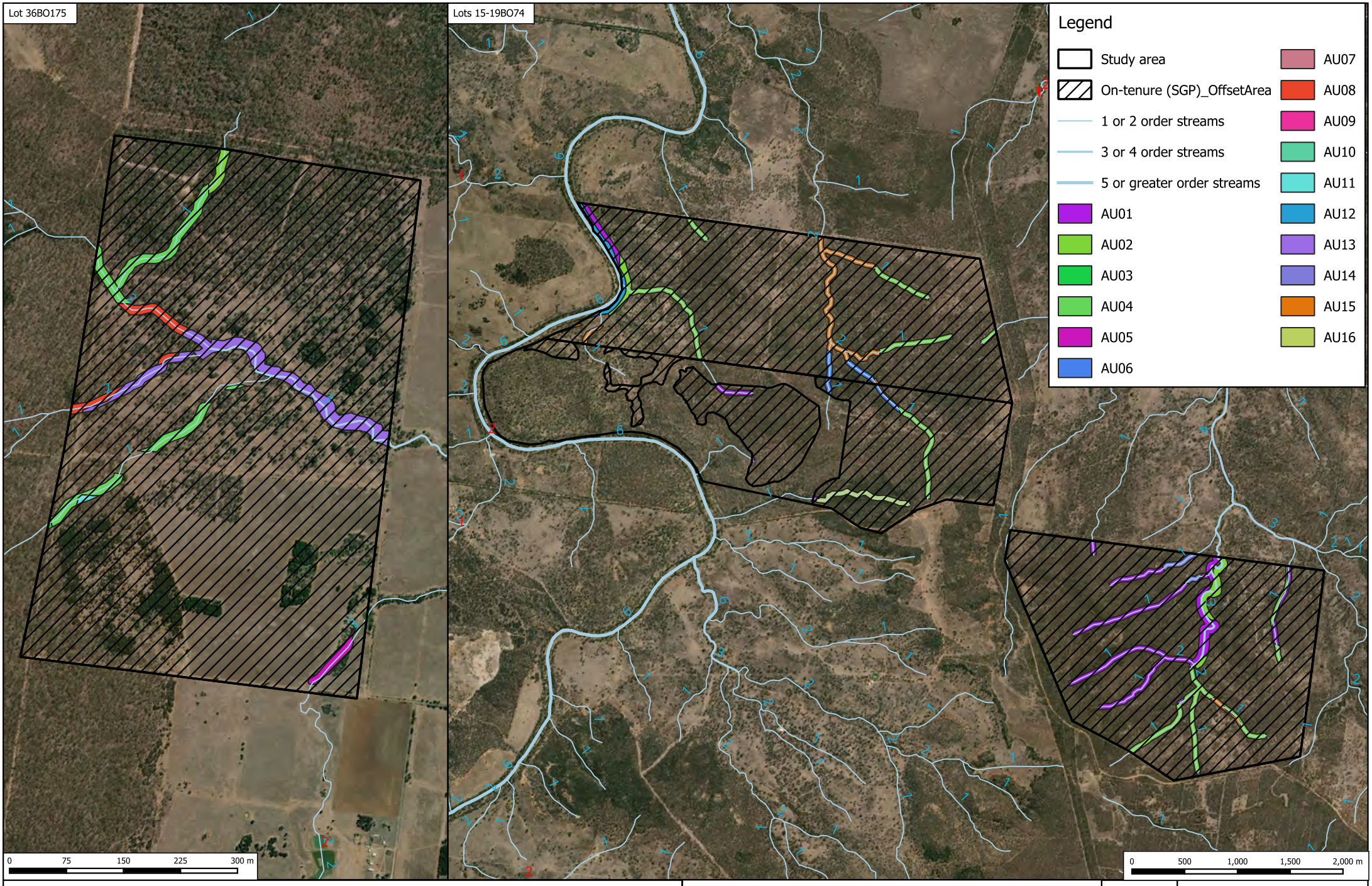

Figure A3
MSES watercourses (stream order) and waterway vegetation

Client: Arrow Energy
Project: Killara Offset Habitat Quality Assessment

ecosmart ECOLOGY

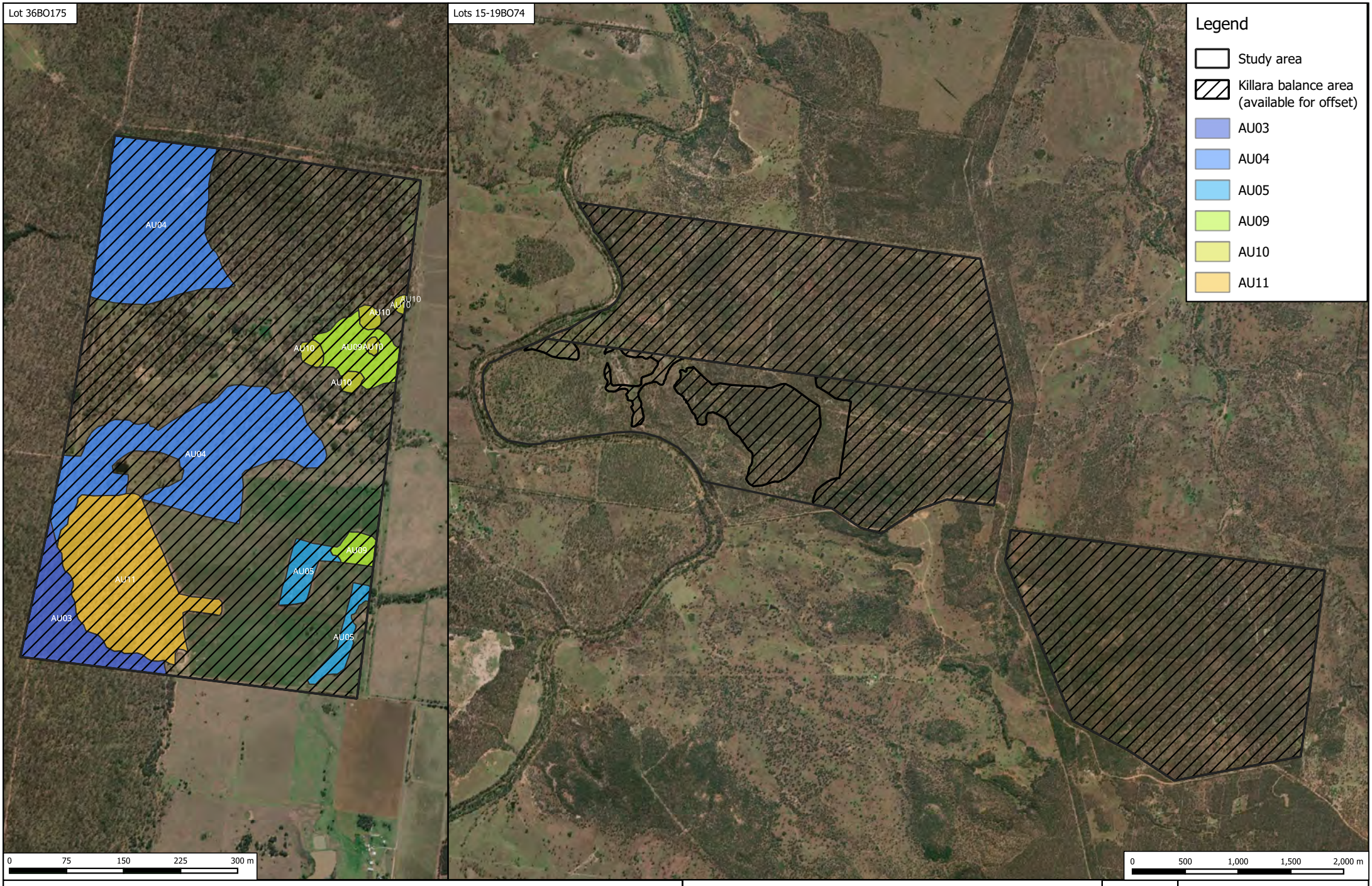

Figure A4
Assessed vegetation for Belson's Panic (*Homopholis belsonii*)

Client: Arrow Energy
Project: Killara Offset Habitat Quality Assessment

ecosmart ECOLOGY

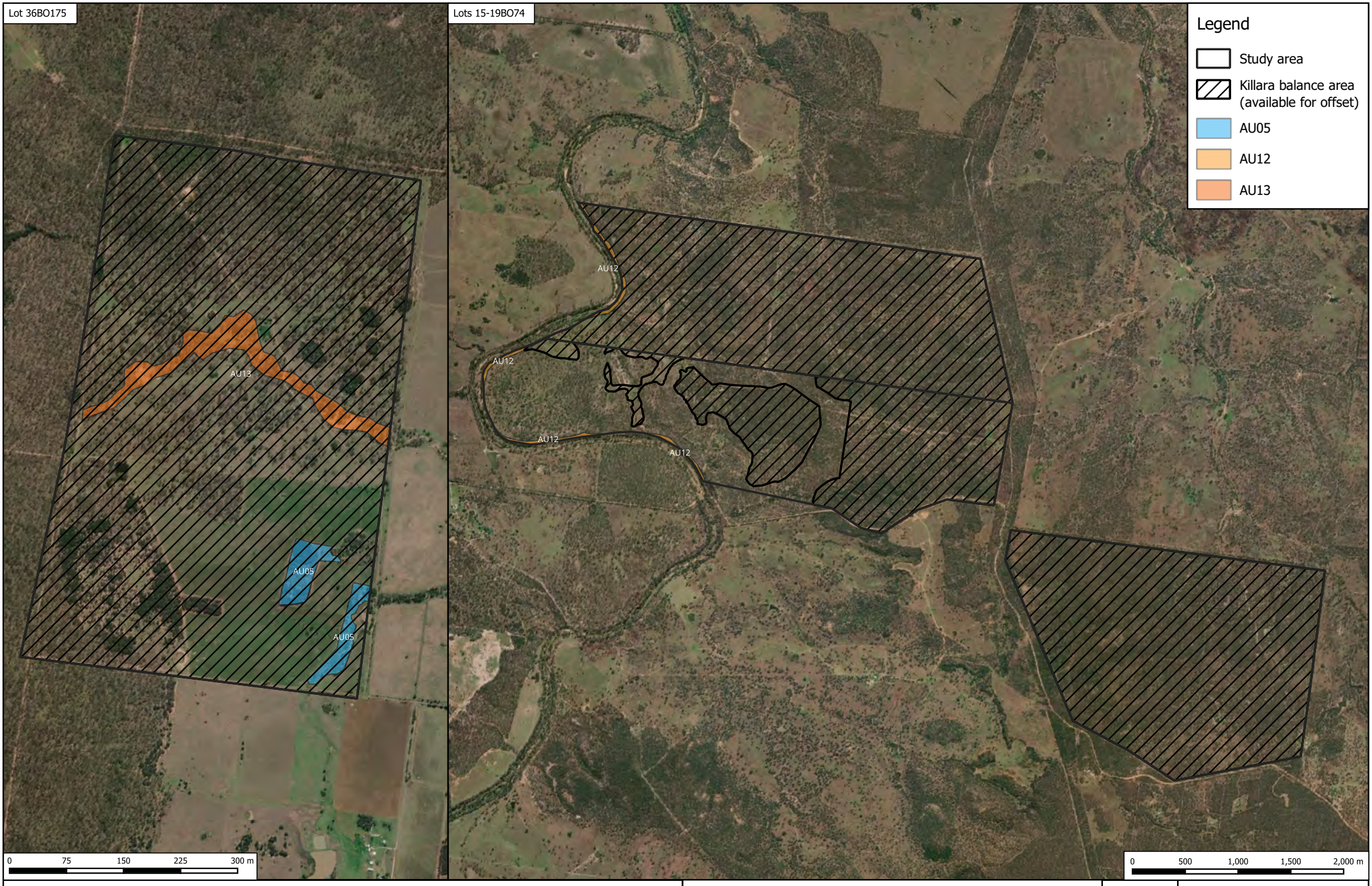

Figure A5
Assessed vegetation for *Fimbristylis vagans*

Client: Arrow Energy
Project: Killara Offset Habitat Quality Assessment

ecosmart ECOLOGY

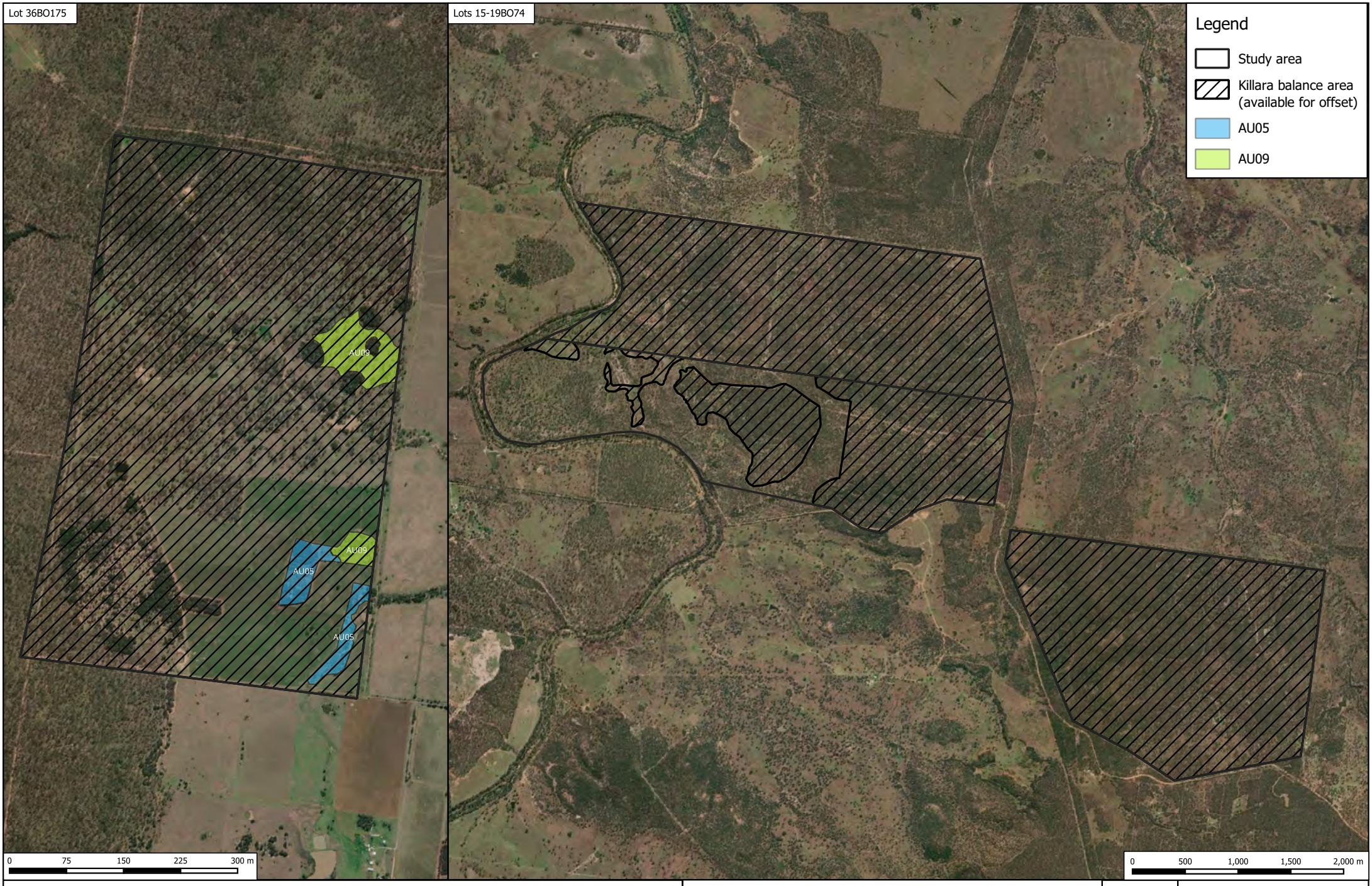

Figure A6
Assessed vegetation for *Solanum stenopterum*

Client: Arrow Energy
Project: Killara Offset Habitat Quality Assessment

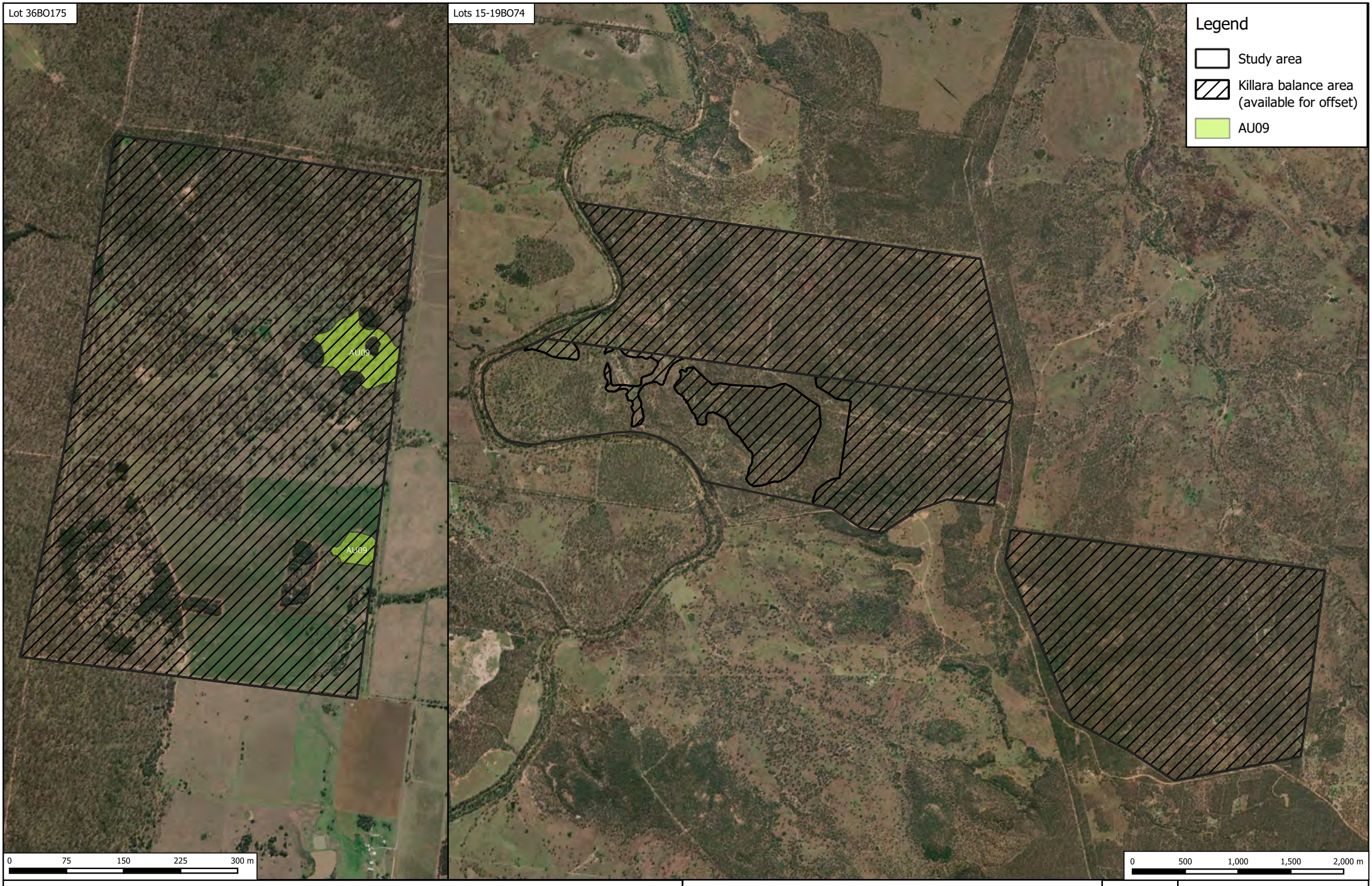

Figure A7
Assessed vegetation for Austral Toadflax (*Thesium australe*)

Client: Arrow Energy
Project: Killara Offset Habitat Quality Assessment

ecosmart ECOLOGY

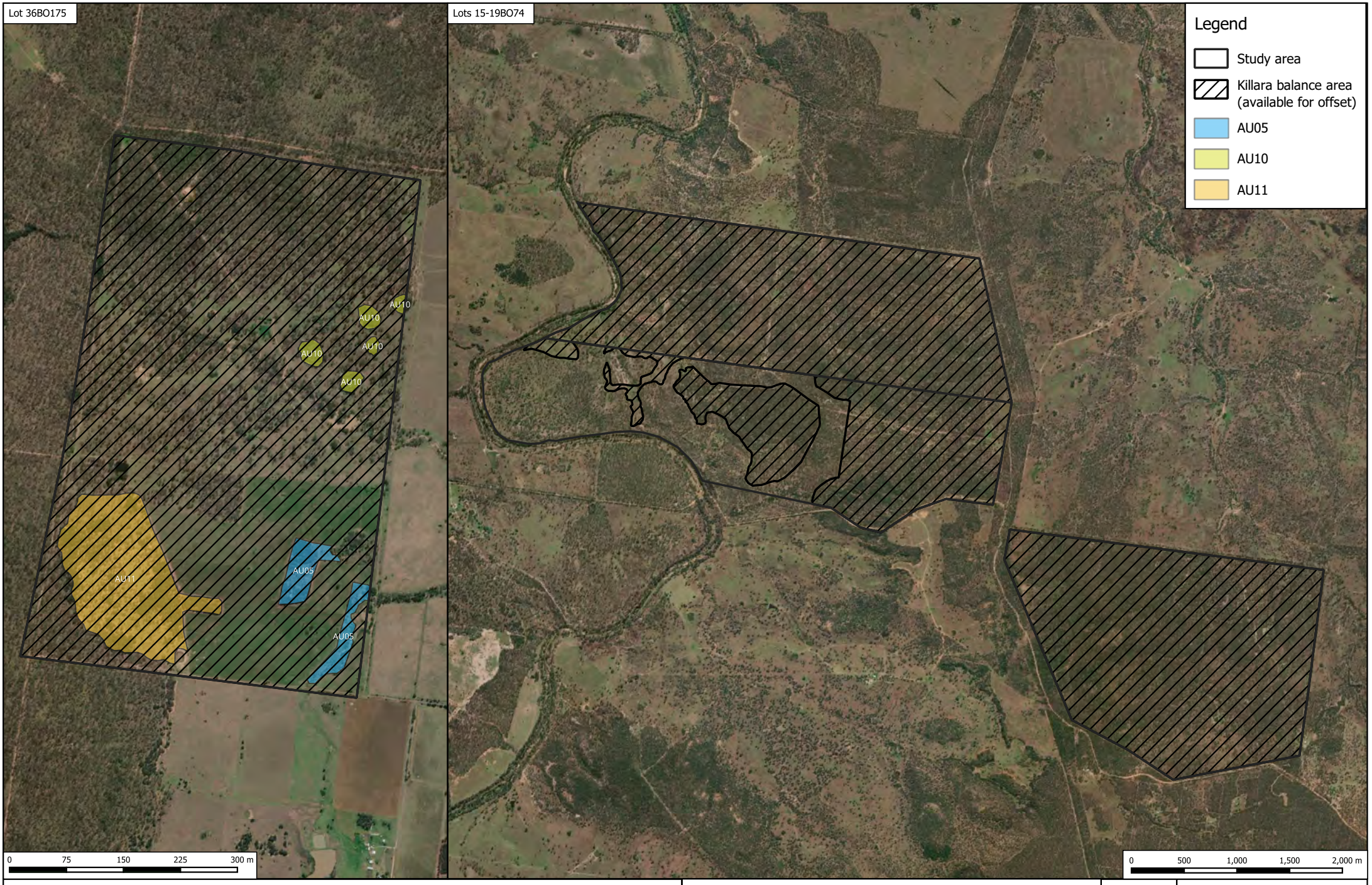

Figure A8
Assessed vegetation for *Xerothamnella herbacea*

Client: Arrow Energy
Project: Killara Offset Habitat Quality Assessment

ecosmart ECOLOGY

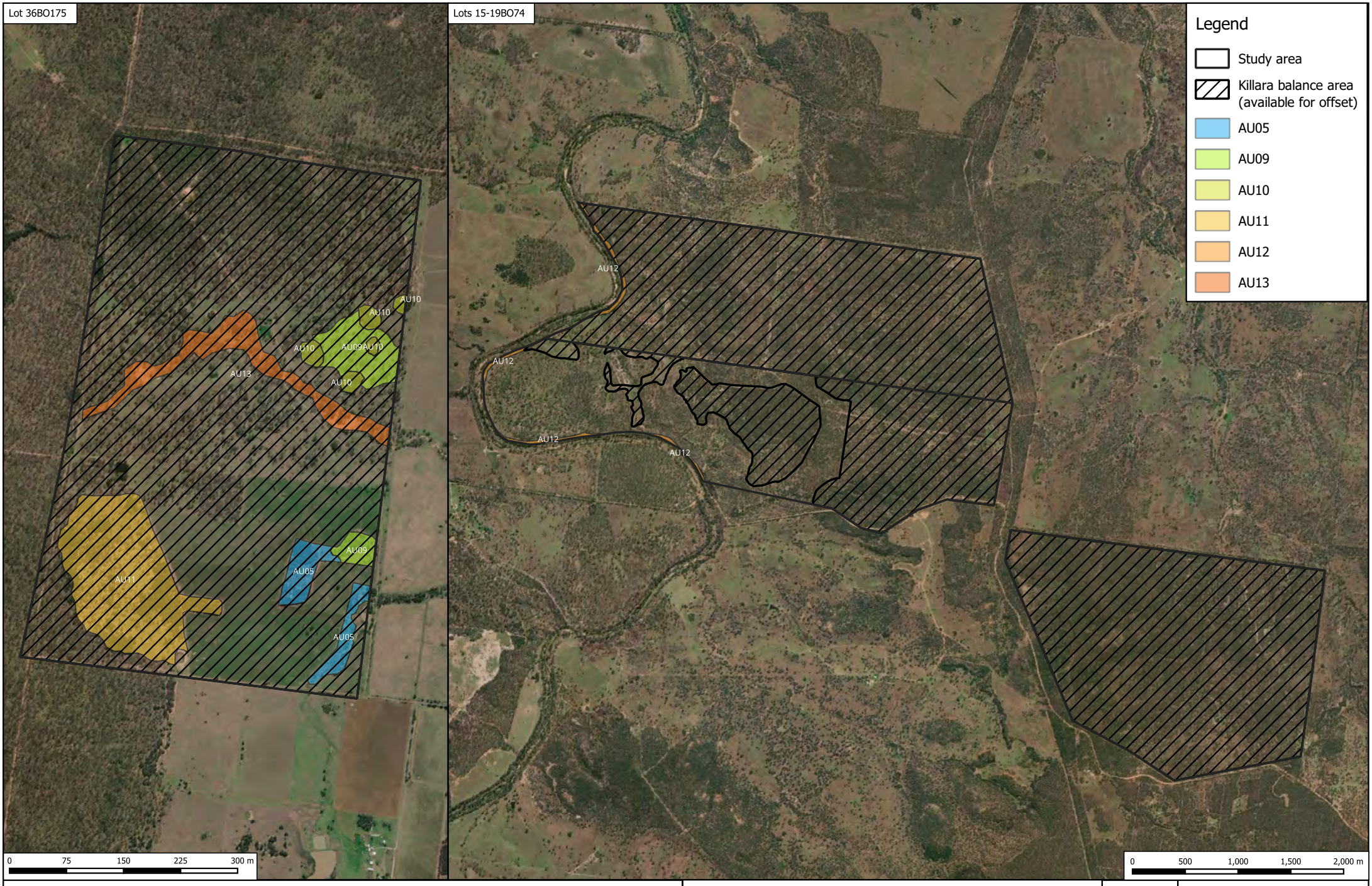

Figure A9
Assessed vegetation for Brigalow Woodland Snail (*Adclarkia cameroni*) and Grey Snake (*Hemiaspis damelii*)

Client: Arrow Energy
Project: Killara Offset Habitat Quality Assessment

ecosmart ECOLOGY

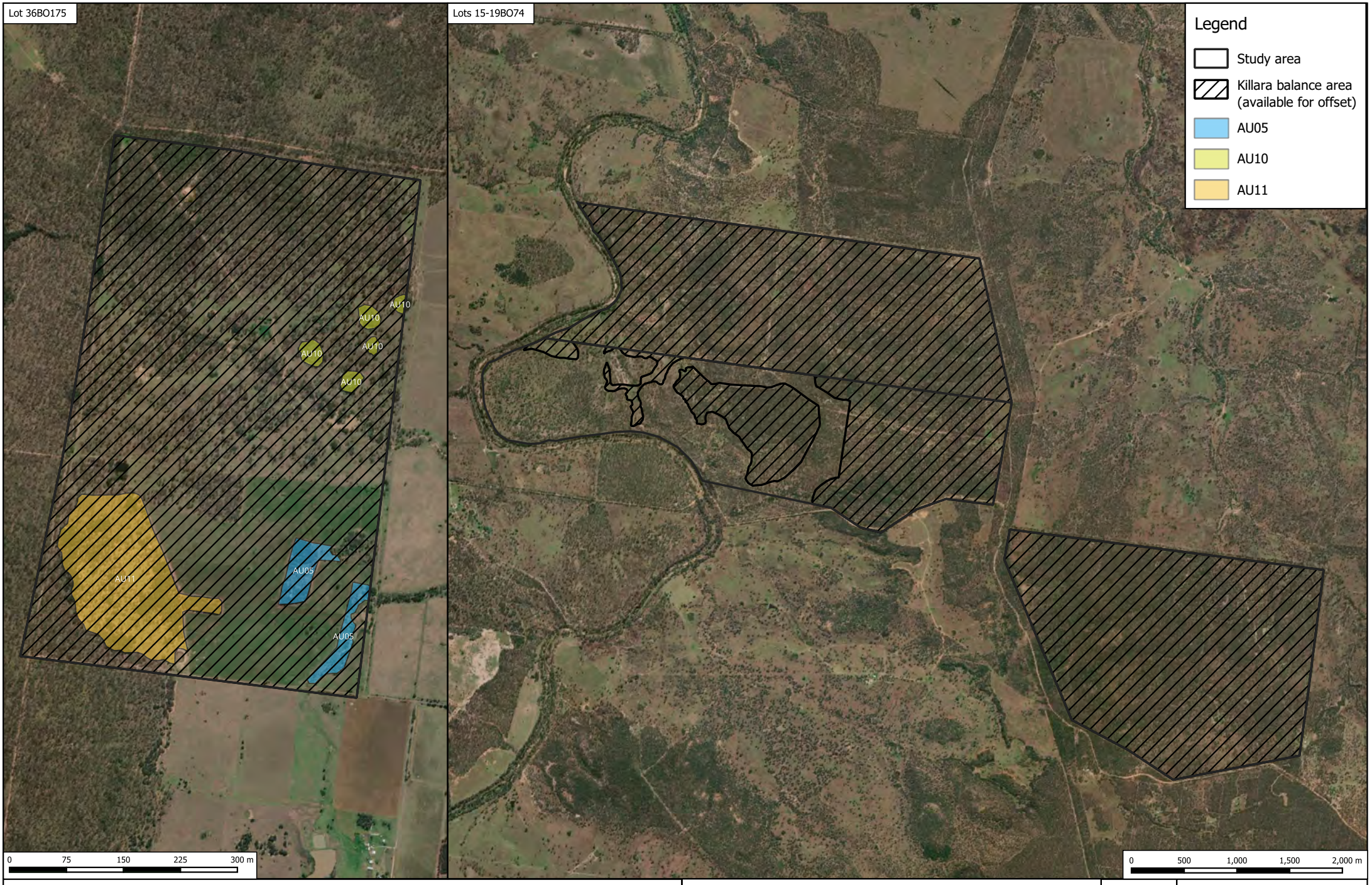

Figure A10
Assessed vegetation for Pale Imperial Hairstreak (*Jalmenus eubulus*) and Painted Honeyeater (*Grantiella picta*)

Client: Arrow Energy
Project: Killara Offset Habitat Quality Assessment

ecosmart ECOLOGY

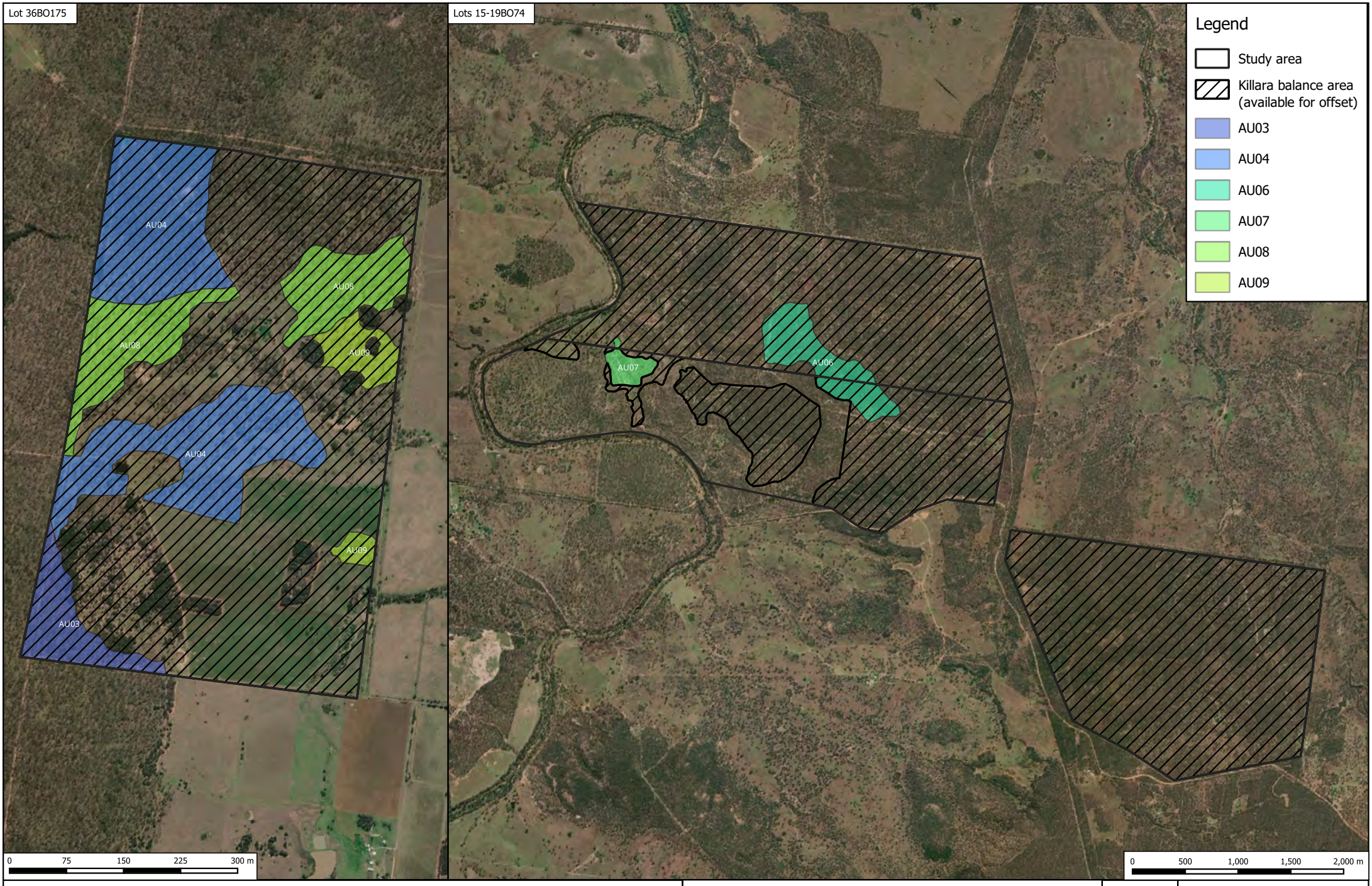

Figure A11
Assessed vegetation for Yakka Skink (*Egernia rugosa*)

Client: Arrow Energy
Project: Killara Offset Habitat Quality Assessment

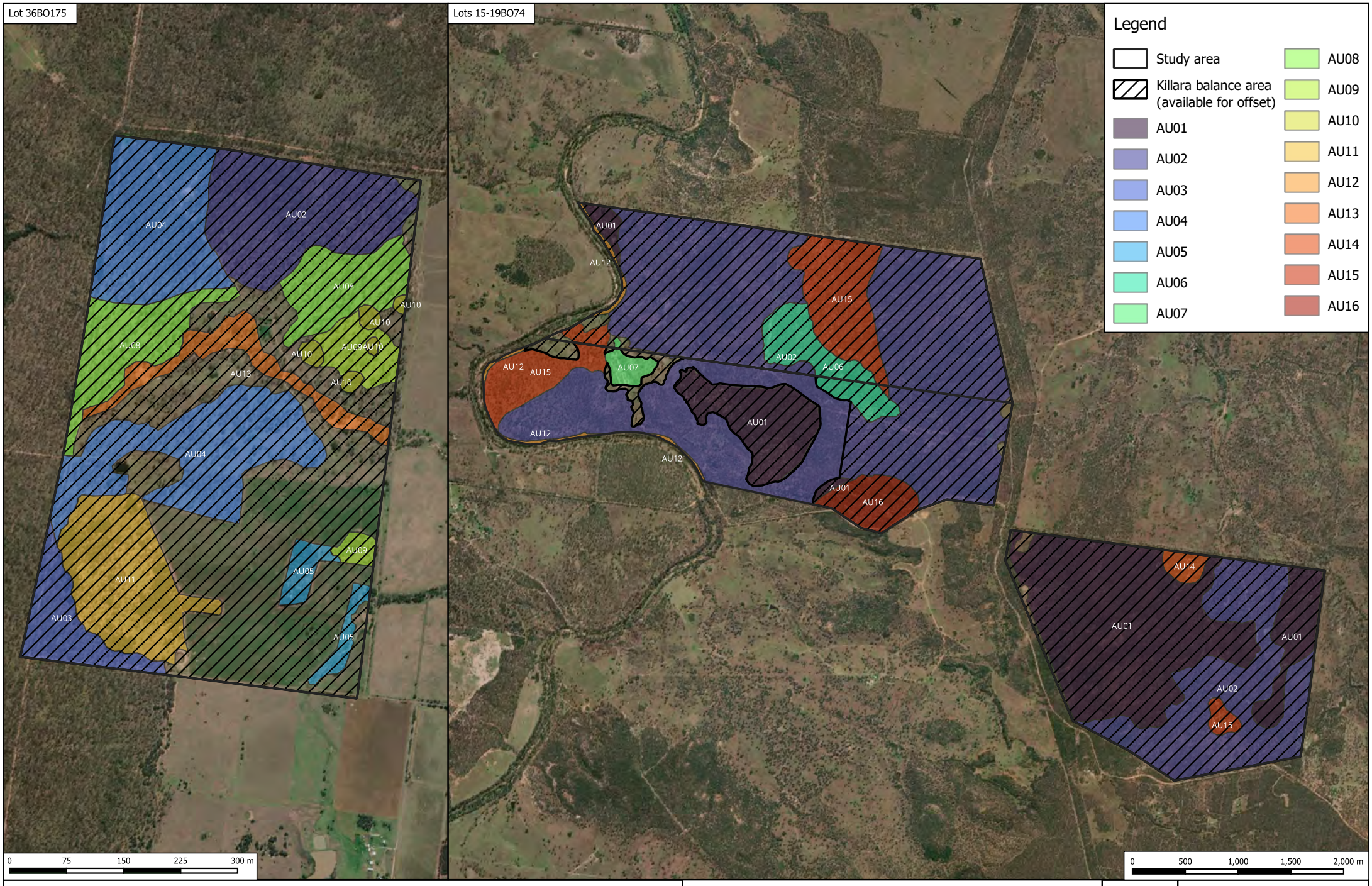

Figure A12
Assessed vegetation for Common Death Adder (*Acanthophis antarcticus*), Short-beaked Echidna (*Tachyglossus aculeatus*) and Koala (*Phascolarctos cinereus*)

Client: Arrow Energy
Project: Killara Offset Habitat Quality Assessment

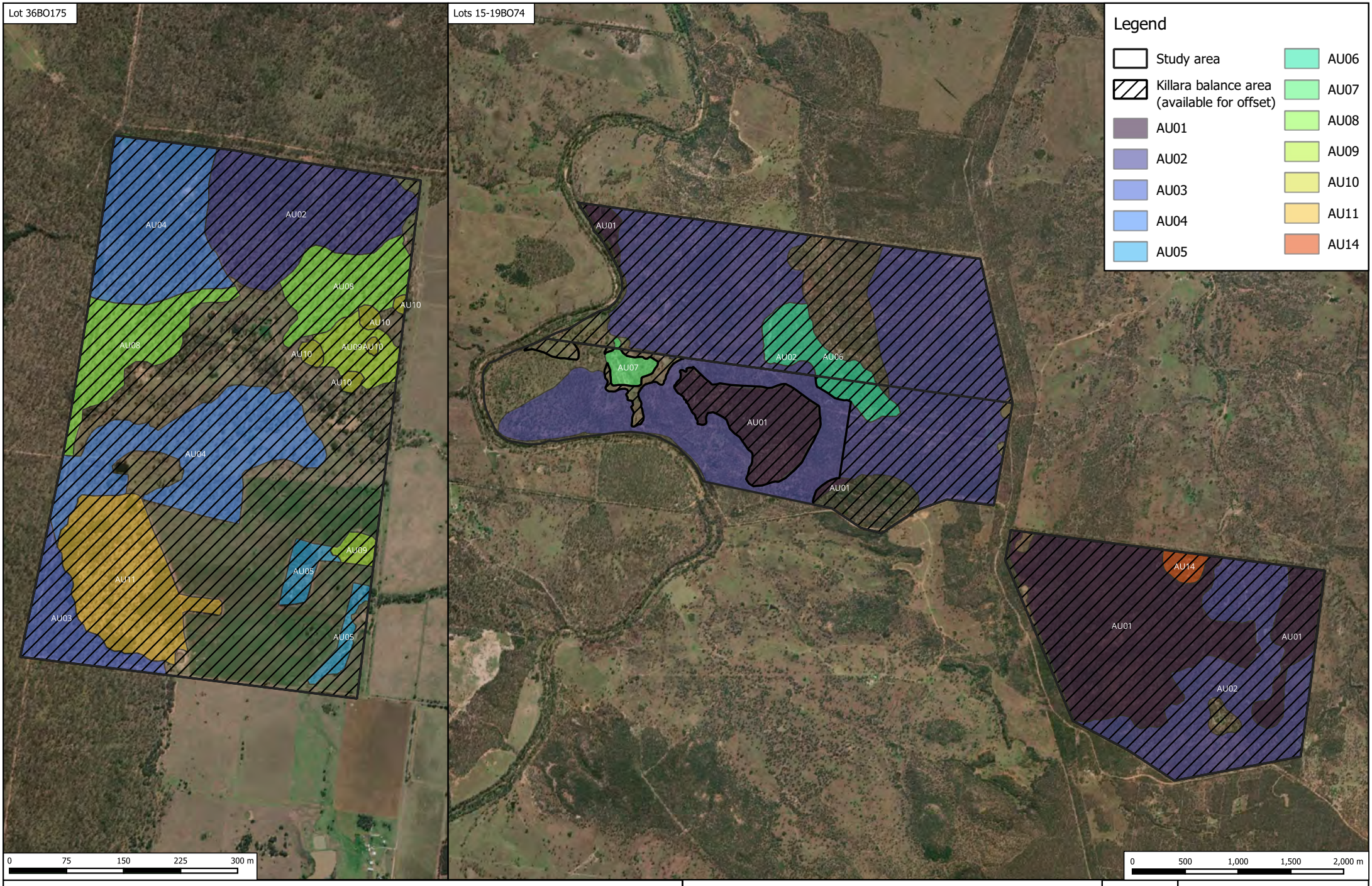

Figure A13
Assessed vegetation for Dunmall's Snake (*Glyphodon dumnalli*)

Client: Arrow Energy
Project: Killara Offset Habitat Quality Assessment

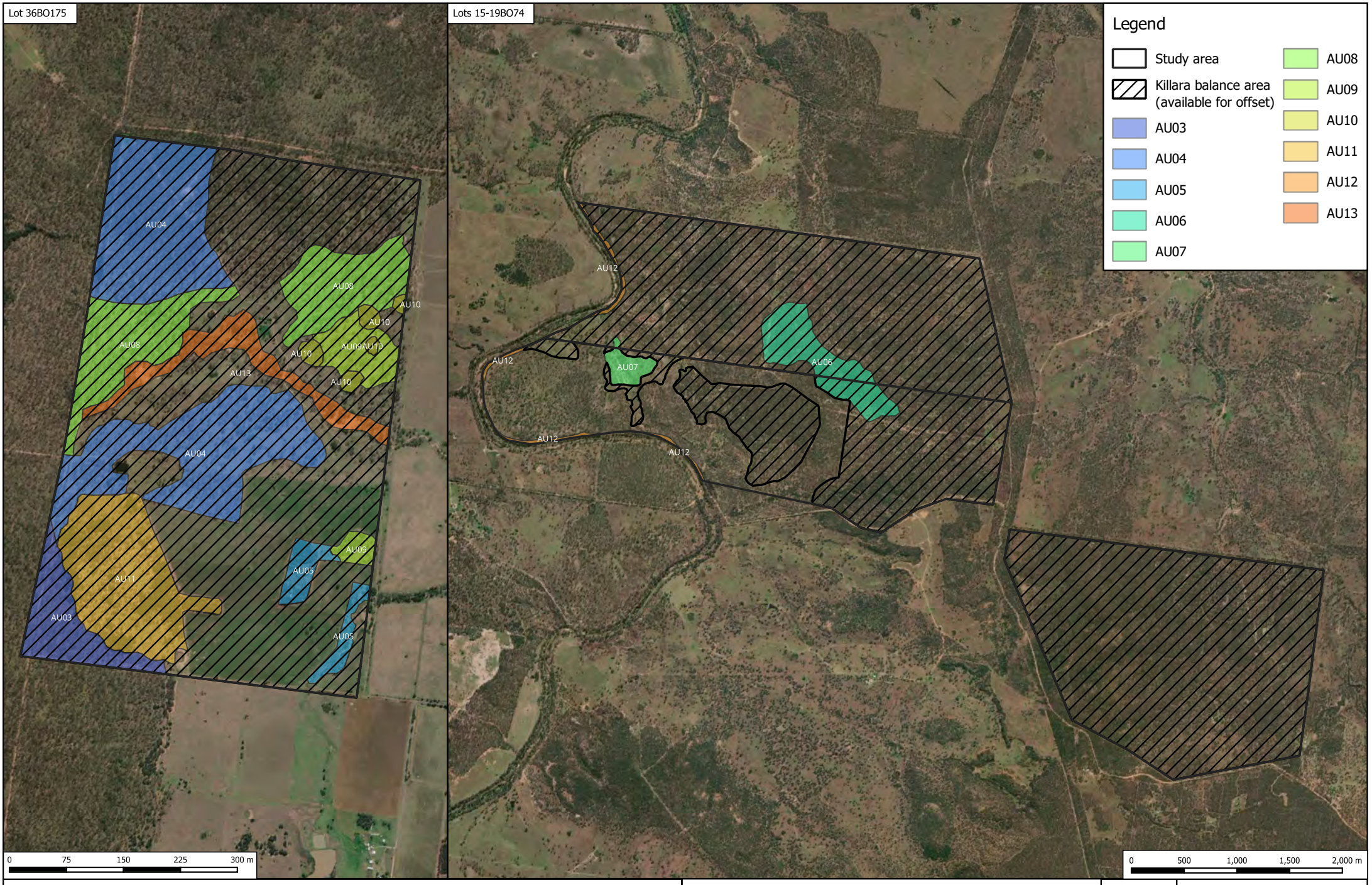

Figure A14
Assessed vegetation for Squatter Pigeon (*Geophaps scripta scripta*)

Client: Arrow Energy
Project: Killara Offset Habitat Quality Assessment

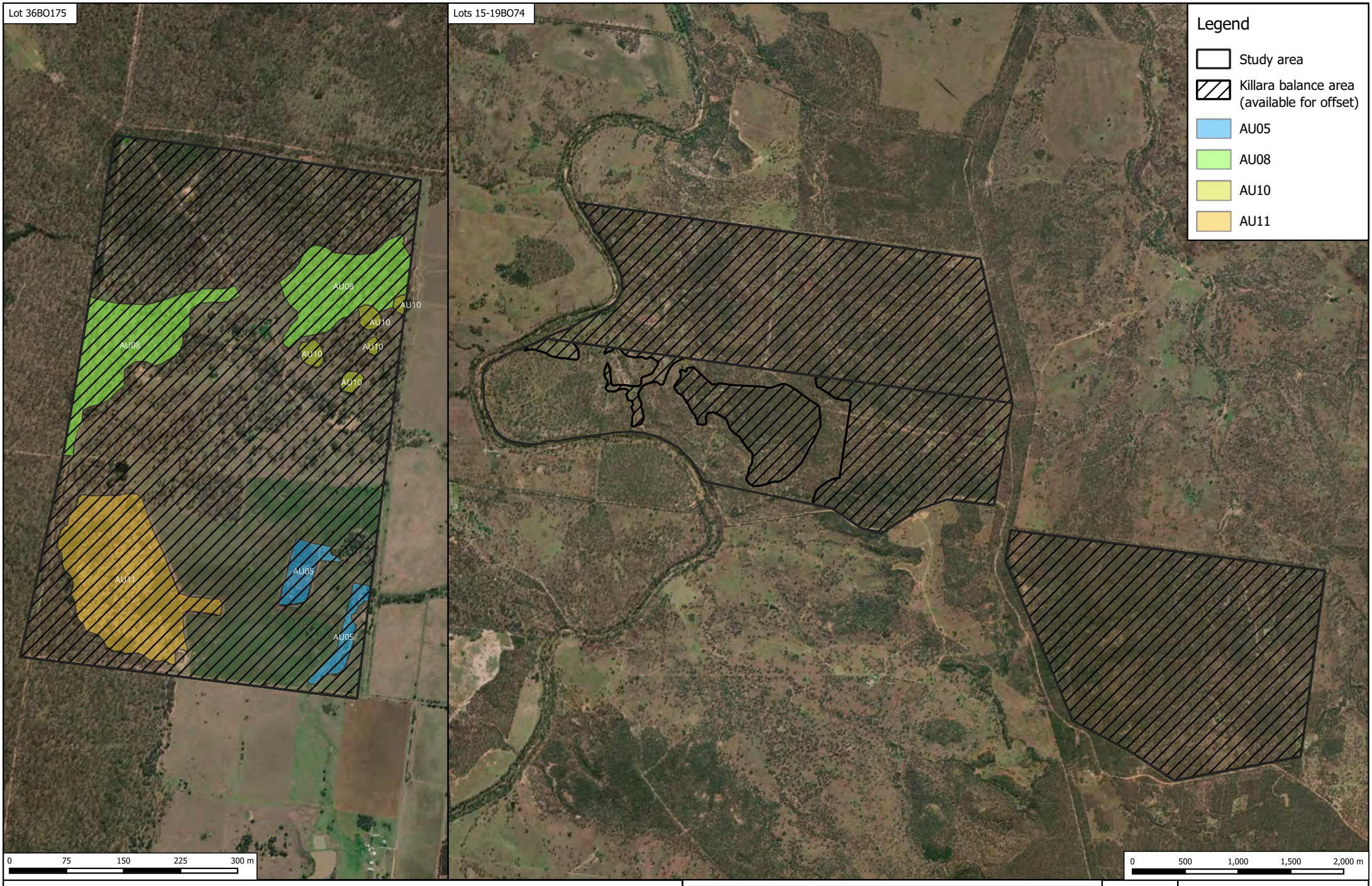

Figure A15
Assessed vegetation for Glossy Black Cockatoo (*Calyptorhynchus lathami*)

Client: Arrow Energy
Project: Killara Offset Habitat Quality Assessment

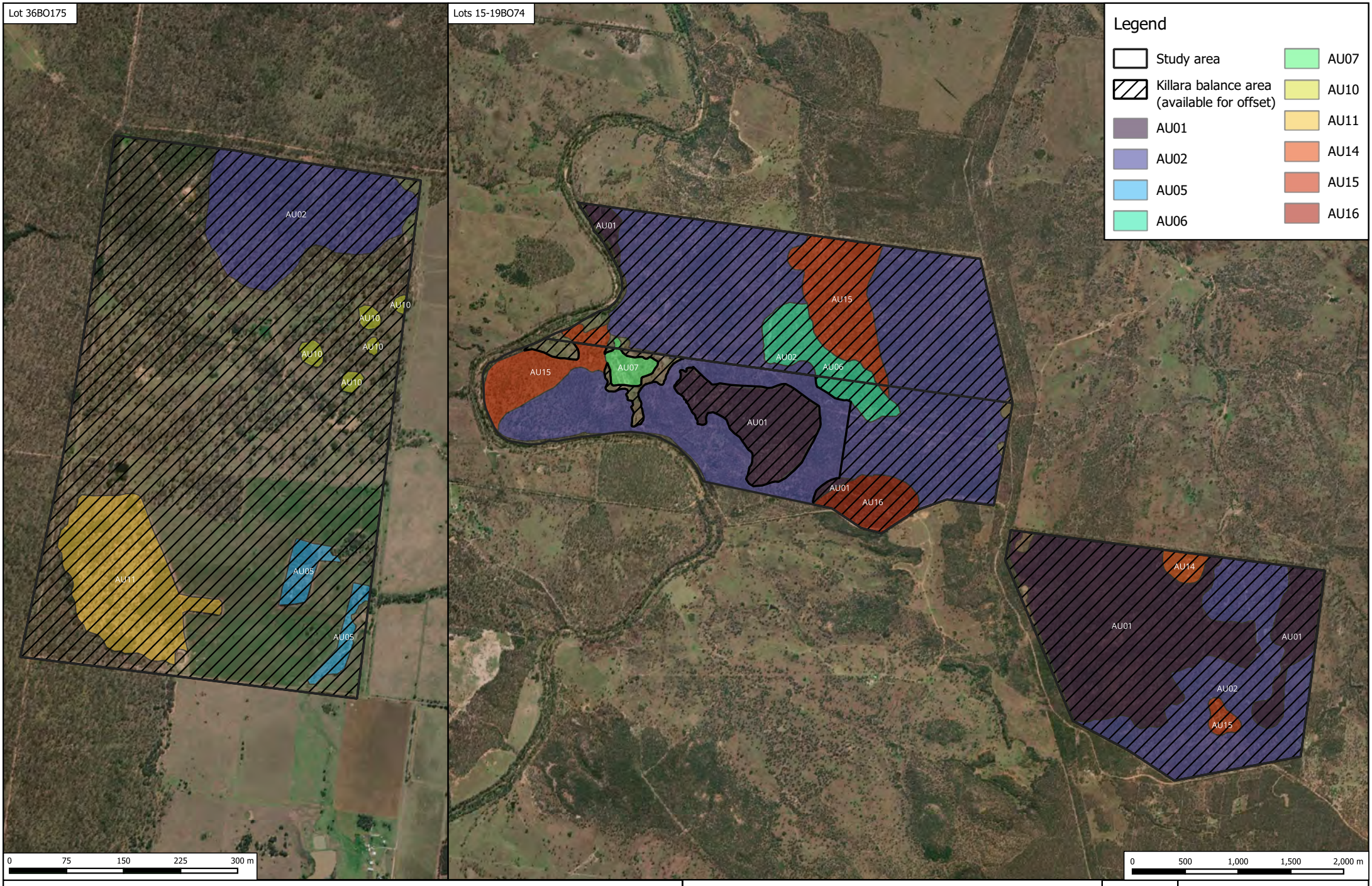

Figure A16
Assessed vegetation for South-eastern Long-eared Bat (*Nyctophilus corbeni*)

Client: Arrow Energy
Project: Killara Offset Habitat Quality Assessment

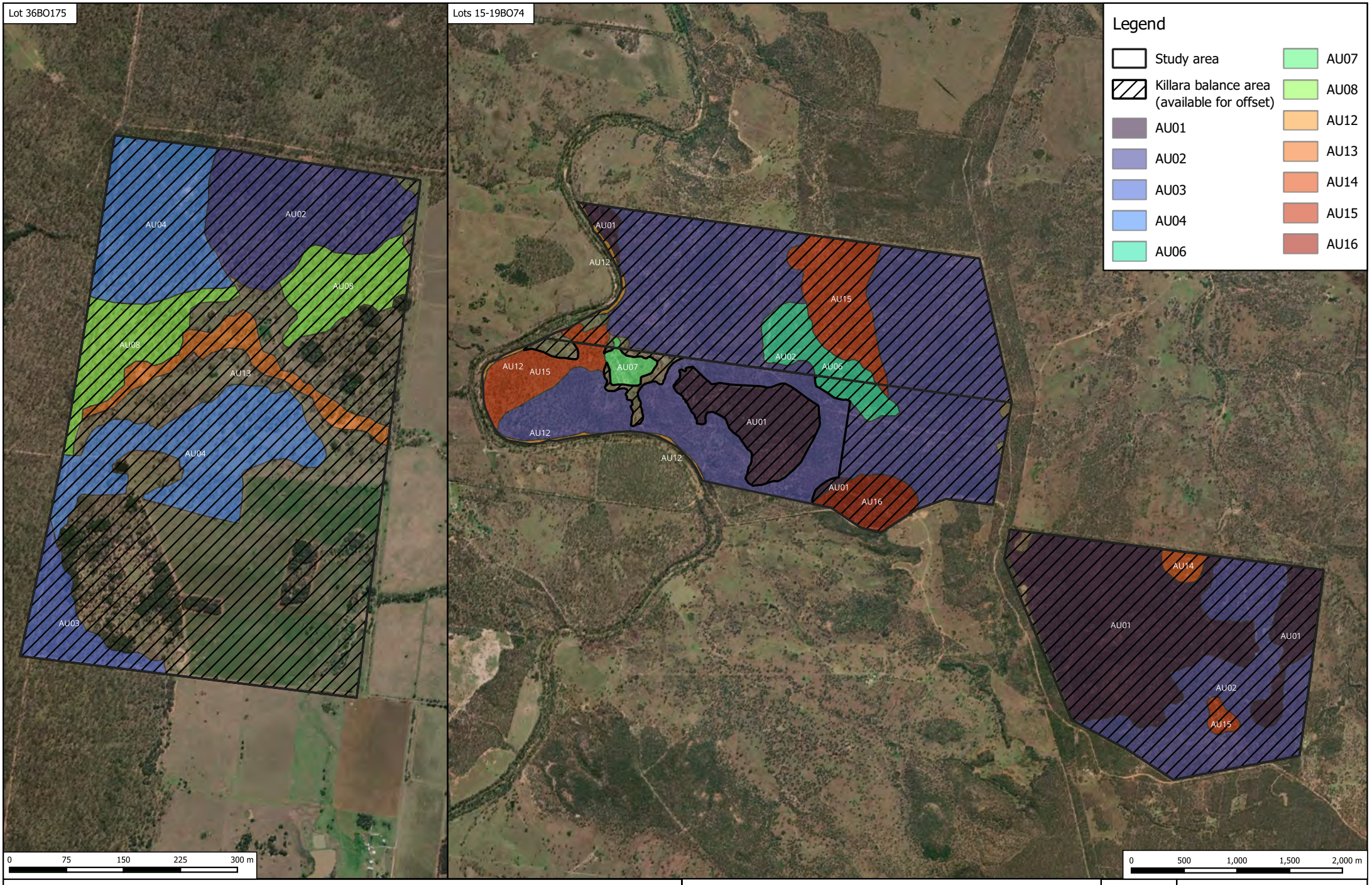

Figure A17
Assessed vegetation for Greater Glider (*Petauroides volans* sensu lato) and Yellow-bellied Glider (*Petaurus australis australis*)

Client: Arrow Energy
Project: Killara Offset Habitat Quality Assessment

Appendix B:
BioCondition Site Details

Site	AU	RE	Condition	GPS Points			
				Start_lat	Start_long	End_lat	End_long
B01	AU04	11.7.6	Regrowth	-26.25073	151.14018	-26.24982	151.140033
B02	AU02	11.12.1a	Regrowth	-26.25289	151.15147	-26.25267	151.15052
B03	AU04	11.7.6	Regrowth	-26.26428	151.14268	-26.26456	151.14356
B04	AU11	11.4.3	Regrowth	-26.26789	151.13718	-26.26877	151.137025
B05	AU02	11.12.1a	Regrowth	-26.31595	151.29148	-26.31678	151.291264
B06	AU07	11.5.1a	Regrowth	-26.32832	151.28595	-26.32751	151.286423
B07	AU02	11.12.1a	Regrowth	-26.33285	151.2924	-26.33197	151.292294
B08	AU02	11.12.1a	Regrowth	-26.33402	151.31723	-26.33475	151.31773
B09	AU06	11.5.1	Regrowth	-26.32912	151.30884	-26.32826	151.30867
B10	AU02	11.12.1a	Regrowth	-26.34656	151.34476	-26.34569	151.344506
B11	AU02	11.12.1a	Regrowth	-26.36085	151.34026	-26.36176	151.34018
B12	AU01	11.12.1a	Remnant	-26.35802	151.34542	-26.35878	-26.358781
B13	AU08	11.5.20	Regrowth	-26.25747	151.14195	-26.25701	151.14113
B14	AU08	11.5.20	Regrowth	-26.25481	151.1514	-26.25515	151.150569
B15	AU03	11.7.6	Remnant	-26.27086	151.13541	-26.27164	151.135292
B16	AU04	11.7.6	Regrowth	-26.26077	151.14476	-26.26137	151.145288
B17	AU09	11.3.2	Regrowth	-26.25858	151.15145	-26.25831	151.150674
B18	AU09	11.3.2	Regrowth	-26.25787	151.1539	-26.25748	151.153011
B19	AU13	11.3.25	Regrowth	-26.26007	151.13842	-26.2598	151.139341
B20	AU13	11.3.25	Regrowth	-26.258	151.14614	-26.25857	151.146814
B21	AU02	11.12.1a	Regrowth	-26.2509	151.15074	-26.2513	151.149943
B22	AU02	11.12.1a	Regrowth	-26.25218	151.14569	-26.25184	151.144924
B23	AU05	11.3.1	Regrowth	-26.2693	151.14831	-26.26846	151.148625
B24	AU11	11.4.3	Regrowth	-26.27155	151.13932	-26.27066	151.139094
B25	AU08	11.5.20	Regrowth	-26.25836	151.13887	-26.25894	151.138221
B26	AU02	11.12.1a	Regrowth	-26.33064	151.28076	-26.32988	151.28124
B27	AU01	11.12.1a	Remnant	-26.33199	151.30114	-26.33119	151.300636
B28	AU16	11.12.6b	Remnant	-26.34109	151.30838	-26.34046	151.309088
B30	AU12	11.3.25	Remnant	-26.32306	151.28178	-26.3227	151.282585
B31	AU10	11.4.3	Remnant	-26.25601	151.1522	-26.2569	151.152582
B32	AU06	11.5.1	Regrowth	-26.3242	151.30126	-26.32342	151.300919
B33	AU06	11.5.1	Regrowth	-26.3305	151.30686	-26.33009	151.307615
B34	AU15	11.12.3	Regrowth	-26.31842	151.30855	-26.31796	151.307781
B35	AU15	11.12.3	Regrowth	-26.31967	151.30625	-26.32035	151.306715
B36	AU15	11.12.3	Regrowth	-26.32496	151.30745	-26.32502	151.306515
B37	AU15	11.12.3	Regrowth	-26.32751	151.27794	-26.32763	151.278914
B38	AU01	11.12.1a	Remnant	-26.34952	151.32824	-26.35028	151.328119
B39	AU14	11.12.3	Remnant	-26.3444	151.3404	-26.34511	151.340176
B40	AU15	11.12.3	Regrowth	-26.35862	151.34233	-26.35929	151.341699
B41	AU14	11.12.3	Remnant	-26.3445	151.33727	-26.34533	151.33757
B42	AU16	11.12.6b	Remnant	-26.33941	151.30702	-26.33893	151.3071
B43	AU07	11.5.1a	Regrowth	-26.32756	151.28607	-26.32671	151.28575
B44	AU12	11.3.25	Remnant	-26.33726	151.29332	-26.33806	151.29385
B45	AU03	11.7.6	Remnant	-26.27032	151.13544	-26.26943	151.1355
B46	AU04	11.7.6	Regrowth	-26.25416	151.14198	-26.25399	151.14243
B47	AU10	11.4.3	Remnant	-26.25823	151.14975	-26.25823	151.14877
B48	AU09	11.3.2	Regrowth	-26.26755	151.15074	-26.26714	151.15158
B49	AU01	11.12.1a	Remnant	-26.35221	151.34409	-26.35134	151.34438

Appendix C:
Example site photos

Site	North photo	South photo	East photo	West photo
B41				
B42				
B43				

Site	North photo	South photo	East photo	West photo
B44				
B45				
B46				

Site	North photo	South photo	East photo	West photo
B47				
B48				
B49