Biodiversity Offset Strategy

Carmichael Coal Mine and Rail Project

Adani Mining Pty Ltd

DOCUMENT CONTROL

Rev	Date	Description	Internal document control	Government approved version
0	29/10/14	Final	✓	
1	26/05/15	Revised final based on feedback from regulators	✓	
2	16/06/15	Revised final based on feedback from Adani	✓	
3	23/08/16	Revised final based on feedback from the Department of the Environment and Energy, and Department of Environment and Heritage Protection	✓	✓
4	12/07/19	Revised to reflect amendments to the Moray Downs property boundary, updated impact assessment and associated plan for offset delivery	✓	
4.1	19/07/19	Revised based on feedback from Adani	✓	
4.2	11/10/19	Revised based on feedback from Adani	✓	
5	21/05/21	Revised based on updated impact assessment and inclusion of alternative offset area	✓	
5a	14/12/21	Revised based on feedback from regulators	✓	✓

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Images

Front cover image: Sparse open grassy woodland dominated by *Eucalyptus melanophloia*; representative of RE 10.5.5a. This vegetation community is one known to support black-throated finch on Moray Downs West.

Recommended citation

CO2 Australia Limited (2021). Biodiversity Offset Strategy. Carmichael Coal Mine and Rail Project. Version 5a (under consultation). Prepared for Adani Mining Pty Ltd. CO2 Australia Limited, Brisbane.

EXECUTIVE SUMMARY

This document is the Biodiversity Offset Strategy (BOS) for the Adani Mining Pty Ltd (Adani) Carmichael Coal Mine and Rail Project (the Project), an integrated, thermal coal mine located in the northern Galilee Basin approximately 160 kilometres northwest of Clermont, Queensland. The Project has been approved by the Queensland and Commonwealth Government subject to a range of conditions, including the requirement to prepare and implement a BOS that outlines how Adani proposes to address Project offset requirements for significant residual impacts on matters of state environmental significance (MSES) and matters of national environmental significance (MNES).

Accordingly, Adani has prepared this BOS to provide a comprehensive document that details how Project offset requirements will be fulfilled and to guide ongoing offset delivery. BOS version 3 received original Commonwealth Government approval on 7 October 2016 and Queensland Government approval on 25 October 2016. The BOS has now been updated (this document, approved version 5a) in accordance with the process outlined in Section 6.2 to reflect a revised impact assessment associated with Project design refinement (see Section 4.2) and associated updates to the plan for offset delivery (see Section 5).

The Project comprises multiple staged components (see Section 2.1): mining operations North of the Carmichael River, mining operations south of the Carmichael River, underground mining (in several stages), off-lease infrastructure and a rail component (rail east and rail west). To reflect the incremental nature of project development, delivery of the associated offsets will also be staged (see Section 3), underpinned by ongoing monitoring and reassessment of predicted versus actual impacts on the ground. The completion of each offset delivery stage will be determined through the implementation of an offset area management plan (OAMP), which will set the objectives and outcomes to be achieved within the offset area, and the completion criteria that will demonstrate these outcomes have been achieved. Following approval of an offset area management plan the offset areas will be legally secured to satisfy the requirement under condition 8 of the Project's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act; Cwth) approval.

Offsets are required for a suite of matters of MNES (Table ES 1) and MSES (Table ES 2). The Project's EPBC Act approval defines the minimum offset area required for each MNES (see Section 4.1). For MSES, the offset areas have been calculated using the tools for assessing land-based offsets under the Queensland *Environmental Offsets Policy* - the *Guide to Determining Terrestrial Habitat Quality* Version 1.2 (GTDTHQ; Department of Environment and Heritage Protection 2017) and the Land-based Offset Multiplier Calculator (see Section 2.2 and Section 4.2). The minimum offset areas required for MNES and MSES will be delivered based on the staged approach outlined in Table ES 1 and Table ES 2.

Table ES 1: Minimum offset areas required for MNES

MNES	Staged offset requirements (ha)		Minimum total offset area required (ha) (EPBC 2010/5736)
	Stage 1	Stage 2	
Black-throated finch (southern) (*Poephila cincta cincta*)	20,274.49	10,741.83	31,016.32[2]
Squatter pigeon (southern) (*Geophaps scripta scripta*)	2,500.00	-	2,500.00
Ornamental snake (*Denisonia maculata*)	135.00	-	135.00
Yakka skink (*Egernia rugosa*)	5,600.00		5,600.00
Waxy cabbage palm (*Livistona lanuginosa*)	90.00	-	90.00
Brigalow (*Acacia harpophylla* dominant and codominant) threatened ecological community (Brigalow TEC) [1]	87.62	727.37	814.99

[1] Offsets for the MNES Brigalow TEC include MSES RE 11.3.1, 11.4.8, and 11.4.9 (BVG 25a), which constitute Brigalow TEC, in line with the Coordinator-General's decision to not require any additional offsets for impacts on MSES if the Commonwealth Government also requires an offset for the same value – see Section 4.2.
[2] Total offset requirements defined in EPBC 2010/5736 plus 16.33 ha additional offset for 3D seismic activities (Adani 2015).

Table ES 2: Minimum offset areas required for MSES

MSES	Staged offset requirements (ha)		Minimum total offset area required (ha) [1]
	Stage 1	Stage 2	
Wetland Protection Area	63.45	-	63.45
Significant wetland	131.41	164.99	296.40
RE 11.4.6. (BVG 26a)	20.96	881.16	902.12
Watercourse vegetation [2]	1,219.25	670.77	1,890.02
Connectivity [3]	4,568.28	3,703.67	8,271.95

[1] Minimum offset area required calculated based on ground-truthed regional ecosystem (RE) mapping updated since the Project Supplementary Environmental Impact Statement (SEIS) in 2013, and using the GTDTHQ and the Land-based Offsets Multiplier Calculator, with respect to offsets on Moray Downs West – see Section 4.2 and Section 5.4 (except for RE 11.4.6 (broad vegetation group (BVG) 26a) for which financial settlement offsets are proposed – see Section 5.9).
[2] The watercourse vegetation impacted area was recalculated from BOS version 3 based on remnant vegetation areas within the buffers of mapped watercourses, according to stream order (SO) 1-5. A breakdown of watercourse vegetation impacts by stream order is given in Appendix A.
[3] Connectivity corresponds to those areas of remnant vegetation within state significant terrestrial and terrestrial/riparian biodiversity corridors (excluding state significant riparian biodiversity corridors).

Through landscape-level assessment of the availability of potential offsets in the broader landscape within the Brigalow Belt and Desert Uplands Bioregions, Adani identified Moray Downs West (MDW) as a priority offset area for Project Stage 1 offset delivery, on which most Project offsets can be acquitted (Table ES 3; see Section 5.4), and a financial settlement offset for one MSES (Table ES 3; see Section 5.9). Adani has prepared and submitted the MDW OAMP which received Commonwealth approval in September 2019. Following approval of the MDW OAMP the MDW offset area was legally secured through a Voluntary Declaration under the *Vegetation Management Act 1999* (Qld) on 22 April 2020 (see Section 6.1.3). Adani has since made the decision to extend the MDW offset area to secure an additional area to acquit the Project's remaining Stage 1 MNES offset requirements for Brigalow TEC. The approved MDW OAMP will be updated and the Voluntary Declaration will be extended to include the additional offset area.

The MDW OAMP is consistent with relevant recovery plans, threat abatement plans and conservation advice (see Section 6.1.2) and includes comprehensive monitoring strategies for each offset value. Appropriate properties for Stage 2 offset delivery are currently being explored, according to the staged approach defined in Section 3 and Section 6.

Adani has also developed a series of management plans for the management of direct and indirect impacts of mining operations on MNES/MSES, in accordance with Project approval conditions (see Section 2.3 and Section 6.3), and a Great Artesian Basin (GAB) Offset Strategy (see Section 5.7), modelled on the Commonwealth Government's Great Artesian Basin Sustainability Initiative (the objective of which was to repair uncontrolled artesian bores and replace open earthen bore drains with piped water reticulation systems).

EPBC Act approval Condition 10 states that 'offsets for authorised unavoidable impacts (in Table 1 of EPBC 2010/5736) must be managed in accordance with the BOS and the GAB Offset Strategy'. This BOS will be reviewed before commencement of each offset delivery stage (see Table 4), and if there is deviation from the approved minimum offset areas required for MNES, or the impacts on MSES, Adani will update the BOS and seek approval, to ensure that the BOS (and offset requirements) are based on actual impacts (see Section 6.2 and Figure 22).

Table ES 3: Summary of approach to Stage 1 offset delivery

Environmental value	Total Stage 1 offset requirement (ha) [A]	Stage 1 offset area to be secured on Moray Downs West (ha) [D]
MNES		
Black-throated finch	20,274.49*	20,286.75
Squatter pigeon	2,500.00	2,509.00
Ornamental snake	135.00	138.95
Yakka skink	5,600.00	5,619.31
Waxy cabbage palm	90.00	99.62
Brigalow TEC	87.62	102.44
MSES		
Wetland Protection Area [C, B]	63.45	67.03
Significant Wetlands [B, C]	296.40	303.32
RE 11.4.6 (BVG 26a)	20.96	Financial settlement offset proposed (see Section 5.9)
Watercourse vegetation [B, C]	1,890.02	1,894.87
Connectivity [B, C]	8,271.95	8,917.27

* Total offset requirements defined in EPBC 2010/5736 plus additional offset for 3D seismic activities (see Section 5.6).
[A] For MNES, these minimum offset areas are as specified in EPBC Act approval 2010/5736; for MSES they have been calculated using the GTDTHQ and the Land-based offset multiplier calculator for the MDW offset area (see Section 5.4).
[B] See Table 9, Section 5.4.
[C] Where offsets are available on MDW to satisfy the total Stage 1 and Stage 2 offset requirement, impacts have been combined into Stage 1 offset delivery (see Table 4). More detail is given in Section 5.4.
[D] See Section 5.4 for more detail on offset availability on MDW.

CONTENTS

FIGURES

TABLES

GLOSSARY

Adani	Adani Mining Pty Ltd
AEIS	Additional information for the EIS
BOS	Biodiversity Offset Strategy
Brigalow TEC	Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community
BTFMP	Black-throated Finch Management Plan
BVG	Broad Vegetation Group
CA	Conservation Advice
Coordinator-General's Report	Coordinator-General's Environmental Impact Statement evaluation report
CTRC	Charters Towers Regional Council
DAWE	Department of Agriculture, Water and the Environment; formerly Department of the Environment and Energy (DEE); Department of the Environment (DoE); Department of Sustainability, Environment, Water, People and Communities (DSEWPaC); Department of the Environment, Water, Heritage and the Arts (DEWHA); and the Department of the Environment and Heritage (DEH).
DES	Department of Environment and Science; formerly Department of Environment and Heritage Protection (DEHP)
DoR	Department of Resources; formerly Department of Natural Resources, Mines and Energy (DNRME)
DSDIP	Department of State Development, Tourism and Innovation
EA	Environmental Authority
EEM	Ecological Equivalence Methodology Guideline Version 1
EIS	Environmental Impact Statement
ELA	Eco Logical Australia
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwth)
GABSI	Great Artesian Basin Sustainability Initiative
GAB	Great Artesian Basin
GBOS	Galilee Basin Offset Strategy
GDE	Groundwater Dependent Ecosystem
GDEMP	Groundwater Dependent Ecosystem Management Plan
GMMP	Groundwater Management and Monitoring Program
GTDTHQ	Guide to Determining Terrestrial Habitat Quality
ha	Hectare
IRC	Isaac Regional Council
km	Kilometres
LGA	Local Government Area
m	Metre
MDW	Moray Downs West

MIA	Mining infrastructure area
ML	Mining Lease
MNES	Matters of national environmental significance
MNESMP	MNES Management Plan
MSES	Matters of state environmental significance (formerly referred to as SSBV)
NC Act	*Nature Conservation Act 1992* (Qld)
OAG	*Offsets Assessment Guide*
OAMP	Offset Area Management Plans
PMAV	Property Map of Assessable Vegetation
RE	Regional Ecosystem
REMP	Receiving Environment Monitoring Program
ROM	Run-of-mine
RP	Recovery Plan
SDPWO Act	*State Development and Public Works Organisation Act 1971* (Qld)
SEIS	Supplementary EIS
SMP	Subsidence Management Plan
SO	Stream Order
SSBV	State significant biodiversity values (now called MSES)
SPRAT	Species Profile and Threats Database
TAP	Threat Abatement Plan
TEC	Threatened Ecological Community
the Project	Carmichael Coal Mine and Rail Project
UAV	Unmanned Aerial Vehicle
UG	Underground mine
UM	Underground Mining
VM Act	*Vegetation Management Act 1999* (Qld)

1 INTRODUCTION

Adani Mining Pty Ltd (Adani) proposes to develop the Carmichael Coal Mine and Rail Project (the Project), an integrated, thermal coal mine located in the northern Galilee Basin approximately 160 km northwest of Clermont, Queensland (Figure 1). The Project has been approved by the Queensland and Commonwealth Government subject to a range of conditions. The Queensland Government approval was received in May 2014 through the Coordinator-General's Environmental Impact Statement (EIS) evaluation report (Coordinator-General's Report). The Commonwealth Government approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was received on 14 October 2015 (EPBC 2010/5736). The approvals include conditions that relate to the requirements for offsets. A full list of all offset-related conditions for the Project is provided for reference in Appendix A.

1.1 PURPOSE AND SCOPE

The Coordinator-General's Report and the EPBC Act approval include a requirement to prepare and implement a Biodiversity Offset Strategy (BOS) that outlines how Adani proposes to address Project offset requirements for significant residual impacts on matters of state environmental significance (MSES) and matters of national environmental significance (MNES). The EPBC Act approval defines what the MNES are for the purpose of this BOS and the full definition is provided in Appendix B. Accordingly, Adani has prepared this BOS to provide a comprehensive document that details how Project offset requirements will be fulfilled and to guide ongoing offset delivery.

The scope of this BOS is restricted to the conditions listed in Table 1 that are directly related to the development, submission and implementation of a BOS. The BOS includes:

- a Project description, including a description of the underground mining stages
- background information regarding the Project approvals process and offset development
- the offset requirements of the Project for impacts on MNES and MSES
- details of the staged approach to offset delivery
- proposed offsets to fulfil the requirements of offset delivery Stage 1 and 2
- an implementation and review plan including details for compliance reporting and updating the BOS.

BOS version 3 (CO2 Australia 2016) originally received Commonwealth Government approval on 7 October 2016 and Queensland Government approval on 25 October 2016. The BOS has now been updated (this document, approved version 5a) in accordance with the process outlined in Section 6.2 of this document, to reflect revised impact assessment (see Section 4.2) and associated updates to the plan for offset delivery, as well as amendments to the Moray Downs property boundary.

Table 1: Approval conditions addressed in this BOS

Condition Number	Summary of Condition	Relevant Section	Status
EPBC Act Approval			
Condition 8[A]	Adani must legally secure the minimum offset areas detailed in Table 1 of the EPBC Act approval for the rail (west) component within five years of commencement of the specified component of the action. Adani must legally secure the minimum offset areas for the other specified components detailed in Table 1 of the EPBC Act approval within three years of commencement of those specified components of the action.	Section 6.1.3	Ongoing for duration of the BOS.
Condition 9	The submission of a BOS and a Great Artesian Basin (GAB) Offset Strategy at least three months prior to commencement of mining operations.	Entire BOS	The BOS was submitted on 16 January 2015. The GAB Offset Strategy was submitted 13 July 2016. Mining operations commenced in October 2017.
Condition 10	Offsets for authorised unavoidable impacts and water resource impacts must be managed in accordance with the BOS and the GAB Offset Strategy.	Section 5, Section 5.9	Ongoing for duration of the BOS.
Condition 11[B]	The BOS must be consistent with the Galilee Basin Offset Strategy, recovery plans, conservation advices and MNES management plans (MNESMP).	Sections 2.3, 5, 5.9, 6.1.2, and 6.3.7	Ongoing for duration of the BOS.
Condition 11 (a)	The location of species and communities' habitat offset areas including maps in electronic GIS format.	Section 5 (see figures)	Spatial data has been provided electronically to the Department of Agriculture, Water and the Environment [DAWE]).
Condition 11 (b)	Details of how offsets have been or will be legally secured within required timeframes to ensure their long-term protection.	Section 6.1.3	Ongoing for duration of the BOS. The MDW offset area was legally secured on 21 April 2020 (via Voluntary Declaration under the Queensland *Vegetation Management Act 1999* [VM Act]). The Voluntary Declaration will be updated following approval of the MDW OAMP (version 5).
Condition 11 (c)	An offset monitoring program.	Section 6.1.2	Ongoing for duration of the BOS.
Condition 11 (d)	A description of the potential risks to the successful implementation of the BOS, and details of contingency measures that will be implemented to mitigate these risks.	Appendix E	Ongoing for duration of the BOS.
Condition 11 (e) and (j)	Details of how the BOS will be updated to incorporate outcomes from research undertaken for MNES, including outcomes of baseline research required by the Queensland Coordinator-General to identify whether the Mellaluka Springs Complex provides high value habitat for the black throated finch.	Section 6.1.4 and 6.2 Table 23 and Table 25	Ongoing for duration of the BOS.
Condition 11 (f)	An outline of how compliance will be reported.	Section 6.1.4 and Table 23	Ongoing for duration of the BOS.
Condition 11 (g)	Provisions to ensure that suitably qualified and experienced persons are undertaking monitoring, review, and implementation of the BOS.	Section 6.1	Ongoing for duration of the BOS.
Condition 11 (h)	Details of how offsets will be addressed in consultation with the Department and relevant Queensland Government agencies where it is determined that management measures set out in the MNESMP are not achieving the goals for habitat management and offsets are required as a corrective action.	Section 6.3.7 and Table 25	Ongoing for duration of the BOS.
Condition 11 (i)	A detailed process addressing offset requirements for any significant residual impact on any EPBC listed threatened species or ecological community not identified in Section 3.	Section 6.2, 6.3.6, Table 25	Ongoing for duration of the BOS.
Condition 11 (k)	Implementation of an annual Great Artesian Basin (GAB) offset measure of returning at least 730 mega litres per annum for a minimum five-year period.	Section 5.7	Ongoing for duration of the BOS. Details outlined in GAB Offset Strategy approved 18 August 2016.
Condition 11 (l)	Develop GAB offset measure in consultation with the Queensland Government.	Section 5.7	Details outlined in GAB Offset Strategy approved 18 August 2016.
Condition 11 (m)(i)	Description and map of underground mining stages.	Section 2.1	Ongoing for duration of the BOS.
Condition 11 (m)(ii, iii, iv and v)	Details of how staged subsidence, groundwater and water resource will be addressed in the BOS.	Section 3, 6 and 6.3.3	Ongoing for duration of the BOS.
Condition 11(m)(vi)	Written commitment that the balance of offset requirement at each underground mining stage will be implemented prior to commencement of that stage.	Section 6.2	Ongoing for duration of the BOS.

Condition Number	Summary of Condition	Relevant Section	Status
Condition 11 (n)	Rationale for the balance of offset required for underground mining impacts to be updated at each underground mining stage.	Section 6.2 and 6.3	Ongoing for duration of the BOS.
Condition 11 (o)	Details of how groundwater and water resource impacts on the MNES will be addressed including identification of additional potential offsets for the Carmichael River and Doongmabulla Springs Complex.	Section 6.2 and 6.3	Ongoing for duration of the BOS.
Condition 11 (p)	Details of how the BOS will be revised and provided to the Minister for approval prior to commencement of each underground mining stage.	Section 6.2	Ongoing for duration of the BOS.
Condition 12	Mining operations must not commence until the BOS and the GAB Offset Strategy is approved by the Minister in writing and the approved BOS and the GAB Offset Strategy must be implemented.	Section 5.7	GAB Offset Strategy approved 18 August 2016. BOS (version 3) approved 7 October 2016 (Cwlth)/25 October 2016 (State). Mining operations commenced June 2019.
Condition 20 (d)	Identification of offsets for residual impacts on 115 ha of black-throated finch habitat arising from seismic survey activities.	Section 5.6	Incorporated into the MDW OAMP. Ongoing for duration of the BOS.
Condition 31	Within three months of every 12-month anniversary of the commencement of the action, the person taking the action must publish a report on their website addressing compliance with each of the conditions of the EPBC Act approval.	Section 6.1.4	Refer to Plans, Reports and Strategies page on Adani website[c]. Ongoing for duration of the BOS.
Coordinator-General's Report			
Condition 7 (a)(i) (Appendix 1, Section 3)	Preparation of a BOS that is consistent with the final Environmental Offset Package (CO2 Australia 2014) submitted with the AEIS.	Section 4.2 and Appendix B	Ongoing for duration of the BOS.
Condition 7 (a)(ii) (Appendix 1, Section 3)	Details the offset requirements conditioned by the Commonwealth Minister for the Environment in the approval for the project under the EPBC Act.	Section 4.1 and Appendix B	Ongoing for duration of the BOS.
Condition 7 (a)(iii) (Appendix 1, Section 3)	Details proposed offsets to address significant residual impacts for MSES consistent with the EPBC Act approval.	Section 5, Section 6.1	Ongoing for duration of the BOS.
Condition 7 (a)(iv) (Appendix 1, Section 3)	Takes account of the results of any ecological equivalence assessments.	Section 2.2, Section 5 and Appendix C	Ongoing for duration of the BOS.
Condition 7 (a)(v) (Appendix 1, Section 3)	A detailed description of the land to which the BOS relates, the values affected and the extent and likely timing of impact on each. Evidence that values to be impacted can be offset, the offset delivery mechanism(s) comprising one or more of: land-based offsets; direct benefit management plans; offset transfers and/or offset payments. A legally binding mechanism that ensures protection and management of offset areas.	Section 5, Section 6.1	Ongoing for duration of the BOS.
Condition 7 (b) (Appendix 1, Section 3)	Prepares a BOS within 60 days of approval under the EPBC Act prior to construction.	Entire BOS	BOS was prepared on the 29 October 2014 and the initial version of this BOS was submitted on 16 January 2015. Mining operations commenced in June 2019.
Condition 7 (c) (Appendix 1, Section 3)	The BOS must be implemented in accordance with the Coordinator-General's stated conditions in Schedule I (Appendix 1) of the draft Environmental Authority (EA).	Section 6	Ongoing for duration of the BOS.
Schedule I – Offsets and biodiversity, I1 to I5 (Appendix 1, Section 1)	Implementation of the BOS through the EA.	Section 6	Ongoing for duration of the BOS.
Environmental Authority EPML01470513			
I1	The holder of this environmental authority must provide an offset for impacts on applicable Matters of State Environmental Significance, in accordance with the Carmichael Coal Project Biodiversity Offset Strategy, as approved. The biodiversity offset must be provided:	Section 6	Ongoing for duration of the BOS.
I1 (a)	prior to impacting on Matters of State Environmental Significance; or	Section 6	BOS version 3 approved by the State 25 October 2016. Mining operations commenced June 2019.
I1 (b)	where a land-based offset is to be provided, within 36 months of the later of either of the following: 1. the date of issue of this environmental authority; or 2. the relevant stage identified in the Biodiversity Offset Strategy; or	Section 6	Environmental Authority EPML01470513 effective 1 July 2020. Stage 1 MSES offsets outlined in BOS (version 3) approved by the State 25 October 2016.

Condition Number	Summary of Condition	Relevant Section	Status
I1 (c)	where an offset payment is to be provided, within 4 months of the later of either of the following: 1. the date of issue of this environmental authority; or 2. the relevant stage identified in the Biodiversity Offset Strategy.	Section 6	Environmental Authority EPML01470513 effective 1 July 2020. Land-based offset still being pursued for remaining Stage 1 impacts on RE 11.4.6.
I2	The Biodiversity Offset Strategy must be reviewed by the 2nd February 2021, and thereafter every 5 years with a report prepared by an appropriately qualified person. The report must: a) Assess the area of Matters of State Environmental Significance proposed to be impacted by the mining activities in the Biodiversity Offset Strategy; and b) Identify the actual on ground areas of Matters of State Environmental Significance impacted by the mining activities.	Section 6	The BOS Review was completed on 1 February 2021.
I3	If an investigation conducted under conditions E13 or E14 of this environmental authority indicates that there is a risk of impacting a Matter of State Environmental Significance, or condition J11 is triggered, the Biodiversity Offset Strategy must be reviewed and a report must be prepared within 3 months by an appropriately qualified person. The report must: a) Assess the area of Matter of State Environmental Significance proposed to be impacted by the mining activities in the Biodiversity Offset Strategy; and b) Identify the actual on ground areas of Matter of State Environmental Significance impacted by the mining activities.	Section 6	No known investigations have been conducted under conditions E13 or E14. Ongoing for duration of the BOS.
I4	If the review under condition I2 or I3 finds that the actual areas of disturbance to Matters of State Environmental Significance are greater than the areas of disturbance as detailed in the Biodiversity Offset Strategy, or that additional Matters of State Environmental Significance will be impacted, the environmental authority holder must amend the Biodiversity Offset Strategy as per condition I5 and deliver the amended offset requirement within 12 months.	Section 6	The BOS review did not identify actual impacts to MSES greater than areas of disturbance in the BOS.
I5	In response to condition I4 the environmental authority holder may apply to the administering authority to amend the Biodiversity Offset Strategy within either 30 days, or a lesser period agreed to by the administering authority, prior to impacting on the applicable Matter of State Environmental Significance.	Section 6	The BOS review did not identify actual impacts to MSES greater than areas of disturbance in the BOS.

[A] As varied on 13 January 2021.
[B] As varied on 26 September 2019.
[C] https://www.bravus.com.au/sustainability/environment/#plans-reports-strategies.

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Townsville
Bowen
Mackay
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alignment
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63
A2
A1
70
44
15

Adani Mining Pty Ltd - Carmichael Coal Mine and Rail Project

Figure 1
Project overview and context

CCMR project
NGBR project
Roads
Existing rail network

Biogeographic regions

Brigalow Belt
Desert Uplands

DATA SOURCE:
The following datasets are © State of Qld:
- Biogeographic regions - Queensland v5 (2010)
- Roads
- Existing rail network (connecting NGBR project)
Project footprint provided by Adani (January 2019)

Date: 1/29/2021 Coordinate System: GCS GDA 1994 Datum: GDA 1994 Scale: 1:3,750,000@A3

0 50 100 150 200
Kilometres

N

CO2 Australia

Location diagram

2 BACKGROUND

2.1 PROJECT DESCRIPTION

The Project is an integrated, thermal coal mine located in the northern Galilee Basin approximately 160 km north-west of Clermont, Queensland. Coal will be transported by rail from the mine to the Port of Abbot Point via Adani's Northern Galilee Basin Rail Project and an existing third-party rail network over the mine life.

The Project comprises two components – the mine component and the rail component. For the purpose of staging offset delivery under this BOS, and in accordance with the EPBC Act approval, the Project has been further broken down into:

- Mining operations north of the Carmichael River
- Mining operations south of the Carmichael River
- Underground mining
- Off-lease infrastructure
- Rail east
- Rail west

2.1.1 Mine component

The mine component of the Project consists of a greenfield coal mine over Mining Lease (ML) 70441, ML70505 and ML70506, which includes both open cut and underground mining, on-lease infrastructure and associated mine processing facilities. The mine component is subject to conditions of Environmental Authority (EA) EPML01470513 issued under the *Environmental Protection Act 1994* (Qld).

The mine is predominantly within the Local Government Area (LGA) of Isaac Regional Council (IRC), except for 167 ha within the north-western corner of ML 70441, which is located within the LGA of Charters Towers Regional Council (CTRC). The IRC is located within the Isaac, Mackay and Whitsunday Region while the CTRC is located within the Northern Region of Queensland.

The mine on-lease infrastructure includes all infrastructure located within the boundary of the mining lease area. ML70441 runs northwest to southeast, covering approximately 45 km in length and approximately 7 km in width. ML70505 is approximately 40 km in length and between 2 and 4 km wide, also running northwest to southeast. ML70506 is approximately 5 x 3.5 km, adjacent to ML70505 to the north and. Offsite infrastructure is located to the east of the mining leases on Moray Downs.

Mining operations north of the Carmichael River

Mining operations north of the Carmichael River include extraction of coal from the ground as well as any immediately associated activities such as on-lease infrastructure and exploratory surveys, including initial clearing of vegetation, removal and storage of overburden, storage of coal and dewatering, but not including the construction or operation of off-lease transport, accommodation or power generation infrastructure. The Carmichael River includes its riparian zone between the Doongmabulla Springs and the Belyando River. Activities associated with mining operations north of the Carmichael River commenced in June 2019.

Mining operations south of the Carmichael River

Mining operations south of the Carmichael River include the extraction of coal from the ground as well as any immediately associated activities such as on-lease infrastructure and exploratory surveys, including initial clearing of vegetation, removal and storage of overburden, storage of coal and dewatering, but not including the construction or operation of off-lease transport, accommodation or power generation infrastructure. Activities associated with mining operations south of the Carmichael River are anticipated to commence in 2024.

Underground mining

The underground mine consists of:

- underground mine 1: installed with up to four longwall units
- underground mine 2: installed with up to four longwall units
- underground mine 3: installed with up to four longwall units
- underground mine 4: installed with two longwall units
- underground mine 5: installed with two longwall units.

In accordance with the EPBC Act approval, underground mining Stage 1 is defined as years 1-10 of underground mining and includes all associated activities including box cut excavation, portal construction, long wall construction and longwall panel mining. Multi seam mining within the first underground mine will occur during this time period. Table 2 provides an overview of the underground mining stages and the activities scheduled to commence and be completed as part of each underground mining stage. Figure 2, Figure 3 and Figure 4 illustrate the activities scheduled to commence in each underground mining stage.

Table 2: Underground mining stages

Year*	Activities
UNDERGROUND MINING STAGE 1	
Year 1	Commence underground box cut and levees for underground mine (UG) 1 Commence construction of UG 1 mining infrastructure area (MIA) facilities Commence development operations of underground mine UG 1
Year 2	Commence longwall operations of underground mine UG 1
Year 3	*No commencement or completion activities for underground mining*
Years 6-10	Year 8 – Commence development of underground mine UG 5 Year 9 – Commence development of underground mine UG 4 Year 10 – Commence UG 4, MIA, run-of-mine (ROM) and overland conveyors
UNDERGROUND MINING STAGE 2	
Years 11-15	Year 12 – Commence longwall operation of underground mine UG 5 – Complete UG 5 MIA Year 13 – Commence longwall operation of underground mine UG 4– Complete UG 4 overland conveyors and facilities Year 14 – Commence development of underground mine UG 3

Year*	Activities
	– Complete expansion of Pit D/E MIA for UG 3
Years 16-18	Year 16 – Complete UG 5 Infrastructure
Years 19-23	Year 20 – Commence development of underground mine UG 2 – Commence UG 2 MIA Year 21 – Commence longwall operation of underground mine UG 3 – Complete UG 3 infrastructure
UNDERGROUND MINING STAGE 3	
Years 24-28	Year 25 – Complete UG 1 longwall operations – Commence longwall operation of underground mine UG 2 – Complete UG 2 infrastructure – Complete UG 4 longwall operations
Years 29-33	Year 30 – Complete UG 5 longwall operations
Years 34 - 58	Year 35 – Complete UG 3 longwall operations Year 44 – Complete UG 2 longwall operations Years 57 + – Rehabilitate mine site

Off-lease infrastructure

The mine component includes supporting off-lease infrastructure such as a workers' accommodation village and associated facilities, a permanent airport site and water supply infrastructure. Off-lease infrastructure also consists of the use of five (5) local quarries to extract quarry materials for construction and operational purposes. These are Moray, North Creek, Disney, Borrow 7 and South Back Creek Quarries.

Exploratory surveys

The 'mine operations north of the Carmichael River' and 'underground mining' components include the residual impacts associated with 3D seismic exploration activities as described under Conditions 20 and 21 of the EPBC Act Approval for the Project. The conditions note that in relation to offsets for 3D seismic activities, these are not intended to duplicate offset areas identified in accordance with Condition 11 for the greater Project. This BOS satisfies those requirements (see Section 5.6). A map of the 3D seismic area overlaying the mine plan is presented in Appendix J. It is not proposed to carry out 3D seismic activities until immediately prior to underground mining.

2.1.2 Rail component

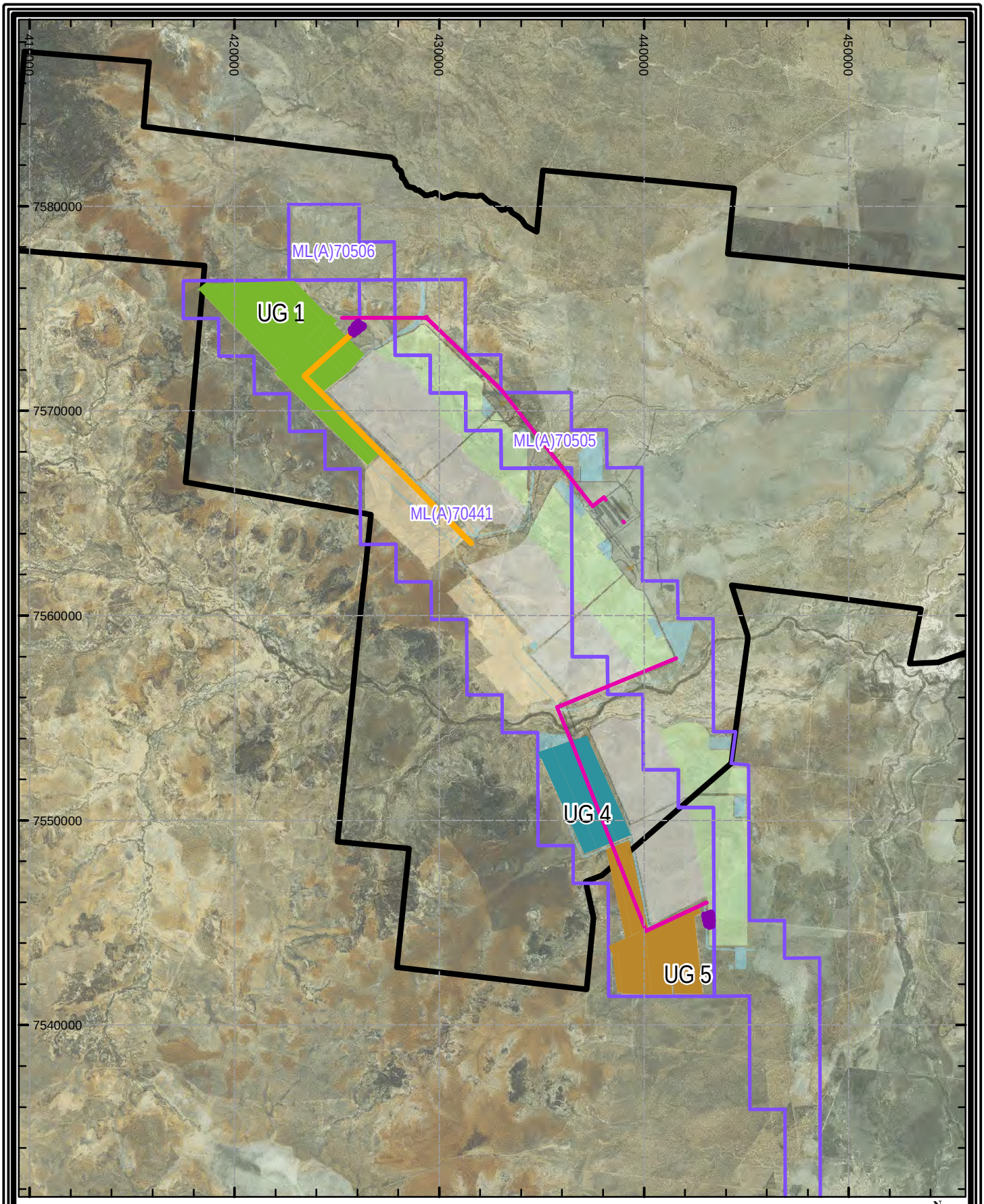
The rail component of the Project is a 95 m wide and 189 km long greenfield rail line connecting the mine to the existing Goonyella and Newlands rail systems. Temporary infrastructure areas and a construction camp are also required during the rail construction phase.

Rail west

The rail west component is a 120 km dual gauge greenfield rail line connecting the Mine as far east as Diamond Creek to be transported by rail to the Port of Abbot Point via Adani's Northern Galilee Basin Rail Project. Construction of the rail west component of the Project commenced in October 2017. All impacts occur during the construction phase of the Project.

Rail east

A 69 km narrow gauge portion of greenfield rail line running east from Diamond Creek to be transported by rail to the Port of Abbot Point via Adani's Northern Galilee Basin Rail Project. Construction of the rail east component of the project is not expected to commence until at least 2024.



0 2 4 6 8 10

Kilometers

GDA94
MGA Zone 55

Carmichael Mine Development

Mine Approvals

Figure 2

N
W E
S

- CCMP Mining Lease Application
- Moray Downs (662PH1491)
- UG Access Road
- UG Coal Overland CV
- UG MIA
- UG 1
- UG 4
- UG 5

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Biodiversity Offset Strategy Underground Mining Stage 1

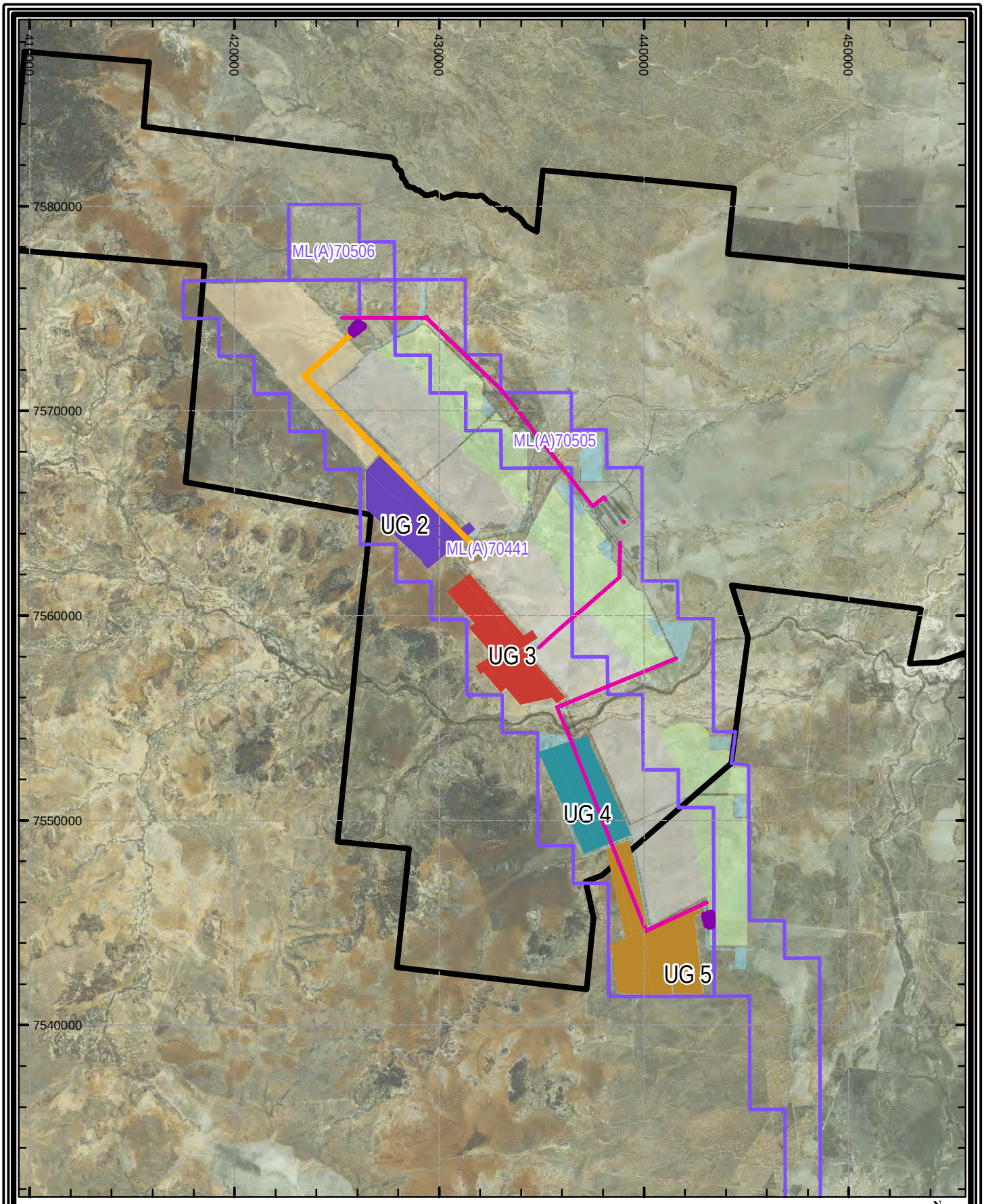
Sheet No.
CCMP-ADERC-MAP-EN-0246(A)

Drawn By: Chris Schlebusch

Checked by: Melinda Bergmann

Date: 2014-10-07

Path: G:\Plans\Project Specific\Carmichael\2014\ESRI\Project Approvals\Underground Offset Strategy\Carmichael Coal Mine Project Offset Strategy UG Stage 1 A4 CCMP-ADERC-MAP-EN-0246.mxd



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Kilometers

GDA94
MGA Zone 55

Carmichael Mine Development

Mine Approvals

Figure 3

N
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- CCMP Mining Lease Application
- Moray Downs (662PH1491)
- UG Access Road
- UG Coal Overland CV
- UG MIA
- UG 2
- UG 3
- UG 4
- UG 5

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Biodiversity Offset Strategy Underground Mining Stage 2

Drawn By:	Chris Schlebusch
Checked by:	Melinda Bergmann
Date:	2014-10-09

Sheet No.
CCMP-ADERC-MAP-EN-0247(A)

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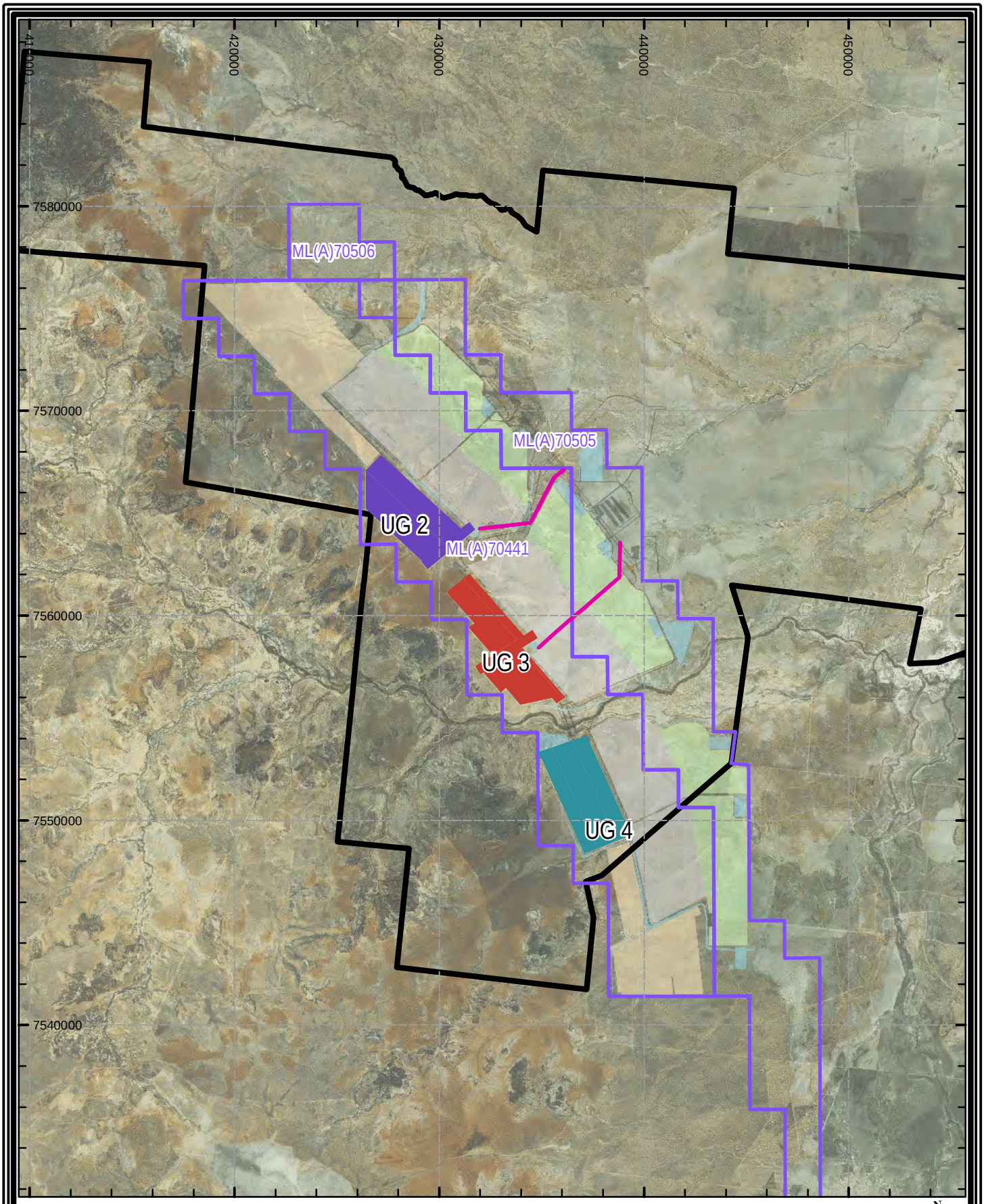

0 2 4 6 8 10

Kilometers

GDA94
MGA Zone 55

Carmichael Mine Development

Mine Approvals

Figure 4

N
W E
S

- CCMP Mining Lease Application
- Moray Downs (662PH1491)
- UG Coal Overland CV
- UG 2
- UG 3
- UG 4

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Biodiversity Offset Strategy Underground Mining Stage 3

Drawn By:	Chris Schlebusch
Checked by:	Melinda Bergmann
Date:	2014-10-09

Sheet No.
CCMP-ADERC-MAP-EN-0248(A)

Path: G:\Plans\Project Specific\Carmichael\2014\ESRI\Project Approvals\Underground Offset Strategy\Carmichael Coal Mine Project Offset Strategy UG Stage 3 A4 CCMP-ADERC-MAP-EN-0248.mxd

2.2 APPROVALS AND OFFSETS BACKGROUND

- November 2010: Project declared a 'significant project'1 under the Queensland State Development and Public Works Organisation Act 1971 (SDPWO Act), which triggered the requirement for an EIS.
- January 2011: Project also designated a 'controlled action' under the Commonwealth EPBC Act, requiring assessment and approval under the EPBC Act2.
- December 2012: EIS submitted (prepared in accordance with the terms of reference issued by the Queensland Coordinator-General in May 2011). A Project Environmental Offset Strategy (Ecofund 2012) was submitted as a component of the EIS, identifying residual impacts on environmental values, the offset requirements under relevant Queensland and Commonwealth Government policies and providing an overview of potential offset areas and delivery methods.
  - Moray Downs, an Adani-owned property, was assessed as part of the Environmental Offset Strategy and the western section, on which no Project activities are proposed, and identified as a priority offset area on which most Project offsets could be located. A landscape availability assessment of all compliant offset areas within the Brigalow Belt and Desert Uplands bioregions was also undertaken to assess the availability of potential offsets in the broader landscape and determine their ability to acquit the offset requirements for the mine and rail components.
- August 2013: Adani submitted the Project supplementary EIS (SEIS), including a comprehensive Project Environmental Offset Package (Ecofund 2013) based on updated Project information and addressing stakeholder submissions on the EIS.
  - Following a review of the Environmental Offset Package, the Queensland Government requested Adani revise Project impact calculations due to the uncertainty of how subsidence associated with underground mining activities might impact state significant biodiversity values (SSBV; now referred to as MSES). In addition, the Queensland Government advised Adani that vegetation identified as remnant, as defined by the VM Act, was acceptable to acquit Project offset requirements for MSES.
  - The Commonwealth Government also requested that Adani provide additional information about the potential to deliver offsets for impacts on MNES, including providing greater certainty that commensurate offsets were available and could be delivered, particularly for the MNES black-throated finch.
- October 2013: further fieldwork undertaken to inform further development of the Project's environmental offsets.
  - BioCondition assessments were conducted within the Project's off-lease impact area (GHD 2013a) which included the workers' accommodation village and airport, industrial precinct, new rail loop, off-stream storage and pump station near the Belyando River and a five gigalitre storage dam.
  - The purpose of the assessment was to determine the condition and quality of ecological values requiring offsetting for the Project's off-lease infrastructure and to support the identification of commensurate offsets. The results of this assessment are presented in Appendix C.

[1] The term 'significant project' was replaced with the term 'coordinated project' with the amendment of the SDPWO Act in December 2012.

[2] The EIS process was accredited by the Commonwealth Government, under its bilateral agreement with the Queensland Government, to be conducted under the SDPWO Act.

- December 2013: ecological equivalence assessments of the mine and off-lease infrastructure areas conducted to determine baseline condition of impact areas and inform the suitability of offsets (Eco Logical Australia 2014a). Surveys were undertaken in accordance with the Ecological Equivalence Methodology (EEM) Guideline Version 1 (Department of Environment and Resource Management [DERM] 2011) and the results are presented in Appendix C.
- February 2014: Adani commenced preliminary landholder engagement and field assessments of several preferred offset properties, which included those identified in the Environmental Offset Package as well as additional properties.
- March 2014: further revision of the Environmental Offset Package (CO2 Australia 2014) submitted as part of the additional information for the EIS (AEIS), addressing Commonwealth and Queensland Government advice and request for information received following the submission of the SEIS. A preferred offset package was identified through a process that included a strategic desktop assessment, spatial analysis and consultation with government departments and landholders.
- May 2014: Offsets Assessment Guides (OAGs) for Moray Downs West (MDW), the preferred offset property for acquitting most Project offset requirements, submitted to the Commonwealth Government. These OAGs informed the development of the offset requirements defined in the Project EPBC Act approval (EPBC 2010/5736) (see Section 4.1). OAGS were also completed for several other potential offset areas.
- September 2014: field surveys of MDW undertaken, following receipt of the Project's Coordinator-General's Report and EPBC Act approval, including ecological equivalence assessments (Eco Logical Australia 2014b). These surveys were conducted in order to determine the suitability of the offset areas identified on MDW to fulfil the Project's offset requirements for impacts on MNES and MSES. The results of the surveys are presented in Section 5.4 and Appendix C and have been used to inform the development of this BOS.
- 1 July 2014: the Queensland Government established the Queensland environmental offset framework, consisting of the:
  - *Environmental Offsets Act 2014* (Qld)
  - *Environmental Offsets Regulation 2014* (Qld)
  - Queensland *Environmental Offsets Policy 2014*.
  - the framework included new supporting documentation to aid implementation, including significant impact criteria and methods of determining what constitutes an appropriate offset.
  - as it was introduced after the Project's Coordinator-General's Report was issued (7 May 2014), the offset framework does not apply to the Project. Notwithstanding, Adani has attempted to align its efforts to offset impacts of the Project on state significant biodiversity values that overlap with MSES by:
- applying the Queensland *Environmental Offsets Policy Significant Residual Impact Guideline* (Department of Environment and Heritage Protection [DEHP] 2014a)
- converting ecological equivalence results in accordance with the *Guide to Determining Terrestrial Habitat Quality* (GTDTHQ) (DEHP 2014b)

- applying the Land-based Offset Multiplier Calculator[3].
- October 2016: Project BOS version 3 received Commonwealth Government (7 October 2016) and Queensland Government (25 October 2016) approval.
- July 2018: a freehold property was assessed and confirmed to contain suitable habitat to offset 102.63 ha of Brigalow TEC and this was incorporated as part of updates to the CCMR BOS (version 4). However, landholder negotiations did not progress as quickly as required to meet Project timeframes due to financial considerations, and Adani began considering alternative options in September 2019.
- September 2019: Adani secured a variation to conditions 8 and 11 of EPBC Act approval 2010/5736 such that:
  - condition 8: legal security of offset areas for the rail (west) component must be achieved within four years of that component, and for other project components within two years of that component; and
  - condition 11: reference to the 'Galilee Basin Strategic Offset Strategy' was replaced with reference to the 'Galilee Basin Offset Strategy', and an updated definition for this added.
- 19 September 2019: MDW Offset Area Management Plan (Version 2b) approved by Commonwealth Government.
- August 2020: as a result of the search for alternative options for Brigalow TEC, field surveys of an additional area of MDW were undertaken. This identified an opportunity to restore 102.44 ha of mature regrowth Brigalow TEC to fully acquit the Stage 1 offset requirement.
- January 2021: Adani secured a variation to conditions 8 and 13 of EPBC Act approval 2010/5736 such that:
  - Condition 8: legal security of offset areas for the rail (west) component must be achieved within five years of that component, and for other project components within three years of that component; and
  - Condition 13: inclusion of a requirement to submit an offset area management plans for any new or altered offset area within four months of approval of a revised version of the BOS.
- March 2021: approved BOS (version 3) updated (version 5) in accordance with the process outlined in Section 6.2 of this document, to reflect revised impact assessment associated with Project design refinement (see Section 4.2) and associated updates to the plan for offset delivery (see Section 5). The BOS (version 5) was also updated to include the additional offset area on MDW as an offset option for Stage 1 offset delivery (see Section 5.4). Version 4 of the CCMR BOS was updated and reviewed internally by Adani; however, was not submitted to the Commonwealth or Queensland Government's for review or approval.

[3] Land-based Offset Multiplier Calculator – Queensland Government.

2.3 RELATIONSHIP BETWEEN BOS AND BIODIVERSITY MANAGEMENT PLANS

Adani has prepared a series of management, monitoring and research plans to guide the management and mitigation of direct and indirect impacts of mining operations and associated activities on MNES and MSES, and subsequently inform the requirement for offsets additional to those identified in this BOS. These plans are summarised in Table 3.

Adani is now progressively implementing the approved plans, which are consistent with relevant recovery plans, threat abatement plans and approved conservation advices. The plans include baseline and impact monitoring measures to be implemented for each MNES, including control and impact sites to be monitored throughout the life of the Project. Monitoring measures have been designed to provide data to quantify likely impacts resulting from mining operations, including subsidence and changes in groundwater levels. The management plans also include measures to mitigate and manage impacts on MNES resulting from mining operations, and specific criteria for assessing the success of management measures against goals, and triggers for implementing corrective measures if criteria are not met within specified timeframes. Corrective measures include the provision of offsets if it is determined that corrective management measures have not achieved goals within specified timeframes.

Implementation of these plans will inform whether there is a requirement to revise the BOS and, if necessary, to provide additional offsets in accordance with the process outlined in Section 6.3. This will ensure that the BOS is consistent with the impacts identified via management plans. The management and monitoring program outlined in the Offset Area Management Plans (OAMPs) is (and will be) consistent with the actions presented in the relevant MNES MPs (see Section 6.1.2 for details of offset management and monitoring). OAMPs are based on adaptive management and will be informed by information obtained through the implementation of relevant management plans and research programs implemented by Adani. If Project offset requirements are revised through this process, revision of the relevant OAMP(s) may be required.

Table 3: Project management, monitoring and research plans relevant to biodiversity

Document	Summary	Reference	Status
Species Management Plan - Carmichael Coal Mine and Offsite Infrastructure	▶ MNES Management Plan prepared in accordance with EPBC Act approval Conditions 5, 6 and 7. ▶ Framework for mitigating risks to listed species and threatened ecological communities; describes practical mitigation and monitoring measures.	(Eco Logical Australia 2019a)	Commonwealth approval received July 2016 (amended version approved August 2019).
Species Management Plan – Carmichael Rail Network – SP1		(Eco Logical Australia 2016)	Commonwealth approval received July 2016.
Black-throated Finch Management Plan (BTFMP)	▶ MNES Management Plan prepared in accordance with EPBC Act approval Conditions 5, 6 and 7. ▶ Specific to the Carmichael Coal Mine and associated infrastructure; describes management, mitigation and monitoring of mining impacts on black-throated finch prior to and during construction. Black-throated Finch Research Program appended to this Plan.	(Eco Logical Australia 2019b)	Commonwealth approval received December 2018. State approval received June 2019.
Groundwater Dependent Ecosystems Management Plan (GDEMP)	▶ MNES Management Plan prepared in accordance with EPBC Act approval Conditions 5, 6 and 7. ▶ Describes management, mitigation and monitoring of Project impacts on listed groundwater dependent species and ecosystems prior to and during construction, during operations, during offsetting and post-operations.	(Eco Logical Australia 2019c)	Commonwealth approval initially received April 2019. Updated version approved September 2019. State approval received June 2019.
Subsidence Management Plan (SMP)	▶ Management Plan developed to provide control, mitigation and management measures for subsidence impacts on MNES/MSES associated with underground mining operations.	Appendix I2 to the Project SEIS (GHD 2013b)	Working draft document – to be finalised prior to commencement of underground mining activities (see Table 2).
3D Seismic Survey Management Plan	▶ Management Plan developed in accordance with EPBC Act approval Condition 20 to describe the impact of seismic activities on MNES, provide mitigation measures and identify offsets for residual impacts on black-throated finch habitat (see Section 5.6).	Additional information to the EIS (2013)	Working draft document – to be finalised prior to commencement of underground mining activities (see Table 2).
Groundwater Management and Monitoring Program (GMMP)	▶ Management Program developed in accordance with EA Condition E4 and EPBC Act approval Condition 3 to provide detailed procedures and processes to determine and assess baseline hydrological regimes and develop trigger levels, contaminant limits, and water level thresholds, which will be used to assess the potential impacts of mining activities on groundwater resources.	(AECOM 2019)	Commonwealth approval initially received April 2019 and revised version approved September 2019. Updated version submitted February 2021 and subsequently approved in June 2021 by the Queensland Government with advice received from Commonwealth Government.

Document	Summary	Reference	Status
Receiving Environment Monitoring Program (REMP)	▶ Monitoring Program developed in accordance with EA Conditions F20 and F21 to monitor, identify and describe any adverse impacts on surface water environmental values, quality and flows due to the authorised mining activity. For the purposes of the REMP, the receiving environment is the waters of the Carmichael River and connected or surrounding waterways within 12 km downstream of the release (this includes the Belyando River, immediately downstream of the confluence with the Carmichael River). The REMP encompasses any sensitive receiving waters or environmental values downstream of the authorised mining activity that will potentially be directly affected by an authorised release of mine affected water.	n/a	Live document. Commonwealth and State approvals not required.
GAB Springs Research Plan	▶ Plan developed in accordance with EPBC Act Condition 25 to identify and evaluate methods to prevent, mitigate and remediate ecological impacts on the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin (the GAB Springs community), including the Doongmabulla Springs Complex.	(Adani 2019)	Approval received September 2019.

3 STAGED APPROACH TO OFFSET DELIVERY

3.1 DESCRIPTION OF OFFSET DELIVERY STAGES

To reflect the incremental nature of project development and the uncertainty of subsidence, groundwater and water resource impacts on MNES and MSES, the EPBC Act approval, Coordinator-General's Report and EA allow a staged approach to offset delivery that is underpinned by ongoing monitoring and reassessment of predicted versus actual impacts on the ground. Based on this approach Adani has designed a staged approach to offset delivery that is aligned with the Project components outlined in Section 2.1 and the timing of commencement of each component. This staged approach includes four offset delivery stages as outlined in Table 4.

The completion of each offset delivery stage will be determined through the implementation of an OAMP. The OAMP will set the objectives and outcomes to be achieved within the offset area and once it is demonstrated that these objectives and outcomes are achieved, offset delivery will be complete.

In order to ensure that any additional or unidentified residual impacts on MNES and MSES are offset, the EPBC Act approval conditions set out specific requirements for ongoing monitoring, assessment and identification of potential future offset requirements. The balance of offset requirements at each stage will be implemented prior to commencement of each stage. Condition 11 of the EPBC Act approval, the EA conditions and the Coordinator-General's report also allow a staged approach to the provision of offsets for subsidence, groundwater and water resource impacts associated with underground mining. At the end of each underground mining stage the results of monitoring activities will be used to reassess the actual impacts on MNES and MSES for the preceding underground mining stage. These results will also be used to update the predicted impact areas for future underground mining stages. The processes that Adani will undertake to monitor, assess and identify impacts and deliver required offsets in the future is discussed in Section 6.2.

Table 4: Description of offset delivery stages *

Relevant Project component	Impacts to be offset	Offsets required for
OFFSET DELIVERY STAGE 1 – COMMENCES YEAR 2019		
Mining operations north of the Carmichael River	All clearing of native vegetation associated with mining operations north of the Carmichael River	MNES and MSES
Off-lease infrastructure	All clearing of native vegetation associated with off-lease infrastructure	MNES and MSES
Rail east	Impacts on yakka skink	MNES only
Rail west	All clearing of native vegetation associated with rail west	MNES only
Mining operations south of the Carmichael River	Clearing of native vegetation associated with mining operations south of the Carmichael River, where offsets are available on Moray Downs West	MNES and MSES
Underground mining	Initial contribution for subsidence impacts based on predicted impacts of Underground Mining Stages 1, 2 and 3	MNES only
OFFSET DELIVERY STAGE 2 – COMMENCES YEAR 2024		
Mining operations south of the Carmichael River	All remaining clearing of native vegetation associated with mining operations south of the Carmichael River	MNES only

Relevant Project component	Impacts to be offset	Offsets required for
Rail east	All remaining clearing of native vegetation associated with rail east	MNES only
OFFSET DELIVERY STAGE 3 – COMMENCES YEAR 2027 (IF REQUIRED)		
Underground mining	Additional contribution for subsidence impacts associated with Underground Mining Stages 1 and 2 if required (i.e. additional offsets may be required for impacts of Underground Mining Stages 1 if the actual impact is greater than predicted and/or additional offsets may be required for Underground Mining Stage 2)	to be confirmed – see Section 6.2
	Groundwater and water resource impacts associated with Underground Mining Stages 1 and 2 if required (i.e. additional offsets may be required for impacts of Underground Mining Stages 1 if the actual impact is greater than predicted and/or additional offsets may be required for Underground Mining Stage 2)	to be confirmed – see Section 6.2

* See Appendix B for a comparison of changes to the offset delivery schedule from BOS version 3 (original approved).

4 OFFSET REQUIREMENTS

4.1 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Condition 8 of the Project's EPBC Act approval specifies the minimum offset area required to address impacts on EPBC Act listed threatened species and communities (MNES) (see Table 5) associated with the open-cut mine, off-lease infrastructure and the rail, and requires that these offsets be legally secured within five years of the specified component for rail (west) and three years of commencement of each of the other components of the Project[4]:

- black-throated finch (southern), *Poephila cincta cincta*
- squatter pigeon (southern), *Geophaps scripta scripta*
- ornamental snake, *Denisonia maculata*
- yakka skink, Egernia rugosa
- waxy cabbage palm, Livistona lanuginosa
- Brigalow (*Acacia harpophylla* dominant and co-dominant) threatened ecological community (Brigalow TEC)[5].

These minimum offset requirements secure the offset obligations for the assessed Project impacts, whilst allowing for the future provision of additional offsets should baseline research identify the requirement. Table 5 also shows the offset delivery stage for each MNES, for each Project component. As per the requirements of the EPBC Act approval they also include the initial offset contribution of 2,000 ha for subsidence impacts associated with the underground mine. This initial contribution of 2,000 ha was conditioned by the Commonwealth Government with regards to the modelling of the cumulative impacts of subsidence, cracking and ponding as per the Draft Subsidence Management Plan (Adani 2013) which included:

- slope changes by more than 2% (> 5 m); or
- cracking of > 100 mm in width occurs; or
- ponding occurs for more than two days.

[4] Achieving legal security of an offset area can only occur once an offset area management plan has been approved by the state and the Commonwealth governments.

[5] Offsets for the MNES Brigalow TEC include the MSES RE 11.3.1, 11.4.8, 11.4.9 (BVG 25a), which constitute Brigalow TEC. in line with the Coordinator-General's decision to not require any additional offsets for impacts on MSES if the Commonwealth Government also requires an offset for the same value – see Section 4.2.

Table 5: Minimum offset area required for MNES, as specified in EPBC Act approval 2010/5736

Environmental Value	Stage 1 offset delivery– minimum offset area (ha) required							Stage 2 offset delivery– minimum offset area (ha) required			Total minimum offset area (ha) required
	Mining Operations North of the Carmichael River	Mining Operations South of the Carmichael River	Underground Mining	Off-lease Infrastructure	Rail East	Rail West	Total	Mining Operations South of the Carmichael River	Rail East	Total	
Black throated finch (southern)	18,220.39*	-	2,000.00	7.62	-	46.48	20,274.49	10,739.39	2.44	10,741.83	31,016.32
Brigalow ecological community	15.12		-	-		72.50	87.62	721.11	6.26	727.37	814.99
Ornamental Snake	96.39	38.61	-	-	-	-	135.00		-	-	135.00
Squatter pigeon (southern)	1,598.00	902.00	-	-	-	-	2,500.00	-	-	-	2,500.00
Waxy cabbage palm	90.00	-	-	-	-	-	90.00	-	-	-	90.00
Yakka skink	3,770.48	1,815.42	-	1.87	0.60	11.63	5,600.00			-	5,600.00

* Total offset requirements defined in EPBC 2010/5736 plus additional offset for 3D seismic activities (see Section 5.6).

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4.2 MATTERS OF STATE ENVIRONMENTAL SIGNIFICANCE

The Coordinator General's report for the Project (DSDIP 2014) contains conditions relating to biodiversity offsets (see Table 1), including that the Project BOS should be consistent with the draft BOS (the Environmental Offset Package, CO2 Australia, 2014) prepared for the Project AEIS, and should detail proposed offsets to address significant residual impacts on MSES.

The Environmental Offset Package presented MSES impacts that were derived from vegetation mapping completed and submitted as part of the Project SEIS in 2013. Since then, MSES impacts have been revised considering:

- the Coordinator-General's decision to not require any additional offsets for impacts on MSES if the Commonwealth Government also requires an offset for the same value
- the new Queensland offsets framework under which offsets are no longer required for
  - near threatened animals or plants as listed under the *Nature Conservation Act 1992* (NC Act)
  - species no longer listed as endangered or of concern under the NC Act
  - some special least concern animals listed under the NC Act
  - threshold regional ecosystems (REs)
  - high value regrowth
  - impacts that are not considered significant in accordance with the Queensland *Environmental Offsets Policy Significant Residual Impact Guideline* (see Appendix D for more detail).
- ground-truthing of regional ecosystem mapping associated with Stage 1 across the mining lease areas and rail component, collated since the 2013 Project SEIS, which showed that (compared to BOS version 3) (see also Appendix D):
  - there is no longer an impact on RE 11.3.3 (broad vegetation group [BVG] 16c)
  - there is no longer an impact on connectivity associated with off-lease infrastructure
  - an impact on connectivity associated with mining operations south of the Carmichael River has been identified (and this can be offset through Stage 1 offset delivery on MDW, see Section 5.4)
  - an impact on significant wetlands associated with mining operations south of the Carmichael River has been identified (and this can be offset on MDW through Stage 1 offset delivery, see Section 5.4)
  - an impact on RE 11.4.6 (BVG 26a) associated with mining operations south of the Carmichael River has been identified (proposed to be offset through a financial settlement offset, see Section 5.9).

Additionally, the Project's Rail component is exempt from obtaining an operational works clearing permit for the removal of native vegetation as it met the criteria of community infrastructure under Schedule 2 of the *Sustainable Planning Regulation 2009* at the time of assessment. Offsets are therefore not required for REs and watercourse vegetation for the Project's rail component. A complete description of the amendments to the offset requirements from those presented in the Environmental Offset Package (CO2 Australia 2014) is provided in Appendix B.

Table 6 outlines Project impacts on MSES, and the minimum offset area required as calculated using the GTDTHQ Version 1.2 (DEHP 2017) and the outputs of the Land-based Offset Multiplier Calculator[6], which are offset site specific and are detailed in Section 5.4.

Table 6 also shows the offset delivery stage for each MSES, for each Project component.

Table 6: Minimum offset area required for Project impacts on MSES

Environmental Value	Stage 1 offset delivery		Stage 2 offset delivery	
	Mining Operations North of the Carmichael River (ha)		Mining Operations South of the Carmichael River (ha)	
	Impact (ha)[A]	Minimum offset area required (ha)[D]	Impact (ha) [A]	Minimum offset area required (ha) [D]
Wetland Protection Area (WPA)	16.61	63.45	-	-
Significant wetland	34.40	131.41	43.19	164.99
11.4.6 (BVG 26a)	5.24	20.96	220.29	881.16
Watercourse vegetation [B]	314.24	1,219.25	172.88	670.77
Connectivity [C]	4,568.28	4,568.28	3,703.67	3,703.67

[A] Based on ground-truthing of RE mapping collated since the 2013 Project SEIS, which showed that compared to BOS version 3: there is no longer an impact on RE 11.3.3 (BVG 16c); there is no longer an impact on connectivity associated with off-lease infrastructure; impacts on significant wetlands, RE 11.4.6 (BVG 26a) and connectivity associated with mining operations south of the Carmichael River have been identified. See Appendix A for a complete description of the amendments to the offset requirements from those presented in the Environmental Offset Package.

[B] The watercourse vegetation impacted area was recalculated from BOS version 3 based on remnant vegetation areas within the buffers of mapped watercourses, according to stream order (SO) 1-5. A breakdown of watercourse vegetation impacts by stream order is given in Appendix B.

[C] Connectivity corresponds to those areas of remnant vegetation within state significant terrestrial and terrestrial/riparian biodiversity corridors (excluding state significant riparian biodiversity corridors).

[D] Minimum offset area required calculated using the GTDTHQ and the Land-based Offsets Multiplier Calculator, with respect to offsets on MDW – see Section 5.4 (except for RE 11.4.6 (BVG 26a) for which financial settlement offsets are proposed – see Section 5.9).

[6] Land-based Offset Multiplier Calculator.

5 OFFSET DELIVERY STAGES 1 AND 2

5.1 OFFSET IDENTIFICATION PROCESS

To identify and prioritise offset options to acquit the Project's offset requirements, Adani has assessed over 50 properties within the Brigalow Belt and Desert Uplands bioregions through strategic spatial analysis using environmental data. These analyses were primarily guided by the requirements of Queensland and Commonwealth Government offset policies, the availability and condition of environmental values, land tenure, mining tenure and the conservation priorities of the State and Commonwealth Governments including the Galilee Basin Offset Strategy (GBOS) (DEHP 2013a). Land-based offsets have also been identified as the preferred offset delivery option for impacted MNES and MSES based on the recommendations for each species or community in recovery plans, threat abatement plans, conservation advices and other relevant documents (see Table 20 for details). All the properties identified are also located within Priority 1 or 2 areas, or the wider GBOS strategic footprint[7]. For several high priority offset properties, preliminary landholder engagement, field surveys, BioCondition assessments and/or assessments using the EPBC Act Environmental OAG have also been undertaken to further determine their suitability and refine priorities.

In addition to land-based offsets, Adani is committed to the delivery of an annual GAB Offset Strategy that will return at least 730 mega litres per annum for a minimum five-year period. An overview of the GAB Offset Strategy is provided in Section 5.7.

5.2 OVERVIEW OF APPROACH TO STAGE 1 OFFSET DELIVERY

Based on the extensive analysis described above, Adani has identified MDW to acquit the majority of Project MNES and MSES land-based offset requirements for Stage 1 offset delivery (Figure 5). One MSES offset matter (RE 11.4.6 (BVG 26a)) will be acquitted through a financial settlement offset, see Section 5.9.

Field surveys have been undertaken on MDW to confirm its offset potential and management requirements, and the results of these surveys are summarised below in Section 5.4, and presented in detail in Appendix C.

Additionally, Adani proposes to manage areas of Moray Downs within ML 70441 and ML 70505 in a manner consistent with the adjacent MDW offset area. These mitigation areas are described in Section 5.8. The mitigation areas cannot be included within the offset area calculations due to the incompatibility with the mining lease tenure. Nevertheless, Adani has made the commitment to manage these areas and the adjacent areas associated with underground mining subsidence (where no significant residual impact is anticipated) under the direction of the proposed MNES and MSES management plans and consistent with the OAMP. Adani notes that the Coordinator-General's report has considered utilising significant areas of MDW for mitigation purposes in addition to offset areas. Adani has identified those areas of MDW for potential mitigation and offset areas subject to Project conditioning requirements. In line with the EPBC Act approval requirements for the Project, Adani has sought to maximise the value of MDW through security for offsets, and additionally, identify substantial areas for concurrent mitigation activities.

A summary of the approach to offset delivery Stage 1 is presented in Table 7.

[7] The GBOS (DEHP 2013b) identifies the following areas – priority 1 (conservation hubs), priority 2 (key north-south and east-west linkages), and the remaining areas of the GBOS footprint (linkages between conservation hubs). The GIS dataset that accompanies the GBOS (the Galilee Basin Strategic Offset Corridors mapping) (DES 2013) identifies priority 1 (high value), priority 2 (key linkage) and priority 3 (strategic footprint) areas.

Section 5.6 provides details of the offset area for seismic survey activities which is required in accordance with Condition 20 (d) of the Project's EPBC Act approval. To satisfy this requirement, Adani has identified 115 ha of black-throated finch habitat on MDW to be legally secured within two years of commencement of seismic survey activities. If it is not possible to acquit Stage 1 offsets using Moray Downs, Adani will continue to investigate other offset options in line with the process of strategic analysis outlined above, and that information will be incorporated into the BOS at such time that BOS update is required in accordance with the process discussed in Section 6.2.

146°30'0"E

147°0'0"E

21°30'0"S

22°0'0"S

22°30'0"S

MORAY DOWNS

Mount Coolon

Belyando Crossing

Belyando

Elgin

Laglan

Dunrobin

Adani Mining Pty Ltd - North Galilee Basin Rail Project

Figure 5
Stage 1 offset property

- Locality
- Road
- Existing rail network
- NGBR project
- CCMR project

IBRA bioregion

- Brigalow Belt North
- Desert Uplands

Location diagram

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Locality
- Road
- Existing rail network (connecting NGBR project)
- IBRA bioregion (v7)

CCMR project and NGBR project footprint provided by Adani

Date: 3/25/2021 Coordinate System: GCS GDA 1994 Datum: GDA 1994 Scale: 1:550,000@A3

0 10 20 30 40
Kilometres

N

CO2 Australia

Table 7: Summary of approach to Stage 1 offset delivery

Environmental value	Mining Operations North of the Carmichael River	Mining Operations South of the Carmichael River	Underground Mining	Off-lease Infrastructure	Rail East	Rail West	Total Stage 1 offset requirement (ha) [A]	Maximum available offset area on Moray Downs West (ha) [D]	
	Min. offset area required (ha) [A]								
Black-throated finch	18,220.39*	-	2,000.00	7.62	-	46.48	20,274.49	Critical habitat:	10,564.00
								Core habitat:	6,751.96
								Marginal habitat:	2,970.79
								Total:	20,286.75
Squatter pigeon	1,598.00	902.00	-	-	-	-	2,500.00	29,104.00	
Ornamental snake	96.39	38.61	-	-	-	-	135.00	1,414.44	
Yakka skink	3,770.48	1,815.42	-	1.87	0.60	11.63	5,600.00	23,459.63	
Waxy cabbage palm	90.00	-	-	-	-	-	90.00	429.29	
Brigalow (*Acacia harpophylla*) dominant and co-dominant (Brigalow TEC)	15.12	-	-	-	-	72.50	87.62	102.44	
Wetland Protection Area [C, B]	63.45	-	-	-	-	-	63.45	675.72	
Significant Wetlands [B, C]	131.41	164.99	-	-	-		296.40	2,032.06	
RE 11.4.6 (BVG 26a)	20.96	881.16	-	-	-	-	20.96	Financial settlement offset proposed (see Section 5.9)	

Environmental value	Mining Operations North of the Carmichael River	Mining Operations South of the Carmichael River	Underground Mining	Off-lease Infrastructure	Rail East	Rail West	Total Stage 1 offset requirement (ha) [A]	Maximum available offset area on Moray Downs West (ha) [D]
	Min. offset area required (ha) [A]							
Watercourse vegetation [B, C]	1,219.25	670.77	-	-	-	-	1,890.02	2,612.98
Connectivity [B, C]	4,568.28	3,703.67	-	-	-	-	8,271.95	24,895.80

* Total offset requirements defined in EPBC 2010/5736 plus additional offset for 3D seismic activities (see Section 5.6).

[A] For MNES, these minimum offset areas are as specified in EPBC Act approval 2010/5736; for MSES they have been calculated using the GTDTHQ and the Land-based offset multiplier calculator for the MDW offset area (see Section 5.4).

[B] See Table 9, Section 5.4.

[C] Where offsets are available on MDW to satisfy the total Stage 1 and Stage 2 offset requirement, impacts have been combined into Stage 1 offset delivery (see Table 4). More detail is given in Section 5.4.

[D] See Section 5.4 for more detail on offset availability on MDW. The area of maximum available offset area available on MDW differs between the approved version 3 and the current version 5a as a consequence of slight boundary amendments following detailed surveys of the Moray Downs property.

5.3 OVERVIEW OF OFFSET DELIVERY STAGE 2 OPTIONS

Prior to offset delivery Stage 2, the actual impacts associated with offsets delivery Stage 1 (mining operations north of the Carmichael River, off-lease infrastructure and rail west) will be reviewed to determine if there are any offset debits or credits. The BOS will also be reviewed to ensure that the predicted impacts associated with mining operations south of the Carmichael River and rail east are based on the most up to date information about the project. The process for BOS update is outlined in Section 6.2.

In preparation for Stage 2 offset delivery, Adani has identified the following offset options to acquit offset delivery Stage 2 requirements for impacts on black-throated finch habitat and Brigalow TEC:

- ML70506 - Adani-owned and within the Moray Downs property
- Property 1
- Property 2
- Property 3
- Property 4
- Property 5
- Property 6.

Adani proposes to address Stage 2 offset requirements for BVG26a via a financial settlement offset (see Section 5.9.

A summary of the land-based offset options relevant to offset delivery Stage 2 is presented below in Table 8, which shows:

- The minimum offset requirement for each MNES, defined in Table 1 of the EPBC Act approval.
- The minimum offset area to be secured for each offset option.
- The maximum available offset area for each offset option.
- For MNES, the percent of impact offset based on the application of the EPBC Act *Environmental Offsets Policy Offsets Assessment Guide*. The *Offsets Assessment Guide* has been applied for both the minimum and maximum offset areas, where relevant. A copy of each spreadsheet, including a general overview of assumptions made, is presented in Appendix H.
- For black-throated finch, additional *Offsets Assessment Guides* have been prepared to align with habitat classifications and are presented in Appendix I.
- A summary of which offset options are required to acquit the offset requirement for each value.

Prior to the commencement of Stage 2 impacts, a revised BOS will be submitted (see process outlined in Section 6.2) to identify suitable Stage 2 offsets on MDW and other properties, if required.

Table 8: Summary of approach to Stage 2 offset delivery

Environmental Value		Black-throated finch			Brigalow TEC [B]
Stage 2 minimum offset requirement (ha)		10,741.83[F]			727.37 [G]
Stage 2 minimum offset requirement by habitat class (ha) [A]		Critical: 9,736.31	Core: 909.74	Marginal: 95.79	n/a
Offset option	Parameter	Offset for critical habitat	Offset for core habitat	Offset for marginal habitat	
ML70506 [C]	Max available offset area (ha)	1,059.93	468.58	43.46	No proposed Brigalow TEC offset on ML70506
	% of impact offset	9.87	45.57	41.55	
	Indicative offset area (ha)	1,528.51 [E]	0	43.46	
	% of impact offset	15.04	0	41.55	
Property 1 [C]	Max available offset area (ha)	1,682.46	1,211.55	545.16	No proposed Brigalow TEC offset on Property 1
	% of impact offset	15.66	117.83	521.20	
	Indicative offset area (ha)	2,894.01 [E]	0	545.16	
	% of impact offset	29.02	0	521.20	
Property 2[D]	Max available offset area (ha)	878.71	19,739.02	2,665.48	No proposed Brigalow TEC offset on Property 2
	% of impact offset	9.35	2,662.95	2,184.30	
	Indicative offset area (ha)	8,128.00 [E]	750.00	123.00	
	% of impact offset	100.82	101.18	100.80	
Property 3[D]	Max available offset area (ha)	16,914.88	37,656.36	3,092.12	No proposed Brigalow TEC offset on Property 3
	% of impact offset	179.96	5,080.14	2,600.72	
	Indicative offset area (ha)	9,500.00	750.0 0	120.00	
	% of impact offset	101.07	101.18	100.93	

Environmental Value		Black-throated finch			Brigalow TEC [B]
Stage 2 minimum offset requirement (ha)		10,741.83[F]			727.37 [G]
Stage 2 minimum offset requirement by habitat class (ha) [A]		Critical: 9,736.31	Core: 909.74	Marginal: 95.79	n/a
Offset option	Parameter	Offset for critical habitat	Offset for core habitat	Offset for marginal habitat	
Property 4[D]	Max available offset area (ha)	No proposed black-throated finch offset on Property 4			38.62
	% of impact offset				5.63
	Min offset area (ha)				n/a
	% of impact offset				n/a
Property 5 [D]	Max available offset area (ha)	No proposed black-throated finch offset on Property 5			1,106.18
	% of impact offset				154.09
	Min offset area (ha)				727.37
	% of impact offset				101.32
Property 6 [D]	Max available offset area (ha)	No proposed black-throated finch offset on Property 6			101.39
	% of impact offset				14.12
	Min offset area (ha)				n/a
	% of impact offset				n/a
Stage 2 offset requirement acquit?		Yes			Yes
Options required to acquit offset requirement		Property 2 OR Property 3			Property 5

[A] Based on the proportion of the impact in each habitat class.
[B] RE 11.3.1, 11.4.8, 11.4.9; BVG 25a.
[C] Options identified since the originally approved BOS (version 3).
[D] *Offsets Assessment Guide* inputs as per the originally approved BOS (version 3), see Appendix H and Appendix I.
[E] Prioritising critical black-throated finch habitat by combining maximum extent of critical and core black-throated finch habitat. See Section 5.5.1 – ML70506, Section 5.5.2 Property 1 and Section 5.5.3 Property 2.
[F] Mining operations South of Carmichael River; Rail East component; also includes offsets for 3D seismic activity (see Section 5.6).
[G] Mining operations South of Carmichael River; Rail East component.

5.4 MORAY DOWNS WEST

5.4.1 Property description

The Moray Downs property (Lot 662 SP316209) is a 98,597 ha leasehold grazing property located approximately 140 km north-west of Moranbah in central Queensland within the IRC LGA. The Moray Downs property leasehold was purchased by Adani in November 2011 for the purpose of housing most of the off-lease mine infrastructure associated with the project. The proposed mining area also overlays much of the property; however, sections in the east and west of the property will not be mined as part of the project (Figure 6). MDW is located predominantly within the Desert Uplands bioregion with a small portion located within the Brigalow Belt bioregion. The primary land use on MDW is cattle grazing. Parts of MDW are mapped as priority 1 areas in the Queensland Government's Galilee Basin Offset Strategy (GBOS) (DEHP 2013a) (Figure 7). Priority 1 areas contain high levels of conservation value and are likely to have the lowest risk of future development through mining. MDW also borders priority 1, 2 and 3 GBOS areas.

5.4.2 Biodiversity offset potential

The MDW offset area for Stage 1 offset delivery is 33,668.90 ha and is located across five consolidated areas in the western, northern and eastern sections of the Moray Downs property, adjacent to the North Galilee Basin Rail Project offset area and outside of the proposed mining area (ML 70441 and 70505; Figure 6). The location of the offset area was determined based on the presence of habitat and biodiversity values following desktop and field assessments (Figure 6). Field surveys were undertaken by CO2 Australia and Eco Logical Australia (ELA) between 8 and 12 September 2014. The MDW Ecological Equivalence Assessment Report was finalised by ELA on 9 October 2014 (Eco Logical Australia 2014b) and is presented in Appendix C. CO2 Australia and ELA undertook additional surveys of the MDW offset area in July 2015. In October 2017, detailed field surveys (including ground-truthing of regional ecosystems) were undertaken by CO2 Australia to determine the baseline condition of MNES through the application of the GTDTHQ Version 1.2 (DEHP 2017). Further detailed field surveys were conducted by CO2 Australia from 3-7 August 2020 within the eastern most portion of the MDW offset area to assess the presence and extent of MNES values (within the West Obangeena paddock; Figure 6). Field assessments included ground-truthing and mapping of vegetation communities, assessment of vegetation and habitat condition generally in accordance with the Guide to Determining Terrestrial Habitat Quality (version 1.2; DEHP 2017) and assessment of habitat attributes reflecting the appropriateness and integrity of potential offset areas (e.g. presence and characteristics of gilgai in areas of potential ornamental snake offset areas). The results of the August 2020 field surveys are also presented in Appendix C.

The results of the field surveys indicate that MDW contains significant areas of habitat and biodiversity values for the majority of the MNES and MSES for which offsets are required. The field surveys also allowed for a comparison of the ecological condition score at the impact and offset site for each value.

Table 9 shows the minimum offset area required to be secured for each value for Stage 1 offset delivery, the maximum available habitat area and the offset management area to be secured for each value on MDW. The results of the application of the EPBC Act *Environmental Offsets Policy Offsets Assessment Guide* are presented in Appendix H and Appendix I (black-throated finch). A description of the offset area for each MNES and MSES is presented in the following sections, including an overview of the indicative management requirements for each value. Figure 8 to Figure 17 illustrate the area of potential habitat for each value within the offset area and the indicative area that Adani proposes to manage for each species.

The Stage 1 MDW offset area also comprises surplus areas of suitable habitat for Stage 1 MNES and MSES offset values greater than what is currently required to acquit the offset requirements associated with Stage 1 offset delivery identified as part of this BOS (Table 9). These are only available to acquit any additional offset requirements associated with Stage 1 offset delivery following review of the actual Stage 1 impacts and offset requirements, outlined in Section 6.2.

Areas of surplus habitat are also located outside of the current Stage 1 MDW offset area in the east of MDW and are proposed to be legally secured and managed as part of the MDW offset area for Adani to draw down on to acquit any future project offset requirements. Based on the results of detailed field surveys in August 2020, this area comprises areas of ground-truthed remnant and regrowth RE 11.4.9, 11.4.8, 11.3.1, 11.3.7 and 11.3.10, partially analogous with Brigalow TEC and providing potentially suitable habitat for ornamental snake and squatter pigeon (Table 9, Figure 9, Figure 10, Figure 13).

Table 9: Offset availability on Moray Downs West

Environmental value	MNES/MSES	Minimum offset area required (ha)	Stage 1: Offset area to be secured (ha)	Stage 1: Maximum offset availability (ha)	Surplus available within Stage 1 offset area (ha)	Surplus available outside of Stage 1 offset area for future offset drawdown (ha)
Black-throated finch	MNES/MSES	20,274.49 [A]	20,286.75	20,286.75	-	-
Squatter pigeon	MNES/MSES	2,500.00 [A]	2,509.00	29,104.00	26,595.00	347.11
Ornamental snake	MNES/MSES	135.00 [A]	138.95	1,414.44	1,275.49	545.65
Yakka skink	MNES/MSES	5,600.00 [A]	5,619.31	23,459.63	17,840.32	-
Waxy cabbage palm	MNES/MSES	90.00 [A]	99.62	429.29	329.67	-
Brigalow TEC	MNES	87.62 [A]	102.44	102.44	-	621.18
Wetland Protection Area (WPA)	MSES	63.45 [B]	67.03	675.72	608.69	-
Significant wetland	MSES	296.40 [B]	303.32	2,032.06	1,728.74	-
Watercourse vegetation	MSES	1,890.05 [B]	1,894.87	2,612.98	718.11	-
Connectivity	MSES	8,271.95 [B]	8,917.27	24,895.80	15,978.53	-

[A] Defined in EPBC Act approval EPBC 2010/5736 plus additional offset for 3D seismic activities (see Section 5.6).
[B] Determined using the Land-based Offset Multiplier Calculator.

146°10'0"E
146°20'0"E
146°30'0"E
146°40'0"E
21°50'0"S
22°0'0"S
22°10'0"S
22°20'0"S

Sandy Creek
Wilandspey Conservation Park
Brigalow Belt bioregion
Desert Uplands bioregion
Tomahawk Creek
Belyando River
Belyando River
North Creek
Dyllingo Creek
Cattle Creek
Carmichael River
Bimbah Creek
Belyando River

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Figure 6
Moray Downs West offset area

Moray Downs
Major watercourse

Moray Downs West offset areas
CCMR project - Stage 1 offset area
CCMR project - Proposed Stage 2 offset area
NGBR project - Offset area
Surplus offset area

Biogeographic Regions
Brigalow Belt bioregion
Desert Uplands bioregion

Location diagram
Queensland
Brisbane

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Biogeographic regions
- Major watercourses

Date: 3/25/2021 Coordinate System: GDA 1994 MGA Zone 55 Projection: Transverse Mercator Datum: GDA 1994 Scale: 1:210,000@A3

0 2.5 5 7.5 10
Kilometres

N

CO2 Australia

146°20'0"E

146°40'0"E

22°0'0"S

22°20'0"S

Adani Mining Pty Ltd - Carmichael Coal Mine and Rail Project

Figure 7
Moray Downs West
Galilee Basin Offset Strategy

- Moray Downs
- CCMR project - Stage 1 offset area
- CCMR project - Proposed Stage 2 offset area
- NGBR project - Offset area
- Surplus offset area

Galilee Basin strategic offset corridors

- Priority 1 - High value
- Priority 2 - Key linkage
- Priority 3 - Strategic footprint

Location diagram

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data (July 2019)
- Galilee Basin strategic offset corridors

Date: 3/25/2021 Coordinate System: GDA 1994 MGA Zone 55 Projection: Transverse Mercator Datum: GDA 1994 Scale: 1:210,000@A3

0 2.5 5 7.5 10
Kilometres

N

CO2 Australia

Black-throated finch (southern)

The black-throated finch has been recorded on several occasions on MDW (Eco Logical Australia 2014b) (Figure 8). Black-throated finch habitat on MDW is defined in Table 10. These habitat classifications were confirmed in a workshop held on 9 February 2016 with CO2 Australia, ELA and representatives from the Department of Environment and Science (DES) (formerly Department of Environment and Heritage Protection [DEHP]) and the DAWE (formerly Department of Environment and Energy [DEE]).

Table 10: Black-throated finch habitat types on Moray Downs West

Habitat type >		Core	Critical	Marginal
Habitat definition >		Core habitat within 3 km of water	Important foraging and potential breeding habitat	Potential foraging and dispersal habitat
Regional ecosystems:	10.3.6a	●	●	
	10.3.6ax1	●	●	
	10.3.12a	●	●	
	10.3.13a	●	●	
	10.3.14d	●	●	
	10.3.15g			●
	10.5.1a			●
	10.5.1b			●
	10.5.1c			●
	10.5.2b	●	●	
	10.5.5a	●	●	
	10.5.10	●	●	
	10.7.4			●
	11.3.3c			●
	11.3.25	●	●	
	11.3.27	●	●	

Black-throated finch individuals were predominately observed north of the Carmichael River in areas with diversity of seeding grass species (e.g. *Themeda triandra, Alloteropsis semialalta, Panicum decompositum, Dichanthium sericeum* and *Eragrostis sororia*) and near water. These areas have been mapped as containing critical and core habitat for the black-throated finch. MDW also contains marginal habitat for the black-throated finch. Marginal habitat areas are not as close in proximity to water and/or are in poorer condition than critical or core habitat due to infestations of buffel grass, grazing pressures and fire. Key known threats to the black-throated finch relevant to the management of offset areas within MDW include alteration of habitat by changes in fire regimes and grazing, and invasion of habitat by exotic weeds, including exotic grasses (Eco Logical Australia 2014b).

CO2 Australia has assessed the suitability of different black-throated finch habitat types in the MDW offset area using the EPBC Act *Offsets Assessment Guide* (see Appendix I). Table 11 summarises these results, which indicate that for each habitat type, the total percent of impact offset exceeds 100%. Additionally, the total offset area of 20,286.75 ha exceeds the minimum black-throated finch Stage 1 offset area of 20,274.49 ha, as required under the EPBC Act approval (EPBC 2010/5736).

The primary management consideration for these offset areas will be the removal and/or reduction of cattle, provision of water sources and the implementation of a weed control program targeting *Cenchrus ciliaris.* This is to ensure that seeding grass species diversity is optimised and that fuel loads are minimised. Other management actions may include the development of a fire management plan to ensure that inappropriate fire regimes do not alter habitat and provide a mosaic of grass species and diversity (Eco Logical Australia 2014b). Figure 8 illustrates species records, the availability of potential habitat for black-throated finch in the offset areas and indicative offset management areas for the species.

Table 11: Moray Downs West Offsets Assessment Guides results for Stage 1 black-throated finch offset delivery

Habitat definition	Stage 1 impact (ha)	Stage 1 offset area Moray Downs West				Total percent of impact offset (%)
		Critical (ha)	Core (ha)	Marginal (ha)	Total offset area (ha)	
Critical	4,628.23	10,564.00	4,839.56	0.00	15,403.56	100.96
Core	725.83	0.00	1,912.40	0.00	1,912.40	102.29
Marginal	739.32	0.00	0.00	2,970.79	2,970.79	116.40
Total (ha)	6,093.38	10,564.00	6,751.96	2,970.79	20,286.75	--

Squatter pigeon (southern)

Squatter pigeon habitat on MDW is associated with woodland vegetation with a grassy understory, on well drained soils and near water sources. There is approximately 29,104.00 ha of suitable habitat for the squatter pigeon in the offset areas. The condition of this habitat ranges from good to poor with buffel grass present in many areas. Squatter pigeon habitat that is in poorer condition has been highly disturbed due to grazing. The key known threat to the squatter pigeon that is relevant to the management of offset areas within MDW is degradation of habitat by invasive weeds, such as buffel grass (Eco Logical Australia 2014b). The primary management consideration for squatter pigeon offset areas will be the implementation of a weed control program targeting buffel grass and the provision of additional water sources in areas of foraging habitat. Figure 9 illustrates the extent of potential habitat for squatter pigeon in the offset area and indicative offset management areas for the species.

Ornamental snake

Habitat for the ornamental snake on MDW is associated with the gilgai and clay soils of Brigalow and Gidgee REs. There are approximately 1,414.44 ha of suitable habitat for the ornamental snake in the MDW offset area.

The condition of ornamental snake habitat ranges from good to poor (Eco Logical Australia 2014b). Large areas of Brigalow and Gidgee have been highly disturbed due to grazing and several areas have also been recently burnt, resulting in a reduction of microhabitat features for the ornamental snake such as fallen wooden debris. Key known threats to the ornamental snake that are relevant to the management of offset areas within MDW are alteration of landscape hydrology in and around gilgai environments, and invasive weeds (Eco Logical Australia 2014b).

The main management consideration will be the removal of cattle and/or reduction, the control of weeds as well as the regeneration of regrowth Brigalow and Gidgee. Brigalow and Gidgee ecosystems are also fire sensitive therefore the development and implementation of a fire management plan is likely to also benefit the ornamental snake in the MDW offset area. Figure 10 illustrates the extent of potential habitat for the ornamental snake in the offset areas and indicative offset management areas for the species.

Yakka skink

Habitat for the yakka skink on MDW is associated with woodland vegetation; particularly those with microhabitats such as fallen timber, log or rock piles. There is approximately 23,459.63 ha of suitable habitat for the yakka skink in the offset area. The main threat to the yakka skink on MDW is habitat reduction and degradation by fire and grazing (Eco Logical Australia 2014b). Actions that may improve species habitat are the removal of grazing, retaining fallen timber and ground cover and restricting the use and spread of agricultural weeds, such as buffel grass. Figure 11 illustrates the extent of potential habitat for yakka skink in the offset area, and indicative offset management areas for the species.

Waxy cabbage palm

A total of 102 waxy cabbage palm individuals have been recorded within MDW (Eco Logical Australia 2014b), with a further 280 identified from detailed aerial photography. The recorded individuals occur in or adjacent to the Carmichael River and these areas are reported to be in good condition. There is approximately 429.29 ha of waxy cabbage palm habitat within the offset area on MDW. With a restricted distribution, waxy cabbage palms on MDW are at risk of trampling from cattle and fire. Trampling is known to severely restrict recruitment (DoE 2019a) and several of the larger waxy cabbage palms have been previously scarred by fire. Adani will implement specific management measures designed to protect waxy cabbage individuals and their habitat. The measures will include (but are not limited to) removal and/or reduction of cattle grazing and the development of a fire management plan to minimise the risk of an uncontrolled, high intensity fire. Figure 12 illustrates the available habitat for waxy cabbage palms, species records, the location of the offset area and indicative offset management areas for the species.

Brigalow TEC

Brigalow TEC is located on the eastern portion of the MDW offset area (within the West Obangeena paddock; Figure 13). Within this section of the offset area, total of 102.44 ha of Brigalow TEC comprising areas of mature regrowth RE 11.4.9 and 11.4.8 with canopy heights greater than 5 m.

Within the south-east of the West Obangeena paddock RE 11.4.8 is interspersed amongst eucalypt-dominated woodland (RE 11.3.10 and 11.3.7) comprising mature regrowth (>5 m canopy) *Eucalyptus cambageana* and *Acacia harpophylla* shrubby woodland on clay and texture-contrast soils supporting a diverse midstorey and understorey dominated by *Flindersia dissosperma*, *Atalaya hemiglauca*, *Terminalia oblongata, Citrus glauca* and *Carissa ovata*. To the north of these eucalypt-dominated areas, the balance of the paddock is comprised a mix of mature regrowth *Acacia harpophylla* woodland on clay (RE 11.4.9) with occasional alluvially-influenced areas supporting remnant *Eucalyptus brownii* grassy woodland (RE 11.3.10). An east-west draining alluvial channel in the north of the area supports *Acacia harpophylla* and *Casuarina cristata* mature regrowth (RE 11.3.1).

146°10'0"E

146°20'0"E

146°30'0"E

21°50'0"S

22°0'0"S

22°10'0"S

NB the offset management area for black-throated finch covers the whole offset area

Adani Mining Pty Ltd - Carmichael Coal Mine and Rail Project

Figure 8
Moray Downs West offset area black-throated finch habitat

- Moray Downs
- Stage 1 offset area
- Surplus offset area
- BTF records

Black-throated finch habitat

- Critical habitat
- Core habitat
- Marginal habitat

Location diagram

DATA SOURCE:
Offset value data: Ecological Australia Pty Ltd (2014)
BTF records: Ecological Australia Pty Ltd (2014) and GHD
The following datasets are © State of Qld:
- Cadastral data

Date: 3/25/2021 Coordinate System: GDA 1994 MGA Zone 55 Projection: Transverse Mercator Datum: GDA 1994 Scale: 1:151,168@A3

0 2 4 6 8
Kilometres

N

CO2 Australia

146°10'0"E
146°20'0"E
146°30'0"E
21°50'0"S
22°0'0"S
22°10'0"S

Adani Mining Pty Ltd - Carmichael Coal Mine and Rail Project

Figure 9
Moray Downs West offset area squatter pigeon

- Squatter pigeon records
- Moray Downs
- Stage 1 offset area
- Surplus offset area
- Squatter pigeon offset management area
- Squatter pigeon habitat

Location diagram

DATA SOURCE:
Offset value data: Ecological Australia Pty Ltd (2014)
The following datasets are © State of Qld:
- Cadastral data

0 2 4 6 8
Kilometres

N

CO2 Australia

Date: 3/25/2021 Coordinate System: GDA 1994 MGA Zone 55 Projection: Transverse Mercator Datum: GDA 1994 Scale: 1:150,000@A3

146°10'0"E
146°20'0"E
146°30'0"E
21°50'0"S
22°0'0"S
22°10'0"S

Adani Mining Pty Ltd - Carmichael Coal Mine and Rail Project

Location diagram

Figure 10
Moray Downs West offset area ornamental snake

- Moray Downs
- Stage 1 offset area
- Surplus offset area
- Ornamental snake offset management area
- Ornamental snake habitat

DATA SOURCE:
Offset value data: Ecological Australia Pty Ltd (2014)
The following datasets are © State of Qld:
- Cadastral data (July 2019)

Date: 3/25/2021 Coordinate System: GDA 1994 MGA Zone 55 Projection: Transverse Mercator Datum: GDA 1994 Scale: 1:150,000@A3

0 2 4 6 8
Kilometres

N

CO2 Australia

146°10'0"E

146°20'0"E

146°30'0"E

21°50'0"S

22°0'0"S

22°10'0"S

Adani Mining Pty Ltd - Carmichael Coal Mine and Rail Project

Location diagram

Figure 11
Moray Downs West offset area
yakka skink

- Moray Downs
- Stage 1 offset area
- Surplus offset area
- Yakka skink offset management area
- Yakka skink habitat

DATA SOURCE:
Offset value data: Ecological Australia Pty Ltd (2014)
The following datasets are © State of Qld:
- Cadastral data

Date: 3/25/2021 Coordinate System: GDA 1994 MGA Zone 55 Projection: Transverse Mercator Datum: GDA 1994 Scale: 1:150,000@A3

0 2 4 6 8
Kilometres

N

CO2 Australia

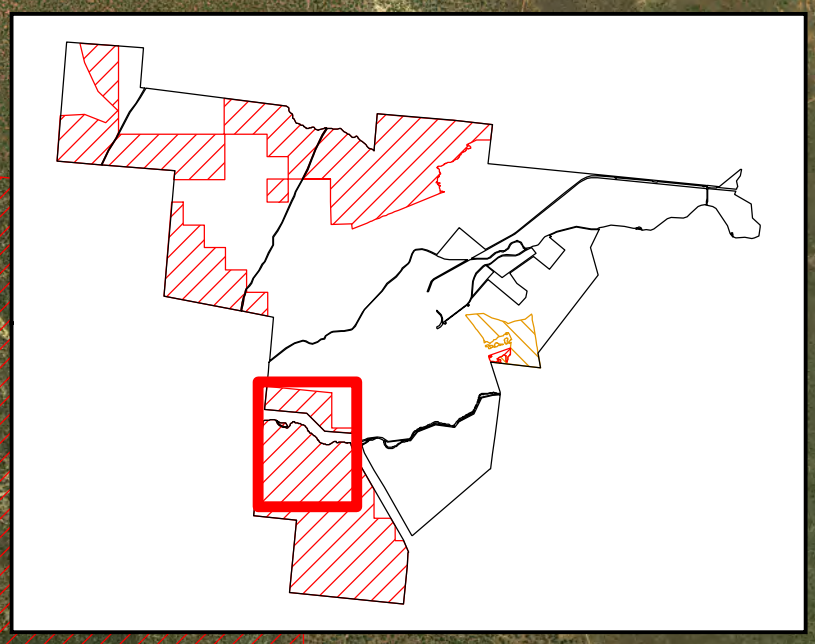
146°18'0"E

146°20'0"E

22°4'0"S

22°6'0"S

22°8'0"S



Adani Mining Pty Ltd - Carmichael Coal Mine and Rail Project

Location diagram

Figure 12
Moray Downs West offset area
waxy cabbage palm

- Moray Downs
- Stage 1 offset area
- Surplus offset area
- Waxy cabbage palm records
- Waxy cabbage palm offset management area
- Waxy cabbage palm habitat

DATA SOURCE:
Offset value data: Ecological Australia Pty Ltd (2014)
WCP sightings: Ecological Australia Pty Ltd (2014) and field observations
The following datasets are © State of Qld:
- Cadastral data

0 0.25 0.5 0.75 1
Kilometres

N

CO2 Australia

Date: 10/11/2021 Coordinate System: GDA 1994 MGA Zone 55 Projection: Transverse Mercator Datum: GDA 1994 Scale: 1:28,000@A3

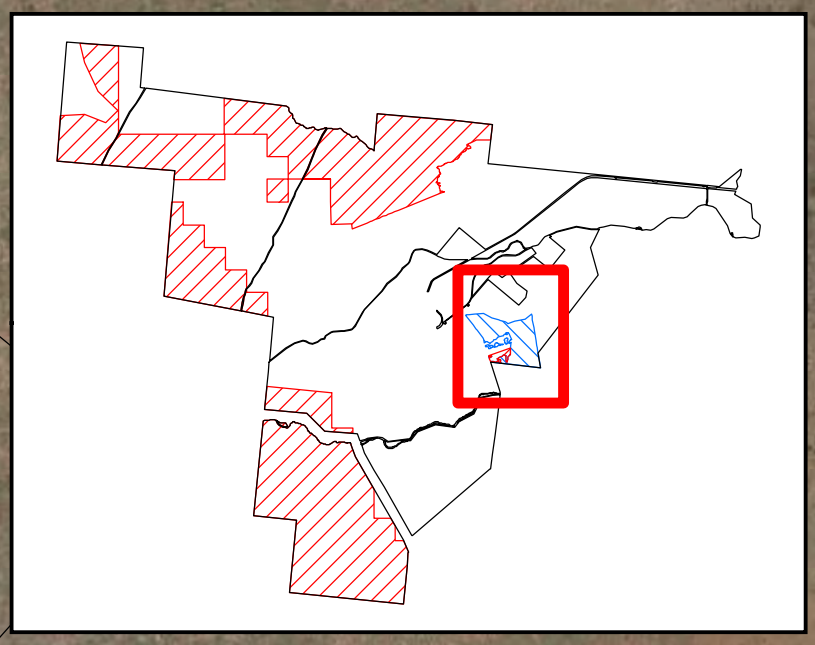
146°28'0"E

146°30'0"E

22°0'0"S

22°2'0"S

22°4'0"S



Adani Mining Pty Ltd - Carmichael Coal Mine and Rail Project

Location diagram

Figure 13
Moray Downs West offset area
Brigalow TEC

- Moray Downs
- Stage 1 offset area
- Surplus offset area
- Brigalow TEC offset management area
- Brigalow TEC habitat

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data

0 0.5 1 1.5 2
Kilometres

N

CO2 Australia

Date: 3/25/2021 Coordinate System: GDA 1994 MGA Zone 55 Projection: Transverse Mercator Datum: GDA 1994 Scale: 1:30,000@A3

Wetlands

MDW contains several areas classified as significant wetlands and/or wetland protection areas of general environmental significance. The significant wetlands are represented by approximately 2,032.06 ha of seasonal and ephemeral wetlands which include the small areas of Coolibah woodlands on closed depressions. The wetland protection areas include approximately 675.72 ha of floodplain country of the Carmichael River and small palustrine wetlands associated with gilgai that occur within Brigalow and Gidgee ecosystems. The wetland areas on MDW are in reasonable condition; however, there was evidence of disturbance by cattle and some clearing of the vegetation surrounding the wetlands. The implementation of management measures, such as the removal of grazing, will improve the quality of the wetland areas on MDW. Figure 14 and Figure 15 illustrate the location of significant wetlands and WPAs on MDW, respectively. They also show indicative offset management areas.

Watercourse vegetation

Watercourse vegetation on MDW occurs along the Carmichael River, Cabbage Tree Creek, North Creek and smaller drainage lines running across the sand plains. These range from stream order 1 to stream order 5 watercourses. The larger watercourses on MDW are associated with River Red Gum (*Eucalyptus camaldulensis*) or Coolibah (*E. coolabah*) species. The smaller drainage lines which traverse through various woodlands on sand plains and clay plains are not associated with any distinctive riparian vegetation. There are approximately 2,612.98 ha of watercourse vegetation in the offset area on MDW, as illustrated in Figure 16. The location of indicative watercourse management areas is also illustrated.

Connectivity

Approximately 24,895.80 ha of the offset area on MDW is mapped within a state significant biodiversity corridor (Figure 17). Remnant vegetation within this area is considered to provide important connectivity for protected environmental values. Through securing MDW as an offset, Adani will ensure the long-term protection of the connectivity value of this area.

146°10'0"E
146°20'0"E
146°30'0"E
21°50'0"S
22°0'0"S
22°10'0"S

Adani Mining Pty Ltd - Carmichael Coal Mine and Rail Project

Location diagram

Figure 14
Moray Downs West offset area
Significant Wetlands

- Moray Downs
- Stage 1 offset area
- Surplus offset area
- Significant Wetland offset management area (buffer)
- Significant Wetland habitat

DATA SOURCE:
Offset value data: Ecological Australia Pty Ltd (2014)
The following datasets are © State of Qld:
- Cadastral data

Date: 3/25/2021 Coordinate System: GDA 1994 MGA Zone 55 Projection: Transverse Mercator Datum: GDA 1994 Scale: 1:150,000@A3

0 2 4 6 8
Kilometres

N

CO2 Australia

146°10'0"E
146°20'0"E
146°30'0"E
21°50'0"S
22°0'0"S
22°10'0"S

0 0.25 0.5 0.75 1
Kilometres
1:30,000

Adani Mining Pty Ltd - Carmichael Coal Mine and Rail Project

Location diagram

Figure 15
Moray Downs West offset area
Wetland Protection Area

- Moray Downs
- Stage 1 offset area
- Surplus offset area
- WPA offset management area
- WPA habitat

DATA SOURCE:
Offset value data: Ecological Australia Pty Ltd (2014)
The following datasets are © State of Qld:
- Cadastral data

Date: 3/25/2021 Coordinate System: GDA 1994 MGA Zone 55 Projection: Transverse Mercator Datum: GDA 1994 Scale: 1:150,000@A3

0 2 4 6 8
Kilometres

N

CO2 Australia

146°10'0"E
146°20'0"E
146°30'0"E
21°50'0"S
22°0'0"S
22°10'0"S

Adani Mining Pty Ltd - Carmichael Coal Mine and Rail Project

Location diagram

Figure 16
Moray Downs West offset area watercourse vegetation

- Moray Downs
- Stage 1 offset area
- Surplus offset area
- Watercourse vegetation offset management area (buffer)
- Watercourse vegetation habitat

DATA SOURCE:
Offset value data: Ecological Australia Pty Ltd (2014)
The following datasets are © State of Qld:
- Cadastral data
- Watercourses (v4)

Date: 3/25/2021 Coordinate System: GDA 1994 MGA Zone 55 Projection: Transverse Mercator Datum: GDA 1994 Scale: 1:150,000@A3

0 2 4 6 8
Kilometres

N

CO2 Australia

Queensland

146°10'0"E

146°20'0"E

146°30'0"E

21°50'0"S

22°0'0"S

22°10'0"S

Adani Mining Pty Ltd - Carmichael Coal Mine and Rail Project

Location diagram

Figure 17
Moray Downs West offset area
Connectivity

- Surplus offset area
- Moray Downs
- Stage 1 offset area
- Connectivity offset management area
- Connectivity habitat

DATA SOURCE:
Offset value data: Ecological Australia Pty Ltd (2014)
The following datasets are © State of Qld:
- Cadastral data
- Statewide corridors (v1.3)

Date: 3/25/2021 Coordinate System: GDA 1994 MGA Zone 55 Projection: Transverse Mercator Datum: GDA 1994 Scale: 1:150,000@A3

0 2 4 6 8
Kilometres

N

CO2 Australia

Queensland

5.5 STAGE 2 OFFSET PROPERTIES

As summarised in Table 8, Adani has identified seven additional potential offset options – ML70506, Properties 1-6– as offset options to acquit Stage 2 offset requirements for black-throated finch and Brigalow TEC, to ensure 100% acquittal of offset requirements for these values in combination with Stage 1 offset delivery. These properties are all located within 30 km of the Project. A description of each additional potential offset property, including its biodiversity offset potential, is outlined below.

These potential Stage 2 offset properties have been included as examples of how direct offsets for the Project could be delivered. This BOS makes no assumptions on the actual availability of the properties under assessment to be used as offsets. Prior to the commencement of Stage 2 impacts, a revised BOS will be submitted (see process outlined in Section 6.2) to review offset options suitable for Stage 2 offset delivery. Should Adani deem it necessary (e.g. for commercial considerations, landholder willingness to participate, etc.), different properties that contain comparable environmental values may be substituted.

5.5.1 ML70506

ML70506 is a 1,588.10 ha Adani-owned mining lease on the Moray Downs property, adjacent to the Project (ML70441 and ML70505, see Section 2.1.1) in the north. Adani intends to relinquish this mining lease and has explored the potential for black-throated finch offsets in the ML70506 area. ML70506 is adjacent to GBOS priority 1 areas.

CO2 Australia has assessed the suitability of critical, core and marginal black-throated finch habitat on ML70506 based on field surveys of the Moray Downs property, identifying approximately 1,572 ha of potential habitat for black-throated finch. The assessment indicates that ML70506 could be suitable to acquit a portion of the Stage 2 offset requirement for black-throated finch (Figure 18). *Offsets Assessment Guides* are included in Appendix H. Table 12 shows:

- the maximum area of each black-throated finch habitat types available for offsets on ML70506
- the indicative offset area for each habitat type, prioritising critical habitat offsets by combining the maximum extent of critical (1,059.93 ha) and core (468.58 ha) black-throated finch habitat to meet the Stage 2 offset requirement for critical black-throated finch habitat. This is in line with the approach applied on MDW for Stage 1 impacts on black-throated finch (described in Appendix I).

Table 12: Offset availability by habitat type on ML70506

	Critical habitat (core habitat within 3 km of water)	Core habitat (important foraging and potential breeding habitat)	Marginal habitat (potential foraging and dispersal habitat)	Total (ha)
Stage 2 impact (ha)	3,079.81	287.77	30.30	3,397.88
Maximum area available on ML70506 (ha)	1,059.93	468.58	43.46	1,571.96
% of impact offset based on maximum area available	9.87	63.22	41.55	--
Indicative offset area (ha)	1,528.51 (1,059.93 ha critical + 468.58 ha core)	0 *	43.46	1,571.97
% of impact offset based on indicative offset area	15.04	0	41.55	--

* Indicative offset area is zero here because all available core habitat is being used to offset critical habitat (in line with the approach used for Stage 1 black-throated finch habitat on MDW, see Appendix I).

146°16'0"E

146°18'0"E

21°52'0"S

21°54'0"S

21°56'0"S

Adani Mining Pty Ltd - Carmichael Coal Mine and Rail Project

Figure 18
ML70506 indicative offset area

- Moray Downs
- ML70506
- CCMR project footprint
- Stage 1 CCMR MDW offset area
- Black-throated finch sightings

Black-throated finch habitat

- Critical habitat
- Core habitat
- Marginal habitat

Location diagram

DATA SOURCE:
Offset value data: Ecological Australia Pty Ltd (2014)
BTF records: Ecological Australia Pty Ltd (2014) and GHD
The following datasets are © State of Qld:
- Cadastral data
Project footprint provided by Adani (January 2019)

Date: 5/14/2021 Coordinate System: GDA 1994 MGA Zone 55 Projection: Transverse Mercator Datum: GDA 1994 Scale: 1:25,000@A3

0 0.25 0.5 0.75 1
Kilometres

N

CO2 Australia

5.5.2 Property 1

Property 1 is an approximately 20,000 ha site in the Galilee Basin, to the north of the Project, adjacent to both priority 1 and priority 2 GBOS areas. A portion of Property 1 overlaps with the Adani-owned Moray Downs property.

CO2 Australia has assessed the suitability of critical, core and marginal black-throated finch habitat in this overlapping area (which was previously excluded from the MDW offset area) based on field surveys of the Moray Downs property, identifying approximately 3,439 ha of potential habitat for black-throated finch. The assessment indicates that Property 1 could be suitable to acquit a portion of the Stage 2 offset requirement for black-throated finch. *Offsets Assessment Guides* are included in Appendix H. Table 13 shows:

- the maximum area of each black-throated finch habitat types available for offsets on Property 1
- the indicative offset area for each habitat type, prioritising critical habitat offsets by combining the maximum extent of critical (1,682.46 ha) and core (1,211.55 ha) black-throated finch habitat to meet the Stage 2 offset requirement for critical black-throated finch habitat. This is in line with the approach applied on MDW for Stage 1 black-throated finch offsets (described in Appendix I).

Table 13: Offset availability by habitat type on Property 1

	Critical habitat (core habitat within 3 km of water)	Core habitat (important foraging and potential breeding habitat)	Marginal habitat (potential foraging and dispersal habitat)	Total (ha)
Stage 2 impact (ha)	3,079.81	287.77	30.30	3,397.88
Maximum area available on Property 1 (ha)	1,682.46	1,211.55	545.16	3,439.17
% of impact offset based on maximum area available	15.66	192.35	521.20	--
Indicative offset area (ha)	2,893.91 (1,682.46 ha critical + 1,211.55 ha core)	0 *	105.00	2,998.91
% of impact offset based on indicative offset area	29.02	0	100.39	--

* Indicative offset area is zero here because all available core habitat is being used to offset critical habitat (in line with the approach used for Stage 1 black-throated finch habitat on MDW, see Appendix I).

5.5.3 Property 2

Property 2 is a 34,400-ha cattle grazing property located approximately 30 km west of the Project and approximately 190 km north-west of Clermont. The property is located wholly within a priority 1 designated GBOS area and within the Desert Uplands bioregion in the CTRC LGA. Property 2 consists almost entirely of remnant vegetation dominated by eucalypt woodlands. A desktop assessment identified approximately 14,148 ha of potential habitat for the black-throated finch on the property. Extensive areas of critical, core and marginal habitat for the black-throated finch have also been identified on Property 2. Additionally, the black-throated finch has been recorded on a number of occasions on the property, most commonly in fairly dense and tall native grasslands in close proximity to water. Studies of the species on the property have been undertaken by a University PHD candidate; however, the results of the studies have not yet been obtained.

Adani commenced landholder engagement in February 2014 and a preliminary property assessment was undertaken by CO2 Australia on behalf of Adani. At that time the property was drought affected and in areas showed signs of severe erosion caused by overgrazing. Large populations of feral pigs were observed, as well as, around heavily disturbed areas, dense infestations of the weed species parthenium (*Parthenium hysterophorus*). Based on this assessment, there is considerable potential to improve the quality of habitat for the black-throated finch through delivery of an offset on Property 2.

The assessment indicates that there is enough habitat available on Property 2 to acquit Stage 2 offset requirements for black-throated finch. *Offsets Assessment Guides* are included in Appendix H. Table 14 shows:

- the maximum area of each black-throated finch habitat types available for offsets on Property 2
- the indicative offset area for each habitat type, combining the maximum available extent of critical black-throated finch habitat (878 ha) with a portion of the available core black-throated finch habitat (7,250 ha) to meet the Stage 2 offset requirement for critical black-throated finch habitat. This is consistent with the approach applied on MDW for Stage 1 black-throated finch impacts described in Appendix I.

Table 14: Offset availability by habitat type for the black-throated finch on Property 2

	Critical habitat (core habitat within 3 km of water)	Core habitat (important foraging and potential breeding habitat)	Marginal habitat (potential foraging and dispersal habitat)	Total (ha)
Stage 2 impact (ha)	3,079.81	287.77	30.30	3,397.88
Maximum area available on Property 2 (ha)	878.71	19,739.02	2,665.48	23,283.21
% of impact offset based on maximum area available	9.35	2,662.95	2,184.30	--
Indicative offset area (ha)	8,128.71 (878.71 ha critical + 7,250.00 ha core)	750.00	123.00	9,001.71
% of impact offset based on indicative offset area	100.74	101.18	100.80	--

5.5.4 Property 3

Property 3 is a cattle grazing property located to the south-west of the Project. The property is located wholly within a priority 1 designated GBOS area and within the Desert Uplands bioregion in the IRC LGA. Most of the property consists of least concern remnant vegetation and contains significant areas of known habitat for the black-throated finch.

The suitability of the habitat on the property was confirmed during surveys by GHD in October 2013, although the condition of the habitat varied from poor to good quality. The poorer quality areas have been subjected to heavy grazing. A desktop assessment of critical, core and marginal habitat identified extensive areas of each on Property 3. Several black-throated finch individuals were also recorded during the preliminary surveys. Additionally, records of the finch on the property are noted on the DAWE Species Profile and Threats Database (SPRAT), Wildlife Online and surveys undertaken by Birdlife Southern Queensland.

Assessment indicates that there is enough habitat available on Property 3 to acquit Stage 2 offset requirements for black-throated finch. *Offsets Assessment Guides* are included in Appendix H. Table 15 shows:

- the maximum area of each black-throated finch habitat types available for offsets on Property 3
- the indicative offset area for each habitat type to meet the Stage 2 offset requirement for critical, core and marginal black-throated finch habitat.

Table 15: Offset availability by habitat type for the black-throated finch on Property 3

	Critical habitat (core habitat within 3 km of water)	Core habitat (important foraging and potential breeding habitat)	Marginal habitat (potential foraging and dispersal habitat)	Total (ha)
Stage 2 impact (ha)	3,079.81	286.96	30.30	3,397.07
Maximum area available on Property 3 (ha)	16,914.88	37,656.36	3,092.12	57,663.36
% of impact offset based on maximum area available	179.96	5,080.14	2,533.93	--
Indicative offset area (ha)	9,500.00	750.00	123.00	10,373
% of impact offset based on indicative offset area	101.07	101.18	100.93	--

5.5.5 Property 4

Property 4 is a 19,000-ha leasehold property located to the west of Moranbah. The property is located within the IRC LGA and is currently used for cattle grazing.

The property is located on the boundary of the Desert Uplands and Brigalow Belt bioregions and is mapped within a priority 2 designated area under GBOS. The property consists of a mixture of endangered, of concern and least concern remnant vegetation and category X areas which contain vegetation not regulated under the VM Act.

A desktop assessment has been undertaken to determine the biodiversity offset potential of Property 4.

Assessment shows that Property 4 could be suitable to acquit a portion of the Stage 2 offset requirement for Brigalow TEC (Table 16). The availability of Brigalow TEC on Property 4 will be confirmed through field surveys. *Offsets Assessment Guides* are included in Appendix H.

Table 16: Indicative offset availability on Property 4

Environmental value	Available habitat area on property (ha)	Stage 2 offset area required (ha)	Shortfall (ha)
Brigalow TEC (11.3.1, 11.4.8, 11.4.9; BVG 25a)	126.24	727.37	601.13

5.5.6 Property 5

Property 5 is a leasehold property located approximately 125 km west of Moranbah. The property is in the Brigalow Belt bioregion within the IRC LGA. The current primary land use on Property 5 is cattle grazing. The property consists of a mixture of endangered, of concern and least concern remnant vegetation and category X areas which contain vegetation not regulated under the VM Act. The western portion of the property is mapped within priority 2 designated area under the GBOS.

A desktop assessment has been undertaken to determine the biodiversity offset potential of Property 5. Assessment shows that Property 5 could be suitable to acquit all of the Stage 2 offset requirement for Brigalow TEC (Table 17). The availability of Brigalow TEC on Property 5 will be confirmed through field surveys. *Offsets Assessment Guides* are included in Appendix H.

Table 17: Indicative offset availability on Property 5

Environmental value	Available habitat area on property (ha)	Stage 2 offset area required (ha)	Total area to be secured (ha)	Shortfall (ha)
Brigalow TEC (11.3.1, 11.4.8, 11.4.9; BVG 25a)	1,193.80	727.37	727.37	0.00

5.5.7 Property 6

Property 6 is a freehold property located approximately 130 km west of Moranbah. The property is in the Brigalow Belt bioregion within the IRC LGA. The current primary land use on Property 6 is cattle grazing. The property consists of a mixture of endangered, of concern and least concern remnant vegetation and category X areas which contain vegetation not regulated under the VM Act. The western portion of the property is mapped within priority 2 designated area under the GBOS.

A desktop assessment has been undertaken to determine the biodiversity offset potential of Property 6. Assessment shows that Property 6could be suitable to acquit a portion of the Stage 2 offset requirement for Brigalow TEC (Table 18). The availability of Brigalow TEC on Property 6 will be confirmed through field surveys. *Offsets Assessment Guides* are included in Appendix H.

Table 18: Indicative offset availability on Property 6

Environmental value	Available habitat area on property (ha)	Stage 2 offset area required (ha)	Shortfall (ha)
Brigalow TEC (11.3.1, 11.4.8, 11.4.9; BVG 25a)	189.01	727.37	583.36

5.6 OFFSETS FOR SEISMIC SURVEY ACTIVITIES

In accordance with Condition 20 (d) of the Project's EPBC Act approval, Adani has identified 115 ha of black-throated finch habitat to be legally secured within two years of commencement of seismic survey activities, plus an additional 16.33 ha to offset seismic survey disturbance during later stages of the Project (Adani 2015). This offset area is located within the Stage 1 offset area on MDW as illustrated in Figure 19. This offset will be delivered in accordance with the process for offset delivery as presented in Section 6.1, which includes details of offset management, monitoring and security.

5.7 GREAT ARTESIAN BASIN OFFSET STRATEGY

The EPBC Act approval (Condition 11(k)) requires Adani to design and deliver a GAB Offset Strategy, including implementation of an annual Great Artesian Basin offset measure that returns at least 730 mega litres per annum for five years[8] to offset the predicted annual water take associated with the Project. Condition 11(l) requires this to be developed in consultation with the Queensland Government Department of Resources (DoR; formerly the Department of Natural Resources, Mines and Energy [DNRME]).

In November 2014, Adani met with relevant Department of Resources representatives who provided extensive advice regarding the approach for meeting the conditions via an environmental auction program. Advice was consequently sought from CSIRO (Ecosystem Sciences) as the leading environmental auction experts in Australia. From 1999 to 2014 the Commonwealth Government ran a program called the Great Artesian Basin Sustainability Initiative (GABSI). The Commonwealth also recently announced a smaller, shorter program extension to 2017. The GABSI aims to repair uncontrolled artesian bores and replace open earthen bore drains with piped water reticulation systems. The GABSI was delivered through State agencies.

Adani has worked with CSIRO to develop the GAB Offset Strategy (CSIRO 2016), modelled on the GABSI, and the strategy received Commonwealth approval on 18 August 2016. The GAB Offset Strategy will directly reduce extraction rates from the GAB by reducing artesian groundwater extraction through capping free flowing artesian bores to reduce flows and piping artesian bore drains to reduce consumption from capped bores. The GAB Offset Strategy addresses EPBC Act approval conditions 9, 10, 11(k) and 11(l).

5.8 MITIGATION AREAS

Figure 20 shows that there are approximately 2,700 ha located on Moray Downs within the proposed mining lease that are not likely to be impacted by the Project. Based on the results of fieldwork undertaken for the off-lease and mine impact areas (GHD 2013a, b; Eco Logical Australia 2014a), and given their location adjacent to the MDW offset areas, these areas are likely to provide potential habitat for a range of species, including the black-throated finch. Whilst these areas are not included in the BOS as offset areas due to conflicting tenure, they do offer indirect offset benefits in being adjacent to the proposed offset areas and in not being directly impacted by mining activities. Adani proposes to manage these areas in a manner consistent with the adjacent offset areas.

[8] From the commencement of excavation of the first box cut.

146°10'0"E

146°20'0"E

146°30'0"E

21°50'0"S

22°0'0"S

22°10'0"S

Adani Mining Pty Ltd - Carmichael Coal Mine and Rail Project

Location diagram

Figure 19
Seismic survey offset area for black-throated finch Moray Downs West

- Moray Downs
- Stage 1 CCMR MDW offset area
- NGBR MDW offset area
- Surplus offset area
- Indicative seismic survey offset area
- BTF records

Black-throated finch habitat

- Critical habitat
- Core habitat
- Marginal habitat

DATA SOURCE:
Offset value data: Ecological Australia Pty Ltd (2014)
The following datasets are © State of Qld:
- Cadastral data

Date: 5/14/2021 Coordinate System: GDA 1994 MGA Zone 55 Projection: Transverse Mercator Datum: GDA 1994 Scale: 1:150,000@A3

0 2 4 6 8
Kilometres

N

CO2 Australia

146°10'0"E
146°20'0"E
146°30'0"E
21°50'0"S
22°0'0"S
22°10'0"S

794 ha

324 ha

Adani Mining Pty Ltd - Carmichael Coal Mine and Rail Project

Figure 20
Mitigation areas

- CCMR project footprint
- Other areas of potential value
- Stage 1 CCMR MDW offset area
- NGBR MDW offset area
- Surplus offset area

Location diagram

DATA SOURCE:
The following datasets are © State of Qld:
Project footprint provided by Adani (January 2019)

Date: 5/24/2021 Coordinate System: GDA 1994 MGA Zone 55 Projection: Transverse Mercator Datum: GDA 1994 Scale: 1:150,000@A3

0 2 4 6 8
Kilometres

N

CO2 Australia

5.9 FINANCIAL SETTLEMENT OFFSETS

Adani proposes to address the offset requirement for MSES RE 11.4.6 (BVG 26a) via a financial settlement offset. Table 19 shows the estimated financial settlement amounts for Stage 1 and Stage 2 offset delivery for BVG 26a, calculated using the Queensland Government's online financial settlement offset calculator[9].

Table 19: Estimated financial settlement offset payment for RE 11.4.6 (BVG 26a)

Payment details	Stage 1 offset delivery	Stage 2 offset delivery [B]
	Mining operations North of the Carmichael River	Mining operations South of the Carmichael River
Impact area (ha) [A]	5.24	220.29
Total offset area from calculator (ha)	20.96	881.16
On ground cost	$83,840.00	$2,743,480.00
Landholder incentive payment	$10,000.00	$272,290.39
Administrative cost	$50,000.00	$685,870.00
Total financial payment	**$143,840.00**	**$3,701,640.39**

[A] Calculated March 2021. See section 4.2.
[B] Stage 2 financial settlement offset payment are estimates only - the financial settlement offset payment calculator is subject to changes by Queensland Government from time to time.

[9] Queensland Government - Financial settlement offset calculator.

6 IMPLEMENTATION AND REVIEW

6.1 OFFSET DELIVERY

Outlined in this section are the tasks that Adani commits to undertake for offset delivery Stages 1 and 2 in accordance with the Project's EPBC Act approval and Coordinator-General's Report. Adani is wholly responsible for the implementation, monitoring and review of this BOS which will be undertaken by personnel qualified in environmental management and supplemented with expert advice via consultants. Adani will continue to engage suitably qualified and experienced persons to monitor, review, and implement the BOS in accordance with Condition 11 (g) of the EPBC Act approval. For the purposes of this BOS and the OAMPs, 'suitably qualified and experience persons' means:

"persons who have professional qualifications, training, skills or experiences related to the nominated subject matter and can give authoritative assessment, advice and analysis on performance relative to the subject matter using the relative protocols, standards, methods or literature."

An overview of tasks, indicative timing (along with the timing of commencement and completion of each Project component) and responsibility for implementation is given in Section 6.1.5, Table 23.

6.1.1 Detailed assessments of offset properties and landholder negotiations

Stage 1 offset delivery

The Adani owned MDW offset area is the priority offset property for Stage 1 offset delivery (see Section 5.4). A timeline of the MDW landholder engagement and field surveys to date is provided below:

- Moray Downs was purchased by Adani in November 2011.
- Decision was made to exclude mining from the western section of the property and propose this area as an offset for the project (MDW offset area).
- Preliminary assessments undertaken of the MDW offset area from 29 June to 5 July 2015, to collate initial information on offset management issues.
- Detailed field ecological assessment of the MDW offset area completed between 16 and 19 October 2017, to support OAMP preparation.
- The Offset Agreement with Adani was executed on 28 February 2018.
- The MDW offset area approved as part of the BOS (version 3) was legally secured through a Voluntary Declaration on 22 April 2020.
- Additional detailed field surveys were completed between 3 and 7 August 2020 within the eastern most portion of MDW offset area (West Obangeena paddock).

Stage 2 offset delivery

In accordance with the staged approach to offset delivery (see Section 3) and the process for BOS update (see Section 6.2), Adani continues to explore potential offset properties for Stage 2 offset delivery (see Section 5.5). This will include detailed property assessments and identification of potential risks/threatening processes and management requirements, as appropriate. The results of these assessments will be used to refine the options for Stage 2 offset delivery.

As detailed in Section 6.2, the BOS will be reviewed before commencement of each offset delivery stage (see Table 4). If there is deviation in from the approved minimum offset areas required for MNES, or the impacts on MSES, Adani will update the BOS and seek approval, to ensure that the BOS (and offset requirements) are based on actual impacts.

If it is not possible to acquit offsets using the properties outlined in this BOS, Adani will continue to investigate other offset options according to the process of strategic analysis outlined in Section 5.1, and that information will be incorporated into the BOS at such time that BOS update is required in accordance with the process discussed in Section 6.2. For example, prior to Stage 2 offset delivery, Adani will update the BOS (see Section 6.2) and to ensure offset obligations are met (for Stage 1 and Stage 2).

6.1.2 Development of OAMPs

Adani has prepared and submitted the MDW OAMP in accordance with condition 13 of the EPBC Act approval to guide the ongoing management of the MDW offset area for Stage 1 offset delivery. The MDW OAMP (version 2b) was subsequently approved on 19 September 2019 by the Commonwealth Government. Adani will update the approved MDW OAMP to include the expansion of the MDW offset area, specifically the easternmost portion of the MDW offset area providing offsets for Brigalow TEC. In accordance with condition 13 of the EPBC Act approval the updated MDW OAMP has been submitted to the Commonwealth Government within four months of approval of this BOS since the MDW offset area has increased in size from the proposed offsets in the originally approved BOS (version 3). Any amended OAMP will also be submitted to the relevant administering authority (DES) for approval as required in accordance with the relevant Queensland Project approval conditions.

The OAMP is based on the principles of adaptive management as illustrated in Figure 21 and includes:

- a map of the offset area, including GPS points
- the type and location of MNES and MSES to be offset, including the area of primary habitat for each EPBC Act listed threatened species and community
- a detailed baseline description of offset areas, including:
  - results of surveys undertaken
  - condition of existing MNES and MSES and their habitats
  - connectivity with other habitat areas and biodiversity corridors
  - the results of ecological equivalence assessments
- the management objectives and outcomes to achieve a conservation outcome for the impacted MNES and MSES
- activities that will be undertaken to achieve the management objectives and outcomes
- a table of specific goals and associated timeframes for management measures with criteria for assessing the success of management measures, and corrective measures to be implemented if criteria are not met
- a monitoring and reporting program
- estimated time until the offset management objectives and outcomes will be achieved, and

- identification of all registered interests including mortgages, leases, subleases, covenants, easements and building statements, that have been registered on title under the Queensland *Land Act 1994* and *Land Title Act 1994*.

Management actions for offset areas are based on detailed site assessments and aligned with the key threats and recommended priority actions for each species and community as listed in recovery plans, threat abatement plans and conservation advices. Key threats and management recommendations for species and communities, and how these are addressed in the OAMP, are listed in Table 20. Site- and species-specific details for management are defined in the OAMP, developed in consultation between Adani, the landholder and the regulators.

Implementation of the MDW OAMP commenced in all offset areas on the property from the commencement of offset delivery Stage 1. Other OAMPs will be developed and implemented in accordance with the staged approach to offset delivery.

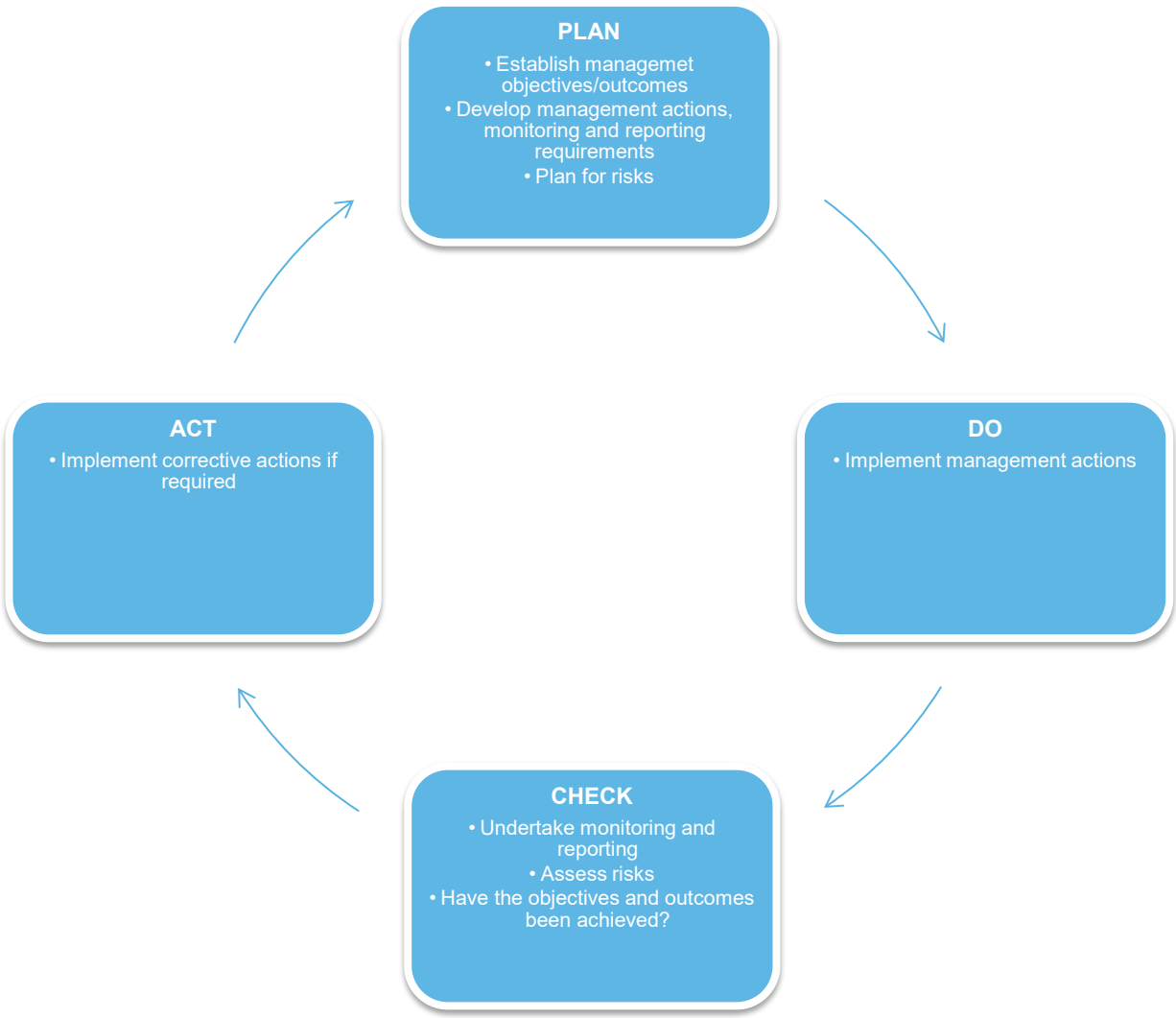


Figure 21: Process for adaptive implementation of the OAMP

Offset management

Based on detailed site assessments, Adani has developed management actions for the offset areas in accordance with the key threats and recommended priority actions for each offset matter, as listed in relevant recovery plans, threat abatement plans and conservation advices. Table 20 summarises these relevant documents, to clearly identify current knowledge and understanding with regards to key threatening processes specific to each MNES, and the types of management actions that these documents have identified as suitable and appropriate with respect to mitigating and managing those threats. This is not intended to be an exhaustive list of individual requirements; it is intended to demonstrate the significance of how this material will be incorporated into the OAMP activities. Property and species-specific details for management are defined in detail in the respective OAMPs.

For example, where a diverse range of threatened species will be managed as part of an OAMP, the suite of management actions required to address threats is complex. To avoid the potential for conflicting management actions (e.g. where some actions are favourable for one species and detrimental to others), a spatial mosaic of management actions is required, informed by the results of ongoing monitoring activities refining the known or likely distributions of protected matters.

Offset areas for Stage 2 offset delivery will be managed accordingly.

Offset Monitoring

For the purpose of meeting the relevant requirements for inclusion of monitoring details in the BOS, a high-level overview of the proposed monitoring approach is presented in Table 21.

The approaches outlined in Table 21 have been identified in accordance with recognised survey guidelines and other relevant documents, and best practice and relevant methods outlined in the MNESMPs (see Section 2.3). Monitoring activities will include habitat quality assessments, photo monitoring, weed surveys, pest animal surveys, targeted flora and fauna surveys, biomass monitoring, ground cover and erosion monitoring and general inspections of fencing, access tracks and firebreaks. Site- and species-specific monitoring measures will be developed as part of the individual OAMPs, in consultation between Adani, the landholders and regulators.

A detailed monitoring program, developed as part of each OAMP, will:

- assess how the offset area is tracking against interim performance targets and completion criteria
- identify any potential risks to achieving the objectives and outcomes of the OAMP
- inform the implementation of corrective actions
- identify when the objectives and outcomes have been achieved.

As part of the OAMPs, regular reports will be prepared and submitted to the relevant administering authority detailing the progress of the offset area in achieving the offset area performance criteria including, but not limited to, the management actions implemented for the relevant management period, results of monitoring events and any corrective actions undertaken.

Information provided in the OAMP annual reports will also be used by Adani to address compliance with the relevant conditions of the EPBC Act approval, including implementation of any management plans, reports or strategies as specified in the conditions in accordance with the condition 31 of EPBC 2010/5736 (see Section 6.1.4).

Table 20: Recovery Plans, Threat Abatement Plans, Conservation Advices or other documents relevant to this BOS and OAMPs

Recovery Plan (RP)	Threat Abatement Plan (TAP)	Conservation Advice (CA) or other relevant document/s
Black-throated finch (southern)		
▶ National RP for the black-throated finch southern subspecies *Poephila cincta cincta* (BTFRT 2007) identified threats as inter alia, clearing and fragmentation of habitat, degradation of habitat by domestic stock and rabbits, alteration of habitat by changes in fire regime, weed invasion and predation by feral predators. ▶ Relevant OAMPs will be consistent with the RP by incorporating management actions addressing relevant identified threats to the black-throated finch, including: – minimising degradation of habitat by domestic stock by removal and/or reduction of cattle – control of feral pest animals (e.g. rabbits, feral cats and foxes) – controlling invasion of habitat by exotic weed species, including exotic grasses by implementing a weed control program – development and implementation of a fire management plan.	▶ TAP for competition and land degradation by rabbits (DEE 2016) identified black-throated finch (southern) as a species that may be adversely affected by competition and land degradation caused by rabbits (*Oryctolagus cuniculus*). OAMP will be consistent with the goals and objectives of the TAP, as ongoing management of the offset areas, including rabbit control, will promote the maintenance and recovery of native species affected by rabbit competition and land degradation. ▶ TAP to address 'Ecosystem degradation, habitat loss and species decline due to invasion of northern Australia by introduced gamba grass (*Andropogon gayanus*), para grass (*Urochloa mutica*), olive hymenachne (*Hymenachne amplexicaulis*), mission grass (*Cenchrus polystachios syn. Pennisetum polystachion*) and annual mission grass (*Cenchrus pedicellatus syn. Pennisetum pedicellatum*)'. The Department of Sustainability, Environment, Water Population and Communities (DSEWPaC 2012) identified the black-throated finch as a threatened species under immediate threat from the five listed grasses. The OAMP will include weed control measures and weed hygiene practices to prevent the establishment of these species in the offset areas and if present control and reduce infestations consistent with the objectives and actions of the TAP.	▶ The Species Profile and Threats Database (SPRAT) identifies that CA is not available (DoE 2019b). ▶ Project has developed a Black-throated Finch Management Plan (BTFMP) (Eco Logical Australia 2019b) to guide the management of direct and indirect Project-related impacts on black-throated finch. The BTFMP includes a Research Program designed to increase the knowledge of the species' ecological requirements, biology and range. The relevant OAMPs will be consistent with the management plan and be informed by the outcomes of the research program.
Squatter pigeon (southern)		
▶ SPRAT (Department of the Environment [DoE] 2019f) identifies that a RP is not available and not required.	▶ SPRAT identifies three TAPs as relevant for squatter pigeon:	▶ CA (Threatened Species Scientific Committee 2015) identifies threats to the species include ongoing clearance of habitat for farming or development

Recovery Plan (RP)	Threat Abatement Plan (TAP)	Conservation Advice (CA) or other relevant document/s
	– TAP for competition and land degradation by rabbit (Commonwealth of Australia 2016) – TAP for predation by feral cats (DoE 2015) – TAP for predation by European red fox Department of Environment, Water, Heritage and the Arts [DEWHA] 2008a). ▶ Relevant OAMP(s) will be consistent with these TAPs via: – promoting maintenance and recovery of native species affected by rabbit competition and land degradation; and, – limiting opportunities for the entry of tramp ants, with ongoing management incorporating passive surveillance, inspection and treatment of any tramp ants identified within offset areas.	purposes, grazing of habitat by livestock and feral herbivores and predation by feral cats and foxes. ▶ Relevant OAMP(s) will be consistent with CA via: – minimising degradation of habitat by removal and/or reduction of stock (e.g. cattle) – control of feral pest animals (e.g. feral cats and foxes); and, – controlling invasion of habitat by exotic weed species, including exotic grasses by implementing a weed control program.
Ornamental snake		
▶ SPRAT (DoE 2019d) identifies that a RP is not available and not required for the ornamental snake, and that the approved conservation advice for the species provides sufficient direction to implement priority actions and mitigate against key threats. ▶ However, SPRAT notes the Draft National Recovery Plan for the Queensland Brigalow Belt Reptiles (Richardson 2008) as relevant management documentation for ornamental snake. The relevant OAMPs will be consistent with the Draft RP via: – preventing habitat loss through clearing – minimising degradation of habitat by domestic stock by removal and/or reduction of cattle	▶ SPRAT notes that no TAP has been identified as relevant for ornamental snake, but refers to three TAPs as relevant management documentation for the species: – TAP for predation by feral cats (DoE 2015) – TAP for predation by the European red fox (DEWHA 2008a) – TAP for predation, habitat degradation, competition and disease transmission by feral pigs Department of the Environment and Heritage [DEH] 2005) – These TAPs do not specifically mention ornamental snake. Notwithstanding, ongoing pest animal management of the offset areas will be implemented to control inter alia, feral cats, foxes and feral pigs.	▶ CA (DoE 2014a) identifies threats as habitat degradation in the Brigalow Belt, as well as destruction of wetland habitat and associated destruction of frog habitat, especially by pigs. ▶ Relevant OAMPs will be consistent with CA via: – incorporating areas of gilgai and clay soils of Brigalow and Gidgee REs as well as riparian habitats of the Carmichael River as part of offset areas; and, – minimising degradation of Brigalow and Gidgee habitat by removal and/or reduction of stock (e.g. cattle); – control/monitoring of feral pest animals (e.g. pigs and cane toads).

Recovery Plan (RP)	Threat Abatement Plan (TAP)	Conservation Advice (CA) or other relevant document/s
– control of feral pest animals (e.g. rabbits, feral cats and foxes) – controlling invasion of habitat by exotic weed species, including exotic grasses by implementing a weed control program – development and implementation of a fire management plan.		
Yakka skink		
▶ SPRAT (DoE 2019e) identifies that a RP is not available and not required for the yakka skink, and that the approved conservation advice for the species provides sufficient direction to implement priority actions and mitigate against key threats. ▶ However, SPRAT notes the Draft National Recovery Plan for the Queensland Brigalow Belt Reptiles (Richardson 2008) as relevant management documentation for yakka skink. The relevant OAMP will be consistent with the Draft RP via: – preventing habitat loss through clearing – minimising degradation of habitat by domestic stock by removal and/or reduction of cattle – control of feral pest animals (e.g. rabbits, feral cats and foxes) – controlling invasion of habitat by exotic weed species, including exotic grasses by implementing a weed control program – development and implementation of a fire management plan.	▶ SPRAT identifies that no TAPs are identified as relevant to the Yakka Skink.	▶ CA (DoE 2014b) identifies threats as land clearing and habitat degradation, inappropriate roadside management, removal of wood debris and rock microhabitat features, ripping of rabbit warrens and predation by feral animals. ▶ Relevant OAMP(s) will be consistent with CA via: – minimising degradation of habitat by removal and/or reduction of stock (e.g. cattle); – development and implementation of a fire management plan to maximise retention of important microhabitat features (e.g. woody debris); – control of pest animals (e.g. feral cats, foxes); and, – considered, non-mechanical approach for control of rabbits and their warrens in vicinity of known Yakka Skink colonies.

Recovery Plan (RP)	Threat Abatement Plan (TAP)	Conservation Advice (CA) or other relevant document/s
Waxy cabbage palm		
▶ SPRAT (DoE 2019a) identifies that a RP is not available for the waxy cabbage palm.	▶ SPRAT identifies that no TAPs are identified as relevant to the waxy cabbage palm.	▶ CA (Department of the Environment, Water, Heritage and the Arts, 2008b) identifies threats as fire, trampling and grazing by stock and clearing for agricultural development, with potential threats including dams that affect water level and flow in the area of occurrence and the introduction of invasive weeds. ▶ Relevant OAMP(s) will be consistent with CA via: – minimising degradation of habitat by removal and/or reduction of stock (e.g. cattle) – development and implementation of a fire management plan.
Brigalow TEC		
▶ SPRAT (DoE 2019c) identifies that a RP is not available for the Brigalow ecological community.	▶ TAP for the biological effects, including lethal toxic ingestion, caused by cane toads (DSEWPaC 2011a). – Whilst SPRAT acknowledges that feral pigs are the most widespread and problematic pest animal in Brigalow country, cane toads are also noted as a pest animal (DoE 2019c). – The TAP also notes that it is not currently possible to contain or eradicate cane toads. Therefore, relevant OAMPs will align with the TAP through monitoring of cane toad presence/abundance in offset areas.	▶ CA (DoE 2013) identifies threats as clearing, fire, weeds, feral animals and inappropriate grazing. ▶ Relevant OAMPs will be consistent with the CA via: – minimising degradation of habitat by removal and/or reduction of stock (e.g. cattle) – control of feral pest animals (e.g. pigs, goats, cats, foxes and cane toads) – controlling invasion of habitat by exotic weed species, including exotic grasses by implement a weed control program – development and implementation of a fire management plan to exclude fire from areas of Brigalow.

Table 21: Monitoring measures relevant to the OAMPs

Monitoring measure		Description	Relevant guideline/methodology	Timing
Habitat quality assessments		▶ Assessed generally in accordance with the GTDTHQ (which is based on the BioCondition Assessment Manual).	GTDTHQ Version 1.2 (DEHP 2017).	Year 1 and year 2, followed by assessments every 2 years up to the end of the management period.
Photo monitoring		▶ Permanent photo-monitoring sites will be established to enable visual assessment of changes over time. Site locations will be recorded using GPS. ▶ Photos are to be taken from each end of the BioCondition transect looking down each transect.	Photos at each photo monitoring point will be taken in a north, east, south and westerly direction. A record of the photographs will be maintained, including GPS co-ordinates, date and time of each photograph and the direction in which the photograph was taken.	Year 1 and year 2, followed by assessments every 2 years up to 10 years, and then every 5 years up to the end of the management period.
Pest animal surveys		▶ Pest animal survey to assess species present, distribution and density across offset area. A distribution and density map will be produced following the year 1 survey.	Species-specific control methods as applicable.	Year 1 survey at the end of the wet season.
		▶ Ongoing pest animal surveys to assess the effectiveness of pest animal control.		Annually at the end of the wet season.
Weed surveys		▶ Year 1 weed survey to map the distribution and abundance of weed infestations.	▶ NSW Guidelines for Monitoring Weed Control and recovery of native vegetation (Auld 2009). ▶ Photo monitoring of selected sites to assess visual changes in weed species and infestations over time. ▶ The use of precision unmanned aerial vehicles (drone) technology, aerial imagery and/or remote sensing.	Year 1 survey at the end of the wet season.
		▶ Ongoing weed surveys to assess the effectiveness of weed control.		Annually at the end of the wet season.
Targeted fauna surveys	Black-throated finch (southern)	Monitoring of black throated finch populations, habitat condition and watering points including: ▶ water source watches ▶ active searches	Survey guidelines for Australia's threatened birds. EPBC Act survey guidelines 6.2 (DEWHA 2010).	Biannually for the first 10 years, then annually for the next 10 years with a review of the timing to be undertaken in year 20 to

Monitoring measure		Description	Relevant guideline/methodology	Timing
		▶ incidental observations ▶ remote cameras ▶ vegetation condition assessments ▶ habitat quality assessments ▶ weekly watering point inspections.	National recovery plan for the Black-throated finch southern subspecies (*Poephila cincta cincta*) (BTFRT 2007).	assess the progress towards achieving the completion criteria and determine the required timing for monitoring for the remaining life of the EPBC Act approval.
	Ornamental snake	▶ Nocturnal surveys during periods of frog activity (i.e. after rainfall events between September to April) in suitable habitat, including: – gilgai habitat with an overstorey of brigalow (*Acacia harpophylla*); and, – fringing vegetation along watercourses such as the Carmichael River. ▶ Diurnal searches in suitable habitat under sheltering sites (rocks, logs or other large objects on the ground). ▶ In order to determine the efficacy of management actions (e.g. control of cattle, pest animals and weeds), areas of suitable habitat will be surveyed for: – the presence of frog populations, including known prey species (*Litoria* spp. and *Cyclorana* spp.); – evidence of stock and pest animal species, including cattle, pigs, goats, cats, foxes and cane toads; and, – presence of exotic weed species, including exotic grasses, within permanent grass monitoring plots.	Survey guidelines for Australia's threatened reptiles. EPBC Act survey guidelines 6.6 (DSEWPaC 2011b).	With habitat quality assessments.
	Squatter pigeon (southern)	▶ Land-based area searches, transect searches or flushing surveys in areas less than 50 ha in suitable habitat areas, identified as areas of eucalypt woodland with short, grassy understorey near permanent water. ▶ Area surveys or transect surveys with a minimum survey effort of 15 hours over 3 days; and, ▶ Flushing surveys with a minimum survey effort of 10 hours over 3 days.	Survey guidelines for Australia's threatened birds. EPBC Act survey guidelines 6.2 (DEWHA 2010).	With habitat quality assessments.

Monitoring measure		Description	Relevant guideline/methodology	Timing
		▶ In order to determine the efficacy of management actions (e.g. control of cattle, pest animals and weeds), areas of suitable habitat will be surveyed for: – evidence of stock and pest animal species, including cattle, pigs, goats, cats, foxes, cane toads and tramp ants; and, – presence of exotic weed species, including exotic grasses, within permanent grass monitoring plots.		
	Yakka skink	▶ Detectability and activity are greatest during warmer months (from mid-September), coinciding with those times of the year characterised by reduced ground cover. ▶ Active searching for burrow systems and communal defecation sites, supplemented by distant observation with binoculars or spotlighting down burrows at night. ▶ Elliott trapping around suspected burrows can be undertaken to confirm identification. ▶ In order to determine the efficacy of management actions (e.g. control of cattle, pest animals, weeds and fire), areas of suitable habitat will be surveyed for: – evidence of stock and pest animal species, including cattle, cats, foxes and rabbits; – presence of exotic weed species, including exotic grasses, within permanent grass monitoring plots; – spatial extent of any wildfire or fire management.	Survey guidelines for Australia's threatened reptiles. EPBC Act survey guidelines 6.6 (DSEWPaC 2011b). Targeted species survey guidelines – Yakka Skink *Egernia rugosa* (Ferguson & Mathieson 2014).	With habitat quality assessments.
Targeted flora and vegetation surveys	Brigalow threatened ecological community	▶ Assessed generally in accordance with the Guide to Determining Terrestrial Habitat Quality (which is based on the BioCondition Assessment Manual).	Guide to Determining Terrestrial Habitat Quality Version 1.2 (DEHP 2017).	With habitat quality assessments.
	Waxy cabbage palm	Population surveys: ▶ actively search all suitable habitats within the survey area, defined as both main banks, including instream channels, and adjacent pools. The search area extends	No specific guideline or survey methodology. Survey methodology consistent with Pettit & Dowe, 2016).	Assessment in year 1, with follow-up surveys every five years.

Monitoring measure		Description	Relevant guideline/methodology	Timing
		out of the alluvial bank until individuals are no longer observed. ▶ note the key attributes where *Livistona lanuginosa* are encountered: – spatial location using differential GPS – life-stage category – average number of individuals (in that life-form) within 5 m radius – height (m). ▶ note key features of habitat condition i.e. weeds, pests, erosion.		
		Habitat condition surveys: ▶ transect survey: – number of individuals classified by life-stages – height (m) – condition of individuals (evidence of poor health including evidence of fire damage, erosion or drought stress) – presence and abundance of weeds and evidence of pests – habitat condition assessed in accordance with the GTDTHQ		Year 1 and year 2, followed by assessments every 2 years.
Biomass		▶ Biomass monitoring for fire management is required to be undertaken to determine the risk of fire to the offset area and inform fire management strategies. It will also be used to inform grazing management decisions, including the duration of strategic grazing events and number of cattle grazed in the offset areas. Biomass monitoring will be undertaken prior to any strategic grazing event. Biomass is at its greatest at the end of the wet season (around April) and fire risk is greatest towards the end of the dry season (September/October).	Department of Natural Resources, Queensland GRASS Check – Grazier Rangeland Assessment for Self-Sustainability DNRQ97002, Second edition-revised methodology.	Twice every year at the end of the wet season (March/April) and towards the end of the dry season (October).

Monitoring measure	Description	Relevant guideline/methodology	Timing
Monitoring groundcover for erosion control	▶ Groundcover assessments will be undertaken to provide an indication of the potential for erosion. Erosion prone areas will also be monitored during strategic grazing events and following significant weather events (i.e. flooding).	Groundcover within the offset areas will be monitored annually using the Level 1 monitoring (as described in the 'Land Manager's Monitoring Guide – Ground cover indicator' (DERM 2010). Level 1 monitoring involves a visual assessment of percentage ground cover by making several observations while driving or walking around assessment area.	Annually.
General inspections	▶ Inspections are required throughout the offset area at least annually to assess: – condition of fencing – condition of access tracks – condition of firebreaks – stray stock – areas of erosion – damage/degradation resulting from pest animals – assessment of all works conducted in the period since the previous inspection. ▶ Opportunistic visual inspections to assess the above should also be undertaken when conducting other management actions within the offset areas. Any issues observed should be addressed as soon as possible following identification.	Not applicable.	Inspections will be undertaken at least twice a year, usually at the end of the wet season and the end of the dry season, with one of the inspections occurring prior to the submission of the annual report.

6.1.3 Securing offset areas and commencement of management

Condition 8 of the EPBC Act approval requires that the offset areas be legally secured. The appropriate mechanism for each offset will be determined through negotiation with regulators, Adani and the landholder. Mechanisms include:

- voluntary declaration under the VM Act
- statutory covenant under the *Land Title Act 1994* or the *Land Act 1994*
- nature refuge under the NC Act
- special wildlife reserve under the NC Act

A brief comparison of each legally binding mechanism is provided in Table 22.

Measures to legally secure an offset area are linked to an approved management approach (e.g. an application for a Voluntary Declaration must be accompanied by an approved OAMP, and a nature refuge must be managed in accordance with the declared management intent). Due to the timeframes involved (both Project and regulatory), it is Adani's preference to first secure offsets via Voluntary Declaration under the VM Act (as the mechanism with the shortest timeframe to achieve legal security of the offset areas).

A Voluntary Declaration over the MDW offset area (approved as part of the BOS version 3) for the CCMR Project was certified by the DoR (formerly the DNRME) on 22 April 2020. Approval of the voluntary declaration over the CCMR MDW offset area satisfies the requirement under condition 8 of EPBC 2010/5736 for "Offset for mining operations north of the Carmichael River", "initial offset for underground mining component", and "offset for off lease infrastructure" relevant to Stage 1 offset delivery and requirements under the CCMR Project's Environmental Authority. Following approval of the updated MDW OAMP, the Voluntary Declaration will be extended to include the remainder of the MDW offset area required to acquit the remaining Stage 1 offsets under condition 8 of EPBC 2010/5736 for the CCMR Project.

This process to legally secure the Voluntary Declaration is expected to take a minimum of up to 6 months post approval of the respective OAMP. Adani commenced management of the MDW offset in October 2017 and will commence management of additional offset areas as soon as the updated OAMP is approved.

Under Queensland mining legislation, Adani Mining Pty Ltd as the holder of the Moray Downs Pastoral Lease in which the MDW offset area is located, must be approached by a proponent to carry out any resource (such as coal or gas exploration, production or operation) activities on the pastoral lease. Adani commits to withholding consent for any activities within MDW in contravention with its biodiversity offset obligations under the CCMR and NGBR approvals, legally binding mechanism protecting the offset area, this OAMP and the guiding principles of the Commonwealth and Queensland Environmental Offsets Policies.

Table 22: Legally binding mechanisms for the offset areas

Mechanism	Summary
Voluntary Declaration ▶ *Vegetation Management Act 1999* ▶ Division 4, Subdivision 2 - Declarations by the Chief Executive, sections 19E to 19L	▶ Voluntary mechanism for protecting areas of native vegetation on privately-owned land of high conservation value. ▶ Registered on property title so its associated restrictions and obligations are binding on any subsequent landowner. ▶ Requires implementation of an approved management plan [i.e. offset area management plan; s.19E(2)-(4)]. ▶ Remains in place until the objectives of that plan are achieved, the declaration ends (s.19J and 19L), or in some cases, permanently.

Mechanism	Summary
	▶ Offset area is mapped on a property map of assessable vegetation (PMAV) and given at least the same level of protection as a remnant endangered regional ecosystem under the VM Act. ▶ Simple application process and less costly than other forms of protection such as a statutory covenant. ▶ Enforcement is more certain than a statutory covenant. ▶ Some activities can be exempt from the protection. ▶ Can be removed by the Chief Executive if it is found to be not in the interests of the State, having regard to the public interest. ▶ Timeframe: 6 to 12 months.
Statutory Covenant ▶ Freehold land - *Land Title Act 1994* (Qld), Part 6 Div. 4A ▶ Non-freehold land - *Land Act 1994* (Qld), Chapter 6 Part 4 Div. 8A	▶ Voluntary written agreement between two or more parties that restricts or requires certain activities be carried out upon the land. ▶ Registered on the land title, so the obligations they impose also bind any subsequent purchaser of the land. ▶ For statutory covenants related to environmental offsets, the parties are typically: - The State of Queensland or another entity representing the State or a local government (covenantee) who ensures that the conditions of the statutory covenant are observed, and - The landowner (covenantor) who is subject to the obligations outlined by the covenant which, for an offset, includes complying with restrictions outlined in the offset area management plan. ▶ To be capable of registration under Queensland legislation a statutory covenant must: - relate to the use of a lot or part of a lot; or a proposed or existing building on the lot; or - be aimed directly at preserving a native animal or plant; or a natural or physical feature of cultural or scientific significance; or - ensure that the subject lots are transferred to single ownership only. ▶ A plan of survey is required if covenant affects part of the lot. ▶ Can be expensive due to survey costs as per the Registrar of Titles Directions for the Preparation of Plans. May not be suitable for land with multiple owners. ▶ Can be terminated or amended by agreement of the Government covenantee. ▶ Timeframe: 6 to 12 months.
Nature Refuge ▶ Nature Conservation Act 1992 (Qld) ▶ Part 4, Division 4	▶ Voluntary nature refuge agreement between a landholder and the Government that acknowledges a commitment to manage and preserve land with significant conservation values while allowing compatible and sustainable land uses to continue. ▶ High-level, long-term protection. ▶ Nature Refuges are managed to: - conserve the area's significant cultural and natural resources - provide for the controlled use of the area's cultural and natural resources - provide for the interests of landholders to be considered. ▶ Can allow for the continuation of other land uses including grazing, forestry and mining. ▶ Some landholders may not wish to enter such a long-term agreement.

Mechanism	Summary
	▶ The Queensland Government no longer directly handles the establishment of privately-owned nature refuges. The Queensland Trust for Nature has been appointed by the Queensland Government to facilitate the application process for privately owned nature refuges. ▶ The referral process with the Queensland Government can encounter bottlenecks, which can cause time delays. ▶ Timeframe: 12-24 months.

6.1.4 Compliance reporting

Condition 31 of the EPBC Act approval requires Adani to publish a compliance report on their website[10]. within three months of every 12-month anniversary of the commencement of the action. The reports address compliance with each of the conditions of the EPBC Act approval, including implementation of any management plans as specific in the conditions.

Adani will also prepare a compliance report for the BOS every five years, beginning 2021, for submission to the Commonwealth Minister for the Environment and the relevant State administering authority of the EA. The report will:

- assess the area of MSES and MNES proposed to be impacted by underground mining, open-cut mining, off-lease infrastructure and rail activities
- identify the actual areas of MSES and MNES impacted by the activities based on monitoring results.

6.1.5 Tasks and timeframes for BOS implementation

Table 23 summarises key tasks for BOS implementation, with completion dates/indicative timing and the responsible party. The tasks and indicative timeframes outlined below are subject to change due to a number of variables including regulatory (Queensland and Commonwealth Government) approval of documentation, regulatory requirements, climatic conditions, stakeholder inactivity and other unexpected delays.

Table 23: Tasks and timeframes for BOS implementation

Tasks	Completion Date	Responsible Person
OFFSET DELIVERY STAGE 1 COMMENCES IN 2016		
Mining lease/EA granted	February 2016	DNRME (now DoR)/DEHP (now DES)
BOS approved by Queensland Coordinator-General	7 October 2016	Queensland Coordinator General
BOS approved by Commonwealth Minister for the Environment	26 October 2016	Commonwealth Minister for the Environment
GAB Offset Strategy approved by Commonwealth Minister for Environment	18 August 2016	Commonwealth Minister for the Environment
Submit Moray Downs OAMP for approval	February 2017	Adani
Construction of rail west and off-lease Infrastructure commences	Rail west commenced October 2017	Adani

[10] https://www.bravus.com.au/sustainability/environment/#plans-reports-strategies.

Tasks	Completion Date	Responsible Person
	Off-lease infrastructure commenced November 2019	
Mining operations north of the Carmichael River commence	June 2019	Adani
Commence management of offset areas for offset delivery Stage 1 in accordance with OAMP	September 2019	Adani
Underground Mining Stage 1 commences	10 years from commencement	Adani
MDW OAMP approved	September 2019	Commonwealth Minister for the Environment/Department of Environment and Science
Legally secure MDW Stage 1 offset areas	April 2020	Adani
Update BOS to include revised MDW offset area and submit for approval	December 2021	Adani
Update MDW OAMP based on revised BOS and submit for approval	December 2021	Adani
Approval of revised BOS	February 2022	Commonwealth Minister for the Environment/Queensland Coordinator General/ Department of Environment and Science
Approval of revised MDW OAMP	Early 2022	Commonwealth Minister for the Environment /Department of Environment and Science
Extend MDW Voluntary Declaration to include additional offset area	Mid 2022	Adani
Annual compliance report submitted	Annually 2017 - 2023	Adani
Submit compliance report for the BOS (every five years)	February 2021	Adani
Revise and update BOS prior to commencement of offset delivery Stage 2 and submit to Minister for approval at least three months before commencing offset delivery Stage 2	Late 2023	Adani's consultant
OFFSET DELIVERY STAGE 2 COMMENCES IN 2024		
Revised BOS approved	2024	Commonwealth Minister for the Environment/Queensland Coordinator General/Department of Environment and Science
Prepare OAMPs for offset delivery Stage 2	2024	Adani's consultant
OAMPs approved	2024	Commonwealth Minister for the Environment /Department of Environment and Science
Legally secure Stage 2 offset area/s	2024 (within 6 months of OAMP approval)	Adani

Tasks	Completion Date	Responsible Person
Annual compliance report submitted	Annually 2024 – 2027	Adani
Mining operations south of the Carmichael River and construction of rail east commences	2024	Adani
Commence management of offset areas for offset delivery Stage 2 in accordance with OAMP	Late 2024	Adani
Underground mining Stage 1 is completed	2026	Adani
Submit compliance report for the BOS (every five years)	2026	Adani
Revise and update BOS (based on results of monitoring activities for underground mining Stage 1) and submit to Minister for approval at least three months before commencing offset delivery Stage 3	2027	Adani's consultant
OFFSET DELIVERY STAGE 3 COMMENCES IN 2027 (IF REQUIRED)		
Revised BOS approved	2027	Commonwealth Minister for the Environment/Queensland Coordinator General/Department of Environment and Science
Undertake field surveys of additional offset area/s (only required if there is an offset debit for offset delivery Stage 1 and 2)	2027	Adani's consultant
Annual compliance report submitted	Annually 2027 – 2042	Adani
Underground mining Stage 2 commences	2027	Adani
Finalise additional offset area/s for offset delivery Stage 2 (if required)	2027/2028	Adani
Commence landholder negotiations with owner/s of additional offset area/s (if required)	2027/2028	Adani and/or engaged land broker
Prepare OAMPs for additional offset area/s (if required)	2027/2028	Adani's consultant
Finalise landholder negotiations and contractual arrangements (if required)	2027/2028	Adani and/or engaged land broker
OAMPs approved (if required)	2027/2028	Commonwealth Minister for the Environment/Department of Environment and Science
Submit legally binding mechanism applications for additional offset area/s (if required)	2027/2028	Adani and/or engaged land broker
Commence management of additional offset areas in accordance with OAMP (if required)	2027/2028	Adani
Execute legally binding mechanisms within 12 months of OAMP approval (if required)	2028/2029	Adani and/or engaged land broker
Submit compliance report for the BOS (every five years)	2031	Adani

Tasks	Completion Date	Responsible Person
Submit compliance report for the BOS (every five years)	2036	Adani
Underground mining Stage 2 is completed	2041	Adani
Revise and update BOS (based on results of monitoring activities for underground mining Stage 2) and submit to Minister for approval at least three months before commencing offset delivery Stage 4	2041/2042	Adani
OFFSET DELIVERY STAGE 4 COMMENCES IN 2042 (IF REQUIRED)		
Revised BOS approved	2041/2042	Commonwealth Minister for the Environment/Queensland Coordinator General/Department of Environment and Science
Undertake field surveys of additional offset area/s (only required if there is an offset debit for offset delivery Stage 2 and 3)	2041/2042	Adani's consultant
Submit compliance report for the BOS (every five years)	2041	Adani
Underground mining Stage 3 commences	2042	Adani
Annual compliance report submitted	Annually 2042 – 2063	Adani
Finalise additional offset area/s for offset delivery Stage 3 (if required)	2042/2043	Adani
Commence landholder negotiations with owner/s of additional offset area/s (if required)	2042/2043	Adani and/or engaged land broker
Prepare OAMPs for additional offset area/s (if required)	2042/2043	Adani's consultant
Finalise landholder negotiations and contractual arrangements (if required)	2042/2043	Adani and/or engaged land broker
OAMPs approved (if required)	2042/2043	Commonwealth Minister for the Environment /Department of Environment and Science
Submit legally binding mechanism applications for additional offset area/s (if required)	2042/2043	Adani
Commence management of additional offset areas in accordance with OAMP (if required)	2042/2043	Adani
Execute legally binding mechanisms within 12 months of OAMP approval (if required)	2043/2044	Adani and/or engaged land broker
Submit compliance report for the BOS (every five years)	2046	Adani
Submit compliance report for the BOS (every five years)	2051	Adani
Submit compliance report for the BOS (every five years)	2056	Adani

Tasks	Completion Date	Responsible Person
Underground mining Stage 3 is completed	2062	Adani
Submit compliance report for the BOS (every five years)	2061	Adani
Prepare final BOS based on results of monitoring activities for underground mining Stage 3 and submit to Minister for approval	2062/2063	Adani

6.2 UPDATE OF BOS

Condition 9 of the EPBC Act approval requires that the BOS be submitted to the Commonwealth at least three months prior to the commencement of mining operations, and Condition 12 of the EPBC Act approval states that mining operations must not commence until the BOS is approved by the Minister. The BOS (version 3) was originally approved by the Commonwealth Government on 7 October 2016 and by the Queensland Government on 25 October 2016. Mining operations commenced in June 2019.

This section details Adani's approach to updating the approved BOS according to ongoing monitoring and reassessment of predicted versus actual impacts to ensure:

- the BOS and OAMPs are based on actual impacts
- the potential requirement for additional offsets is identified and addressed in a timely manner.

EPBC Act approval Condition 10 states that 'offsets for authorised unavoidable impacts (in Table 1 of EPBC 2010/5736) must be managed in accordance with the BOS and the GAB Offset Strategy'. The BOS will be reviewed before commencement of each offset delivery stage (see Table 4). The project's actual and predicted impacts will be reviewed against the relevant habitat definitions detailed in the original approved versions of the Species Management Plans for the Carmichael Coal Mine and Offsite Infrastructure and Carmichael Rail Network SP1 to ensure consistency across the life of the project.

If there is deviation in from the approved minimum offset areas required for MNES, or the impacts on MSES, Adani will update the BOS and seek approval, to ensure that the BOS (and offset requirements) are based on actual impacts. For example:

- prior to offset delivery Stage 2, the actual impacts associated with mining operations north of the Carmichael River, off-lease infrastructure and rail west will be reviewed to determine if there are any offset debits or credits. The BOS will be reviewed to ensure that the predicted impacts associated with mining operations south of the Carmichael River and rail east are based on the most up to date information about the project.
- prior to offset delivery Stages 3 and 4, the review of the BOS will use the results of any available monitoring and research activities undertaken for MNES or MSES (under the EPBC Act approval or any State approval) to reassess the actual impacts of the preceding underground mining stage and to update the predicted impact areas for future underground mining (UM) stages (e.g. via the Subsidence Management Plan). The results will be recorded in Table 24. Any offset credits or debits will be calculated for the previous underground mining stage and the balance of offset required for underground mining impacts will be determined. This will include detailed comparison of the ecological status of EPBC Act listed threatened species and communities within the subsidence impact area between baseline conditions and the end of the most recent underground mining stage.

Table 24: Predicted and actual impact areas for MNES within the underground mining area

Template table for recording results of impact review prior to offset delivery Stages 3 and 4						
MNES	UM Stage 1 (ha)		UM Stage 2 (ha)		UM Stage 3 (ha)	
	Predicted	Actual	Predicted	Actual	Predicted	Actual
Black throated finch (southern)	2,000					
Brigalow ecological community						
Ornamental snake						
Squatter pigeon (southern)						
Waxy cabbage palm						
Yakka skink						

The updated and amended BOS will be provided to the Minister for approval prior to the commencement of each offset delivery stage (and hence each underground mining stage). If offsets are required as a result of this review, they will be developed in consultation with the Commonwealth Government and relevant Queensland Government agencies. The offset requirement will be fulfilled in accordance with EPBC Act *Environmental Offsets Policy* and, in accordance with Condition 11 (vi), the balance of offset requirements will be implemented prior to commencement of that offset delivery stage, if required. This will include the delivery of any additional offsets as a result of subsidence impacts prior to the commencement of each offset delivery stage.

Additionally, as part of this process the goals, criteria and triggers of the MNESMP will be updated if required (for example if there was a requirement to undertake additional management actions on a specific offset property with regards to individual MNES). Figure 22 presents the decision trees that will guide updates of the BOS.

In addition to updating the BOS prior to the commencement of each offset delivery stage, the BOS will be reviewed, offset requirements reassessed, and additional offsets delivered if:

- a review of the Subsidence Management Plan or an annual inspection of subsidence indicates that the impact on MSES or MNES caused by mining activities differs from the area of disturbance detailed in the BOS
- it is determined that the management measures in an approved MNES Management Plan (MNESMP) are not effectively managing impacts on MNES and offset are required as a corrective action
- groundwater fluctuations exceed the defined Groundwater Dependent Ecosystem (GDE) groundwater drawdown trigger levels in the Project's draft EA and the trigger exceedance is determined to be the result of mining activities and impacts on GDE cannot be feasibly mitigated
- any habitat for an EPBC Act listed threatened species or ecological community not previously identified is found within the Project area and it is determined that Project activities will have a significant residual impact on the species or community
- pre-construction surveys of the Project area identify that the project will impact on MNES and MSES not previously identified, or that the impact area for MNES and MSES is greater or less than the impact that was determined through the EIS process.

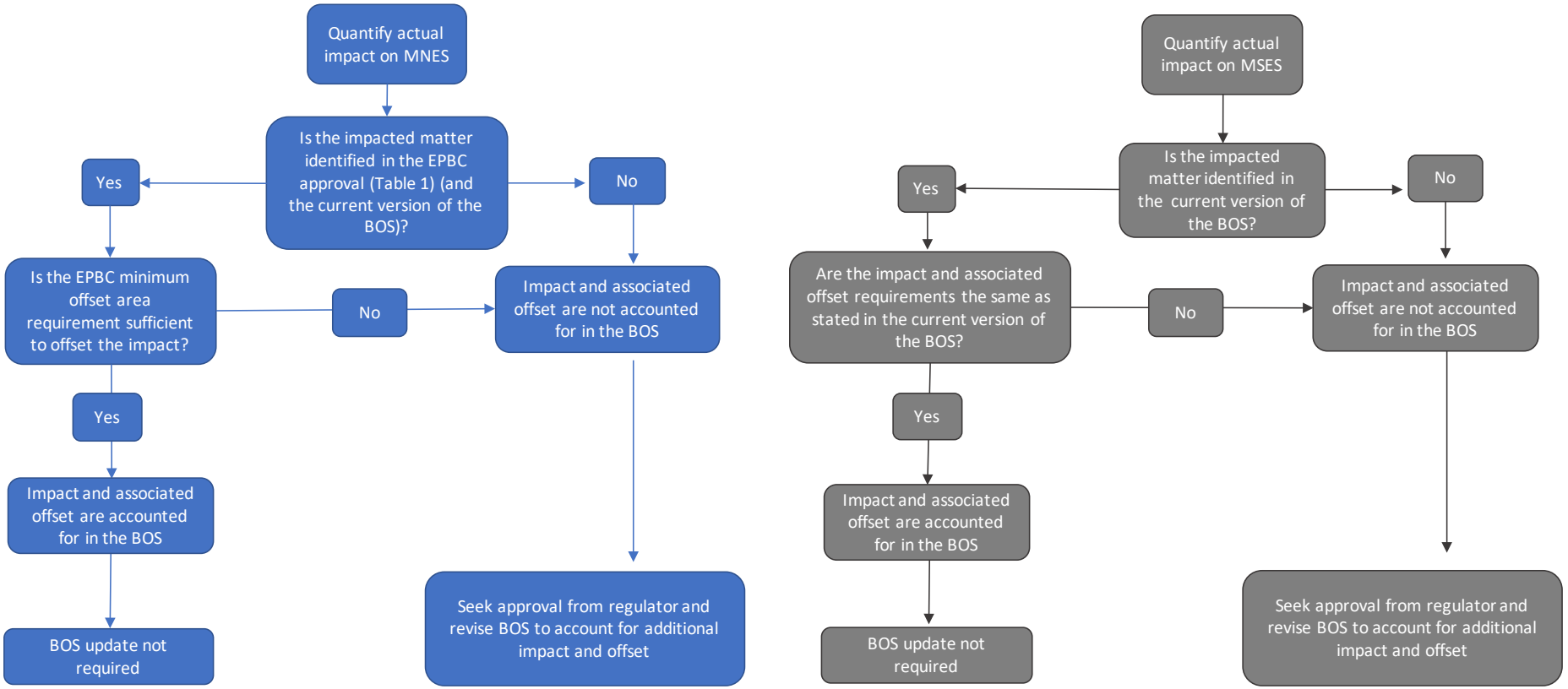


Figure 22: Decision trees for updating the BOS

6.3 POTENTIAL ADDITIONAL OFFSET REQUIREMENTS

The implementation of the suite of biodiversity management, monitoring and research plans and programs summarised in Table 3 will support the identification of the potential requirement for additional offsets as follows:

- determining actual subsidence, groundwater and water resource impacts
- identifying additional offsets for:
  - subsidence impacts (SMP)
  - black-throated finch (BTFMP)
  - groundwater dependent ecosystems (GDEMP, GMMP, GAB Springs Research Program)
  - additional MNES not identified in the EPBC Act approval
- identifying additional offsets as corrective actions for one of the approved MNES MPs.

Table 25 summarises the potential triggers for additional offset requirements, with associated tasks, completion timeframes and responsibilities. The following sections provide more detail.

Table 25: Triggers for additional offsets

Trigger	Tasks	Relevant approval condition	Timeframe	Responsibility
Groundwater fluctuations exceed the defined GDE groundwater drawdown trigger levels (E13) and trigger exceedance is determined to be the result of mining activities and impacts cannot be feasibly mitigated (E14)	Apply to administering authority to amend BOS	Condition I5 of EA	Within 30 days of investigation	Adani
	Review BOS and submit report	Condition I3 of EA	Within 3 months of investigation	Adani
	Deliver amended offset requirements	Condition I4 of EA	Within 12 months	Adani
Annual inspection of subsidence (J7) or annual review of Subsidence Management Plan (J4) finds that the actual impact area differs from the BOS	Apply to administering authority to amend BOS	Condition I5 of EA	Within 30 days of investigation	Adani
	Review BOS and submit report	Condition I3 of EA	Within 3 months of investigation	Adani
	Deliver amended offset requirements	Condition I4 of EA	Within 12 months	Adani
An approved MNESMP is determined to not be achieving goals for impact management and an offset is required	Consult with Commonwealth Government and relevant Queensland Government agencies to determine an appropriate offset requirement	Condition 11 (o) of EPBC Act approval	Within 12 months	Adani

Trigger	Tasks	Relevant approval condition	Timeframe	Responsibility
	Deliver offset requirement in accordance with EPBC Act *Environmental Offsets Policy*	Condition 11 (o) of EPBC Act approval	Within 12 months	Adani
	Incorporate offset requirements into a revised BOS and submit to the Minister for approval.	Condition 11 (o) of EPBC Act approval	Within 12 months	Adani
Habitat for an EPBC Act listed threatened species or ecological community not previously identified in Table 5is found within the project area	Notify Commonwealth Government in writing outlining how the significant residual impacts will be offset in accordance with the EPBC Act *Environmental Offsets Policy*	Condition 11 (i) of EPBC Act approval	Within five business days of finding habitat	Adani
	Update BOS to provide details of the significant residual impact and the proposed offsets and submit to Minister for approval	Condition 11 (i) of EPBC Act approval	Within 12 months	Adani

6.3.1 Determining actual subsidence, groundwater and water resource impacts

Adani has submitted comprehensive monitoring and management plans on matters including subsidence, ground water and water resources as a part of the project's assessment and approval by the Queensland Coordinator-General and the Commonwealth Government. Subsidence, groundwater and water resource impacts will be assessed at each stage in accordance with the SMP, GMMP and REMP. Summary of each plan is provided in Table 3.

6.3.2 Additional offsets based on outcomes of modelling

Adani will review the offset requirements of the project based on the outcomes of modelling undertaken as part of the Groundwater Flow Model, GAB Springs Research Program and Rewan Formation Connectivity Research Plan (see Table 3). If required, following review, the BOS will be updated accordingly, and the revised BOS will be submitted to the Minister for approval (see Section 6.2).

6.3.3 Additional offsets for subsidence impacts

The EA (Schedule J) requires annual monitoring of subsidence (carried out between 1 April and 1 November each year) and review of the approved Subsidence Management Plan. Where a review of the Subsidence Management Plan or an annual inspection of subsidence indicates that the impact on MSES or MNES caused by mining activities differs from the area of disturbance detailed in the BOS, Adani will review the BOS and provide a report within three months. The report will:

- assess the area of MSES/MNES proposed to be impacted by underground mining activities
- identify the actual areas of MSES/MNES impacted by the mining activities based on subsidence monitoring results.

If it is found that the actual areas of disturbance to MSES or MNES differs from the area of disturbance as detailed in the BOS, Adani will apply to the administering authority to amend the BOS within either 30 days, or a lesser period agreed to by the administering authority person, prior to impacting the applicable MSES/MNES and deliver the amended offset requirement within 12 months. Adani will consult with the Commonwealth Government and relevant Queensland Government agencies to determine an appropriate offset and the offset requirement will be fulfilled in accordance with EPBC Act *Environmental Offsets Policy*.

6.3.4 Additional offset requirements for black-throated finch

Adani has completed baseline research to confirm that the Mellaluka Springs Complex does not provide high value habitat for the black-throated finch. The Coordinator-General has confirmed that this research is accepted by both Queensland and Commonwealth Governments and as such satisfies the requirements of the Coordinator-General's report (Appendix 1, Section 3, Condition 1; letter dated 22 July 2016).

6.3.5 Potential offsets for groundwater dependent ecosystems

The EA (Schedule E and Schedule I) requires an adaptive approach to the management of GDE including the affected Carmichael River riparian zone (ecosystems associated with the Carmichael River between Doongmabulla Springs and the Belyando River, including populations of waxy cabbage palm), the Lignum, Stories and Mellaluka springs and the Doongmabulla Spring complex. This approach must include the monitoring of groundwater fluctuations in proximity to GDE and the identification of groundwater drawdown trigger levels which will trigger the implementation of corrective measures for each of the GDEs and/or the provision of offsets.

In the event that groundwater fluctuations exceed the defined GDE groundwater drawdown trigger levels (EA Schedule E) and the trigger exceedance is determined to be the result of mining activities and impacts cannot be feasibly mitigated (EA condition E14), EA condition I4 requires significant residual impacts of the Project will need to be offset in accordance with this BOS and the EPBC Act Offsets Policy.

Where an investigation of groundwater levels indicates that the impact on GDE caused by mining activities differs from the area of disturbance detailed in the BOS, Adani will review the BOS and provide a report to the administering authority within three months. The report will:

- assess the area of GDE proposed to be impacted by underground mining activities
- identify the actual areas of GDE impacted by the mining activities based on monitoring results.

As per EA condition I5, Adani will apply to the administering authority to amend the BOS within either 30 days, or a lesser period agreed to by the administering authority person, prior to impacting the applicable GDE and deliver the amended offset requirement within 12 months. Offset requirements will be developed in consultation with the Commonwealth Government and relevant Queensland Government agencies. The offset requirement will be fulfilled in accordance with EPBC Act *Environmental Offsets Policy*. Example offsets for impacts on the Carmichael River and Doongmabulla Springs Complex are provided in Appendix G.

6.3.6 Potential offset requirements for additional MNES

Where there is a new or increased impact to MNES to that already approved (as defined in the EPBC Act approval 2010/5735), Adani will notify the Commonwealth Government in writing within the timeframes specified in the EPBC Act approval. A variation to the EPBC Act approval (Appendix A) would be required with respect to any new or increased impact to MNES.

If it is determined that there is a new or increased significant residual impact on the EPBC Act listed threatened species or community to that already approved (as defined in the EPBC Act approval), Adani will outline in writing within 20 business days of identifying this new or increased significant residual impact how this will be offset in accordance with the EPBC Act *Environmental Offsets Policy*, consistent with this BOS and the offsets required under the EPBC Act approval. A variation to the BOS will be required for an increase in offset requirements based on the notification made to the Commonwealth Government.

6.3.7 Potential offset requirements as a corrective action for an approved MNESMP

If, through the implementation of an approved MNESMP, it is determined that management measures have not been achieving the goals for impact management, Adani will undertake corrective actions, which may include the provision of offsets. If offsets are required as a corrective action, Adani will consult with the Commonwealth Government and relevant Queensland Government agencies to determine an appropriate offset requirement and the offset requirement will be fulfilled in accordance with EPBC Act *Environmental Offsets Policy*. Any offsets required as a result of this process, will be incorporated into a revised BOS which will be submitted to the Minister for approval.

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APPENDIX A PROJECT APPROVAL CONDITIONS RELATING TO OFFSETS

Table A-1: Coordinator-General's Report, environmental authority and EPBC Act Approval Offset Conditions for the CCMR Project

Coordinator-General's Report
Appendix 1. Mine conditions, Section 3 Imposed conditions, Pg. 466-467
Condition 7. Offsets a) The proponent must prepare a Biodiversity Offset Strategy that: i) Is consistent with the draft Biodiversity Offset Strategy prepared for the project environmental impact statement ii) Details the offset requirements conditioned by the Commonwealth Minister for the Environment in the approval for the project under the *Environment Protection and Biodiversity Conservation Act 1999* iii) Details proposed offsets to address significant residual impacts for matters of state environmental significance consistent with (a)(ii) iv) Takes account of the results of any pre-clearance surveys undertaken in accordance with my recommendation in Appendix 2, Section 2 (Recommendation 1) v) Includes but is not necessarily limited to: 1) a detailed description of the land to which the strategy relates, the values affected and the extent and likely timing of impact on each 2) evidence that values to be impacted can be offset 3) the offset delivery mechanism(s) comprising one or more of: land-based offsets; direct benefit management plans; offset transfers and/or offset payments 4) a legally binding mechanism that ensures protection and management of offset areas b) The Biodiversity Offset Strategy must be provided to the Coordinator-General for approval within 60 days of the approval under the *Environment Protection and Biodiversity Conservation Act 1999* prior to the commencement of construction. c) The approved Biodiversity Offset Strategy must be implemented: i) For the mine site, in accordance with condition I1 of the project environmental authority under the *Environmental Protection Act 1994.* ii) For other areas, as directed by the Coordinator-General. The Coordinator-General has jurisdiction for this condition.
Environmental Authority EPML01470513 – Carmichael Coal Mine – Schedule I: Offsets and Biodiversity
I1 The holder of this environmental authority must provide an offset for impacts on applicable Matters of State Environmental Significance, in accordance with the Carmichael Coal Project Biodiversity Offset Strategy, as approved. The biodiversity offset must be provided: a) prior to impacting on Matters of State Environmental Significance; or b) where a land based offset is to be provided, within 36 months of the later of either of the following: 1. the date of issue of this environmental authority; or 2. the relevant stage identified in the Biodiversity Offset Strategy; or

c) where an offset payment is to be provided, within 4 months of the later of either of the following:
    1. the date of issue of this environmental authority; or
    2. the relevant stage identified in the Biodiversity Offset Strategy.

I2 The Biodiversity Offset Strategy must be reviewed by the 2nd February 2021, and from then on every 5 years with a report prepared by an appropriately qualified person. The report must:

a) Assess the area of Matters of State Environmental Significance proposed to be impacted by the mining activities in the Biodiversity Offset Strategy; and
b) Identify the actual on ground areas of Matters of State Environmental Significance impacted by the mining activities.

I3 If an investigation conducted under conditions E13 or E14 of this environmental authority indicates that there is a risk of impacting a Matter of State Environmental Significance, or condition J11 is triggered, the Biodiversity Offset Strategy must be reviewed and a report must be prepared within 3 months by an appropriately qualified person. The report must:

a) Assess the area of Matter of State Environmental Significance proposed to be impacted by the mining activities in the Biodiversity Offset Strategy; and
b) Identify the actual on ground areas of Matter of State Environmental Significance impacted by the mining activities.

I4 If the review under condition I2 or I3 finds that the actual areas of disturbance to Matters of State Environmental Significance are greater than the areas of disturbance as detailed in the Biodiversity Offset Strategy, or that additional Matters of State Environmental Significance will be impacted, the environmental authority holder must amend the Biodiversity Offset Strategy as per condition I5 and deliver the amended offset requirement within 12 months.

I5 In response to condition I4 the environmental authority holder may apply to the administering authority to amend the Biodiversity Offset Strategy within either 30 days, or a lesser period agreed to by the administering authority, prior to impacting on the applicable Matter of State Environmental Significance.

Black-throated finch (BTF) Management Plan at Carmichael project (BTFMP)

I6 The environmental authority holder must submit a BTFMP, prepared and certified by a suitably qualified person to the administering authority for approval prior to commencement of Project Stage 2. The holder must publish the BTFMP on its website within 10 business days of receiving the administering authority's approval in writing. The approved BTFMP must be implemented. The holder must align the BTFMP with any Bioregional BTF Management Plan and relevant documentation requirements under the *Environmental Protection and Biodiversity Conservation Act 1999* including the BTF Recovery Plan, conservation advice and the threat abatement plan.

The submitted BTFMP must include:

a) a baseline research program on the specific nesting and feeding requirements of the species that will be undertaken prior to and during Project Stage 1;
b) a baseline research program to establish whether the BTF at the project site are sedentary, locally migratory or regionally migratory;
c) a description of how the results of baseline research program are to be used to determine any changes of classification of and/or impact on BTF habitat;
d) details of proposed impacts to BTF habitat from each Project Stage including impacts from clearing, subsidence, ecological function changes, hydrological changes and weed and pest infestation changes;
e) mitigation measures to be undertaken to avoid, mitigate and manage impact resulting from each stage of the project, including rehabilitation of habitat;
f) monitoring of watering points that must be conducted for a minimum 3 hour period commencing from 9am, to accurately capture BTF utilisation of watering points;
g) detailed botanical assessment that must occur at all BTF sighting locations in the project area to record habitat values at those locations;

h) detailed surveys that must occur across the mining lease area and approved offset areas and must include information on BTF movements. The survey method and effort must be sufficient to accurately describe the BTF home range and detail BTF resource usage patterns between seasons and years (for up to 10 years) and allow robust management actions to be developed for the maintenance of a viable local BTF population; i) survey work that should incorporate the usage of call playback and identify all birds present when BTF are encountered; j) specific surveys that must be undertaken during the BTF breeding season and include nest location and assessment of the habitat attributes associated with the breeding locations. The survey method and effort must be sufficient to accurately describe the BTF breeding requirements with consideration to spatial and temporal variation of resources of up to 10 years; and k) survey and monitoring that must be undertaken by experienced ecologists.
I7 The BTFMP required under Condition I6 must be reviewed by a suitably qualified person annually. The review must: a) assess the plan against the requirements under Condition I6; b) include recommended actions to ensure actual and potential environmental impacts are effectively managed for the coming year; c) identify any amendments made to the BTFMP following the review; d) all revisions of the survey and monitoring program must be carried out in consultation with the BTF recovery team; and e) any revisions must be independently peer reviewed, f) a report of the review that addressed the outcomes of the review must be provided to the administering authority by no later than 1 July each year.
I8 The baseline research program must fund a research project to determine the relationship between water sources, woody habitat and the BTF food sources within the mining lease area and approved offset areas to determine the inter-relationships among these factors.
I9 The baseline research program under Condition I6 must: a) establish whether the Ten Mile Bore and surrounds are high value habitat for the species; and b) establish management actions to maintain the current BTF population of Ten Mile Bore and surrounds.
I10 The environmental authority holder must maintain water troughs for BTF within undisturbed areas and surface areas of underground mining footprint, and where necessary repair troughs, pipes and tanks to a standard that maintains a constant source of water.
Groundwater Dependent Ecosystems Management Plan
I11 The environmental authority holder must develop and implement a Groundwater Dependent Ecosystems Management Plan (GDEMP) to detail the management of threats to defined environmental values and to report results and corrective actions for each GDE over the full period of mining activities and for a period of five years post mining rehabilitation.
I12 The GDEMP must be approved by the administering authority in writing and the GDEMP published on the EA website before the commencement of Project Stage 2.
I13 For the purposes of Conditions I11 and I12, the GDEs include the affected Carmichael River riparian zone (ecosystems associated with the Carmichael River between Doongmabulla Springs and the Belyando River, including populations of Waxy Cabbage Palm), the Lignum, Stories and Mellaluka springs and the Doongmabulla Spring complex.
I14 A report of the findings of the GDEMP, including all monitoring results and interpretations, must be prepared annually and made available on request to the administering authority. The report must include:

a) an assessment of background reference groundwater levels,
b) the condition of each GDE compared with previous monitoring results;
c) the suitability of current groundwater trigger thresholds **Table E4 – Groundwater level drawdown thresholds in Schedule E;**
d) detail on the effectiveness of avoidance, mitigation and management actions in curtailing adverse impacts on GDEs;
e) a description of any adaptive management initiatives implemented;
f) any offsets required for residual impacts.

Schedule J: Subsidence

J11 If the review under Conditions J4 or J7 indicates that the impact to Matters of State Environmental Significance caused by mining activities authorised under this environmental authority differs from the area of disturbance detailed in the Biodiversity Offset Strategy, the environmental authority holder must undertake a review in accordance with Conditions I4 and I5.

EPBC Act Approval

Matters of National Environmental Significance management plan/s

6. The MNESMP must be consistent with relevant recovery plans, threat abatement plans and approved conservation advices and must include:

f) a table of specific criteria for assessing the success of management measures against goals, and triggers for implementing corrective measures if criteria are not met within specified timeframes. This table must include but not be limited to measures relating to subsidence and groundwater impacts, including early warning triggers for impacts on groundwater at the Doongmabulla Springs Complex and the Carmichael River. Goals and triggers must be based on the baseline condition of the relevant Matters of National Environmental Significance as determined through baseline monitoring (see Conditions 3b) and 6b)). Corrective measures must include provision of offsets where it is determined that corrective management measures have not achieved goals within specified timeframes (see Conditions 11m) and 11o))

7. Mining operations must not commence until the required MNESMP have been approved by the Minister in writing. The approved plan/s must be implemented.

Note: Impacts of the action other than mining operations will be offset as required in accordance with Conditions 8 to 11, but will be otherwise managed in accordance with state approvals – this is of particular relevance when impacts may occur prior to approval of the MNESMP.

Offset requirements

8. The approval holder must legally secure the minimum offset areas detailed in Table 1 for the rail (west) component within five years of commencement of the specified component of the action. The approval holder must legally secure the minimum offset areas for the other specified components detailed in Table 1 within three years of commencement of those specified components of the action.

Table 1. Minimum offset areas required for impacts on EPBC Act listed threatened species and communities and initial contribution to offsets for subsidence impacts from underground mining.

Environmental value	*Offset for mining operations north of Carmichael River (hectares)*	*Offset for mining operations south of Carmichael River (hectares)*	*Initial offset for underground mining component (hectares)*	*Offset for off-lease infrastructure (hectares)*	*Offset for rail east component (hectares)*	*Offset for rail west component (hectares)*
Black throated finch (southern)	18 204.06	10 739.39	2,000.00	7.62	2.44	46.48
Brigalow ecological community	15.12	721.11		0.00	6.26	72.50
Ornamental snake	96.39	38.61		0.00	0.00	0.00
Squatter pigeon (southern)	1598.00	902.00		0.00	0.00	0.00
Waxy cabbage palm	90.00	0.00		0.00	0.00	0.00
Yakka skink	3770.48	1815.42		1.87	0.60	11.63

Biodiversity Offset Strategy and biodiversity funding

9. To compensate for authorised unavoidable impacts on Matters of National Environmental Significance, the approval holder must submit a Biodiversity Offset Strategy (BOS) and a GAB Offset Strategy to the Minister for approval at least three months prior to commencement of mining operations.

10. Offsets for authorised unavoidable impacts (defined in Table 1), and water resource impacts must be managed in accordance with the BOS.

General requirements

11. The BOS must be consistent with the Galilee Basin Strategic Offset Strategy, relevant recovery plans, threat abatement plans, conservation advices and MNESMP (see Condition 6), including the Black Throated Finch Management Plan (Appendix 1, Section 1, Schedule I, condition I6 of the Coordinator-General's Assessment Report). The BOS must include (except for the matters at 11k) and 11l), which apply to the Great Artesian Basin (GAB) Offset Strategy):

a) location of species and communities habitat offset areas including maps in electronic Geographic Information System (GIS) format
b) details of how offset sites have been or will be legally secured within required timeframes to ensure their long-term protection
c) a monitoring program for the offset site/s suitable to measure the success of the management measures against stated performance criteria including monitoring locations, parameters and timing
d) a description of the potential risks to the successful implementation of the BOS, and details of contingency measures that will be implemented to mitigate these risks
e) details of how the BOS will be updated to incorporate outcomes from research undertaken for Matters of National Environmental Significance under this and any state approvals, including updating of goals, criteria and triggers (as outlined at Conditions 3c), 3d), 6e) and 6f)). This must include **outcomes of** baseline

research required by the Queensland Coordinator-General to identify whether the Mellaluka Springs Complex provides high value habitat for the black throated finch (Appendix 1, Section 3, Condition 1 of the Coordinator-General's Assessment Report) f) an outline of how compliance will be reported g) provisions to ensure that suitably qualified and experienced persons are responsible for undertaking monitoring, review, and implementation of the BOS h) detailed processes for any residual impacts on Matters of National Environmental Significance, (see Condition 6f)) to be offset in accordance with the EPBC Act Offsets Policy including a process for offset requirement to be developed in consultation with the Department and relevant Queensland Government agencies i) a detailed process for any significant residual impact on any EPBC listed threatened species or ecological community not identified in Table 1 to be offset in accordance with the EPBC Act Offsets Policy (refer Condition 6l)) j) in the event that the future baseline research required by the Queensland Coordinator-General (Appendix 1, Section 3, Condition 1 of the Coordinator-General's Assessment Report) identifies that the Mellaluka Springs Complex provides high value habitat for the black throated finch, the approval holder must: i) revise black throated finch offset requirement in the BOS in accordance with the EPBC Act Offsets Policy and submit the revised BOS to the Minister for approval ii) management of any additional black throated finch offsets in accordance with Conditions 13 and 14 must commence prior to hydrological impacts on the Mellaluka Springs Complex, with sites being legally secured within two years of that time.
Requirements for GAB Offsets Strategy
a) implementation of an annual GAB offset measure, of returning at least 730 megalitres per annum to the GAB for a minimum five year period from commencement of excavation of the first box cut, to offset the predicted annual water take associated with the action. This offset measure is to achieve a measurable outcome in accordance with one or more of the following principles: i) reduce current extraction rates from the GAB to increase hydraulic pressure ii) increase pressure in the GAB iii) protect and rehabilitate the GAB springs iv) other measures consistent with government policies and strategies to protect and manage the GAB. b) the offset measure described in Condition 11k) is to be developed and delivered in consultation with the Queensland Government department administering the authorisation of the water take
Requirements for offsets for potential subsidence, groundwater and water resource impacts
a) details of how staged subsidence, groundwater and water resource impacts in the Project Area will be addressed in the BOS, including: i) description and map of the proposed stages of underground mining. The approval holder must advise the Minister of any changes to these staging details. Underground mining Stage 1 must be consistent with the corresponding definition in these conditions ii) description of how actual subsidence, groundwater and water resource impacts for all completed stages (as defined through Condition 11m)(i)) will be assessed at each stage iii) description of the extent, magnitude and timing of actual subsidence impacts observed in completed stages (as defined through Condition 11m)(i))

iv) description of how actual subsidence and groundwater impacts from completed stages (as defined through Condition 11m)(i)) will be used to revise and update predicted impact areas for future stages

v) table of predicted impact areas for each EPBC Act listed threatened species and community in Table 1 within the underground mining area (consistent with Condition 6c)) that allows comparison of actual impact areas with initial impact area predictions and updated impact area predictions. If additional impacted areas are identified as a result of the predictions, additional offsets must be implemented in line with Condition 11h)

vi) written commitments from the approval holder that the balance of offset requirement at each stage (as defined through Condition 11m)(i)) will be implemented prior to commencement of that stage.

b) rationale for the balance of offset required for underground mining impacts to be updated at each underground mining stage (as defined through Condition 11m)(i)) that includes detailed comparison of the ecological status of EPBC Act listed threatened species and communities within the subsidence impact area between baseline conditions and the end of the most recent underground mining stage

c) details of how groundwater and water resource impacts on the Matters of National Environmental Significance will be addressed in the BOS including identification of additional potential offsets (see Condition 6f)) for the Carmichael River and Doongmabulla Springs Complex, to be developed in consultation with the Department and relevant Queensland Government agencies

d) detail of how the BOS will be revised and provided to the Minister for approval prior to commencement of each underground mining stage (as defined through Condition 11m)(i)) including timeframes for revision that allow three months for review and approval of the plan.

12. Mining operations must not commence until the BOS and the GAB Offset Strategy is approved by the Minister in writing. The approved BOS and the GAB Offset Strategy must be implemented.

Note: A Biodiversity Offset Strategy is also required under the State Government approval for the project. A combined document should be prepared to address both State Government and EPBC Act approval conditions where possible.

Offset area management plans

13. Within four months of approval of the BOS, the approval holder must submit to the Minister for approval a management plan for each offset area proposed in the approved BOS. Each offset area management plan must address the relevant requirements of the BOS, and contain:

a) detailed baseline description of offset areas, including surveys undertaken, condition of existing Matters of National Environmental Significance and their habitats, relevant environmental values, area of primary habitat for each EPBC Act listed threatened species and community, connectivity with other habitat areas and biodiversity corridors

b) management measures and offset plans for each offset area to improve the habitats of Matters of National Environmental Significance

c) a table of specific goals and associated timeframes for habitat management measures for each offset area with criteria for assessing the success of habitat management measures and corrective measures to be implemented if criteria are not met.

If the BOS is revised, and the revised BOS is approved by the Minister, and if the revision changed the proposed offsets from those proposed in the previously approved BOS, then the approval holder must, within four months of the approval of the revised BOS, submit to the Minister for approval on offset area management plan for any new offset area and a revised offset area management plan for any altered offset area.

14. Once approved, offset area management plans must be implemented.

3D Seismic Survey Management Plan
20. The approval holder must submit a 3D Seismic Survey Management Plan to the Minister for approval, allowing at least one month for approval. The Seismic Survey Management Plan must include the following information in relation to the 2014 program of seismic survey activities:
a) identification of offsets for residual impacts on at least 115 ha of black throated finch habitat, to be legally secured within two years of commencement of seismic survey activities.
Note: Offset areas identified are not intended to duplicate offset areas identified in accordance with Condition 11l).
Research and management requirements
GAB springs research plan
25. At least three months prior to commencing excavation of the first box cut, the approval holder must submit for the approval of the Minister a GAB Springs Research Plan that investigates, identifies and evaluates methods to prevent, mitigate and remediate ecological impacts on the EPBC listed community of native species dependent on natural discharge of groundwater from the Great Artesian Basin, including the Doongmabulla Springs Complex, in the Galilee Basin. The GAB Springs Research Plan must include but is not limited to the following: a) identify priority actions for potential offsets to protect and manage the GAB springs
31. Within three months of every 12 month anniversary of the commencement of the action the person taking the action must publish a report on their website addressing compliance with each of the conditions of this approval, including implementation of an management plans as specified in the conditions. Documentary evidence providing proof of the date of publication and non-compliance with any of the conditions of this approval must be provided to the Department at the same time as the compliance report is published.

APPENDIX B MNES AND MSES RELEVANT TO THIS BOS

Summary of MNES for which offsets are required

Table B-1: MNES as defined by the EPBC Act approval 2010/5736

Listed Threatened Species and Communities
Black throated finch (southern) (*Poephila cincta subsp. cincta*)
Brigalow ecological community
Ornamental Snake (*Denisonia maculata*)
Squatter pigeon (southern) (*Geophaps scripta subsp. scripta*)
Waxy cabbage palm (*Livistona lanuginosa*)
Yakka skink (*Egernia rugosa*)
Community of native species dependent on discharge from the GAB (Doongmabulla Springs Complex)
Water Resources
Carmichael River (Carmichael River and its riparian zone between the Doongmabulla Springs and the Belyando River)
Mellaluka Springs Complex
Community of native species dependent on discharge from the GAB (Doongmabulla Springs Complex)
Waxy Cabbage Palm (*Livistona lanuginosa*)

Updates from the 2014 Environmental Offset Package

Table B-2 summarises the amendments to the offset requirements from those presented in the initial Environmental Offset Package (CO2 Australia 2014). Changes are associated with the Queensland environmental offset framework, which was established on 1 July 2014 and consists of the *Environmental Offsets Act 2014* (Qld), *Environmental Offsets Regulation 2014* (Qld), and the Queensland *Environmental Offsets Policy 2014*. The framework was introduced after the Project's Coordinator-General's Report was issued (7 May 2014), and therefore does not apply to the Project. MSES offsets have been revised from the Environmental Offset Package considering that under the Queensland environmental offset framework, offsets are no longer required for:

- near threatened animals or plants as listed under the *Nature Conservation Act 1992* (NC Act)
- species no longer listed as endangered or of concern under the NC Act
- some special least concern animals listed under the NC Act
- threshold regional ecosystems
- high value regrowth
- impacts that are not considered significant in accordance with the Queensland *Environmental Offsets Policy Significant Residual Impact Guideline* (see Appendix D for more detail)

Additionally, the Project's Rail component is exempt from obtaining an operational works clearing permit for the removal of native vegetation as it met the criteria of community infrastructure under Schedule 2 of the *Sustainable Planning Regulation 2009* at the time of assessment. Offsets are therefore not required for regional ecosystems (RE) and watercourse vegetation for the Project's rail component.

Table B-2: Resolving Project offset requirements from the Environmental Offset Package (2014) to the current BOS

Environmental value	EPBC Act (Cwth)	Nature Conservation Act (Qld)	Vegetation Management Act (Qld)	Environmental Offsets Act (Qld)	Offset required?	
					Mine	Rail
Values offset as MNES as defined in the EPBC Act						
Brigalow TEC	E	-	-	-	Yes – Offset as MNES under the EPBC Act. Project approval EPBC 2010/5736 defines minimum required offset area	
Yakka skink	V	V	-	Schedule 2		
Ornamental snake	V	V	-	Schedule 2		
Squatter pigeon (southern)	V	V	-	Schedule 2		
Black-throated finch (southern)	E	E	-	Schedule 2		
Waxy cabbage palm	V	V	-	Schedule 2		
11.3.1 (BVG 25a)	-	-	E	Schedule 2	Yes – these MSES regional ecosystems constitute the MNES Brigalow TEC. It was the Coordinator-General's decision not to require additional offsets for MSES if the Australian Government also requires an offset for the same values. Hence, these regional ecosystems are offset as MNES Brigalow TEC under the EPBC Act.	
11.4.8 (BVG 25a)	-	-	E	Schedule 2		
11.4.9 (BVG 25a)	-	-	E	Schedule 2		
Values offset as MSES as defined in the Queensland Government *Environmental Offsets Act 2014*						
Connectivity	-	-	-	Schedule 2	Yes – significant residual impact identified (see Appendix D). Offset as Schedule 2 prescribed environmental matters.	No significant residual impact identified (see Appendix D)
Watercourse vegetation [A]	-	-	-	Schedule 2		
Wetland Protection Area	-	-	-	Schedule 2		
Significant wetland	-	-	-	Schedule 2		
11.4.6 (BVG 26a)			OC	Schedule 2		
11.3.3 (BVG 16c)	-	-	OC	Schedule 2		

Environmental value	EPBC Act (Cwth)	Nature Conservation Act (Qld)	Vegetation Management Act (Qld)	Environmental Offsets Act (Qld)	Offset required?	
					Mine	Rail
11.4.5 (BVG 26a)	-	-	OC	Schedule 2	No significant residual impact identified (see Appendix D)	No –community infrastructure exemption
11.4.11 (BVG 30b)	-	-	OC	Schedule 2		
Values for which offsets are not required						
Echidna	-	SLC	-	Schedule 2	No – results of assessment [B] indicated no significant residual impact on echidna, meaning that offsets are not required for this Special Least Concern species (see Appendix D)	
Koala	V	SLC	-	Schedule 2	No – results of assessment [B] indicated no significant residual impact on koala, meaning that offsets are not required for this Special Least Concern species (see Appendix D). Koala is not considered as MNES because it was not listed as Vulnerable under the EPBC Act until after the Project was declared a controlled action.	
Cotton pygmy-goose	-	NT	-	-	No – offsets not required under the *Environmental Offsets Act 2014* for species listed as Near Threatened under the NC Act	
Black-necked stork	-	NT	-	-		
Square-tailed kite	-	NT	-	-		
Black-chinned honeyeater	-	NT	-	-		
Little pied bat	-	NT	-	-		
Eastern great egret	M	SLC	-	-	No – offsets not required under the *Environmental Offsets Act 2014* for these Special Least Concern animals listed under the NC Act	
Cattle egret	M	SLC	-	-		
Glossy ibis	M	SLC	-	-		
White-bellied sea-eagle	M	SLC	-	-		
Latham's snipe	M	SLC	-	-		

Environmental value	EPBC Act (Cwth)	Nature Conservation Act (Qld)	Vegetation Management Act (Qld)	Environmental Offsets Act (Qld)	Offset required?	
					Mine	Rail
Black-tailed godwit	M	SLC	-	-		
Common greenshank	M	SLC	-	-		
Marsh sandpiper	M	SLC	-	-		
Common sandpiper	M	SLC	-	-		
Curlew sandpiper	M	SLC	-	-		
Caspian tern	M	SLC	-	-		
Fork-tailed swift	M	SLC	-	-		
White-throated needletail	M	SLC	-	-		
Rainbow bee-eater	M	SLC	-	-		
Satin flycatcher	M	SLC	-	-		
Threshold RE 11.3.5	-	-	LC	-	No – offsets not required under the *Environmental Offsets Act 2014* for threshold regional ecosystems	
Threshold RE 11.4.11	-	-	OC	-		
HVR BVG 25a	-	-	E	-	No – offsets not required for high value regrowth under the *Environmental Offsets Act 2014*	
HVR BVG 16c	-	-	OC	-		
HVR BVG 26a	-	-	OC	-		
HVR BVG 30b	-	-	OC	-		

[A] MSES 'watercourse vegetation' combines impacts on remnant vegetation areas within the buffers of mapped watercourses according to stream orders 1-5. See Table A-3.
[B] Significant impact assessed under the Significant Residual Impact Guideline (DEHP 2014a). Refer to Appendix D for more detailed assessments.

Watercourse impacts calculated by stream order

The impacted area of watercourse vegetation was revised based on ground-truthing of regional ecosystem mapping collated since the 2013 SEIS, using remnant vegetation areas within the buffers of mapped watercourses, according to stream order (1-5). A breakdown of impacts is shown in Table B-3.

Table B-3: Watercourse impacts by stream order

Stream order	Top-of-bank width applied (m) (determined via examination of high-resolution aerial photography)	Buffer applied (to top-of-bank width) (m)	Stage 1 impact area (ha)	Stage 2 impact area (ha)
1 & 2	5	50	214.27	82.51
3 & 4	10 & 20, respectively	100	96.74	76.96
5	30	200	3.23	13.41
		Total	**314.24**	**172.88**
		Overall total		**487.12**

Updates to offsets delivered in Stage 1 versus Stage 2

Table B-4 shows the updates to the plan for offsets to be delivered in Stage 1 and Stage 2, compared to BOS version 3.

Table B-4: Updates to offset delivery staging from BOS version 3 (originally approved) to this document (version 5a; approved)

Relevant Project Component	Impacts to be offset	BOS version 3 (CO2 Australia 2016)		Current BOS version 5a (this document)	
		Offset delivery Stage	Offset values	Offset delivery Stage	Offset values
Mining operations north of the Carmichael River	All clearing of native vegetation associated with mining operations north of the Carmichael River	Stage 1 – commences year 2017	▶ Black-throated finch ▶ Squatter pigeon ▶ Ornamental snake ▶ Yakka skink ▶ Waxy cabbage palm ▶ Brigalow TEC ▶ Wetland Protection Area ▶ Significant Wetland [D] ▶ 11.3.3 (BVG 16c) [A] ▶ 11.4.6 (BVG 26a) [E] ▶ Watercourse vegetation[B] ▶ Connectivity [C]	Stage 1 – commences year 2019	▶ Black-throated finch ▶ Squatter pigeon ▶ Ornamental snake ▶ Yakka skink ▶ Waxy cabbage palm ▶ Brigalow TEC ▶ Wetland Protection Area ▶ Significant Wetland [D] ▶ RE 11.4.6 (BVG26a) [E] ▶ Watercourse vegetation[B] ▶ Connectivity [C]
Off-lease infrastructure	All clearing of native vegetation associated with off-lease infrastructure		▶ Black-throated finch ▶ Yakka skink ▶ Connectivity [C]		▶ Black-throated finch ▶ Yakka skink
Rail east	Impacts on yakka skink		▶ Yakka skink		▶ Yakka skink
Rail west	All clearing of native vegetation associated with rail west		▶ Black-throated finch ▶ Brigalow TEC ▶ Yakka skink		▶ Black-throated finch ▶ Brigalow TEC ▶ Yakka skink

Relevant Project Component	Impacts to be offset	BOS version 3 (CO2 Australia 2016)		Current BOS version 5a (this document)	
		Offset delivery Stage	Offset values	Offset delivery Stage	Offset values
Mining operations south of the Carmichael River	Clearing of native vegetation associated with mining operations south of the Carmichael River, where offsets are available on MDW.		▶ Ornamental snake ▶ Squatter pigeon ▶ Yakka skink ▶ 11.3.3 (BVG 16c) [A] ▶ Watercourse vegetation		▶ Ornamental snake ▶ Squatter pigeon ▶ Yakka skink ▶ Significant Wetland [D] ▶ RE 11.4.6 (BVG 26a) [E] ▶ Watercourse vegetation ▶ Connectivity [C]
Underground mining	Initial contribution for subsidence impacts based on predicted impacts of Underground Mining Stages 1, 2 and 3		▶ Black-throated finch		▶ Black-throated finch
Mining operations south of the Carmichael River	All remaining clearing of native vegetation associated with mining operations south of the Carmichael River	Stage 2 – commences Year 2024	▶ Black-throated finch ▶ Brigalow TEC	Stage 2 – commences year 2024	▶ Black-throated finch ▶ Brigalow TEC ▶ RE 11.4.6 (BVG 26a) [E]
Rail east	All remaining clearing of native vegetation associated with rail east		▶ Black-throated finch ▶ Brigalow TEC		▶ Black-throated finch ▶ Brigalow TEC
Underground mining	Additional contribution for subsidence impacts associated with Underground Mining Stages 1 and 2 if required (i.e. additional offsets may be required for impacts of Underground Mining Stages 1 if the actual impact is greater	Stage 3 – commences Year 2027 (if required)			

Relevant Project Component	Impacts to be offset	BOS version 3 (CO2 Australia 2016)		Current BOS version 5a (this document)	
		Offset delivery Stage	Offset values	Offset delivery Stage	Offset values
	than predicted and/or additional offsets may be required for Underground Mining Stage 2)				
	Groundwater and water resource impacts associated with Underground Mining Stages 1 and 2 if required (i.e. additional offsets may be required for impacts of Underground Mining Stages 1 if the actual impact is greater than predicted and/or additional offsets may be required for Underground Mining Stage 2)				

Revised impact assessment based on ground-truthing of regional ecosystem mapping collated since the SEIS showed that compared to BOS version 3:
A) there is no longer an impact on RE 11.3.3 (BVG 16c)
B) MSES 'watercourse vegetation' combines impacts on remnant vegetation areas within the buffers of mapped watercourses according to stream orders 1-5. See Table B-3
C) there is no longer an impact on connectivity associated with off-lease infrastructure; and an impact on connectivity associated with mining operations south of the Carmichael River has been identified, which can be offset through Stage 1 offset delivery on MDW
D) an impact on significant wetlands associated with mining operations south of the Carmichael River has been identified, and this can be offset on MDW through Stage 1 offset delivery
E) an impact on RE 11.4.6 (BVG 26a) associated with mining operations south of the Carmichael River has been identified, and this is proposed to be offset through a financial settlement offset.

APPENDIX C RESULTS OF FIELD SURVEYS OF IMPACT AND OFFSET AREAS

C1: Carmichael Coal Mine and Rail Project SEIS Report for Offsite Infrastructure Project BioCondition Assessment Report 31 October 2013 (GHD 2013a)

C2: Carmichael Coal Mine Ecological Equivalence Assessment Stage 2 (Eco Logical Australia 2014a)

C3: Moray Downs West Ecological Equivalence Assessment (Eco Logical Australia 2014b)

C4: MDW baseline habitat quality assessment for Brigalow TEC in the eastern portion of the MDW offset area (CO2 Australia August 2020)

C-1: Carmichael Coal Mine and Rail Project SEIS Report for Offsite Infrastructure Project BioCondition Assessment Report 31 October 2013 (GHD 2013a)

Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project SEIS

Report for Offsite Infrastructure Project

BioCondition Assessment Report

31 October 2013

GHD

This Carmichael Coal Mine and Rail Project SEIS: Offsite Infrastructure BioCondition Assessment Report (the Report) has been prepared by GHD Pty Ltd (GHD) on behalf of and for Adani Mining Pty Ltd (Adani) in accordance with an agreement between GHD and Adani.

The Report may only be used and relied on by Adani for the purpose of informing environmental offset assessments and production for the proposed Carmichael Coal Mine and Rail Project and may not be used by, or relied on by any person other than Adani.

The services undertaken by GHD in connection with preparing the Report were limited to those specifically detailed in this Report.

The Report is based on conditions encountered and information reviewed, including assumptions made by GHD, at the time of preparing the Report.

To the maximum extent permitted by law GHD expressly disclaims responsibility for or liability arising from:

- *any error in, or omission in connection with assumptions, or*
- *reliance on the Report by a third party, or use of this Report other than for the Purpose.*

Executive summary

In March, 2013 Adani Mining Pty Ltd commissioned an assessment of BioCondition within and adjacent to an area proposed for offsite infrastructure for the Carmichael Coal Mine and Rail Project (the Project). This assessment has been undertaken as part of a Supplementary Environmental Impact Statement to provide information on areas that were not assessed during the original Environmental Impact Statement.

Offsets will be required under Commonwealth and State legislation where impacts to identified environmental values cannot be reasonably avoided or mitigated. Commonwealth environmental values, such as threatened fauna species, will need to be offset according to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) *Environmental Offset Policy*. Native remnant vegetation will be offset under the Queensland *Policy for Vegetation Management Offsets*. An offset strategy is being produced for the broader Project, including the Mine, Rail and Offsite infrastructure.

BioCondition and habitat quality assessments are required to inform the offset process and the development of an offset strategy. This report provides the results of an assessment of the condition and quality of ecological values requiring offsetting for the Project (Offsite). The information from the assessments will be used to support on offset proposal to offset unavoidable impacts to biodiversity values as a result of the broader Project, combining the Mine, Rail and offsite infrastructure.

Environmental values assessed in this report include threatened species and ecological communities under the Commonwealth EPBC Act, and remnant vegetation protected under the Queensland *Vegetation Management Act* (VM Act) *1999*. Values impacted include:

- Six EPBC Act-listed Matters of Environmental Significance confirmed present or are likely to occur within the Study Area
- Assessable vegetation under the VM Act *1999*, including endangered and of concern regional ecosystems, watercourse and wetland vegetation and corridor vegetation.

Habitat quality is defined within the *Offset Assessment Guidelines* which accompanies the *EPBC Act Environmental Offset Policy*. An investigation was undertaken to describe and map the condition of vegetation and habitat quality for threatened species across the Study Area. Potential habitat was ground-truthed and a condition score derived, using a set criterion based on an individual species' particular habitat preferences/requirements.

Potential habitat and the quality of the habitat were mapped for five threatened fauna species:

- Ornamental snake (*Denisonia maculata*), vulnerable:
  - Thirty-six polygons of potential habitat assessed within the Study Area; a total of 313.8 ha mapped within the Project (Offsite) footprint. Habitat is predominantly low quality (≤ 2 out of 10)
- Black –throated finch (southern) (*Poephila cincta cincta*), endangered:
  - Eleven polygons of potential habitat assessed within the Study Area; a total of 2.5 ha mapped within the Project (Offsite) footprint. The quality of habitat is low across the Study Area (≤ 3 out of 10)

- Squatter pigeon (southern) (*Geophaps stricta stricta*), vulnerable:
  - Ten polygons of potential habitat assessed within the Study Area; a total of 2.5 ha mapped within the Project (Offsite) footprint. The quality of potential habitat within the Study Area was moderate (5 – 7 out of 10).
- Yakka skink (*Egernia rugosa*), endangered:
  - Fifteen polygons of potential habitat assessed within the Study Area; a total of 2.5 ha mapped within the Project (Offsite) footprint. The quality of habitat is predominantly low to moderate (4 – 5 out of 10)
- Koala (Phascolarctos cinereus), vulnerable:
  - Seven polygons of potential habitat assessed within the Study Area; a total of 2.7 ha mapped within the Project (Offsite) footprint. The quality of habitat is moderate (4 – 6 out of 10).

The endangered threatened ecological community, brigalow (*Acacia harpophylla* dominant and subdominant), was not assessed as the size of representative remnant patches were not large enough to accommodate assessment methodology.

Habitat mapping for the Study Area was supported by an assessment of the condition of native remnant vegetation across the Study Area. BioCondition assessments were undertaken, in accordance with the Ecological Equivalence Methodology, were undertaken at 10 sites within the Study Area. These sites were chosen as representative sites to establish a condition score for native vegetation types expected to be cleared for the Project. Benchmarks for these REs were derived for five impacted REs and BioCondition scores were calculated. The remaining two assessed REs could not be scored due to their being no available benchmarks at the time of assessment.

The surveys found that the existing environment within the Study Area had been heavily impacted by past land-uses. The landscape has been substantially fragmented by past land clearing and heavily degraded by decades of moderate intensity cattle grazing. Remnants of native vegetation are predominantly small, fragmented and highly degraded, with high densities of buffel grass, erosion and trampling damage. As a result, the condition of remnant vegetation and many of the areas of potential habitat for EPBC listed species have only low – moderate quality scores. The information provided in this report can be incorporated into a combined offsets strategy for the broader Project, combining offset requirements for the Mine, Rail and offsite infrastructure.

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GHD
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1. Introduction

1.1 Project overview

Adani Mining Pty Ltd (Adani, the Proponent), commenced an Environmental Impact Statement (EIS) process for the Carmichael Coal Mine and Rail Project (the Project) in 2010. On 26 November 2010, the Queensland (Qld) Office of the Coordinator General declared the Project a 'significant project' and the Project was referred to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (referral No. 2010/5736). The Project was assessed to be a controlled action on 6 January 2011 under section 75 and section 87 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The controlling provisions for the Project include:

- World Heritage properties (sections 12 & 15A)
- National Heritage places (sections 15B & 15C)
- Wetlands (Ramsar) (sections 16 & 17B)
- Listed threatened species and communities (sections 18 & 18A)
- Listed migratory species (sections 20 & 20A)
- The Great Barrier Reef Marine Park (GBRMP) (sections 24B & 24C)
- Protection of water resources (sections 24D & 24E)

The Qld Government's EIS process has been accredited for the assessment under Part 8 of the EPBC Act in accordance with the bilateral agreement between the Commonwealth of Australia and the State of Queensland.

The Proponent prepared an EIS in accordance with the Terms of Reference (ToR) issued by the Qld Coordinator-General in May 2011 (Qld Government, 2011). The EIS process is managed under section 26(1) (a) of the *State Development and Public Works Act 1971* (SDPWO Act), which is administered by the Qld Government's Department of State Development, Infrastructure and Planning (DSDIP).

The EIS, submitted in December 2012, assessed the environmental, social and economic impacts associated with developing a 60 million tonne (product) per annum (Mtpa) thermal coal mine in the northern Galilee Basin, approximately 160 kilometres (km) north-west of Clermont, Central Queensland, Australia. Coal from the Project will be transported by rail to the existing Goonyella and Newlands rail systems, operated by Aurizon Operations Limited (Aurizon). The coal will be exported via the Port of Hay Point and the Point of Abbot Point over the 60 year (90 years in the EIS) mine life.

Project components are as follows:

- The Project (Mine): a greenfield coal mine over EPC 1690 and the eastern portion of EPC 1080, which includes both open cut and underground mining, on mine infrastructure and associated mine processing facilities (the Mine) and the Mine (offsite) infrastructure including a workers accommodation village and associated facilities, a permanent airport site, an industrial area and water supply infrastructure

- The Project (Rail): a greenfield rail line connecting the mine to the existing Goonyella and Newlands rail systems to provide for the export of coal via the Port of Hay Point (Dudgeon Point expansion) and the Port of Abbot Point, respectively including:
  - Rail (west): a 120 km dual gauge portion running west from the Mine site east to Diamond Creek
  - Rail (east): a 69 km narrow gauge portion running east from Diamond Creek connecting to the Goonyella rail system south of Moranbah
  - Quarries: five local quarries to extract quarry materials for construction and operational purposes

1.2 Purpose of this report

The purpose of this report is to present an assessment of the condition and quality of ecological values requiring offsetting for the Mine (Offsite) infrastructure. This information will be used to support an offsets proposal to offset unavoidable impacts to biodiversity values as a result of the Project. Where the Project will impact upon important ecological values, such as matters of national environmental significance (NES), high conservation status regional ecosystems (REs), protected fauna and watercourse or corridor vegetation, offsets will be required under relevant Commonwealth and State government offset policies.

This report will identify the Project (Offsite) impacts to terrestrial environmental values and will present the results of habitat quality assessments for threatened species and ecological communities under the EPBC Act and BioCondition assessments for State level environmental values undertaken within the Study Area. This information will be incorporated into a combined offsets strategy that is being undertaken (separate to this report) for the broader Project, including offset obligations from the Mine, Rail and Offsite Infrastructure Area. As such, this report is not intended to represent an independent assessment of BioCondition within the Study Area, rather a summary of BioCondition values that can be incorporated into the offsets strategy for the broader Project.

The study area for this report was defined by the Project (Mine) Offsite footprint. At the time of reporting, the footprint included an offsite bore field and associated pipelines. The bore field is no longer a component of the Carmichael Coal Mine and Rail Project. As such, the study area for this report includes areas where the bore field was to be situated.

1.3 Summary of offsite infrastructure

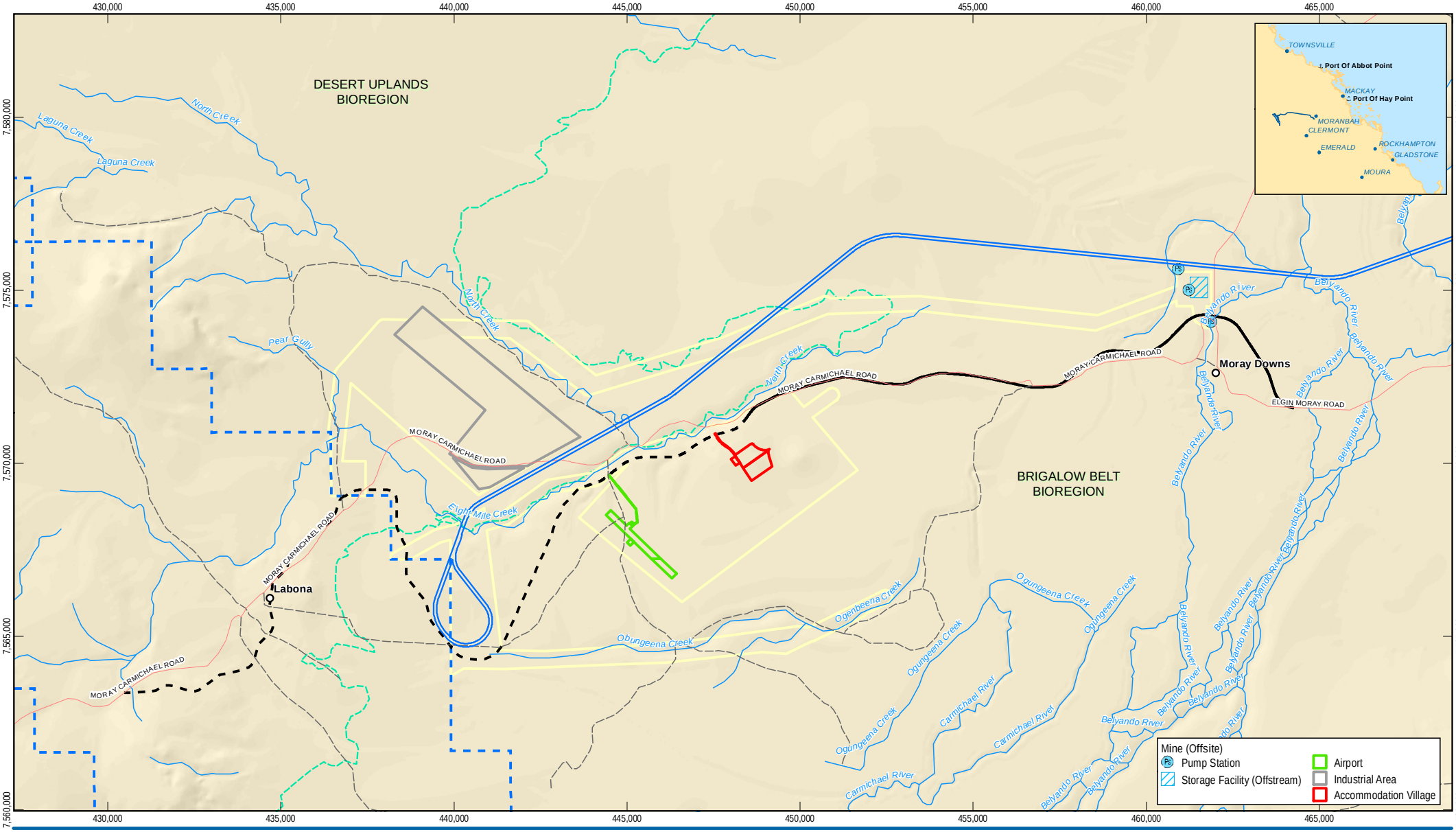
The Study Area for the Mine (Offsite) infrastructure assessed in this report includes:

- Worker accommodation village and airport (126.8 ha).
- Industrial precinct, including rail siding (964.8 ha) to facilitate services such as a fuel farm, rail siding, freight unloading terminal).
- New rail loop (523.5 ha).
- An off-stream storage and pump station near the Belyando River (0.04 ha)
- 5 gigalitres (GL) storage dam (51 ha).

The proposed offsite infrastructure is located immediately east of the Project (Mine). The Study Area for the Mine (Offsite) infrastructure covers an area of 7,187.13 ha, of which the Mine (Offsite) footprint occupies 1,157.7 ha (refer Figure 1).

1.4 Assumptions and limitations

Field BioCondition surveys were undertaken within the Study Area outlined in Figure 1. An additional area of proposed impact (the realignment of the Carmichael Road) was added to the Project (Offsite) footprint after the surveys were completed. The report presents BioCondition data for environmental values within the Study Area shown in Figure 1 and did not include the Carmichael Road. Independent surveys are required to assess the BioCondition of environmental values within that area.



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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Bioregion Boundary
- Study Area
- Rail Corridor
- Project Area
- Road Corridor
- Road Corridor (proposed)

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS
BioCondition Assessment Report

Job Number 41-26422
Revision 1
Date 31-10-2013

Offsite Infrastructure Study Area

Figure 1

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Data source: DME: EPC1690 (2010)/EPC1080 (2011); DNRM: Bioregion Boundary (2011); © Commonwealth of Australia (Geoscience Australia): Watercourse, Tracks (2007); Adani: Alignment Opt11 Rev 2 (SP1 and 2)(2013), Offsite Infrastructure (2013). Created by: AJ

2. Legislative context

2.1 Overview

Offsets will be required under Commonwealth and state legislation where impacts to identified ecological values cannot be reasonably avoided or mitigated. Determining the exact interaction between the State and Commonwealth legislation will require liaison with relevant agencies and a final offset package will need to consider a combination of both legislative jurisdictions.

2.2 Commonwealth legislation and policy

Under the *Environmental Protection Biodiversity Conservation Act 1999* (EPBC Act), environmental offsets are considered a mechanism to compensate for the adverse impacts of developments on matters of NES protected by the EPBC Act.

The Commonwealth government's EPBC Act Environmental Offsets Policy (DSEWPaC, 2012) outlines the Australian Government's position on the use of environmental offsets under the EPBC Act. Under the EPBC Act, environmental offsets can be used to maintain or enhance the health, diversity and productivity of the environment as it relates to matters protected by the Act.

The Offsets Assessment Guide, which accompanies the EPBC Act Environmental Offsets Policy, has been developed to measure impacts associated with a project and applies where the impacted protected matter is a threatened species or ecological community. This guide can be used to calculate offset requirements associated with a project.

The EPBC Act Environmental Offsets Policy requires an assessment and consideration of the existing quality of habitats. For impacts on habitat for threatened species, migratory species and threatened ecological communities, any direct offset must meet, as a minimum, the quality of the habitat at the impact site. Where a proposed offset site has a lower habitat quality than that of the impact site, the offset must be managed and resourced over a defined period of time, so that its habitat quality is improved to meet the quality of habitat originally impacted.

2.3 State legislation and policy

2.3.1 Queensland Government Environmental Offset Policy

The QGEOP (Queensland Government, 2008) provides a framework for the use of environmental offsets in Queensland, in order to counterbalance unavoidable, negative environmental impacts that result from an activity or a development. This policy is based on the premise that offsets are used consistently and transparently across the state, and are only considered after all environmental impacts have been avoided and minimised and all other government environmental standards have been met (Queensland Government, 2008).

2.3.2 Queensland Biodiversity Offset Policy

The Queensland Biodiversity Offset policy (QBOP) does not apply to 'development that is a significant project declared under section 26(1) (a) of the SDPWO Act'. The Project was declared a 'significant project' under Section 26 (1) (a) of the SDPWO Act in January 2011. However, the Coordinator-General may use discretionary powers to require compliance with the QBOP as part

of an approval for a significant project. The policy is expected to be applied to the mine and rail components of the project.

2.3.3 Policy for Vegetation Management Offsets

Vegetation clearing in Queensland is regulated through the *Vegetation Management Act 1999* (VM Act), which outlines the rules and regulations that guide what clearing can be done, and how it must be done in order to comply with the legal requirements. The current Policy for Vegetation Management Offsets (Version 3) (DERM, 2011b) (hereafter referred to as the Vegetation Offset Policy) was developed by the chief executive in accordance with the provisions set out in the VM Act. This policy sets the requirements for an offset as a condition of a development approval that the chief executive considers is necessary or desirable for achieving the purpose of the VM Act (DERM, 2011a).

Under this policy, offsets may be proposed for Project (Offsite) activities, as a solution to meet specific performance requirements for maintaining the current remnant vegetation extent of a particular RE.

The Project (Offsite) will require assessment under the Regional Vegetation Management Code for Brigalow Belt and New England Tablelands Bioregions (Version 2.1) (DNRM, 2012a) and the Regional Management Code for Western Bioregions (Version 2.1) (DNRM, 2012b). These management codes regulate the clearing of vegetation in Queensland using a set of performance criteria. Where the performance criteria cannot be met, offsetting can be offered as a solution for meeting the performance requirements.

Areas offered as offsets must meet a variety of criteria outlined in the Vegetation Offset Policy, including ecological quality (determined through BioCondition assessments and the Ecological Equivalence Methodology (EEM) (see Section 4).

3. Summary of project impacts

3.1 Overview

Potential direct and indirect impacts within and adjacent to the proposed Project (Offsite) have been described in Appendix F of the SEIS (Offsite Infrastructure Ecological Assessment Report). These impacts include the direct loss of native vegetation, habitat and resources as a result of vegetation clearing within the Project (Offsite) footprint. The area of direct impact (i.e. the Project (Offsite) footprint) encompasses 11 REs protected under the VM Act and potential habitat for six matters of NES protected under the EPBC Act. The potential impacts on these environmental values are summarised below.

3.2 *Environmental Protection Biodiversity Conservation Act 1999* Environmental Offsets Policy

Six matters of NES have been confirmed present or are considered 'likely to occur' within the Study Area, based on the results of field surveys and subsequent likelihood of occurrence assessments (refer to Appendix F of the SEIS (Offsite Infrastructure Ecological Assessment Report)). Matters of NES identified include one Threatened Ecological Community (TEC) and five threatened fauna species (refer to Table 1).

Potential habitat for these species (and communities) was identified in field surveys of the Study Area and occurs within the Project (Offsite) footprint. These areas may be permanently impacted as a result of vegetation clearing for the Project (Offsite) footprint. Table 1 below presents a summary of the area of potential habitat impacted by clearing. In accordance with the EPBC Environmental Offsets Policy, it is necessary to assess the quality of these areas to accurately calculate the offset obligations.

Table 1 Area of potential habitat within the Project (Offsite) footprint

Matters of NES Feature	EPBC Status	Likelihood of occurrence	Area of Potential Habitat Impacted (ha)
Ornamental snake (*Denisonia maculata*)	V	Confirmed present	313.8
Black-throated finch (southern) (*Poephila cincta cincta*)	E	Confirmed present	2.5
Squatter pigeon (southern) (*Geophaps scripta scripta*)	V	Confirmed present	2.5
Yakka skink (*Egernia rugosa*)	E	Likely to occur	2.5
Koala (*Phascolarctos cinereus*)	V	Likely to occur	2.7

3.3 Policy for Vegetation Management Offsets

The removal of native vegetation will occur within the Project (Offsite) footprint. Offsets will be required to meet the performance requirements that address the conservation of remnant vegetation that are:

- Of concern REs
- Endangered REs
- Watercourse vegetation
- Wetland vegetation
- Corridor vegetation (with respect to habitat connectivity)

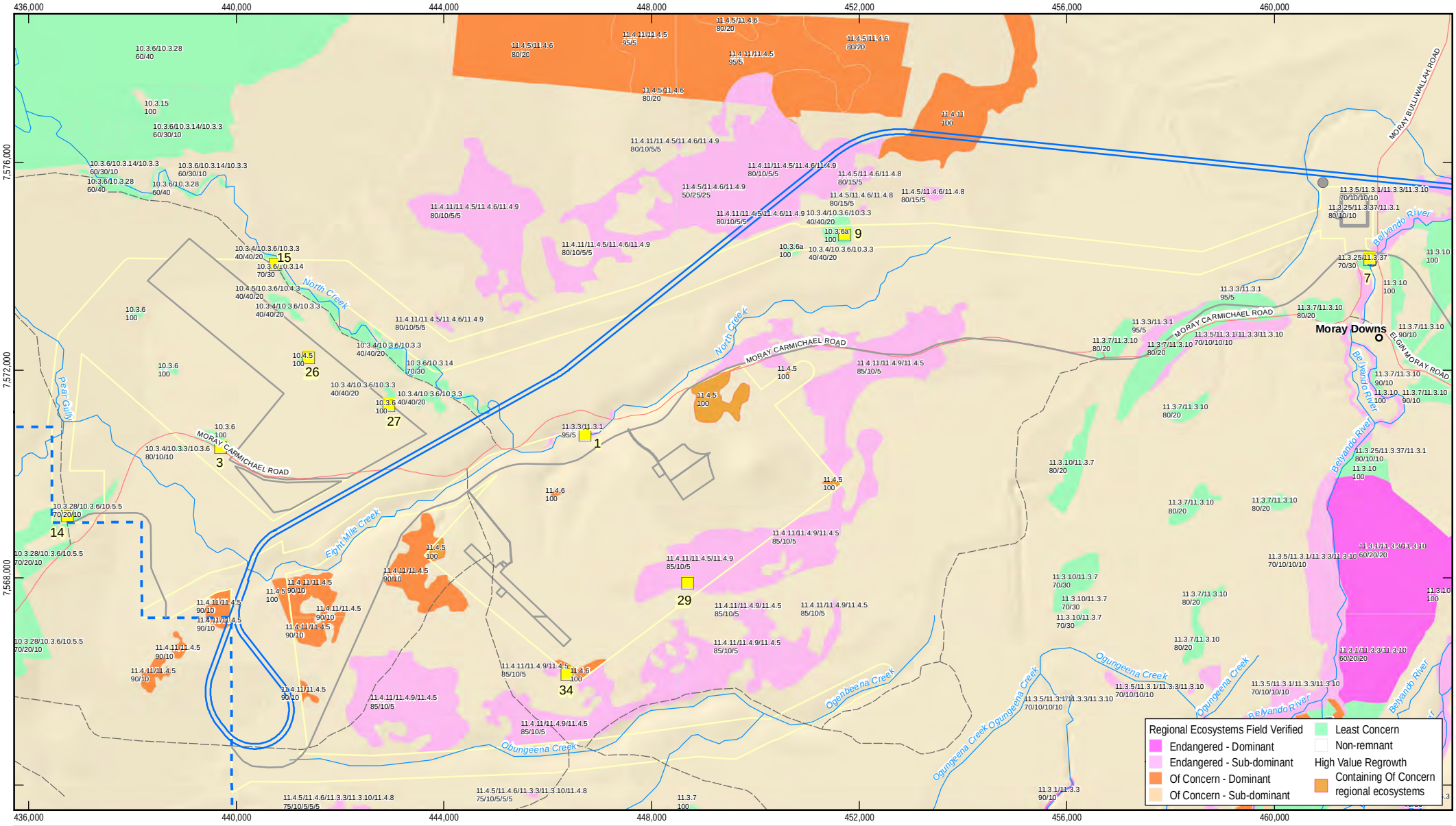
The Project (Offsite) will require clearing of 1,157.7 ha of land (Figure 2). This comprises 7.2 ha of remnant vegetation (least concern REs) and 1,150.7 ha of non-remnant vegetation. Additional areas of officially mapped RE (36.9 ha) and non-remnant vegetation (78.7 ha) are mapped within the Moray-Carmichael Road corridor. These additional areas were not field-verified as they were outside of the original Study Area (see Section 1.4). Where remnant vegetation occurs within watercourses, within wildlife corridors and within wetland areas, offsets will also be required.

Table 2 Area of regional ecosystems within the Project (Offsite) footprint

RE	VM Act Status	Description	Area (ha)
10.3.6a	Least concern	*Eucalyptus brownii* open woodland on alluvial plains	2.9
10.3.28	Least concern	*Eucalyptus melanophloia* or *E. crebra* open woodland on sandy alluvial fans	1.3
10.5.5	Least concern	*Eucalyptus melanophloia* open woodland on sand plains	0.2
10.4.5	Least concern	*Acacia cambagei* low woodland on Cainozoic lake beds	2.5
11.3.1	Endangered	Open-forest dominated by *Acacia harpophylla* and/or *Casuarina cristata,* with or without scattered emergent Eucalyptus sp.	0.0 Not assessed* / outside Study Area
11.3.3	Of concern	*Eucalyptus coolabah* woodland to open-woodland with a grassy understorey	0.0 Not assessed* / outside Study Area
11.3.7	Least concern	*Corymbia clarksoniana, C. tessellaris* and *C. dallachiana* tall woodland to open-woodland.	0.0 Not assessed* / outside Study Area

RE	VM Act Status	Description	Area (ha)
11.3.10	Least concern	*Eucalyptus brownii* grassy woodland	0.0 Not assessed* / outside Study Area
11.3.25	Least concern	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	0.16
11.3.37	Least concern	*Eucalyptus coolabah* fringing woodland on alluvial plains	0.1
11.4.5	Of concern	*Acacia argyrodendron* dominates the very sparse canopy with scattered small trees.	0.0 Not assessed* / outside Study Area
11.4.9	Endangered	Open-forest, occasionally woodland, dominated by *Acacia harpophylla* usually with a low tree mid-storey of *Terminalia oblongata* and *Eremophila mitchellii.*	0.0 Not assessed* / outside Study Area
11.4.11	Of concern	*Dichanthium sericeum* and *Astrebla* spp. grassland with patches of low *Acacia harpophylla* or *Eucalyptus coolabah.*	0.0 Not assessed* / outside Study Area

*Areas not assessed were within the proposed footprint of the Moray-Carmichael Road re-alignment, added to the Project (Offsite) footprint after surveys were completed. These REs have not been field-verified and may be incorrectly mapped in certified RE mapping (See Section 1.4).



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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Homestead
- BioCondition Assessment Sites
- Local Road
- Track
- Watercourse
- Study Area
- Rail Corridor
- Project Area
- Mine (Offsite)
- Mine (Offsite)

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BioCondition Assessment Report

Field Verified Regional Ecosystems and Biocondition Assessment Sites

Job Number 41-26422
Revision 1
Date 15-10-2013

Figure 2

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Data source: DME: EPC1690 (2010)/EPC1080 (2011); DNRM\GHD: Field Verified Regional Ecosystems (2011); GHD: Flora Survey Sites (2013); © Commonwealth of Australia (Geoscience Australia): Watercourse, Tracks (2007);
Adani: Alignment Opt11 Rev 2 (SP1 and 2)(2013), Offsite Infrastructure (2013). Created by: AJ

4. Assessment methodology

4.1 Overview

An investigation of vegetation condition and habitat quality within the Study Area was undertaken on-site by four GHD ecologists between 30 April and 6 May 2013. This section discusses the methods used during the investigations within the Study Area.

4.2 *Environmental Protection Biodiversity Conservation Act 1999* habitat quality assessment for protected matters

4.2.1 Introduction

In order to derive offsets that are suitably equivalent to the residual impacts resulting from a given project, the EPBC Act Environmental Offsets Policy requires not only a measure of the area of habitat affected, but also a measure of existing habitat quality.

The Offsets Assessment Guide, which accompanies the EPBC Act Environmental Offsets Policy, provides a number of measurements which help to quantify the impact associated with a project in order to determine the suitability of offset sites. One of these measurements is that of habitat quality for threatened species or ecological communities under the EPBC Act. There are three components that contribute to the calculation of habitat quality, including:

- **Site condition:** the condition of a site in relation to the ecological requirements of a threatened species or ecological community.
- **Site context:** the relative importance of a site in terms of its position in the landscape, taking into account the connectivity needs of a threatened species or ecological community.
- **Species stocking rate:** the usage and/or density of a species at a particular site. The principle acknowledges that a particular site may have a high value for a particular threatened species, despite appearing to have poor condition and/or context.

These three criteria contribute to a final score of habitat quality for each polygon impacted. Six matters of NES are potentially impacted by the Project (Offsite) and require calculation of habitat quality scores for all areas of potential habitat within the Study Area. The methods used to derive potential habitat and calculate habitat quality scores are described below.

4.2.2 Overview of approach

Defining potential habitat

For each protected matter of NES confirmed present or considered likely to occur within the Study Area, areas of potential habitat were mapped using the Department of Natural Resources and Mines (DNRM) VM Act RE mapping Version 6.1 as a base. For each species, RE communities known to represent potentially suitable habitat were identified and mapped to provide a map of potential habitat within the Study Area. A summary of the REs used to map potential habitat for each species is provided in Section 4.2.3.

Assessing condition

All areas of potential habitat for matters of NES were then ground-truthed in field surveys to assess their 'condition'. For each polygon of potential habitat occupied by a given species, a condition score (from 1 – 10) was derived based on the presence, absence or relative abundance of a number of specific ecological resources that are required by that species. The specific ecological criteria used to assess condition for each species are summarised in Section 4.2.4.

Assessing context

A desktop GIS approach was then used to derive separate scores for site context and site connectivity for each polygon. For both context and connectivity, each polygon was attributed a score from 1 – 10. These were calculated using the methods for measuring context and connectivity outlined in the EEM Guideline (DERM, 2011).

Assessing stocking rates

An assessment of the density and role of a species population to inform the determination of stocking rate requires detailed surveys and techniques (i.e. mark-recapture) to quantify or reliably estimate local population size and carrying capacity of a site. Given the uncertainty associated with this estimate, it has the potential to incorporate an element of error that could bias the results of the habitat quality assessment. Species stocking rates have therefore not been included in the assessment of quality. Information on 'context' and 'condition' provided in this report can be used to calculate a final score of habitat quality once a consistent approach to species stocking rate is available for the broader project.

4.2.3 Regional ecosystems used to map potential habitat

Regional ecosystems used to map potential habitat for EPBC listed species confirmed or likely to occur within the Study Area are summarised in Table 3 below. These are REs known to represent suitable habitat for each species.

Table 3 Regional ecosystems used to map potential habitat for EPBC species

EPBC species	Regional Ecosystems used to map potential habitat
Ornamental snake (*Denisonia maculata*)	RE 10.4.3, 10.4.5, 11.4.5, 11.4.6, 11.4.8, 11.4.9, 11.4.11 AND Cleared areas of non-remnant vegetation and high value regrowth that coincide with pre-cleared extent of the above REs that contain cracking clay soils
Black-throated finch (*Poephila cincta cincta*)	RE 10.3.6, 10.3.9, 10.3.13, 10.3.28, 10.4.8, 10.5.1, 10.5.5, 10.7.11, 11.3.12, 11.3.25b, 11.3.27, 11.3.30, 11.3.35, 11.11.9
Squatter pigeon (*Geophaps scripta scripta*)	RE 11.3.10, 11.3.12, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.2, 11.3.23, 11.3.25, 11.3.26, 11.3.28, 11.3.29, 11.3.3, 11.3.30, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.3.4, 11.3.6, 11.3.7, 11.3.9, 11.4.10, 11.4.12, 11.4.13, 11.4.2, 11.4.7, 11.4.8, 11.5.1, 11.5.12, 11.5.13, 11.5.17, 11.5.2, 11.5.20, 11.5.21, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.8.1, 11.8.12, 11.8.14, 11.8.15, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.9.1, 11.9.10, 11.9.13, 11.9.14, 11.9.2, 11.9.7, 11.9.9, 11.11.1, 11.11.10, 11.11.11, 11.11.12, 11.11.15, 11.11.16, 11.11.19, 11.11.20, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.12.1, 11.12.10, 11.12.11, 11.12.13, 11.12.14, 11.12.17,

EPBC species	Regional Ecosystems used to map potential habitat
	11.12.19, 11.12.2, 11.12.20, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.2, 10.3.20, 10.3.27, 10.3.28, 10.3.5, 10.3.6, 10.3.9, 10.4.3, 10.4.9, 10.5.1, 10.5.10, 10.5.11, 10.5.12, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.9.2, 10.9.3, 10.9.5
Yakka skink (*Egernia rugosa*)	RE 10.4.3, 10.4.5, 11.4.5, 11.4.6, 11.4.11
Koala (*Phascolarctos cinereus*)	RE 10.3.3, 10.3.4, 10.3.6, 11.3.1, 11.3.3

4.2.4 Criteria used to assess site condition

Criteria used to derive condition scores for each EPBC listed species confirmed present or considered likely to occur within the Study Area are summarised for each species below.

The following criteria were used to assess habitat condition in each polygon of potential habitat for EPBC listed species:

- Ornamental snake
  - Remnant vegetation status – remnant / non-remnant
  - Structural complexity of ground level habitats (i.e. woody debris, mixed substrates)
  - Grazing intensity
  - Presence / absence of cracking clay soils
- Black-throated finch (southern)
  - Density of buffel grass (*Cenchrus ciliaris*)
  - Grazing intensity
  - Relative abundance and diversity of native grasses
- Squatter pigeon (southern)
  - Density of buffel grass
  - Grazing intensity
  - Relative abundance and diversity of native grasses
  - Erosion impact
- Yakka skink
  - Structural complexity of ground level habitats (i.e. woody debris, mixed substrates)
  - Relative abundance of large hollow logs
  - Presence / absence of burrows
  - Relative abundance of ground-level vegetation cover
  - Grazing intensity
  - Erosion impact
- Koala
  - Relative abundance of *Eucalyptus tereticornis subsp. tereticornis* and *E. camaldulensis subsp. camaldulensis* (significant koala trees in Isaac Regional Council Area)

– Relative openness of understorey
– Proximity to water/ sources
– Evidence of recent or historic use by koalas (pellets and scratches)

A guide to the condition scores for the habitat of each species is summarised in Appendix A.

4.3 *Vegetation Management Act 1999* ecological equivalency methodology and BioCondition assessment

4.3.1 Ecological equivalency methodology and BioCondition assessments

The EEM Guideline (DEHP 2011c) was developed by the DERM, now the Department of Environment and Heritage Protection (DEHP), to assist in determining ecological equivalence between the areas proposed for clearing and potential offset areas, under the Vegetation Management Offset Policy.

The methodology described within the guideline includes the following criteria:

- Ecological condition
- Special features

Ecological condition is a measure using a number of field-based indicators and is based on the methodology for BioCondition Assessment Methodology Guidelines (Eyre et al., 2011) and the Methodology for the Establishment and Survey of Reference Sites for BioCondition (Eyre et al., 2006).

The special features criterion identifies areas and values which are considered unique and ecologically significant for each of the State's bioregions. There are 14 special features indicators that have been adapted from the spatial layers supporting DEHP's Biodiversity Planning Assessments (BPAs), which are a GIS-based biodiversity decision support tool (DERM, 2011c). These indicators were queried during spatial analyses, which were employed to measure landscape-level attributes and calculate the special feature scores for each assessment site.

For ecological equivalence to be met, potential offset areas must achieve an overall score for ecological condition and special feature that is equal to or greater than the score for the clearing area.

BioCondition assessments were undertaken at 10 RE sites within the Study Area (Figure 2). These sites were chosen as representative sites to establish a condition score for native vegetation types that are expected to be cleared for the Project (Offsite)(refer to Appendix A). Surveys were only undertaken within remnants that were large enough to accommodate the survey method. Assessments of potential cleared areas were undertaken to provide a comparison when determining the ecological equivalence of potential offset areas. The data from these assessments can be used once potential offset sites have been determined for the Project (Offsite). The results of the BioCondition Assessments can be found in Section 5.2.

4.3.2 Comparison with benchmark regional ecosystems

Comparison of condition is based on measurements of specific site-based attributes and a benchmark value for each of these attributes, specific to a particular RE, as well as a BioCondition score obtained from these comparisons.

At the time of the assessments, benchmark values for the impacted REs had not yet been published. Benchmarks can be derived in a number of ways. Table 4 summarises the methods for obtaining benchmark data where published benchmarks were not available.

Additional benchmark data is required to obtain BioCondition scores for the remaining two REs that were assessed within the Study Area. These have been sought from Adani. When these become available, BioCondition scores can be calculated.

The REs that were assessed, and for which benchmarks are not available, can also be used as 'best-on-offer' reference sites to obtain benchmarks for these REs. The benchmarks derived from these sites can in turn be used for comparison with REs impacted in other parts of the broader Project (Mine and Rail) area.

Table 4 Summary of assessments to obtain a BioCondition score

Regional Ecosystem	Method for establishing benchmarks	BioCondition score obtained
10.4.5	Benchmarks were obtained for five of the 13 field-based ecological condition indicators from the published RE technical description (DEHP, 2013). The technical description provides averages for ecological condition indicators (e.g. canopy height, canopy cover, species richness) for REs sampled across their range.	Yes. Scores of 0 were applied where benchmark data was not available. Therefore a low score has been obtained for this RE.
11.3.6a	Benchmarks were obtained from three polygons of RE 10.3.6a located outside of the Project (Offsite) footprint and were assessed during surveys.	Yes
11.3.3	Draft benchmarks for this RE were made available for the purpose of this assessment from the Queensland Herbarium. These benchmarks were used to calculate a BioCondition score for this RE.	Yes
11.3.37	Draft benchmarks for the RE 11.3.3 were used in assessment for RE 11.3.37. These REs are similar in structure and species composition and both fall within the same Broad Vegetation Group (BVG: 16ca). An adjustment to the benchmark canopy height was applied to the RE for a more accurate comparison and calculation of a BioCondition score. These benchmarks were made available for the purpose of this assessment from the Queensland Herbarium.	Yes

Regional Ecosystem	Method for establishing benchmarks	BioCondition score obtained
11.4.5	Benchmarks for the RE 10.3.1 were used in the assessment for RE 11.4.5. These REs are similar in structure and species composition and both fall within the same Broad Vegetation Group (BVG: 26a). An adjustment to the benchmark canopy height was applied to the RE for a more accurate comparison and calculation of a BioCondition score.	Yes

5. Results and discussion

5.1 Overview

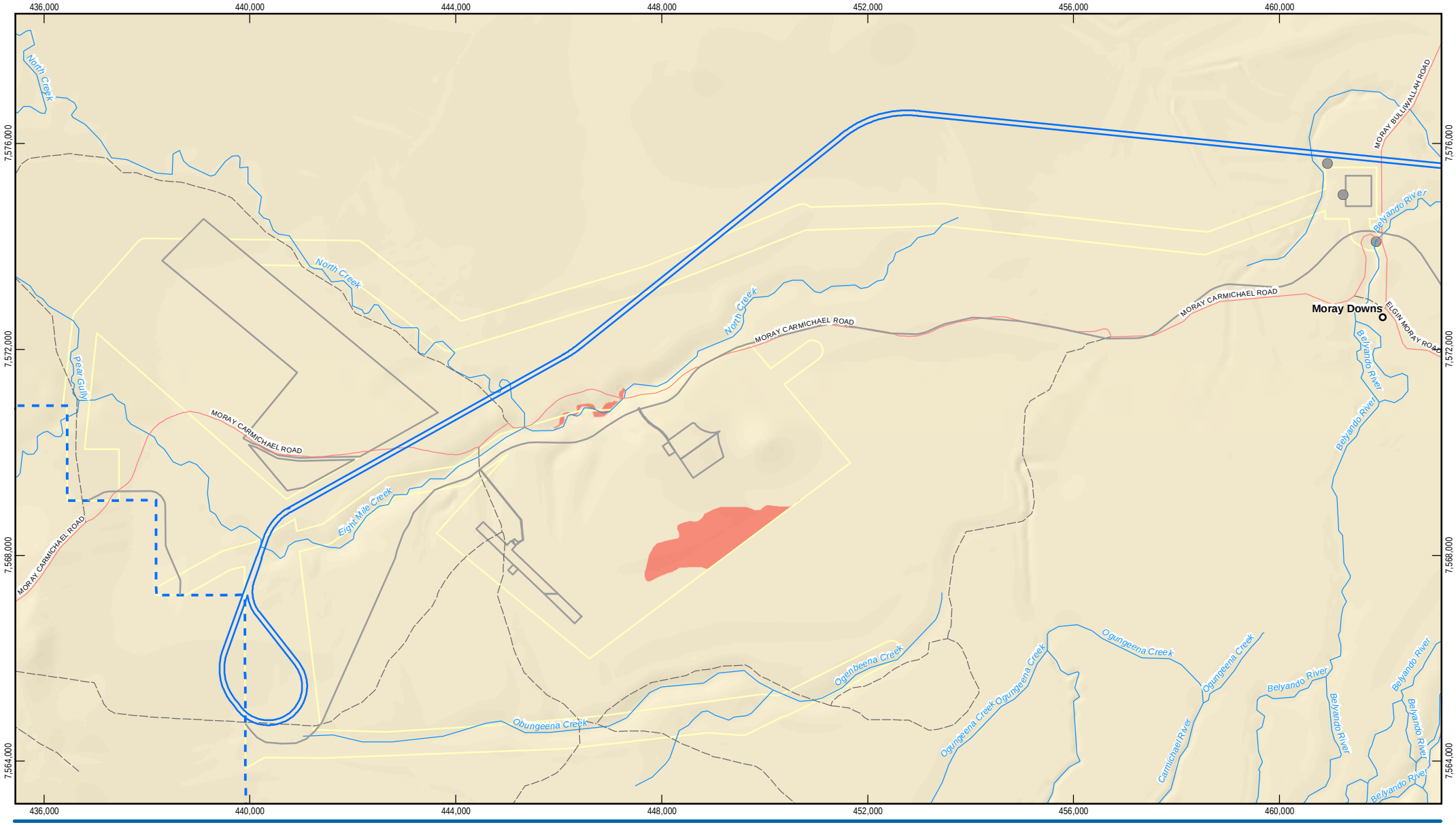
Habitat quality assessments for the single TEC and five threatened fauna species protected under the EPBC Act and BioCondition assessment results for the 11 REs protected under the VM Act are presented respectively in the following sections.

5.2 *Environmental Protection Biodiversity Conservation Act 1999* habitat quality assessment

This section will present the results of the habitat quality assessment for EPBC Act-listed TECs and threatened fauna species confirmed present or likely to occur within the Study Area.

5.2.1 Threatened ecological communities

One TEC was confirmed present within the Study Area, (but outside the Project (Offsite) footprint), Brigalow (*Acacia harpophylla* dominant and sub-dominant) TEC (refer to Figure 3). This RE was represented by the endangered REs 11.3.1 and 11.4.9. The RE 11.3.1 occurred as a narrow heterogeneous RE polygon with 11.3.3 along an ephemeral watercourse. The RE 11.4.9 was observed as patchy open-forest within a larger heterogeneous RE polygon (11.4.11/11.4.5/11.4.9) located at the southern extent of the Study Area. The brigalow RE occurred as minor areas within these heterogeneous polygon, and were too small to sample for BioCondition. As a result, no BioCondition assessment results are presented for these two REs.



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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- *Acacia harpophylla* - Dominant and Subdominant
- Study Area
- Rail Corridor
- Project Area
- Mine (Offsite)
- Mine (Offsite)

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BioCondition Assessment Report

Threatened Ecological Communities within the Study Area

Job Number 41-26422
Revision 1
Date 15-10-2013

Figure 3

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Data source: DME: EPC1690 (2010)/EPC1080 (2011); DNRM\GHD: Threatened Ecological Communities (2011); © Commonwealth of Australia (Geoscience Australia): Watercourse, Tracks (2007);
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5.2.2 Threatened species listed under the *Environmental Protection Biodiversity Conservation Act 1999*

Overview

A summary of the habitat condition, context and overall quality of potential habitat is presented for each species below.

Ornamental snake

A total of 1,432 ha of potential habitat for the ornamental snake was mapped within the Study Area. 313.8 ha of this are potentially impacted by clearing for the Project (Offsite) (refer to Figure 4). This area of potential habitat includes 2.5 ha of RE vegetation and 311.3 ha of non-remnant that coincides with the pre-clear extent of suitable RE vegetation and retains suitable substrate (i.e. cracking clay soils). Such areas are still considered potential habitat for the ornamental snake, given the species' reliance on refuges within cracking clay soils (DSEWPaC, 2011). However, the condition of these areas of non-remnant vegetation was found to be very low, with high levels of impact from grazing and stick-raking. This should be taken into consideration during the offsetting process.

A total of 36 polygons of potential habitat for the ornamental snake were mapped within the Study Area. These areas were ground-truthed to assess condition and their context/connectivity was assessed using a desktop approach in ArcGIS.

As referenced above, most (66 percent) of the polygons had low condition scores (≤ 2 out of 10). These polygons had no remnant vegetation, immature regrowth, and high grazing impacts, but retained the cracking clay soils and gilgais required by the species (refer to Plate 1). Nevertheless, a number of polygons of remnant vegetation had higher habitat condition scores, due to the presence of remnant vegetation, higher structural complexity of the ground-level habitats and a relative lack of grazing impacts (refer to Plate 2).

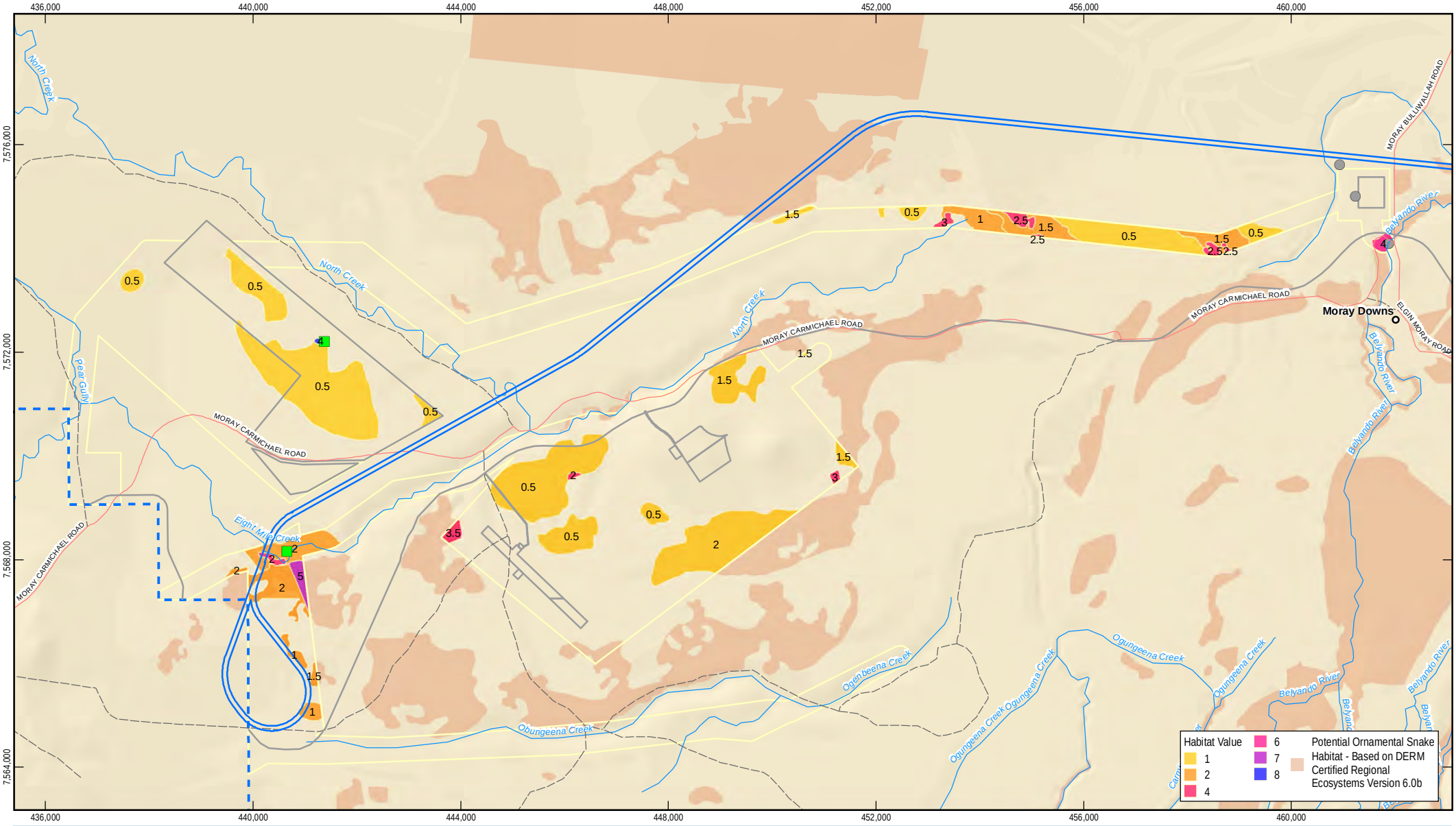
Plate 1 Low condition potential habitat for the ornamental snake

Plate 2 Moderate - high condition potential habitat for the ornamental snake

Table 5 Condition, context and quality scores for ornamental snake habitat

Polygon	Area (ha)	Condition (out of 10)	Context (out of 10)	Quality* (out of 10)
1	16.0	1	0	0.5
2	2.5	8	0	4
3	12.5	1	0	0.5
4	65.8	1	0	0.5
5	294.4	1	0	0.5
6	8.8	1	2	1.5
7	14.0	1	0	0.5
8	11.7	4	1	2.5
9	6.2	4	2	3
10	1.0	4	1	2.5
11	4.4	4	1	2.5
12	6.3	4	1	2.5
13	32.9	2	1	1.5
14	20.2	1	0	0.5
15	110.1	1	0	0.5
16	35.7	2	0	1
17	42.5	2	1	1.5
18	9.8	6	2	4
19	13.7	2	0	1
20	4.0	2	2	2
21	5.0	2	1	1.5
22	10.7	2	0	1
23	59.5	2	2	2
24	6.0	4	0	2
25	63.3	2	2	2
26	15.7	7	3	5
27	16.0	1	0	0.5
28	58.1	1	0	0.5
29	10.0	4	3	3.5
30	65.0	1	2	1.5
31	0.6	1	2	1.5
32	202.3	1	0	0.5
33	189.8	1	3	2
34	2.5	4	0	2
35	3.8	4	2	3
36	11.2	1	2	1.5

*Quality score is yet to include stocking rate estimates



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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Homestead
- Confirmed Location of Ornamental Snake
- Local Road
- Track
- Watercourse
- Study Area
- Rail Corridor
- Project Area
- Mine (Offsite)
- Mine (Offsite)

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BioCondition Assessment Report

Potential Habitat for the Ornamental Snake (Colour-coded by Quality Score)

Job Number 41-26422
Revision 1
Date 15-10-2013

Figure 4

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Data source: DME: EPC1690 (2010)/EPC1080 (2011); DNRM: Potential Habitat (2011); GHD: Confirmed Sightings (2013), Habitat Value (2013); © Commonwealth of Australia (Geoscience Australia): Watercourse, Tracks (2007); Adani: Alignment Opt11 Rev 2 (SP1 and 2)(2013), Offsite Infrastructure (2013). Created by: AJ.

Black-throated finch (southern)

A total of 94.3 ha (11 polygons) of potential habitat for the black-throated finch (southern) was mapped within the Study Area. A total of 2.5 ha is within the current proposed Project (Offsite) footprint (refer to Figure 5). These areas were ground-truthed to assess condition and their context/connectivity was assessed using a desktop approach in ArcGIS.

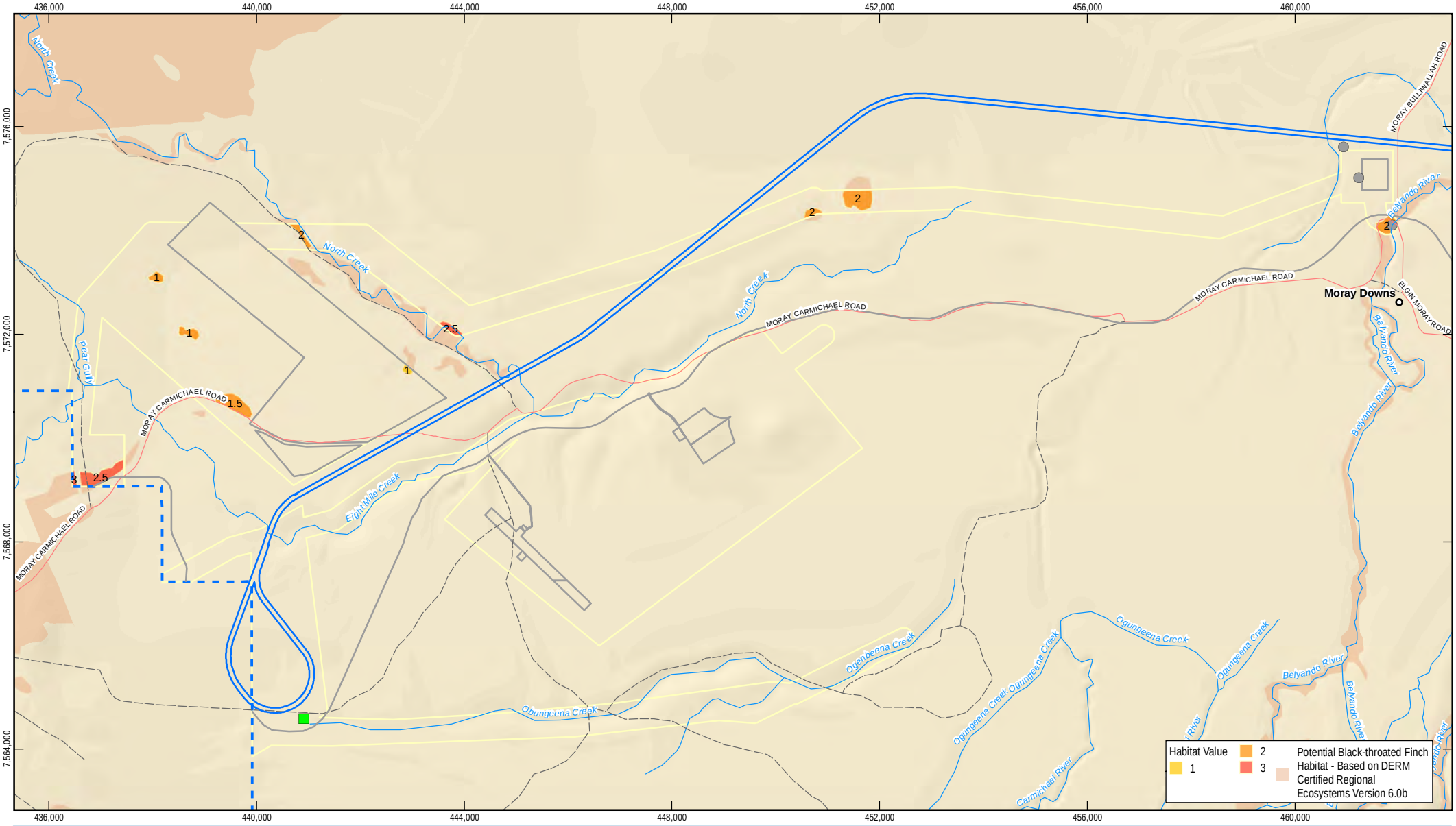
All polygons had low condition scores (≤ 3 out of 10). Despite supporting REs that are potential habitat for the black-throated finch, these areas were generally dominated by buffel grass, contained few (if any) native grasses and were subject to heavy grazing impacts (refer to Plate 3). This is in contrast to the high condition habitats recorded on the Mine, as part of surveys for the EIS (refer to Plate 4).

Table 6 Condition, context and quality scores for black-throated finch habitat

Polygon	Area (ha)	Condition (out of 10)	Context (out of 10)	Quality* (out of 10)
1	17.1	2	1	1.5
2	5.9	2	0	1
3	4.5	2	0	1
4	5.6	2	2	2
5	19.3	2	2	2
6	9.8	2	2	2
7	5.4	3	2	2.5
8	20.2	3	2	2.5
9	2.1	3	3	3
10	2.5	1	1	1
11	1.8	2	2	2
*Quality score is yet to include stocking rate estimates				

Plate 3 Low quality potential habitat for the black-throated finch within the Study Area

Plate 4 High quality potential habitat for the black-throated finch recorded on the Project (Mine) area within the Environmental Impact Statement (April, 2011)



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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Homestead
- Confirmed Location of Black-throated Finch
- Local Road
- Track
- Watercourse
- Study Area
- Rail Corridor
- Project Area
- Mine (Offsite)
- Mine (Offsite)

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Potential Habitat for the Black-throated Finch (Colour-coded by Quailty Score)

Figure 5

Job Number	41-26422
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Squatter pigeon (southern)

A total of 87.1 ha (10 polygons) of potential habitat for the squatter pigeon (southern) was mapped within the Study Area. Approximately 2.5 ha of potential habitat occurs within the current proposed Project (Offsite) footprint (refer to Figure 6). These areas were ground-truthed to assess condition and their context/connectivity was assessed using a desktop approach in ArcGIS.

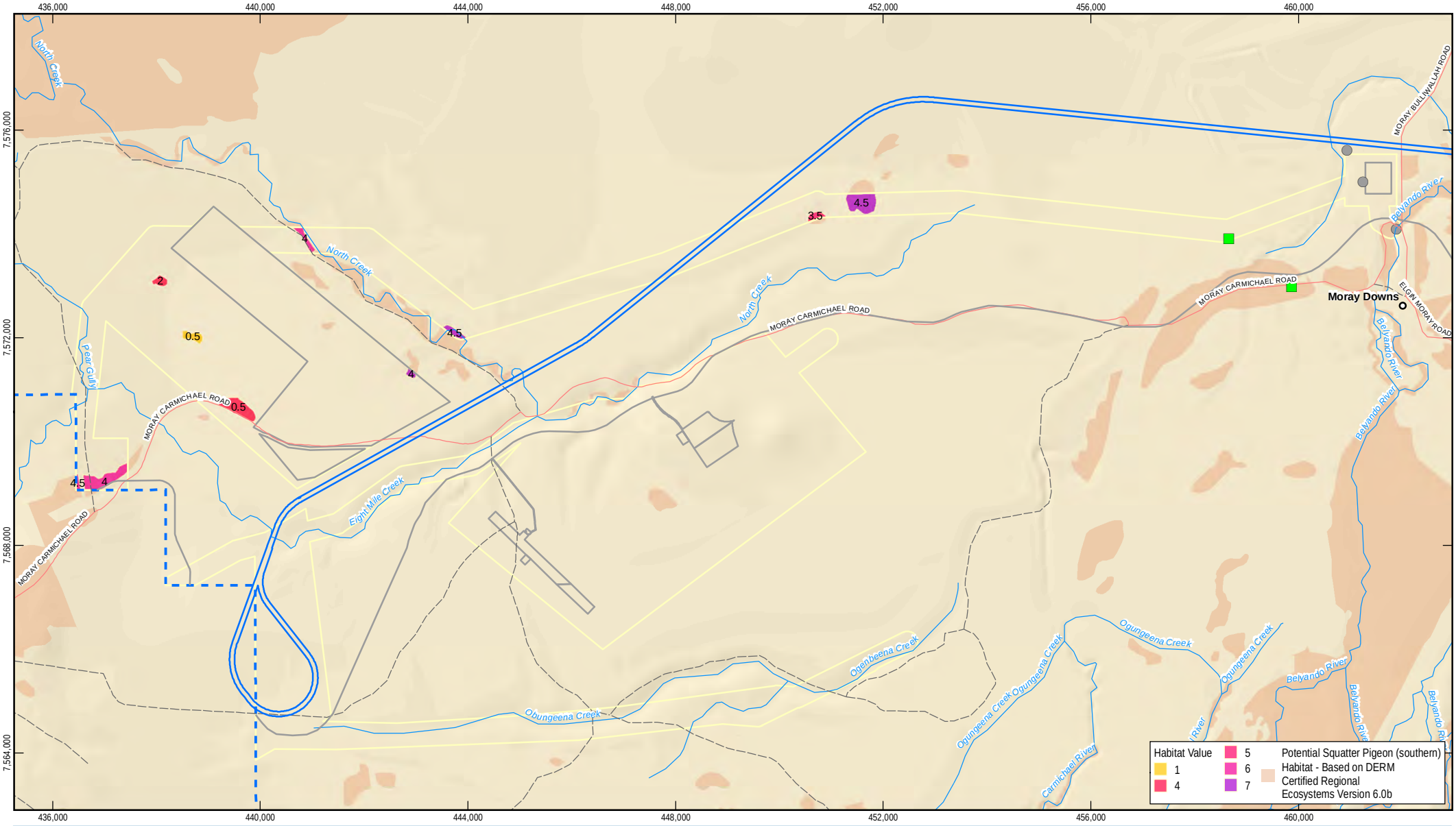
Most polygons (70 percent) had moderate condition scores (5 – 7 out of 10). These areas were characterised by a mix of buffel and native grasses, low-moderate grazing impacts and low-moderate erosion (refer to Plate 5). One polygon of potential habitat had a lower quality score due to heavy grazing pressure and an overall dominance of buffel grass (refer to Plate 6).

Table 7 Condition, context and quality scores for squatter pigeon habitat

Polygon	Area (ha)	Condition (out of 10)	Context (out of 10)	Quality* (out of 10)
1	17.1	4	1	2.5
2	5.9	1	0	0.5
3	4.5	4	0	2
4	5.6	6	2	4
5	20.2	6	2	4
6	2.1	6	3	4.5
7	2.5	7	1	4
8	5.4	7	2	4.5
9	4.4	5	2	3.5
10	19.3	7	2	4.5
*Quality score is yet to include stocking rate estimates				

Plate 5 Moderate condition potential habitat for the squatter pigeon

Plate 6 Low condition potential habitat for the squatter pigeon



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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Homestead
- Confirmed Location of Squatter Pigeon (southern)
- Local Road
- Track
- Watercourse
- Study Area
- Rail Corridor
- Project Area
- Mine (Offsite)
- Mine (Offsite)

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BioCondition Assessment Report

Potential Habitat for the Squatter Pigeon (Colour-coded by Quality Score)

Figure 6

Job Number	41-26422
Revision	1
Date	15-10-2013

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Data source: DME: EPC1690 (2010)/EPC1080 (2011); DNRM: Potential Habitat (2011); GHD: Confirmed Sightings (2013), Habitat Value (2013); © Commonwealth of Australia (Geoscience Australia): Watercourse, Tracks (2007); Adani: Alignment Opt11 Rev 2 (SP1 and 2)(2013), Offsite Infrastructure (2013). Created by: AJ.

Yakka skink

A total of 34.5 ha (5 polygons) of potential habitat for the yakka skink was mapped within the Study Area. A total of 2.5 ha is within the Project (Offsite) footprint potentially subject to clearing (refer to Figure 7). These were ground-truthed to assess condition and their context/connectivity was assessed using a desktop approach in ArcGIS.

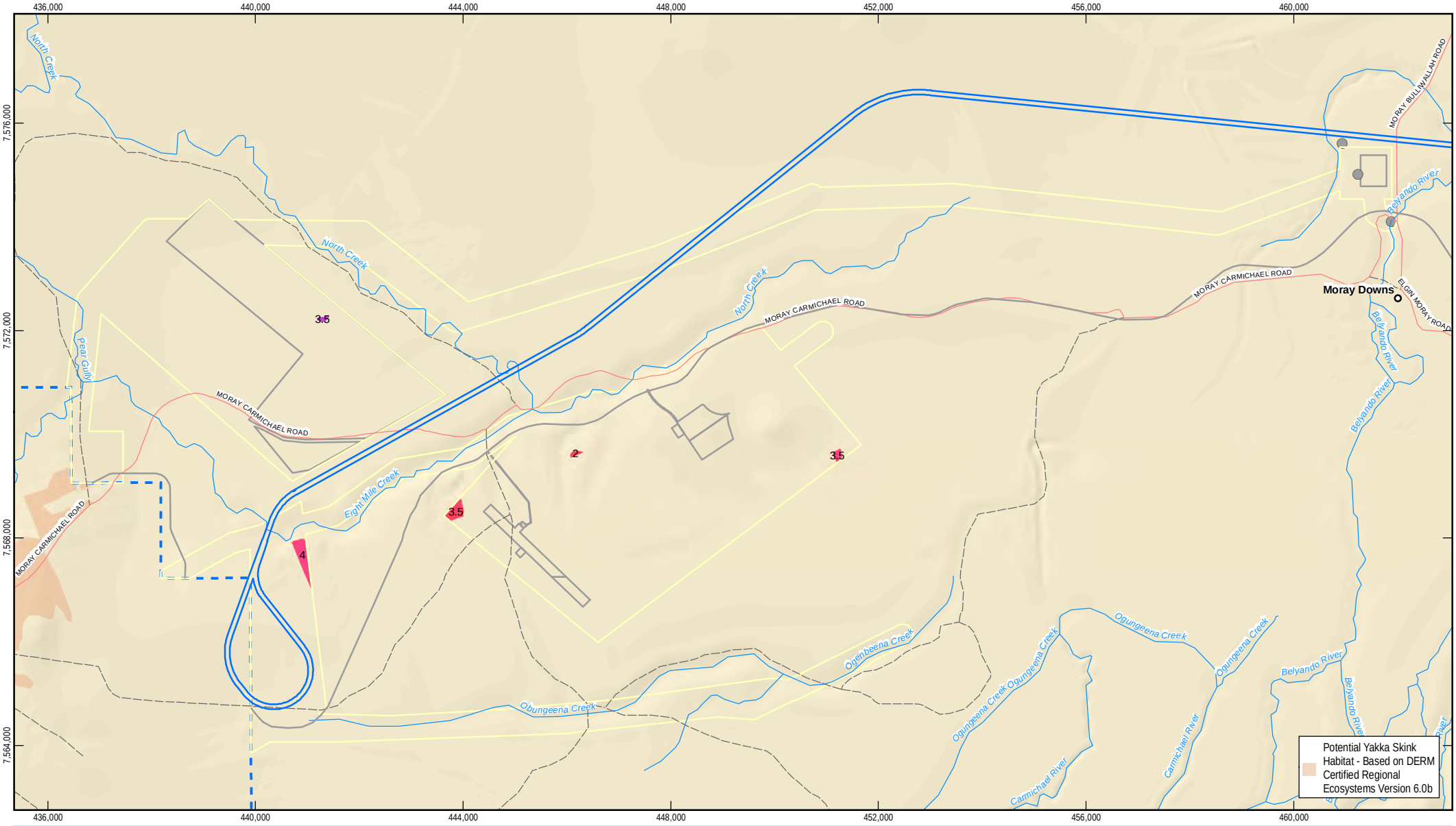
Most polygons (90 percent) had low - moderate condition scores (4 - 5 out of 10). These areas were characterised by moderate structural complexity in the ground-layer, presence of fallen logs and woody debris, but moderate grazing impacts (refer to Plate 7). One polygon of potential habitat had higher quality due to an abundance of fallen logs and relatively low grazing pressure (refer to Plate 8).

Table 8 Condition, context and quality scores for yakka skink habitat

Polygon	Area (ha)	Condition (out of 10)	Context (out of 10)	Quality* (out of 10)
1	2.5	4	0	2
2	2.5	7	0	3.5
3	15.7	5	3	4
4	3.8	5	2	3.5
5	10.0	4	3	3.5
*Quality score is yet to include stocking rate estimates				

Plate 7 Low - moderate condition potential habitat for the yakka skink

Plate 8 Moderate condition potential habitat for the yakka skink



1:100,000 (at A4)

0 2 4

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Study Area
- Habitat Value: 4, 5, 7
- Rail Corridor
- Project Area
- Mine (Offsite)
- Mine (Offsite)

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Potential Habitat for the Yakka Skink (Colour-coded by Quality Score)

Figure 7

Job Number	41-26422
Revision	1
Date	15-10-2013

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Data source: DME: EPC1690 (2010)/EPC1080 (2011); DNRM: Potential Habitat (2011); GHD: Habitat Value (2013); © Commonwealth of Australia (Geoscience Australia): Watercourse, Tracks (2007);
Adani: Alignment Opt11 Rev 2 (SP1 and 2)(2013), Offsite Infrastructure (2013). Created by: AJ.

Koala

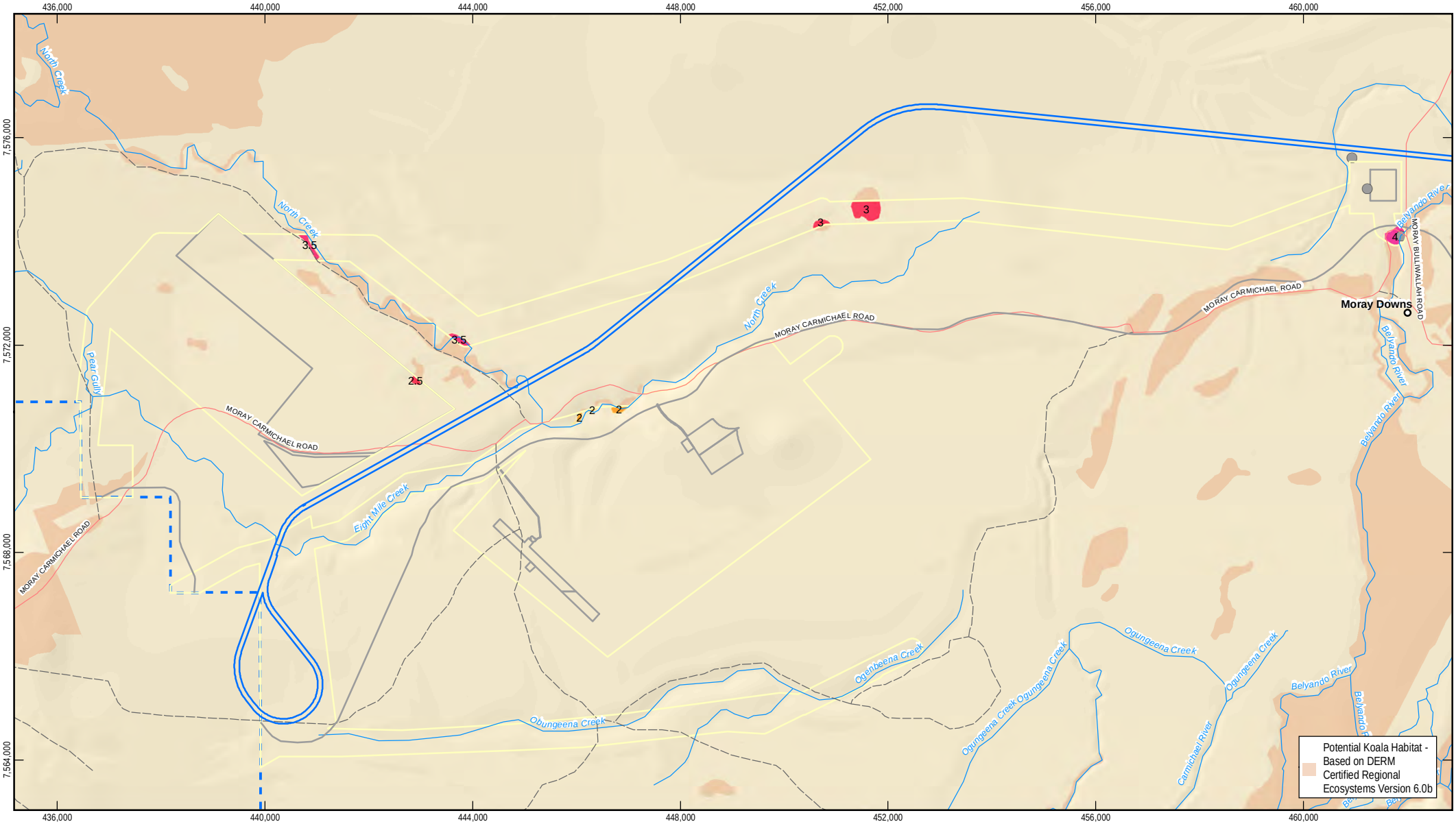
A total of 52.9 ha (7 polygons) of potential habitat for the koala was mapped within the Study Area. A total of 2.7 ha is within the current proposed Project (Offsite) footprint subject to potential clearing (refer to Figure 8). These were ground-truthed to assess condition and their context/connectivity was assessed using a desktop approach in ArcGIS.

All polygons had moderate condition scores (4 – 6 out of 10). These areas were characterised by a sub-dominant canopy of koala food trees (*Eucalyptus tereticornis* and/or *E. camaldulensis*), open understorey, but no pellets or scratches to indicate recent or historic use by koalas (refer to Plate 9).

Table 9 Condition, context and quality scores for koala habitat

Polygon	Area (ha)	Condition (out of 10)	Context (out of 10)	Quality* (out of 10)
1	5.6	5	2	3.5
2	5.4	5	2	3.5
3	2.5	4	1	2.5
4	4.4	4	2	3
5	9.8	6	2	4
6	5.8	4	2	2
7	19.3	4	2	3
*Quality score is yet to include stocking rate estimates				

Plate 9 Moderate condition potential habitat for the koala



1:100,000 (at A4)

0 2 4

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Study Area
- Habitat Value
  - 2
  - 4
  - 5
  - 6
- Rail Corridor
- Project Area
- Mine (Offsite)
- Mine (Offsite)

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BioCondition Assessment Report

Potential Habitat for the Koala (Colour-coded by Quality Score)

Job Number	41-26422
Revision	1
Date	15-10-2013

Figure 8

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Data source: DME: EPC1690 (2010)/EPC1080 (2011); DNRM: Potential Habitat (2011); Habitat Value (2013); © Commonwealth of Australia (Geoscience Australia): Watercourse, Tracks (2007);
Adani: Alignment Opt11 Rev 2 (SP1 and 2)(2013), Offsite Infrastructure (2013). Created by: AJ.

5.3 *Vegetation Management Act 1999* BioCondition assessment results

BioCondition assessments were undertaken at 10 RE sites within the Study Area. These sites were chosen as representative sites to establish a condition score for native vegetation types that occur within the Study Area. The results of these assessments are presented in Table 3 to Table 6.

The BioCondition assessment methodology provides measure of quality, considering patch size, context and connectivity, as well as a number of generic measures of habitat quality for a broad range of fauna species. Assessment of habitat quality for specific threatened fauna species is discussed further in Section 4.2). The ecological condition of assessment sites is just one criterion used in the EEM. The other criterion is 'special features', for which a score is calculated based on 14 indicators (DERM, 2011c). The results of the special features assessments are presented in Table 3 to Table 6.

The condition of remnant vegetation within the Study Area was generally of moderate condition, with moderate-high levels of disturbance from selective clearing and cattle grazing. Substantial fragmentation of remnant vegetation due to past clearing has isolated many of the remnant patches within the Study Area. Remnant vegetation along watercourses has also been cleared such that the riparian vegetation has been reduced to narrow strips along one or both sides of the watercourses.

The calculation of BioCondition scores requires comparison with benchmarks obtained from reference sites. At the time of the assessments, benchmark values for the impacted REs had not yet been published. However, benchmarks were derived for five of the assessed REs using a number of methods (refer to Section 4.3). BioCondition scores were calculated for five REs. The results of the BioCondition assessments for these five REs, including the BioCondition score are provided in Table 10. All BioCondition assessment results can be found in Appendix C. For the remaining two REs assessed within the Study Area, external BioCondition data is needed to obtain benchmarks for comparison to calculate a score.

An additional six REs were observed within the Study Area but were not assessed for BioCondition. These REs occurred as part of heterogeneous RE polygons and were represented by only small areas within these polygons. The extent of each of these REs was not large enough to accommodate the survey method and these REs were not assessed as a result.

Table 10 BioCondition assessment results and BioCondition score for bioregion 10 regional ecosystems

Regional ecosystem		10.3.6a					10.4.5		
Site			Site 27		Site 24			Site 26	
Attribute	Weighting (%)	Benchmark	Value	Score	Value	Score	Benchmark	Value	Score
Recruitment of woody perennial species (%):	5	100	50	3	66	3	100	100	5
Native plant species richness:									
Tree:	5	5	5	5	6	5	2	3	5
Shrub:	5	5	1	0	2	2.5	2	8	5
Grass:	5	3	8	5	7	2.5	5	1	0
Other species:	5	6	8	5	7	2.5	5	3	2.5
Trees:									
Canopy cover (%):	5	25.4 (canopy) 12.1 (subcanopy)	30.5 -	2.5	16.1 4.8	3.5	10.4 (canopy) 3.0 (subcanopy)	21.4 -	1.5
Median canopy height (m):	5	14.3 (canopy) 7.4 (subcanopy)	12 -	2.5	11 7	5	12 (canopy) 6.7 (subcanopy)	12 -	2.5
Large trees:									
Eucalypts									
Number of trees per hectare*:	7.5	5	6	15	8	7.5	unavailable	0	0
Non eucalypts									
Number of trees per hectare*:	7.5	1	2		0		unavailable	74	0
Shrubs:									
Shrub layer cover (%):	5	5.7	3.1	5	0	0	3.0	40.7	3
Ground cover:									
Native perennial grass cover (%):	5	0.7	20.0	5	6.0	5	unavailable	0.0	0
Organic litter cover (%):	5	32.0	32.0	5	14.4	3	unavailable	33.0	0
Coarse woody debris:									
Total length (m) of logs ≥10 cm diameter:	5	32	82	2	56	5	unavailable	1295	0
Non-native plant cover (%):	10	0	25	5	80	0	unavailable	60	0
Distance from permanent water:	20	N/a	2	2	5	5	N/a	2	2
Total:	100	N/a	N/a	62	N/a	50	N/a	N/a	21.5
BioCondition score:	N/a	N/a	0.62	2	0.50	3	N/a	0.22	4
Special features score:	N/a	N/a	N/a	15.01	N/a	0.10	N/a	N/a	20.88

Table 11 BioCondition assessment results and BioCondition score for bioregion 11 regional ecosystems

Regional ecosystem		11.3.3			11.3.37			11.4.5		
Site		Site 1			Site 7			Site 34		
Attribute	Weighting (%)	Benchmark	Value	Score	Benchmark	Value	Score	Benchmark	Value	Score
Recruitment of woody perennial species (%):	5	100	100	5	100	100	5	100	100	5
Native plant species richness:										
Tree:	5	3	3	5	3	6	5	1-5	6	5
Shrub:	5	5	3	2.5	5	3	2.5	1-5	8	5
Grass:	5	12	5	2.5	12	5	2.5	6-15	0	0
Other species:	5	15	2	0	15	7	2.5	8-17	5	2.5
Trees:										
Canopy cover (%):	5	28 (canopy) 5 (subcanopy)	43.5 38.5	4	28 (canopy) 5 (subcanopy)	3.5 25.2	2.5	12 (canopy) 3 (subcanopy)	12 -	2.5
Median canopy height (m):	5	18 (canopy) 10 (subcanopy)	17 12	5	11 (canopy) 10 (subcanopy)	17 13	5	16 (canopy) 4 (subcanopy)	10 -	1.5
Large trees:										
Eucalypts										
Number of trees per hectare*:	7.5	10	30	15	10	28	15	0	n/a	15
Non eucalypts										
Number of trees per hectare*:	7.5	n/a	2	n/a	n/a	2		6	10	
Shrubs:										
Shrub layer cover (%):	5	4.0	7.0	5	4	0.4	3	5-12	13.0	5
Ground cover:										
Native perennial grass cover (%):	5	45	28.0	3	45	38.0	5	16.0	9.4	3
Organic litter cover (%):	5	30	54.0	5	30	54.6	5	10.0	3.0	3
Coarse woody debris:										
Total length (m) of logs ≥10 cm diameter:	5	285	157	5	285	171	5	347	205	5
Non-native plant cover (%):	10	0	5	5	0	5	5	0	60	0
Size of patch:	10	N/a	2	2	N/a	10	10	N/a	10	10
Context:	5	N/a	2	2	N/a	4	4	N/a	4	4
Connectivity:	5	N/a	0	0	N/a	2	2	N/a	2	2
Total:	100	N/a	N/a	66	N/a		79	N/a	N/a	68.5
BioCondition score:	N/a	N/a	0.66	2	N/a	0.79	2	N/a	0.69	2
Special features score:	N/a	N/a	N/a	0.46	N/a		4.77	N/a	N/a	0.24

6. Summary

BioCondition surveys were undertaken within the Project (Offsite) Study Area in May 2013, to provide information to meet the requirements of the EPBC Act Environmental Offsets policy and the VM Act Vegetation Offsets Policy. BioCondition scores were obtained for five of the sampled REs.

Information on habitat condition and context was used to assess BioCondition under each policy. This information is to be incorporated into, and used in support of, a coordinated offsets strategy for the Project (Mine and Rail).

The surveys confirmed the presence of, and assessed the BioCondition of, the following environmental values within the Study Area:

- One TEC protected under the EPBC Act: *Acacia harpophylla* (dominant and sub-dominant) (9.8 ha), None of this mapped TEC occurs within the Project (Offsite) footprint.
- Potential habitat for five threatened fauna species protected under the EPBC Act
  - Ornamental snake (1432 ha)
  - Black-throated finch (southern) (94.3 ha)
  - Squatter pigeon (southern) (87.1 ha)
  - Yakka skink (34.5 ha)
  - Koala (52.9 ha)
- 11 REs protected under the VM Act

This information has been used to inform the design and layout of the Project (Offsite) footprint. Wherever possible, areas of environmental value have been avoided. The Project (Offsite) footprint directly impacts the following environmental values:

- Potential habitat for four threatened fauna species protected under the EPBC Act
  - 313.8 ha of potential habitat for the ornamental snake
  - 2.5 ha of potential habitat for the black-throated finch
  - 2.5 ha of potential habitat for the squatter pigeon (southern)
  - 2.5 ha of potential habitat for the yakka skink
  - 2.7 ha for the koala
- six least concern REs protected under the VM Act (7.2 ha)

The surveys found that the existing environment within the Study Area has been heavily impacted by past land-uses. The landscape has been substantially fragmented by past land clearing and heavily degraded by decades of moderate intensity cattle grazing. Remnants of native vegetation are predominantly small, fragmented and highly degraded, with high densities of buffel grass, erosion and trampling damage. Habitat remnants and REs within the Study Area generally had lower condition, compared with those observed in the Project Area (Mine).

As a result, many of the areas of potential habitat for EPBC listed species have only low – moderate quality scores under the EPBC Environmental Offsets guideline. The information provided in this report can be incorporated into a combined offsets strategy for the broader

Project (Mine and Rail), combining offset requirements for the Mine, Rail and offsite infrastructure.

7. References

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Appendices

Appendix A – BioCondition assessment locations

BioCondition Assessment Site	Easting	Northing	RE Assessed	Comments	Photo
Site 1	446709	7570763	11.3.1 (LC)	Occurs as a heterogeneous polygon with endangered RE 11.3.1 RE 11.3.1 occurred in patches too small to assess separately Also contains watercourse and corridor vegetation	
Site 3	439701	7570525	11.3.6a (LC)	Occurs as a heterogeneous polygon with the least concern REs 10.3.4 and 10.3.3. which were absent	

BioCondition Assessment Site	Easting	Northing	RE Assessed	Comments	Photo
Site 7	461831	7574157	11.3.37 (LC)	Occurs as a heterogeneous polygon with 11.3.25 and endangered 11.3.1 11.3.1 was absent Also contains watercourse and corridor vegetation	
Site 9	451712	7574630	10.3.6a (LC)	Occurs as a heterogeneous polygon with the least concern REs 10.3.4 and 10.3.3. which were absent	

BioCondition Assessment Site	Easting	Northing	RE Assessed	Comments	Photo
Site 14	436745	7569203	10.3.6a (LC)	Occurs as a heterogeneous polygon with the least concern REs 10.3.28 and 10.5.5	
Site 15	440748	7574054	10.3.6a (LC)	Occurs as a heterogeneous polygon with the least concern REs 10.3.4 and 10.3.3. which were absent Also contains watercourse and corridor vegetation	

BioCondition Assessment Site	Easting	Northing	RE Assessed	Comments	Photo
Site 26	441389	7572255	10.4.5 (LC)	Occurs as a heterogeneous polygon with the least concern RE 10.4.3, which was absent	
Site 27	442939	7571336	10.3.6a (LC)	Occurs as a heterogeneous polygon with the least concern REs 10.3.4 and 10.3.3. which were absent	

BioCondition Assessment Site	Easting	Northing	RE Assessed	Comments	Photo
Site 29	448695	7567907	11.4.11 (OC)	Occurs as a heterogeneous polygon with the of concern RE 11.4.5 (present) and the endangered RE 11.4.9, which was absent Also contains corridor vegetation	
Site 34	446364	7566156	11.4.5 (OC)	Occurs as a heterogeneous polygon with the of concern RE 11.4.11 and the endangered RE 11.4.9, which were absent Also contains corridor vegetation	

Appendix B – Habitat condition scores for *Environmental Protection Biodiversity Conservation Act 1999* listed species

Condition Score	Ecological characteristics used to assess habitat condition for each species
Ornamental snake (Denisonia maculata)	
1 - 2	Remnant status - Non-remnant, regrowth - immature, structural complexity - low, grazing intensity - high (evidence of trampling, dung deposition), cracking clay soils - present
3 - 4	Remnant status - non-remnant, regrowth - advanced, structural complexity - low, grazing intensity - high, cracking clay soils - present
5 - 6	Remnant status - remnant (RE), structural complexity - low-moderate, grazing intensity - moderate - high, cracking clay soils - present
7 - 8	Remnant status - remnant (RE), structural complexity - moderate, grazing intensity - moderate, cracking clay soils - present
9 - 10	Remnant status - remnant (RE),vegetation, structural complexity - moderate-high, grazing intensity - low, cracking clay soils - present
Black-throated finch (southern) (Poephila cincta cincta)	
1 - 2	Buffel grass - dense, native grasses absent, grazing intensity - high
3 - 4	Buffel grass - moderate, native grasses absent, grazing intensity - high
5 - 6	Buffel grass - low - moderate, native grasses - moderate, grazing intensity - moderate
7 - 8	Buffel grass - low, native grasses - moderate, grazing intensity - low-moderate
9 - 10	Buffel grass - absent, native grasses - abundant and diverse, grazing intensity – low
Squatter pigeon (southern) (Geophaps scripta scripta)	
1 - 2	Buffel grass - dense, native grasses absent, grazing intensity - high, erosion - high
3 - 4	Buffel grass - moderate, native grasses absent, grazing intensity - high, erosion - high
5 - 6	Buffel grass - low/moderate, native grasses - moderate, grazing intensity – moderate, erosion - moderate
7 - 8	Buffel grass - low, native grasses - moderate, grazing intensity - low/moderate, erosion - low
9 - 10	Buffel grass - absent, native grasses - abundant and diverse, grazing intensity - low, erosion absent
Yakka skink (Egernia rugosa)	
1 - 2	Structural complexity - low, large logs - absent, ground cover - absent, grazing intensity - high, erosion - high, burrows - absent
3 - 4	Structural complexity - low/moderate, large logs - low abundance, ground cover - low abundance, grazing intensity - moderate/high, erosion - moderate/high, burrows - absent
5 - 6	Structural complexity - moderate, large logs - moderate abundance, ground cover - moderate abundance, grazing intensity – low/moderate, erosion - moderate, burrows - absent
7 - 8	Structural complexity - moderate/high, large logs - moderate/high abundance, ground cover - moderate/high abundance, grazing intensity - low, erosion – low, burrows - present
9 - 10	Structural complexity - high, large logs - high abundance, ground cover - high abundance, grazing intensity - low, erosion - low, burrows - abundant
Koala (Phascolarctos cinereus)	
1 - 2	E. tereticornis, E. camaldulensis - sparse, understorey density - high, scratches/pellets - absent

Condition Score	Ecological characteristics used to assess habitat condition for each species
3 - 4	E. tereticornis, E. camaldulensis - sub-dominant, understorey density - moderate, scratches/pellets - absent
5 - 6	E. tereticornis, E. camaldulensis - sub-dominant, understorey density - low/moderate, scratches/pellets - low abundance/old
7 - 8	E. tereticornis, E. camaldulensis – dominant, understorey density - low, scratches/pellets – moderate abundance/old
9 - 10	E. tereticornis, E. camaldulensis - dominant, understorey density - low, scratches/pellets - high abundance/recent

Appendix C – BioCondition assessment results

BioCondition assessment results – bioregion 11 (woodland ecosystems)

Regional Ecosystem		11.3.3	11.3.37	11.4.5
Site		Site 1	Site 7	Site 34
Attribute	Weighting (%)	Value	Value	Value
Recruitment of woody perennial species (%):	5	100	100	100
Native plant species richness:				
Tree:	5	3	6	6
Shrub:	5	3	3	8
Grass:	5	5	5	0
Other species:	5	2	7	5
Trees:				
Canopy cover (%):	5	43.5(canopy) 38.5 (subcanopy)	3.5 (canopy) 25.2 (subcanopy)	12.0 (canopy) - (subcanopy)
Median canopy height (m):	5	17 (canopy) 12 (subcanopy)	17 (canopy) 13 (subcanopy)	10 (canopy) - (subcanopy)
Large trees:				
Eucalypts Number of trees per hectare*:	7.5	30	28	n/a
Non eucalypts Number of trees per hectare*:	7.5	2	2	10
Shrubs:				
Shrub layer cover (%):	5	7	0.4	13
Ground cover:				
Native perennial grass cover (%):	5	28.0	38.0	9.4
Organic litter cover (%):	5	54.0	54.6	3.0
Coarse woody debris:				
Total length (m) of logs ≥10 cm diameter:	5	157	171	205
Non-native plant cover (%):	10	5	5	60
Size of patch:	10	2	10	10
Context:	5	2	4	4
Connectivity:	5	0	2	2
Total:	**100**			
Special features score:		**0.46**	**4.77**	**0.24**

BioCondition assessment results - bioregion 11 (grassland ecosystems)

Regional Ecosystem		11.4.11
Site		Site 29
Attribute	Weighting (%)	Value
Recruitment of woody perennial species (%):	**0**	n/a
Native plant species richness: Tree: Shrub: Grass: Other species:	 **0** **0** **5** **5**	 n/a n/a 10 12
Trees: Canopy cover (%): Median canopy height (m):	 **0** **0**	 n/a n/a
Large trees: Eucalypts Number of trees per hectare*: Non eucalypts Number of trees per hectare*:	 **0** **0**	 n/a n/a
Shrubs: Shrub layer cover (%):	 **0**	 n/a
Ground cover: Native perennial grass cover (%): Organic litter cover (%):	 **5** **5**	 70.0 6.0
Coarse woody debris: Total length (m) of logs ≥10 cm diameter:	 **0**	 n/a
Non-native plant cover (%):	**10**	5
Size of patch:	**10**	10
Context:	**5**	4
Connectivity:	**5**	2
Total:	**50**	
Special features score:		0

BioCondition assessment results – bioregion 10 (woodland ecosystems)

Regional Ecosystem		10.3.6a					10.4.5
Site		Site 27	Site 3	Site 9	Site 14	Site 15	Site 26
Attribute	Weighting (%)	Value	Value	Value	Value	Value	Value
Recruitment of woody perennial species (%):	5	50	66	33	66	50	100
Native plant species richness:							
Tree:	5	5	5	4	6	5	3
Shrub:	5	1	7	1	2	8	8
Grass:	5	8	3	3	7	2	1
Other species:	5	8	8	4	7	5	3
Trees:							
Canopy cover (%):	5	30.5 (canopy) - (subcanopy)	54.9 (canopy) - (subcanopy)	14.4 (canopy) 21.0 (subcanopy)	16.1 (canopy) 4.8 (subcanopy)	6.8 (canopy) 15.3 (subcanopy)	21.4 (canopy) - (subcanopy)
Median canopy height (m):	5	12 (canopy) - (subcanopy)	11 (canopy) - (subcanopy)	17 (canopy) 12 (subcanopy)	11 (canopy) 7 (subcanopy)	15 (canopy) 10 (subcanopy)	12 (canopy) - (subcanopy)
Large trees:							
Eucalypts Number of trees per hectare*:	7.5	6	4	10	8	2	n/a
Non eucalypts Number of trees per hectare*:	7.5	2	0	2	0	2	74
Shrubs:							
Shrub layer cover (%):	5	3.1	4.3	3.7	0	9.1	40.7
Ground cover:							
Native perennial grass cover (%):	5	20.0	0	2.0	6.0	0	0.0
Organic litter cover (%):	5	32.0	46.4	16.0	14.4	33.6	33.0

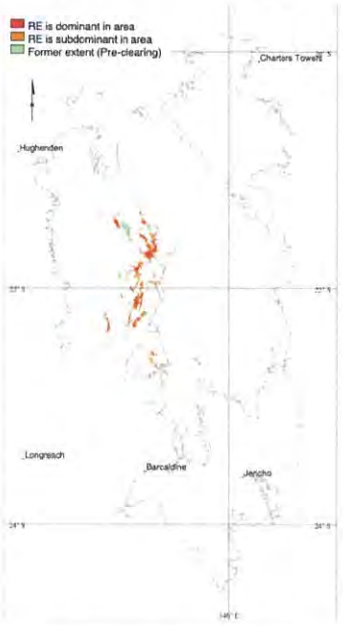
Regional Ecosystem		10.3.6a					10.4.5
Site		Site 27	Site 3	Site 9	Site 14	Site 15	Site 26
Attribute	Weighting (%)	Value	Value	Value	Value	Value	Value
Coarse woody debris: Total length (m) of logs ≥10 cm diameter:	5	82	204	35	56	125	1295
Non-native plant cover (%):	10	25	60	80	80	75	60
Distance from permanent water:	20	2	5	5	5	0	2
Total:	**100**						
Special features score:		**15.01**	**2.85**	**0.01**	**0.1**	**5.52**	**20.88**

Appendix D – BioCondition benchmarks and regional ecosystem technical descriptions

BioCondition benchmark for regional ecosystem condition assessment

Desert Uplands — Regional ecosystem: 10.3.1

Acacia argyrodendron low open-woodland on alluvial plains (western)



Melinda Laidlaw

BioCondition attribute			Benchmark
Recruitment of dominant canopy species (%):			100
Native plant species richness:		Tree:	1-5
		Shrub:	1-5
		Grass:	6-15
		Forbs and other:	8-17
Trees:	Tree canopy	Tree canopy median height (m):	10
		Tree canopy cover (%):	12
	Tree sub-canopy	Tree sub-canopy median height (m):	4
		Tree sub-canopy cover (%):	3
	Large trees	Large eucalypt tree dbh threshold (cm):	30
		Number of large eucalypt trees per hectare:	0
		Large non-eucalypt tree dbh threshold (cm):	25
		Number of large non-eucalypt trees per hectare:	6
	Typical tree species: Acacia argyrodendron (blackwood), Atalaya hemiglauca (western whitewood), Lysiphyllum carronii (ebony tree)		
Shrubs:		Native shrub cover (%):	5-12
	Typical shrub species: Eremophila mitchellii (false sandalwood), Psydrax oleifolia (wild lemon), Carissa lanceolata (conkle berry)		
Ground cover (%):		Native perennial grass cover (%):	16
		Organic litter cover (%):	10
	Typical ground cover species: Sporobolus actinocladus (katoora grass), Astrebla spp., Enteropogon acicularis (curly windmill grass), Evolvulus alsinoides (tropical speedwell), Trianthema triquetra (red spinach)		
Coarse woody debris: Total length (m) of debris ≥ 10cm diameter and ≥0.5m in length per hectare:			347
Non-native plant cover			0
None listed			

Selected typical species are those that characterize the ecosystem, community or stratum at reference sites. Up to five frequently occurring species for each stratum are selected. Users should refer to the regional ecosystem description database (REDD) and/or the technical description for more complete lists of characteristic species. Only the most frequently used common name is given. Other common names may be used in other regions. Declared pest species in Queensland are designated (^).

RE: 11.3.3 ***Eucalyptus coolabah*** **woodland on alluvial plains**

BioCondition Attributes	Benchmark	Typical Species
Tree Canopy Cover (%)	28	
Tree Subcanopy Cover (%)	5	
Native Shrub Cover (%)	4	
Large eucalypt tree DBH threshold (cm)	45	
Number of Large Eucalypt Trees (per ha)	10	
Large non-eucalypt tree DBH threshold (cm)	na	
Number of Large non-eucalypt Trees (per ha)	na	
Tree Canopy Height (m)	18	
Tree Subcanopy height (m)	10	
Coarse Woody Debris (m/ha)	285	
Species Richness – Trees	3	*Eucalyptus coolabah, E. populnea, Acacia pendula, Acacia salicina,*
Species Richness – shrubs	5	*Acacia stenophylla, Acacia pendula, Acacia salicina, Casuarina cristata,*

Species Richness – grasses	12	*Aristida leptopoda, Bothriocloa erianthoides, Chloris divaricata,*
Species Richness - forbs and other	15	*Cyperus bifax, Sida hackettiana, Brunoniella australis, Cyperus gracilis,*
Ground cover – native perennial grass cover (%)	45	
Ground cover – organic litter (%)	30	
Non-native plant cover (%)	0	*Malvastrum americanum var. americanum (spiked malvastrum), Parkinsonia aculeata, Megathyrsus maximus (green panic grass), Vachellia farnesiana (mimosa bush), Cenchrus ciliaris (buffel grass), Parthenium hysterophorus, Opuntia stricta (smooth*
Reliability ranking (* = low reliability; ***** highly reliable)	****	
Benchmarks developed by the Queensland Herbarium, based on 14 CorVeg and two Qld Herbarium BioCondition reference sites (MGD0012, MGD0013), two O2 Ecology reference sites and expert opinion. April 2013.		

Technical Description Regional ecosystem: **10.4.5**

Acacia cambagei low woodland on Cainozoic lake beds

E.J. Thompson

Pre-clearing area (ha), remnant area (ha) and per cent remaining:	45,550	17,639	39%

Species recorded: Total: 121; woody: 26; ground: 106; Avg. spp./site: 42.8; std dev.: 8.4, 4 site(s)

Basal area: Avg./site: 6.6 m²/ha, range: 3.8 - 9 m²/ha, std. deviation: 2 m²/ha, 4 site(s)

Structural formation: Woodland: 40%; open-woodland: 40%; low open-woodland: 20%, 5 site(s)

Representative sites: 2436, 19972, 20062, 20086, 20124.

Stratum: T1

Height avg. = 12.0m, range 8-16m, 5 sites

Crown cover avg. = 10.4%, range 4.0-20.0%, 5 sites

Stem density/ha avg. = 140, range 40-280, 4 sites

Dominant species (relative cover, frequency): Acacia cambagei (86, 100%), Acacia harpophylla (5, 60%)

Frequent species (cover, frequency): Acacia cambagei (10, 100%), Acacia harpophylla (1, 60%), Acacia argyrodendron (2, 20%), Acacia excelsa (20%), Amyema quandang (20%), Eucalyptus cambageana (20%), Flindersia dissosperma (1, 20%)

Stratum: T2

Height avg. = 6.7m, range 5-8m, 3 sites

Crown cover avg. = 3.0%, range 2.0-5.0%, 3 sites

Stem density/ha avg. = 467, range 120-1080, 3 sites

Dominant species (relative cover, frequency): Lysiphyllum carronii (63, 40%), Acacia cambagei (47, 40%)

Frequent species (cover, frequency): Acacia cambagei (2, 40%), Lysiphyllum carronii (2, 40%), Acacia argyrodendron (20%), Acacia harpophylla (1, 20%), Eremophila mitchellii (1, 20%), Terminalia oblongata (1, 20%)

Dominant species: Relative cover (mean of cover of species / total cover of all species in that stratum for all values > zero) and frequency (percent of total sites) ordered by decreasing relative abundance. Up to five most dominant species with frequency > 20% listed for each stratum.

Frequent species: Cover (mean of all values > zero) and frequency (percent of total sites) of all species occurring in more than 5% of sites ordered by decreasing frequency. Ground layer species are listed as either graminoid or forb.

Naturalised species have an asterisk (*) after the name. indet. after listed name = indeterminate species or genus

Technical Description Regional ecosystem: **10.4.5**

Stratum: S1

Height avg. = 2.0m, range 0.6-4m, 5 sites

Crown cover avg. = 3.0%, range 1.0-6.0%, 5 sites

Stem density/ha avg. = 1250, range 200-2760, 4 sites

Dominant species (relative cover, frequency): Eremophila mitchellii (52, 40%), Acacia cambagei (50, 60%), Eremophila deserti (11, 40%), Santalum lanceolatum (9, 40%), Ehretia membranifolia (8, 60%)

Frequent species (cover, frequency): Acacia cambagei (2, 60%), Ehretia membranifolia (60%), Eremophila deserti (1, 40%), Eremophila mitchellii (3, 40%), Santalum lanceolatum (40%), Acacia harpophylla (20%), Alectryon diversifolius (20%), Apophyllum anomalum (20%), Atalaya hemiglauca (20%), Carissa lanceolata (1, 20%), Carissa ovata (1, 20%), Enchylaena tomentosa (20%), Flindersia dissosperma (20%), Hakea leucoptera (20%), Owenia acidula (20%), Psydrax oleifolia (1, 20%), Senna artemisioides subsp. filifolia (20%)

Stratum: S2

Height avg. = 0.6m, range 0.5-0.6m, 2 sites

Crown cover avg. = 0.5%, range 0.0-1.0%, 2 sites

Stem density/ha avg. = 400, 1 site

Frequent species (cover, frequency): Abutilon otocarpum (20%), Acacia cambagei (1, 20%), Atalaya hemiglauca (20%), Carissa lanceolata (20%), Enchylaena tomentosa (20%), Eremophila deserti (20%), Psydrax oleifolia (20%), Salsola kali (20%), Sarcostemma viminale subsp. brunonianum (20%), Senna artemisioides subsp. filifolia (20%)

Stratum: G

Height avg. = 0.2m, range 0.1-0.3m, 4 sites

PFC avg. = 7.3%, range 5-11%, 4 sites

Dominant species (relative cover, frequency): Tripogon loliiformis (16, 40%), Paspalidium caespitosum (13, 60%), Enteropogon acicularis (7, 80%), Eragrostis lacunaria (6, 40%), Sporobolus caroli (3, 80%)

Frequent species (cover, frequency): GRAMINOIDS: Enteropogon acicularis (1, 80%), Pennisetum ciliare (80%), Sporobolus caroli (80%), Paspalidium caespitosum (1, 60%), Paspalidium constrictum (60%), Bothriochloa ewartiana (40%), Dactyloctenium radulans (40%), Enneapogon polyphyllus (40%), Enteropogon ramosus (40%), Eragrostis lacunaria (1, 40%), Sporobolus actinocladus (40%), Tripogon loliiformis (1, 40%), Aristida latifolia (20%), Brachyachne convergens (20%), Chloris pectinata (20%), Chrysopogon fallax (20%), Cyperus bifax (20%), Cyperus concinnus (20%), Dichanthium fecundum (20%), Echinochloa colona* (20%), Enneapogon lindleyanus (20%), Enneapogon pallidus (20%), Eragrostis microcarpa (20%), Eragrostis schultzii (20%), Eragrostis setifolia (20%), Eriochloa pseudoacrotricha (20%), Eulalia aurea (2, 20%), Fimbristylis dichotoma (20%), Heteropogon contortus (20%), Iseilema vaginiflorum (20%), Leptochloa decipiens (5, 20%), Leptochloa fusca (1, 20%), Leptochloa fusca subsp. fusca (20%), Oxychloris scariosa (1, 20%), Panicum effusum (20%), Sporobolus coromandelianus* (20%), Sporobolus disjunctus (20%), Tragus australianus (20%), Urochloa gilesii (20%)*
FORBS: Abutilon oxycarpum (60%), Capparis lasiantha (60%), Portulaca oleracea (60%), Sida fibulifera (60%), Sida trichopoda (60%), Alternanthera micrantha (40%), Amyema quandang var. bancroftii (40%), Boerhavia dominii (40%), Chamaesyce drummondii (40%), Commelina lanceolata (40%), Dipteracanthus australasicus (40%), Enchylaena tomentosa (40%), Evolvulus alsinoides (40%), Marsdenia viridiflora (40%), Marsilea hirsuta (40%), Portulaca australis (40%), Salsola kali (40%), Trianthema triquetra (40%), Achyranthes aspera (20%), Alternanthera angustifolia (20%), Alternanthera nana (20%), Atalaya hemiglauca (20%), Centipeda minima (20%), Cheilanthes distans (20%), Einadia hastata (20%), Einadia nutans (20%), Einadia trigonos (20%), Epaltes australis (20%), Galactia tenuiflora (20%), Goodenia lunata (20%), Harrisia martini* (20%), Hibiscus brachysiphonius (20%), Hibiscus krichauffianus (20%), Hybanthus enneaspermus (20%), Hygrophila angustifolia (20%), Indigofera linnaei (20%), Maireana villosa (20%), Malvastrum americanum* (20%), Melhania oblongifolia (20%), Neptunia dimorphantha (20%), Neptunia gracilis (20%), Ocimum tenuiflorum (2, 20%), Parsonsia lanceolata (20%), Phyllanthus maderaspatensis (20%), Portulaca filifolia (20%), Psydrax oleifolia (20%), Rhynchosia minima (20%), Rostellularia adscendens (20%), Sarcostemma brevipedicellatum (20%), Sauropus trachyspermus (20%), Sclerolaena convexula (20%), Sclerolaena diacantha (20%), Sclerolaena everistiana (20%), Sclerolaena ramulosa (20%), Sclerolaena tricuspis (20%), Senna artemisioides (20%), Senna artemisioides subsp. filifolia (20%), Sesbania cannabina (20%), Sida everistiana (20%), Sida spinosa* (20%), Solanum esuriale (20%), Stylosanthes hamata* (20%), Xenostegia tridentata (20%)*

Dominant species: Relative cover (mean of cover of species / total cover of all species in that stratum for all values > zero) and frequency (percent of total sites) ordered by decreasing relative abundance. Up to five most dominant species with frequency > 20% listed for each stratum.

Frequent species: Cover (mean of all values > zero) and frequency (percent of total sites) of all species occurring in more than 5% of sites ordered by decreasing frequency. Ground layer species are listed as either graminoid or forb.

Naturalised species have an asterisk (*) after the name. indet. after listed name = indeterminate species or genus

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C-2: Carmichael Coal Mine Ecological Equivalence Assessment Stage 2 (Eco Logical Australia 2014a)

Carmichael Coal Mine Ecological Equivalence Assessment

Stage 2

Prepared for
Adani Mining Pty Ltd

30 January 2014

DOCUMENT TRACKING

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Prepared by	Dr Alana Burley, Bruce Wilson
Reviewed by	Brad Dreis
Approved by	Brad Dreis
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Contents

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Abbreviations

Abbreviation	Description
API	Aerial photographic interpretation
BRB	Brigalow Belt bioregion
BVG	Broad Vegetation Group
CCM	Carmichael Coal Mine
CWD	Coarse woody debris
DERM	Department of Environment and Resource Management (Queensland)
DEU	Desert Uplands bioregion
DoE	Department of Environment (Commonwealth)
EA	Environmental Authority
EEM	Ecological Equivalence Methodology
EHP	Department of Environment and Heritage Protection (Queensland)
EIS	Environmental Impact Statement
ELA	Eco Logical Australia
EP Act	*Environmental Protection Act 1994* (Queensland)
EPBC Act	*Environment Protection and Biodiversity Act 1999* (Commonwealth)
EPC	Exploration Permit for Coal
GIS	Geographic Information System
IBRA	Interim Biogeographic Regionalisation for Australia
ML	Mining Lease
MNES	Matters of National Environmental Significance
MR Act	*Mineral Resources Act 1989* (Queensland)
OAG	Offset Assessment Guide
PVMO	Policy for Vegetation Management Offsets (Queensland)
QBOP	Queensland Biodiversity Offset Policy

Abbreviation	Description
QGEOP	Queensland Government Environmental Offsets Policy
QGIS	Queensland Government Information System
RE	Regional Ecosystem
SDPWO Act	*State Development and Public Works Organisation Act 1971* (Queensland)
SSBV	State Significant Biodiversity Value
TEC	Threatened Ecological Community
VM Act	*Vegetation Management Act 1999* (Queensland)

1 Introduction

1.1 Project background

Adani Mining Pty Ltd (herein referred to as Adani) is developing the Carmichael Coal Mine (CCM) Project in the Galilee Basin, central Queensland. The proposed mine site is located about 170 km north-west of Clermont, which is approximately 100 km north of the regional centre of Emerald. The mine and supporting infrastructure for the CCM project will be located within the boundary of Exploration Permit for Coal (EPC) 1690 and the eastern part of EPC1080, a total area of approximately 45,048 ha. The CCM proposed mine site is located within two Bioregions, the Desert Uplands (DEU) in the western portion and the Brigalow Belt (BRB) to the east.

The proposed mine is expected to produce 60 million tonnes per annum of product coal at peak production. The project has a potential mine life of 60 years, including construction, operation and closure. It is expected that operations will be in six open cut pits and five underground pits. The overall workable length of the mine will be approximately 45 km. Export coal from this project will predominantly service the Indian market.

1.1.1 Need for assessment

In order to satisfy State and Commonwealth policy requirements, offsets will be necessary where unavoidable impacts to identified ecological values cannot be reasonably avoided or mitigated.

Adani currently holds EPC1690 under the *Mineral Resources Act 1989* (MR Act) and an associated Environmental Authority (EA). The eastern and northern portions of EPC1080, and its associated code of environmental compliance, are held by Waratah Coal, with whom Adani have an agreement to undertake exploration activities. One of the conditions listed in the EA for EPC1690 (permit no. EPPR00745013) is the identification of state significant biodiversity values (SSBV) and the completion of an ecological equivalence assessment for those values present on all sites to be impacted. Ecological equivalence must be demonstrated as it is a requirement for the identification of offset supply areas as stipulated in the EA issued for the proposed works under the Queensland Biodiversity Offsets Policy (QBOP). The requirement for 'obtaining ecological equivalence' is set out in Section 10, Part A Criteria of the QBOP.

It is anticipated that offsets will be required under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) environmental approval conditions. The EPBC Act Environmental Offsets Policy (EPBC Act Offsets Policy) provides transparency around how the suitability of offsets is determined, based on the level of residual impact to a protected matter. Offset requirements under the EPBC Act are set out in Section 7 of the EPBC Act Offsets Policy. The suitability of a proposed offset is considered as part of the decision as to whether or not to approve a proposed action under the EPBC Act.

Adani applied for a Mining Lease application (ML) in July 2013 and has also sought a single EA for the mining project to cover the following activities:

- six open cut coal mining pits (Pits B to G) running from north to south
- five underground mining areas (Underground Mines 1 to 5) running from north to south
- haul roads and ramps
- mine stockpile and crushing areas
- rejects and 'dry' tailings dumping

- spoil dumps.

Once approved, these activities would be regulated by the ML issued under the MR Act and the EA issued under the *Environmental Protection Act 1994* (EP Act).

Prior to that approval, Adani still has an obligation to meet the conditions of the current EA for EPC1690 and comply with the standard code of compliance of the EA for EPC1080.

1.1.2 Offset policies

The Queensland Government Environmental Offsets Policy (QGEOP) establishes a framework for using environmental offsets in Queensland and came into effect on 1 July 2008. The QGEOP is based on seven principles that guide the use of offsets to achieve ecologically sustainable development:

- offsets will not replace or undermine existing environmental standards or regulatory requirements, or be used to allow development in areas otherwise prohibited through legislation or policy
- environmental impacts must first be avoided, then minimised, before considering the use of offsets for any remaining impact
- offsets must achieve an equivalent or better outcome
- offsets must provide environmental values as similar as possible to those being lost
- offset provision should minimise lag time between the impact and the offset delivery
- offsets must provide additional protection to environmental values at risk, or additional management actions to improve environmental values
- offsets must be legally secured for the duration of the offset requirement.

The Queensland Policy for Vegetation Management Offsets, Version 3, 2011 (PVMO) supports the *Vegetation Management Act 1999* (VM Act), which regulates vegetation clearing in Queensland. The VM Act is not applicable to Level 1 mining activities as Level 1 mining activities are defined as 'not assessable development' under the Sustainable Planning Regulation 2009. As such, the PVMO does not apply to project activities that are subject to a mining lease.

The Queensland Biodiversity Offset Policy, Version 1, 2011 (QBOP) does not expressly apply to projects declared as 'significant projects' under the *State Development and Public Works Organisation Act 1971* (SDPWO Act); however, the Coordinator-General may use discretionary powers to require compliance with the policy for approval. The QBOP's objective is to increase long-term protection and viability of SSBV by offsetting residual impacts from development. The current EA for EPC1690 requires offsets to be met in accordance with the QBOP. Although projects declared as significant projects under the SDPWO Act are not directly bound to the QBOP, an offset requirement is almost certain to form part of the approval conditions set by the Coordinator-General and QBOP is likely to be used as the basis for equitable offsets requirements.

Based on the results of the project's EIS assessment which identified significant impacts on three matters of environmental significance (MNES) listed under the EPBC Act, in addition to the various SSBVs, it is also assumed that offsets will be required under Commonwealth policy. The EPBC Act Environmental Offsets Policy, October 2012 (EPBC Act Offsets Policy) outlines the Australian Government's approach on the use of environmental offsets to compensate for the residual adverse impacts on MNES protected under the EPBC Act. The EPBC Act Offsets Policy is accompanied by the Offsets Assessment Guide (OAG) which uses a balance sheet approach to estimate impacts and offsets for MNES. Offsets seek to provide a net environmental gain through targeted actions (direct or

indirect) and do not necessarily facilitate onsite impact. Under the EPBC Act, environmental offsets can be used to maintain or enhance the health, diversity and productivity of the environment.

1.1.3 Environmental Offset Strategy

An Environmental Offset Strategy for the Carmichael Coal Mine and Rail Project was prepared by Ecofund Queensland Pty Ltd, part of CO2 Group (Ecofund) in November 2012 and submitted as a component of the EIS. An Environmental Offset Strategy for the Exploration Program on EPC1690 was also prepared by Ecofund in December 2012.

The Environmental Offset Package for the Carmichael Coal Mine and Rail Project was prepared by Ecofund as a second stage in the delivery of the project's offset plan in November 2013 and submitted as a component of the supplementary EIS. This package further refines and confirms the residual impacts of the project requiring offsets and outlines the approach for implementation and delivery of the offset package.

1.2 Project scope

Eco Logical Australia (ELA) was engaged by Adani to undertake an ecological equivalence assessment for the Carmichael Coal Mine. ELA has assumed that significant impacts will result from open cut mining. The Queensland Government's Ecological Equivalence Methodology (EEM) was used to undertake the assessment for the clearing areas (impact areas) that support SSBVs and hence trigger the requirements of the QBOP. For the purpose of the QBOP, state significant biodiversity values are those values listed in Appendix 1 of the QBOP and include regional ecosystems, essential habitat, wetlands, watercourses, connectivity and protected animals.

The assessment also included areas within the mine development footprint that support MNES and/or their habitat. There are six MNES protected under the EPBC Act of relevance to the project:

- world heritage properties
- national heritage places
- wetlands of international importance (listed under the Ramsar Convention)
- listed threatened species and ecological communities
- migratory species protected under international agreements
- a water resource, in relation to coal seam gas development and large coal mining development

In order to satisfy State environmental offsets policy requirements, offsets will be necessary where unavoidable or residual impacts to identified ecological values cannot be reasonably avoided or mitigated. As Adani is in the process of determining potential offset areas, the scope of the project did not include identifying or conducting ecological equivalence assessments on potential offset areas.

SSBVs and MNES identified across the Carmichael Coal Mine provide an indication of the likely offset liabilities for the CCM and the following have been assessed within this scope:

- Remnant Endangered REs
- Remnant Of Concern REs
- Brigalow TEC
- Wetlands
- Watercourses
- Threatened and migratory fauna species:
    - Squatter Pigeon (*Geophaps scripta scripta*)

  - Black-throated Finch (southern) (*Poephila cincta cincta*)
  - Black-necked Stork (*Ephippiorhynchus asiaticus*)
  - Cotton Pygmy-goose (*Nettapus coromandelianus*)
  - Little Pied Bat (*Chalinolobus picatus*)
  - Koala (*Phascolarctos cinereus*)
  - Ornamental Snake (*Denisonia maculata*)
  - Yakka Skink (*Egernia rugosa*)
  - Square-tailed Kite (*Lophoictinia isura*)
  - Black-chinned Honeyeater (*Melithreptus gularis*)
- Threatened flora species, Waxy Cabbage Palm (*Livistona lanuginosa*)

Completion of the impact calculations as per the Commonwealth Department of Environment's (DoE) Offset Assessment Guide (OAG), which accompanies the EPBC Act Offsets Policy, is also included in this scope of works. The impact calculation of the OAG is the initial phase of determining the offset liabilities for MNES contained within the Carmichael Coal Mine footprint.

In response to the previous work prepared by ELA, the Department of Environment and Heritage Protection (EHP) also recommended the preparation of an RE Map Amendment to address the RE inaccuracies across site. The inaccuracies identified are predominantly associated with incorrect attribution of the RE type in the RE Mapping (version 8.0) provided by EHP. The RE Map Amendment will rectify these current errors through the provision of validated field data (refer to ELA 2014). In doing so, an accurate determination of SSBV and MNES such as threatened species habitat and threatened ecological communities across the Carmichael Coal Mine will be certified in the State Mapping database providing greater confidence in the project's offset liabilities for both the proponent and regulator.

The key objective for this scope of works is the delivery of an EEM report (this report) prepared in accordance with the Ecological Equivalence Methodology Guideline, Version 1 (DERM 2011) which includes survey methods, summary of results and ecological condition and special features scores for the clearing area.

1.3 Ecological equivalence method and criterion indicators

This section outlines the ecological equivalence assessment method set by DERM (2011). Usually offsets would be considered as part of this method. However, assessment of offsets was not part of ELA's scope for this report as offset areas are yet to be confirmed.

Ecological equivalence assessments are usually undertaken by assessing two ecological equivalence criteria on proposed clearing and offset areas. The first criterion, 'ecological condition', is assessed using a standard set of 14 indicators, including ten field-based and four GIS-based indicators (refer to **Appendix B**). The ten field-based indicators require the collection of a range of data characterising the structure and composition of plant assemblages. The four GIS-based indicators are assessed by undertaking spatial analyses on available spatial data layers and/or aerial imagery. Assessment of three of the GIS-based indicators is undertaken for sites in fragmented bioregions only and for one of the indicators in intact bioregions only.

The ten field-based indicators are assessed by following the method set out in the Ecological Equivalence Methodology Guideline, Version 1 (DERM 2011). Clearing sites and offset sites are initially stratified, where necessary, into homogeneous assessment units by identifying different REs and broad condition states (i.e. remnant, high value regrowth, low value regrowth and/or cleared areas).

A 100 m x 50 m nested sampling plot is then established and assessed within the assessment unit of focus, ensuring that the plot does not cross any environmental gradients. The plot is established in an area that is at least 50 m from a major disturbance (e.g. a road). The ten field-based indicators are all assessed within this plot.

The on-ground delineation of homogeneous assessment units can sometimes be problematic, especially in areas mapped as heterogeneous polygons (i.e. those polygons attributed with more than one RE). In these situations, areas within these polygons need to be ground truthed to ascertain the RE present within the clearing site. This task was undertaken by ELA for Adani in September 2013 with site stratification into assessment units and sampling sites based on site assessment. The site stratification for this report was approved by EHP on 28 October 2013.

The second criterion, 'special features', is assessed by undertaking a desktop spatial analysis using GIS data available from EHP. The relevant GIS layers required for assessment are downloaded from the Queensland Government Information System (QGIS).

2 Methods

2.1 Desktop review and analysis

Data reviewed at a desktop level, prior to field work, including the following documents and information sources:

- Carmichael Coal Mine Environmental Impact Statement (GHD 2012)
- Carmichael Coal Mine Supplementary Environmental Impact Statement (GHD 2013)
- Environmental Offset Strategy (Ecofund 2012)
- Environmental Offset Package (Ecofund 2013)
- Galilee Basin Offset Strategy (EHP 2013)
- Carmichael Coal Mine Exploration Sites Ecological Equivalence Assessment (ELA 2013)
- Carmichael Coal Mine Regional Ecosystem Map Amendment (ELA 2014)
- Relevant GIS layers
- BioCondition data and regional ecosystem technical descriptions
- Aerial imagery

Site stratification and the delineation of assessment units across the mining footprint was based on ground-truthed Regional Ecosystem (RE) mapping produced in ArcGIS from field data collected at sample sites across the mining footprint, and from aerial photographic interpretation (API) of high resolution 2012 imagery of the Moray Downs property.

2.1.1 Results of stage 1 RE ground-truthing

RE's that were the focus of the ground-truthed mapping included those that were found to correspond to a SSBV (**Table 1**). The Interim Biogeographic Regionalisation for Australia (IBRA) bioregion boundaries version 7.0 was used to determine REs from the Desert Uplands and Brigalow Belt bioregion across the mining footprint.

As per the EEM Guideline, delineation of assessment units was based on the following rules:

- The area is a unique regional ecosystem; or
- The area is the same regional ecosystem but in a different condition; or
- The area is an isolated area.

Assessment units were then further grouped by Broad Vegetation Groups (BVG's) (**Table 1**). The BVG's for RE10.3.6a and RE10.5.5a, which provide habitat for Black-throated Finch, were combined as one assessment unit (BVG 17a/17b) due to the similar habitat structure, resources and values these areas provide for the target species, as well as the difficulty in delineating these communities through aerial photographic interpretation (API). Further analysis was undertaken to determine whether the entirety of this assessment unit provided habitat for the threatened species, particularly Black-throated Finch. This involved buffering all known water points (farm dams, troughs, creeks and wetlands) and Black-throated Finch records by 5 km, and identifying habitat that intersected the buffer.

Table 1: SSBVs within the Carmichael Coal Mine mining footprint and the corresponding ground-truthed REs and BVGs

SSBV	Desert Uplands RE's	Brigalow Belt RE's	BVG
Endangered REs (VM Class)	-	11.4.9	25a
Of Concern REs (VM Class)	-	11.4.6	26a
Wetlands	10.3.4b, 10.3.13a, 10.3.14a, 10.4.5a	11.3.25, 11.3.27f, 11.4.9	16a, 25a, 26a, 34d
Watercourses	10.3.4b, 10.3.6a, 10.3.12a, 10.3.13a, 10.3.14a	11.3.10, 11.3.25, 11.3.27f	16a, 17a, 18a, 26a
Black-throated Finch habitat	10.3.6a, 10.3.6ax1, 10.3.12a, 10.3.13a, 10.3.14a, 10.5.1a, 10.5.1d, 10.5.5a, 10.7.5	11.3.10, 11.3.25, 11.3.27f	12a, 16a, 17a, 17b, 17c, 18a, 34d
Ornamental Snake habitat	10.3.4b, 10.3.13a, 10.3.14a, 10.4.3a, 10.4.5a	11.3.25, 11.3.27f, 11.4.6, 11.4.9	16a, 25a, 26a, 34d
Squatter Pigeon habitat	10.3.6a, 10.3.6ax1, 10.3.12a, 10.3.13a, 10.3.14a, 10.5.1a, 10.5.1d, 10.5.5a, 10.7.5	11.3.10, 11.3.25, 11.3.27f	12a, 16a, 17a, 17b, 17c, 18a, 34d
Yakka Skink habitat	10.3.6a, 10.3.6ax1, 10.3.12a, 10.3.13a, 10.3.14a, 10.5.1a, 10.5.1d, 10.5.5a, 10.7.5	11.3.10, 11.3.25, 11.3.27f	12a, 16a, 17a, 17b, 17c, 18a, 34d
Square-tailed Kite habitat	10.3.6a, 10.3.6ax1, 10.3.12a, 10.3.13a, 10.3.14a, 10.5.1a, 10.5.1d, 10.5.5a, 10.7.5	11.3.10, 11.3.25, 11.3.27f	12a, 16a, 17a, 17b, 17c, 18a, 34d
Black-chinned Honeyeater habitat	10.3.6a, 10.3.6ax1, 10.3.12a, 10.3.13a, 10.3.14a, 10.5.1a, 10.5.1d, 10.5.5a, 10.7.5	11.3.10, 11.3.25, 11.3.27f	12a, 16a, 17a, 17b, 17c, 18a, 34d
Black-necked Stork habitat	10.3.13a, 10.3.14a	11.3.25, 11.3.27f	16a, 34d
Cotton Pygmy-goose habitat	10.3.14a	11.3.27f	16a, 34d
Little Pied Bat habitat	10.3.6a, 10.3.6ax1, 10.3.12a, 10.3.13a, 10.3.14a, 10.5.1a, 10.5.1d, 10.5.5a, 10.7.5	11.3.10, 11.3.25, 11.3.27f	12a, 16a, 17a, 17b, 17c, 18a, 34d
Koala habitat	10.3.6a, 10.3.6ax1, 10.3.12a, 10.3.13a, 10.3.14a	11.3.10, 11.3.25, 11.3.27f	12a, 16a, 17a, 17b, 17c, 18a, 34d
Echidna habitat	10.3.6a, 10.3.6ax1, 10.3.12a, 10.3.13a, 10.3.14a, 10.5.1a, 10.5.1d, 10.5.5a, 10.7.5	11.3.10, 11.3.25, 11.3.27f	12a, 16a, 17a, 17b, 17c, 18a, 34d
Waxy Cabbage Palm	10.3.13a	11.3.25	16a

No High Value Regrowth was identified on the site and although there is one Threshold RE polygon (RE11.3.5) it is not located within the mine footprint.

2.1.2 State significant biodiversity values (SSBVs)

The SSBVs identified across the Carmichael Coal Mine sites that were assessed through the ecological condition field component are listed below:

- Remnant Endangered RE11.4.9
- Remnant Of Concern RE11.4.6
- Wetlands
- Watercourses
- Threatened and migratory fauna species:
    - Squatter Pigeon (*Geophaps scripta scripta*)
    - Black-throated Finch (southern) (*Poephila cincta cincta*)
    - Black-necked Stork (*Ephippiorhynchus asiaticus*)
    - Cotton Pygmy-goose (*Nettapus coromandelianus*)
    - Little Pied Bat (*Chalinolobus picatus*)
    - Ornamental Snake (*Denisonia maculata*)
    - Yakka Skink (*Egernia rugosa*)
    - Square-tailed Kite (*Lophoictinia isura*)
    - Black-chinned Honeyeater (*Melithreptus gularis*)
- Threatened flora species, Waxy Cabbage Palm (*Livistona lanuginosa*)

Further details on each of the SSBVs listed above are shown in **Table A1** of **Appendix A**.

2.1.3 Matters of national environmental significance (MNES)

The EIS and SEIS identified three MNES across the Carmichael Coal Mine as significantly impacted. Sites were assessed simultaneously during the ecological condition field component for the three MNES listed below:

- Brigalow Belt Threatened Ecological Community
- Black-throated Finch (southern) (*Poephila cincta cincta*)
- Waxy Cabbage Palm (*Livistona lanuginosa*)

Other MNES known to occur across the Carmichael Coal Mine site but which will not be significantly impacted by the mine footprint and were therefore not assessed as MNES during this survey, include:

- Squatter Pigeon (*Geophaps scripta scripta*)
- Ornamental Snake (*Denisonia maculata*)
- Koala (*Phascolarctos cinereus*)
- Yakka Skink (*Egernia rugosa*)

2.1.4 Site stratification

The site stratification framework was developed based on the known occurrence of SSBVs and MNES as listed above. A total of eight assessment units were delineated across the mining footprint. Assessment unit 4 (BVG 17a/17b) is the largest units and is associated with Black-throated Finch

habitat. Further analysis through buffering of all water points and species records indicated that the entirety of this unit is potential habitat for the species. **Table 2** and **Figure 1** provide an outline of each of the assessment units and the area (ha) of impact due to the surface mining footprint.

At the time of site stratification and field survey, version 7 of the Regional Ecosystem Description Database (REDD) was used. For this report, REDD version 8 has been used. This has resulted in the conservation status change of RE10.7.4 from of concern to least concern/no concern at present for both VM class and Biodiversity Status. Four sites were sampled within RE10.7.4 (EE5, EE6, EE7, EE8) making up an assessment unit for BVG 19d. This assessment unit will not be further discussed in this report, leaving the total number of assessment units as eight with the total number of EE sites as 46 (**Table 2**).

Table 2: Assessment unit delineation and site stratification results

Assessment unit	BVG	Total surface[1] impacted area on mining lease (EPC1690 and eastern portion of EPC1080 (ha)	Total area on mining lease (EPC1690 and eastern portion of EPC1080 (ha)	EE sites
1	12a	13	13	EE10
2	16a	50	407	EE1, EE2, EE11, EE12, EE31, EE32, EE33, EE34, EE45, EE50
3	34d	33	56	EE3, EE4, EE9
4	17a/17b	8,811	20,823	EE13, EE14, EE15, EE16, EE17, EE18, EE19, EE20, EE21
5	17c	711	5,754	EE22, EE23, EE24, EE25, EE26
6	18a	332	385	EE27, EE28, EE29, EE30, EE46, EE47
7	25a	573	851	EE35, EE36, EE37, EE38, EE39, EE44
8	26a	430	912	EE40, EE41, EE42, EE43, EE48, EE49
Other	19d, 21b, 24a	115	615	n/a
Total[2]		**10,942**	**29,201**	**46 EE sites**

1. Disturbance of surface area within the mining footprint only, does not include underground disturbance

2. Total area values do not include 'Other'.

The Bygana West Nature Refuge is located south of the Carmichael River and extends across both EPC1690 and EPC1080. An area designated as a Nature Refuge is not regarded as a SSBV under the QBOP. However, it contains SSBVs that require offsets and these have been considered and included in the assessment.

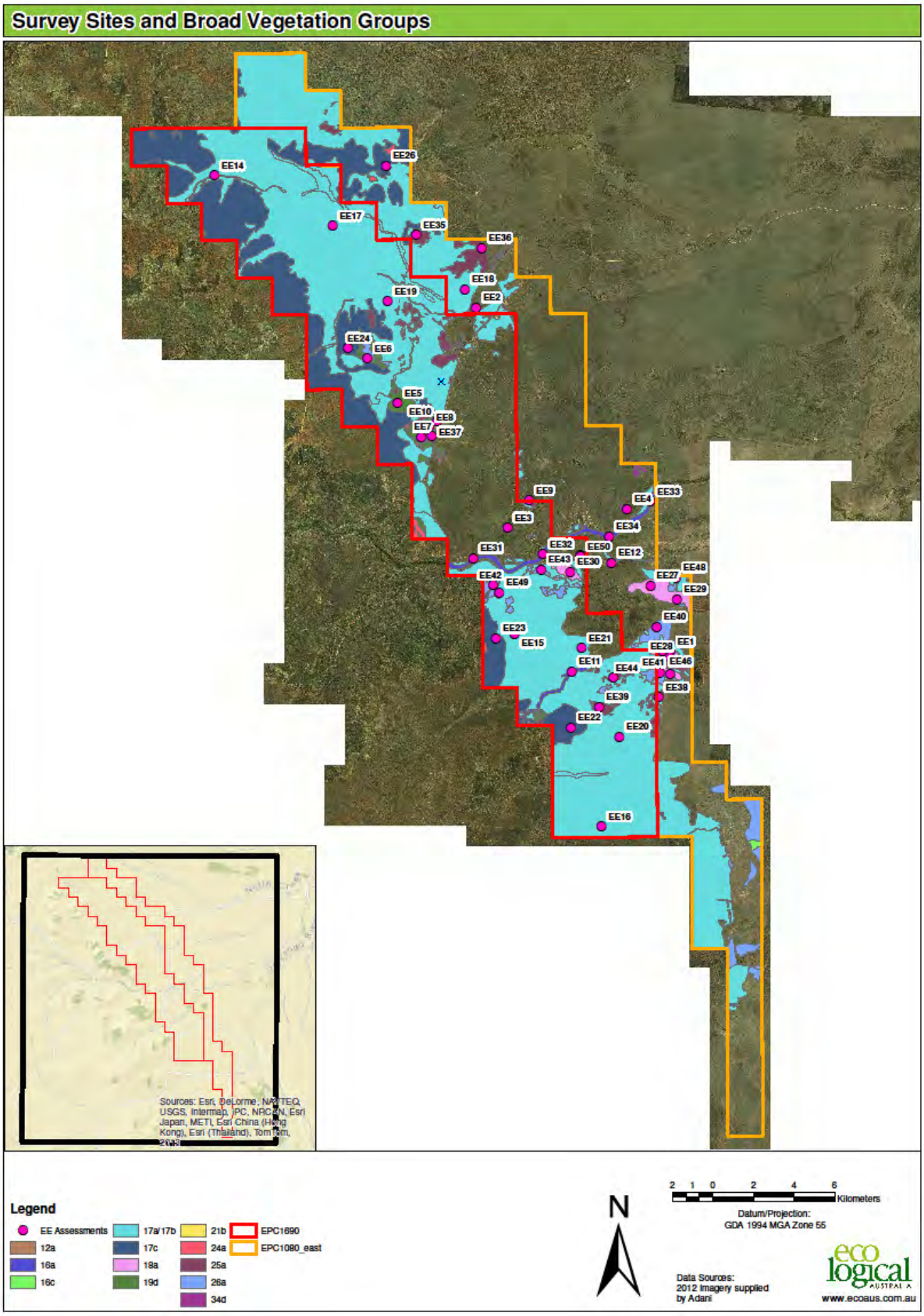

Figure 1: Ecological equivalence survey sites and broad vegetation groups

2.2 Field survey – ecological condition

Field survey was undertaken by two teams of ecologists (i.e. four ecologists) from 9-16 December 2013. The survey consisted of data collection relating to ten field based indicators of ecological condition identified in the EEM (refer to **Appendix B**). Data was collected at 46 sites representing the eight assessment units, refined based on the results of the Stage 1 assessment. Survey of each of these sites was completed over five days.

Ecological condition of the areas to be impacted by mining activities was assessed using the method outlined in the EEM and the *BioCondition Assessment Manual* (Eyre et al. 2011).

The only variation from the prescribed method was that three sampling sites (EE2, EE12, and EE45) were sampled using a plot size of 100 m x 25 m (0.25 ha), as opposed to the recommended plot size of 100 m x 50 m (0.5 ha). Each of these sites consisted of a relatively narrow strip of riparian vegetation. All scores were adjusted accordingly for the ecological condition scoring in **Section 3.3**.

2.2.1 Additional survey consideration of MNES

In addition to the ecological condition indicators collected for SSBVs, the following was also recorded for MNES threatened species:

- Black-throated Finch – presence of key grass species and permanent water bodies within Black-throated Finch habitat
- *Livistona lanuginosa* – counts of individuals where clearing is proposed within habitat (i.e. the Carmichael River corridor)

2.3 GIS analysis – ecological condition

The GIS analysis was undertaken independent of the field assessment. This section describes the methods used in both the calculation and scoring of spatial features for ecological condition, as defined under the EEM (DERM 2010). Special features scoring methods are discussed in **Section 2.4**.

Assessment of the GIS-based indicators was undertaken using the GIS analysis protocols set out in the EEM. The four indicators (listed in **Table B2** of **Appendix B**) measured are:

- 11. Patch size
- 12. Connectivity
- 13. Context
- 14. Distance from permanent water

The intact landscape of the DEU bioregion requires only the GIS-based indicator 14 to be assessed. The BRB bioregion is classified as a fragmented landscape and requires assessment of GIS-based indicators 11, 12 and 13. Ecological indicator 13 and the special features indicators require assessment of patch characteristics using Queensland Government GIS data.

The updated RE map layer (GTRE_Jan14, ELA 2014) was used in the assessment of GIS-based indicators. The spatial layers used to assess the GIS-based ecological indicators were:

- GTRE_Jan14 (updated RE mapping, ELA 2014)
- RE mapping Version 8 (EHP RE Mapping)
- Dams_Hydro_Indicative_MorayDowns_GHD_Pre_20130101 (GHD 2013)
- PastSurveys_Waterbodies_GHD_Pre_20130101 (GHD 2013)

- Carmichael River spatial location
- Aerial imagery provided by Adani

2.4 Special features

Assessment of the special features indicators was undertaken using the special features assessment protocols set out in the EEM. The scoring criteria for the special features are listed in **Table B3** of **Appendix B**. The spatial layers used to assess the special features were:

- GTRE_Jan14 (updated RE mapping, ELA 2014)
- QLD_VEG_OFFSET_BPA_SF_CUR (State-wide special features data based on Biodiversity Planning Assessments)
- SEIS_Footprint_Breakdown_v3 (GHD 2013)
- Aerial imagery provided by Adani

Calculation of indicators 1 to 12 involved querying the Queensland Government's offsets special features dataset spatial layer. Special features indicator 13 requires the calculation of the percentage of remnant and high value regrowth vegetation within a 1 km buffer around the assessment unit. Special features indicator 14 requires determination of whether the area is within a 2 km buffer from the boundary of a protected area estate.

The updated RE map layer (GTRE_Jan14, ELA 2014) was intersected with the state-wide special features data (QLD_VEG_OFFSET_BPA_SF_CUR.shp), the mining footprint (SEIS_Footprint_Breakdown_v3) and the lease boundaries of EPC1690 and eastern portion of EPC1080 to determine special features for each assessment unit within the clearing area. As each assessment unit intersected with a range of special feature polygons, the special feature score for each unique assessment unit/special feature combination was calculated separately and then summed across each assessment unit (refer to **Table D1** in **Appendix D** for the breakdown of clearing areas and special feature scores).

3 Ecological equivalence scoring

3.1 Clearing area assessment units

A description of each assessment unit sampled on the Carmichael Coal Mine site is given below and the location of each on the mine site is shown in **Figure 2**. Photos representative of each assessment unit are presented in **Appendix E**.

Assessment unit 1

Eucalyptus thozetiana dominates the woodland canopy in association with *Acacia harpophylla*. Low trees or shrubs such as *Eremophila mitchellii, Carissa lanceolata* and *Eremophila deserti* are frequently present. The ground layer is sparse with the exotic *Cenchrus ciliaris* often the most prominent species. Occurs on lower slopes with shallow stony soils.

Assessment unit 2

Eucalyptus camaldulensis dominates the woodland canopy with *E. coolabah* dominating on clay soils and *Melaleuca leucadendra* fringing the Carmichael River. Other eucalypts such *as E. brownii* and *Corymbia tessellaris* are occasionally present. Low trees and shrubs including *Acacia salicina, Livistona lanuginosa* occur in the mid layers. The ground layer is sparse and dominated by grasses such as *Themeda triandra*, *Chrysopogon fallax* and the rush like *Lomandra longifolia*. Occurs along watercourses.

Assessment unit 3

Wetlands dominated by *Eucalyptus coolabah* open woodland with a ground layer dominated by *Eleocharis* sp. and ephemeral forbs and grasses. Occurs in closed depressions with clay soils that are frequently flooded. The tree layer is absent from wetter areas.

Assessment unit 4

Eucalyptus melanophloia or *E. brownii* dominate the open woodland to woodland tree layer. Other species such as *Corymbia plena, C. dallachiana* and may be present in the tree layer. A sparse low tree/shrub layer occurs with a variety of species including *Carissa lanceolata, Acacia coriacea, Maytenus cunninghamii* and *Melaleuca nervosa*. The ground layer is dominated by grasses most commonly *Aristida* spp., *Triodia* spp. and *Bothriochloa* spp. The exotic *Cenchrus ciliaris* was prevalent. Occurs on gently undulating plains with sandy surface soils.

Assessment unit 5

Eucalyptus similis and/or *Corymbia setosa* dominate the low open woodland canopy. The low tree/shrub layer is usually sparse with a wide range of species including *Melaleuca nervosa*, *M. tamariscina, Grevillea parallela, Bursaria incana, Petalostigma* spp. and *Acacia leptostachya*. *Triodia pungens* usually dominates the very sparse to mid-dense ground layer. Occurs on flat to gently undulating sand-plains with sandy soils which are sometimes shallow.

Assessment unit 6

Corymbia plena dominates the open woodland tree layer with other species including *C. dallachiana* prominent. Scattered trees and shrubs occur including *Grevillea parallela* and *Petalostigma pubescens*. The ground layer is sparse to moderate and often dominated by the exotic *Cenchrus ciliaris*. Occurs on sandy alluvial terraces.

Assessment unit 7

Acacia harpophylla dominates the woodland – low woodland tree layer with *Eucalyptus cambageana* and *Acacia cambagei* co-occurring in the tree layer or as emergents. There is a low tree/shrub layer comprising a wide range of species including *Lysiphyllum carronii*, *Eremophila mitchellii, Carissa lanceolata, Terminalia oblongata*. The ground layer is sparse comprising grasses and forbs including *Sporobolus actinocladus, Paspalidium caespitosum,* and *Bothriochloa ewartiana*. Occurs on flat to undulating clay plains with brown to grey clay soils often with gilgai. The gilgai are ephemerally flooded during which time they support wetland species including *Eleocharis* sp.

Assessment unit 8

Acacia cambagei dominates the sparse low woodland canopy often in association with *Acacia harpophylla*. A range of small trees/shrubs are frequently present including *Lysiphyllum carronii* and *Terminalia oblongata, A. cambagei, Alectryon diversifolius, Erythroxylon australe, Atalaya hemiglauca, Santalum lanceolatum, Carissa* spp.. The ground layer is sparse comprising grasses and forbs including *Sporobolus actinocladus, Paspalidium caespitosum,* and *Bothriochloa ewartiana*. Occurs on flat to undulating clay plains with brown to grey clay soils often with gilgai. The gilgai are ephemerally flooded during which time they support wetland species including *Eleocharis* sp.

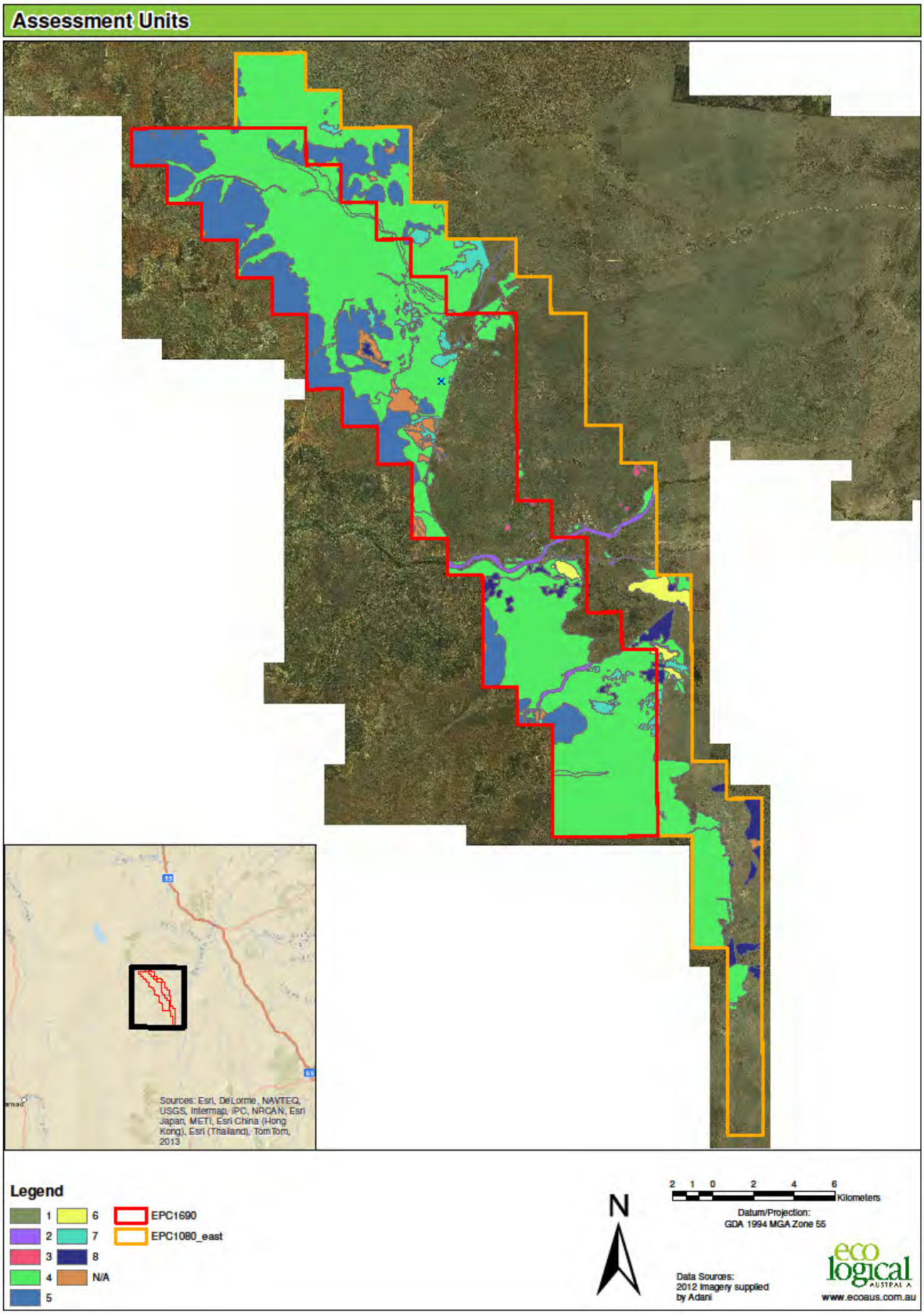

Figure 2: Assessment units on the Carmichael Coal Mine site

3.2 Offset area assessment units

Assessment of offset areas was not included as part of the scope for this project and hence has not been undertaken.

3.3 Ecological condition scoring

The scores for each of the 14 ecological condition indicators in the clearing area assessment units are presented in **Table 3**. These scores were derived from comparison of the field and GIS site data to the benchmark data and scored using **Table B1** (field based attributes) and **Table B2** (GIS attributes) listed in **Appendix B**. The full breakdown on ecological condition scoring for each sample site within assessment units is presented in **Table C1** in **Appendix C**.

Table 3: Ecological condition indicator scores for each assessment unit

Ecological condition indicators	Clearing assessment units							
	1	2	3	4	5	6	7	8
Field based attributes								
Recruitment	5.0	3.7	4.3	5.0	4.6	4.7	4.7	4.7
Native plant species richness	17.5	16.5	7.5	14.2	15.5	14.2	14.6	15.8
Tree canopy height	5.0	4.8	4.2	4.9	2.6	5.0	4.5	4.2
Tree canopy cover	1.5	2.7	3.0	2.6	2.2	3.3	4.3	3.0
Shrub canopy cover	3.0	1.9	0.0	4.1	3.8	1.5	4.0	3.7
Native perennial grass cover	3.0	3.1	0.7	4.8	4.6	1.0	2.7	2.3
Organic litter cover	3.0	4.4	5.0	3.2	4.6	4.0	4.7	4.0
Large trees	15.0	13.5	15.0	11.1	5.0	10.0	7.5	8.3
Coarse woody debris	5.0	3.8	4.0	3.7	5.0	3.5	4.0	4.0
Weed cover	10.0	6.0	8.3	7.2	10.0	3.8	7.5	6.3
Total Field based attributes	**68.0**	**60.4**	**52.0**	**60.7**	**57.9**	**50.9**	**58.4**	**56.3**
GIS based attributes								
Fragmented - Patch size	0.0	1.0	2.0	0.0	0.0	0.0	1.7	3.3
Fragmented - Connectivity	0.0	0.4	2.3	0.0	0.0	0.0	0.8	1.7
Fragmented - Context	0.0	0.4	1.3	0.0	0.0	0.0	0.7	1.5
Intact - Distance from water	2.0	3.0	0.0	3.8	4.4	5.3	3.3	2.0
Total BioCondition Score	**70.0**	**65.2**	**57.7**	**64.5**	**62.3**	**56.3**	**64.9**	**64.8**
Area (ha)	13	50	33	8,811	711	332	573	430
Assessment unit ecological condition score	**9.1**	**32.6**	**19.0**	**5,683.1**	**443.0**	**186.8**	**372.0**	**278.8**

3.3.1 Benchmarks

It is important to note that benchmarks were not available for all REs. **Table 4** below lists which benchmarks were used and provides justification where necessary.

Table 4: Regional ecosystem benchmarks used in the ecological condition scoring

Regional ecosystem	Benchmark used in scoring	Origin and justification for use of benchmark
10.3.4b	11.4.6	Preliminary draft benchmarks Galilee draft benchmarks for the Galilee Project supplied by Queensland Herbarium, Jan 2014. BRB equivalent.
10.3.6ax1	10.3.6a	Preliminary draft benchmarks Galilee draft benchmarks for the Galilee Project supplied by Queensland Herbarium, Jan 2014.
10.3.12a	10.3.12a	Preliminary draft benchmarks Galilee draft benchmarks for the Galilee Project supplied by Queensland Herbarium, Jan 2014.
10.3.13a	10.3.13a	Preliminary draft benchmarks Galilee draft benchmarks for the Galilee Project supplied by Queensland Herbarium, Jan 2014.
10.3.14a	10.3.14a	Preliminary draft benchmarks Galilee draft benchmarks for the Galilee Project supplied by Queensland Herbarium, Jan 2014.
10.4.3a	11.4.9	Draft benchmark supplied by Queensland Herbarium, Jan 2014. BRB equivalent.
10.4.5a	11.4.6	Preliminary draft benchmarks Galilee draft benchmarks for the Galilee Project supplied by Queensland Herbarium, Jan 2014. BRB equivalent.
10.5.1a	Derived benchmark for 10.5.1a	The benchmark for 10.5.1a was derived by Bruce Wilson (ELA) based on the current technical descriptions combined with expert knowledge. The tree and shrub canopy height and covers were taken directly from the mean values in the technical descriptions. The grass cover was assumed to equate to 80% of the ground layer cover. The technical descriptions do not have mean values for the species richness, organic litter, large tree number and coarse woody debris. For these attributes, RE site benchmark values were made by inspection of the technical descriptions in combination with the mode values recorded from the Carmichael Coal Mine sites, which were considered by the author to generally be in good condition.
10.5.1d	Derived benchmark for 10.5.1d	The benchmark for 10.5.1d was derived by Bruce Wilson (ELA) based on the current technical descriptions combined with expert knowledge. The tree and shrub canopy height and covers were taken directly from the mean values in the technical descriptions. The grass cover was assumed to equate to 80% of the ground layer cover. The technical descriptions do not have mean values for the species richness, organic litter, large tree number and coarse woody debris. For these attributes, RE site benchmark values were made by inspection of the technical descriptions in combination with the mode values recorded from the Carmichael Coal Mine sites, which were considered by the author to generally be in good condition.
10.5.5a	10.3.6a	Preliminary draft benchmarks Galilee draft benchmarks for the Galilee Project supplied by Queensland Herbarium, Jan 2014. Both REs are very similar in vegetation structure, understorey composition and species

		diversity with the main difference being the dominant canopy species.
10.7.5	10.7.5	Preliminary draft benchmarks Galilee draft benchmarks for the Galilee Project supplied by Queensland Herbarium, Jan 2014.
11.3.3c	11.3.3	Draft benchmark supplied by Queensland Herbarium, Jan 2014.
11.3.25	11.3.25	Queensland Herbarium (2013) BioCondition benchmarks of Regional Ecosystems, (June, 2013) (Department of Science, Information Technology, Innovation and the Arts: Brisbane).
11.4.6	11.4.6	Preliminary draft benchmarks Galilee draft benchmarks for the Galilee Project supplied by Queensland Herbarium, Jan 2014.
11.4.9	11.4.9	Draft benchmark supplied by Queensland Herbarium, Jan 2014.

3.4 Special features scoring

The special features scores for each of the clearing area assessment units are shown in **Table 5**. These scores were derived from comparison of the GIS data to the special feature indicator scores listed in **Table B3** in **Appendix B**. Further breakdown of the special features scoring is presented in **Table D1** of **Appendix D**, which includes the areas of impact used in the calculations.

Table 5: Special features indicator scores for each assessment unit

Special feature indicators	Clearing area assessment units							
	1	2	3	4	5	6	7	8
Centres of endemism	0.0	0.5	0.0	0.2	1.7	0.0	0.0	0.0
Wildlife refugia	2.5	8.3	2.3	645.7	66.3	57.8	15.2	17.8
Disjunct populations	0.0	4.6	0.0	372.5	39.7	6.3	7.0	8.3
Taxa at limits of geographic range	0.0	1.5	0.0	124.2	13.2	2.1	2.3	2.8
High species richness	0.0	8.1	0.0	633.6	68.0	11.2	12.6	14.6
Relictual populations	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Regional ecosystems with distinct variation in species associated with geomorphologic and other environmental variables	0.0	0.2	0.0	6.4	0.8	0.0	4.8	0.0
Artificial waterbody of ecological significance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
High density hollow bearing trees	0.0	2.0	0.0	149.0	15.5	2.8	3.1	3.6
Breeding or roosting areas used by significant numbers of individuals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Special feature indicators	Clearing area assessment units							
	1	2	3	4	5	6	7	8
Strategic ecological corridor	2.5	6.0	2.0	1,135.5	92.8	4.4	54.6	33.0
Priority species within the bioregion	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Significance of patch within a 1 km buffer	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0
Protected areas estate buffer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Assessment unit special features score	**5.1**	**31.2**	**9.3**	**3,067.1**	**297.9**	**84.6**	**99.7**	**80.1**

3.5 EPBC calculator scoring

The impact calculation component of the OAG for the Brigalow TEC, Black-throated Finch habitat and *Livistona lanuginosa* is presented in **Table 6**. Photos depicting the three MNES on the CCM site are presented in **Appendix E**.

Table 6: EPBC Act Offsets Assessment Guide impact calculator scores

Protected matter attribute	**MNES**	**Area of community (ha)**	**Quality**	**Total quantum of impact**
Ecological community	Brigalow TEC	124.7	7	87.29
Protected matter attribute	**MNES**	**Area of habitat (ha)**	**Quality**	**Total quantum of impact**
Threatened species habitat	Black-throated Finch	9,950.0	7	6,965.00
Protected matter attribute	**MNES**	**Number of individuals**		**Total quantum of impact**
Threatened species	*Livistona lanuginosa*	12		12 individuals

The score of quality for the Brigalow TEC is based on the BioCondition assessment for the only applicable RE within the CCM mining footprint, i.e. RE11.4.9 *Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains. The BioCondition assessment is based on the same attributes as the ecological condition indicators listed in **Table B1** and **Table B2** of **Appendix B** and take into account both field based and spatial attributes including:

- Native plant species richness
- Canopy height and cover
- Native perennial grass cover

- Organic litter cover
- Weed cover
- Number of large trees
- Coarse woody debris
- Size of patch
- Connectivity
- Surrounding remnant vegetation and high value regrowth

The ecological condition score for RE11.4.9 was 73 out of a possible 100 against the benchmark data. This was conferred as a quality score of 7 on the scale of 1-10 for the OAG. This calculated a total quantum of impact of 87.29.

Determination of habitat quality for Black-throated Finch was based on the ecological condition scores, presence of key grass species and presence of waterbodies. The ecological condition scores were averaged with a result of 63.6. The number of key grass species at each site was averaged with a result of one key grass species being present. Presence of water was given a score of 1 and absence of water a score of 0, with the percentage of sites with water being 33%. Qualitative assessment using the above indicators suggests that a habitat quality score of 7 for the OAG would be justified. This calculated a total quantum of impact of 6,965.00.

Nine sites were surveyed within habitat for *Livistona lanuginosa* that intersected the mining footprint. The 12 *Livistona lanuginosa* individuals were found to occur within a 20 m buffer zone of the two designated road crossings of the Carmichael River in the mining footprint. Six of these individuals are in the road alignment and will be directly impacted. The other six individuals will either be directly or indirectly impacted depending upon the final road width and clearing zone during construction.

4 Biodiversity values

4.1 State significant biodiversity values and matters of environmental significance

The following sections discuss the SSBVs and MNES that formed this ecological equivalence assessment in the context of their condition and value to the Carmichael Coal Mine site.

4.1.1 Remnant Endangered and Of Concern Regional Ecosystems.

The REs listed as Endangered or Of Concern under the VM Act 1999 include the Brigalow (*Acacia harpophylla* - 11.4.9 endangered) and Gidgee (*A. cambagei* - 11.4.6 of concern) dominated woodlands on clay plains in the Brigalow Belt bioregion. The Brigalow ecosystem RE 11.4.9 is also considered a MNES as it is included in the Brigalow (*Acacia harpophylla* dominant and co-dominant) endangered ecological community listing under the EPBC Act.

The Brigalow ecosystem (11.4.9) is mapped on the site across an area of 126.1 ha which mostly occurs in two patches adjacent to the sand plains of the Desert Uplands (**Figure 3**). Another small area of remnant Brigalow also occurs north of the Carmichael River (**Figure 3**). All but 1.4 ha of this area falls within the proposed mine surface footprint. This ecosystem is in good condition on the site although the canopy is more open and lower than normal and the species richness is low which perhaps reflects its location at western limit of the ecosystems range.

The Gidgee ecosystem (11.4.6) is mapped across 220 ha all of which occurs within the proposed mine surface footprint (**Figure 4**). The sites assessed were in good condition although were shorter and more open than good examples of this community elsewhere in the bioregion.

Areas of Brigalow and Gidgee RE's also occur in the Desert Uplands however these communities have a VM Class of Least Concern and therefore do not require offsets.

4.1.2 Wetlands

Seasonal and ephemeral wetlands include the small areas of Coolibah woodlands on closed depressions. Most of the wetlands occur on the flood plains of the Carmichael River (**Figure 5**). These wetlands only fill with water for short durations following rain when they support a range of wetland flora (observed during field survey) and fauna (few observed). There is 32.6 ha of this ecosystem mapped in the proposed surface footprint. The wetlands are in reasonable condition although are isolated by clearing of surrounding vegetation up to their edges.

Other very small (< 0.25 ha) wetlands are associated with gilgai that are a minor feature across the Gidgee and Brigalow REs on low lying clay plains in both the Brigalow Belt and Desert Uplands bioregions (**Figure 5**). These ecosystems are generally made up of large numbers of small gilgai of varying relief. A substantial number of these were full of water at the time of the survey and supported wetland flora.

Riverine wetlands are associated with the Carmichael River, Cabbage Tree Creek and unnamed creeks to the north and south of Carmichael River (**Figure 5**). These areas are generally quite narrow due to clearing up to the high bank of the watercourses. They are therefore subject to edge affects and impacts from grazing and weed incursions are often evident.

4.1.3 Watercourses

Watercourses on the sites are associated with River Red Gum (*Eucalyptus camaldulensis*) or Coolibah (*E. coolabah*) woodlands that occur along the Carmichael River and Cabbage Tree Creek and smaller drainage lines running across the sand plains (**Figure 6**). There are also more minor watercourses traversing through various woodlands on sand plains and clay plains that do not support distinctive riparian vegetation. The habitats associated with water courses are generally in good condition although there is some high grazing impacts to the ground layer and weed incursions in some areas particularly associated with permanent water along the Carmichael River and Cabbage Tree Creek.

4.1.4 Threatened and migratory fauna species

Black-throated Finch (southern) (Poephila cincta cincta)

This species is associated with a range of grassy eucalypt woodland to open woodlands, particularly those areas with permanent to semi-permanent water sources, which are widespread on sand and alluvial plains across the site (**Figure 7**). All information currently available for Black-throated Finch on the CCM site (including those recorded by GHD in the EIS and SEIS and subsequent observations by ELA during the EEA survey) show that the species is mainly recorded north of the Carmichael River. Habitat for the Black-throated Finch occurs mostly within either the 3 km buffer of water sources or the 5 km buffer of Black-throated Finch sightings, each described as a key determination of habitat in the EPBC Act Significant Impact Guidelines for Black-throated Finch (DEWHA 2009) (**Figure 7**). These habitats are generally in good condition and mostly occur in large continuous tracts. Several of the seeding grass species (e.g. *Themeda triandra*, *Alloteropsis semialata*, *Panicum decompositum*, *Dichanthium sericeum* and *Eragrostis sororia*) associated with preferential habitat were commonly found in these habitats.

This species is also listed as a MNES.

Woodland dependent fauna

Numerous threatened species associated with woodland to open woodland habitat have been recorded on the site or are considered likely to occur. These species may potentially use the extensive woodland habitat that dominates the remnant vegetation on the site, as suggested by EIS and SEIS records and observations by ELA during the EEA survey (**Figure 8**). This vegetation is generally in good condition occurring in large continuous tracts.

In particular, several woodland birds including the Squatter Pigeon (*Geophaps scripta scripta*), Square-tailed Kite (*Lophoictinia isura*) and Black-chinned Honeyeater (*Melithreptus gularis*), as well as the Little Pied Bat (*Chalinolobus picatus*) are likely to utilise all woodland habitats across the site. These species are generally potentially associated with the range of eucalypt woodland to open woodlands that are widespread across the sand and alluvial plains on the site. Woodland habitat close to permanent water is likely to be more important for the Squatter Pigeon which is also listed as a MNES.

Two Koala (*Phascolarctos cinereus*) observations have been made on the site during ecological surveys (One during the EIS surveys by GHD and one by ELA during the December 2013 survey) (**Figure 8**). Koalas are more likely to use riparian habitats where preferred food trees, especially River Red Gum (*Eucalyptus camaldulensis*), occur. They may occasionally use other eucalypt ecosystems on the site for dispersals and shelter. This species is listed as a MNES.

Yakka Skink (*Egernia rugosa*) is associated with woodland vegetation on landzones 3, 4, 5 and 7, particularly areas with microhabitats such as fallen timber and log/rock piles. These microhabitats occur occasionally across the site but are not common. This species is listed as a MNES.

Wetland dependent fauna

Two species associated with wetland habitat are known or likely to occur on the site, Black-necked Stork (*Ephippiorhynchus asiaticus*) and Cotton Pygmy-goose (*Nettapus coromandelianus*). These species are mainly associated with permanent water which occurs along the Carmichael River and large dams (**Figure 9**). Ephemeral wetlands will also provide habitat for these species when filled with water (**Figure 9**).

Ornamental Snake (Denisonia maculata)

Suitable habitat for this species on the Carmichael Coal Mine site is associated with the gilgai and clay soils of the Brigalow and Gidgee ecosystems as well as riparian habitats such as Carmichael River and Cabbage Tree Creek (**Figure 10**). These communities are found scattered across the western parts of the site where they are surrounded but the eucalypt woodlands on the sand plains. In the east of the site there are more fragmented remnants of suitable habitat left after clearing of the surrounding vegetation.

This species is listed as a MNES.

4.1.5 Threatened flora species

Waxy Cabbage Palm (*Livistona lanuginosa*) is associated with the River Red Gum (*Eucalyptus camaldulensis*) woodlands that occur on the levees of the Carmichael River (**Figure 11**). The density of the species varied across its range although generally where it occurred the sites were in good condition with a range of age classes present. A detailed search found 12 individuals in or immediately adjacent to the proposed mine surface impact area.

This species is also listed as a MNES.

4.1.6 Connectivity

A large portion of the site is mapped within a state significant corridor (**Figure 12**). Remnant vegetation within this area is considered to provide important connectivity for biodiversity.

4.1.7 Matters of national environmental significance

Although seven MNES are known to exist or likely to occur on the site, only three are expected to be significantly impacted by the Carmichael Coal Mine and therefore require offsets (SEIS, GHD 2013). These MNES are the Brigalow TEC (endangered), Black-throated Finch (endangered) and *Livistona lanuginosa* (vulnerable).

Brigalow TEC is associated with RE 11.4.9 of which 126.1 ha occurs in three patches across the site (**Figure 3**). All but 1.4 ha of this area falls within the proposed mine surface footprint. This ecosystem is in good condition on the site although the canopy is more open and lower than normal and the species richness is low which perhaps reflects its location at western limit of the ecosystems range.

Refer to previous section for discussion of the Black-throated Finch and *Livistona lanuginosa*.

4.2 Interpretation of ecological equivalence scores

The ecological equivalence score is the main output of the ecological equivalence assessment in Queensland. An ecological equivalence score is calculated for each assessment unit where multiple units have been assessed.

These scores need to be compared to equivalent scores derived by applying the ecological equivalence methodology to proposed offset areas. Similarly, proposed offset areas would need to be compared to

the SSBVs identified in **Section 2.1.2**. This can only be done once potential offset areas have been identified and assessed.

For the offset area to be ecologically equivalent to the clearing area, and hence meet ecological equivalence requirements under QBOP, the offset area must obtain:

- an overall ecological condition score equal to or greater than the overall ecological condition score for the clearing areas
- an overall special features score equal to or greater than the overall special features score for the clearing areas
- a minimum score for ecological condition indicator 1 (recruitment of woody perennial species) must have a minimum score of three (i.e. >20 of overstorey species present as regeneration) and ecological condition indicator 4 (tree canopy cover) must have a minimum score of two (i.e. >10% and less than 50% benchmark) on offset areas (DERM 2011).

In order for ecological equivalence to be met and therefore satisfy the conditions listed in the current EA for EPC1690 (permit no. EPPR00745013), the overall ecological condition and special features scores for the offset areas must be equal to or greater than those derived on the clearing sites.

Where ecological equivalence cannot be demonstrated, the offset area will be deemed as not meeting the relevant requirement within the QBOP.

4.2.1 EPBC Act Environmental Offsets Policy

Under the EPBC Act Offsets Policy and accompanying Offsets Assessment Guide (OAG), it is essential to establish the total quantum of residual impact to a protected matter in order to determine the offset requirements. To assist in determining the level of impact for threatened species and ecological communities, a measure of habitat condition of the impact area is required. The ecological equivalence scores calculated using the BioCondition method of survey provides a metric condition value that can be measured against a benchmark value. This score, combined with other condition measures described in **Section 3.5** were used to calculate the total quantum of impact for the OAG calculator.

As for the state ecological equivalence scores, the final score calculations under the EPBC Act Offsets Policy cannot be completed until suitable offset areas have been identified and assessed.

The offset requirements under the EPBC Act Offsets Policy are:

- Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the protected matter
- Suitable offsets must be built around direct offsets but may include other compensatory measures
- Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter
- Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter
- Suitable offsets must effectively account for and manage the risks of the offset not succeeding
- Suitable offsets must be additional to what is already required, determined by law or planning regulations, or agreed to under other schemes or programs
- Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable

- Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.

It is also important to note when determining suitable offset supply areas that a state offset will count toward an offset under the EPBC Act to the extent that it compensates for the residual impact to the protected matter identified under the EPBC Act.

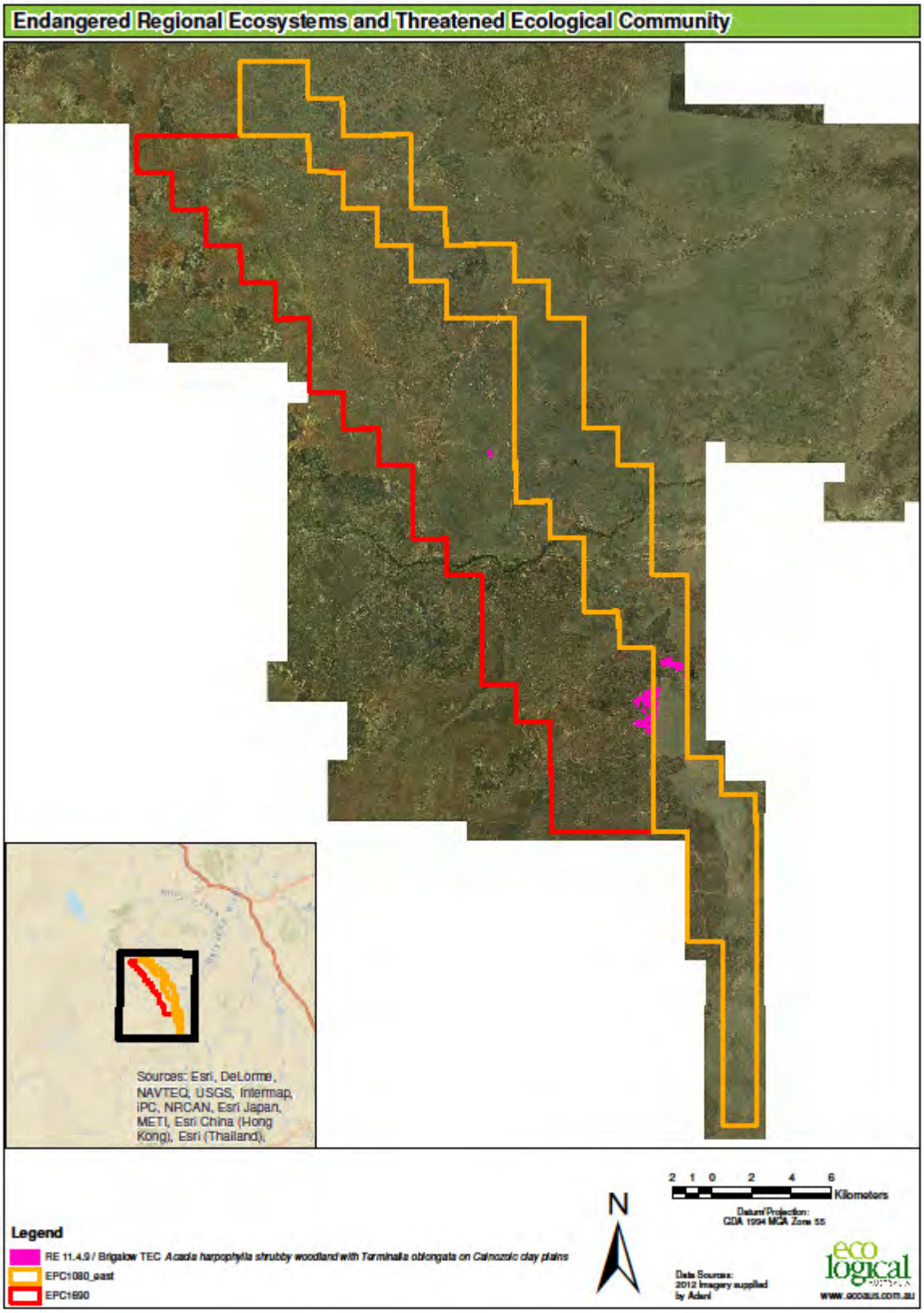

Figure 3: Endangered Regional Ecosystems and Threatened Ecological Community

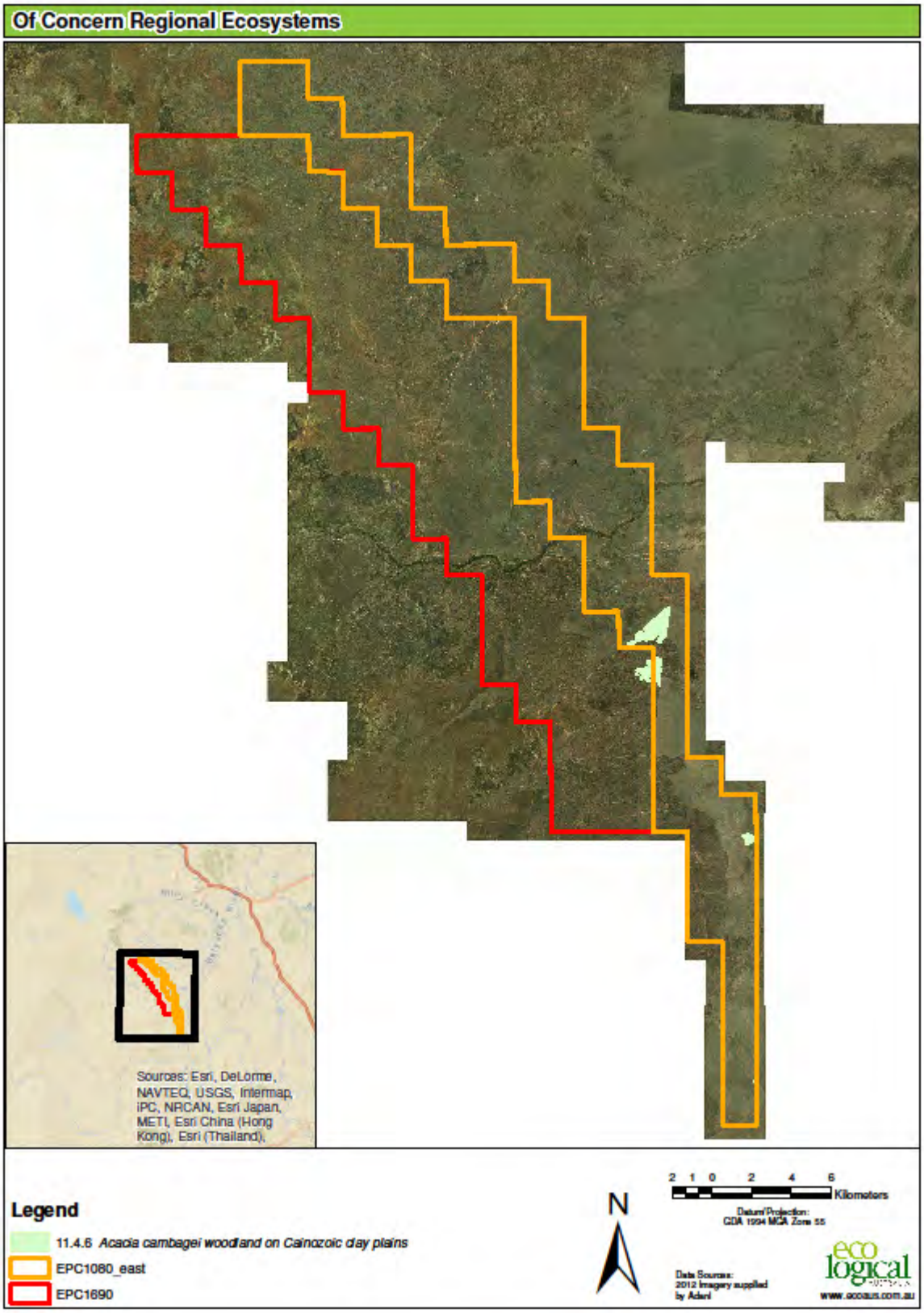

Figure 4: Of Concern Regional Ecosystems

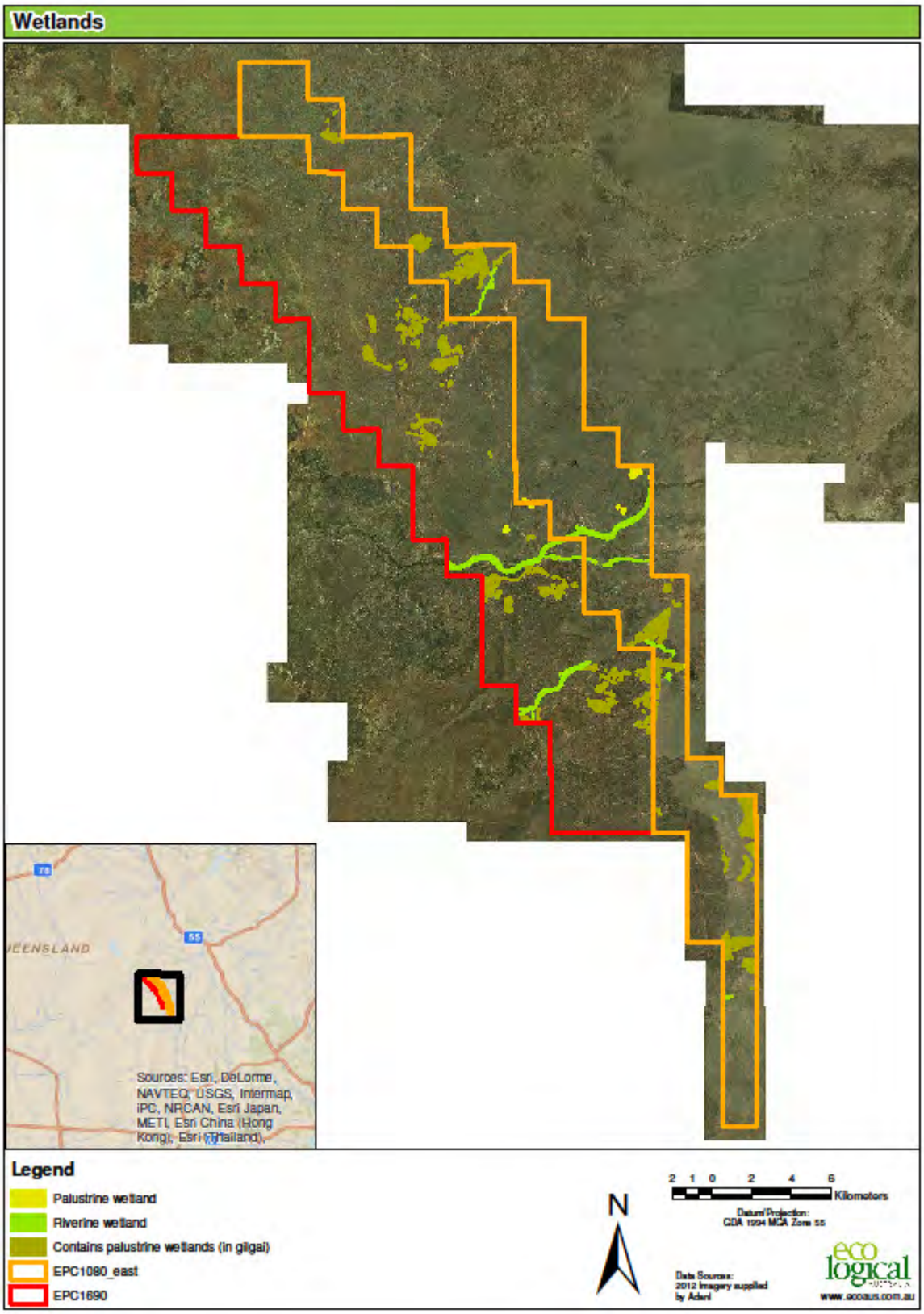

Figure 5: Wetlands

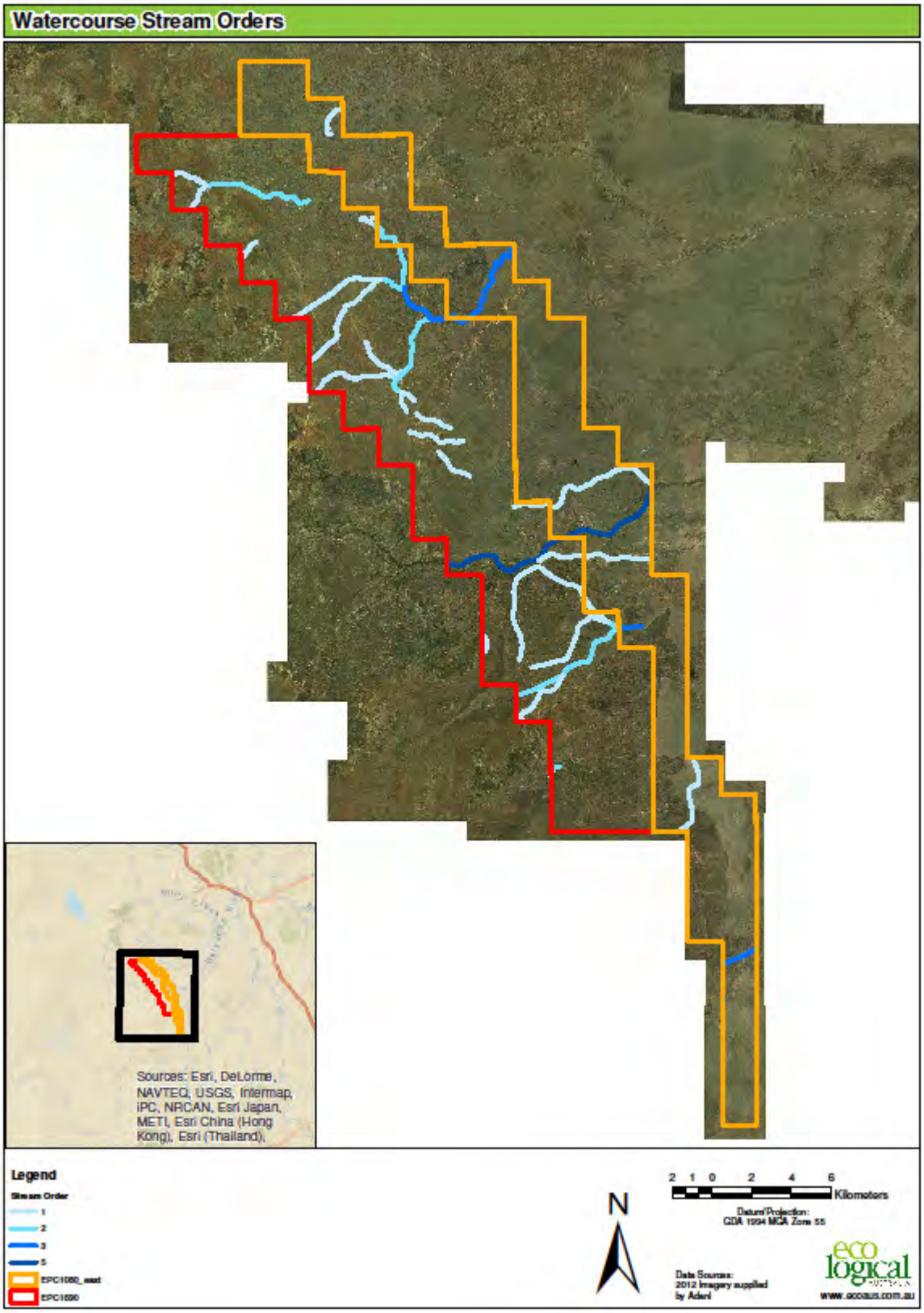

Figure 6: Watercourses

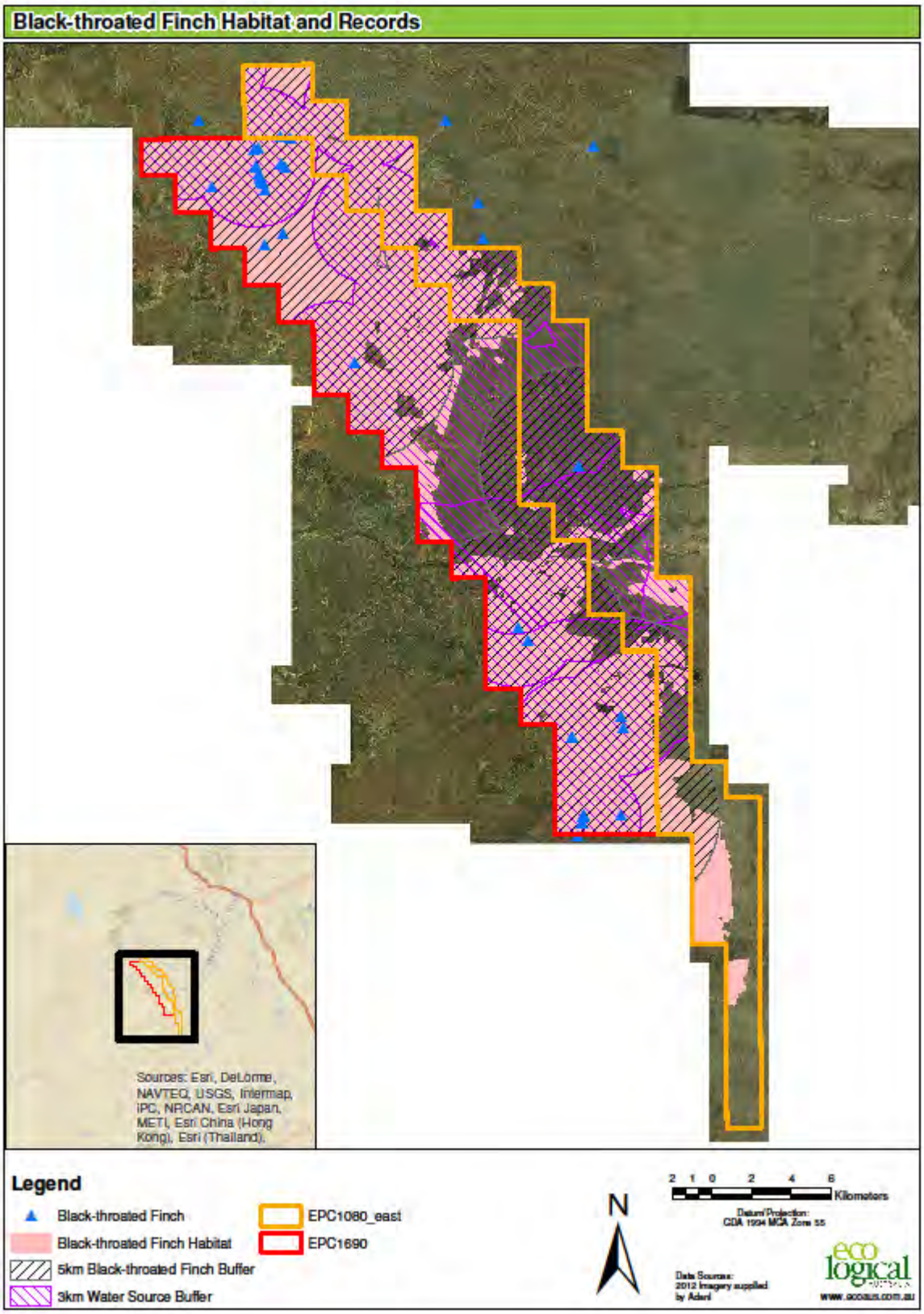

Figure 7: Black-throated Finch habitat and records (based on surveys for EIS and SEIS by GHD, and EEA survey by ELA)

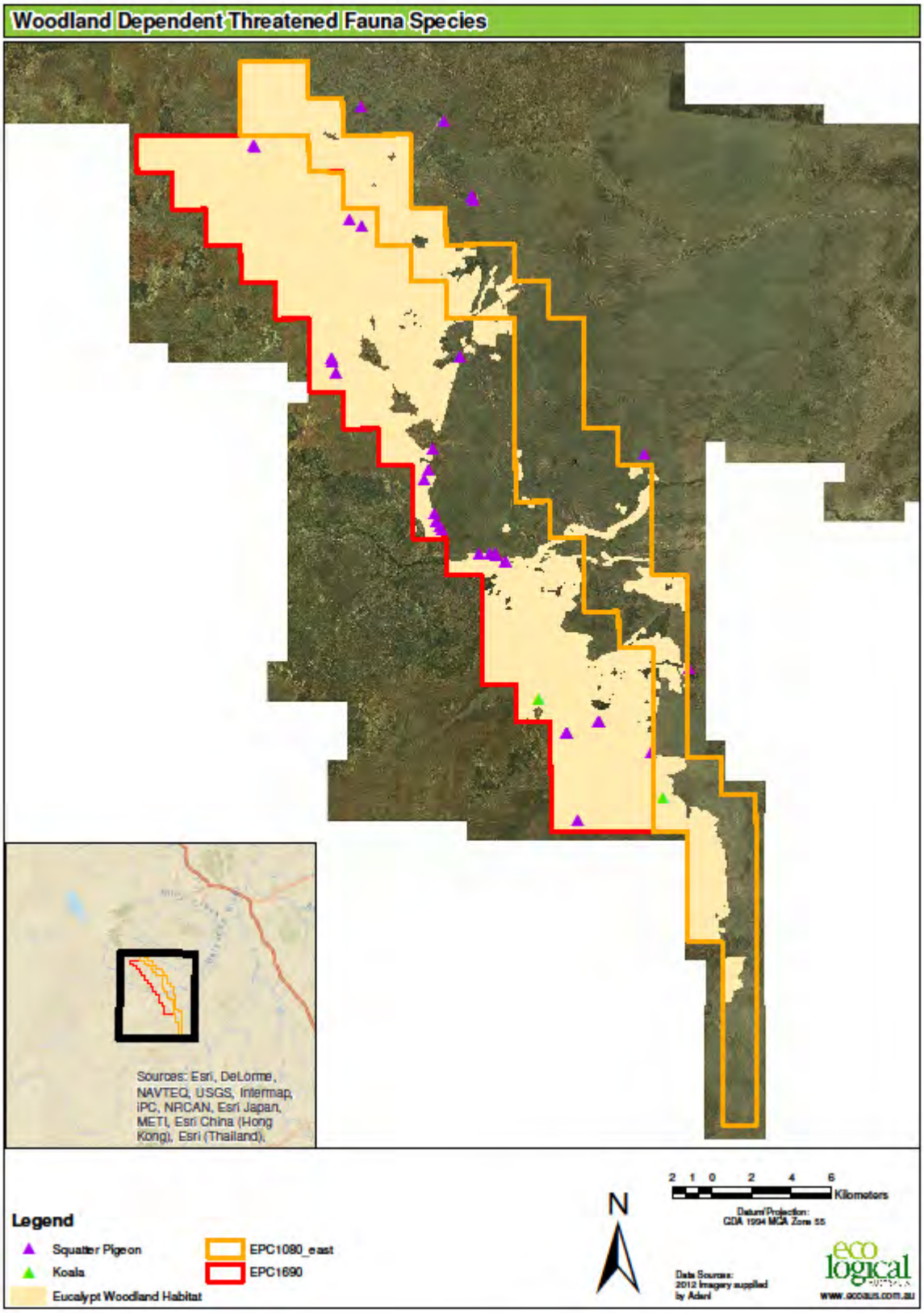

Figure 8: Woodland dependent threatened fauna species (based on surveys for EIS and SEIS by GHD, and EEA survey by ELA)

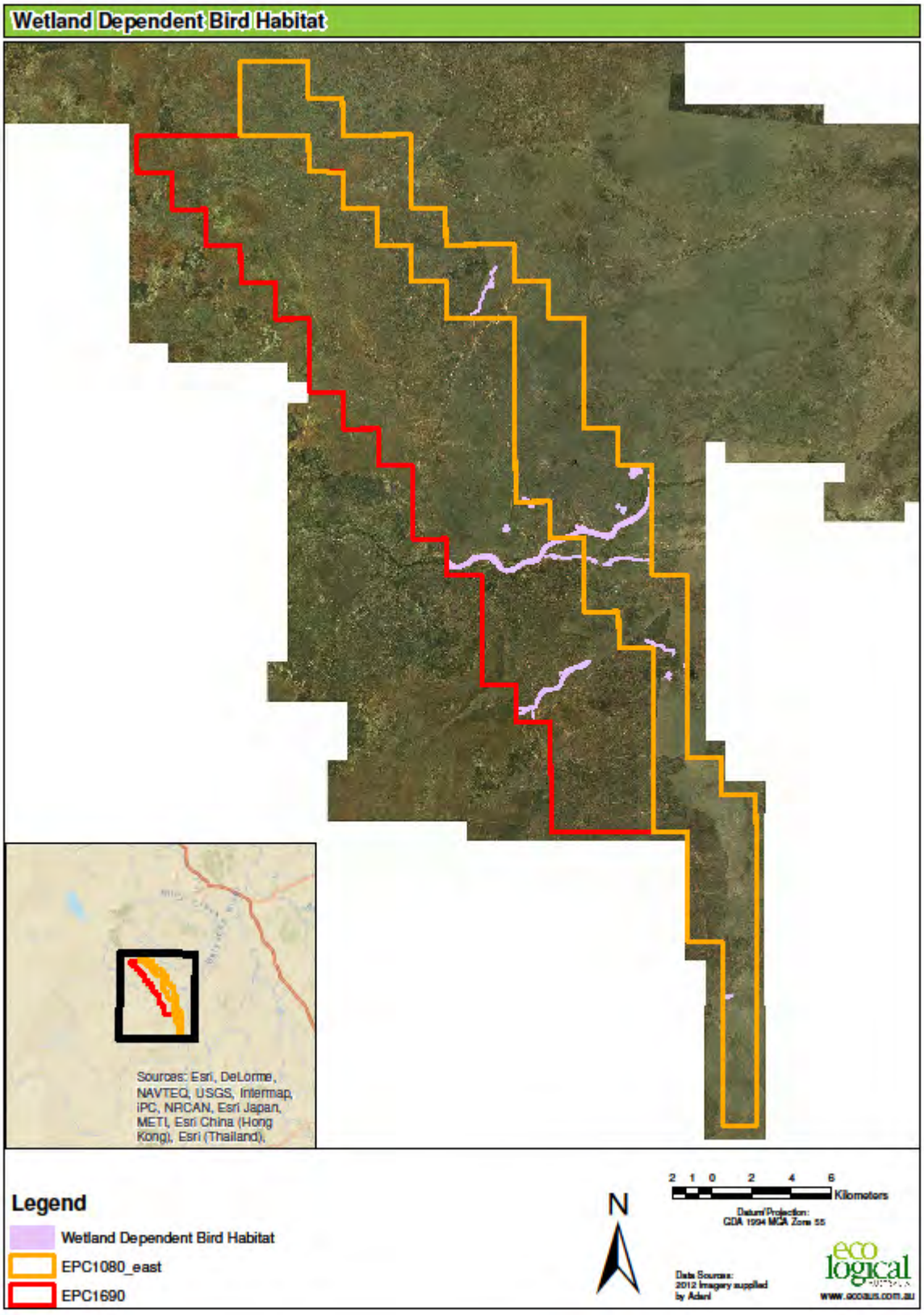

Figure 9: Wetland dependent bird habitat

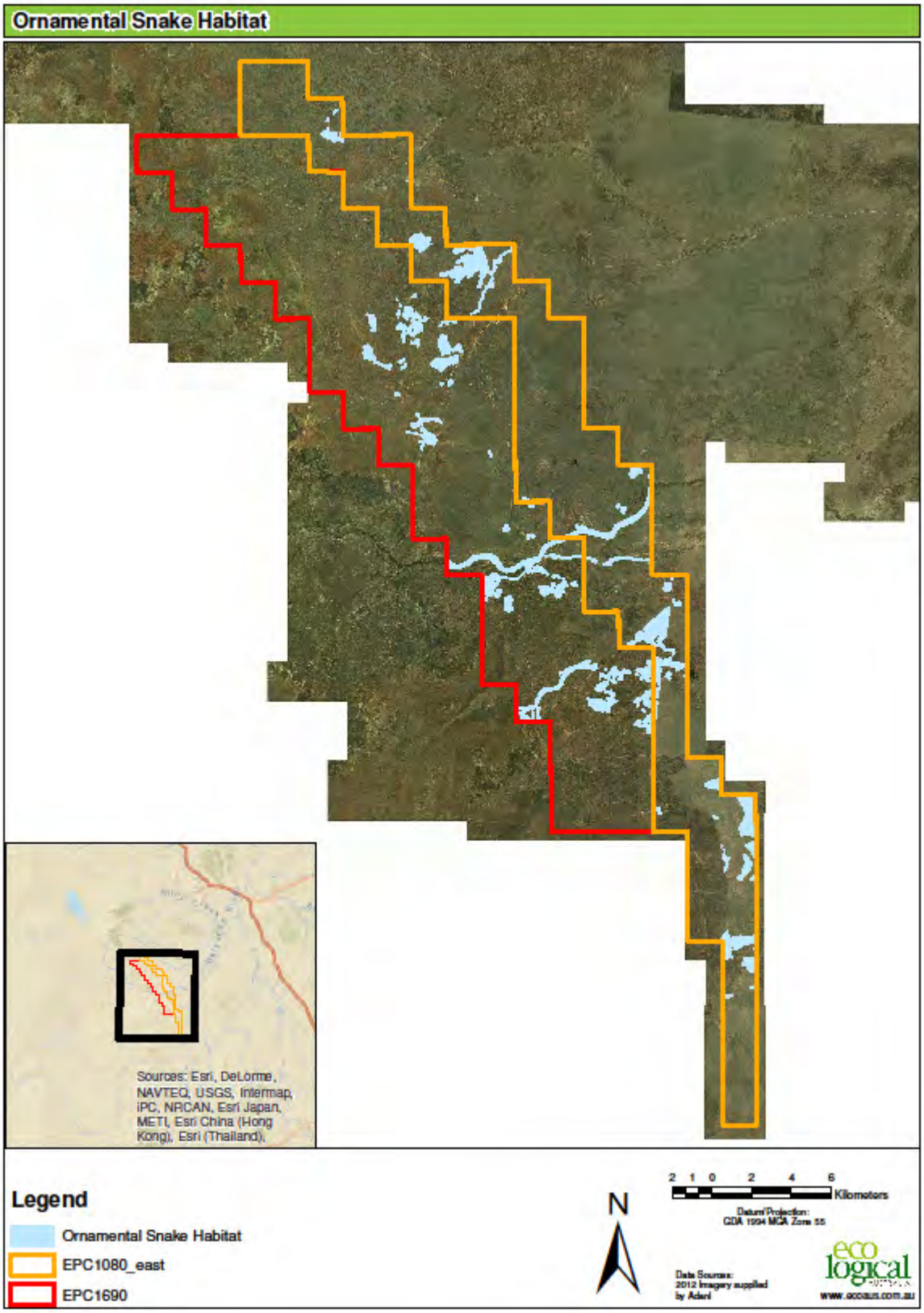

Figure 10: Ornamental snake habitat

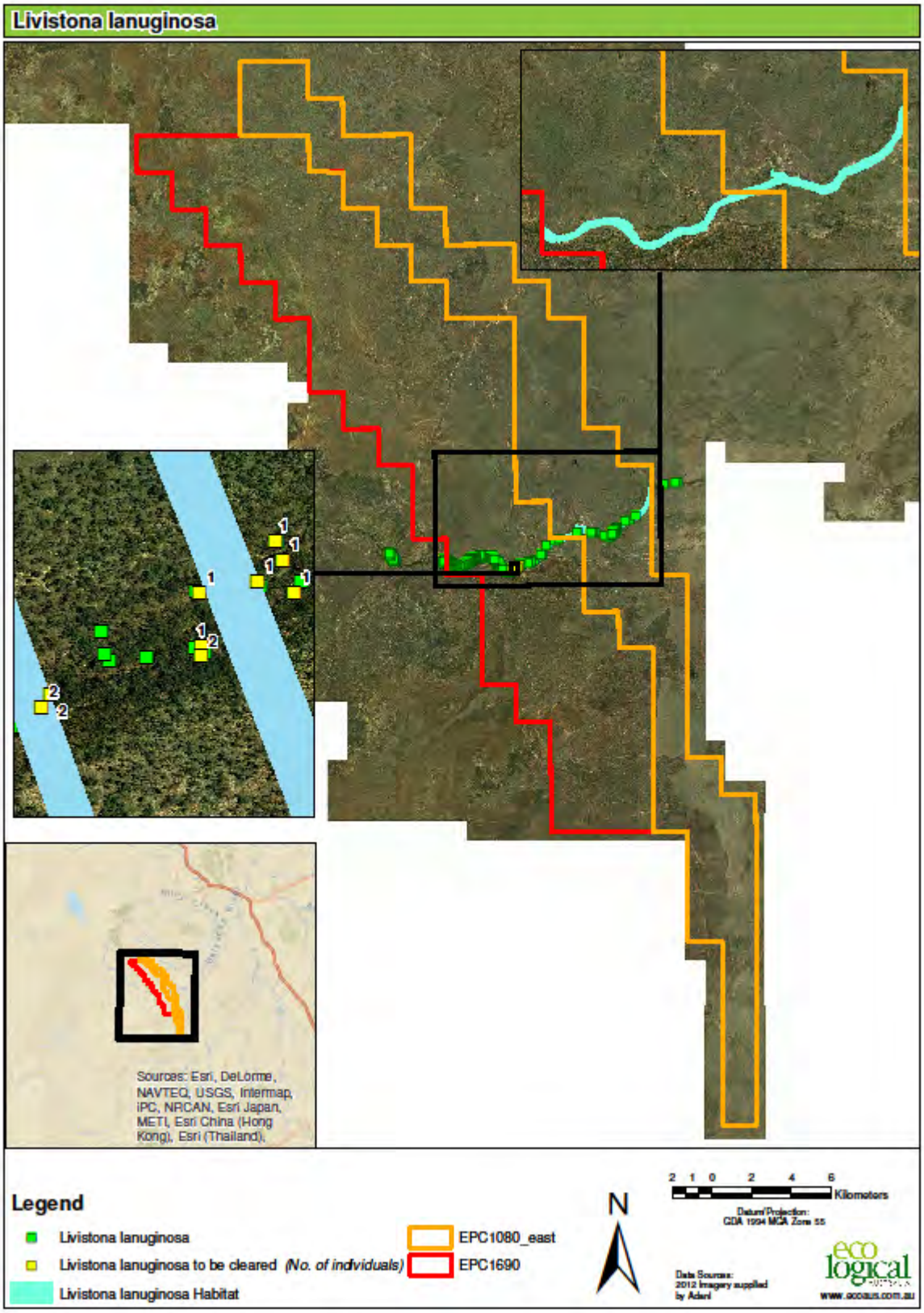

Figure 11: *Livistona lanuginosa* habitat and records

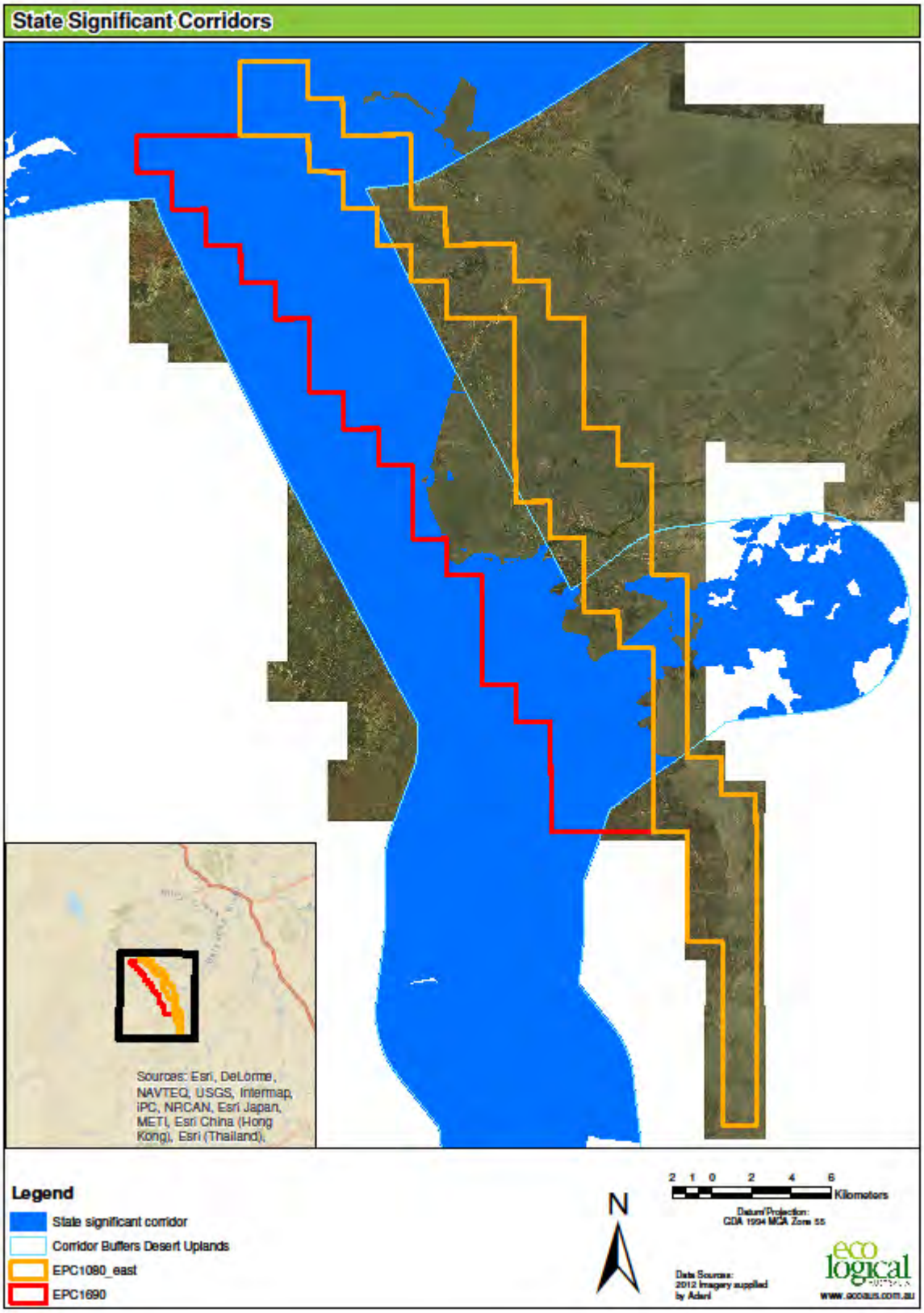

Figure 12: State significant corridors

5 Recommendations

5.1 Offset options

The offset area ecological condition and special feature scores need to exceed those of the clearing area, i.e. the impact area of the mining footprint. Offset areas need to be in the same BVG as the clearing area RE and need to be of equal or higher VM class.

The QBOP requires ecological equivalence to be demonstrated between the offset area and the clearing area. However, the EEM is not a definitive measure as to whether an offset will be approved by EHP; it is to assist in determining if ecological equivalence has been achieved. Similarly the offsets for MNES must provide a minimum conservation gain.

Ecological equivalence is only part of an offsets proposal. The offsets proposal will also need to demonstrate how the area has been legally secured and will also include a management and monitoring plan for the area.

If Moray Downs does not supply all offset areas required to meet ecological equivalence, Adani will need to either secure alternative offset supply areas with the aid of an offset broker or negotiate with EHP on indirect offset options.

5.2 Conclusions

The ecological equivalence assessment presented in this report represents a scenario of the impacts to SSBVs based on the proposed mining footprint. The total area of direct impact to SSBVs is 10,942 ha.

The assessment also included a preliminary indication of the impact calculations required under the EPBC Act Offset Assessment Guide for Brigalow TEC, Black-throated Finch habitat and *Livistona lanuginosa*. The total area of direct impact to MNES is 10,075 ha (Brigalow TEC and Black-throated Finch habitat) as well as 12 *Livistona lanuginosa* individuals.

Further assessment will be needed of the potential offset areas in order to fulfil obligations under the QBOP and anticipated approval conditions under the EPBC Act. For the QBOP this will need to include ecological equivalence assessments for relevant state significant biodiversity values on offset areas.

In order to achieve ecological equivalence, the offset areas will need to achieve a higher score for the ecological condition and special features scores for each relevant assessment unit as identified in **Table 7**.

Table 7: Ecological condition and special features scores for each assessment unit

	Clearing assessment units							
	1	2	3	4	5	6	7	8
Ecological condition score	9.1	32.6	19.0	5,683.1	443.0	186.8	372.0	278.8
Special features score	5.1	31.2	9.3	3,067.1	297.9	84.6	99.7	80.1

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Appendix A: State significant biodiversity values

Table A 1: Details of each state significant biodiversity value

Environmental Value	Relevant to CCM	VM Act Class (Version 8.0) or NC Act status	Biodiversity status (Version 8.0)	EPBC Act status	Relevant BVG's	Relevant Assessment Units
Endangered Regional Ecosystems	11.4.9 *Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains	Endangered	Endangered	Endangered	25a	7
Of Concern Regional Ecosystems	11.4.6 *Acacia cambagei* woodland on Cainozoic clay plains	Of concern	Endangered	-	26a	8
Wetland (Vegetation Management Act 1999)	10.3.4a Contains palustrine wetland (e.g. in swales). *Acacia cambagei* open woodland (western)	Least concern	Of concern	-	26a	8
	10.3.13a: Riverine wetland or fringing riverine wetland. *Eucalyptus camaldulensis* dominates the very sparse to sparse canopy. *E. coolabah*, *Casuarina cunninghamiana* and *Melaleuca leucadendra* are frequently present in the canopy	Least concern	Of concern	-	16a	2
	10.3.14a: Floodplain (other than floodplain wetlands). Eucalyptus coolabah dominates the very sparse canopy	Least concern	Of concern	-	16a	2
	10.4.5a: Contains palustrine wetland (e.g. in swales). Acacia *cambagei* dominates the small tree layer sometimes with *A.*	Least concern	Of concern	-	26a	8

Environmental Value	Relevant to CCM	VM Act Class (Version 8.0) or NC Act status	Biodiversity status (Version 8.0)	EPBC Act status	Relevant BVG's	Relevant Assessment Units
	harpophylla. Occurs on plains and gently undulating downs on Cainozoic lake deposits					
	11.3.25 *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	Least concern	Of concern	-	16a	2
	11.3.27f: Palustrine wetland (e.g. vegetated swamp). *Eucalyptus coolabah* and/or *E. tereticornis* open woodland to woodland fringing swamps	Least concern	Of concern	-	34d	3
	11.4.9 *Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains	Endangered	Endangered	Endangered	25a	7
Significant wetland (Vegetation Management Act 1999)	11.3.27f: Palustrine wetland (e.g. vegetated swamp). *Eucalyptus coolabah* and/or *E. tereticornis* open woodland to woodland fringing swamps	Least concern	Of concern	-	34d	3
Watercourses	Stream orders 1 and 2 – watercourse vegetation	-	-	-	12a, 16a, 17a, 17b, 17c, 26a & 34d (only those areas interested by watercourses)	1, 2, 4, 5, 7 & 8 (only those areas interested by watercourses)
	Stream orders 3 and 4 – watercourse	-	-	-	17a, 17b, 25a	4, 7 & 8 (only

Environmental Value	Relevant to CCM	VM Act Class (Version 8.0) or NC Act status	Biodiversity status (Version 8.0)	EPBC Act status	Relevant BVG's	Relevant Assessment Units
	vegetation				& 26a (only those areas interested by watercourses)	those areas interested by watercourses)
	Stream orders 5 or greater – watercourse vegetation	-	-	-	16a (Carmichael River only)	2 (Carmichael River only)
Connectivity	State significant corridor remnant vegetation and SSBV remnant vegetation >5ha	-	-	-	12a, 16a, 17a, 17b, 17c, 18a, 25a, 26a & 34d	1, 2, 3, 4, 5, 6, 7 & 8
Protected animals	Squatter Pigeon (southern) (*Geophaps stricta stricta*)	Vulnerable	-	Vulnerable	12a, 16a, 17a, 17b, 17c, 18a & 34d	1, 2, 3, 4, 5, & 6
	Black-throated Finch (southern) (*Poephila cincta cincta*)	Endangered	-	Endangered	12a, 16a, 17a, 17b, 17c, 18a & 34d	1, 2, 3, 4, 5, & 6
	Black-necked Stork (*Ephippiorhynchus asiaticus*)	Near threatened	-	n/a	16a & 34d	2 & 3
	Cotton Pygmy-goose (*Nettapus coromandelianus*)	Near threatened	-	n/a	16a & 34d	2 & 3
	Little Pied Bat (*Chalinolobus picatus*)	Near threatened	-	n/a	12a, 16a, 17a, 17b, 17c, 18a	1, 2, 3, 4, 5, & 6

Environmental Value	Relevant to CCM	VM Act Class (Version 8.0) or NC Act status	Biodiversity status (Version 8.0)	EPBC Act status	Relevant BVG's	Relevant Assessment Units
					& 34d	
	Koala (*Phascolarctos cinereus*)	Special least concern	-	Vulnerable	12a, 16a, 17a, 17b, 17c, 18a & 34d	1, 2, 3, 4, 5, & 6
	Echidna (*Tachyglossus aculeatus*)	Special least concern	-	n/a	12a, 16a, 17a, 17b, 17c, 18a & 34d	1, 2, 3, 4, 5, & 6
	Ornamental Snake (*Denisonia maculata*)	Vulnerable	-	Vulnerable	16a, 17a, 25a, 26a & 34d	2, 3, 7 & 8
	Yakka Skink (*Egernia rugosa*)	Vulnerable	-	Vulnerable	12a, 16a, 17a, 17b, 17c, 18a & 34d	1, 2, 3, 4, 5, & 6
	Square-tailed kite (*Lophoictinia isura*)	Near threatened	-	n/a	12a, 16a, 17a, 17b, 17c, 18a & 34d	1, 2, 3, 4, 5, & 6
	Black-chinned honeyeater (*Melithreptus gularis*)	Near threatened	-	n/a	12a, 16a, 17a, 17b, 17c, 18a & 34d	1, 2, 3, 4, 5, & 6
Protected plants	Waxy Cabbage Palm (*Livistona lanuginosa*)	Vulnerable	-	Vulnerable	16a	2

Appendix B: Indicator scores

Table B 1: Field based ecological condition indicator scores (reproduced from the Ecological Equivalence Methodology Guideline, v1 (DERM 2011))

Indicator	Description	Score
1. Recruitment of woody perennial species	<20% of overstorey species present as regeneration	0
	≥20 -75 of overstorey species present as regeneration	3
	≥75% of overstorey species present as regeneration	5
2. Native plant species richness (trees, shrubs, grasses, forbs)	<25% of benchmark number of species within each life-form	0
	≥25% to 90% of benchmark number of species within each life-form	2.5
	>90% of benchmark number of species within each life-form	5
3. Tree canopy height	<25% of benchmark height	0
	≥25% to 70% of benchmark height	3
	≥70% of benchmark height	5
4. Tree canopy cover	<10% of benchmark	0
	≥10% and <50% of benchmark	2
	≥50% to ≤200% of benchmark	5
	>200% of benchmark	3
5. Shrub canopy cover	<10% of benchmark shrub cover	0
	<50% or >200% of benchmark shrub cover	3
	≥50% to ≤200% of benchmark shrub cover	5
6. Native perennial grass cover	<10% of benchmark perennial grass cover	0
	≥10 to 50% of benchmark perennial grass cover	1
	>50 to 90% of benchmark perennial grass cover	3
	>90% of benchmark perennial grass cover	5
7. Organic litter cover	<10% of benchmark organic litter	0
	<50% or >200% of benchmark organic litter	3
	≥50% to ≤200% of benchmark organic litter	5
8. Large trees	No large trees present	0
	0 to 50% of benchmark large trees	5
	>50% to 100% of benchmark of large trees	10
	>benchmark number of large trees	15

Indicator	Description	Score
9. Coarse woody debris	<10% of benchmark number or total length of CWD	0
	<50% or >200% of benchmark number or total length of CWD	2
	≥50% or ≤200% of benchmark number or total length of CWD	5
10. Weed cover	>50% weed cover	0
	>25 to 50% weed cover	3
	≥5 to 25% weed cover	5
	<5% weed cover	10

Table B 2: GIS based ecological condition indicator scores (reproduced from the Ecological Equivalence Methodology Guideline, v1 (DERM 2011))

Indicator	Description	Score
11. Size of patch *(measured only in fragmented landscapes)*	<5 ha	0
	5-25 ha	2
	26-100 ha	5
	101-200 ha	7
	>200 ha	10
12. Connectivity *(measured only in fragmented landscapes)*	The assessment unit is not connected using any of the below descriptions	0
	The assessment unit adjoins with adjacent remnant vegetation along ≥10% to <50% of its perimeter; or adjoins with adjacent remnant vegetation along <10% of its perimeter AND adjoins with adjacent non-remnant native vegetation >25% of its perimeter	2
	The assessment unit adjoins with adjacent remnant vegetation along 50% to 75% of its perimeter	4
	The assessment unit adjoins with adjacent remnant vegetation along >75% of its perimeter; or includes >500 ha remnant vegetation	5
13. Context *(measured only in fragmented landscapes)*	<10% remnant vegetation AND <30% native non-remnant vegetation (regrowth)	0
	≥10% to 30% remnant vegetation AND <30% high value regrowth; or <10% remnant vegetation AND ≥30% high value regrowth	2
	≥30% to 75% remnant vegetation; OR ≥10% to 30% remnant vegetation AND ≥ 50% high value regrowth	4
	>75% remnant vegetation	5
14. Distance from permanent water *(measured only in intact landscapes)*	0-500 m from water point	0
	500 m to 1 km from water point	2
	1-3 km from water point	5
	3-5 km from water point	10
	>5 km from water point	20

Table B 3: Special features indicator scores (reproduced from the Ecological Equivalence Methodology Guideline, v1 (DERM 2011))

Special feature indicator	Description	Score
1: Centres of endemism	No value	0
	Medium	5
	High	17
	Very high	20
2: Wildlife refugia	No value	0
	Medium	7
	High	17
	Very high	20
3: Areas with concentrations of disjunct populations	No value	0
	Medium	3
	High	12
	Very high	15
4: Areas with taxa at limits of geographic range	No value	0
	Medium	1
	High	4
	Very high	5
5: Areas with high species richness	No value	0
	Medium	5
	High	17
	Very high	20
6: Areas considered to be important for maintaining populations of ancient and primitive taxa	No value	0
	Medium	3
	High	12
	Very high	15
7: Areas containing regional ecosystems with distinct variation in taxa composition associated with geomorphology and other environmental variables	No value	0
	Medium	2
	High	8
	Very high	10
8: Artificially created waterbodies of ecological significance	No value	0
	Medium	1
	High	4

Special feature indicator	Description	Score
	Very high	5
9: Areas considered to be important because of high relative density of hollow-bearing trees	No value	0
	Medium	1
	High	4
	Very high	5
10: Breeding or roosting sites used by significant number of individuals	No value	0
	Medium	3
	High	12
	Very high	15
12: Priority species	No value	0
	Medium	5
	High	8
	Very high	10

Appendix C: Ecological condition scores for each site

Table C 1: Ecological condition scores for each sample site in each assessment unit

Assessment unit	Sample site	Recruitment of woody perennial species	Native plant species richness	Tree canopy height	Tree canopy cover	Shrub canopy cover	Native perennial grass cover	Organic litter cover	Large trees	Coarse woody debris	Weed cover	**Total Field based attributes**	Patch size	Connectivity	Context	Distance from water (km)	**Total BioCondition Score**
1	EE10	5	17.5	5	1.5	3	3	3	15	5	10	**68**	0	0	0	2	**70**
2	EE1	3	17.5	5	3	5	3	5	10	5	10	**66.5**	0	0	0	5	**71.5**
2	EE2	3	10	5	2.5	0	0	3	15	5	0	**43.5**	0	0	0	5	**48.5**
2	EE11	5	17.5	2.5	1.5	0	3	5	10	2	10	**56.5**	0	0	0	10	**66.5**
2	EE12	0	12.5	5	3	3	0	3	15	2	0	**43.5**	0	0	0	0	**43.5**
2	EE31	5	20	5	3	3	5	5	10	2	10	**68**	0	0	0	5	**73**
2	EE32	5	17.5	5	3	0	5	5	15	5	10	**70.5**	0	0	0	0	**70.5**
2	EE33	5	20	5	5	0	5	3	15	5	5	**68**	10	4	4	0	**86**
2	EE34	5	15	5	1.5	5	5	5	15	2	5	**63.5**	0	0	0	5	**68.5**
2	EE45	3	15	5	3	3	0	5	15	5	0	**54**	0	0	0	0	**54**
2	EE50	3	20	5	1.5	0	5	5	15	5	10	**69.5**	0	0	0	0	**69.5**
3	EE3	5	5	5	4	0	0	5	15	2	10	**51**	2	0	0	0	**53**
3	EE4	5	7.5	2.5	2.5	0	1	5	15	5	10	**53.5**	2	2	2	0	**59.5**
3	EE9	3	10	5	2.5	0	1	5	15	5	5	**51.5**	2	5	2	0	**60.5**
4	EE13	5	10	5	1.5	5	5	3	15	5	5	**59.5**	0	0	0	2	**61.5**
4	EE14	5	12.5	5	4	3	5	3	10	2	5	**54.5**	0	0	0	5	**59.5**

Assessment unit	Sample site	Recruitment of woody perennial species	Native plant species richness	Tree canopy height	Tree canopy cover	Shrub canopy cover	Native perennial grass cover	Organic litter cover	Large trees	Coarse woody debris	Weed cover	**Total Field based attributes**	Patch size	Connectivity	Context	Distance from water (km)	**Total BioCondition Score**
4	EE15	5	17.5	5	3	3	5	3	5	2	5	**53.5**	0	0	0	0	**53.5**
4	EE16	5	15	5	4	3	5	3	10	2	10	**62**	0	0	0	5	**67**
4	EE17	5	12.5	4	1.5	5	5	3	10	5	5	**56**	0	0	0	5	**61**
4	EE18	5	12.5	5	3	5	5	5	15	5	10	**70.5**	0	0	0	5	**75.5**
4	EE19	5	15	5	1.5	3	5	3	10	5	5	**57.5**	0	0	0	5	**62.5**
4	EE20	5	17.5	5	1.5	5	5	3	15	2	10	**69**	0	0	0	2	**71**
4	EE21	5	15	5	3	5	3	3	10	5	10	**64**	0	0	0	5	**69**
5	EE22	5	20	2.5	1.5	5	3	5	10	5	10	**67**	0	0	0	0	**67**
5	EE23	5	15	5	4	3	5	5	15	5	10	**72**	0	0	0	5	**77**
5	EE24	3	17.5	1.5	1.5	3	5	5	0	5	10	**51.5**	0	0	0	2	**53.5**
5	EE25	5	10	1.5	2.5	3	5	5	0	5	10	**47**	0	0	0	10	**57**
5	EE26	5	15	2.5	1.5	5	5	3	0	5	10	**52**	0	0	0	5	**57**
6	EE27	5	12.5	5	2.5	0	0	5	10	5	0	**45**	0	0	0	10	**55**
6	EE28	5	15	5	5	0	1	3	10	5	5	**54**	0	0	0	5	**59**
6	EE29	5	17.5	5	2.5	0	1	3	5	2	3	**44**	0	0	0	5	**49**
6	EE30	3	12.5	5	4	3	1	3	10	2	5	**48.5**	0	0	0	5	**53.5**
6	EE46	5	15	5	1.5	3	3	5	10	2	5	**54.5**	0	0	0	5	**59.5**
6	EE47	5	12.5	5	4	3	0	5	15	5	5	**59.5**	0	0	0	2	**61.5**
7	EE35	5	20	5	2.5	3	3	5	5	5	5	**58.5**	0	0	0	5	**63.5**

Assessment unit	Sample site	Recruitment of woody perennial species	Native plant species richness	Tree canopy height	Tree canopy cover	Shrub canopy cover	Native perennial grass cover	Organic litter cover	Large trees	Coarse woody debris	Weed cover	**Total Field based attributes**	Patch size	Connectivity	Context	Distance from water (km)	**Total BioCondition Score**
7	EE36	5	15	4	5	5	5	3	10	5	5	**62**	0	0	0	5	**67**
7	EE37	3	15	4	3.5	5	3	5	10	2	5	**55.5**	0	0	0	0	**55.5**
7	EE38	5	10	5	5	3	1	5	5	5	10	**54**	10	5	4	0	**73**
7	EE39	5	12.5	4	5	5	1	5	10	5	10	**62.5**	0	0	0	5	**67.5**
7	EE44	5	15	5	5	3	3	5	5	2	10	**58**	0	0	0	5	**63**
8	EE40	5	20	5	2.5	3	3	5	5	2	5	**55.5**	10	5	4	0	**74.5**
8	EE41	5	15	5	4	5	1	3	15	2	10	**65**	10	5	5	0	**85**
8	EE42	5	15	2.5	2.5	3	3	5	5	5	10	**56**	0	0	0	5	**61**
8	EE43	3	12.5	2.5	2.5	3	3	5	0	5	5	**41.5**	0	0	0	2	**43.5**
8	EE48	5	15	5	4	5	3	3	15	5	3	**63**	0	0	0	0	**63**
8	EE49	5	17.5	5	2.5	3	1	3	10	5	5	**57**	0	0	0	5	**62**

Appendix D: Special features scoring

Table D 1: Breakdown of special feature indicators scoring by each special feature and assessment unit combination including the impact area of the surface disturbance in the mining footprint

Special feature indicator	Assessment unit	Area of surface impact (ha)	Special feature rating	Special feature score
1: Centres of endemism	2	2.47536	VERY HIGH	20
	4	1.09866	HIGH	17
	4	0.14044	VERY HIGH	20
	5	9.929	HIGH	17
2: Wildlife refugia	1	12.6865	VERY HIGH	20
	2	41.2638	VERY HIGH	20
	3	13.6556	HIGH	17
	4	182.124	HIGH	17
	4	3073.79	VERY HIGH	20
	5	26.1981	HIGH	17
	5	309.389	VERY HIGH	20
	6	289.032	VERY HIGH	20
	7	0.05081	HIGH	17
	7	75.9085	VERY HIGH	20
	8	89.2262	VERY HIGH	20
3: Areas with concentrations of disjunct populations	2	38.291	HIGH	12
	4	3104.08	HIGH	12
	5	330.493	HIGH	12
	6	52.748	HIGH	12
	7	58.3631	HIGH	12
	8	68.9356	HIGH	12
4: Areas with taxa at limits of geographic range	2	38.291	HIGH	4
	4	3104.08	HIGH	4
	5	330.493	HIGH	4
	6	52.748	HIGH	4
	7	58.3631	HIGH	4
	8	68.9356	HIGH	4
5: Areas with high species richness	2	2.47536	HIGH	17

Special feature indicator	Assessment unit	Area of surface impact (ha)	Special feature rating	Special feature score
	2	38.291	VERY HIGH	20
	4	182.264	HIGH	17
	4	3013.01	VERY HIGH	20
	5	26.1981	HIGH	17
	5	317.538	VERY HIGH	20
	6	55.7965	VERY HIGH	20
	7	0.05081	HIGH	17
	7	62.977	VERY HIGH	20
	8	72.9189	VERY HIGH	20
6: Areas considered to be important for maintaining populations of ancient and primitive taxa	na	nil	nil	nil
7: Areas containing regional ecosystems with distinct variation in taxa composition associated with geomorphology and other environmental variables	2	2.47536	HIGH	8
	4	71.135	HIGH	8
	4	7.2	VERY HIGH	10
	5	9.23229	HIGH	8
	5	0.45711	VERY HIGH	10
	7	47.813	VERY HIGH	10
8: Artificially created waterbodies of ecological significance	na	nil	nil	nil
9: Areas considered to be important because of high relative density of hollow-bearing trees	2	40.7664	VERY HIGH	5
	4	2980.52	VERY HIGH	5
	5	309.389	VERY HIGH	5
	6	55.7965	VERY HIGH	5
	7	62.977	VERY HIGH	5
	8	72.9189	VERY HIGH	5
10: Breeding or roosting sites used by a significant number of individuals	na	nil	nil	nil
11: Ecological corridors	1	12.6865	State	20
	2	1.19583	State	20
	2	26.0584	State	20
	2	2.6032	State	20
	3	10.0065	State	20

Special feature indicator	Assessment unit	Area of surface impact (ha)	Special feature rating	Special feature score
	4	0.63988	State	20
	4	5671.82	State	20
	4	5.04492	State	20
	5	463.938	State	20
	6	22.0084	State	20
	7	273.11	State	20
	8	165.222	State	20
12: Priority species	na	nil	nil	nil
13: Significance of patch within a 1 km buffer	na	nil	nil	nil
14: Protected area estate buffer	na	nil	nil	nil

Appendix E: Photos

Assessment unit 1 – *Eucalyptus thozetiana* dominated woodland

Assessment unit 2 – *Eucalyptus camaldulensis* dominated woodland with *Melaleuca leucadendra* fringing the Carmichael River

Assessment unit 3 – Wetlands dominated by *Eucalyptus coolabah*

Assessment unit 4 – *Eucalyptus melanophloia* or *E. brownii* dominated woodland

Assessment unit 5 – *Eucalyptus similis* and/or *Corymbia setosa* dominated low open woodland

Assessment unit 6 – *Corymbia plena* dominated woodland

Assessment unit 7 – *Acacia harpophylla* dominated woodland

Assessment unit 8 – *Acacia cambagei* dominated woodland

Brigalow (*Acacia harpophylla* dominant and co-dominant) endangered ecological community (Brigalow TEC) under the EPBC Act.

Waxy Cabbage Palm (*Livistona lanuginosa*) listed as vulnerable under the EPBC Act

Black-throated Finch (southern) (*Poephila cincta cincta*) listed as endangered under the EPBC Act

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C-3: Moray Downs West Ecological Equivalence Assessment (Eco Logical Australia 2014b)

Moray Downs West Ecological Equivalence Assessment

Prepared for
Adani Mining Pty Ltd

9th October 2014

DOCUMENT TRACKING

Item	Detail
Project Name	Moray Downs West Ecological Equivalence Assessment
Project Number	14BRIECO-0008
Project Manager	Brad Dreis 07 3503 7195 Lv 3, 471 Adelaide Street, Brisbane, Qld 4006
Prepared by	Katrina Cousins, Chays Ogston, Bruce Wilson
Reviewed by	Brad Dreis
Approved by	Brad Dreis
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Contents

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Abbreviations

Abbreviation	Description
API	Aerial photographic interpretation
BRB	Brigalow Belt bioregion
BVG	Broad Vegetation Group
CCM	Carmichael Coal Mine
CWD	Coarse woody debris
DERM	Department of Environment and Resource Management (Queensland)
DEU	Desert Uplands bioregion
DoE	Department of Environment (Commonwealth)
DSDIP	Department of State Development, Infrastructure and Planning
EA	Environmental Authority
EEM	Ecological Equivalence Methodology
EHP	Department of Environment and Heritage Protection (Queensland)
EIS	Environmental Impact Statement
ELA	Eco Logical Australia
EP Act	*Environmental Protection Act 1994* (Queensland)
EPBC Act	*Environment Protection and Biodiversity Act 1999* (Commonwealth)
EPC	Exploration Permit for Coal
EO Act	*Environmental Offsets Act 2014* (Queensland)
GIS	Geographic Information System
MDW	Moray Downs West Offset area
ML	Mining Lease
MNES	Matters of National Environmental Significance
MR Act	*Mineral Resources Act 1989* (Queensland)
MSES	Matters of State Environmental Significance
NC Act	*Nature Conservation Act 1992* (Queensland)
OAG	Offset Assessment Guide
PVMO	Policy for Vegetation Management Offsets (Queensland)
QBOP	Queensland Biodiversity Offset Policy
QEOP	Queensland Environmental Offsets Policy
QGIS	Queensland Government Information System
RE	Regional Ecosystem

Abbreviation	Description
SDPWO Act	*State Development and Public Works Organisation Act 1971* (Queensland)
SSBV	State Significant Biodiversity Value
TEC	Threatened Ecological Community
VM Act	*Vegetation Management Act 1999* (Queensland)

1 Introduction

1.1 Project background

Adani Mining Pty Ltd (herein referred to as Adani) is developing the Carmichael Coal Mine (CCM) Project in the Galilee Basin, central Queensland. The mine site is located approximately 170 km north-west of the township of Clermont (**Figure 1**). The mine will be located within the boundary of Exploration Permit for Coal (EPC) 1690 and the eastern part of EPC1080, a total area of approximately 45,048 ha. The CCM proposed mine site is located within two Bioregions, the Desert Uplands (DEU) in the western portion and the Brigalow Belt (BRB) to the east.

The proposed mine is expected to produce 60 million tonnes per annum of product coal at peak production. The project has a potential mine life of 60 years, including construction, operation and closure. It is expected that operations will be in six open cut pits and five underground pits. The overall workable length of the mine will be approximately 45 km. Export coal from this project will predominantly service the Indian market.

The CCM Project had been declared:

- A state significant project under section 26(1)(a) of the Queensland *State Development and Public Works Organisation Act 1971* (SDPWO Act) on 26 November 2010, requiring Adani to prepare an Environmental Impact Statement (EIS). This was replaced with the term 'coordinated project' with the amendment of the SDPWO Act in December 2012.
- A controlled action under the *Environment Protection and Biodiversity Act 1999* (Commonwealth) (EPBC Act) on the 6 January 2011 (EBPC 2010/5736).

Adani has since gained environmental approval by the Coordinator-General under the SDPWO Act and EBPC Act. As part of their conditions for approval, Adani will need to meet State and Commonwealth offset requirements. The Moray Downs property was acquired by Adani in 2012, with Moray Downs West identified as a potential offset area.

1.1.1 Summary of assessment process

With the current bilateral agreement between the Commonwealth and the Queensland Governments, an EIS can be prepared for the State of Queensland which satisfies the impact assessment requirements of both the SDPWO Act and the EPBC Act. An EIS was prepared for the Project by GHD (2012) and identified ecological values within the Project site. Ecological values were defined as the following protected matters:

- Matters of State Environmental Significance (MSES), and
- Matters of National Environmental Significance (MNES) listed under the EPBC Act.

The EIS also identified unavoidable impacts to these protected matters. In order to satisfy State and Commonwealth environmental offsets policy requirements (described further in ELA 2014b), offsets would be necessary where unavoidable or residual impacts to identified protected matters cannot be reasonably avoided or mitigated.

Given this necessity for offsets, an Environmental Offset Strategy for the CCM Project was prepared by Ecofund Queensland Pty Ltd, part of CO2 Australia Group (Ecofund), and submitted with the EIS (Ecofund 2012). This package further refined and confirmed the residual impacts of the project requiring

offsets and outlined the approach for implementation and delivery of the offset package (Ecofund 2013). It also listed five properties that could suitability offset residual impacts to protected matters.

Although not included in the final Offset Package for the SEIS and AEIS, Moray Downs West was included in the original EIS Offset Strategy and was also included in an Offsets Assessment Guide report as a potential offset for CCM.

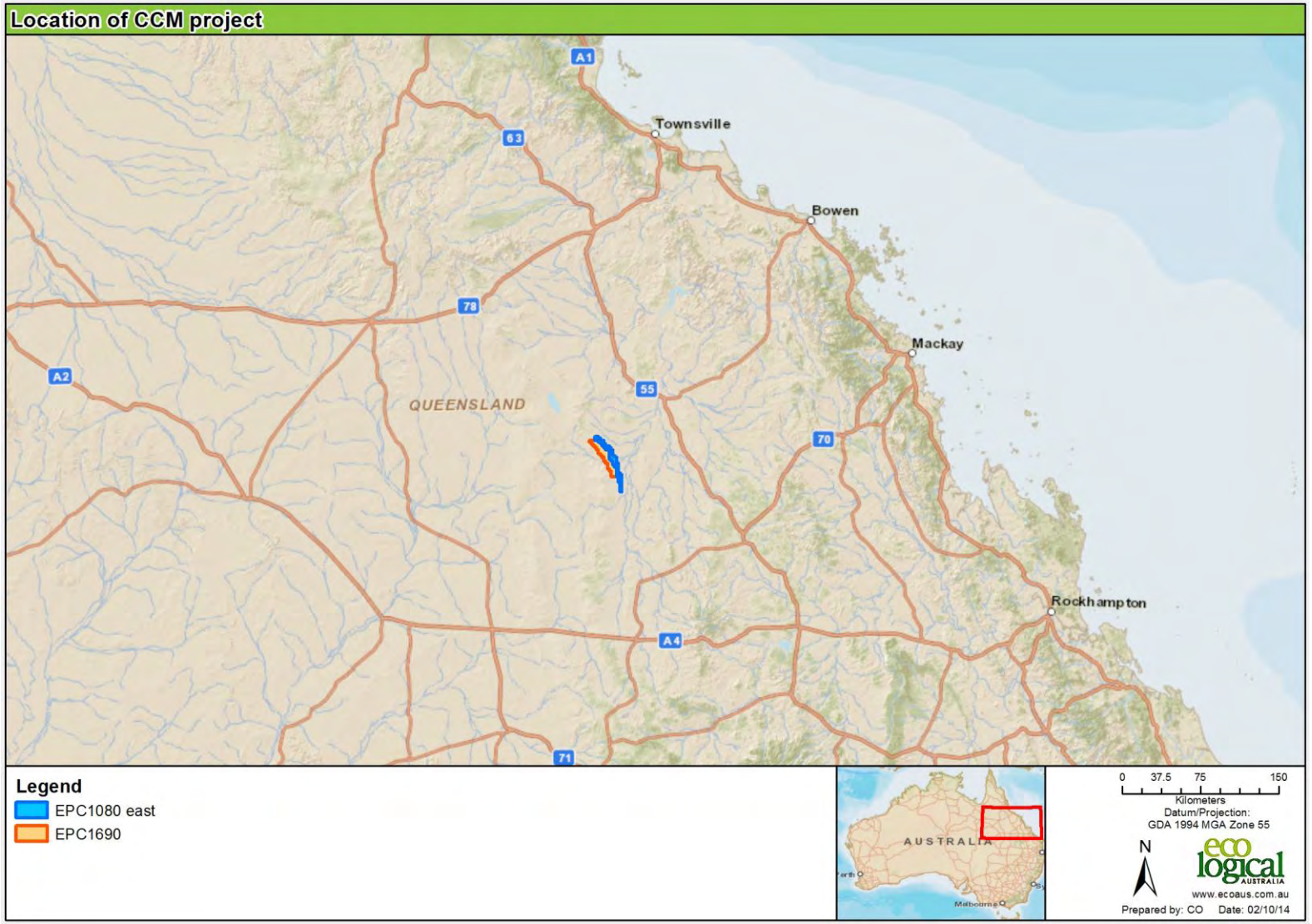

Figure 1. Location of CCM project

1.1.2 Need for assessment

The Coordinator-General's EIS evaluation report (prepared under section 35 of the SDPWO Act) was released in May 2014 (DSDIP 2014). This report acknowledged Ecofund's Environmental Offsets Package and the ability to offset residual impacts to all MNES and the majority of MSES within the five properties identified. The Coordinator-General outlined their powers to decide State offsets as part of the broad conditioning powers under the SDPWO Act, and to also determine and approve any State offset conditions that are considered necessary to deal with significant residual impacts over and above requirements under the EPBC Act (DSDIP 2014).

The Coordinator-General has imposed Condition 7(a)(i) which will require the proponent to finalise a Biodiversity Offset Strategy for approval that details how EPBC Act offset requirements will be met and identifies any significant residual impacts for MSES that could need offsetting. The approved strategy must be implemented through conditions stated for the Environmental Authority. Details of offset requirements were outlined in Appendix 1, Schedule I, of the EIS evaluation report.

With the release of the Coordinator-General's EIS evaluation report, the Commonwealth government were able to assess this controlled action (EBPC 2010/5736). On the 24th July 2014, Adani gained environmental approval under section 133 of EPBC Act for the Carmichael Coal Mine and Rail Infrastructure Project. The CCM Project is subject to 34 environmental approval conditions, and includes offset requirements for the MNES that were outlined in the Coordinator-General's report:

- Condition 8 - The approval holder must legally secure the minimum offset areas (detailed in **Appendix A)** within two years of commencement of the specified component of the action.

CO2 Australia Pty Ltd (CO2 Australia) is currently developing the Biodiversity Offset Strategy (BOS) for Adani, to satisfy Condition 7(a)(i) of the CG EIS evaluation report. This BOS will address the MNES and MSES outlined in the Coordinator-General's EIS environmental report and environmental approval under the EPBC Act and will be delivered using a staged approach with the first two stages outlined in **Table 1**. The requirements for offset stages 3 and 4 will be determined through ongoing monitoring and assessment of the actual impacts of the project on MNES.

In regards to MSES, there are recent changes to Queensland offset requirements with the introduction of the new Queensland Environmental Offset Policy (QEOP) (outlined further in ELA 2014b). CO2 Australia has applied the following rules for determining how to address MSES requirements in the BOS:

- exclusion of MSES that are also MNES
- exclusion of MSES that are:
    - near threatened animals or plants as listed under the NC Act
    - special least concern animals listed under the NC Act that no longer require offsets (i.e. except echidna and koala)
    - threshold Regional Ecosystems (REs)
    - high value regrowth
- exclusion of remaining MSES impacts that do not constitute a significant impact in accordance with the Draft Significant Residual Impact Guideline (September 2014)
- co-location of MSES with MNES to the greatest extent possible.

To inform this BOS, an assessment of the proposed offset areas will be required. These assessments will determine if EPBC Act offset requirements will be met, and to identify any significant residual impacts for MSES that could need offsetting.

Table 1. Summary of offset requirements for the CCM project

Environmental Value	EPBC Act status	NC Act status	VM Act status	Offset Delivery Stage 1 (ha)[1]	Offset Delivery Stage 2 (ha)[1]
Ornamental snake	V	V	-	96.39	38.61
Squatter Pigeon (sth. subsp.)	V	V	-	1,598.00	902.00
Black-throated Finch (southern)	E	E	-	20,258.16	10,741.83
Yakka Skink	V	V	-	3,783.98	1,816.02
Waxy Cabbage Palm	V	V	-	90.00	0.00
Brigalow threatened ecological community (11.3.1, 11.4.8, 11.4.9; BVG 25a)	E	-	E	87.62	727.37
Brigalow scaly-foot	-	V	-	7,562.00	1,277.03
Echidna	-	SLC	-	8,906.40	1,699.79
Koala*	N/A	SLC	-	11,759.58	2,415.70
WPA	-	-	-	8.92	0.00
Significant wetland	-	-	-	6.53	0.00
RE 11.3.3 (Broad Vegetation Group (BVG) 16c)	-	-	OC	11.06	1.38
RE 11.4.5 (BVG 26a)	-	-	OC	1.52	0.00
RE 11.4.6 (BVG 26a)	-	-	OC	148.00	0.00
RE 11.4.11 (BVG 30b)	-	-	OC	138.17	7.64
Stream order 2	-	-	-	288.38	105.81
Stream order 4	-	-	-	131.74	0.00
Stream order 5	-	-	-	12.64	0.00
Connectivity	-	-	-	4,680.07	1,223.61

*The Koala was listed under the EPBC Act after the project was designated a control action and was not included as a MNES the offset strategy package.

[1] For MNES and MSES occurring on Moray Downs West the value presented is the total offset requirement; for MSES not occurring on Moray Downs West the value presented is the total impact.

1.2 Project scope

Eco Logical Australia (ELA) was engaged by CO2 Australia to undertake an ecological equivalence assessment for the proposed Moray Downs West (MDW) offset area. The Queensland Government's Ecological Equivalence Methodology (EEM) was used to undertake the assessment of the offset area. For the purpose of this assessment, MSES are those values listed in the Coordinator-Generals EIS evaluation report and includes regional ecosystems, essential habitat, wetlands, watercourses, connectivity and protected species (**Appendix A**).

As a condition of Adani's environmental approval (**Appendix B**), an assessment of MNES will also be required. This will include the collection of additional data, such as presence of micro-habitats and individuals for listed MNES.

The key objective for this scope of works is the delivery of an EEM report (this report) prepared in accordance with the Ecological Equivalence Methodology Guideline, Version 1 (DERM 2011) which includes survey methods, summary of results and ecological condition and special features scores for the proposed MDW offset area. This report will also assess of the offset suitability of MNES within the proposed MDW offset area and will only focus on offset requirements for stage one of the BOS.

1.2.1 Moray Downs West (MDW) offset area

The proposed MDW offset area is part of the Moray Downs property and is adjacent to CCM (**Figure 2**). The entire offset area is located in the Desert Uplands bioregion with approximately half of the property north of CCM and the remaining area is immediately adjacent to the western boundary of CMM. The northern section has the intermittent North Creek flowing through the area from west to east. The western section runs the length of the ML to cover both sides of the Carmichael River. In total, the proposed MDW offset area covers 40,825 ha.

The Moray Downs property is an existing cattle fattening farm and the proposed MDW offset area is still used for cattle grazing. The majority of the proposed MDW offset area is grazed for native pasture and contains existing infrastructure including fencing, access roads and dams. The offset area has also been recently burnt (summer 2012/13) and several areas are impacted by exotic weed *Cenchrus ciliaris* (Buffel Grass).

1.3 Ecological equivalence method and criterion indicators

This section outlines the ecological equivalence assessment method set by DERM (2011).

Ecological equivalence assessments are undertaken by assessing two ecological equivalence criteria on proposed clearing and offset areas. The first criterion, 'ecological condition', is assessed using a standard set of 11 indicators, including ten field-based and one GIS-based indicators (refer to **Appendix B**). The ten field-based indicators require the collection of a range of data characterising the structure and composition of plant assemblages. The one GIS-based indicator is assessed by undertaking spatial analysis on available spatial data layers and/or aerial imagery.

The ten field-based indicators are assessed by following the method set out in the Ecological Equivalence Methodology Guideline, Version 1 (DERM 2011). Offset sites are initially stratified, where necessary, into homogeneous assessment units by identifying different REs and broad condition states (i.e. remnant, high value regrowth, low value regrowth and/or cleared areas). A 100 m x 50 m nested sampling plot is then established and assessed within the assessment unit of focus, ensuring that the plot does not cross any environmental gradients. The plot is established in an area that is at least 50 m from a major disturbance (e.g. a road). The ten field-based indicators are all assessed within this plot.

The second criterion, ‘special features’, is assessed by undertaking a desktop spatial analysis following the methods DERM (2011) and using the special features GIS spatial data set available from EHP.

An EEM assessment of clearing sites was previously undertaken in May 2014 (ELA 2014b).

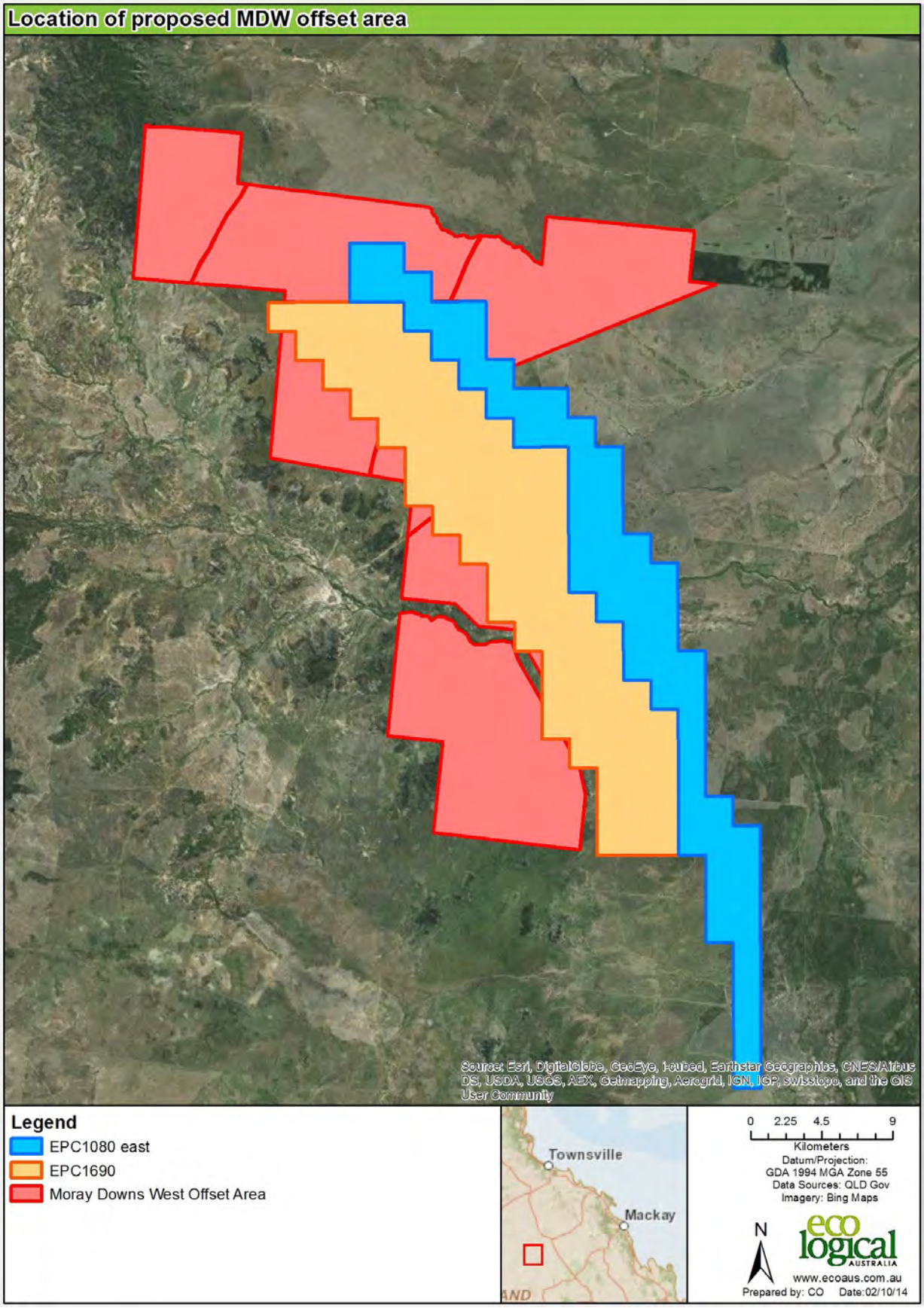

Figure 2. Location of proposed MDW offset area

2 Methods

2.1 Desktop review and analysis

Data reviewed at a desktop level, prior to field work, including the following documents and information sources:

- Carmichael Coal Mine Environmental Impact Statement (GHD 2012)
- Carmichael Coal Mine Supplementary Environmental Impact Statement (GHD 2013)
- Environmental Offset Strategy (Ecofund 2012)
- Environmental Offset Package (Ecofund 2013)
- Carmichael Coal Mine Exploration Sites Ecological Equivalence Assessment (ELA 2013)
- Carmichael Coal Mine Regional Ecosystem Map Amendment (ELA 2014a)
- Carmichael Coal Mine Exploration Sites Ecological Equivalence Assessment Stage 2 (ELA 2014b)
- Previous BTF surveys within Moray Downs (GHD unpublished)
- Preliminary information from the Biodiversity Offset Strategy
- Relevant GIS layers
- BioCondition benchmarks and regional ecosystem technical descriptions
- Aerial photography.

Site stratification and the delineation of assessment units across the offset footprint was based on Regional Ecosystem (RE) mapping produced in ArcGIS and from aerial photographic interpretation (API) of high resolution 2012 imagery of the proposed MDW offset area.

2.1.1 Black-throated Finch Monitoring

GHD (Unpublished) conducted preliminary Black-throated Finch monitoring within two proposed offset areas for the CCM project: Moray Downs and Doongmabulla. The monitoring program comprised of three surveys methods based on Significant Impact Guidelines for the Black-throated Finch (southern) *Poephila cincta cincta* (DEWHA 2009): waterbody watches for 20 minutes, area counts (two x 2 ha) within different habitat areas and remote fauna cameras.

Three waterbody sites were investigated within Moray Downs on the 27th of October 2013 for watches and area counts: Unnamed Spring (Four Mile Paddock), Spring (Humes Paddock) and Desert Bore (Desert Paddock). Three camera traps were set; one at Desert Bore and two at the Unnamed Spring in Four Mile Paddock.

No Black-throated Finches were observed during these surveys. Desert Bore was still recommended as a potential offset area due to the high quality and condition of habitat and close proximity to Black-throated Finch records. Habitat was defined as 'ironbark, box and yellowjacket woodland (REs 10.5.5, 10.3.6 and 10.5.1) with a significant rocky ephemeral drainage line'.

2.1.2 Site stratification

The site stratification framework was developed based on the known occurrence of MNES as listed above across the different assessment unit. The delineation of each assessment unit was undertaken using the Broad Vegetation Groups (BVGs). A total of fifteen assessment units were delineated across the proposed MDW offset area footprint. Assessment unit 1 and 2 (BVG 17a/17b) are the largest units and are associated with Black-throated Finch habitat. Further analysis through buffering of all water points, habitat mapping by GHD and species records indicated that the entirety of this unit is potential

habitat for the species. **Table 2** and **Figure 3** provide an outline of each of the assessment units, the area (ha) within the MDW offset area and the total number of EE sites assessed.

Table 2. Assessment unit delineation and site stratification results

Assessment unit	BVG	Description	Total area on MDW property (ha)	EE sites
1	17a, 17b	*Eucalyptus melanophloia* & *E. brownii* woodland	17,247.95	EE12, EE13, EE29, EE30, EE32, EE33, EE34
2	17a, 17b	*E. melanophloia* & *E. brownii* regrowth	1,350.96	EE11, EE31
3	17c	*E. similis* & *Corymbia setosa* low woodland	10,340.13	EE23, EE24, EE25, EE26, EE27
4	25a	*Acacia harpophylla* +/- *E. cambageana* woodland	456.39	EE14, EE18, EE19, EE42, EE43
5	25a	*A. harpophylla* regrowth	1,888.77	EE15, EE16, EE17
6	24a	*A. shirleyi* woodland	1,843.49	EE1, EE2, EE36
7	26a	*A. cambagei* woodland	80.79	EE20
8	26a	*A. cambagei* regrowth	27.12	EE21
9	16a	*E. camaldulensis* riparian open forest	733.62	EE6, EE7, EE8, EE9
10	16c	*E. coolabah* billabongs	8.58	EE41
11	12a	*C. leichhardtii* or *E. thozetiana* woodland	4,752.06	EE4, EE35, EE37
12	18a, 18b	*C. plena* open woodland	921.61	EE5, EE22, EE28
13	19d	*E. persistens* low woodland	1,028.47	EE38, EE39
14	21b	*Melaleuca tamarascina* shrubland	138.05	EE3, EE40
15	34b	*E. camaldulensis* billabong	7.43	EE10
Total			**40,825.42**	**43 EE sites**

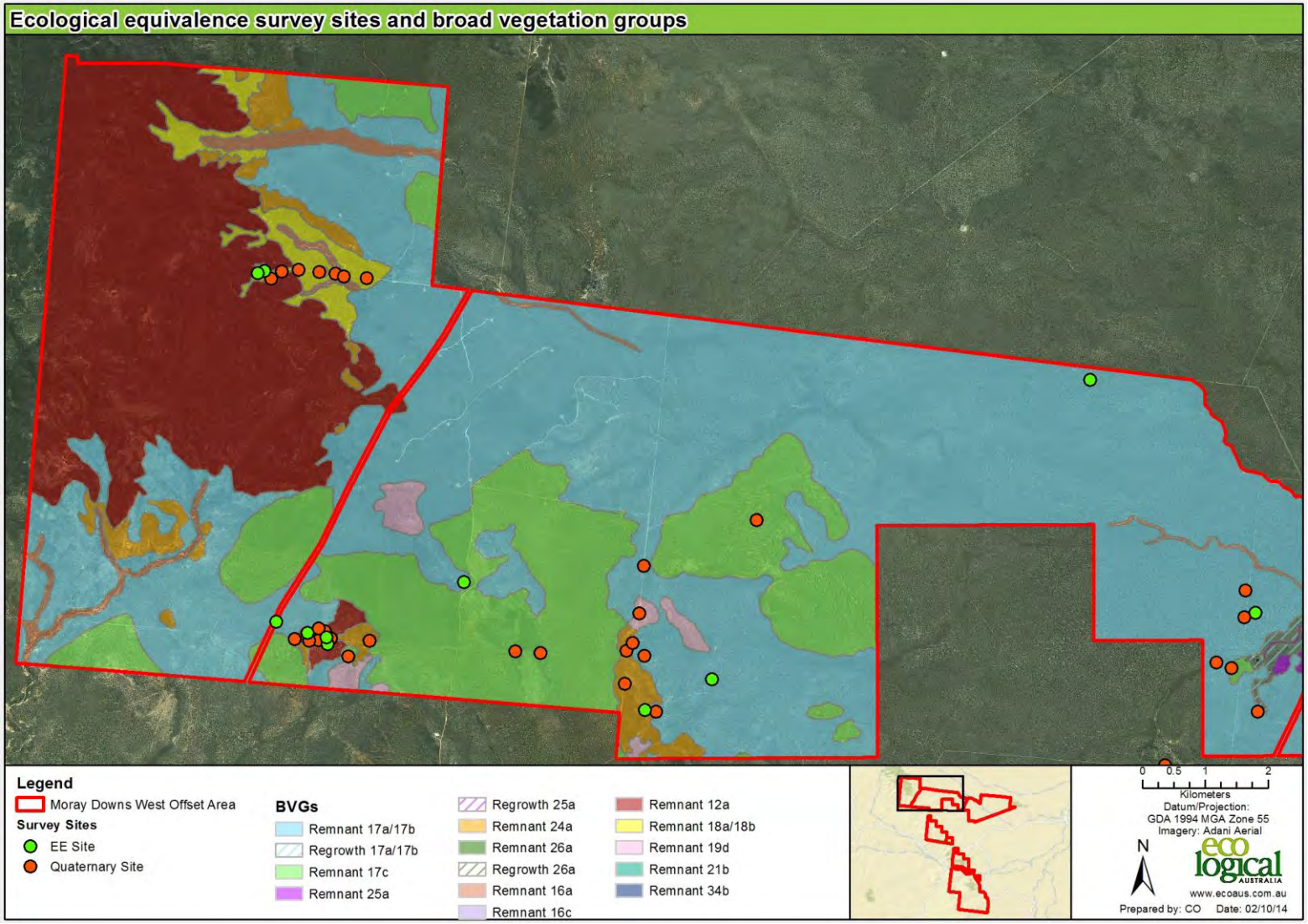

Figure 3. Ecological equivalence survey sites and broad vegetation groups

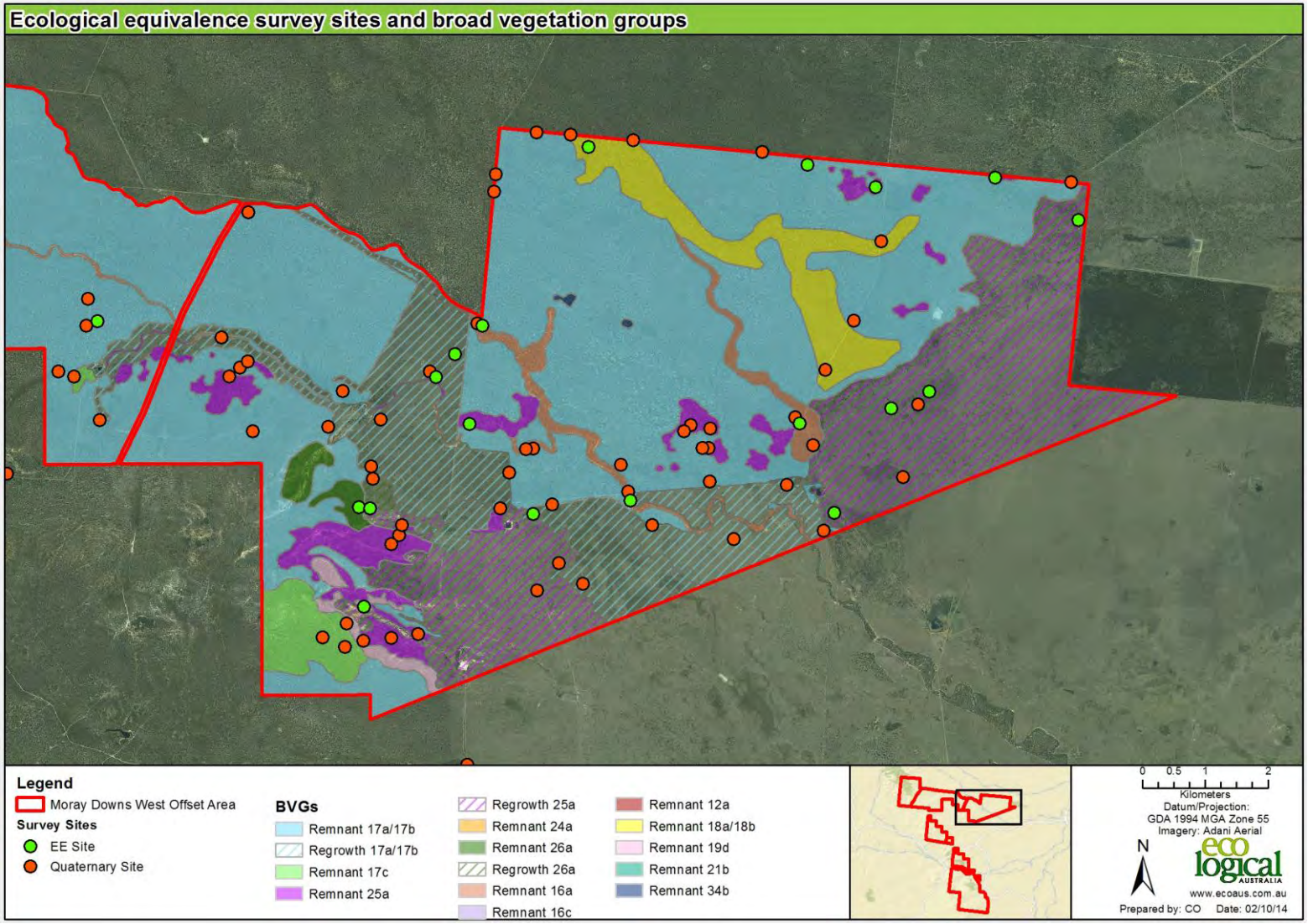

Figure 3. Ecological equivalence survey sites and broad vegetation groups (continued)

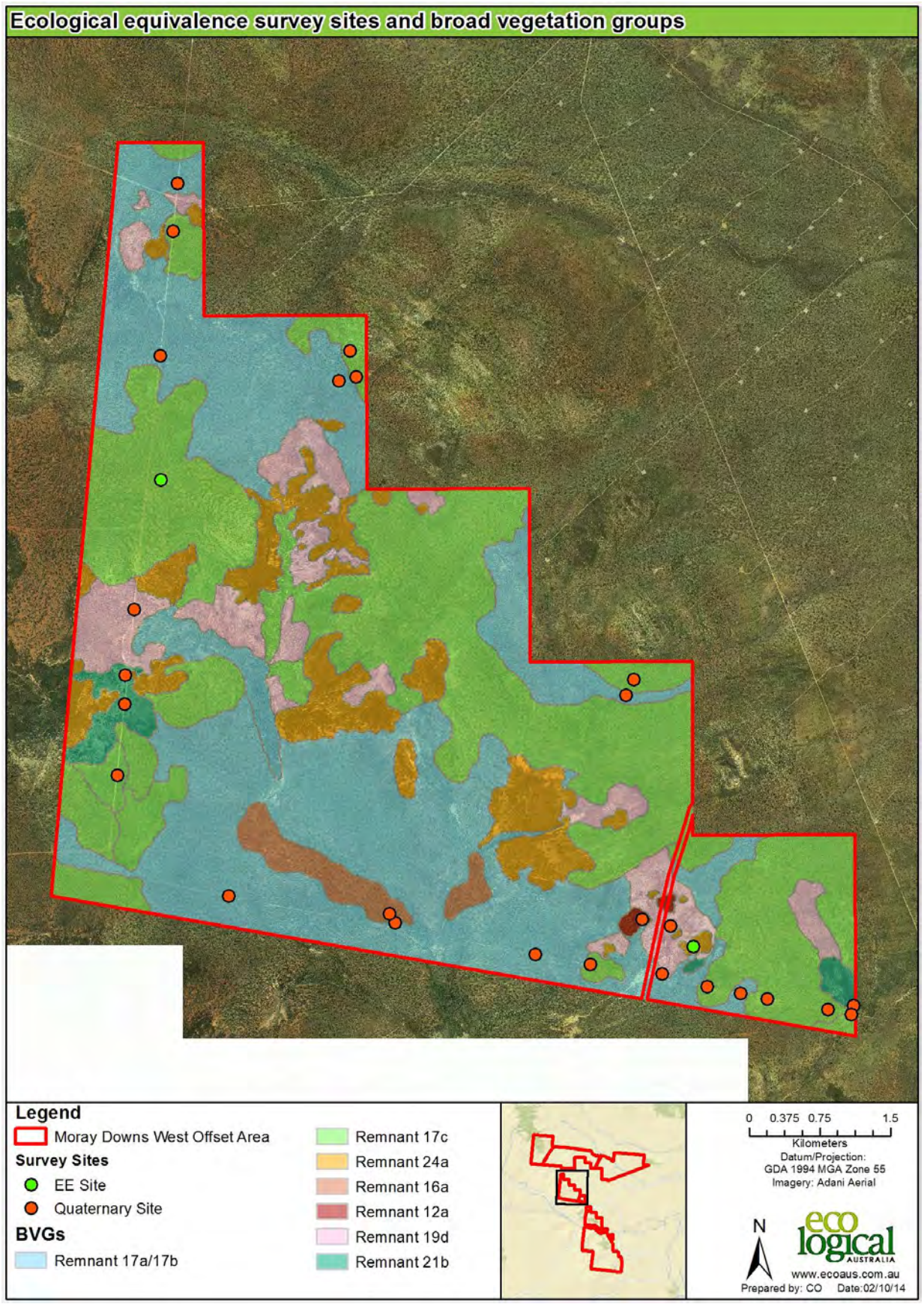

Figure 3. Ecological equivalence survey sites and broad vegetation groups (continued)

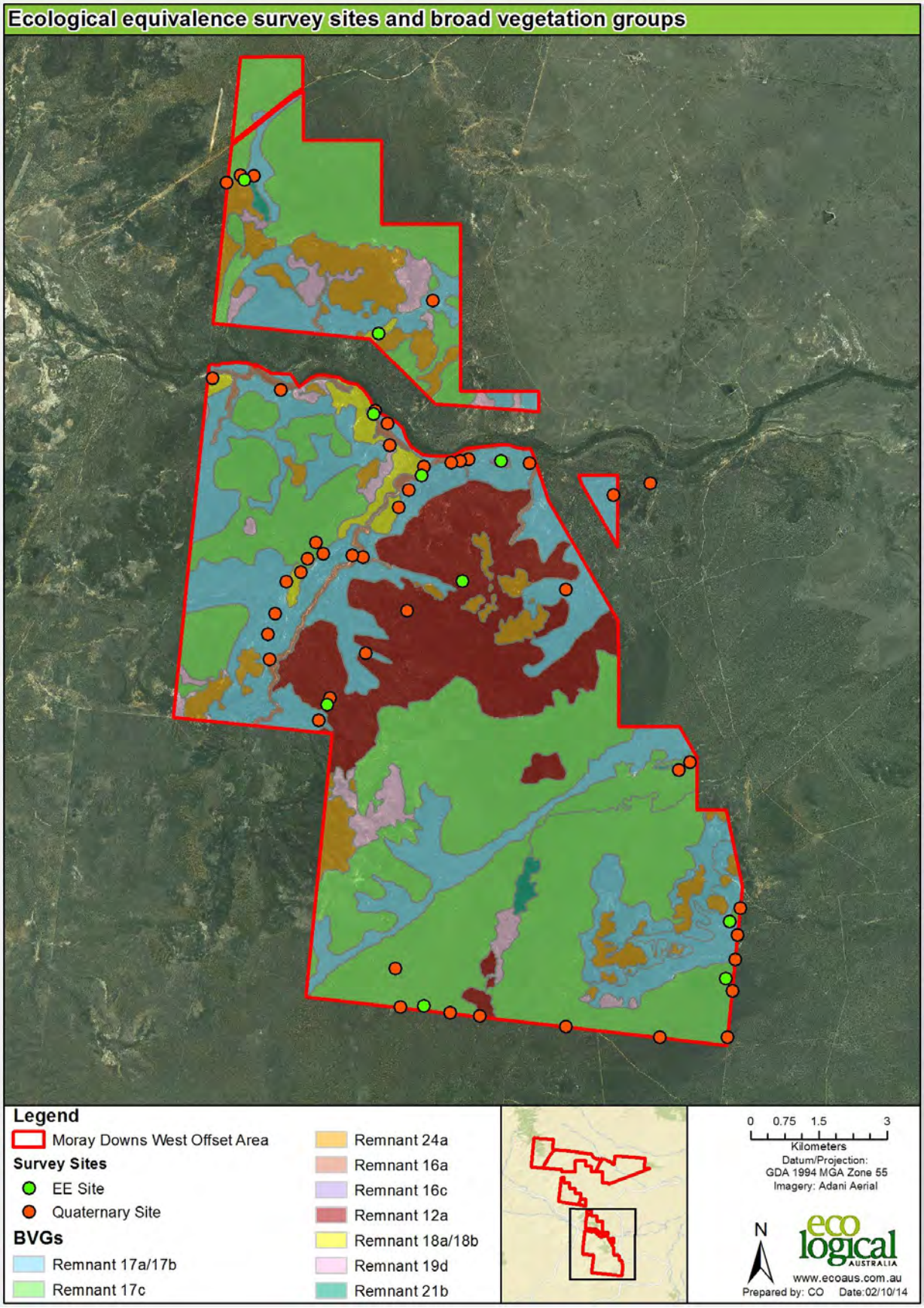

Figure 3. Ecological equivalence survey sites and broad vegetation groups (continued)

2.2 Field surveys

2.2.1 Ecological condition

Field surveys were undertaken by two teams of ecologists (i.e. four ecologists) from 8-14 September 2014. The survey consisted of data collection relating to ten field based indicators of ecological condition identified in the EEM (refer to **Appendix C**). Data was collected at 43 sites representing the 15 assessment units (described further in **Section 3.1**).

To assist with the calculation of assessment unit areas, Regional Ecosystem mapping was also verified during the field survey through Quaternary surveys. A total of 164 quaternary surveys were undertaken.

Ecological condition of the area to be used as an offset was assessed using the method outlined in the EEM and the *BioCondition Assessment Manual* (Eyre et al. 2011).

2.2.2 Additional survey consideration of MNES

In addition to the ecological condition indicators collected for EEM, the following was also recorded for MNES threatened species:

- Black-throated Finch – presence of key grass species and permanent water bodies within Black-throated Finch habitat
- *Livistona lanuginosa* – counts of individuals within MDW
- Ornamental Snake – presence of gilgai's and fallen woody debris within Ornamental Snake habitat
- Squatter Pigeon - counts of individuals within MDW
- Yakka Skink – evidence of burrowing or latrine sites within MDW
- The locations of these MNES assessments are outlined in **Figure 4**.

2.3 GIS analysis

2.3.1 Ecological condition

The GIS analysis was undertaken independent of the field assessment. This section describes the methods used in both the calculation and scoring of spatial features for ecological condition, as defined under the EEM (DERM 2010). Special features scoring methods are discussed in **Section 3.2**.

Assessment of the GIS-based indicators was undertaken using the GIS analysis protocols set out in the EEM. The one indicator (listed in **Table C2** of **Appendix C**) measured is:

- 14. Distance from permanent water

The intact landscape of the DEU bioregion requires only the GIS-based indicator 14 to be assessed.

A ground-truthed RE map layer was used in the assessment of GIS-based indicators. The spatial layers used to assess the GIS-based ecological indicators were:

- Ground-truthed RE mapping (ELA 2014)
- RE mapping Version 8 (EHP RE Mapping)
- Dams_Hydro_Indicative_MorayDowns_GHD_Pre_20130101 (GHD 2013)
- PastSurveys_Waterbodies_GHD_Pre_20130101 (GHD 2013)
- Carmichael River spatial location
- Aerial imagery provided by Adani.

2.3.2 Special features

Assessment of the special features indicators was undertaken using the special features assessment protocols set out in the EEM. The scoring criteria for the special features are listed in **Table B3** of **Appendix B**. The spatial layers used to assess the special features were:

- Ground-truthed RE mapping (ELA 2014)
- QLD_VEG_OFFSET_BPA_SF_CUR (State-wide special features data based on Biodiversity Planning Assessments)
- Aerial imagery provided by Adani.

Calculation of indicators 1 to 12 involved querying the Queensland Government's offsets special features dataset spatial layer. The ground-truthed RE map layer (ELA 2014) was intersected with the state-wide special features data (QLD_VEG_OFFSET_BPA_SF_CUR.shp), and the MDW offset area to determine special features for each assessment unit within the clearing area. As each assessment unit intersected with a range of special feature polygons, the special feature score for each unique assessment unit/special feature combination was calculated separately and then summed across each assessment unit as per the methods in DERM (2011, section 3.2 and Appendix B). Special features other than Ecological Corridors (SF11) for the non-remnant assessment units (2, 5 & 8) were calculated from the same data set using the adjacency calculations (see DERM, 2011 Appendix B).

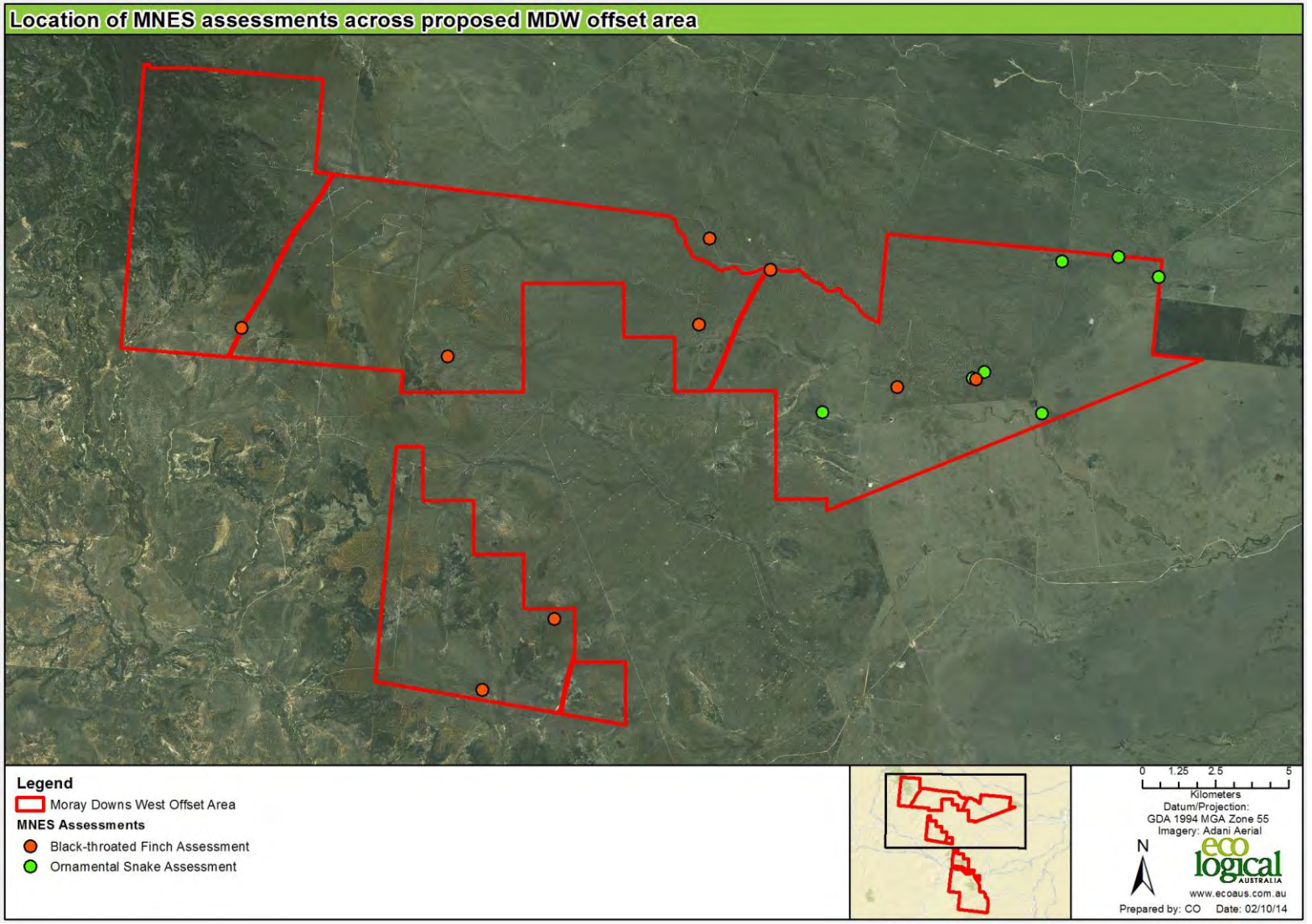

Figure 4. Location of MNES assessments across proposed MDW offset area

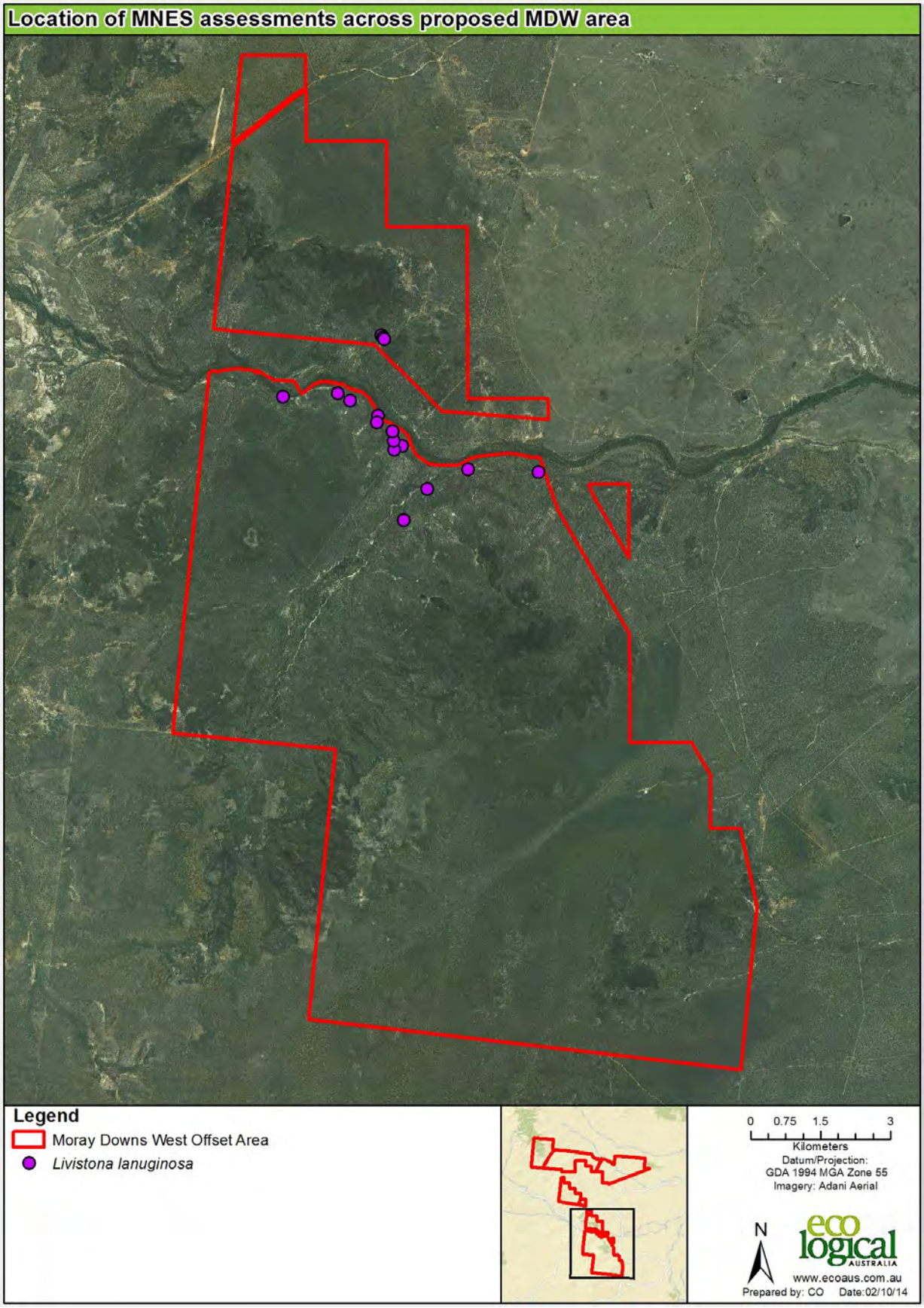

Figure 4. Location of MNES assessments across proposed MDW offset area (continued)

3 Ecological equivalence scoring

3.1 Offset area assessment units

A description of each assessment unit sampled on the MDW offset area, including relevance to offset values, is given below. The location of each assessment unit on the property is shown in **Figure 3**. The MDW offsets area was stratified into 15 assessment units which are described below. Assessment units were based on Broad Vegetation Groups (BVGs), condition classes (i.e. remnant, regrowth or non-remnant) and ecological function.

Assessment unit 1 (AU1)

This assessment unit consists of BVG 17a and 17b which include REs 10.5.5.a, 10.3.6a and 10.3.6ax1. It occurs on flat to gently undulating plains with sandy surface soils (RE 10.5.5a and 10.3.6ax1) or alluvial plains (RE 10.3.6a) particularly in the northern portion of MDW. All areas of AU1 are remnant vegetation.

AU1 consists of an open woodland to woodland with grassy understorey which is dominated by either *Eucalyptus melanophloia* and/or *E. brownii*. Other co-dominant tree species present were *E. whiteii, Corymbia plena* and *C. dallachiana.* Vegetation structure is characterised by an open tree canopy and sparse shrub layer, although a variety of species were recorded in the shrub layer, including: *Carissa lanceolata, Acacia coriacea, Maytenus cunninghamii* and *Melaleuca nervosa.* The ground layer was mid-dense to dense and dominated by grasses, most commonly *Aristida* spp. *Themeda triandra*, *Triodia* spp., *Eragrostis* spp. and *Heteropogon contortus*. The exotic *Cenchrus ciliaris* was occasionally present but not prevalent.

AU1 was predominately in moderate to good condition, however, grazing was present at all assessment sites and there was also evidence of fire activity across MDW offset area. The grassy understorey in many areas of this BVG was dominated by *Aristida* spp. which is an indicator of over grazing.

Given the sparse shrub canopy within open woodland on sandy soils, presence of seeding grass speciesAU1 provides high value offset area for the Black-throated Finch and. areas in close to proximity to permanent water sources provide very high habitat values. This assessment unit also provide offset values for the Brigalow-scaly Foot, Koala and Squatter Pigeon.

Assessment unit 2 (AU2)

The assessment unit consists of regrowth vegetation of the same BVGs and REs as AU1. These areas have been historically cleared and heavily grazed.

AU2 consists of a low woodland dominated by either *Eucalyptus melanophloia* and/or *E. brownii* regrowth. Similar shrub species diversity to AU1 and a mid-dense canopy commonly occurs. The ground layer was sparse and dominated by *Aristida* spp, *Themeda triandra*. and *Heteropogon contortus*. The exotic *Cenchrus ciliaris* was more prevalent in regrowth areas and generally dominates the ground layer.

AU 2 was in poor condition, particularly having a reduced canopy structure, minimal amount of large woody debris and also sparse ground cover. These areas have been more heavily grazed which has reduced the cover of native understorey species, especially grasses. AU2 has the same offset values as AU1.

Assessment unit 3 (AU3)

This assessment unit consists of BVG 17c which includes REs 10.5.1a, RE 10.5.1c and 10.5.1d. It occurs on flat to gently undulating sand-plains with red sandy soils which are sometimes shallow. AU3 occurs across the full length of the MDW offset area, often along the interface between lower tertiary soils and higher lateritic ridges.

This assessment unit is characterised by *Eucalyptus similis* (RE 10.5.1a and RE 10.5.1c) and/or *Corymbia setosa* (RE 10.5.1d) dominate the low open woodland canopy. *C. brachycarpa* was frequently present in the canopy. The low tree/shrub layer is usually sparse with a wide range of species including *Grevillea* spp.*, Petalostigma* spp. *Alphitonia excelsa* and *Acacia leptostachya*. *Aristida* spp., *Themeda triandra* and *Triodia pungens* usually dominate the sparse to mid-dense ground layer.

AU3 was generally in moderate to good condition. These REs have low grazing value and several areas located on undulating sand-plains are currently excluded for grazing and are in good condition. AU3 provides offset values for the Yakka Skink, including logs and sandy soils that can be used as burrowing habitat.

This assessment unit provides moderate habitat for the Black-throated Finch, especially in RE 10.5.1a which often has a grassier understorey. However the dominant grass species in AU3 is *Triodia pungens* which is not known to be an important dietary component for the Black-throated Finch. These areas are generally not in close proximity to water.

Assessment unit 4 (AU4)

This assessment unit consists of BVG 25a which includes RE 10.4.3a. It occurs on flat to undulating clay plains with brown to grey clay soils often with gilgai's. These gilgai are ephemerally flooded during which time they support wetland species including *Eleocharis* sp. All areas of AU4 are remnant vegetation.

Acacia harpophylla dominates the woodland tree layer with *Eucalyptus cambageana* and *E. brownii* co-occurring as emergents (RE 10.4.3a). There is a shrub layer comprising a wide range of species including *Eremophila mitchellii, Carissa lanceolata* and *Terminalia oblongata*. The ground layer is sparse comprising grasses and forbs including *Aristida* spp. *Eragrostis* spp. and *Paspalidium caespitosum*. Exotic species were prevalent and *Cenchrus ciliaris* dominant.

AU4 was in moderate to good condition with grazing present across the entire assessment area, resulting minor compaction of gilgai's. Some areas were also burnt, leading to reduced recruitment with Acacias being fire sensitive. AU4 provides high value offset are for the Ornamental Snake given the quality of gilgai habitat. However, it only provides low offset values for Black-throated Finch due to the low cover of native grasses and the lack of preferred food species.

This assessment unit does not qualify as the Brigalow TEC as it is not included in 16 REs listed as the TEC in Queensland.

Assessment unit 5 (AU5)

The assessment unit consists of regrowth vegetation of the same BVG and RE as AU4. These areas have been historically cleared and heavily grazed.

Low woodland to shrubland dominated by *Acacia harpophylla* regrowth with similar shrub species diversity to AU4 observed (RE 10.4.3a). The ground layer was sparse to mid-dense and dominated by

Aristida spp. *Eragrostis* spp. and *Paspalidium caespitosum*. Occurs on flat clay plains with brown to grey clay soils with gilgai (BVG1M: 25a). The exotic *Cenchrus ciliaris* dominates the ground layer and *Parthenium* was recorded in several locations.

AU5 was in moderate condition with more intensive grazing in these regrowth areas, resulting minor to moderate compaction of gilgai's. AU5 has the same offset values as AU4.

Assessment unit 6 (AU6)

This assessment unit consists of BVG 24a which includes REs 10.7.3a and 10.10.1a. It occurs on scarps (RE 10.7.3a) and sandstone ranges (RE 10.10.1a).

Acacia shirleyi dominates the mid-dense to dense low tree layer with *Corymbia leichardtii* and/or *C. lamprophylla* as emergents. The shrub layer is very sparse to mid-dense and dominated by *Grevillea spp.* and *Alphitonia excelsa. Triodia pungens* frequently dominates the very sparse to sparse ground layer.

AU6 was in good condition with grazing intensity reduced, particularly in areas located on the ranges. Recruitment was reduced in some areas where fire activity had occurred with *Acacias* being fire sensitive. Sandstone ridges used as potential burrowing holes provides offset values for the Yakka Skink. This assessment unit only provides low offset values for Black-throated Finch due the lack of grassy understorey and the absence of preferred food sources and water.

Assessment unit 7 (AU7)

This assessment unit consists of BVG 26a which includes RE 10.4.5a. It occurs on flat to undulating clay plains with brown to grey clay soils often with gilgai. The gilgai are ephemerally flooded, during this period they support wetland species including *Eleocharis* spp. Exotic species were observed and *Cenchrus ciliaris* dominant. All areas of AU7 are remnant vegetation.

Acacia cambagei dominates the low woodland canopy often in association with *Acacia harpophylla.* . A range of small trees/shrubs are frequently present including *Lysiphyllum carronii, A. cambagei, Atalaya hemiglauca* and *Carissa lanceolata*. The ground layer is sparse comprising grasses and forbs including *Aristida* spp. and *Paspalidium caespitosum*.

AU7 was in moderate to good condition with grazing present across the entire assessment area, resulting minor compaction of gilgai's. Some areas were also burnt, leading to reduced recruitment with Acacias being fire sensitive. AU7 provides high value offset are for the Ornamental Snake given the quality of gilgai habitat. It is also provides potential habitat for the Brigalow-scaly Foot. However, it only provides low offset values for Black-throated Finch due to the low cover of native grasses and the lack of preferred food species.

RE 10.4.5 is listed as a Wetland under the VM Act and therefore this assessment unit provides a suitable offset for Significant Wetlands.

Assessment unit 8 (AU8)

The assessment unit consists of regrowth vegetation of the same BVG and RE as AU7. These areas have been historically cleared and grazed.

Acacia cambagei regrowth dominates the shrubland with similar tree/shrub species diversity to AU4 observed. The ground layer is sparse comprising grasses and forbs including *Aristida* spp., *Bothriochloa* spp., *Carissa lanceolata* and *Eragrostis* spp. Occurs on flat to undulating clay plains with brown to grey

clay soils often with gilgai (BVG1M: 26a). The gilgai are ephemerally flooded during which time they support wetland species including *Eleocharis* spp. The exotic *Cenchrus ciliaris* dominated the ground layer.

AU8 was in poor condition with more intensive grazing and weed cover in these regrowth areas, resulting minor to moderate compaction of gilgai's. AU8 has the same offset values as AU7.

Assessment unit 9 (AU9)

This assessment unit consists of BVG 16a which includes REs 10.3.13a and 10.3.14d. It occurs along watercourses (RE 10.3.13a) and floodplains (RE 10.3.14d) (BVG1M: 16a).

AU9 is characterised by a riverine wetland or fringing riverine wetland with *Eucalyptus camaldulensis*, *Melaleuca leucadendra* and *M. fluviatilis* dominating a sparse canopy. *Corymbia plena*, *E. teriticornis*, *E. brownii* and *Livistona lanuginosa* sometimes occur as subdominants in the canopy. Acacia spp. *Atalaya hemiglauca* and *Carissa lanceolata* usually define the very sparse to sparse shrub layer. *Aristida* spp., *Eragrostis* spp. and *Paspalidum* spp. dominates the ground layer. Exotic species were observed and *Cenchrus ciliaris* dominant.

AU9 was in moderate condition and impacted by grazing and fire activities. This riverine ecosystem provides offset values for the Black-throated Finch, Squatter Pigeon (southern), Brigalow-scaly Foot and Koala. In particular AU9 provides very high habitat values for the Black-throated Finch due to the provision of water, especially those areas where water is permanent such as the Carmichael River. Areas of this assessment unit along the Carmichael River also provide high habitat values for the Waxy Cabbage Palm which was regularly observed on MDW in these areas.

REs 10.3.13 and 10.3.14 are listed as Wetlands under the VM Act and therefore provide a suitable offset for Significant Wetlands.

Assessment unit 10 (AU10)

This assessment unit consists of BVG 16c which includes REs 11.3.3c. It occurs in closed depressions with clay soils that are frequently flooded along the Carmichael River floodplain.

This assessment unit consists of wetlands dominated by *Eucalyptus coolabah* open woodland with a ground layer dominated by *Eleocharis* sp. and ephemeral forbs and grasses. The exotic species *Cenchrus ciliaris* is present. The tree layer is absent in the wetter areas.

AU10 was in moderate condition with minimal understorey due to grazing and fire pressures. This riverine ecosystem on clay soils provides offset values for the Black-throated Finch, Ornamental Snake and Significant Wetlands as RE 11.3.3 is listed as a Wetland under the VM Act.

Assessment unit 11 (AU11)

This assessment unit consists of BVG 12a which includes REs 10.7.3c, 10.10.3 and 10.10.4. It occurs on slopes of rocky hills with skeletal soils to shallow sandy earths, often gravelly, on sandstone ranges (RE 10.10.3) and also scarps (RE 10.7.3c).

Open woodland with *Corymbia leichhardtii* and/or *Eucalyptus drepanophylla* dominating the sparse canopy. *Corymbia lamprophylla*, *C. dallachiana* and *Melaleuca* spp dominates the small tree layer. *Dodonaea dodecandra, Jacksonia ramosissima*, *Grevillea* spp., *Hovea longipes* and *Petalostigma banksii* are present in the very sparse to sparse shrub layer. *Triodia* spp. and *Eragrostis* spp dominate very sparse ground layer.

AU11 is in good condition with minimal grazing activity observed, although several areas have been previously burnt. The rocky outcrops provide offset values for the Brigalow-scaly Foot and Yakka Skink. This assessment unit has low offset value for Black-throated Finch.

Assessment unit 12 (AU12)

This assessment unit consists of BVG 18a which includes REs 10.3.12a, 10.5.2b and 10.5.10. It occurs on sandy alluvial terraces (RE 10.3.12a) and sand plains (RE 10.5.2b, 10.5.10) (BVG1M: 18a).

Open woodland with *Corymbia plena* dominating the tree layer with other species including *Eucalyptus camaldulensis*, *C. leichardtii* and *C. dallachiana* are co-dominant. Other scattered trees and shrubs occurring include *Livistona lanuginosa, Grevillea glauca* and *Petalostigma pubescens*. The ground layer is sparse to moderate and often dominated *Aristida* spp., *Eragrostis* spp. and *Heteropogon contortus*. The exotic *Cenchrus ciliaris* can also occur. .

AU12 was in moderate to good condition. In some areas there was minimal understorey due to grazing and several of the *Livistona lanuginosa* has fire scars. The riverine ecosystem on sandy alluvial soils provides offset values for the Black-throated Finch, Squatter Pigeon (southern) Brigalow-scaly Foot, Echidna and Waxy Cabbage Palm (RE 10.3.12a only).

In particular AU12 provides very high habitat values for the Black-throated Finch where it is in close proximity water, especially areas of 10.3.12a along the Carmichael River floodplain. Areas of this assessment unit along the Carmichael River (i.e. RE 10.3.12a) also provide high habitat values for the Waxy Cabbage Palm which was regularly observed on MDW in these areas.

Assessment unit 13 (AU13)

This assessment unit consists of BVG 19d which includes REs 10.7.4. It occurs on pediments with texture contrast soil.

Eucalyptus persistens dominates the mostly very sparse tree layer of this low open woodland. *Carissa lanceolata, Hakea lorea* and *Acacia* spp. can occur as scattered trees and shrubs. *Aristida* spp., *Eragrostis* spp*, Triodia* spp. *Themeda australis* dominate the very sparse to sparse ground layer.

AU13 was in moderate to good condition and primarily provides offset values for the Brigalow-scaly Foot, Echidna and Yakka Skink. This assessment unit has moderate offset value for Black-throated Finch. Although these areas contain a grassy understorey, the dominant grass species is *Triodia pungens* which is not known to be an important dietary component for the Black-throated Finch.

Assessment unit 14 (AU14)

This assessment unit consists of BVG 21b which includes RE 10.7.7. It occurs on ferricrete and often in areas adjacent to REs 10.7.7 and 10.7.4.

Melaleuca tamariscina shrubland dominates the very sparse canopy. *Petalostigma banksii* and *Acacia* spp. also often present in the canopy yet rarely dominant. *Aristida* spp. and *Triodia* spp. usually dominate the very sparse to sparse ground layer.

AU14 was in moderate to good condition and primarily provides offset values for the Brigalow-scaly Foot and Yakka Skink. This assessment unit only provides low offset values for Black-throated Finch due the lack of grassy understorey and the absence of preferred food sources and water.

Assessment unit 15

This assessment unit consists of BVG 34b which includes REs 10.3.15g. It occurs in closed depressions in the northeast portion of MDW.

These areas are palustrine wetlands with *Eucalyptus camaldulensis* dominating the very sparse canopy. *Eucalyptus plena* and *Hakea lorea* occur in the mid layers. The ground layer is sparse and dominated by the exotic *Cenchrus ciliaris* and *Opuntia tomentosa*.

AU15 was in good condition and provides offset values for the Black-throated Finch and Koala. RE 10.3.15 is listed as a Wetland RE under the VM Act and therefore provide a suitable offset for Significant Wetlands.

3.2 Ecological condition scoring

The scores for each of the 11 ecological condition indicators in the offset area assessment units are presented in **Table 3**. These scores were derived from comparison of the field and GIS site data to the benchmark data and scored using **Table C1** (field based attributes) and **Table C2** (GIS attributes) listed in **Appendix C**. The full breakdown on ecological condition scoring for each sample site within assessment units is presented in **Table D1** in **Appendix D**. A description of the RE benchmarks used in the ecological condition scoring is provided in **Appendix E.**

The ecological equivalence score is the main output of the EEM. An ecological equivalence score is calculated for each assessment unit where multiple units have been assessed.

3.3 Special features scoring

The special features scores for each of the offset area assessment units are shown in **Table 4.** These scores were derived from comparison of the GIS data to the special feature indicator scores listed in **Table B3** in **Appendix B**.

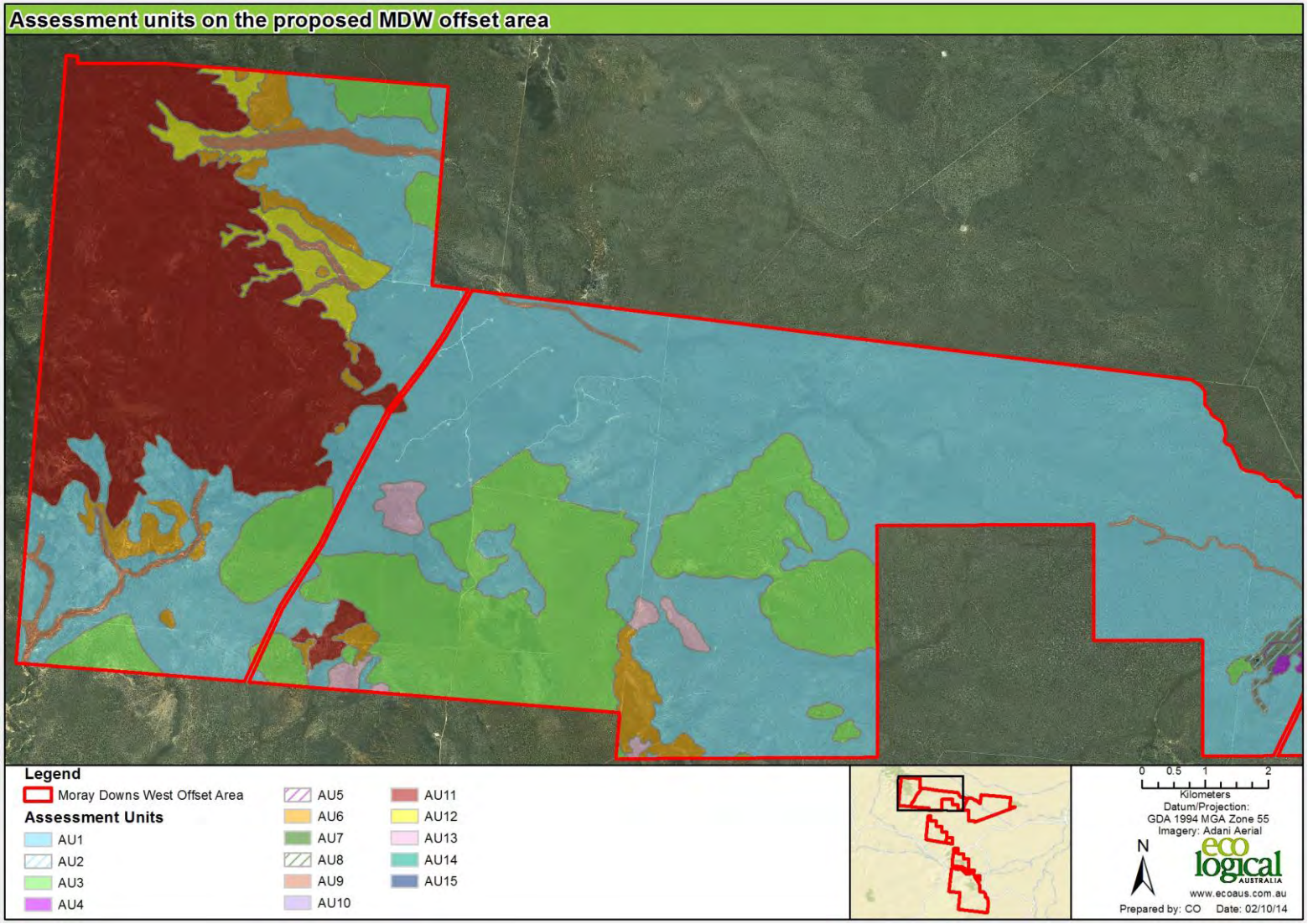

Figure 5. Assessment units on the proposed Moray Downs West offset area

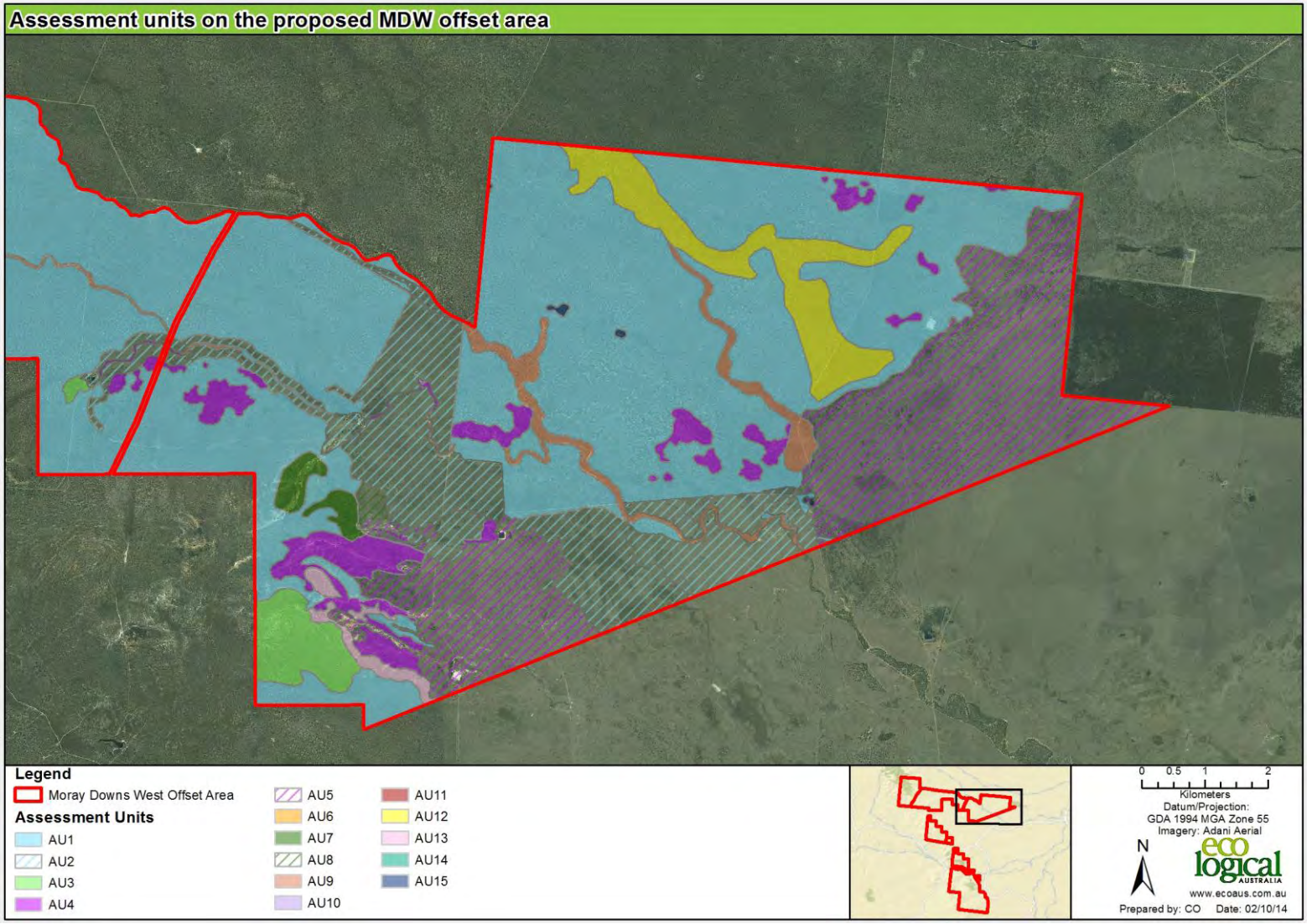

Figure 5. Assessment units on the proposed Moray Downs West offset area (continued)

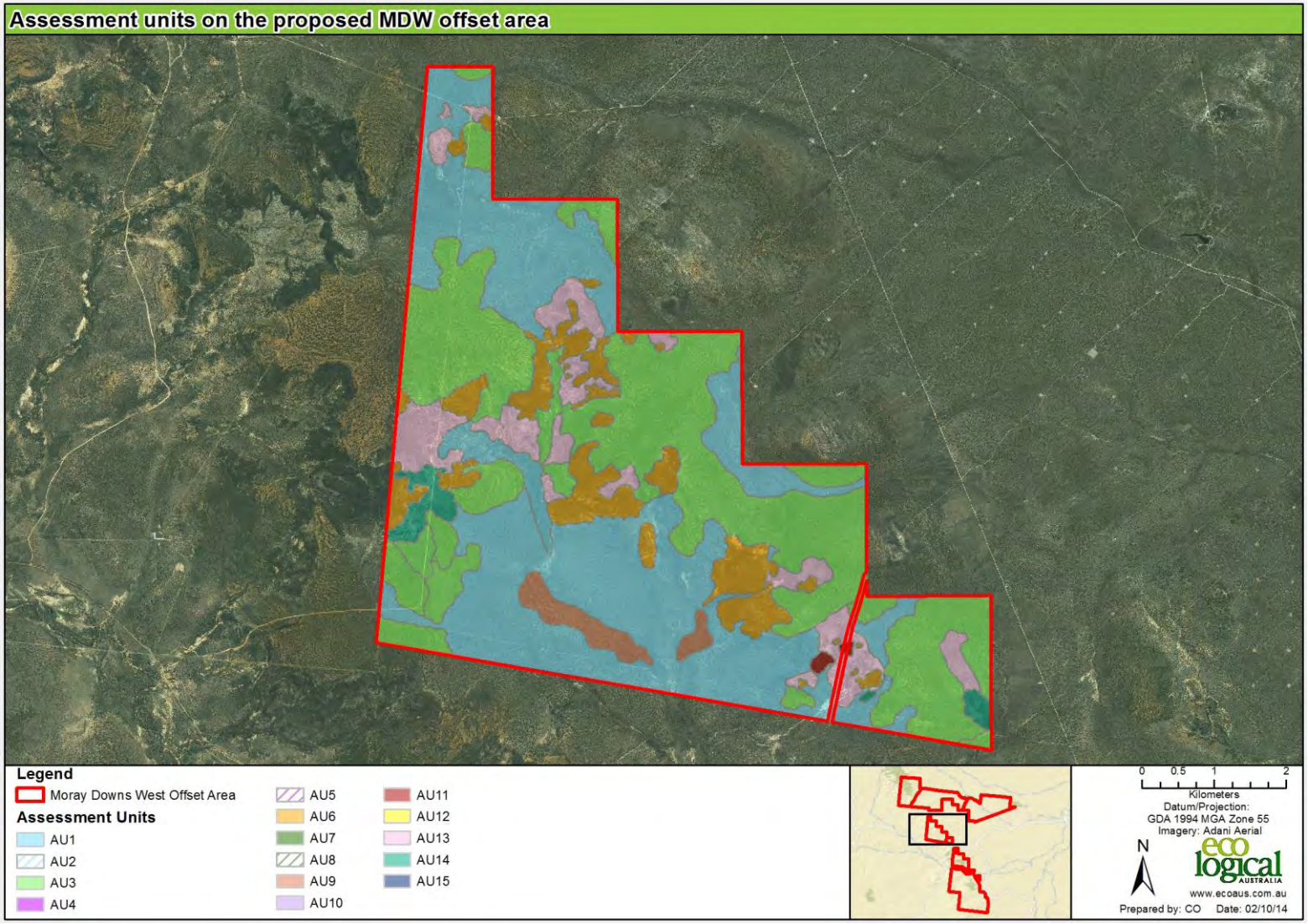

Figure 5. Assessment units on the proposed Moray Downs West offset area (continued)

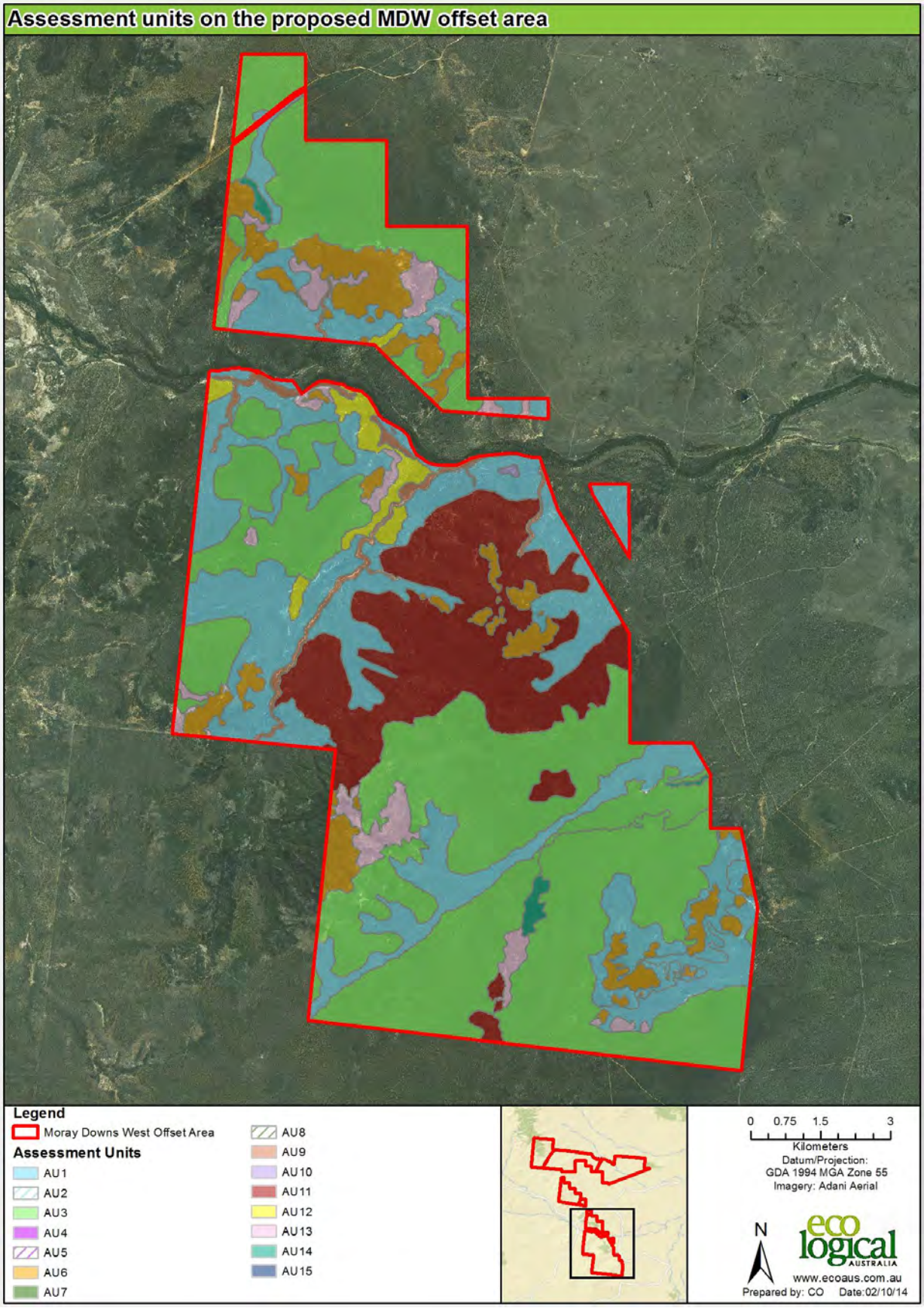

Figure 5. Assessment units on the proposed Moray Downs West offset area (continued)

Table 3. Ecological condition indicator scores for each assessment unit

Ecological condition indicators	Offset area assessment units														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Field based attributes															
Recruitment	3.6	5.0	4.0	4.6	3.7	4.3	5.0	5.0	4	5	2.7	4.3	5	1.5	3.0
Native plant species richness	10.4	7.5	9.5	9.0	5.0	13.3	12.5	12.5	15	2.5	15.0	13.3	8.75	10	5.0
Tree canopy height	4.5	1.5	3.1	3.1	1.5	4.3	5.0	1.5	5	5	5.0	5.0	5	3.75	5.0
Tree canopy cover	3.0	1.8	2.4	2.3	0.7	4.3	3.5	0.0	5	4	3.5	2.8	3	2.75	5.0
Shrub canopy cover	3.9	4.0	3.4	3.8	3.7	1.7	3.0	3.0	3.5	0	4.3	3.0	3	2.5	0.0
Native perennial grass cover	4.4	5.0	4.2	2.4	0.0	2.7	5.0	5.0	4	0	5.0	3.7	3	5	1.0
Organic litter cover	3.6	3.0	5.0	4.2	5.0	2.0	5.0	5.0	4.5	5	3.7	3.7	5	4	5.0
Large trees	12.1	0.0	11.0	5.0	0.0	10.0	5.0	0.0	11.25	15	11.7	15.0	7.5	7.5	5.0
Coarse woody debris	2.0	2.0	1.8	1.4	2.3	2.3	2.0	2.0	2.75	5	1.3	2.3	3.5	1	2.0
Weed cover	7.9	1.5	10.0	3.2	1.0	10.0	5.0	3.0	6.25	5	10.0	6.7	10	10	0.0
Total Field based attributes	**55.3**	**31.3**	**54.4**	**39.0**	**22.8**	**55.0**	**51.0**	**37.0**	**61.25**	**46.5**	**62.2**	**59.8**	**53.75**	**48**	**31.0**
GIS based attributes															
Intact - Distance from water	9.1	20.5	10	4.0	3.3	5.0	5.0	5.0	3.0	0.0	11.7	10	12.5	20.0	5.0
Total BioCondition Score	**64.4**	**15.8**	**64.4**	**43**	**26.2**	**60.0**	**56**	**42**	**64.3**	**46.5**	**73.8**	**69.8**	**66.3**	**68.0**	**36.0**
Area (ha)	17,231	1,350.95	10,340	456.39	1,888.77	1,843.49	80.79	27.12	733.62	8.58	4,752.06	921.61	1,028.47	138.05	7.43
Assessment unit ecological condition score	**11,096**	**213.5**	**6,659.0**	**196.2**	**494.9**	**1,106**	**45.2**	**11.4**	**471.7**	**4.0**	**3,507**	**643.3**	**681.9**	**93.9**	**2.7**

Table 4. Special features indicator scores for each assessment unit

Special feature indicators	Offset area assessment units														
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Special feature value	7,530	1,117	6,236	90	1,053	910	15	7	310	2	1774	259	431	74	5
Connectivity value	1,695	0	1,400	0	0	284	0	0	58	2	640	90	126	18	0
Assessment unit special features score	**9,225**	**1,117**	**7,636**	**90**	**1,053**	**1,194**	**15**	**7**	**368**	**4**	**2,414**	**349**	**557**	**93**	**5**

3.4 Offset Suitability for MNES

The offset suitability within the proposed MDW offset area for each MNES is discussed below. The Black-throated Finch, Ornamental Snake, Squatter Pigeon (southern), Yakka Skink and Waxy Cabbage Palm were based on the assessment units identified as providing habitat values (as outlined in **Section 3.1**). **Section 4** of this report discusses the available area of offsets for each of these MNES.

3.4.1 Black-throated Finch

As outlined in **Section 3.1**, assessment units 1, 2, 9, and 12 were considered to contain high value habitat. High habitat values for the Black-throated Finch are areas of grassy woodland containing key seeding grass species (BTF Recovery Team 2007). These areas are consistent with the habitat where most records of the Black-throated Finch were recorded through the CCM EIS.

Nine sites were assessed for Black-throated Finch habitat across the MDW offset area with the (**Figure 4**) location of sites based on assessment units of high to medium habitat value. Black-throated Finches were also observed adjacent to the proposed MDW offset area and in the same vegetation community as assessment unit 1 (**Figure 6**). These habitat assessments and recordings confirmed that these areas provide habitat values. For high value habitats, these areas provide an average number of two key grass species per site and 54% of sites contain water. High value habitat was assessed as having a moderate BioCondition score, with an average score of 57.9.

The EPBC Act Significant Impact Guidelines for Black-throated Finch (DEWHA 2009) also states that habitat for the Black-throated Finch occurs mostly within either the 3 km buffer of water sources or the 5 km buffer of Black-throated Finch sightings. Therefore, areas of high value habitat that were also within 3 km of a water source, where defined as very high habitat value through GIS analysis (**Figure 6**).

The assessment units 3, 10, 13 and 15 were also considered to provide medium habitat value, being areas defined as open woodland with a grassy understorey. The remaining assessment units of 4, 5, 6, 7, 8 and 11 were considered to provide low habitat value and were not assessed for suitable habitat values.

For medium value habitats, these areas only provided low densities of known key seeding grass species such as *Themeda triandra* and were not in close proximity to a water source. However because of the presence of grassy understories across much as this assessment these areas are considered to provide potential foraging habitat and therefore considered as suitable offset for the Black-throated Finch.

All other assessment units were considered to provide low habitat value for the Black-throated Finch.

3.4.2 Ornamental Snake

Assessment unit areas 4, 5, 7, and 8 were considered to provide habitat values for the Ornamental Snake as they contained REs occurring on cracking clay soils. To confirm Ornamental Snake habitat, nine sites were assessed in these areas to define key habitat values, including presence of gilgais, gilgai type and presence of soil cracking. The majority of sites contained diverse gilgai's and had evidence of soil cracking (77%). The average BioCondition scores across these assessment units, was 41.8 and indicates that these areas are in moderate condition.

The habitat assessments confirmed that these assessment unit areas provide habitat values for the Ornamental Snake (**Figure 8**). All other assessment units were considered to provide low habitat value for the Ornamental Snake.

3.4.3 Squatter Pigeon

Assessment unit areas 1, 2, 3, 9, 10, 12, 13 and 15 were considered to provide habitat values for the Squatter Pigeon as they contain grassy woodlands on sandy or alluvial plains, often in proximity to a water source. To determine habitat suitability, the distance to water in these assessment areas was identified using GIS analysis. All riverine assessment units (3, 9, and 12) are within close proximity to a water source and provide breeding habitat values. Squatter pigeons were also observed in assessment units 1, 2 and 11.

Both desktop and field assessments confirmed that these assessment unit areas provide habitat values for the Squatter Pigeon (**Figure 9**).

3.4.4 Yakka Skink

Assessment unit areas 1, 2, 6, 11, 12, 13 and 14 were considered to provide habitat values for the Yakka Skink based on micro-habitat features and quality within landzone 3, 4, 5, 7 and 10. Determination of habitat suitability was based on assessing ecological condition scores across the assessment sites. An average ecological condition score for these areas was 43.65 and all areas contained large woody debris.

The BioCondition assessments confirmed that these assessment unit areas provide habitat values for the Yakka Skink (**Figure 10**).

3.4.5 Waxy Cabbage Palm

Fourteen sites were surveyed within habitat for *Livistona lanuginosa* that intersected MDW offset area (**Figure 11**). There were 102 *Livistona lanuginosa* individuals recorded in RE 10.3.12a, 10.3.13a and 11.3.3 These REs occur along Carmichael River and covers 316.20 ha, providing offset requirements for the *Livistona lanuginosa* on the proposed MDW offset area (**Figure 11**).

4 Biodiversity values

4.1 Matters of National Environmental Significance

The following sections discuss the MNES relevant to this ecological equivalence assessment in the context of their condition and the value provided by the MDW offset area.

4.1.1 Brigalow Belt Threatened Ecological Community

Brigalow (*Acacia harpophylla* dominant and co-dominant) (Brigalow TEC) is listed as Endangered under the EBPC Act. This TEC is a woodland ecological community which contains *Acacia harpophylla* as either a dominant or co-dominant species in the canopy. The community is usually characterised by an open forest or open woodland structure with a mixture of eucalypts, acacia and casuarina species in the canopy. This community usually includes a well-developed shrub layer. The community is found throughout a number of bioregions in Queensland including Brigalow Belt North (RE equivalent is 11.4.9).

Although Brigalow REs occur on MDW, they don't quality as Brigalow TEC as the Desert Uplands Brigalow REs are not included in the TEC listing. Therefore, MDW does not provide any offsets for Brigalow TEC.

4.1.2 Black-throated Finch

The Black-throated Finch has been previously observed on the CCM and MDW sites (GHD 2013; ELA 2013). Individuals were mainly recorded north of the Carmichael River and within habitats that were generally in good condition and mostly occurring in large continuous tracts. Several of the seeding grass species (e.g. *Themeda triandra*, *Alloteropsis semialata*, *Panicum decompositum*, *Dichanthium sericeum* and *Eragrostis sororia*) associated with preferential habitat was commonly found in these habitats.

Black-throated Finches were also observed during this survey, within and immediately adjacent to the MDW area in the northern area (**Figure 6**). These sightings were within an area identified as high value habitat by GHD and mapped as RE 10.5.5a (**Figure 7**). This RE is characteristic of offset assessment unit AU1.

The offset suitability assessment confirmed that MDW provides a total of 31,621.66 ha of Black-throated Finch habitat that meets offset requirements for offset delivery stage 1 of the project. This area consists of very high, high and medium habitat values:

- 9,678.07 ha of very high value habitat
- 10,559.11 ha of high value habitat
- 11,384.48 ha of medium value habitat.

These areas vary in their range of values and condition which will define management requirements. Areas of very high habitat value are unlikely to require the extensive management as they are in good condition and are in close proximity to water. The removal or reduction of cattle grazing is likely to improve the condition of the areas and increase the abundance and diversity of key grass species.

The remaining areas are not in close proximity to water and are in poor to good condition, depending on the impact of the exotic grass *Cenchrus ciliaris*, grazing and fire. The provision of water sources in these remaining areas has the potential to provide very high value habitat in the future. The removal or

reduction of cattle grazing is likely to improve the condition of the areas and increase the abundance and diversity of key grass species as well as promote regeneration of disturbed areas such as AU2.

The key known threats to the Black-throated Finch (southern), that are relevant to the management of offset areas within MDW, include:

- alteration of habitat by changes in fire regimes and grazing, and
- invasion of habitat by exotic weeds, including exotic grasses (BTF Recovery Team 2007; NRA 2005).

The primary management consideration for these offset areas should be the removal of cattle, provision of water sources and the implementation of a weed control program targeting *Cenchrus ciliaris.* This is to ensure that seeding grass species diversity is optimised and that fuel loads are minimised.

Other management actions may include the development of a fire management plan to ensure that inappropriate fire regimes do not alter habitat and provide a mosaic of grass species and diversity.

4.1.3 Ornamental Snake

Critical habitat has not been described for the Ornamental Snake. However, its preferred habitat is woodlands and open forests associated with moist areas, particularly gilgai mounds and depressions and is likely to be found in Brigalow (*Acacia harpophylla*), Gidgee (*Acacia cambagei*), Blackwood (*Acacia argyrodendron*) or Coolabah (*Eucalyptus coolabah*) dominated vegetation communities, or pure grassland associated with gilgais (Brigalow Belt Reptiles Workshop 2010). Microhabitat features also include soil cracks, coarse woody debris and ground litter to provide shelter.

The offset suitability assessment confirmed that MDW provides 2,453.07 ha of Ornamental Snake habitat that meets offset requirements for offset delivery stage 1 of the project.

Suitable habitat for this species on the MDW offset area is associated with the gilgai and clay soils of the Brigalow and Gidgee REs (assessment units 4, 5, 7 and 8) as well as riparian habitats such as Carmichael River (**Figure 8**). The condition of these areas ranged from poor to good with large areas of regrowth Brigalow and Gidgee highly disturbed due to grazing and soil compaction (assessment units 5 and 8). Several areas have also been previously burnt, resulting in a reduction of available microhabitats such as fallen woody debris.

The key known threats to the Ornamental Snake that are relevant to the management of offset areas within MDW are:

- alteration of landscape hydrology in and around gilgai environments, and
- invasive weeds (Brigalow Belt Reptiles Workshop 2010; Cogger *et al*. 1993).

The main management consideration will be the removal of cattle and the control of weeds as well as the regeneration of regrowth Brigalow and Gidgee (assessment units 5 and 8). Brigalow and Gidgee ecosystems are also fire sensitive therefore the development and implementation of a fire management plan is likely to also benefit the Ornamental Snake on MDW.

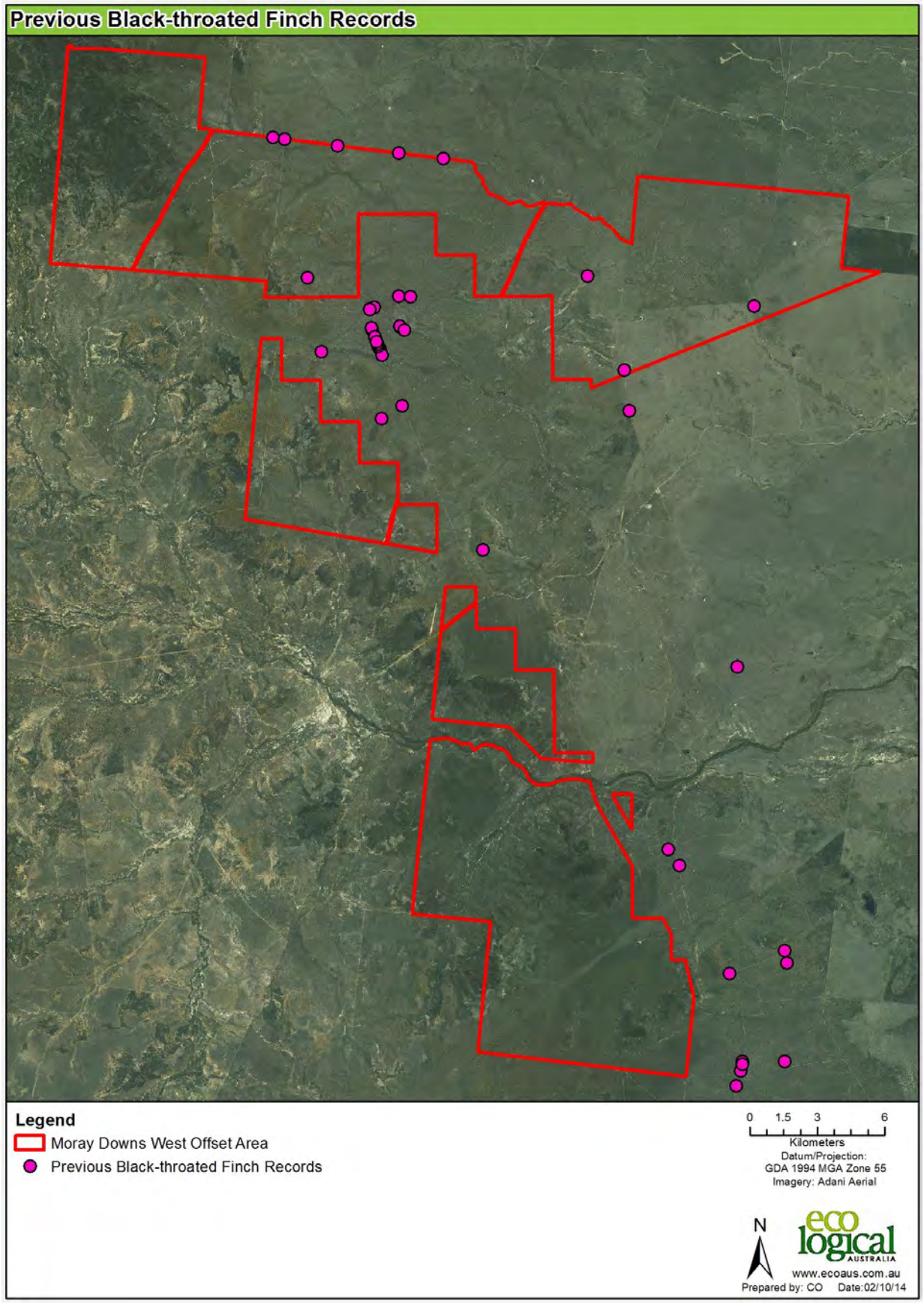

Figure 6. Previous Black-throated Finch records (based on surveys for EIS and SEIS by GHD and EEA survey by ELA)

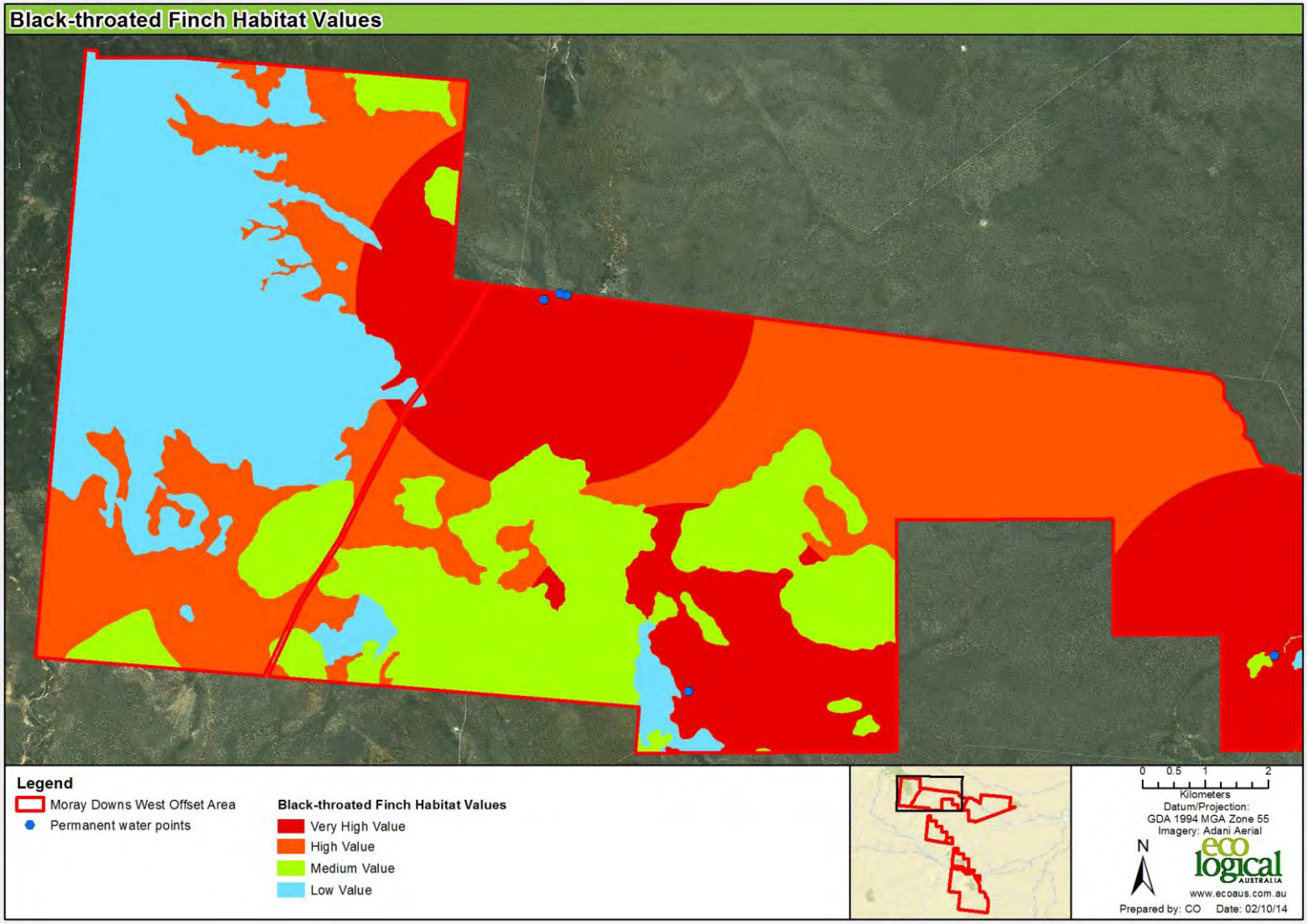

Figure 7. Black-throated Finch habitat values

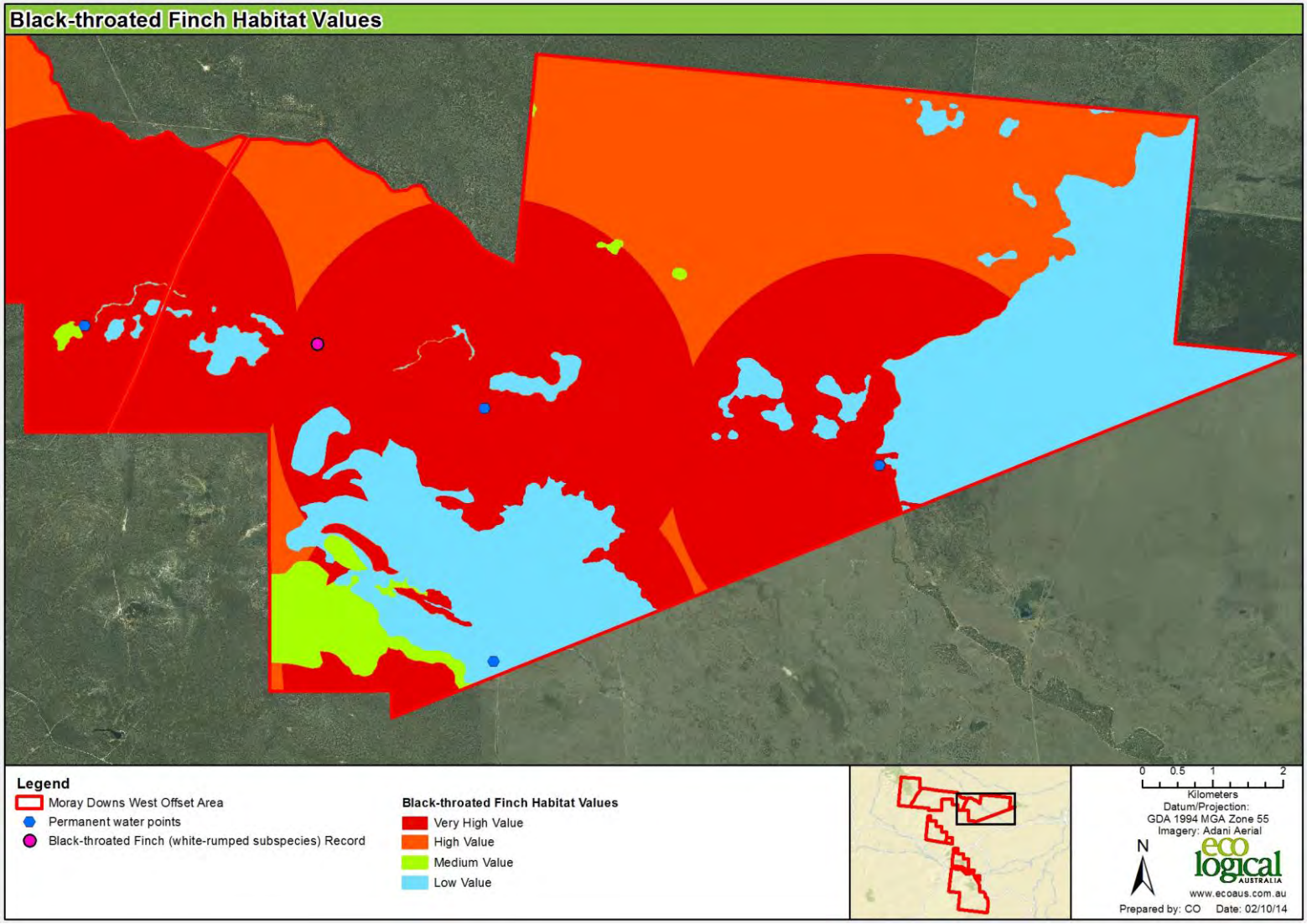

Figure 7. Black-throated Finch habitat values (continued)

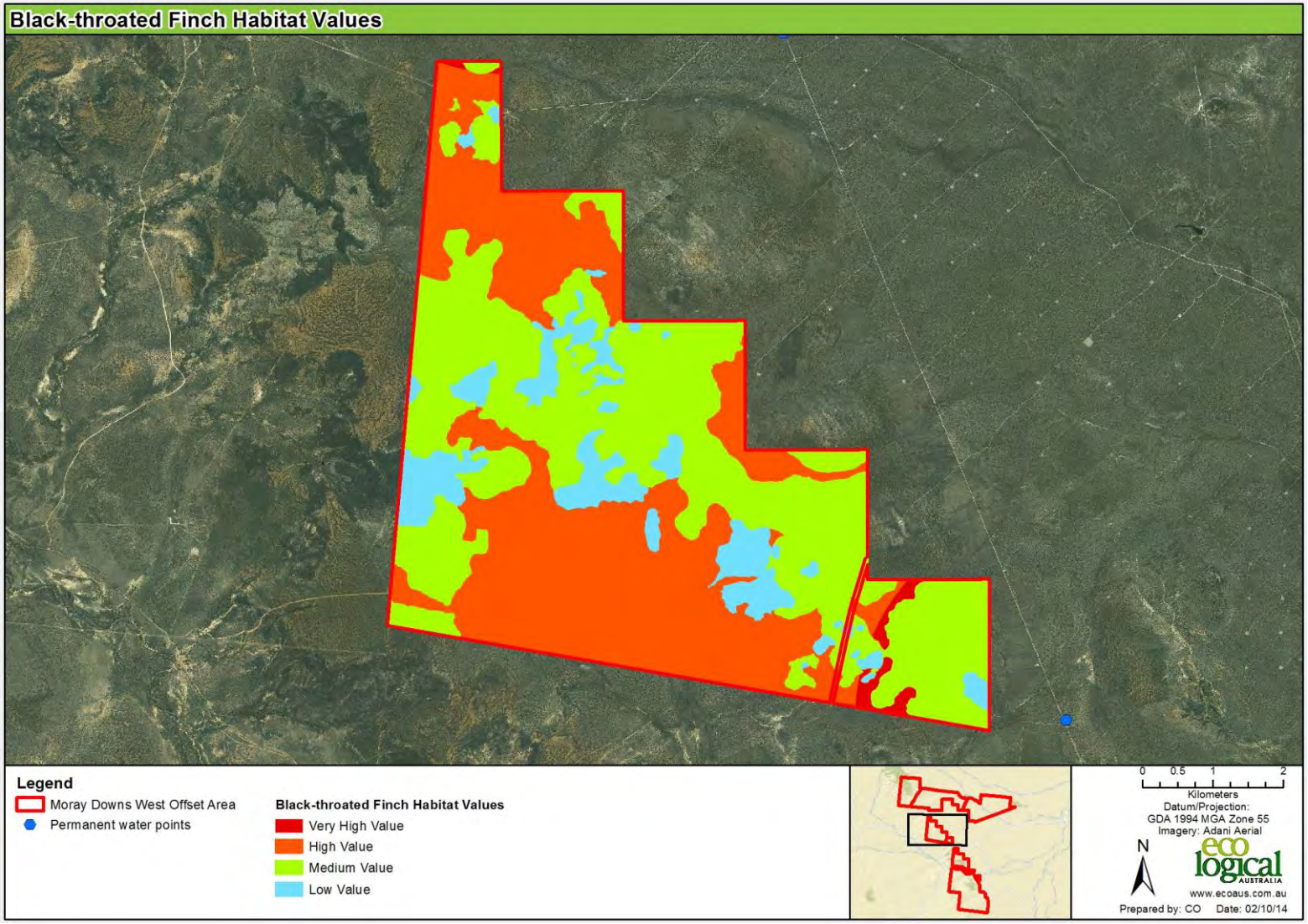

Figure 7. Black-throated Finch habitat values (continued)

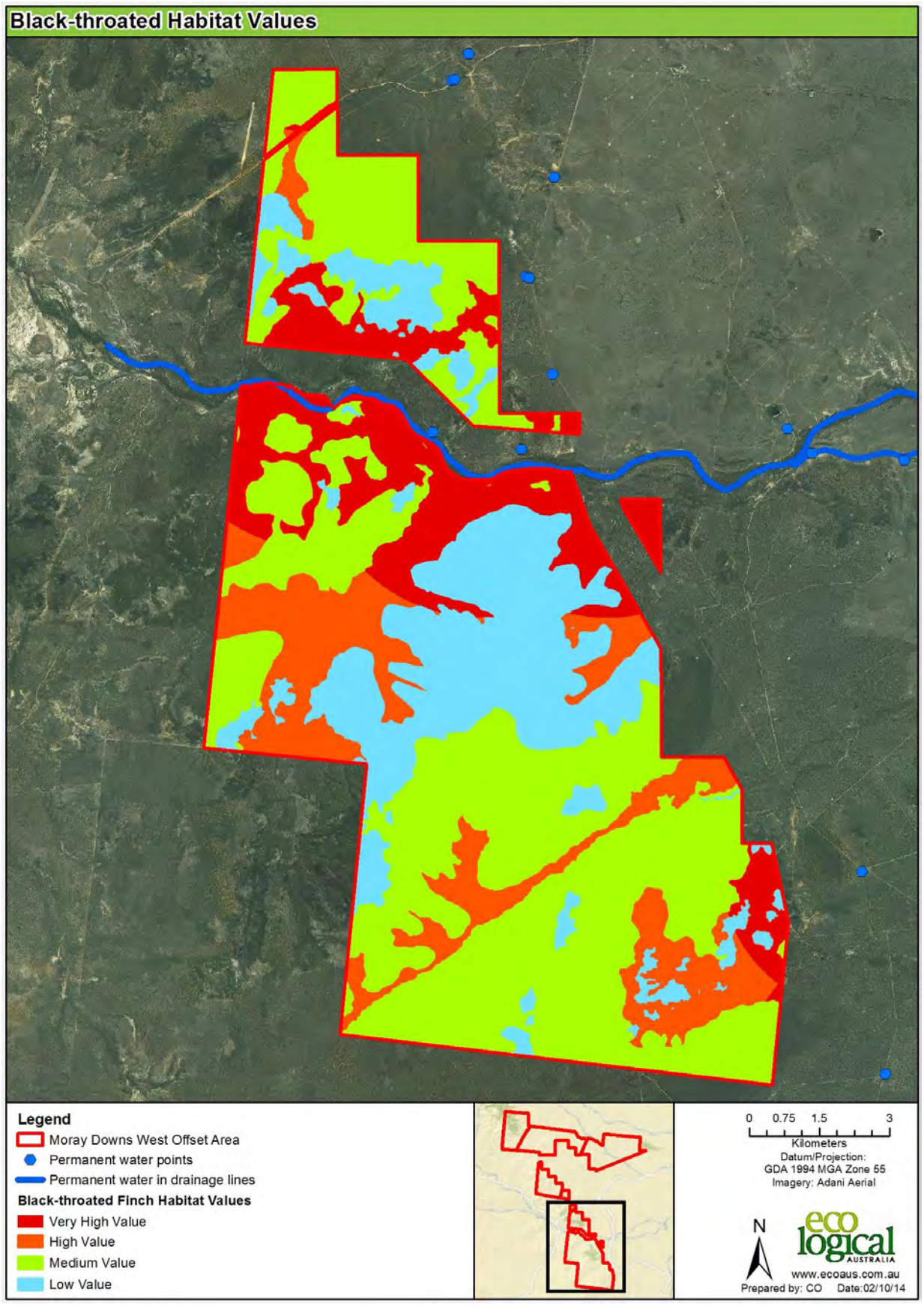

Figure 7. Black-throated Finch habitat values (continued)

4.1.4 Squatter Pigeon

Although critical habitat has not been described for the Squatter Pigeon, habitat is defined as open forests dominated by *Eucalyptus*, *Corymbia*, *Acacia* or *Callitris* vegetation communities which are remnant or regrowth and within 1 to 3 km of a water source (DoE 2014). These areas also have well-draining soils to allow the Squatter Pigeon to breed in shallow depressions, generally after heavy rainfall.

The offset suitability assessment confirmed that MDW provides 31,621.66 ha of Squatter Pigeon habitat that meets offset requirements for offset delivery stage 1 of the project.

Suitable habitat for the Squatter Pigeon within the MDW offset area is associated with woodland vegetation on landzones 3, 5 and 7; particularly with a grassy understorey, well-drained soils and in close proximity to a water source (**Figure 9**). Squatter Pigeons were also recorded in assessment units 1, 2 and 11. Given their proximity to water sources, assessment units 3, 9 and 12 provide breeding habitat values. The assessment units 1, 2 and 11 provide foraging habitat values and potential breeding habitat where they are close to water.

The exotic grass *Cenchrus ciliaris* was present within all units and ecological condition ranged from poor to good. Assessment unit 2 had the poorest ecological condition and was highly disturbed and grazed.

The key known threat to the Squatter Pigeon that is relevant to the management of offset areas within MDW is:

- degradation of habitat by invasive weeds, such as *Cenchrus ciliaris* (DoE 2014).

The primary management consideration for these offset areas should be the implementation of a weed control program targeting *Cenchrus ciliaris* and the provision of additional water sources in areas of foraging habitat.

4.1.5 Yakka Skink

Critical habitat has not been described for the Yakka Skink. Habitat for the Yakka Skink is often found in association with common woodland and open forest types such as Brigalow (*Acacia harpophylla*), Mulga (*A. aneura*), Bendee (*A. catenulata*), Lancewood (*A. shirleyi*), Belah (*Casuarina cristata*), Poplar Box (*Eucalyptus populnea*) and Ironbark (*Eucalyptus* spp.) (DoE 2014). The species lives in colonies and often takes refuge in large hollow logs and has been known to excavate deep burrow systems, sometimes under dense ground vegetation (Cogger 2000; Ehmann 1992; Wilson & Knowles 1988). Yakka Skink characteristically use communal latrine sites outside of burrow entrances, which can be used as an indicator of species presence (Brigalow Belt Reptiles Workshop 2010). The species also exhibits high site-fidelity and low fecundity (DoE 2014).

The offset suitability assessment confirmed that MDW provides 27,265.63 ha of Yakka Skink habitat that meets the offset requirements for offset delivery stage 1 of the project. Suitable habitat within the MDW offset area for the Yakka Skink is associated with woodland vegetation on landzones 3, 4, 5, 7, and 10 particularly areas with microhabitats such as fallen timber and log or rock piles.

Given high site-fidelity, the main threat to the Yakka Skink is habitat reduction and degradation by fire and grazing. Some actions that may improve species habitat could be the removal of grazing, retaining fallen timber and ground cover and restricting the use and spread of agricultural weeds, such as *Cenchurus ciliaris*.

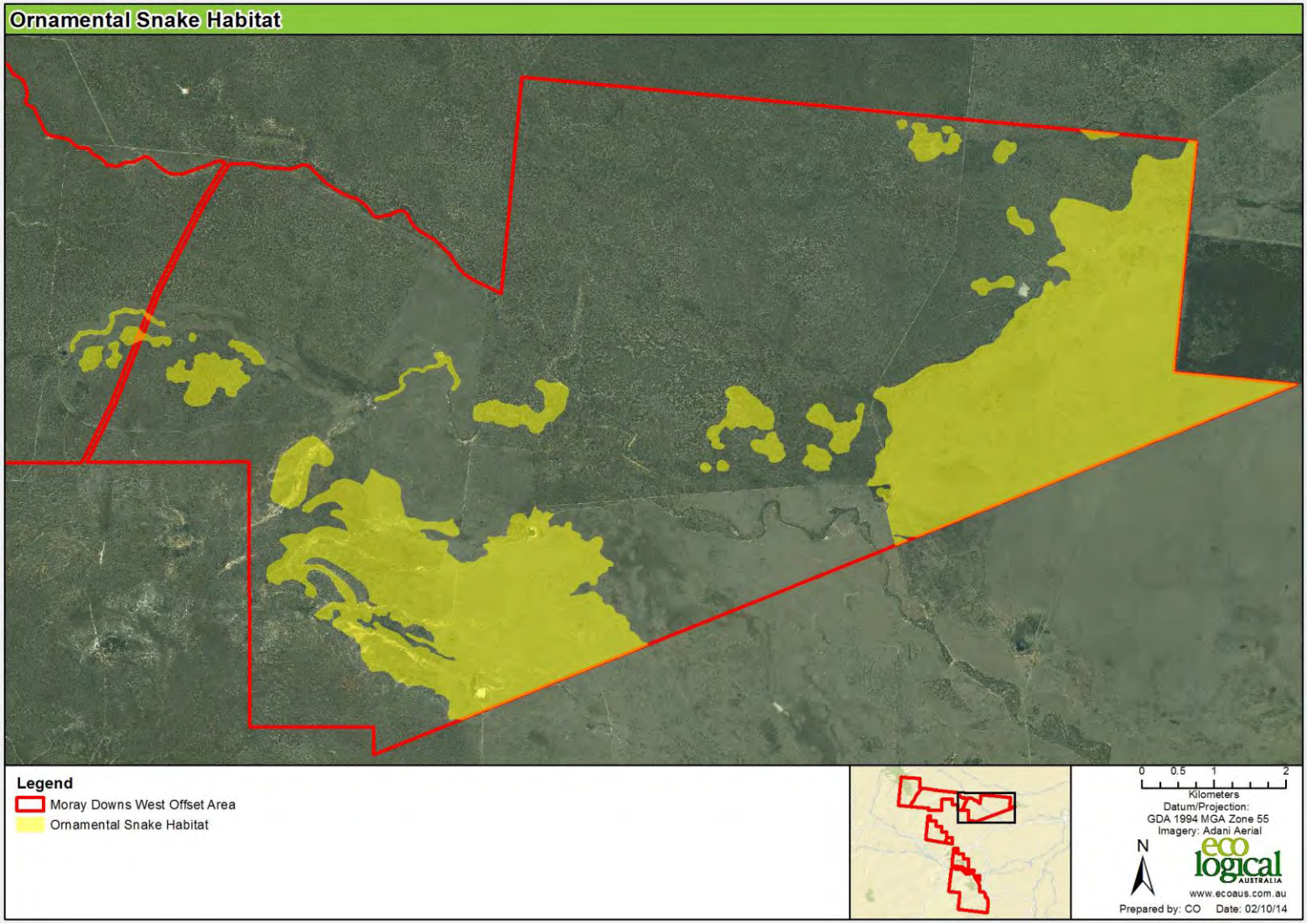

Figure 8. Ornamental snake habitat

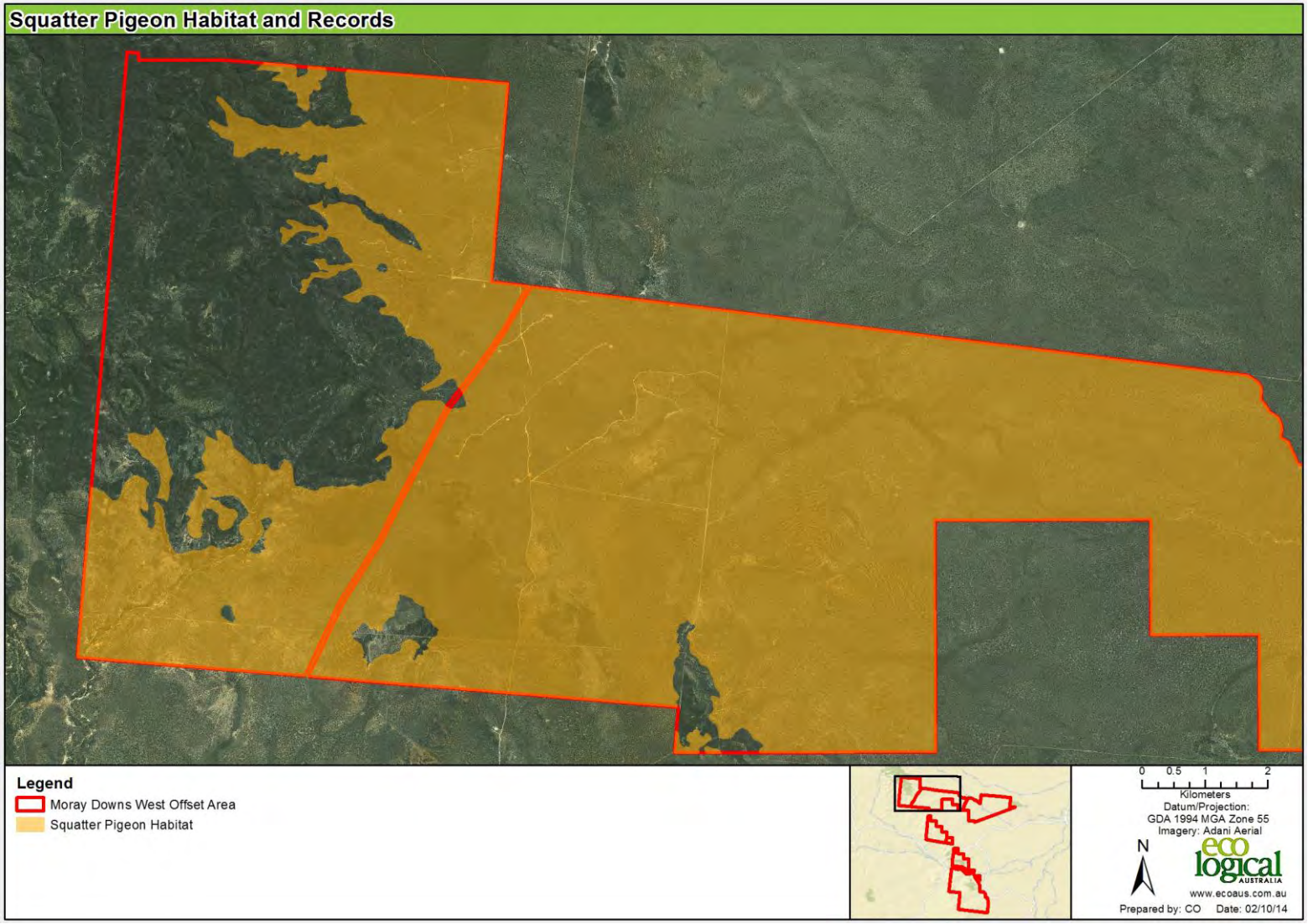

Figure 9. Squatter Pigeon habitat and records

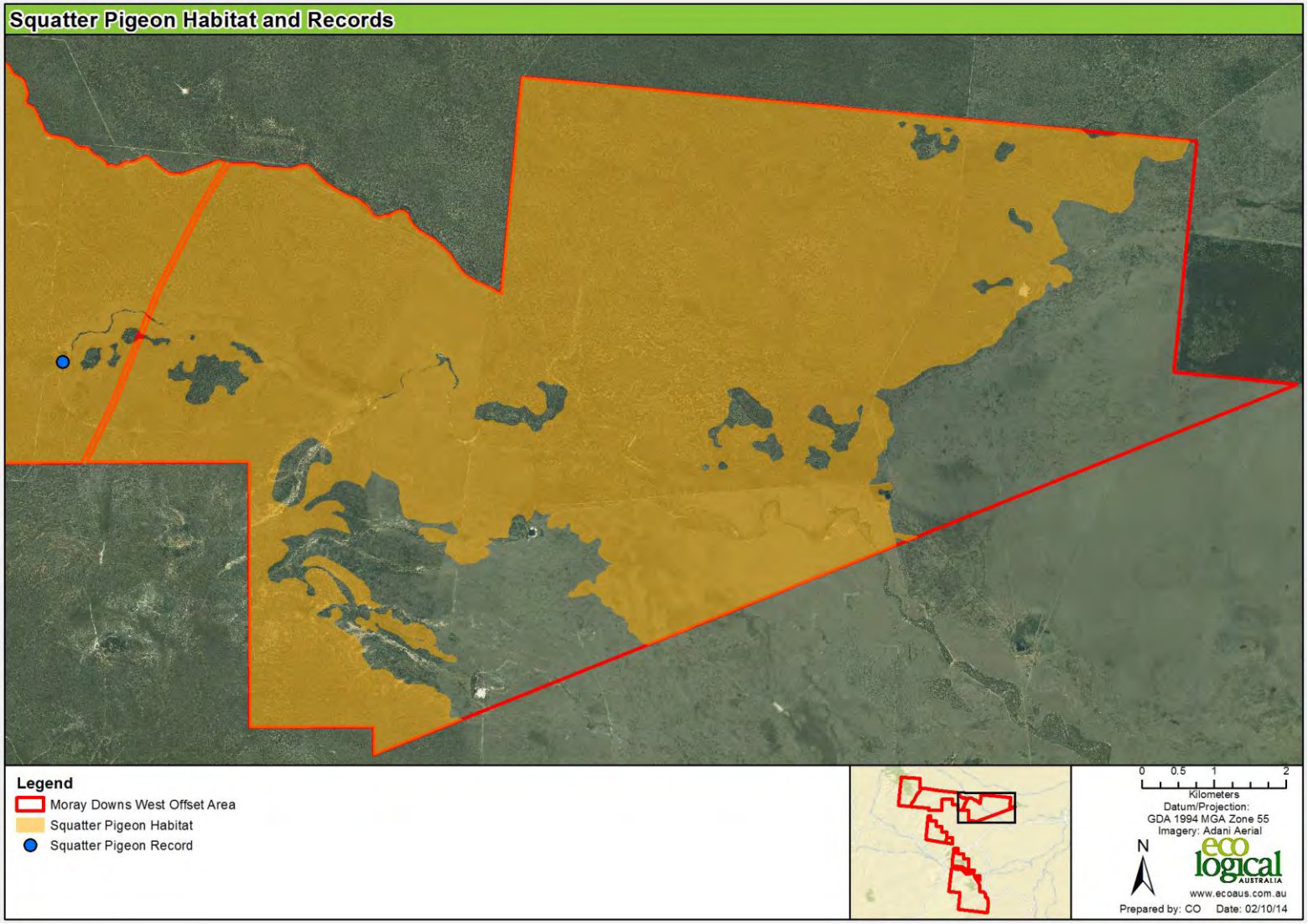

Figure 9. Squatter Pigeon habitat and records (continued)

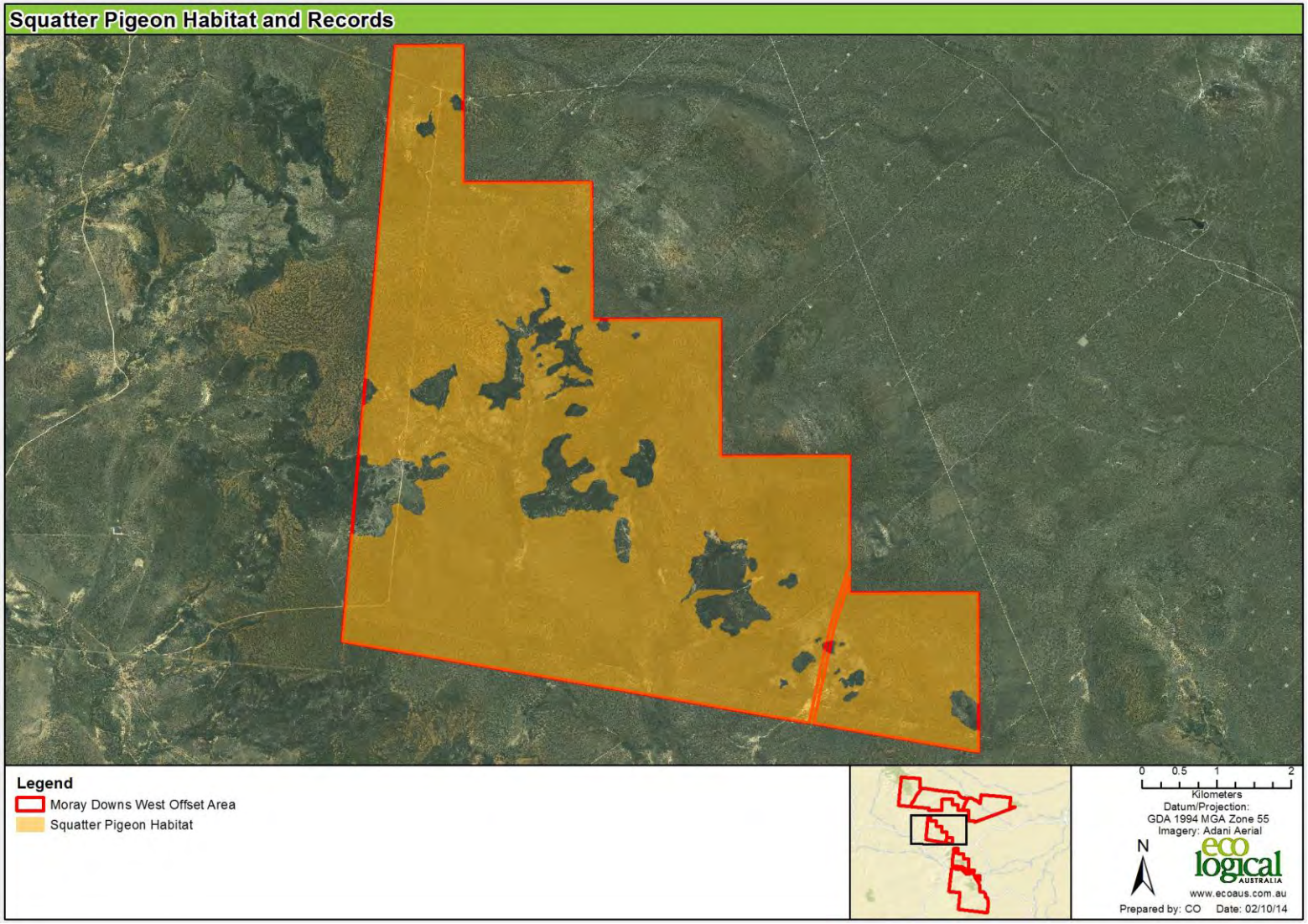

Figure 9. Squatter Pigeon habitat and records (continued)

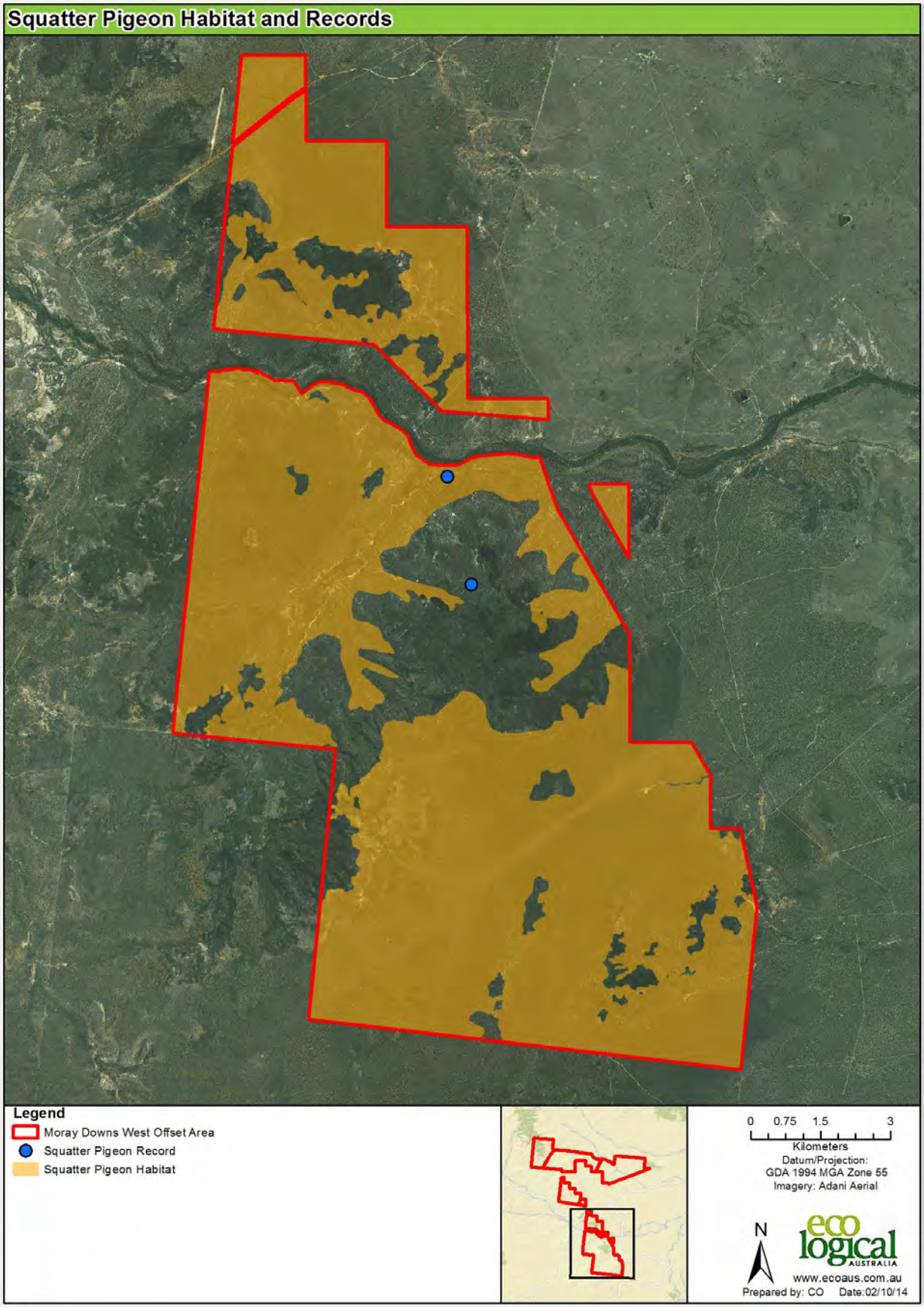

Figure 9. Squatter Pigeon habitat and records (continued)

4.1.6 **Waxy Cabbage Palm**

Critical habitat has not been described for the Waxy Cabbage Palm. DoE (2014) identifies species' habitat as open woodland on sandy river and creek channels which flow for part of the year, with permanent pools or soaks. Waxy Cabbage Palm is usually associated with *Corymbia brachycarpa*, River Red Gum (*Eucalyptus camaldulensis*), Broad-leaved Teatree (*Melaleuca leucadendra*). BAAM (2011) identified suitable habitat as RE's 10.3.13, 10.3.14, 10.3.6 and 11.3.4. Previous searches by ELA also identified suitable habitat as RE 10.3.12a (ELA 2014a).

Waxy Cabbage Palm has been previously recorded along the Carmichael River (GHD 2012) and was associated with the River Red Gum (*Eucalyptus camaldulensis*) woodlands that occur on the levees of this riverine ecosystem. Searches within MDW offset area found 102 individuals in or immediately adjacent to Carmichael River and in areas associated with assessment units 9, 10 and 12 (**Figure 11**). More individuals are likely to be present within the MDW offset area.

The offset suitability assessment confirmed that MDW provides 316.20 ha of Waxy Cabbage Palm habitat that meets offset requirements for offset delivery stage 1 of the project. The density of the species varied across MDW and there was a range of age classes present. Although areas of MDW where it occurred were in good condition, several of the larger trees were scarred by fire.

With a restricted distribution, Waxy Cabbage Palm is at risk of localised threats such as trampling by cattle grazing and fire (TSSC 2008). Trampling is known to severely restrict recruitment (DoE 2014). The main management consideration should be the removal of cattle from these areas and fire management.

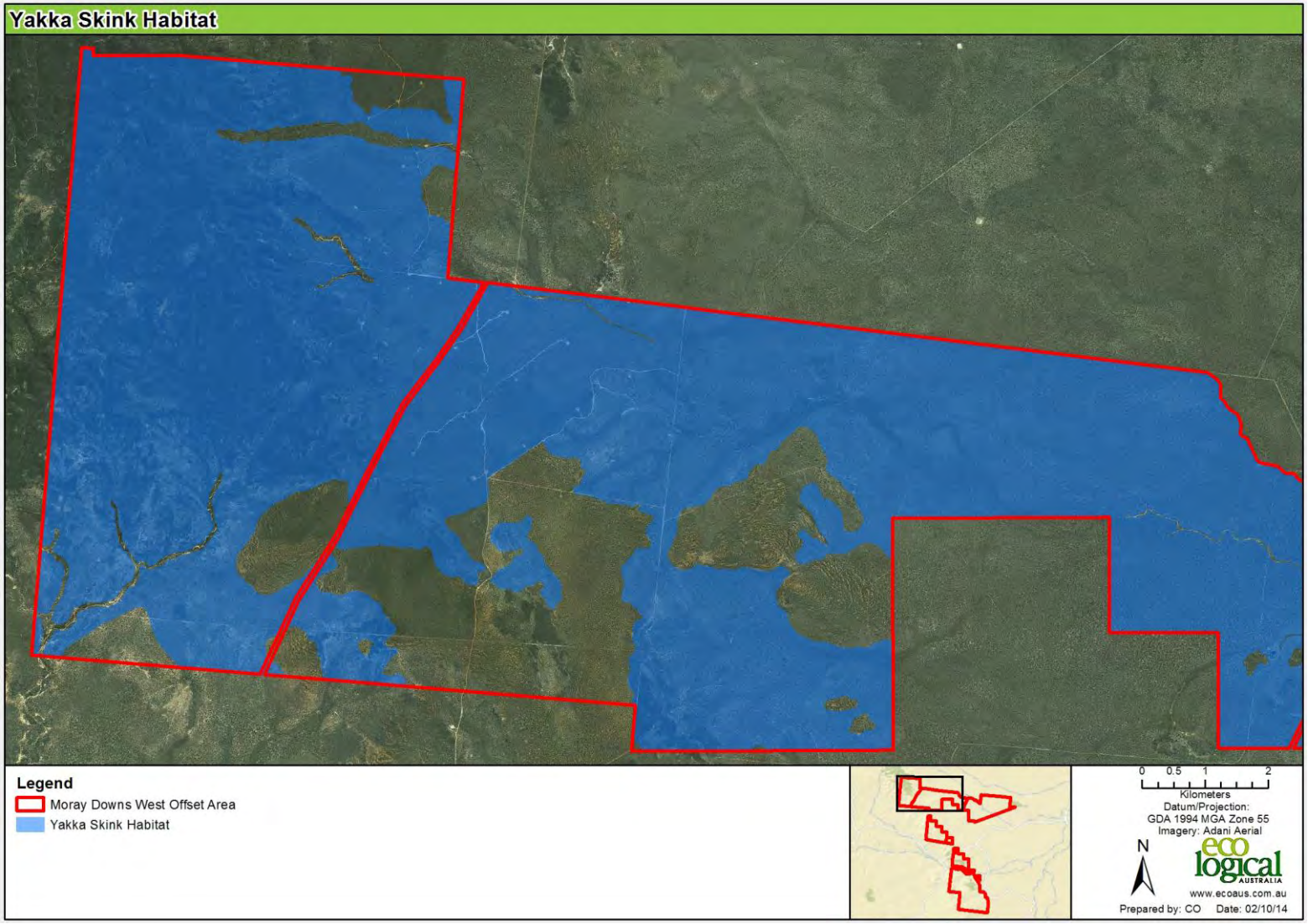

Figure 10. Yakka Skink habitat

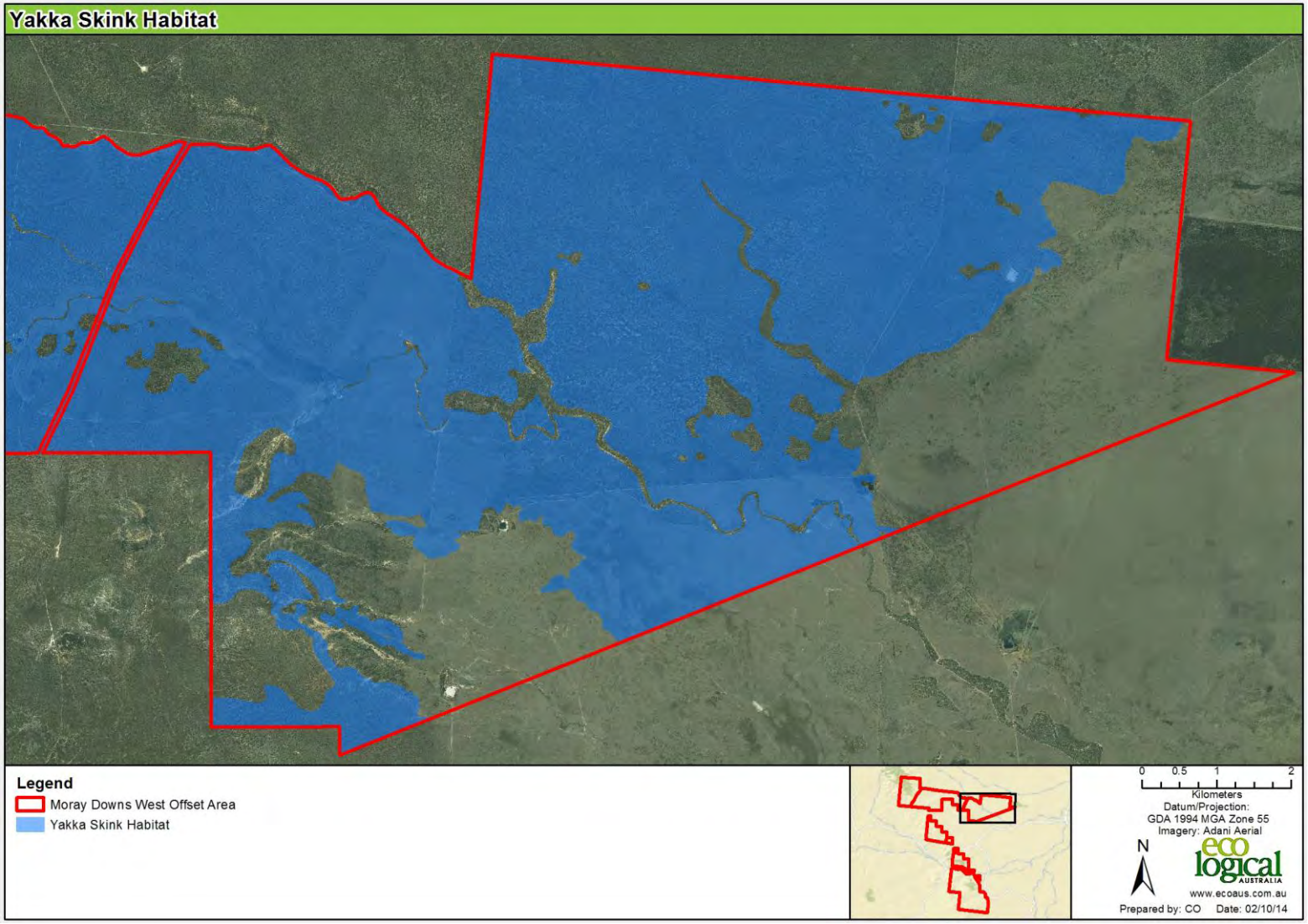

Figure 10. Yakka Skink habitat (continued)

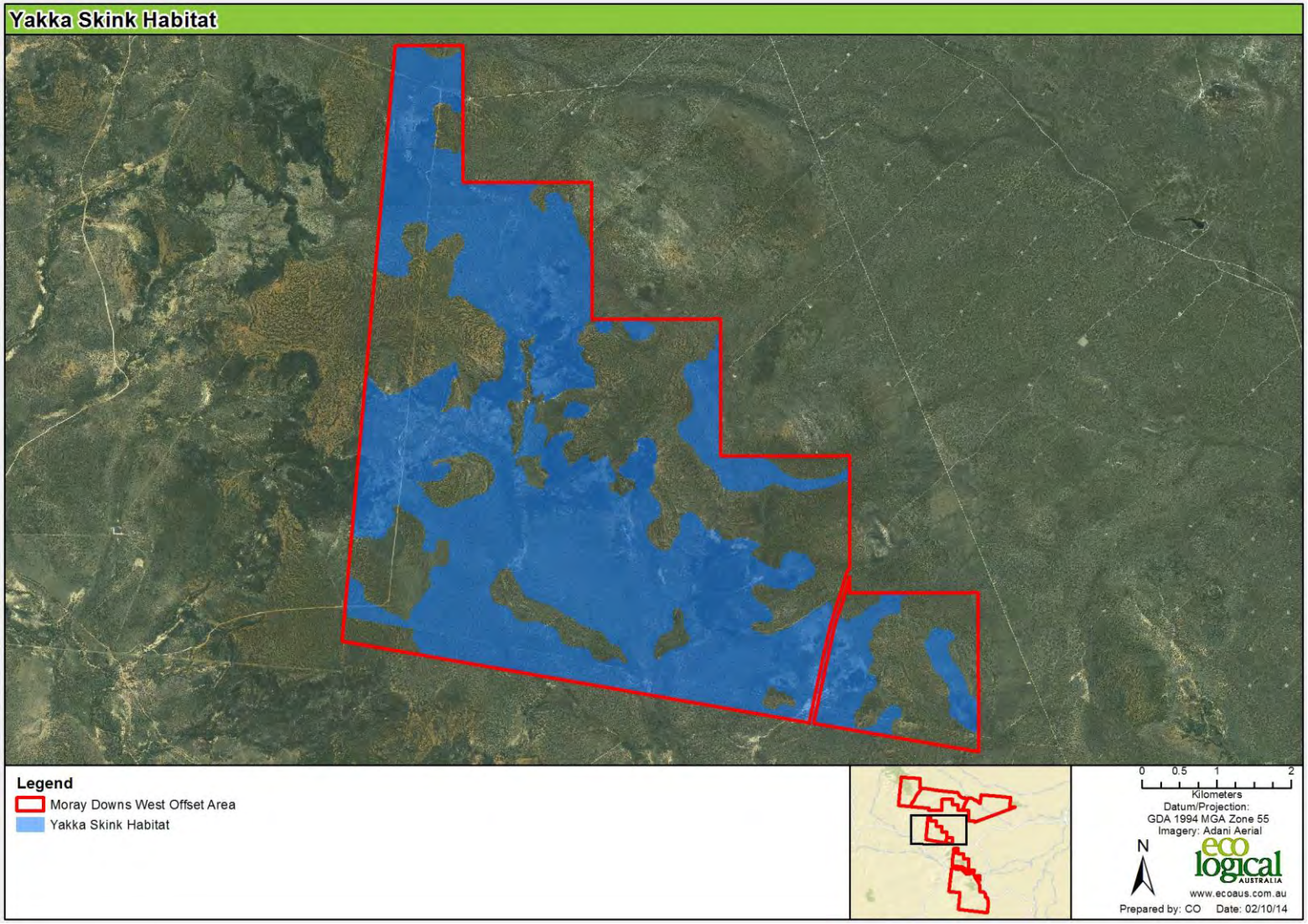

Figure 10. Yakka Skink habitat (continued)

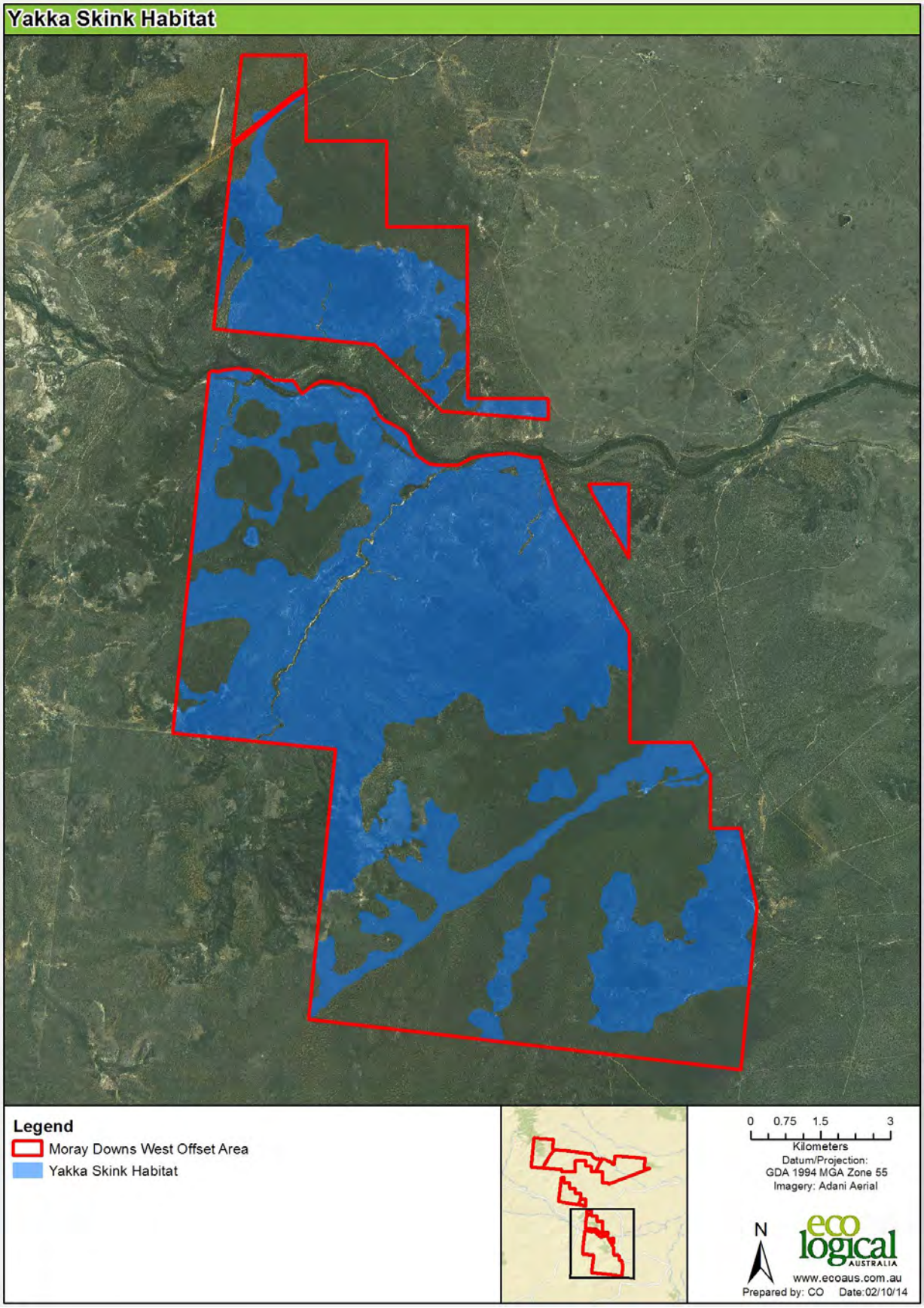

Figure 10. Yakka Skink habitat (continued)

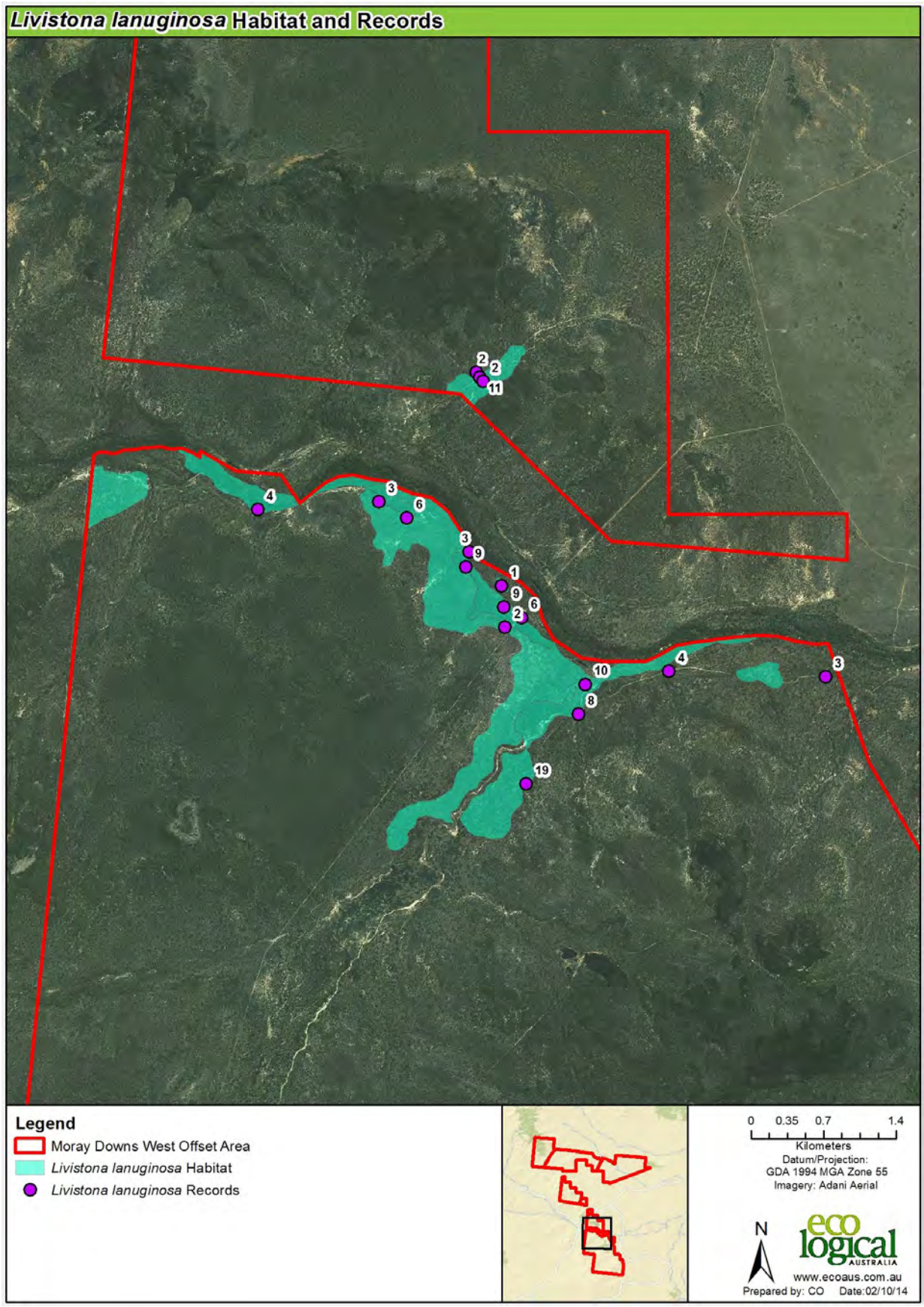

Figure 11. *Livistona lanuginosa* habitat and records

4.2 Matters of State Environmental Significance

As outlined in **Section 1.1.2**, offsets for MSES have been excluded if they are:

- MSES that are also MNES
- near threatened animals or plants as listed under the NC Act
- special least concern animals listed under the NC Act that no longer require offsets (i.e. except Echidna and Koala)
- threshold Regional Ecosystems (REs)
- high value regrowth.

This section addresses the remaining MSES outlined in **Table 1**.

4.2.1 Endangered Regional Ecosystems

No Endangered RE offsets occur on MDW. Although areas of Brigalow (10.4.3a) occur on MDW, these have a VM status of Least Concern.

4.2.2 Of Concern Regional Ecosystems

The Of Concern RE's listed under the offset requirements include BVGs 16c, 26a and 30b (**Table 1**). Desktop and field assessments verified 8.58 ha of the RE 11.3.3 (*Eucalytpus coolabah* billabongs) within the MDW offset area. This RE is listed as Of Concern under the VM Act and consists of BVG 16c (**Figure 12**).

Assessment units 7 and 8 consist of BVG 26a that was characterised by *Acacia cambagei* (Gidgee) woodland and regrowth. However because these REs have a Least Concern VM Status, they are not a suitable offset for RE 11.4.5 and RE 11.4.6.

BVG 30b was not identified within the proposed MDW offset area.

4.2.3 Wetlands

Offsets for Wetland Protection Areas and Significant Wetlands are provided by several assessment units on MDW. Assessment unit 10 comprises of RE 11.3.3 which is listed as a significant wetland under the VM Act. Seasonal and ephemeral wetlands include the small areas of Coolibah woodlands on closed depressions.

Other assessment units comprising of REs listed as a wetland under the VM Act include assessment units 4, 5, 7 and 8 that contain small palustrine wetlands associated with gilgai that are a feature across the Brigalow and Gidgee REs on MDW (**Figure 13**) . The wetlands in assessment unit 9 and 10 occur on the floodplains of the Carmichael River (**Figure 13**).

The offset suitability assessment identified 3,195.26 ha of Significant Wetlands across the MDW offset area which meets offset requirements for offset delivery stage 1 of the project.

These wetlands are ephemeral and fill with water for short durations following rain when they support a range of wetland flora (observed during field survey) and fauna (few observed). The wetlands are in reasonable condition although some isolated by clearing of surrounding vegetation up to their edges.

It is likely that the removal of cattle will improve the condition of these wetlands. Also further regeneration of regrowth Brigalow and Gidgee (assessment units 5 and 8) will also improve the condition of palustrine wetlands associated with their gilgai habitat.

4.2.4 Watercourses

Watercourses on the proposed MDW sites are associated with River Red Gum (*Eucalyptus camaldulensis*) or Coolibah (*E. coolabah*) woodlands. Watercourses occur along the Carmichael River, Cabbage Tree Creek and smaller drainage lines running across the sand plains in the western section and North Creek in the northern section of the offset area (**Figure 14**). There are also drainage lines traversing through various woodlands on sand plains and clay plains that do not support distinctive riparian vegetation.

The MDW offset area provides 733.62 ha of watercourse habitat with the following stream orders:

- 227.34 ha of stream order 2 watercourse vegetation
- 191.25 ha of stream order 3 watercourse vegetation
- 12.35 ha of stream order 4 watercourse vegetation
- 50.51 ha of stream order 5 watercourse vegetation.

No stream order 8 watercourses occur on MDW.

Most habitats associated with water courses are generally in good condition. Although there are some high grazing impacts to the ground layer and weed incursions in areas particularly associated with permanent water along the Carmichael River and Cabbage Tree Creek.

4.2.5 Threatened species

Brigalow scaly-foot

The Brigalow scaly-foot (*Paradelma orientalis*) occurs in Acacia and eucalypt woodlands on substrates including cracking clays and sandy alluvium (DoE 2014). This species has been previously recorded in the region and suitable habitat in the proposed MDW offset area was identified in assessment units 1, 2, 4, 5, 7, 8, 9 and 12 (**Figure 15**).

There areas cover 22,690.25 ha and provides adequate offset requirements for offset delivery stage 1 of the project.

4.2.6 Special least concern species

There are two special least concern species that require offsets, the Echidna and Koala.

Echidna

GHD (2012) observed traces of the Echidna (*Tachyglossus aculeatus*) across the EPC 1690 and during different survey events (**Figure 15**). This species occurs in a range of habitats and is likely to inhabit woodland areas within the MDW offset area and were identified in assessment units 1, 2, 3, 11, 12, and 13.

There areas cover 38,077.16 ha and provides adequate offset requirements for offset delivery stage 1 of the project.

Koala

Two Koala (*Phascolarctos cinereus*) observations have been made in the CCM project area during ecological surveys (One during the EIS surveys by GHD and one by ELA during the December 2013 survey) (**Figure 15**). Koalas are more likely to use riparian habitats where preferred food trees, especially where River Red Gum (*Eucalyptus camaldulensis*) occur. They may occasionally use other eucalypt ecosystems on the site for dispersals and shelter.

The assessment units 1, 2, 9 and 15 were identified as providing habitat values. These areas cover 19,323.30 ha and provide adequate offset requirements for offset delivery stage 1 of the project.

4.2.7 Connectivity

Over half of the MDW offset area (21,564 ha) is mapped within a state significant corridor (**Figure 16**). Remnant vegetation within this area is considered to provide important connectivity for protected matters. This area provides adequate offset requirements for offset delivery stage 1 of the project.

4.3 Interpretation of ecological equivalence scores

The ecological equivalence score was calculated for each MSES based on the ecological condition and special feature scores for the relevant assessment units for both the impact and offset areas (**Table 5**). This demonstrates that MDW meets the ecological equivalence requirements for all MSES other than RE 11.3.3.

Table 5. Ecological Equivalence for MSES occurring on Moray Downs West

Environmental Value	Ecological Condition			Special Features		
	Stage 1	Stage 2	MDW	Stage 1	Stage 2	MDW
Brigalow scaly-foot	3,625.03	612.18	1,087,713.86	50,546.10	8,535.98	203,859.94
Echidna	5,291.89	1,009.96	2,116,664.68	73,788.04	14,082.51	419,645.33
Koala	5,365.31	1,102.16	881,611.88	74,811.79	15,368.13	401,837.49
WPA	3.81	-	105,210.92	3.33	-	4,062.77
Significant wetland	2.79	-	105,210.92	2.43	-	4,062.77
RE 11.3.3 (BVG 16c)	7.21	0.90	3.99	3.45	0.43	0.34
Watercourse Stream Order 2	185.43	68.04	471.72	2,412.50	885.17	2,699.72
Watercourse Stream Order 4	84.71	-	471.72	1,102.08	-	2,699.72
Watercourse Stream Order 5	8.13	-	471.72	105.72	-	2,699.72
Connectivity	2,491.36	651.37	2,172,363.43	18,105.07	4,733.58	170,868.37

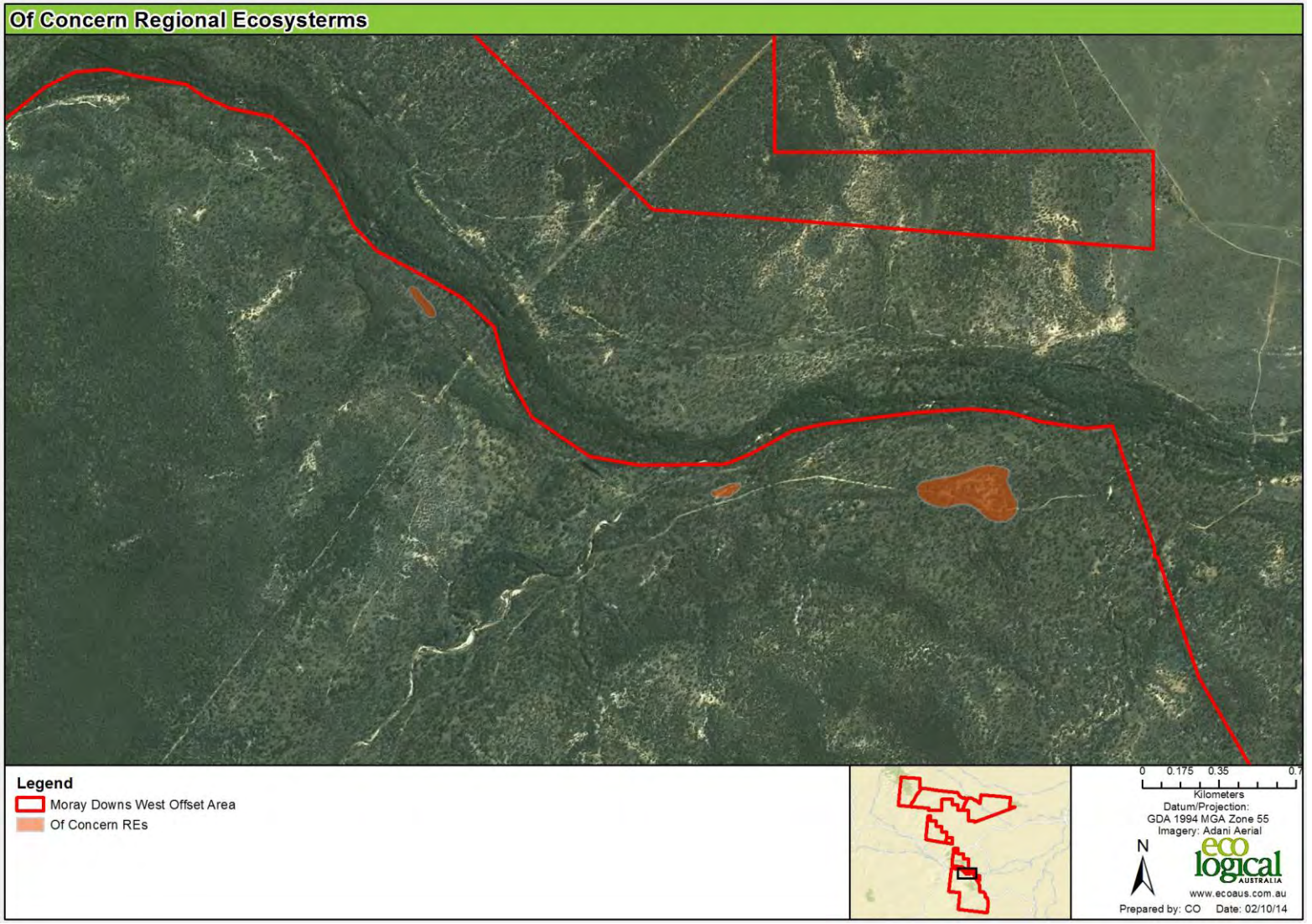

Figure 12. Of Concern Regional Ecosystems

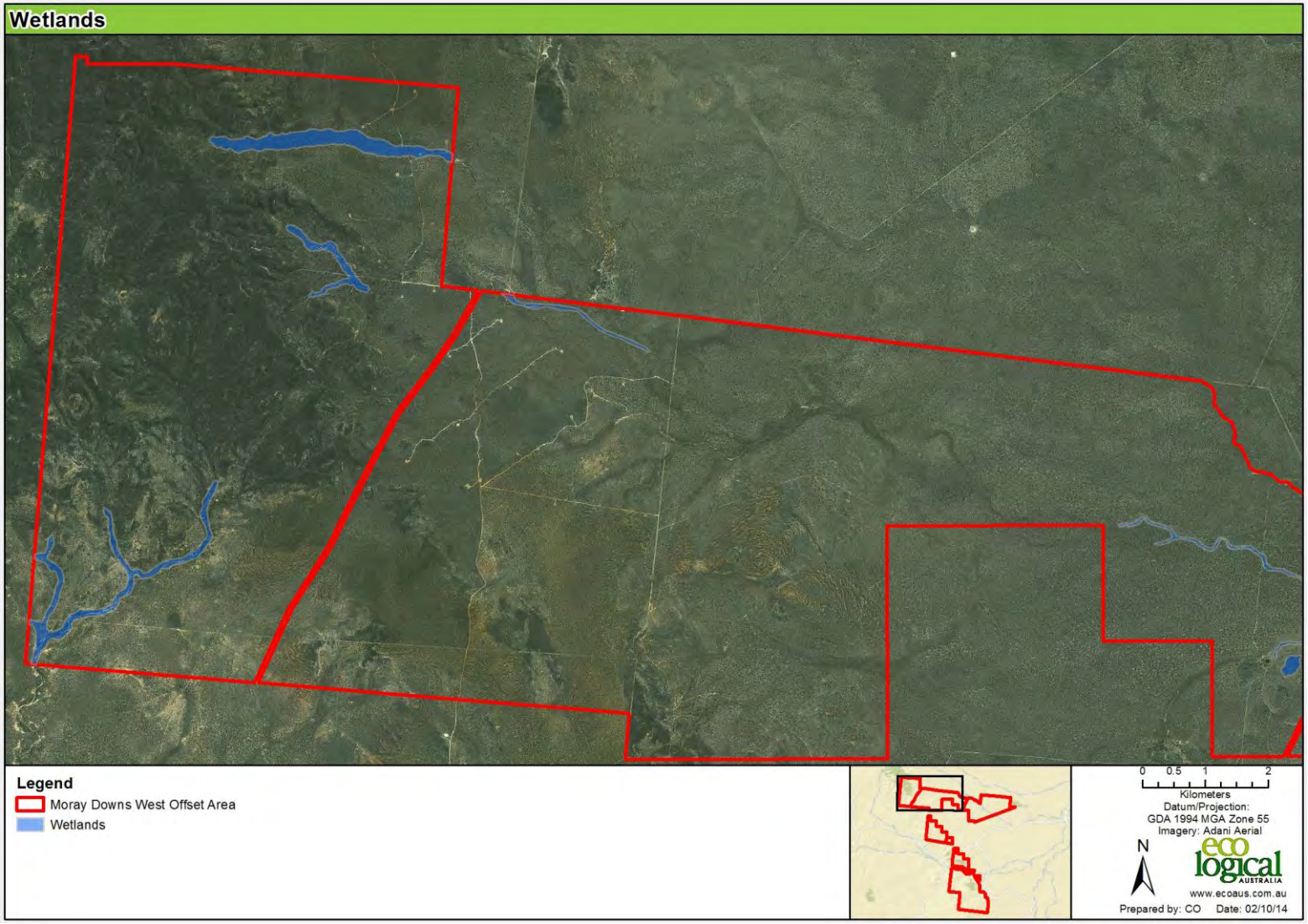

Figure 13. Wetlands

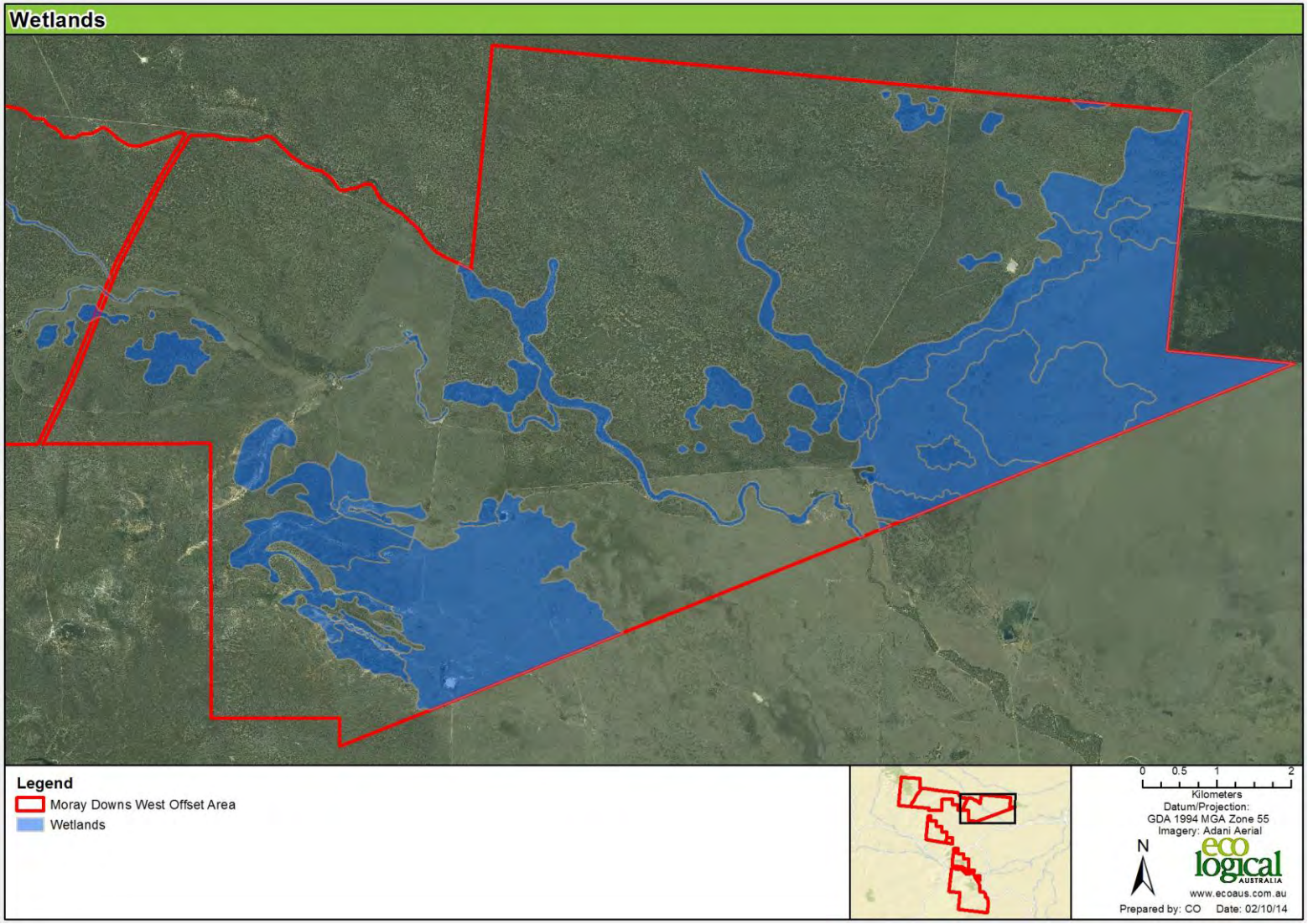

Figure13. Wetlands (continued)

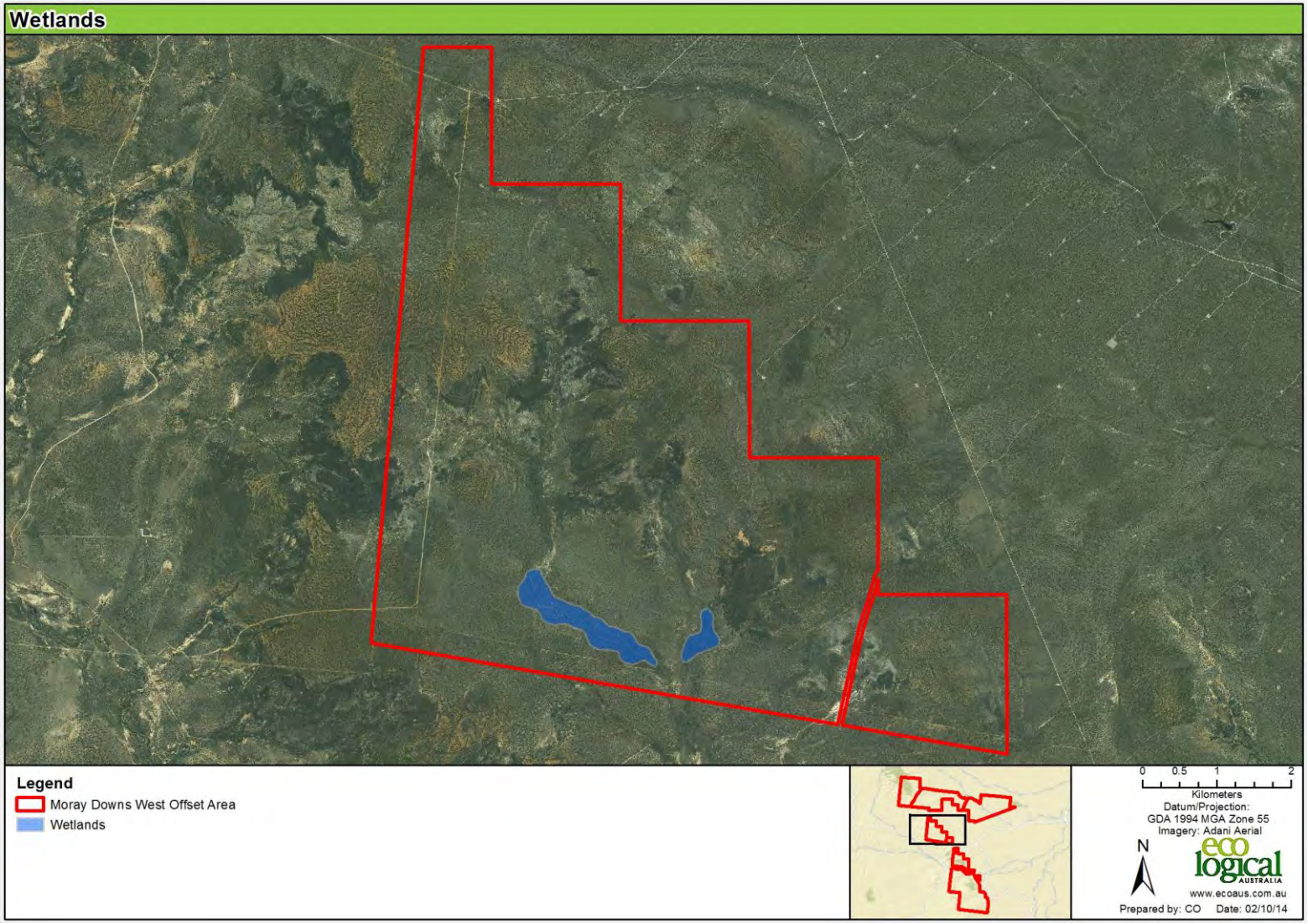

Figure13. Wetlands (continued)

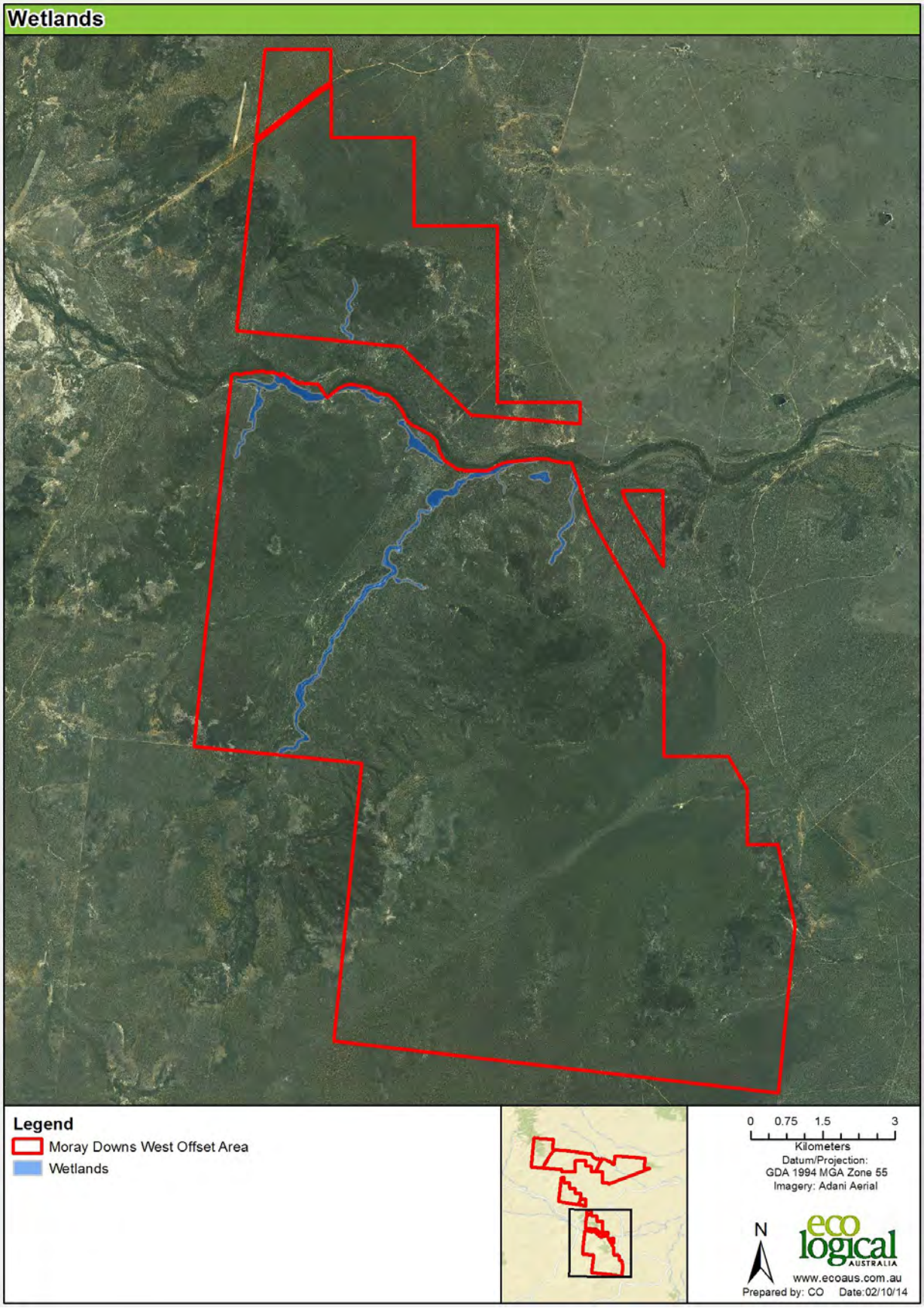

Figure13. Wetlands (continued)

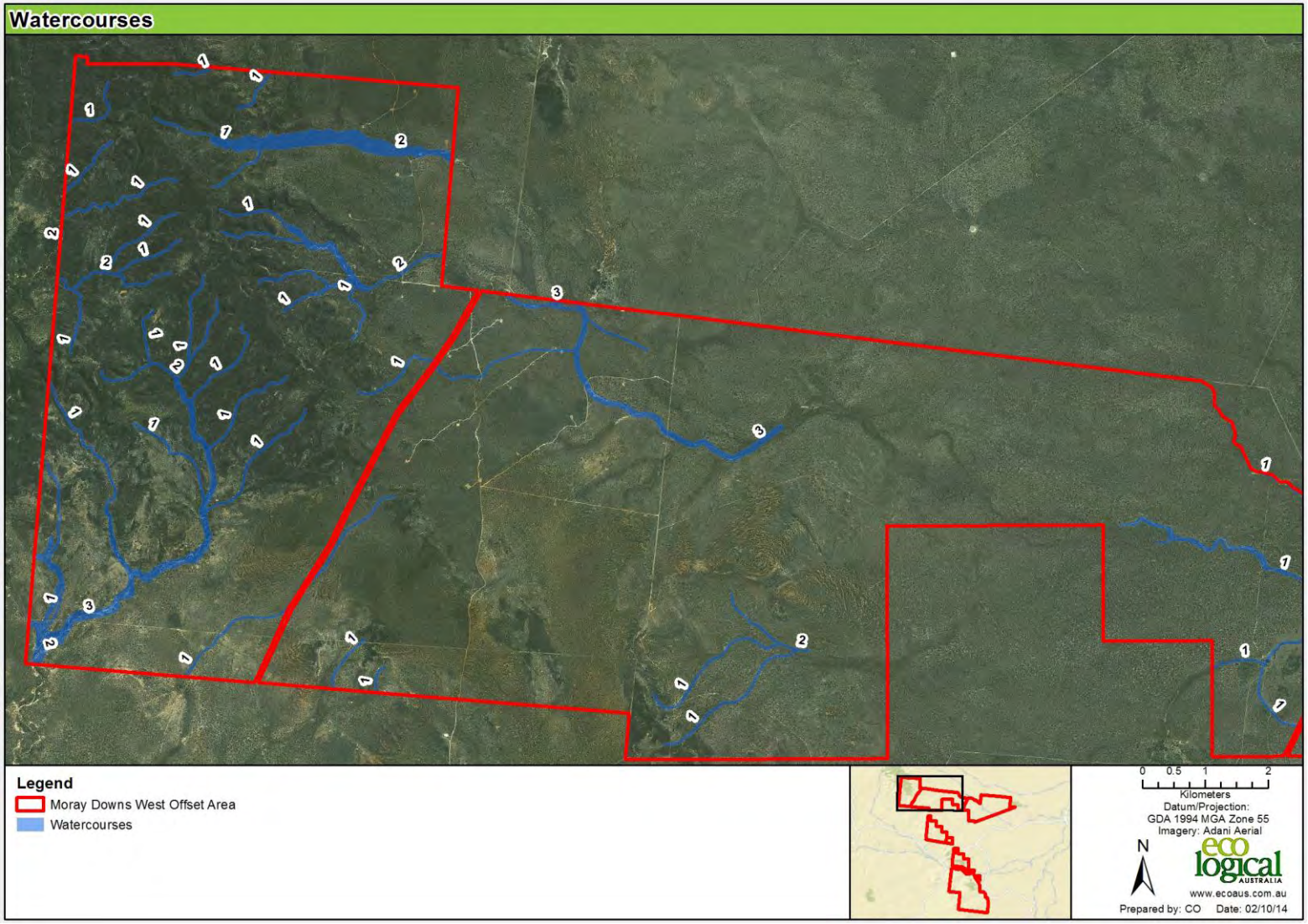

Figure 14. Watercourses

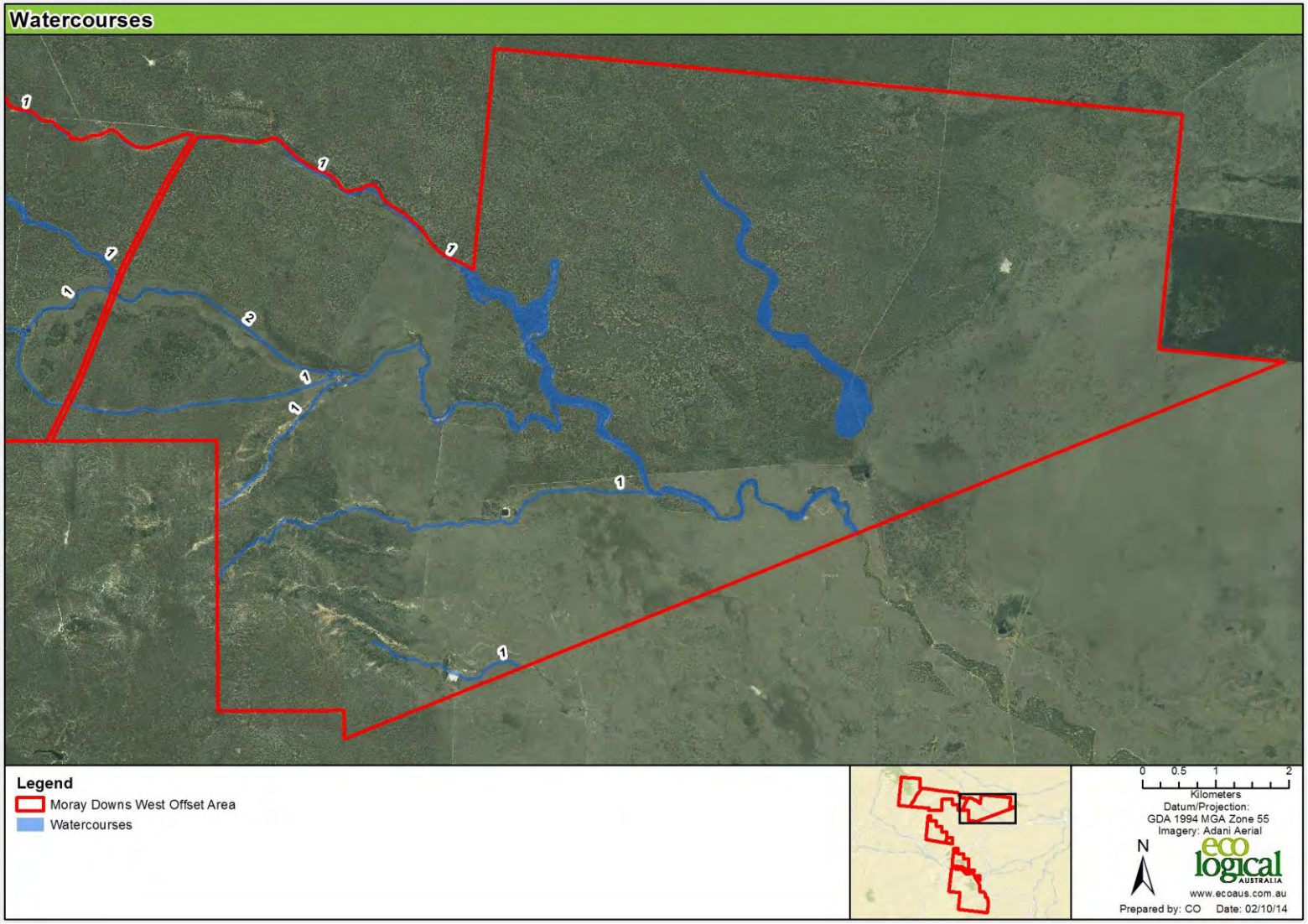

Figure 14. Watercourses (continued)

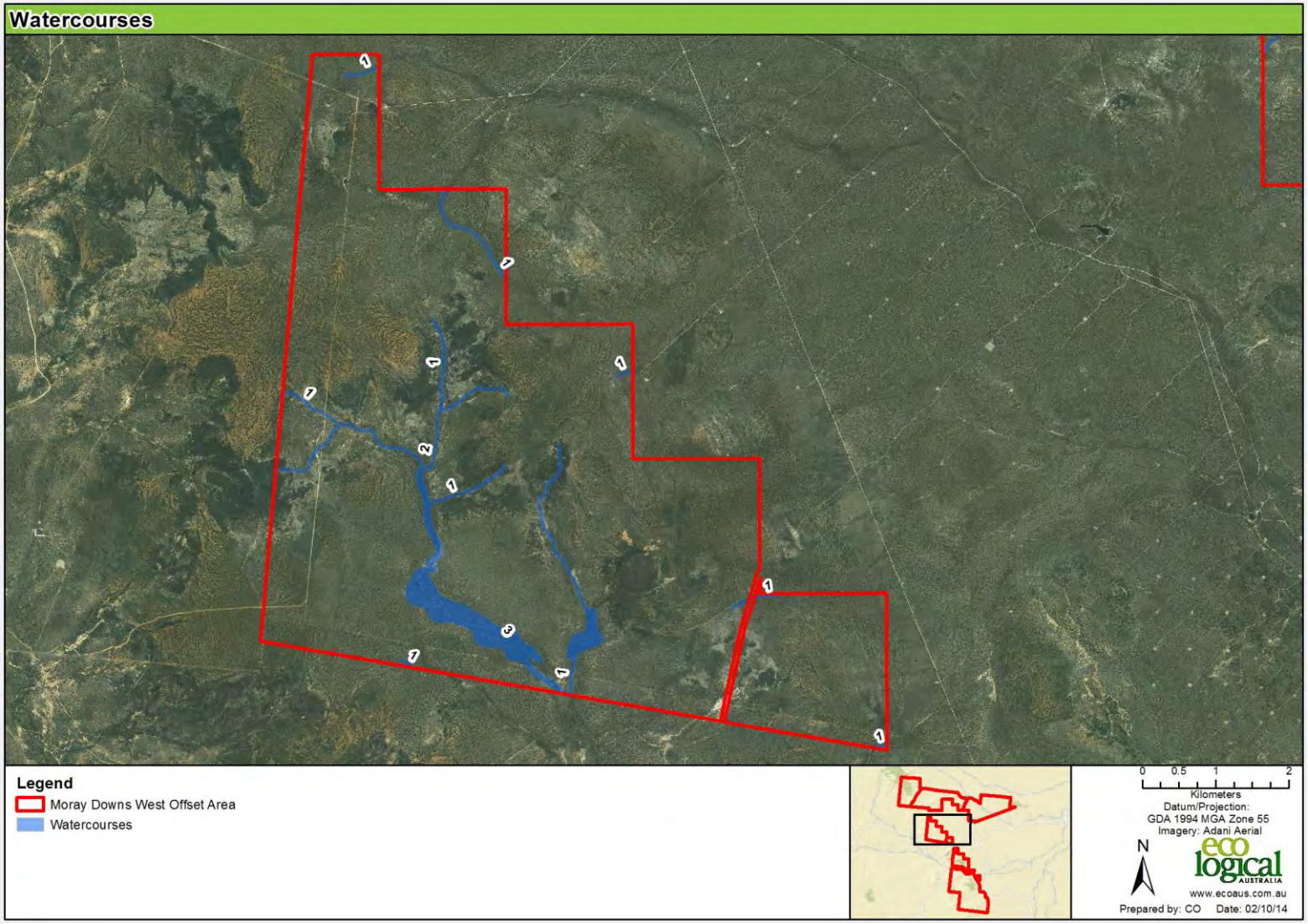

Figure 14. Watercourses (continued)

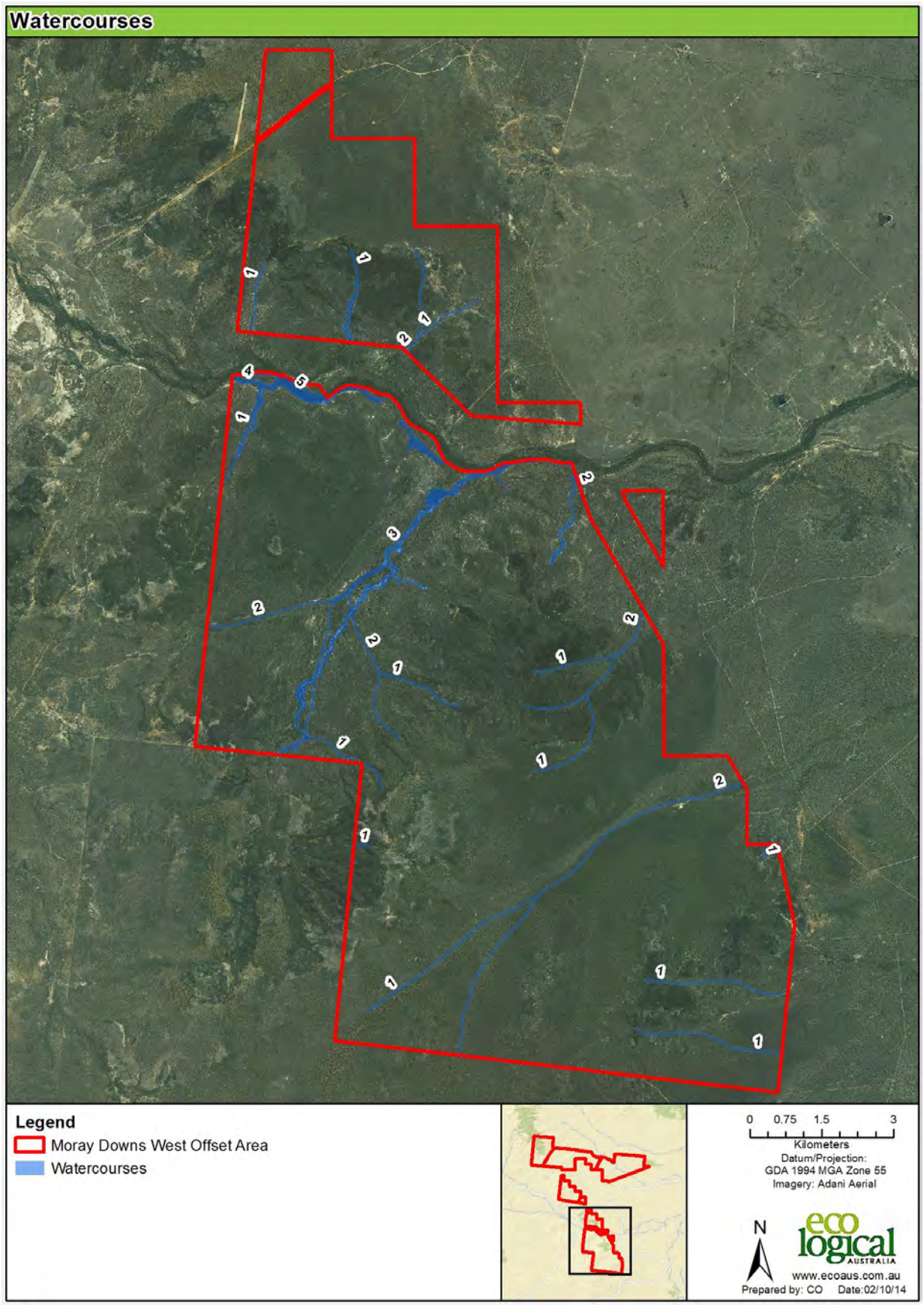

Figure 14. Watercourses (continued)

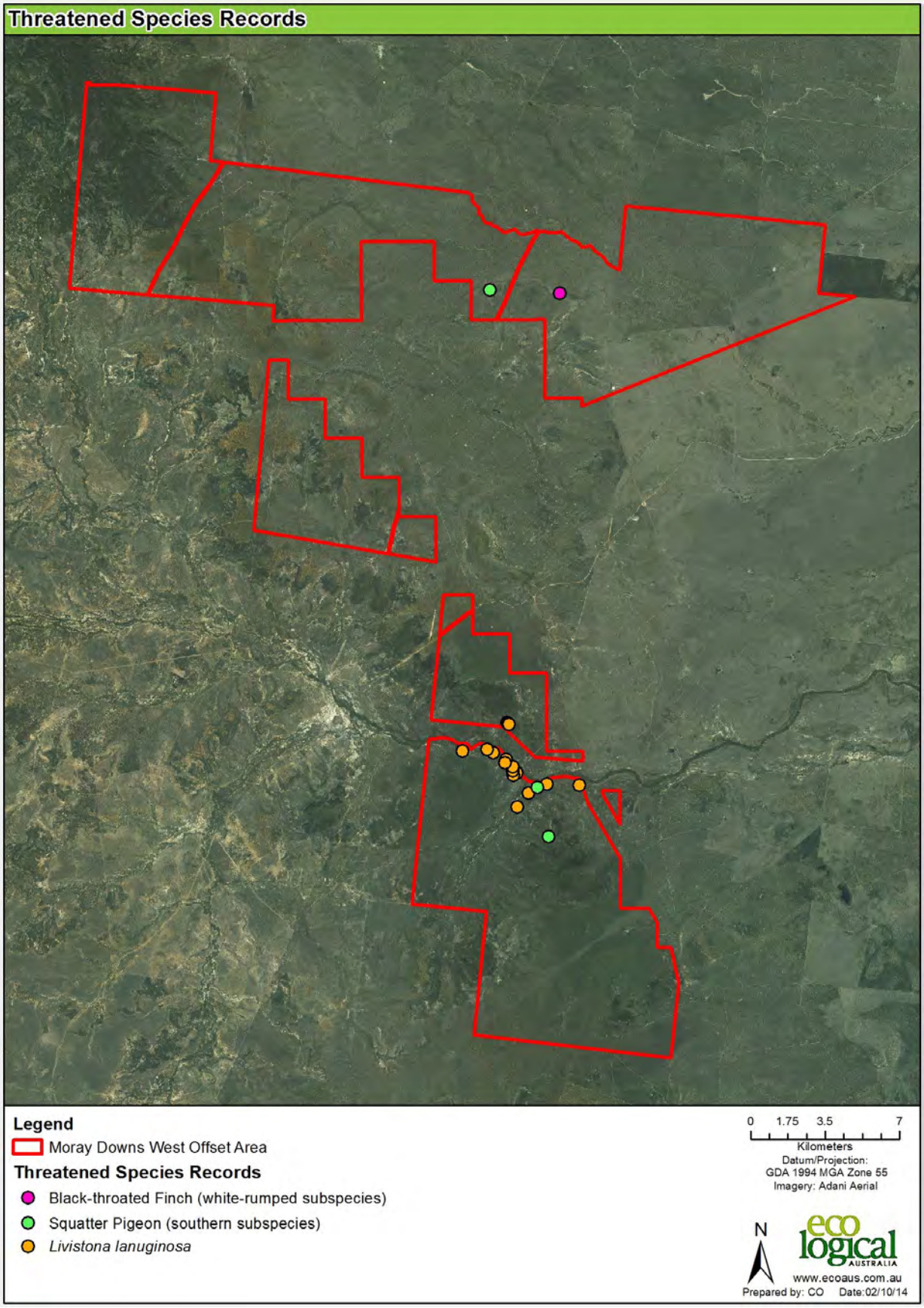

Figure 15. Threatened species records

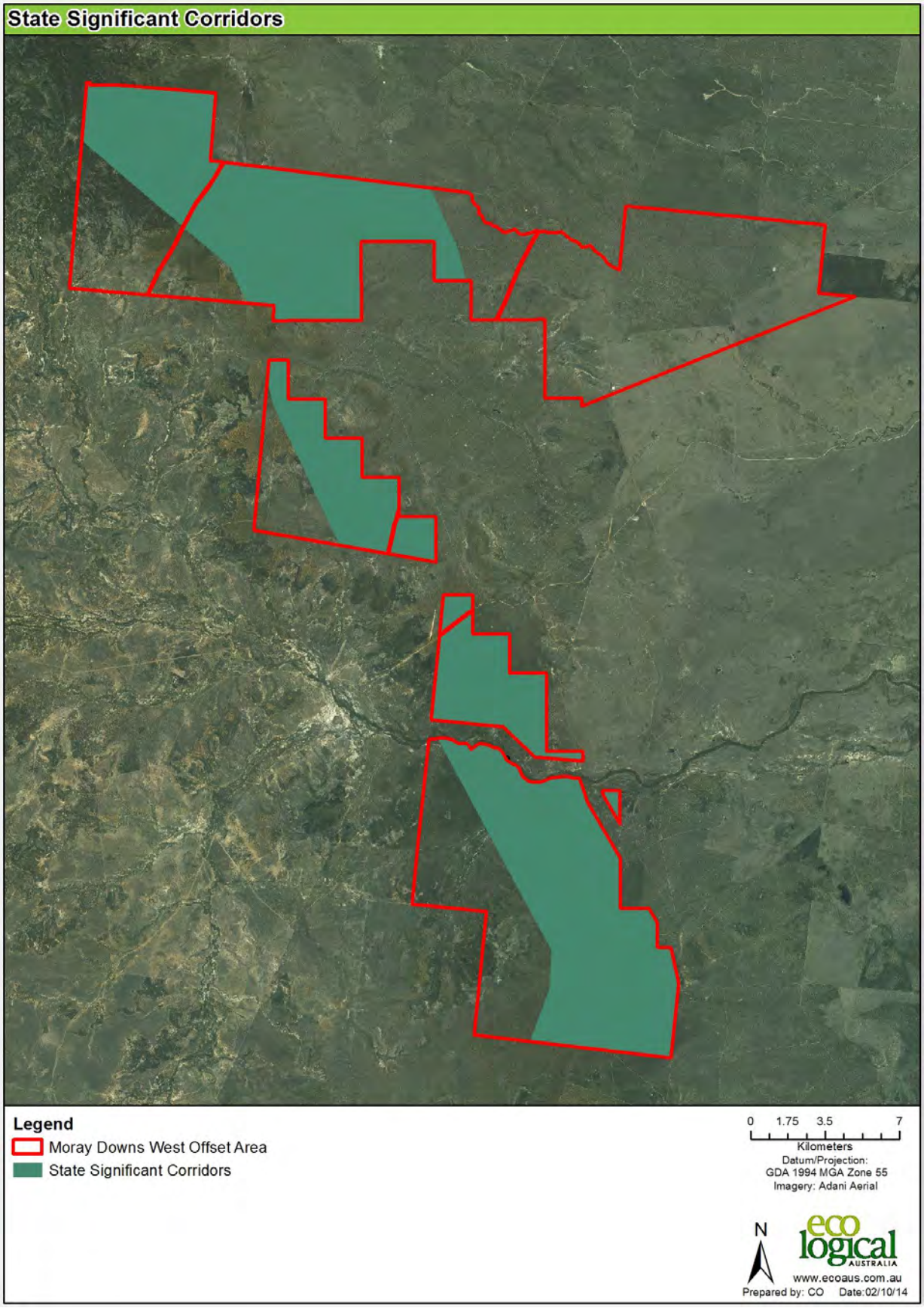

Figure 16. State significant corridors

5 Conclusions and Recommendations

Based on State and Commonwealth Offset Policies, the proposed MDW offset area provides the offset requirements for the majority of the MNES and MSES listed in the environmental approval conditions for the CCM (**Table 6**).

However because MDW is located in the Desert Uplands bioregion, it cannot meet the offset requirements for the Brigalow TEC. The Brigalow RE (10.4.3a) that occurs on MDW is not included in the TEC listing and has a VM Status of Least Concern meaning that it cannot be used to offset of concern REs.

The ecological equivalence and offset suitability assessment presented in this report outlines the potential offset area in the proposed MDW offset area for MNES listed in Adani's environmental approval conditions. This assessment confirms that MDW meets the ecological equivalence requirements for all MSES occurring on the site.

Table 6. Summary of offset values provided by Moray Downs West

Environmental Value	EPBC Act status	NC Act status	VM Act status	Offset Delivery Stage 1 (ha) [1]	Offset Delivery Stage 2 (ha)[1]	Moray Downs West Area (ha)
Ornamental snake	V	V	-	96.39	38.61	2,453.07
Squatter Pigeon (sth. subsp.)	V	V	-	1,598.00	902.00	31,621.66
Black-throated Finch (southern)	E	E	-	20,258.16	10,741.83	31,621.66
Yakka Skink	V	V	-	3,783.98	1,816.02	27,265.63
Waxy Cabbage Palm	V	V	-	90.00	0.00	316.20
Brigalow threatened ecological community (11.3.1, 11.4.8, 11.4.9; BVG 25a)	E	-	E	87.62	727.37	0
Brigalow scaly-foot	-	V	-	7,562.00	1,277.03	22,690.25
Echidna	-	SLC	-	8,906.40	1,699.79	30,577.18
Koala*	N/A	SLC	-	11,759.58	2,415.70	19,331.58
WPA	-	-	-	8.92	-	3,195.26
Significant wetland	-	-	-	6.53	-	3,195.26
RE 11.3.3 (BVG 16c)	-	-	OC	15.51	1.93	8.58
RE 11.4.5 (BVG 26a)	-	-	OC	1.52	0.00	0
RE 11.4.6 (BVG 26a)	-	-	OC	148.00	0.00	0
RE 11.4.11 (BVG 30b)	-	-	OC	138.17	7.64	0
Stream order 2	-	-	-	288.38	105.81	418.59[+]
Stream order 4	-	-	-	131.74	0.00	12.35

Environmental Value	EPBC Act status	NC Act status	VM Act status	Offset Delivery Stage 1 (ha) [1]	Offset Delivery Stage 2 (ha)[1]	Moray Downs West Area (ha)
Stream order 5	-	-	-	12.64	0.00	50.51
Connectivity	-	-	-	4,680.07	1,223.61	21,564

*The Koala was listed under the EPBC Act after the project was designated a control action and was not included as a MNES the offset strategy.

+Includes 191.25 ha of stream order 3 watercourse vegetation.

[1] For MNES and MSES occurring on Moray Downs West the value presented is the total offset requirement; for MSES not occurring on Moray Downs West the value presented is the total impact.

To ensure that the offset values identified in MDW are maintained and/or enhanced, key threats and management considerations for each MNES need to be considered. The offset area management plan for MDW should especially consider the following management actions to improve the condition of habitats and for the removal of threatening processes for MNES and MSES:

- Removal of cattle grazing
- Fire management plan to include mosaic burning and to reduce bushfire hazards to key offset areas
- Provision of additional water sources for the Black-throated Finch
- Rehabilitation or regrowth areas
- Weed management.

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Appendix A: MNES

Table A-1: Minimum offset areas (ha) required for impacts on EPBC Act listed threatened species and communities and initial contribution to offsets for subsidence impacts from underground mining

Environmental Value	Mining operations north of Carmichael River	Mining operations south of Carmichael River	Underground mining component	Off-lease infrastructure	Rail east component	Rail west component
Black throated Finch (southern)	18,204.06	10,739.39	20,000	7.62	2.44	46.48
Brigalow ecological community	15.12	721.11	-	0.00	6.26	72.50
Ornamental snake	96.39	38.61	-	0.00	0.00	0.00
Squatter pigeon (southern)	1598.00	902.00	-	0.00	0.00	0.00
Waxy Cabbage Palm	90.00	0.00	-	0.00	0.00	0.00
Yakka skink	3770.48	1815.42	-	1.87	0.60	11.63

*Offsets for different species may overlap where they share the same habitat requirements.

Appendix B: MSES

Table B-1: Details of each MSES value

Environmental Value	Relevant to MDW	VM Act Class (Version 8.0) or NC Act status	Biodiversity status (Version 8.0)	EPBC Act status	Relevant BVG's	Relevant Assessment Units
Of Concern Regional Ecosystems	10.10.3: *Eucalyptus drepanophylla* open woodland on sandstone ranges	Of concern	Of concern	-	12a	11
Wetland (Vegetation Management Act 1999)	10.3.13a: Riverine wetland or fringing riverine wetland. *Eucalyptus camaldulensis* dominates the very sparse to sparse canopy. *E. coolabah*, *Casuarina cunninghamiana* and *Melaleuca leucadendra* are frequently present in the canopy	Least concern	Of concern	-	16a	9
	10.3.14d: Floodplain (other than floodplain wetlands). Eucalyptus coolabah dominates the very sparse canopy	Least concern	Of concern	-	16a	9
	10.3.15g: Palustrine wetland (e.g. vegetated swamp). *Eucalyptus camaldulensis* dominates the very sparse canopy. *E. brownii* is usually present in the canopy.	Least concern	Of concern	-	34b	15
	10.4.3: Contains palustrine wetland (e.g. in swales). *Acacia harpophylla* and/or *Eucalyptus cambageana* open woodland on Cainozoic lake beds	Least concern	Endangered	-	25a	4, 5

Environmental Value	Relevant to MDW	VM Act Class (Version 8.0) or NC Act status	Biodiversity status (Version 8.0)	EPBC Act status	Relevant BVG's	Relevant Assessment Units
	10.4.5a: Contains palustrine wetland (e.g. in swales). *Acacia cambagei* dominates the small tree layer sometimes with *A. harpophylla.* Occurs on plains and gently undulating downs on Cainozoic lake deposits	Least concern	Of concern	-	26a	7 & 8
Significant wetland (Vegetation Management Act 1999)	11.3.3: Contains floodplain (other than floodplain wetlands). *Eucalyptus coolabah* woodland on alluvial plains	Of concern	Of concern	-	25a, 26a, 16a &16c	4,5,7,8,9 & 10
Watercourses	Stream orders 1 and 2 – watercourse vegetation	-	-		12a, 16a, 17a, 17b, 17c, 26a & 34d (only those areas interested by watercourses)	1, 2, 4, 5, 7 & 8 (only those areas interested by watercourses)
	Stream orders 3 and 4 – watercourse vegetation	-	-	-	17a, 17b, 25a & 26a (only those areas interested by watercourses)	4, 7 & 8 (only those areas interested by watercourses)
	Stream orders 5 or greater – watercourse vegetation	-	-	- -	16a (Carmichael River only)	2 (Carmichael River only)

Environmental Value	Relevant to MDW	VM Act Class (Version 8.0) or NC Act status	Biodiversity status (Version 8.0)	EPBC Act status	Relevant BVG's	Relevant Assessment Units
Connectivity	State significant corridor remnant vegetation and remnant vegetation >5ha	-	-	-		
Protected animals	Black-throated Finch (southern) (*Poephila cincta cincta*)	Endangered	-	Endangered	16a, 17a, 17b, 18a, 18b, 34b	1, 2, 9, 10, 12, 15
	Koala (*Phascolarctos cinereus*)	Special least concern	-	Vulnerable	16a, 17a, 17b & 34b	1,2,9 and 15
	Echidna (*Tachyglossus aculeatus*)	Special least concern	-	n/a	12a, 17a, 17b, 17c, 18a & 19d	1, 2, 3,11, 12, and 13
	Squatter Pigeon (southern) (*Geophaps stricta stricta*)	Vulnerable	-	Vulnerable	16a, 17a, 17b, 17c, 18a, 18b	1, 2, 3, 9, 12
	Ornamental Snake (*Denisonia maculata*)	Vulnerable	-	Vulnerable	16c, 25a, 26a	4, 5, 7, 8, 10
	Yakka Skink (*Egernia rugosa*)	Vulnerable	-	Vulnerable	12a, 17c, 24a	3, 6 11
Protected plants	Waxy Cabbage Palm (*Livistona lanuginosa*)	Vulnerable	-	Vulnerable	16a, 17a, 17b	1, 2, 9

Appendix C: Indicator scores

Table C 1: Field based ecological condition indicator scores (reproduced from the Ecological Equivalence Methodology Guideline, v1 (DERM 2011)

Indicator	Description	Score
1. Recruitment of woody perennial species	<20% of overstorey species present as regeneration	0
	≥20 -75 of overstorey species present as regeneration	3
	≥75% of overstorey species present as regeneration	5
2. Native plant species richness (trees, shrubs, grasses, forbs)	<25% of benchmark number of species within each life-form	0
	≥25% to 90% of benchmark number of species within each life-form	2.5
	>90% of benchmark number of species within each life-form	5
3. Tree canopy height	<25% of benchmark height	0
	≥25% to 70% of benchmark height	3
	≥70% of benchmark height	5
4. Tree canopy cover	<10% of benchmark	0
	≥10% and <50% of benchmark	2
	≥50% to ≤200% of benchmark	5
	>200% of benchmark	3
5. Shrub canopy cover	<10% of benchmark shrub cover	0
	<50% or >200% of benchmark shrub cover	3
	≥50% to ≤200% of benchmark shrub cover	5
6. Native perennial grass cover	<10% of benchmark perennial grass cover	0
	≥10 to 50% of benchmark perennial grass cover	1
	>50 to 90% of benchmark perennial grass cover	3
	>90% of benchmark perennial grass cover	5
7. Organic litter cover	<10% of benchmark organic litter	0
	<50% or >200% of benchmark organic litter	3
	≥50% to ≤200% of benchmark organic litter	5
8. Large trees	No large trees present	0
	0 to 50% of benchmark large trees	5
	>50% to 100% of benchmark of large trees	10
	>benchmark number of large trees	15

Indicator	Description	Score
9. Coarse woody debris	<10% of benchmark number or total length of CWD	0
	<50% or >200% of benchmark number or total length of CWD	2
	≥50% or ≤200% of benchmark number or total length of CWD	5
10. Weed cover	>50% weed cover	0
	>25 to 50% weed cover	3
	≥5 to 25% weed cover	5
	<5% weed cover	10

Table C 2: GIS based ecological condition indicator scores (reproduced from the Ecological Equivalence Methodology Guideline, v1 (DERM 2011))

Indicator	Description	Score
14. Distance from permanent water *(measured only in intact landscapes)*	0-500 m from water point	0
	500 m to 1 km from water point	2
	1-3 km from water point	5
	3-5 km from water point	10
	>5 km from water point	20

Table C 3: Special features indicator scores (reproduced from the Ecological Equivalence Methodology Guideline, v1 (DERM 2011))

Special feature indicator	Description	Score
1: Centres of endemism	No value	0
	Medium	5
	High	17
	Very high	20
2: Wildlife refugia	No value	0
	Medium	7
	High	17
	Very high	20
3: Areas with concentrations of disjunct populations	No value	0
	Medium	3
	High	12
	Very high	15
4: Areas with taxa at limits of geographic range	No value	0

Special feature indicator	Description	Score
	Medium	1
	High	4
	Very high	5
5: Areas with high species richness	No value	0
	Medium	5
	High	17
	Very high	20
6: Areas considered to be important for maintaining populations of ancient and primitive taxa	No value	0
	Medium	3
	High	12
	Very high	15
7: Areas containing regional ecosystems with distinct variation in taxa composition associated with geomorphology and other environmental variables	No value	0
	Medium	2
	High	8
	Very high	10
8: Artificially created waterbodies of ecological significance	No value	0
	Medium	1
	High	4
	Very high	5
9: Areas considered to be important because of high relative density of hollow-bearing trees	No value	0
	Medium	1
	High	4
	Very high	5
10: Breeding or roosting sites used by significant number of individuals	No value	0
	Medium	3
	High	12
	Very high	15
12: Priority species	No value	0
	Medium	5
	High	8
	Very high	10

Appendix D: Ecological condition scores for each site

Table D 1: Ecological condition scores for each sample site in each assessment unit

Assessment unit	Sample site	Recruitment of woody perennial species	Native plant species richness	Tree canopy height	Tree canopy cover	Shrub canopy cover	Native perennial grass cover	Organic litter cover	Large trees	Coarse woody debris	Weed cover	**Total Field based attributes**	Distance from water (km)	**Total BioCondition Score**
1	EE12	5	12.50	5	4	5	5	3	10	2	5	**56.5**	2	**59**
1	EE13	3	12.50	5	2.5	3	5	3	5	0	5	**44**	10	**54**
1	EE29	3	7.50	5	2.5	3	3	5	10	2	10	**51**	20	**71**
1	EE30	5	10.00	5	3.5	5	5	3	15	5	10	**66.5**	20	**87**
1	EE32	3	10.00	5	4	5	5	5	15	0	10	**62**	2	**64**
1	EE33	3	10.00	1.5	1.5	3	3	3	15	5	5	**50**	5	**55**
1	EE34	3	10.00	5	3	3	5	3	15	0	10	**57**	5	**62**
2	EE11	5	7.5	1.5	1	3	5	3	0	2	3	**31**	5	**36**
2	EE31	5	7.5	1.5	2.5	5	5	3	0	2	0	**31.5**	**0**	**32**
3	EE23	5	10	2.5	2.5	3	5	5	10	2	10	**55**	10	**65**
3	EE24	5	10	1.5	2.5	3	5	5	15	0	10	**57**	20	**77**
3	EE25	5	10	5	1.5	3	5	5	10	2	10	**56.5**	10	**67**
3	EE26	0	10	2.5	1.5	5	1	5	10	0	10	**45**	5	**50**

Assessment unit	Sample site	Recruitment of woody perennial species	Native plant species richness	Tree canopy height	Tree canopy cover	Shrub canopy cover	Native perennial grass cover	Organic litter cover	Large trees	Coarse woody debris	Weed cover	**Total Field based attributes**	Distance from water (km)	**Total BioCondition Score**
3	EE27	5	7.5	4.0	4.0	3	5	5	10	5	10	**58.5**	5.0	**64**
4	EE14	5	15	1.5	2.5	3	5	5	5	0	5	**47**	5	**52**
4	EE18	3	5	1.5	1	3	0	3	0	0	0	**16.5**	5	**22**
4	EE19	5	10	5	1.5	5	1	3	5	0	5	**40.5**	5	**46**
4	EE42	5	7.5	2.5	1.5	3	5	5	10	2	3	**44.5**	5	**50**
4	EE43	5	7.5	5	5	5	1	5	5	5	3	**46.5**	0	**47**
5	EE15	5	5	1.5	1	3	0	5	0	2	3	**25.5**	0	**26**
5	EE16	3	5	1.5	1	5	0	5	0	5	0	**25.5**	5	**31**
5	EE17	3	5	1.5	0	3	0	5	0	0	0	**17.5**	5	**23**
6	EE1	3	12.5	5	5	0	0	0	10	2	10	**47.5**	10	**58**
6	EE2	5	17.5	3	5	5	3	3	5	0	10	**56.5**	0	**57**
6	EE36	5	10	5	3	0	5	3	15	5	10	**61**	5	**66**
7	EE20	5	12.5	5	3.5	3	5	5	5	2	5	**51**	5	**56**
8	EE21	5	12.5	1.5	0	3	5	5	0	2	3	**37**	5	**42**
9	EE6	3	17.5	5	5	3	5	3	10	2	10	**63.5**	0	**64**

Assessment unit	Sample site	Recruitment of woody perennial species	Native plant species richness	Tree canopy height	Tree canopy cover	Shrub canopy cover	Native perennial grass cover	Organic litter cover	Large trees	Coarse woody debris	Weed cover	**Total Field based attributes**	Distance from water (km)	**Total BioCondition Score**
9	EE7	3	15	5	5	3	1	5	15	2	5	**59**	2	**61**
9	EE8	5	15	5	5	3	5	5	15	2	5	**65**	5	**70**
9	EE9	5	12.5	5	5	5	5	5	5	5	5	**57.5**	5	**63**
10	EE41	5	2.5	5	4	0	0	5	15	5	5	**46.5**	0	**47**
11	EE4	3	12.5	5	2.5	5	5	3	5	0	10	**51**	10	**61**
11	EE35	5	17.5	5	3	3	5	5	15	2	10	**70.5**	5	**76**
11	E37	0	15	5	5	5	5	3	15	2	10	**65**	20	**85**
12	EE5	5	12.5	5	3	3	3	5	15	2	5	**58.5**	10	**69**
12	EE22	5	12.5	5	3	3	3	3	15	0	10	**59.5**	10	**70**
12	EE28	3	15	5	2.5	3	5	3	15	5	5	**61.5**	10	**72**
13	EE38	5	7.5	5	3	3	3	5	5	5	10	**51.5**	20	**72**
13	EE39	5	10	5	3	3	3	5	10	2	10	**56**	5	**61**
14	EE3	3	12.5	5	3	0	5	5	0	0	10	**43.5**	20	**64**
14	EE40	0	7.5	2.5	2.5	5	5	3	15	2	10	**52.5**	20	**73**
15	EE10	3	5	5	5	0	1	5	5	2	0	**31**	5	**36**

Appendix E: Benchmarks

Table E 2: Regional ecosystem benchmarks used in the ecological condition scoring

Regional ecosystem	Benchmark used in scoring	Origin and justification for use of benchmark
10.3.6ax1	10.3.6a	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane).
10.3.12a	10.3.12a	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane).
10.3.13a	10.3.13a	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane).
10.3.13a	10.3.13c	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane). Both REs are very similar in vegetation structure, understorey composition and species diversity with the main difference being the dominant canopy species.
10.3.14d	10.3.13c	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane). Both REs are very similar in vegetation structure, understorey composition and species diversity with the main difference being the dominant canopy species.
10.3.15g	11.3.3	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane). Both REs are very similar in vegetation structure, understorey composition and species diversity with the main difference being the dominant canopy species.
10.4.3a	10.4.3a	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane).
10.4.5a	11.4.6	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane). Both REs are very similar in vegetation structure, understorey composition and species diversity with the main difference being the dominant canopy species.
10.5.1a	10.5.1a	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science,

Regional ecosystem	Benchmark used in scoring	Origin and justification for use of benchmark
		Information Technology, Innovation and the Arts: Brisbane).
10.5.1c	10.5.1a	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane). Both REs are very similar in vegetation structure, understorey composition and species diversity with the main difference being the dominant canopy species.
10.5.1d	10.5.1a	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane). Both REs are very similar in vegetation structure, understorey composition and species diversity with the main difference being the dominant canopy species.
10.5.2b	10.5.2a	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane). Both REs are very similar in vegetation structure, understorey composition and species diversity with the main difference being the dominant canopy species.
10.5.5a	10.5.5a	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane).
10.5.10	10.5.2a	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane). Both REs are very similar in vegetation structure, understorey composition and species diversity with the main difference being the dominant canopy species.
10.7.3a	10.7.3a	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane
10.7.3b	10.7.3a	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane). Both REs are very similar in vegetation structure, understorey composition and species diversity with the main difference being the dominant canopy species.
10.7.3c	10.7.3a	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane). Both REs are very similar in vegetation structure, understorey composition and species diversity with the main difference being the dominant canopy

Regional ecosystem	Benchmark used in scoring	Origin and justification for use of benchmark
		species.
10.7.4	10.7.4	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane).
10.7.7	10.7.7a	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane).
10.7.7b	10.7.7a	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane). Both REs are very similar in vegetation structure, understorey composition and species diversity with the main difference being the dominant canopy species.
10.10.1a	10.7.3a	Queensland Herbarium (2014). BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane). Both REs are very similar in vegetation structure, understorey composition and species diversity with the main difference being the dominant canopy species.
10.10.3	10.10.3	Queensland Herbarium (2014) BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane).
11.3.3c	11.3.3	Queensland Herbarium (2014) BioCondition Benchmarks for Regional Ecosystem Condition Assessment. (July 2014) (Department of Science, Information Technology, Innovation and the Arts: Brisbane).

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C-4: MDW baseline habitat quality assessment for Brigalow TEC in the eastern portion of the MDW offset area (CO2 Australia August 2020)

The following tables provide a summary of the data used to calculate the baseline habitat quality score for Brigalow TEC located in the eastern most portion of MDW, within the West Obangeena paddock, in accordance with the GTDTHQ (DEHP 2014b). The data required to inform the site condition scores were collected as part of detailed field surveys by CO2 Australia from 3-7 August 2020. The site context scores were calculated based on a desktop assessment following the method prescribed in the GTDTHQ.

Table C-1: Summary of the site condition and site context scores used to calculate the habitat quality score for each RE assessment unit

Offset values	Site C57 11.4.8 Brigalow TEC	Site S01[A] 11.4.8 Brigalow TEC	Site S02[A] 11.4.9 Brigalow TEC	Site S03[A] 11.4.9 Brigalow TEC	Site S04[A] 11.4.9 Brigalow TEC	Site S05[A] 11.4.9 Brigalow TEC
Site condition						
Recruitment of woody perennial species	5	5	5	5	5	5
Native plant species richness - trees	5	5	3	5	3	3
Native plant species richness - shrubs	3	3	3	3	3	3
Native plant species richness - grasses	3	5	5	3	5	5
Native plant species richness - forbs	3	3	2.5	3	3	3
Tree canopy height	1.5	1.5	1.5	1.5	1.5	1.5
Tree canopy cover	2.5	1	1	2.5	2.5	1
Shrub canopy cover	3	3	3	3	3	5
Native perennial grass cover	1	1	0	1	1	1
Organic litter	5	5	3	5	3	5
Large trees	0	0	0	0	0	0
Coarse woody debris	0	2	0	0	0	0
Non-native plant cover	10	5	0	10	5	5
Total of BioCondition attributes	42	39.5	27	42	35	37.5
MAX ecological condition score	80	80	80	80	80	80
Score /10	**5.25**	**4.94**	**3.38**	**5.25**	**4.38**	**4.69**
Site context						
Size of patch (fragmented bioregions)	0	0	0	0	0	0
Connectivity (fragmented bioregions)	0	0	0	0	0	0
Context (fragmented bioregions)	4	4	0	2	4	2
Distance to permanent watering point (intact bioregions)	-	-	-	-	-	-
Ecological corridors	0	0	0	0	0	0
Total of site context attributes	4	4	0	2	4	2
MAX site condition score	26	26	26	26	26	26
Score /10	**1.54**	**1.54**	**0.00**	**0.77**	**1.54**	**0.77**

[A] Sites S01 – S05 represent sites assessed as part of calculation of the CCMR habitat quality score for Brigalow TEC but are located outside of the final CCMR offset area.

Table C-2: Calculation of the Brigalow TEC habitat quality score for each RE assessment unit

	Site C57 11.4.8	Site S01[A] 11.4.8	Site S02[A] 11.4.9	Site S03[A] 11.4.9	Site S04[A] 11.4.9	Site S05[A] 11.4.9
Brigalow TEC						
Site condition score (/80)	42	40	27	35	38	39
Site context score (/26)	4	4	2	2	2	4
Converted habitat quality score (/10)	**4.34**	**4.10**	**2.74**	**3.49**	**3.73**	**4.06**

[A] Sites S01 – S05 represent sites assessed as part of calculation of the CCMR habitat quality score for Brigalow TEC but are located outside of the final CCMR offset area.

Table C-3: Final area weighted habitat quality score for Brigalow TEC

RE	Area (ha)	Average habitat quality score (/10) Brigalow TEC
11.4.8	59.17	4.22
11.4.9	43.27	3.50
	MNES offset management area (ha)	102.44
	Area-weighted habitat quality score	3.92
	FINAL OAG HABITAT QUALITY SCORE	**4**

APPENDIX D SIGNIFICANT RESIDUAL IMPACT ASSESSMENT FOR MSES

Table D-1 and Table D-2 summarise the significant impact assessment for MSES for the Project mine and rail components (respectively), to determine the requirement for offsets (see Appendix B). The impacts presented in Table D-1 and Table D-2 have been revised since the BOS version 3 using ground-truthed regional ecosystem mapping collated since the 2013 SEIS based on the mapping sources presented in Table D-3. Impacts on echidna and koala will be managed as part of the approved versions of the Species Management Plans for the Carmichael Coal Mine and Offsite Infrastructure and Carmichael Rail Network SP1. Residual impacts to echidna and koala were not considered to be significant, therefore offsets will not be provided for these species unless identified otherwise through the review process identified in Section 6.2 of this BOS.

Table D-1: Significant residual impact assessment of MSES for the Project's mine component

MSES	VM Act	NC Act	Structural category [A]	Mine and subsidence impact (ha) [B]	Off-lease impact (ha) [B]	Significant impact criteria (DEHP 2014a)	Assessment	Significant impact?
Echidna	n/a	Special Least Concern	n/a	Refer to Species Management Plan - Carmichael Coal Mine and Offsite Infrastructure (Eco Logical Australia 2019a)	Refer to Species Management Plan - Carmichael Rail Network SP1 (Eco Logical 2019d)	For special least concern (non-migratory) animal wildlife habitat an action is likely to have a significant impact if it is likely it will result in: ▶ a long-term decrease in the size of a local population; or ▶ a reduced extent of occurrence of the species; or ▶ fragmentation of an existing population; or ▶ result in genetically distinct populations forming as a result of habitat isolation; or ▶ disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species.	The echidna was recorded within the mine Project area (GHD 2013a). However, the mine component of the Project is unlikely to have a significant impact on the species as it is not expected to result in: ▶ a long-term population decrease ▶ a reduced extent of occurrence ▶ fragmentation of the existing population	No

MSES	VM Act	NC Act	Structural category [A]	Mine and subsidence impact (ha) [B]	Off-lease impact (ha) [B]	Significant impact criteria (DEHP 2014a)	Assessment	Significant impact?
							▶ genetically distinct populations forming ▶ disruption to ecologically significant locations.	
Koala	n/a	Special Least Concern	n/a	Refer to Species Management Plan - Carmichael Coal Mine and Offsite Infrastructure (Eco Logical Australia 2019a)	Refer to Species Management Plan - Carmichael Rail Network SP1 (Eco Logical 2019d)	For special least concern (non-migratory) animal wildlife habitat and action is likely to have a significant impact if it is likely to result in: ▶ a long-term decrease in the size of a local population; or ▶ a reduced extent of occurrence of the species; or ▶ fragmentation of an existing population; or ▶ result in genetically distinct populations forming as a result of habitat isolation; or ▶ disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	There is one record of the koala from the proposed mine site. GHD (2012). considered that the koala was likely to be present in the Project area in low densities. Therefore, the mine component of the Project is unlikely to have a significant impact on the species as it is not expected to result in: ▶ long-term population decrease ▶ a reduced extent of occurrence ▶ fragmentation of the existing population	No

MSES	VM Act	NC Act	Structural category [A]	Mine and subsidence impact (ha) [B]	Off-lease impact (ha) [B]	Significant impact criteria (DEHP 2014a)	Assessment	Significant impact?
							▶ genetically distinct populations forming ▶ disruption to ecologically significant locations.	
Wetland Protection Area	n/a	n/a	n/a	16.61	0.00	An action is likely to have a significant residual impact on prescribed wetlands or watercourses if there is a real possibility that the action will result in environmental values being affected in any of the following ways: ▶ areas of the wetland or watercourse being destroyed or modified; ▶ a measurable change in water quality of the wetland or watercourse- for example a change in the level of the physical and/or chemical characteristics of the water, including salinity, pollutants, or nutrients in the wetland or watercourse, to a level that exceeds the water quality guidelines for the waters; or ▶ the habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected; or ▶ a substantial and measurable change in the hydrological regime or recharge zones of the wetland, e.g., a substantial change to the volume, timing, duration and frequency	Project will result in clearance of vegetation associated with significant wetlands and WPA.	Yes
Significant wetland	n/a	n/a	n/a	77.59	0.00			Yes

MSES	VM Act	NC Act	Structural category [A]	Mine and subsidence impact (ha) [B]	Off-lease impact (ha) [B]	Significant impact criteria (DEHP 2014a)	Assessment	Significant impact?
						of ground and surface water flows to and within the wetland; or ▶ an invasive species that is harmful to the environmental values of the wetland being established (or an existing invasive species being spread) in the wetland.		
11.3.3 (BVG 16c)	Of Concern	-	Sparse	0.00	0.00	Clearing in a regional ecosystem that is endangered, or of concern. For clearing other than linear clearing: ▶ area greater than 5 ha where in a grassland (structural category) regional ecosystem; or ▶ area greater than 2 ha where in a sparse (structural category) regional ecosystem; or ▶ area greater than 0.5 ha where in a dense to mid-dense (structural category) regional ecosystem.	No impact (see Table D-3)	No
11.4.6 (BVG 26a)	Of Concern	n/a	Sparse	225.53	0.00	Clearing in a regional ecosystem that is endangered, or of concern. For clearing other than linear clearing: ▶ area greater than 5 ha where in a grassland (structural category) regional ecosystem; or ▶ area greater than 2 ha where in a sparse (structural category) regional ecosystem; or ▶ area greater than 0.5 ha where in a dense to mid-dense (structural category) regional ecosystem.	Proposed clearing in this sparse structure RE is greater than 2 ha	Yes
Watercourse vegetation [C]	n/a	n/a	Various (mostly sparse)	487.12	0.00	Clearing in a regional ecosystem that is associated with a watercourse. Clearing within 5 m of the defining bank.	Proposed clearing of watercourse vegetation within 5 m	Yes

MSES	VM Act	NC Act	Structural category [A]	Mine and subsidence impact (ha) [B]	Off-lease impact (ha) [B]	Significant impact criteria (DEHP 2014a)	Assessment	Significant impact?
						For clearing other than linear clearing: ▶ area greater than 5 ha where in a grassland (structural category) regional ecosystem; or ▶ area greater than 2 ha where in a sparse (structural category) regional ecosystem; or ▶ area greater than 0.5 ha where in a dense to mid-dense (structural category) regional ecosystem.	of the defining bank; and proposed clearing is greater than 2 ha	
Connectivity	n/a	n/a	n/a	8,271.95	0.00	Impacts associated with connectivity are significant if it will change the size and configuration of remnant core vegetation areas and the level of fragmentation that will result at the local scale (5 km radius) given regard to the regional scale (20 km radius).	Should clearing associated with the mine Project footprint occur, the extent of remnant vegetation is likely to decrease by ~6% at a local scale (5 km radius) and by ~2% at a regional scale (20 km radius).	Yes

[A] Classification under the Regional Ecosystem Description Database (REDD).

[B] Based on revised impact assessment using ground-truthed regional ecosystem mapping collated since the 2013 SEIS.

[C] See Table B-3.

Table D-2: Significant residual impact assessment of MSES for the Project's rail component (Stage 1 and Stage 2)

MSES	NC Act	Rail impact (ha)[A]	Significant Impact Criteria	Assessment	Significant impact?
Koala	Special Least Concern	154.98	For special least concern (non-migratory) animal wildlife habitat, an action is likely to have a significant impact if it is likely that it will result in: ▶ a long-term decrease in the size of a local population; or ▶ a reduced extent of occurrence of the species; or ▶ fragmentation of an existing population; or ▶ result in genetically distinct populations forming as a result of habitat isolation; or ▶ disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species.	Potential habitat for the koala and echidna may occur in open eucalypt woodland, including riparian vegetation along the watercourses intersected by the rail corridor. However, the rail corridor is unlikely to have a significant residual impact on the two species as it is not expected to result in: ▶ long-term population decrease ▶ a reduced extent of occurrence ▶ fragmentation of the existing population ▶ genetically distinct populations forming ▶ disruption to ecologically significant locations.	No
Echidna	Special Least Concern	154.98			No
Connectivity	n/a	65.38	Impacts associated with connectivity are considered to be significant if it will change the size and configuration of remnant core vegetation areas and the level of fragmentation that will result at the local scale (5 km radius) given regard to the regional scale (20 km radius).	Should clearing associated with the rail footprint occur, the extent of remnant vegetation is likely to decrease by <1% at a local scale (5km radius) and by <1% at a regional scale (20km radius). Therefore, connectivity impacts within the rail footprint fall below the significant residual impact threshold so are not considered to be significant.	No

[A] Assuming a width of 95 m for the rail corridor and based revised impact assessment using ground-truthing of regional ecosystem mapping collated since the 2013 SEIS.

Table D-3: Summary of source of MSES impacts for which Stage 1 offsets are provided as part of this BOS (version 5a)

Protected value	Source	Mapping rules / method
Wetland protection area (WPA)	Disturbance footprint (Stage 1 and 2; Adani Mining) Map of Great Barrier Reef wetland protection areas (March 2020) Ground-truthed regional ecosystem mapping (2014; Adani Mining)	Ground-truthed wetland areas within WPA mapping intersected with the disturbance footprint.
Significant wetland	Disturbance footprint (Stage 1 and 2; Adani Mining) Map of Queensland wetland environmental values (March 2020) Ground-truthed regional ecosystem mapping (2014; Adani Mining)	Ground-truthed wetland areas identified as riverine or palustrine wetland within areas mapped as high ecological significance (HES) wetlands, as well as additional areas outside of HES mapping, intersected with the disturbance footprint.
RE 11.4.6 (BVG 26a)	Disturbance footprint (Stage 1 and 2; Adani Mining) Ground-truthed regional ecosystem mapping (2014; Adani Mining)	Intersected any RE 11.4.6 (remnant) mapped in the ground-truthed regional ecosystem layer with disturbance footprint
RE 11.3.3 (BVG 16c)		Intersected any RE 11.3.3 (remnant) mapped in the ground-truthed regional ecosystem layer with disturbance footprint
Watercourse vegetation (stream orders 2, 4, 5)	Disturbance footprint (Stage 1 and 2; Adani Mining) Ground-truthed regional ecosystem mapping (2014; Adani Mining) Vegetation management watercourse and drainage feature map (1:100000 and 1:250000) – Queensland except South East Queensland Version 4.0	Stream order (SO) buffers were applied to the watercourse and drainage feature map as follows*: ▶ SO 1 or 2: 5m nominal top of bank (ToB) width applied from centreline, 50m buffer applied to top of bank width ▶ SO 3 or 4: 10m nominal ToB width applied from centreline, 100m buffer applied to ToB ▶ SO 5+: 30m nominal ToB width applied from centreline, 200m buffer applied to ToB All ground-truthed remnant vegetation within buffers was identified as watercourse vegetation Intersected the resulting watercourse vegetation layer with disturbance footprint
Connectivity	Disturbance footprint (Stage 1 and 2; Adani Mining) Ground-truthed regional ecosystem mapping (2014; Adani Mining) Queensland Statewide Corridors (v1)	Identify relevant corridors – State significant terrestrial and terrestrial/riparian biodiversity corridors (excluding State significant riparian biodiversity corridors) All areas of remnant vegetation (as per ground-truthed regional ecosystem layer) within relevant corridors identified as connectivity areas Intersected resulting connectivity area layer with disturbance footprint

APPENDIX E RISK ASSESSMENT

Table E-1: Potential Risks to the Successful Implementation of the BOS and Proposed Contingency Measures

Risk	Risk rating			Contingency Measures
	Impact	Likelihood	Risk Rating	
Due to its proximity to the site, the construction of the Carmichael Coal Mine adversely impacts on the Moray Downs West offset area.	M	L	L	▶ See Appendix F
Moray Downs West and/or additional property are not approved	M	L	L	▶ Adani has assessed several other potentially suitable offset properties that could be substituted for Moray Downs West and/or the additional offset properties if they are not approved. This information has already been provided to relevant government agencies. The BOS will be revised accordingly and submitted to the Minister for approval.
Adani is unable to secure Moray Downs West and/or an additional property	M	L	L	▶ Adani has assessed several other potentially suitable offset properties that could be substituted for Moray Downs West and/or the additional offset properties if they are not approved. The BOS will be revised accordingly and submitted to the Minister for approval.
Research identifies that the Mellaluka Springs Complex provides high value habitat for the black throated finch	L	L	L	▶ If this research identifies that the Mellaluka Springs Complex provides high value habitat for the black throated finch Adani will: ▶ revise the black-throated finch offset requirement in the Biodiversity Offset Strategy in accordance with the EPBC Act Environmental Offsets Policy and submit the revised BOS to the Minister for approval ▶ commence management of any additional black-throated finch offsets in accordance with an approved management plan prior to hydrological impacts on the Mellaluka Springs Complex and legally secure offset areas within two years of commencement of management
Implementation of management measures outlined in the MNESMP do not achieve the goals for habitat management for the black throated finch within the specified timeframes	M	L	L	▶ Adani will take corrective actions, which may include the provision of offsets. If offsets are required as a corrective action, Adani will consult with DAWE and relevant Queensland Government agencies to determine an appropriate offset requirement and the offset requirement will be fulfilled in accordance with EPBC Act Environmental Offsets Policy. Any offsets required as a result of this process, will be incorporated into a revised BOS which will be submitted to the Minister for approval.
Implementation of management measures outlined in the MNESMP do not achieve the goals for habitat management for other MNES within the specified timeframes	M	L	L	▶ Adani will take corrective actions, which may include the provision of offsets. If offsets are required as a corrective action, Adani will consult with DAWE and relevant Queensland Government agencies to determine an appropriate offset requirement and the offset requirement will be fulfilled in accordance with EPBC Act Environmental Offsets Policy. Any offsets required as a result of this process, will be incorporated into a revised BOS which will be submitted to the Minister for approval.
Habitat for an EPBC Act listed threatened species or ecological community not previously identified is found within the Project area	L	L	L	▶ Adani will notify DAWE in writing within five business days of finding this habitat. If it is determined that project activities will have a significant residual impact on the EPBC Act listed threatened species or community, Adani will outline in writing within 20 business days of finding this habitat how the significant residual impacts will be offset in accordance with the EPBC Act Environmental Offsets Policy. The Biodiversity Offset Strategy will be updated to provide details of the significant residual impact and the proposed offsets and submitted to the Minister for approval.
At the end of an underground mining stage the actual impacts arising from subsidence, groundwater drawdown and/or water resource use are found to be greater than the predicted impacts	M	L	L	▶ The actual impacts arising from subsidence, groundwater drawdown and water resource use for all underground mining stages will be monitored and assessed over the life of the Project in accordance with methods set out in the relevant management and monitoring plans (see Table 3, Section 6.2 and Section 6.3). ▶ The relevant plans include details of baseline and impact monitoring measures to be implemented for each of the MNES, including control and impact sites to be monitored throughout the life of the Project. The monitoring undertaken as part of each relevant plan will provide data to quantify likely impacts resulting from mining operations, including subsidence and changes in groundwater levels. ▶ At the end of each underground mining stage, the results of monitoring activities will be used to reassess the actual impacts on MNES for the preceding underground mining stage. These results will also be used to update the predicted impact areas for future underground mining stages. Prior to the commencement of each underground mining stage, the BOS will be updated considering any offset credits or debits from the previous offset delivery stage and the revised predicted impacts for future stages. ▶ The revised BOS will be provided to the Minister for approval prior to the commencement of each underground mining stage and will include rationale for the balance of offset required for underground mining impacts that includes detailed comparison of the ecological status of EPBC Act listed threatened species and communities within the subsidence impact area between baseline conditions and the end of the most recent underground mining stage. The balance of offset requirement at each underground mining stage will be implemented in accordance with the BOS prior to the commencement of that underground mining stage.

Risk	Risk rating			Contingency Measures
	Impact	Likelihood	Risk Rating	
In accordance with the EA, an investigation of groundwater level fluctuations finds that fluctuations are in excess of groundwater level thresholds	M	L	L	▶ If an investigation indicates that there is a risk of impacting a MSES value, the BOS will be reviewed, and a report will be prepared within 3 months. The report will: – assess the area of MSES proposed to be impacted by the mining activities in the Biodiversity Offset Strategy; and – identify the actual on ground areas of MSES impacted by the mining activities. ▶ If the review outlined above finds that the actual areas of disturbance to MSES differs from the area of disturbance as detailed in the BOS, Adani will apply to the administering authority to amend the BOS within either 30 days, or a lesser period agreed to by the administering authority, prior to impacting on the applicable MSES. The amended offset requirement will be delivered within 12 months.
In accordance with the EA, a review of the Subsidence Management Plan and/or an annual inspection of subsidence indicates that the impact to MSES caused by mining activities authorised under the EA differs from the area of disturbance detailed in the BOS	M	L	L	▶ If an investigation indicates that there is a risk of impacting a MSES value, the BOS will be reviewed, and a report will be prepared within 3 months. The report will: – assess the area of MSES proposed to be impacted by the mining activities in the Biodiversity Offset Strategy; and – identify the actual on ground areas of MSES impacted by the mining activities. ▶ If the review outlined above finds that the actual areas of disturbance to MSES differs from the area of disturbance as detailed in the BOS, Adani will apply to the administering authority to amend the BOS within either 30 days, or a lesser period agreed to by the administering authority, prior to impacting on the applicable MSES. The amended offset requirement will be delivered within 12 months.

APPENDIX F RISK ASSESSMENT OF POTENTIAL OPERATIONAL IMPACTS OF THE MINE ON MORAY DOWNS WEST

Due to the proximity of the MDW offset area to the Project site, Adani has assessed whether there are any potential impacts on the offset areas on MDW arising from the construction and operation of the Carmichael Coal Mine. Outlined below is a description of each issue with reference to the relevant analysis undertaken in the EIS and SEIS.

Air Quality

The SEIS presents the predicted air quality impacts to sensitive receptors in association with construction and operations. Impacts peak at around year 10. The key air quality indicators modelled include exposure to 50 µg/m3, total suspended particulates of 90 µg/m^3 (ambient criterion) and deposited dust of 4 g/m^2/month (criterion based on background levels). Prevailing winds are typically from west to east, blowing away from the proposed offset areas.

The modelled air quality impacts are predicted to be less than the:

- Environmental Protection (Air) Policy 2008 (Qld; EPP) criterion of 50 µg/m3 at the nearest sensitive receptors
- 90 µg/m3 total suspended particulates at the nearest sensitive receptors
- 4 g/m2/month deposited dust at the nearest sensitive receptors.

The criteria set in the EPP are designed to protect environmental values, including human health and wellbeing and air quality characteristics conducive to protecting the health and biodiversity of ecosystems. Air quality impacts are not predicted to have an impact on the MDW offset areas.

Noise and Vibration

Noise and vibration impacts are primarily associated with operational activities including movement of vehicles, the operating of mine infrastructure and blasting. The SEIS (Volume 4 Appendix N) predicts the following impacts:

- construction noise generated by construction is predicted to be less than 10 db at sensitive receptors
- vibration generated by construction is limited to 300 m from the on-site source
- operational noise levels are predicted to be less than the noise criteria at all sensitive receptors (except the Mine Workers Accommodation Village)
- low frequency noise is predicted to be less than the noise criteria at all sensitive receptors
- blasting impacts are predicted to be less than the criteria at all sensitive receptors and won't be undertaken at night.

Noting that there are no established criteria for disturbance to wildlife, these criteria for human health and disturbance have been considered in the EIS and SEIS as representative. Atmospheric conditions including wind speed and direction are generally west to east resulting in noise impacts being more pronounced in the east and south-east. Noise and vibration are not predicted to have a significant impact on the offset areas.

Physical Access / Disturbance

The Moray Downs property is currently being used for low intensity cattle grazing with access via existing farm tracks. Infrastructure includes dams and boreholes as well as fencing. If utilised for environmental offsets, physical access and disturbance levels will be similar to or less than those currently experienced on these areas. Access will be required for property management (weeds, fences, fire management, water management etc.) but there will be no construction or operational access to these areas.

Surface Water

The property is currently managed for low intensity cattle grazing. Surface water is intercepted at several farm dams, but the majority can flow through various ephemeral waterways. The SEIS Hydrology Report (Volume 4 Appendix K5) provides details of the local catchment and topography.

The site topography is such that on the western and north-western edges of the mining lease, a natural ridgeline marks the edge of a catchment that flows away from the mining lease (and in the west, towards the Carmichael River), hence these areas of the property will not have surface water flows interrupted by mining operations. On the south-western edge, the topography flows towards the mining lease area hence surface flows will also not be intercepted.

Surface water diversions are anticipated within the mining lease only, hence it is not expected that mining operations will impact existing surface water conditions on the offset areas on MDW.

Groundwater

The EIS and SEIS hydrogeological investigations and modelling have predicted impacts on several groundwater aquifers, with an expressed ecological impact at groundwater dependent ecosystems (GDEs). These GDEs include the Doongmabulla Springs to the west of the mining lease (on the adjacent Doongmabulla Station property), the population of waxy cabbage palm along the Carmichael River through the mining lease, and the Mellaluka Springs Complex to the south/south-east of the mining lease area.

The proposed offset areas are generally unaffected by predicted groundwater drawdown as there are no GDEs present. Groundwater in these areas has been used for cattle watering purposes, with an unintended consequence of providing water for several fauna species. Groundwater infrastructure would be maintained to continue the availability of this water source.

APPENDIX G EXAMPLE OFFSETS CARMICHAEL RIVER AND DOONGMABULLA SPRINGS COMPLEX

The provision of the offsets for impacts on groundwater at the Doongmabulla Springs Complex and the Carmichael River will be required where it is determined that mitigation and management measures have not achieved specified criteria identified in the GDEMP. If future monitoring and modelling suggest that impacts are significant, and mitigation and management measures are not feasible, the following offset options may be considered.

If required, offsets to compensate for changes in groundwater hydrogeology on the Carmichael River and native vegetation of the Doongmabulla Springs complex will aim to reduce the effects of water drawdown and reduced surface water flow on remnant riparian vegetation and other environmental values.

The Doongmabulla Springs complex is currently used as a water source for cattle, which directly impacts the springs through trampling, pugging, fouling of water and compaction and browsing vegetation (GHD 2012). Joshua Springs at Doongmabulla has been completely altered from its natural state and now consists of a single turkey's nest dam and the overflow water channel is infested with the grass *Hymenachne amplexicaulis*, a class two declared weed.

The 'Recovery plan for the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin' (the recovery plan; (Fensham et al. 2010) provides a list of actions that if implemented effectively on appropriate wetlands would provide offsets for direct and indirect groundwater impacts on the Carmichael River and native vegetation dependent on discharge from the GAB within the Doongmabulla Springs Complex. The overall objective of the recovery plan is to maintain or enhance groundwater supplies to GAB discharge spring wetlands, maintain or increase habitat area and health, and increase all populations of endemic organisms.

The following actions have been identified from the recovery plan as potential offset delivery options based on the current threatening processes occurring within the Doongmabulla Springs Complex and potential predicted residual impacts identified in the Project's EIS.

- Action 1.1 Control bores that may benefit flows to springs
  - Capping bores in areas adjacent to important GAB wetlands can increase the extent and condition in the GAB wetlands. This includes action 1.1 under the recovery plan (Fensham et al. 2010).
- Action 3.1 Establish fencing where appropriate including the option to regulate stock use rather than exclude stock
- Action 3.2 Control feral animals
- Action 4.3 Eradicate exotic plants from springs and ensure no further deliberate introductions of exotic species occur
  - Appropriate management of threatening processes at an equivalent GAB wetland will provide offsets for the zero to small residual impacts that are predicted to occur to the Doongmabulla Springs Complex under worst case scenarios in the EIS studies (GHD 2014). This includes actions 3.1, 3.2 and 4.3 under the recovery plan (Fensham et al. 2010). Specific offset areas for

management, which are not currently being managed for conservation and include habitat for listed threatened species, will be identified if required.

- Action 6.2 Monitor populations of endemic species and understand their ecology and biology
  - The monitoring and adaptive management that is part of the conditions under the Carmichael Mine approvals is likely to develop further understanding and improvement in the management of the springs and associated species. For example, the *Eriocaulon carsonii* (listed as endangered under the EPBC Act and NC Act) is readily grown in pots (Bruce Wilson pers. comm, October 1 2014) and the spring endemic *Myriophyllum artesium* is found to grow in artificial bore drains in western Queensland (Desert Channels Queensland 2014). These species are known to occur within the Doongmabulla Springs Complex and further research may provide options for other offset delivery methods to compensate for potential impacts on these communities and associated species. This is consistent with action 6.2 under the recovery plan (Fensham et al. 2010).

APPENDIX H EPBC ACT ENVIRONMENTAL OFFSETS POLICY OFFSETS ASSESSMENT GUIDES

STAGE 1 OFFSET DELIVERY

Moray Downs West

Offsets Assessment Guides for the following values were completed and approved for MDW as part of the originally approved BOS (version 3):

- Ornamental snake
- Squatter pigeon
- Waxy cabbage palm
- Yakka skink.

The BOS (version 5a) includes an additional offset area in the eastern portion of MDW to acquit Stage 1 offset requirements Brigalow TEC. Detailed field surveys were undertaken within this section of the MDW offset area in August 2020 to inform the *Offsets Assessment Guide* and supporting justifications for Brigalow TEC presented in Table H-1 below. A summary of the changes between version 3 and version 5a of the BOS are shown in Table H-2.

The following justifications support the selected scores, originally approved in version 3 of the BOS, for Stage 1 ornamental snake, squatter pigeon, waxy cabbage palm and yakka skink offset requirements.

- The quality of the habitat had been reduced at the time of the surveys due to the drought conditions, particularly where high grazing pressures has resulted in lower cover and diversity of native grasses.
- Each species has either been recorded within offset areas, or the offset areas are known to contain suitable habitat for the species.
- The vegetation in the proposed offset area is contiguous with larger areas of remnant and regrowth vegetation.
- Without offset management MDW will continue to be managed as a grazing property. Habitat degradation by stock has the potential to reduce the quality of habitat for all species.
- Grazing and trampling by stock impacts on the recruitment of native flora species.
- Without offset management exotic pasture grasses including buffel grass and other invasive weeds will continue to decline the quality of habitat within the offset area.
- Inappropriate fire regimes may also impact on the quality of habitat for some species within the offset area.
- The quality of habitat will be improved and maintained through the establishment of an offset area on MDW. An OAMP has been developed detailing management and monitoring actions for each species that are complementary to actions undertaken on the mine site.
    - The proximity of the offset area adjacent to the Project site and Adani's proposed mitigation area will allow greater coordination and consolidation of management actions across these areas and will improve habitat connectivity.

- The management actions detailed in the OAMP are based on the threat abatement and recovery actions identified in the species recovery plan and detailed field assessments of the offset area. The OAMP also details objectives and outcomes to ensure that the quality of habitat for the black-throated finch is improved and/or maintained. Biodiversity monitoring will be conducted as part of the OAMP to measure the progress of the offset area and ensure the OAMP achieves its desired outcomes.
- These management measures include, but are not limited to:
  - pest animal control
  - weed control
  - fire management.
- Current grazing regimes have been reviewed and a strategic grazing regime is proposed as a management tool to decrease presence/abundance of weeds and to maintain/decrease fuel loads in the offset area.
- The clearing of remnant vegetation in Queensland is regulated by the VM Act and the *Sustainable Planning Act 2009* and associated policies and codes. Under the VM Act, an application must be made to the state government to clear remnant vegetation unless an exemption applies. The VM Act prevents broad scale clearing of remnant vegetation for agriculture or other development activities; however, allows clearing of some remnant vegetation for resource development purposes (e.g. mining). MDW is currently subject to coal exploration permits and coal exploration permit applications and is located adjacent to the Project. The property is therefore exposed to the possibility of future resource development.
- The offset area will be secured in perpetuity through a legally binding mechanism negotiated between Adani and the Queensland and Australian Governments. Examples of legally binding mechanisms available in Queensland include an area declared as an area of high nature conservation value under the Section 19F of the VM Act, statutory covenants under the *Land Titles Act 1994* and *Land Act 1994*, declaration by regulation under Section 29(1) or 46 of the NC Act, and environmental offset protection areas under the *Environmental Offsets Act 2014*.
- The legally binding mechanism will be registered on the land title and will be binding on all current and future landowners to ensure that the habitat protected is perpetuity. Measures to legally secure the offset area are linked to an approved management approach (e.g. an application for a Voluntary Declaration must be accompanied by an approved OAMP, and a nature refuge must be managed in accordance with the declared management intent). Legal security of the offset can only occur once an OAMP has been approved by the state and Commonwealth governments.
- By selecting offsets in areas where current habitat for species already exists, the time lag between the establishment of the offset area and ecological benefit is reduced.

Table H-1: Summary of scores applied to the Brigalow TEC Offsets Assessment Guide

Input	Score	Justification
Quality of impact area	6	Ecological equivalence assessments of the mine and off-lease infrastructure areas conducted to determine baseline condition of impact areas and inform the suitability of offsets (Eco Logical Australia 2014a). Surveys were undertaken in accordance with the Ecological Equivalence Methodology (EEM) Guideline Version 1 (Department of Environment and Resource Management [DERM] 2011) and the results are presented in Appendix C..
Quality of offset area	4	Brigalow TEC is located on the eastern portion of the MDW offset area comprising areas of mature regrowth RE 11.4.9 and 11.4.8 with canopy heights greater than 5 m. The property is currently used for livestock grazing, with most areas of Brigalow TEC showing evidence of livestock grazing. Consequently, weeds and exotic pasture grasses are present throughout the offset areas, including buffel grass. The quality of Brigalow TEC was assessed in accordance with the DEHP Guide to Determining Terrestrial Habitat Quality (Version 1.2) (DEHP 2017), which identified a site quality score of 3.92/10.
Future quality without offset	4	Ongoing grazing and weed invasion will continue to reduce the quality of Brigalow TEC on MDW. Areas of Brigalow TEC will continue to be impacted by browsing, trampling and erosion, with natural regeneration of native vegetation likely to be suppressed. The likelihood of a high intensity fire may also increase due to the presence of exotic pasture grasses. High-intensity fire has the potential to detrimentally alter the Brigalow TEC vegetation structure (Butler & Fairfax 2003). On this basis and without offset management, quality is unlikely to change.
Future quality with offset	7	An offset area for Brigalow TEC on MDW will be secured and managed, with the aim to improve the quality of Brigalow TEC and provide a conservation benefit for the ecological community. As part of the offset area, an OAMP will be implemented, including specific management actions aimed at reducing the impact of threatening processes and improving the quality of Brigalow TEC within the offset area. The OAMP will be developed in accordance with approved conservation advice, recovery plans and recommended threat abatement and management advice for Brigalow TEC, including: Livestock management – livestock will be excluded from the offset area except during strategic grazing events. Strategic grazing events will be undertaken in the offset area in order to control fuel loads and exotic pasture grasses. Periods of grazing will be followed by an extended period of rest and stocking rates will depend on seasonal conditions and pasture growth. Weed control – weed hygiene restrictions and weed control activities will be undertaken within the offset area in order to reduce the threat of invasive weeds species (including exotic pasture grasses) on the structure and function of Brigalow TEC. Fire management – fire management including establishment of fire breaks and control of fuel loads will be undertaken within the offset area. This will aim to reduce the risk of high intensity bushfires within the offset and assist with natural regeneration of Brigalow TEC.
Confidence in result – future quality	70%	An OAMP will be developed in accordance with approved conservation advice, recovery plans and recommended threat abatement and management advice for Brigalow TEC, including the national recovery plan for Brigalow (Butler 2008), and discussions with the landholder. The results of published research on the threats to Brigalow TEC and the response of both remnant and regrowth vegetation to management of grazing, weeds and fire will be used to inform the OAMP. The OAMP will detail specific management objectives and outcomes aimed at improving the quality of Brigalow TEC. Ongoing monitoring of the offset area will also be undertaken to regularly assess the progress of the offset and ensure the OAMP achieves its required outcomes.

Input	Score	Justification
Risk of loss without offset	10%	Without the offset, the risk that vegetation within the offset area will be lost is taken as 10% One exploration permit (EPC 1080, granted, Waratah Coal Pty Ltd, expires 11/2022) and one Mining Lease application (ML 700031, Waratah Coal Pty Ltd, lodged 5/2018) currently overlap the NGBR offset area on MDW, and the offset area is adjacent to the CCMR Project. Consequently, it is possible that future exploration could be undertaken within the offset area. Exploration activities have the potential to lead to the establishment of mining leases, resulting in the loss of vegetation. Whilst this is a real risk, it is recognised that there may be some limitations to mining in the offset area including constraints associated with the extraction of coal, and the need to obtain approval from both the Queensland and Commonwealth Governments. Therefore, based on the above, a 10% risk is considered a reasonable estimate of the risk of loss without the offset.
Risk of loss with offset	0%	The MDW offset area will be secured in perpetuity through a legally binding mechanism negotiated between Adani and the Queensland and Australian Governments. The preferred mechanism for the protection of the offset area is Voluntary Declaration under the *Vegetation Management Act 1999*. Adani is confident that this mechanism can be achieved for the offset area. Risk of loss with offset is therefore estimated to be 0%, as protection of the offset area will prevent clearing and any future proposals to clear this vegetation would likely result in a multiplier of the original offset requirement.
Confidence in result – risk of loss	90%	The legally binding mechanism (e.g. Voluntary Declaration) will be registered on the land title and will be binding on all current and future landowners to ensure that the habitat protected is perpetuity. The legally binding mechanism will preclude all development except where the Queensland Government authorises an activity and offsets for both the original offset and any protected matters present on site are provided. Consequently, the resultant difficulty and expense acts as a strong disincentive for development within a protected offset area.
Time over which loss is averted (years)	20	The offset area will be protected by a legally binding mechanism which will remain in effect in perpetuity as required by the applicable State and Commonwealth legislative requirements, therefore, the time over which loss is averted is accorded the maximum allowable time of 20 years.
Time until ecological benefit (years)	20	It is estimated that it will take 20 years for the Brigalow TEC habitat within the offset area to realise habitat quality score improvements. This increase in the habitat quality score will principally be achieved by: ▶ improving the quality of habitat (structure and composition) through weed control, with a focus on replacing perennial weed species with native shrubs and grasses. ▶ reducing impacts of pest animals (e.g. pigs) through the implementation of pest animal control strategies (i.e. improving species habitat index score).

Table H-2: Summary of offset areas used in OAGs for offset values from BOS version 3 to version 5a

Offset Values	CCMR BOS Version 3	CCMR BOS Version 4	CCMR BOS Version 5a	Justification
Ornamental snake	MDW	MDW	MDW	OAGs completed and approved for MDW as part of the originally approved BOS (version 3). Unchanged in version 5a.
Squatter pigeon	MDW	MDW	MDW	OAGs completed and approved for MDW as part of the originally approved BOS (version 3). Unchanged in version 5a.
Waxy cabbage palm	MDW	MDW	MDW	OAGs completed and approved for MDW as part of the originally approved BOS (version 3). Unchanged in version 5a.
Yakka skink	MDW	MDW	MDW	OAGs completed and approved for MDW as part of the originally approved BOS (version 3). Unchanged in version 5a.
Brigalow TEC	Property 3, Property 4, Property 5 and Property 6 (as referred to in version 3)	Additional land-based offset	MDW	The 'additional land-based offset' replaced the previous group of four properties to acquit the Stage 1 offset requirements for Brigalow TEC in version 4 of the BOS. After the 'additional land-based offset' was withdrawn as an offset option, this BOS (version 5a) included a new additional offset area in the eastern portion of MDW to acquit Stage 1 offset requirements for Brigalow TEC.

Except for black-throated finch (refer to Appendix I), relevant OAG spreadsheets for the MDW Stage 1 offset area are presented below, including:

- Ornamental snake
- Squatter pigeon
- Waxy cabbage palm
- Yakka skink
- Brigalow TEC.

STAGE 2 OFFSET DELIVERY

ML70506 and Property 1

Offsets Assessment Guides for the following values have been completed for ML70506 and for a designated portion of Property 1 area:

- Black-throated finch.

As a precautionary approach, conservative estimates have been made when selecting scores to populate the spreadsheets, justifications for the scores selected include:

- Assessment identified approximately 1,572 ha potential habitat for the black-throated finch in the ML70506 area, and approximately 3,439 ha in the Property 1 area
- The quality of the habitat had been reduced at the time of the surveys due to the drought conditions, particularly where high grazing pressures has resulted in lower cover and diversity of native grasses
- The vegetation in the ML70506 area and the Property 1 area is contiguous with larger areas of remnant and regrowth vegetation, including the offset areas for Stage 1 offset delivery
- Without offset management, habitat degradation by stock has the potential to reduce the quality of habitat for black-throated finch
- Without offset management exotic pasture grasses including buffel grass and other invasive weeds will continue to decline the quality of habitat within the offset area
- Inappropriate fire regimes may also impact on the quality of habitat within the offset area
- The quality of habitat will be improved and maintained through the establishment of an offset area in ML70506 and the designated portion of Property 1. The location of both offset areas adjacent to the Project site and the MDW offset area will allow greater coordination and consolidation of management actions across these areas and will improve habitat connectivity
- The management actions required for an offset in ML70506 and the Property 1area will be the same, or similar to, those detailed in the submitted MDW OAMP, based on the threat abatement and recovery actions identified in the species recovery plan, detailed field assessments of the offset area and negotiations with the landholder. The OAMP will also detail objectives and outcomes to ensure that the quality of habitat for the black-throated finch is improved and/or maintained. Biodiversity monitoring will be conducted as part of the OAMP to measure the progress of the offset area and ensure the OAMP achieves its desired outcomes
- These management measures include, but are not limited to:
  - pest animal control
  - weed control
  - fire management.
- The clearing of remnant vegetation in Queensland is regulated by the VM Act and the *Sustainable Planning Act 2009* and associated policies and codes. Under the VM Act, an application must be made to the state government to clear remnant vegetation unless an exemption applies. The VM Act prevents broad scale clearing of remnant vegetation for agriculture or other development activities; however, allows clearing of some remnant vegetation for resource development purposes (e.g. mining).

- The offset area will be secured in perpetuity through a legally binding mechanism negotiated between Adani and the Queensland and Australian Governments. Examples of legally binding mechanisms available in Queensland include an area declared as an area of high nature conservation value under the Section 19F of the VM Act, statutory covenants under the *Land Titles Act 1994* and *Land Act 1994*, declaration by regulation under Section 29(1) or 46 of the NC Act, and environmental offset protection areas under the *Environmental Offsets Act 2014*.
- The legally binding mechanism will be registered on the land title and will be binding on all current and future landowners to ensure that the habitat protected is perpetuity.
- By selecting offsets in areas where current habitat for species already exists, the time lag between the establishment of the offset area and ecological benefit is reduced.

All relevant spreadsheets for ML70506 and Property 1 are presented below, these include:

- BTF ML70506 Stage 2 impacts on:
  - critical habitat offset with critical habitat
  - critical habitat offset with core habitat
  - core habitat offset with core habitat
  - marginal habitat offset with marginal habitat.
- BTF Property 1 Stage 2 impacts on:
  - critical habitat offset with critical habitat
  - critical habitat offset with core habitat
  - core habitat offset with core habitat
  - marginal habitat offset with marginal habitat.

Property 2

Offsets Assessment Guides for the following values have been completed for Property 2:

- Black-throated finch.

As a precautionary approach, conservative estimates have been made when selecting scores to populate the spreadsheets, justifications for the scores selected include:

- Property 2 consists almost entirely of remnant vegetation dominated by eucalypt woodlands.
- A desktop assessment identified approximately 14,148 ha of potential habitat for the black-throated finch on the property. Additionally, the black-throated finch has been recorded on a number of occasions on the property.
- The property is currently used for cattle grazing, with an average stocking rate of 2,000 – 3,000 head of cattle. At the time of the field assessment (February 2014) the property was drought affected and in areas showed signs of severe erosion caused by overgrazing.
- Large populations of feral pigs were observed, as well as, around heavily disturbed areas, dense infestations of the weed species parthenium (Parthenium hysterophorus).

- Black-throated finch habitat on Property 2 is currently at risk from overgrazing, degradation caused by feral pig populations, drought and invasion by exotic weed species. These factors will continue to impact on the black-throated finch and its habitat and further degrade the quality of the offset area.
- The quality of habitat for the black-throated finch will be improved and/or maintained through the establishment of an offset area on Property 2. An OAMP will be developed which will detail management actions to improve and/or maintain habitat for the black-throated finch. These management measures will include, but are not limited to:
  - water point management
  - pest animal control
  - weed control
  - fire management.
- Current grazing regimes will also be reviewed in consultation with the landholder in order to minimise overgrazing within areas of habitat for the black-throated finch.
- The proximity of the offset area adjacent to the project site and Adani's proposed offset areas will allow greater coordination and consolidation of management actions for the black-throated finch across these areas and will improve habitat connectivity.
- The management actions detailed in the OAMP will be based on the threat abatement and recovery actions identified in the species recovery plan, detailed field assessments of the offset area and negotiations with the landholder. The OAMP will also detail objectives and outcomes to ensure that the quality of habitat for the black-throated finch is improved and/or maintained. Biodiversity monitoring will be conducted as part of the OAMP to measure the progress of the offset area and ensure the OAMP achieves its desired outcomes.
- The clearing of remnant vegetation in Queensland is regulated by the VM Act and the *Sustainable Planning Act 2009* and associated policies and codes. Under the VM Act, an application must be made to the state government to clear remnant vegetation unless an exemption applies. The VM Act prevents broad scale clearing of remnant vegetation for agriculture or other development activities; however, allows clearing of some remnant vegetation for resource development purposes (e.g. mining).
- Property 2 is currently subject to coal exploration permits and coal exploration permit applications. The property is therefore exposed to the possibility of future resource development.
- The offset area will be secured in perpetuity through a legally binding mechanism negotiated between Adani and the Queensland and Australian Governments. Examples of legally binding mechanisms available in Queensland include an area declared as an area of high nature conservation value under the Section 19F of the VM Act, statutory covenants under the *Land Titles Act 1994* and *Land Act 1994*, declaration by regulation under Section 29(1) or 46 of the NC Act, and environmental offset protection areas under the *Environmental Offsets Act 2014*.
- The legally binding mechanism will be registered on the land title and will be binding on all current and future landowners to ensure that the habitat protected is perpetuity.
- By selecting offsets in areas where current habitat for species already exists, the time lag between the establishment of the offset area and ecological benefit is reduced.

All relevant spreadsheets for Property 2 are presented below, these include:

- BTF Property 2 Stage 2 impacts on:
  - critical habitat offset with critical habitat
  - critical habitat offset with core habitat
  - core habitat offset with core habitat
  - marginal habitat offset with marginal habitat.

Property 3

Offsets Assessment Guides for the following values have been completed for Property 3:

- Black-throated finch.

As a precautionary approach, conservative estimates have been made when selecting scores to populate the spreadsheets, justifications for the scores selected include:

- The majority of Property 3 is mapped as least concern remnant vegetation and is estimated to contain 57,663 ha of suitable habitat for the black-throated finch.
- The species has been recorded on the property by several sources including during a preliminary survey by GHD.
- While the surveys identified that Property 3 does contain important habitat for the species, the condition of the habitat varied from poor to good quality. The poorer quality areas have been subjected to heavy grazing.
- Black-throated finch habitat on Property 3 is at risk of degradation and loss due to current land management actions, including heavy cattle grazing. Additionally, weed infestations, pest animals and inappropriate fire regimes all have the potential to impact on the black-throated finch and its habitat.
- The quality of habitat for the black-throated finch will be improved and/or maintained through the establishment of an offset area on Property 3. An OAMP will be developed which will detail management actions to improve and/or maintain habitat for the black-throated finch on the property. These management measures will include, but are not limited to:
  - water point management
  - livestock management
  - pest animal control
  - weed control
  - fire management.
- Current grazing regimes will be reviewed in consultation with the landholder in order to minimise overgrazing within areas of habitat for the black-throated finch.
- The proximity of the offset area adjacent to the project site and Adani's proposed offset areas will allow greater coordination and consolidation of management actions for the black-throated finch across these areas and will improve habitat connectivity.
- The management actions detailed in the OAMP will be based on the threat abatement and recovery actions identified in the species recovery plan, detailed field assessments of the offset area and

negotiations with the landholder. The OAMP will also detail objectives and outcomes to ensure that the quality of habitat for the black-throated finch is improved and/or maintained. Biodiversity monitoring will be conducted as part of the OAMP to measure the progress of the offset area and ensure the OAMP achieves its desired outcomes.

- The clearing of remnant vegetation in Queensland is regulated by the VM Act and the *Sustainable Planning Act 2009* and associated policies and codes. Under the VM Act, an application must be made to the state government to clear remnant vegetation unless an exemption applies. The VM Act prevents broad scale clearing of remnant vegetation for agriculture or other development activities; however, allows clearing of some remnant vegetation for resource development purposes (e.g. mining).
- Property 3 is currently subject to coal exploration permits and coal exploration permit applications. The property is therefore exposed to the possibility of future resource development. Additionally, areas that are not mapped as remnant vegetation (i.e. regrowth) are not protected by the VM Act and can be cleared.
- The offset area will be secured in perpetuity through a legally binding mechanism negotiated between Adani and the Queensland and Australian Governments. Examples of legally binding mechanisms available in Queensland include an area declared as an area of high nature conservation value under the Section 19F of the VM Act, statutory covenants under the *Land Titles Act 1994* and *Land Act 1994*, declaration by regulation under Section 29(1) or 46 of the NC Act, and environmental offset protection areas under the *Environmental Offsets Act 2014*.
- The legally binding mechanism will be registered on the land title and will be binding on all current and future landowners to ensure that the habitat protected is perpetuity.
- By selecting offsets in areas where current habitat for species already exists, the time lag between the establishment of the offset area and ecological benefit is reduced.

All relevant spreadsheets for Property 3 are presented below, these include:

- BTF Property 3 Stage 2 impacts on:
  - critical habitat offset with critical habitat
  - core habitat offset with core habitat
  - marginal habitat offset with marginal habitat.

Properties 4, 5 and 6

Offsets Assessment Guides for the following values have been completed for Properties 4, 5, and 6:

- Brigalow threatened ecological community.

As a precautionary approach, conservative estimates have been made when selecting scores to populate the spreadsheets, justifications for the scores selected include, but are not limited to:

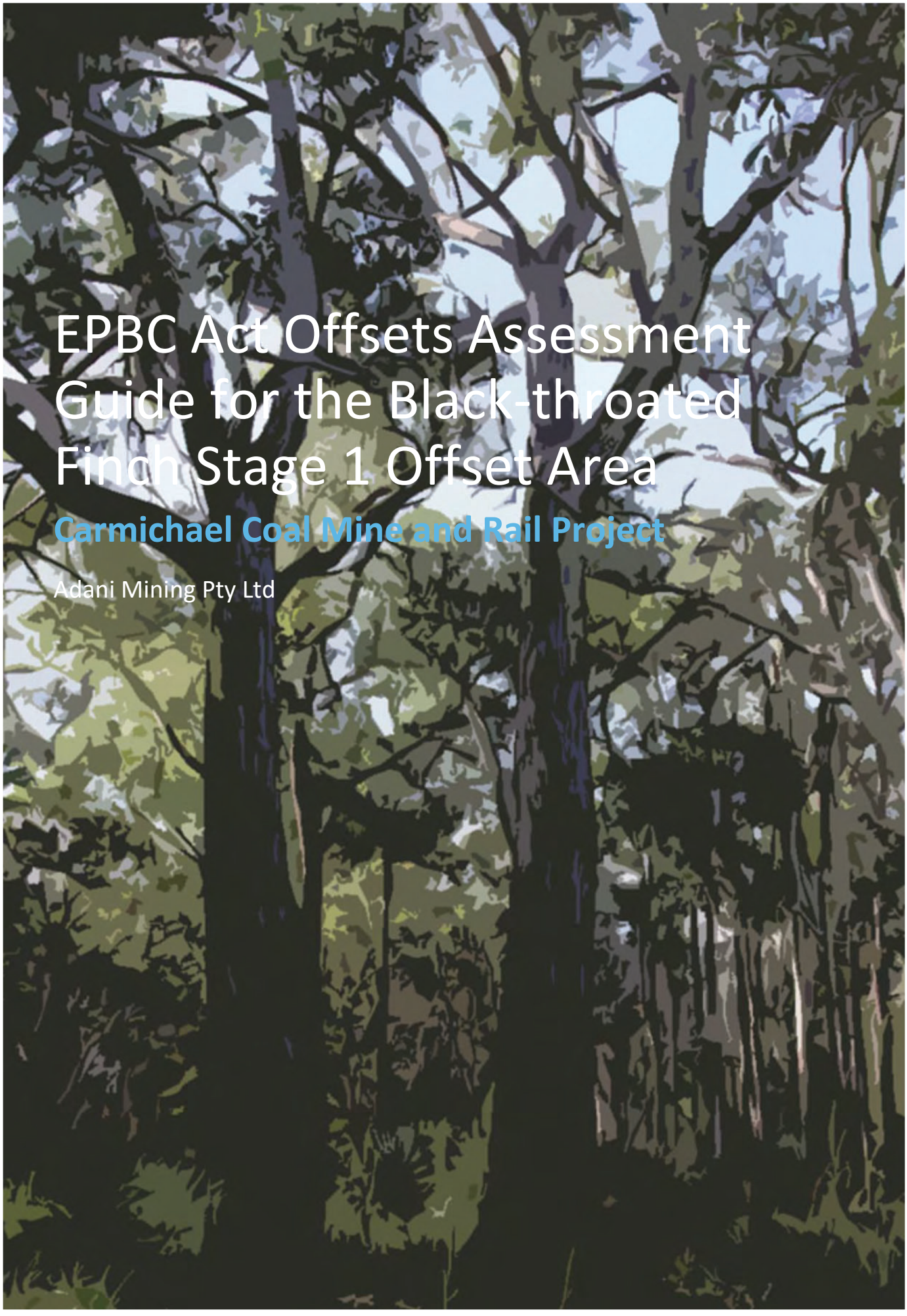
- A desktop assessment has identified Brigalow TEC is likely to be present on the properties based on the presence of relevant regional ecosystems.
- Most of this vegetation is expected to be regrowth, with some remnant vegetation on some properties.
- No field surveys of the properties have been undertaken.

- Current land management practices on the properties include cattle grazing. High intensity preferential grazing of Brigalow can result in the removal of trees, prevent regrowth and cause the eventual transition of the Brigalow vegetation to grasslands.
- As part of securing an offset area on a property, an OAMP will be developed to improve and/or maintain the ecological condition and viability of Brigalow TEC on the property. The OAMP will detail specific management actions to control the presence of weed species and exotic grasses and reduce the occurrence of high intensity fires within Brigalow TEC. Current grazing regimes will also be reviewed in consultation with the landholder in order to restrict access of cattle into Brigalow TEC.
- The management actions detailed in the OAMP will be developed based on published conservation recommendations, detailed field assessments of the offset area and negotiations with the landholder. The OAMP will also detail objectives and outcomes to ensure that the ecological condition and viability of regrowth and remnant Brigalow TEC is improved and/or maintained. Biodiversity monitoring will be conducted as part of the OAMP to measure the progress of the offset area and ensure the OAMP achieves its desired outcome.
- The clearing of remnant vegetation in Queensland is regulated by the VM Act and the *Sustainable Planning Act 2009* and associated policies and codes. Under the VM Act, an application must be made to the state government to clear remnant vegetation unless an exemption applies. The VM Act prevents broad scale clearing of remnant vegetation for agriculture or other development activities; however, allows clearing of some remnant vegetation for resource development purposes (e.g. mining). Additionally, areas of Brigalow that are not mapped as remnant vegetation on the property (i.e. regrowth Brigalow) are not protected by the VM Act and can be cleared.
- The offset area will be secured in perpetuity through a legally binding mechanism negotiated between the landholder, Adani and the Queensland/Australian Governments.
- The legally binding mechanism will be registered on the land title and will remain in effect in perpetuity.
- The implementation of site-specific land management actions through the development of an OAMP is expected to increase the quality of the offset area by reducing potential threats to Brigalow TEC on the property. Research on the response of Brigalow TEC to management actions such as reducing grazing pressure and managing fuel loads has shown that measurable improvements in ecological condition over relatively short timeframes.

All relevant spreadsheets for these properties are presented below:

- Brigalow Property 4 Stage 2
- Brigalow Property 5 Stage 2
- Brigalow Property 6 Stage 2.

APPENDIX I MORAY DOWNS WEST BLACK-THROATED FINCH EPBC ACT OFFSETS ASSESSMENT GUIDES



EPBC Act Offsets Assessment Guide for the Black-throated Finch Stage 1 Offset Area

Carmichael Coal Mine and Rail Project

Adani Mining Pty Ltd

DOCUMENT CONTROL

Rev	Date	Description
0	02 June 2016	Final for issue to client
1	09 July 2019	Available offset areas for each habitat type updated to reflect surveyed Moray Downs West property boundary (dated 26 June 2019) – all other information as per Rev 0

	Name	Position	Date
ORIGINATORS	Jarrad Cousin Claire Fletcher	Senior Ecologist Consultant	12 July 2019
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TABLE OF CONTENTS

1 INTRODUCTION

CO2 Australia Limited (CO2 Australia) has prepared this summary report to outline justifications for the input scores used in the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Offsets Assessment Guides (the guides) for the black-throated finch southern subspecies (*Poephila cincta cincta*). The guides have been prepared to assess the suitability of the proposed black-throated finch Stage 1 offset area for the Carmichael Coal Mine and Rail Project (the Project). The Stage 1 offset area is located on Moray Downs West and is further described in the Project's Biodiversity Offset Strategy, including detailed surveys undertaken between 2014 and 2019. The Stage 1 impacts of the Project and corresponding offset area include habitat defined as critical, core and marginal for the black-throated finch. Accordingly, guides have been prepared to assess the suitability of offsets for impacts on:

- critical habitat, which is proposed to be offset using critical habitat (Section 4)
- critical habitat, which is proposed to be offset using core habitat (Section 5)
- core habitat, which is proposed to be offset using core habitat (Section 6)
- marginal habitat, which is proposed to be offset using marginal habitat (Section 7)

2 SUMMARY OF RESULTS

A summary of results, based on the inputs presented in this report, is provided in Table 1 below. These results indicate that for each habitat type, the total percent of impact offset exceeds 100. Additionally, the total offset area of 20,284.24 ha exceeds the minimum black-throated finch Stage 1 offset area of 20,274.49 ha, as required under the EPBC Act approval (EPBC 2010/5736).

Table 1: Offsets Assessment Guide results for the black-throated finch Stage 1 offset area on Moray Downs West

Habitat definition	Regional Ecosystems	Stage 1 impact (ha)	Stage 1 offset area Moray Downs West				Total percent of impact offset (%)
			Critical (ha)	Core (ha)	Marginal (ha)	Total offset area (ha)	
Critical Core habitat within 3 km to water	10.3.6a 10.3.6ax1 10.3.12a 10.3.13a 10.3.14d 10.5.2b 10.5.5a 10.5.10 11.3.25 11.3.27	4,628.23	10,564.00	4,839.56	0.00	15,403.56	100.96
Core Important foraging and potential breeding habitat		725.83	0.00	1,912.40	0.00	1,912.40	102.29
Marginal Potential foraging and dispersal habitat	10.3.15g 10.5.1a 10.5.1b 10.5.1c 10.7.4 11.3.3c	739.32	0.00	0.00	2,970.79	2,970.79	116.40

Habitat definition	Regional Ecosystems	Stage 1 impact (ha)	Stage 1 offset area Moray Downs West				Total percent of impact offset (%)
			Critical (ha)	Core (ha)	Marginal (ha)	Total offset area (ha)	
Total	-	**6,093.38**	**10,564.00**	**6,751.96**	**2,970.79**	**20,286.75**	-

3 INPUT SCORES AND JUSTIFICATIONS

3.1 IMPACTS ON CRITICAL HABITAT

3.1.1 Critical habitat offsets

Table 2 outlines the input scores and corresponding justifications used to assess the suitability of the offset for impacts on critical habitat, which is proposed to be offset using critical habitat. The corresponding spreadsheet for this table is presented in Section 4.

Table 2: Offsets Assessment Guide input scores and justifications for impacts on critical habitat which are proposed to be offset using critical habitat

Field	Value	Justification
Habitat quality of the impact area (scale of 0-10)	8	The habitat quality of the impact area considers site condition, site context and species stocking rate. Scores for site condition and context are based on the results of BioCondition assessments undertaken within the impact area by Eco Logical Australia Pty Ltd in December 2013 (EcoLogical Australia 2014a). Detailed calculations of habitat quality for the impact area are presented in Section 8 Based on these calculations, site condition and context scored 6.43/10, and species stocking rate scored 10/10. Site condition and context comprise 60% of the overall habitat quality score, and species stocking rate comprises 40%. Based on this assessment the overall habitat quality score for the impact area is 7.86/10. This score has been rounded up to 8 in the guide.
Time over which loss is averted (max 20 years)	20	The preferred protection mechanism for the offset area is a Nature Refuge under the *Nature Conservation Act 1992* (NC Act). As the offset area is proposed to be protected in perpetuity, the time over which loss is averted is the maximum allowable time of 20 years.
Time until ecological benefit (years)	5	The National Recovery Plan for the black-throated finch southern subspecies *Poephila cincta cincta* (BTFRT 2007) identified threats as inter alia, clearing and fragmentation of habitat, degradation of habitat by domestic stock and rabbits, alteration of habitat by changes in fire regime, weed invasion and predation by feral predators. The Threat Abatement Plan for competition and land degradation by rabbits (DEE 2016) identified black-throated finch (southern) as a species that may be adversely affected by competition and land degradation caused by rabbits (*Oryctolagus cuniculus*). Offset management within critical habitat areas will be consistent with the National Recovery Plan and Threat Abatement Plan by incorporating management actions addressing relevant threats, including: ▶ minimising degradation of habitat by domestic stock by removal and/or reduction of cattle ▶ control of feral pest animals (e.g. rabbits, feral cats and foxes) ▶ controlling invasion of habitat by exotic weed species, including exotic grasses by implementing a weed control program ▶ development and implementation of a fire management plan.

		Critical habitat is defined as core habitat located within 3 km of a water source. The black-throated finch has been recorded in critical habitat within the Stage 1 offset area. Selecting offsets in areas with known habitat for the species reduces the time lag between the establishment of the offset and ecological benefit. As the critical offset areas are known habitat for the black-throated finch, it is anticipated that the management actions described above (and actions further described in the 'future quality with offset' section below) will result in an improvement of the habitat quality score from 8/10 to 9/10 within a five year timeframe.
Start quality (scale of 0-10)	8	The start quality of the offset area considers site condition, site context and species stocking rate. Scores for site condition and context are based on the results of BioCondition assessments undertaken within the offset areas by Eco Logical Australia Pty Ltd in September 2014 (EcoLogical Australia 2014b). Detailed calculations of habitat quality for the offset area are presented in Section 9. Based on these calculations, site condition and context scored 6.30/10, and species stocking rate scored 10/10. Site condition and context comprise 60% of the overall habitat quality score, and species stocking rate comprises 40%. Based on this assessment the overall habitat quality score for the offset area is 7.78/10. This score has been rounded to 8 in the guide.
Future quality without offset (scale of 0-10)	7	Without the offset Moray Downs West will continue to be managed as a grazing property. Degradation of habitat by domestic stock is listed as a threat to the black-throated finch in the National Recovery Plan (BTFRT 2007). Additionally, without the offset, species specific offset management actions will not be implemented. Consequently, the critical habitat areas will continue to be at risk of degradation from identified threatening processes, particularly from grazing of domestic stock, weed incursion, pest animals and inappropriate fire regimes. Without offset management it has been conservatively calculated that the overall habitat quality of the offset area will decrease over time from 8/10 to 7/10.
Future quality with offset (scale of 0-10)	9	Protection of critical habitat for the black-throated finch, and management of threatening processes, has the potential to realise an improvement in overall habitat quality. An offset area management plan (OAMP) has been developed and submitted to the Commonwealth government for approval. It includes management actions based on the threat abatement and recovery actions identified in recovery plans, and detailed field assessments. The OAMP also details specific objectives, performance criteria and corrective actions to ensure that the quality of habitat for the black-throated finch is improved over time. Biodiversity monitoring will be conducted as part of the OAMP to measure the progress of the offset area and ensure the OAMP achieves its desired outcomes. Results of site assessments to date indicate that the offset management areas vary in their range of values and condition, which will define the spatial extent of various management measures. A strategic livestock grazing regime, incorporating a light grazing density, will be implemented to minimise the impact of the current grazing regime. This regime has led to an increase in exotic weed cover (e.g. *Cenchrus ciliaris*) throughout much of the offset areas at the expense of key grass species diversity and abundance. In addition to a strategic livestock grazing regime, ongoing management of the offset areas will include, weed management, pest control, fire management and provision of additional watering points, with the objective of improving the quality of habitat within the offset area and providing a conservation gain for the black-throated finch. Importantly, results of the Project's black-throated finch research program (appended to the Project's Black-throated Finch Management Plan, EcoLogical Australia 2019) will

		be reviewed annually to ensure ongoing management is consistent with the latest understanding of ecological requirements of the species. This adaptive management approach will likely result in revision of management objectives, management measures and monitoring activities in the OAMP, based on the outcomes of the research program, namely, results of experimental manipulation of habitat via grazing, fire and addition of constructed water sources. Therefore, through the implementation of the OAMP an increase in habitat quality, from 8 to 9, is expected to be achieved.
Risk of loss (%) without offset	40%	Parts of the Stage 1 offset area are currently subject to coal exploration permits and petroleum production permits. Applications have also been made for a mineral development licence and mining lease; however, these applications do not represent mining tenure. Future mining of these areas is considered low given the viability of the resources and the status of the applications made. Nonetheless, the Project is exposed to the possibility of future resource development and, therefore, the risk of loss without offset is considered to be 40%.
Risk of loss (%) with offset	20%	The stage 1 offset area will be secured in perpetuity through a legally binding mechanism negotiated between the landholder, Adani and the Queensland and Australian governments. The preferred legal mechanism for offset protection is a Nature Refuge under the NC Act. The legally binding mechanism will be registered on the land title and will be binding on all current and future landowners to ensure that the habitat is protected in perpetuity. Therefore, the risk of loss of black-throated finch habitat on the Moray Downs West property with the offset is anticipated to decrease to 20%.
Confidence in result – averted loss (%)	90%	Under the NC Act, a Nature Refuge provides high level, long term protection for conservation values, including habitat for threatened species. It is perpetual, registrable on title and binds successive owners or lessees of the land. Once the Nature Refuge agreement is made between the Queensland Government and the landholder, it has effect until it expires under its terms and can only be terminated if the landholder requests its termination and the Minister is of the opinion that the Nature Refuge to which the agreement relates is no longer needed for, or is no longer capable of being used to achieve, the declared management intent for the Nature Refuge. Through the protection of the offset area via a Nature Refuge agreement, the confidence in result (averted loss) is considered to be 90%.
Confidence in result - change in habitat quality (%)	90%	Critical habitat in the offset area is known habitat for the species. Accordingly, management of only a small number of threatening processes (e.g. grazing, weed control and fire management) is highly likely to result in an increase in habitat quality. Ongoing monitoring will be undertaken to assess the change in habitat quality. Only a slight increase in site condition, context and species stocking rate is required to increase the overall habitat quality score from an 8 to a 9, therefore the confidence in result (change in habitat quality) is 90%.

3.1.2 Core habitat offsets

Table 3 outlines the input scores and corresponding justifications used to assess the suitability of the offset for impacts on critical habitat, which is proposed to be offset using core habitat. The corresponding spreadsheet for this table is presented in Section 5 .

Table 3: Offsets Assessment Guide input scores and justifications for impacts on critical habitat which are proposed to be offset using core habitat

Field	Value	Justification
Habitat quality of the impact area	8	The habitat quality of the impact area takes into account site condition, site context and species stocking rate. Scores for site condition and context are based on the

(scale of 0-10)		results of BioCondition assessments undertaken within the impact area by Eco Logical Australia Pty Ltd in December 2013 (EcoLogical Australia 2014a).. Detailed calculations of habitat quality for the impact area are presented in Section 8. Based on these calculations, site condition and context scored 6.43/10, and species stocking rate scored 10/10. Site condition and context comprise 60% of the overall habitat quality score, and species stocking rate comprises 40%. Based on this assessment the overall habitat quality score for the impact area is 7.86/10. This score has been rounded up to 8 in the guide.
Time over which loss is averted (max 20 years)	20	The preferred protection mechanism for the offset area is a Nature Refuge under the NC Act. As the offset area is proposed to be protected in perpetuity, the time over which loss is averted is the maximum allowable time of 20 years.
Time until ecological benefit (years)	5	The National Recovery Plan for the black-throated finch southern subspecies *Poephila cincta cincta* (BTFRT 2007) identified threats as inter alia, clearing and fragmentation of habitat, degradation of habitat by domestic stock and rabbits, alteration of habitat by changes in fire regime, weed invasion and predation by feral predators. The Threat Abatement Plan for competition and land degradation by rabbits (DEE 2016) identified black-throated finch (southern) as a species that may be adversely affected by competition and land degradation caused by rabbits (*Oryctolagus cuniculus*). Offset management within core habitat areas will be consistent with the National Recovery Plan and Threat Abatement Plan by incorporating management actions addressing relevant threats, including: • minimising degradation of habitat by domestic stock by removal and/or reduction of cattle • control of feral pest animals (e.g. rabbits, feral cats and foxes) • controlling invasion of habitat by exotic weed species, including exotic grasses by implementing a weed control program • development and implementation of a fire management plan. One of the key differences between critical and core habitat is the absence of watering sources within 3 km of identified core habitat. Therefore, in addition to the management actions outlined above, habitat quality will also be improved through the installation of artificial watering points. These points will be raised and only be accessible to birds. Core habitat is defined as important foraging and potential breeding habitat for the black-throated finch and includes regional ecosystems 10.3.6a, 10.3.6ax1, 10.3.12a, 10.3.13a, 10.3.14d, 10.5.2b, 10.5.5a, 10.5.10, 11.3.25 and 11.3.27. The black-throated finch has been recorded in core habitat within the Stage 1 offset area. Selecting offsets in areas of known habitat for the species reduces the time lag between the establishment of the offset and ecological benefit. As the core offset areas are known habitat for the black-throated finch, it is anticipated that results from the management actions described above (and actions further described in the 'future quality with offset' section below) will improve the habitat quality score from 7/10 to 9/10 within a five year timeframe.
Start quality (scale of 0-10)	7	The start quality of the offset area takes into account site condition, site context and species stocking rate. Scores for site condition and context are based on the results of BioCondition assessments undertaken within the offset areas by Eco Logical Australia Pty Ltd in September 2014 (EcoLogical Australia 2014b).. Detailed calculations of habitat quality for the offset area are presented in Section 9.

		Based on these calculations, site condition and context scored 6.46/10, and species stocking rate scored 8.25/10. Site condition and context comprise 60% of the overall habitat quality score, and species stocking rate comprises 40%. Based on this assessment the overall habitat quality score for the offset area (core habitat) is 7.18/10. This score has been rounded to 7 in the guide.
Future quality without offset (scale of 0-10)	6	Without the offset Moray Downs West will continue to be managed as a grazing property. Degradation of habitat by domestic stock is listed as a threat to the black-throated finch in the National Recovery Plan (BTFRT 2007).. Additionally, without the offset, species specific offset management actions will not be implemented. Consequently, the core habitat areas will continue to be at risk of degradation from identified threatening processes, particularly from grazing of domestic stock, weed incursion, pest animals and inappropriate fire regimes. Without offset management it has been conservatively calculated that the habitat quality of the offset area will decrease over time from 7/10 to 6/10.
Future quality with offset (scale of 0-10)	9	Protection of core habitat for the black-throated finch, management of threatening processes, and the installation of artificial watering points has the potential to realise an improvement in overall habitat quality. An OAMP has been developed and submitted to the Commonwealth government for approval. It includes management actions based on the threat abatement and recovery actions identified in recovery plans, and detailed field assessments. The OAMP also details specific objectives, performance criteria and corrective actions to ensure that the quality of habitat for the black-throated finch is improved over time. Biodiversity monitoring will be conducted as part of the OAMP to measure the progress of the offset area and ensure the OAMP achieves its desired outcomes. Results of site assessments to date indicate that the offset management areas vary in their range of values and condition, which will define the spatial extent of various management measures. A strategic livestock grazing regime, incorporating a light grazing density, will be implemented to minimise the impact of the current grazing regime. This regime has led to an increase in exotic weed cover (e.g. *Cenchrus ciliaris*) throughout much of the offset areas at the expense of key grass species diversity and abundance. In addition to a strategic livestock grazing regime, ongoing management of the offset areas will include, weed management, pest control, fire management and provision of additional watering points, with the objective of improving the quality of habitat within the offset area and providing a conservation gain for the black-throated finch. Importantly, results of the Project's black-throated finch research program (appended to the Project's Black-throated Finch Management Plan, EcoLogical Australia 2019)will be reviewed annually to ensure ongoing management is consistent with the latest understanding of ecological requirements of the species. This adaptive management approach will likely result in revision of management objectives, management measures and monitoring activities in the OAMP, based on the outcomes of the research program, namely, results of experimental manipulation of habitat via grazing, fire and addition of constructed water sources. Therefore, through the implementation of the OAMP an increase in habitat quality, from 7 to 9, is expected to be achieved through improvement in both site condition and context, and also an improved score for species stocking rate.
Risk of loss (%) without offset	40%	Parts of the Stage 1 offset area are currently subject to coal exploration permits and petroleum production permits. Applications have also been made for a mineral development licence and mining lease; however, these applications do not represent mining tenure. Future mining of these areas is considered low given the viability of the resources and the status of the applications made. Nonetheless, the project is

		exposed to the possibility of future resource development and, therefore, the risk of loss without offset is considered to be 40%.
Risk of loss (%) with offset	20%	The stage 1 offset area will be secured in perpetuity through a legally binding mechanism negotiated between the landholder, Adani and the Queensland and Australian Governments. The preferred legal mechanism for offset protection is a Nature Refuge under the NC Act. The legally binding mechanism will be registered on the land title and will be binding on all current and future land owners to ensure that the habitat is protected in perpetuity. Therefore, the risk of loss of black-throated finch habitat on the Moray Downs West property with the offset is anticipated to decrease to 20%.
Confidence in result – averted loss (%)	90%	Under the NC Act, a Nature Refuge provides high level, long term protection for conservation values, including habitat for threatened species. It is perpetual, registrable on title and binds successive owners or lessees of the land. Once the Nature Refuge agreement is made between the Queensland Government and the landholder, it has effect until it expires under its terms and can only be terminated if the landholder requests its termination and the Minister is of the opinion that the Nature Refuge to which the agreement relates is no longer needed for, or is no longer capable of being used to achieve, the declared management intent for the Nature Refuge. Through the protection of the offset area via a Nature Refuge agreement, the confidence in result (averted loss) is considered to be 90%.
Confidence in result - change in habitat quality (%)	85%	Core habitat within the offset area is already recognised as important foraging and potential breeding habitat for the black-throated finch. Accordingly, management of only a small number of threatening processes (e.g. grazing, weed control and fire management) is likely to result in an increase in habitat quality. Additionally, the installation of watering points within core habitat areas is expected to see an increase in the species stocking rate, given the importance of access to water for the subspecies. Ongoing monitoring will be undertaken to assess the change in habitat quality, with specific monitoring activities to assess the use of artificial watering points by individual black-throated finch. Based on the implementation of these actions, the confidence in result (change in habitat quality) is considered to be 85%.

3.2 IMPACTS ON CORE HABITAT

Table 4 outlines the input scores and corresponding justifications used to assess the suitability of the offset for impacts on core habitat, which is proposed to be offset using core habitat. The corresponding spreadsheet for this table is presented in Section 6.

Table 4: Offsets Assessment Guide input scores and justifications for impacts on core habitat which is proposed to be offset using core habitat

Field	Value	Justification
Habitat quality of the impact area (scale of 0-10)	8	The habitat quality of the impact area takes into account site condition, site context and species stocking rate. Scores for site condition and context are based on the results of BioCondition assessments undertaken within the impact area by Eco Logical Australia Pty Ltd in December 2013 (EcoLogical Australia 2014a). Detailed calculations of habitat quality for the impact area are presented in Section 8. Based on these calculations, site condition and context scored 6.45/10, and species stocking rate scored 8.25/10. Site condition and context comprise 60% of the overall habitat quality score, and species stocking rate comprises 40%. Based on this assessment the overall habitat quality score for the impact area is 7.17/10. This score has been rounded down to 7 in the guide.

Time over which loss is averted (max 20 years)	20	The preferred protection mechanism for the offset area is a Nature Refuge under the NC Act. As the offset area is proposed to be protected in perpetuity, the time over which loss is averted is the maximum allowable time of 20 years.
Time until ecological benefit (years)	5	The National Recovery Plan for the black-throated finch southern subspecies *Poephila cincta cincta* (BTFRT 2007) identified threats as inter alia, clearing and fragmentation of habitat, degradation of habitat by domestic stock and rabbits, alteration of habitat by changes in fire regime, weed invasion and predation by feral predators. The Threat Abatement Plan for competition and land degradation by rabbits (DEE 2016) (DEWHA 2008) identified black-throated finch (southern) as a species that may be adversely affected by competition and land degradation caused by rabbits (*Oryctolagus cuniculus*). Offset management within core habitat areas will be consistent with the National Recovery Plan and Threat Abatement Plan by incorporating management actions addressing relevant threats, including: ▶ minimising degradation of habitat by domestic stock by removal and/or reduction of cattle ▶ control of feral pest animals (e.g. rabbits, feral cats and foxes) ▶ controlling invasion of habitat by exotic weed species, including exotic grasses by implementing a weed control program ▶ development and implementation of a fire management plan. One of the key differences between critical and core habitat is the absence of watering sources within 3 km of identified core habitat. Therefore, in addition to the management actions outlined above, habitat quality will also be improved through the installation of artificial watering points. These points will be raised and only be accessible to birds. Core habitat is defined as important foraging and potential breeding habitat for the black-throated finch and includes regional ecosystems 10.3.6a, 10.3.6ax1, 10.3.12a, 10.3.13a, 10.3.14d, 10.5.2b, 10.5.5a, 10.5.10, 11.3.25 and 11.3.27. The black-throated finch has been recorded in core habitat within the stage 1 offset area. Selecting offsets in areas of known habitat for the species reduces the time lag between the establishment of the offset and ecological benefit. As the core offset areas are known habitat for the black-throated finch, it is anticipated that results from the management actions described above (and actions further described in the 'future quality with offset' section below) will improve the habitat quality score from 7/10 to 9/10 within a five year timeframe.
Start quality (scale of 0-10)	7	The start quality of the offset area takes into account site condition, site context and species stocking rate. Scores for site condition and context are based on the results of BioCondition assessments undertaken within the offset areas by Eco Logical Australia Pty Ltd in September 2014 (EcoLogical Australia 2014b).. Detailed calculations of habitat quality for the offset area are presented in Section 9. Based on these calculations, site condition and context scored 6.46/10, and species stocking rate scored 8.25/10. Site condition and context comprise 60% of the overall habitat quality score, and species stocking rate comprises 40%. Based on this assessment the overall habitat quality score for the offset area is 7.18/10. This score has been rounded to 7 in the guide.
Future quality without offset (scale of 0-10)	6	Without the offset Moray Downs West will continue to be managed as a grazing property. Degradation of habitat by domestic stock is listed as a threat to the black-throated finch in the National Recovery Plan (BTFRT 2007). Additionally, without the offset, species specific offset management actions will not be implemented.

		Consequently, the core habitat areas will continue to be at risk of degradation from identified threatening processes, particularly from grazing of domestic stock, weed incursion, pest animals and inappropriate fire regimes. Without offset management it has been conservatively calculated that the habitat quality of the offset area will decrease over time from 7/10 to 6/10.
Future quality with offset (scale of 0-10)	9	Protection of core habitat for the black-throated finch, management of threatening processes, and the installation of artificial watering points has the potential to realise an improvement in overall habitat quality. An OAMP has been developed and includes management actions based on the threat abatement and recovery actions identified in recovery plans, and detailed field assessments. The OAMP also details specific objectives, performance criteria and corrective actions to ensure that the quality of habitat for the black-throated finch is improved over time. Biodiversity monitoring will be conducted as part of the OAMP to measure the progress of the offset area and ensure the OAMP achieves its desired outcomes. Results of site assessments to date indicate that the offset management areas vary in their range of values and condition, which will define the spatial extent of various management measures. A strategic livestock grazing regime, incorporating a light grazing density, will be implemented to minimise the impact of the current grazing regime. This regime has led to an increase in exotic weed cover (e.g. *Cenchrus ciliaris*) throughout much of the offset areas at the expense of key grass species diversity and abundance. In addition to a strategic livestock grazing regime, ongoing management of the offset areas will include, weed management, pest control, fire management and provision of additional watering points, with the objective of improving the quality of habitat within the offset area and providing a conservation gain for the black-throated finch. Importantly, results of the project's black-throated finch research (appended to the Project's Black-throated Finch Management Plan, EcoLogical Australia 2019)will be reviewed annually to ensure ongoing management is consistent with the latest understanding of ecological requirements of the species. This adaptive management approach will likely result in revision of management objectives, management measures and monitoring activities in the OAMP, based on the outcomes of the research program, namely, results of experimental manipulation of habitat via grazing, fire and addition of constructed water sources. Therefore, through the implementation of the OAMP an increase in habitat quality, from 7 to 9, is expected to be achieved through improvement in both site condition and context, and also an improved score for species stocking rate.
Risk of loss (%) without offset	40%	Parts of the stage 1 offset area are currently subject to coal exploration permits and petroleum production permits. Applications have also been made for a mineral development licence and mining lease; however, these applications do not represent mining tenure. Future mining of these areas is considered low given the viability of the resources and the status of the applications made. Nonetheless, the project is exposed to the possibility of future resource development and, therefore, the risk of loss without offset is considered to be 40%.
Risk of loss (%) with offset	20%	The stage 1 offset area will be secured in perpetuity through a legally binding mechanism negotiated between the landholder, Adani and the Queensland and Australian Governments. The preferred legal mechanism for offset protection is a Nature Refuge under the NC Act. The legally binding mechanism will be registered on the land title and will be binding on all current and future landowners to ensure that the habitat is protected in perpetuity. Therefore, the risk of loss of black-throated finch habitat on the Moray Downs West property with the offset is anticipated to decrease to 20%.

Confidence in result – averted loss (%)	90%	Under the NC Act, a Nature Refuge provides high level, long term protection for conservation values, including habitat for threatened species. It is perpetual, registrable on title and binds successive owners or lessees of the land. Once the Nature Refuge agreement is made between the Queensland Government and the landholder, it has effect until it expires under its terms and can only be terminated if the landholder requests its termination and the Minister is of the opinion that the Nature Refuge to which the agreement relates is no longer needed for, or is no longer capable of being used to achieve, the declared management intent for the Nature Refuge. Through the protection of the offset area via a Nature Refuge agreement, the confidence in result (averted loss) is considered to be 90%.
Confidence in result - change in habitat quality (%)	85%	Core habitat within the offset area is already recognised as important foraging and potential breeding habitat for the black-throated finch. Accordingly, management of only a small number of threatening processes (e.g. grazing, weed control and fire management) is likely to result in an increase in habitat quality. Additionally, the installation of watering points within core habitat areas is expected to see an increase in the species stocking rate, given the importance of access to water for the subspecies. Ongoing monitoring will be undertaken to assess the change in habitat quality, with specific monitoring activities to assess the use of artificial watering points by individual black-throated finch. Based on the implementation of these actions, the confidence in result (change in habitat quality) is considered to be 85%.

3.3 IMPACTS ON MARGINAL HABITAT

Table 5 outlines the input scores and corresponding justifications used to assess the suitability of the offset for impacts on marginal habitat, which is proposed to be offset using marginal habitat. The corresponding spreadsheet for this table is presented in Section 7.

Table 5: Offsets Assessment Guide input scores and justifications for impacts on marginal habitat which is proposed to be offset using marginal habitat

Field	Value	Justification
Habitat quality of the impact area (scale of 0-10)	6	The habitat quality of the impact area takes into account site condition, site context and species stocking rate. Scores for site condition and context are based on the results of BioCondition assessments undertaken within the impact area by Eco Logical Australia Pty Ltd in December 2013 (EcoLogical Australia 2014a). Detailed calculations of habitat quality for the impact area are presented in Section 8. Based on these calculations, site condition and context scored 6.23/10, and species stocking rate scored 6.5/10. Site condition and context comprise 60% of the overall habitat quality score, and species stocking rate comprises 40%. Based on this assessment the overall habitat quality score for the impact area is 6.34/10. This score has been rounded down to 6 in the guide.
Time over which loss is averted (max 20 years)	20	The preferred protection mechanism for the offset area is a Nature Refuge under the NC Act. As the offset area is proposed to be protected in perpetuity, the time over which loss is averted is the maximum allowable time of 20 years.
Time until ecological benefit (years)	10	The National Recovery Plan for the black-throated finch southern subspecies *Poephila cincta cincta* (BTFRT 2007). identified threats as inter alia, clearing and fragmentation of habitat, degradation of habitat by domestic stock and rabbits, alteration of habitat by changes in fire regime, weed invasion and predation by feral predators. The Threat Abatement Plan for competition and land degradation by rabbits (DEE 2016) identified black-throated finch (southern) as a species that may be adversely affected by competition and land degradation caused by rabbits (*Oryctolagus cuniculus*).

		Offset management within marginal habitat areas will be consistent with the National Recovery Plan and Threat Abatement Plan by incorporating management actions addressing relevant threats, including: ▶ minimising degradation of habitat by domestic stock by removal and/or reduction of cattle ▶ control of feral pest animals (e.g. rabbits, feral cats and foxes) ▶ controlling invasion of habitat by exotic weed species, including exotic grasses by implementing a weed control program ▶ development and implementation of a fire management plan. In addition to the management actions outlined above, marginal habitat will also be improved through the installation of artificial watering points. These points will be raised and only be accessible to birds. It is anticipated that results from the management actions described above (and actions further described in the 'future quality with offset' section below) will improve habitat quality for the black-throated finch; however, given the black-throated finch has yet to be recorded in these areas (as opposed to the critical and core habitat areas where there are currently records), a longer timeframe of 10 years to ecological benefit has been assigned.
Start quality (scale of 0-10)	6	The start quality of the offset area takes into account site condition, site context and species stocking rate. Scores for site condition and context are based on the results of BioCondition assessments undertaken within the offset areas by Eco Logical Australia Pty Ltd in September 2014. Detailed calculations of habitat quality for the offset area are presented in Section 9. Based on these calculations, site condition and context scored 6.44/10, and species stocking rate scored 6.5/10. Site condition and context comprise 60% of the overall habitat quality score, and species stocking rate comprises 40%. Based on this assessment the overall habitat quality score for the offset area is 6.46/10. This score has been rounded down to 6 in the guide.
Future quality without offset (scale of 0-10)	5	Without the offset Moray Downs West will continue to be managed as a grazing property. Degradation of habitat by domestic stock is listed as a threat to the black-throated finch in the National Recovery Plan (BTFRT 2007). Additionally, without the offset, species specific offset management actions will not be implemented. Consequently, the marginal habitat areas will continue to be at risk of degradation from identified threatening processes, particularly from grazing of domestic stock, weed incursion, pest animals and inappropriate fire regimes. Without offset management it has been conservatively calculated that the habitat quality of the offset area will decrease over time from 6/10 to 5/10.
Future quality with offset (scale of 0-10)	7	Protection of marginal habitat for the black-throated finch, management of threatening processes, and the installation of watering points has the potential to realise an improvement in overall habitat quality. An OAMP has been developed and includes management actions based on the threat abatement and recovery actions identified in recovery plans, and detailed field assessments. The OAMP also details specific objectives, performance criteria and corrective actions to ensure that the quality of habitat for the black-throated finch is improved over time. Biodiversity monitoring will be conducted as part of the OAMP to measure the progress of the offset area and ensure the OAMP achieves its desired outcomes. Results of site assessments to date indicate that the offset management areas vary in their range of values and condition, which will define the spatial extent of various management measures. A strategic livestock grazing regime, incorporating a light grazing density, will be implemented to minimise the impact of the current grazing

		regime. This regime has led to an increase in exotic weed cover (e.g. *Cenchrus ciliaris*) throughout much of the offset areas at the expense of key grass species diversity and abundance. In addition to a strategic livestock grazing regime, ongoing management of the offset areas will include, weed management, pest control, fire management and provision of additional watering points, with the objective of improving the quality of habitat within the offset area and providing a conservation gain for the black-throated finch. Importantly, results of the project's black-throated finch research program (appended to the Project's Black-throated Finch Management Plan, EcoLogical Australia 2019)will be reviewed annually to ensure ongoing management is consistent with the latest understanding of ecological requirements of the species. This adaptive management approach will likely result in revision of management objectives, management measures and monitoring activities in the OAMP, based on the outcomes of the research program, namely, results of experimental manipulation of habitat via grazing, fire and addition of constructed water sources. Therefore, through the implementation of the OAMP an increase in habitat quality, from 6 to 7, is expected to be achieved.
Risk of loss (%) without offset	40%	Parts of the stage 1 offset area are currently subject to coal exploration permits and petroleum production permits. Applications have also been made for a mineral development licence and mining lease; however, these applications do not represent mining tenure. Future mining of these areas is considered low given the viability of the resources and the status of the applications made. Nonetheless, the project is exposed to the possibility of future resource development and, therefore, the risk of loss without offset is considered to be 40%.
Risk of loss (%) with offset	20%	The stage 1 offset area will be secured in perpetuity through a legally binding mechanism negotiated between the landholder, Adani and the Queensland and Australian Governments. The preferred legal mechanism for offset protection is a Nature Refuge under the NC Act. The legally binding mechanism will be registered on the land title and will be binding on all current and future land owners to ensure that the habitat is protected in perpetuity. Therefore the risk of loss of black-throated finch habitat on the Moray Downs West property with the offset is anticipated to decrease to 20%.
Confidence in result – averted loss (%)	90%	Under the NC Act, a Nature Refuge provides high level, long term protection for conservation values, including habitat for threatened species. It is perpetual, registrable on title and binds successive owners or lessees of the land. Once the Nature Refuge agreement is made between the Queensland Government and the landholder, it has effect until it expires under its terms and can only be terminated if the landholder requests its termination and the Minister is of the opinion that the Nature Refuge to which the agreement relates is no longer needed for, or is no longer capable of being used to achieve, the declared management intent for the Nature Refuge. Through the protection of the offset area via a Nature Refuge agreement, the confidence in result (averted loss) is considered to be 90%.
Confidence in result - change in habitat quality (%)	70%	It is anticipated that through the implementation of the OAMP habitat quality within the marginal offset areas will increase from a 6 to a 7 over a 10 year timeframe. Ongoing monitoring will be undertaken to assess the change in habitat quality, with specific monitoring activities to assess the use of artificial watering points by individual black-throated finch. Based on the implementation of these actions, the confidence in result (change in habitat quality) is considered to be 70%.

4 EPBC ACT GUIDE FOR IMPACTS ON CRITICAL HABITAT (CRITICAL HABITAT OFFSET)

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Black-throated finch
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	1.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	Black throated finch - CRITICAL HABITAT	Area	4628	Hectares	Stage 1 Impacts prepared by ELA January 2016. Habitat quality score prepared by CO2 January 2016.
			Quality	8	Scale 0-10	
			Total quantum of impact	#####	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				Risk-related time horizon (max. 20 years)		Start area (hectares)		Risk of loss (%) without offset		Risk of loss (%) with offset									
									Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0								
					Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)									
Threatened species habitat																				
Area of habitat	Yes	3702.58	Adjusted hectares	Stage 1 Offset Area Moray Downs West CRITICAL HABITAT as defined by ELA January 2016	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	1056.4	Risk of loss (%) without offset	40%	Risk of loss (%) with offset	20%	2112.80	90%	1901.52	1497.93	2422.99	65.44%	No	
									Future area without offset (adjusted hectares)	633.84	Future area with offset (adjusted hectares)	845.12								
					Time until ecological benefit	5	Start quality (scale of 0-10)	8	Future quality without offset (scale of 0-10)	7	Future quality with offset (scale of 0-10)	9	2.00	90%	1.80	1.70				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	3702.584	2422.99	65.44%	**No**	$0.00	#DIV/0!	#DIV/0!
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

5 EPBC ACT GUIDE FOR IMPACTS ON CRITICAL HABITAT (CORE HABITAT OFFSET)

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Black-throated finch
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	1.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	Black throated finch CRITICAL HABITAT	Area	4628	Hectares	Stage 1 Impacts prepared by ELA January 2016. Habitat quality score prepared by CO2 January 2016.
			Quality	8	Scale 0-10	
			Total quantum of impact	#####	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				Risk-related time horizon (max. 20 years)		Start area (hectares)		Risk of loss (%) without offset		Risk of loss (%) with offset									
									Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0								
					Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)									
Threatened species habitat																				
Area of habitat	Yes	3702.58	Adjusted hectares	Stage 1 offset Moray Downs West CORE HABITAT as defined by ELA January 2016	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	4839.56	Risk of loss (%) without offset	40%	Risk of loss (%) with offset	20%	967.91	90%	871.12	686.23	1315.19	35.52%	No	
									Future area without offset (adjusted hectares)	2903.7	Future area with offset (adjusted hectares)	3871.6								
					Time until ecological benefit	5	Start quality (scale of 0-10)	7	Future quality without offset (scale of 0-10)	6	Future quality with offset (scale of 0-10)	9	3.00	85%	2.55	2.40				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	3702.584	1315.19	35.52%	**No**	$0.00	#DIV/0!	#DIV/0!
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

6 EPBC ACT GUIDE FOR IMPACTS ON CORE HABITAT

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Black-throated finch
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	1.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	Black throated finch - Impact on CORE HABITAT	Area	725.8	Hectares	Stage 1 Impacts prepared by ELA January 2016. Habitat quality score prepared by CO2 January 2016.
			Quality	7	Scale 0-10	
			Total quantum of impact	#####	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				Risk-related time horizon (max. 20 years)		Start area (hectares)		Risk of loss (%) without offset Future area without offset (adjusted hectares)		Risk of loss (%) with offset Future area with offset (adjusted hectares)									
					Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)									
Threatened species habitat																				
Area of habitat	Yes	508.08	Adjusted hectares	Stage 1 Offset Money Downs West CORE HABITAT as defined by ELA January 2016	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	1912.4	Risk of loss (%) without offset Future area without offset (adjusted hectares)	40% 1147.4	Risk of loss (%) with offset Future area with offset (adjusted hectares)	20% 1529.9	382.48	90%	344.23	271.17	519.71	102.29%	Yes	
					Time until ecological benefit	5	Start quality (scale of 0-10)	7	Future quality without offset (scale of 0-10)	6	Future quality with offset (scale of 0-10)	9	3.00	85%	2.55	2.40				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	508.081	519.71	102.29%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**

7 EPBC ACT GUIDE FOR IMPACTS ON MARGINAL HABITAT

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Black-throated finch
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	1.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	Black throated finch - Impact on MARGINAL HABITAT	Area	739.3	Hectares	Stage 1 Impacts prepared by ELA January 2016. Habitat quality score prepared by CO2 January 2016.
			Quality	6	Scale 0-10	
			Total quantum of impact	#####	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				Risk-related time horizon (max. 20 years)		Start area (hectares)		Risk of loss (%) without offset		Risk of loss (%) with offset									
									Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0								
					Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)									
Threatened species habitat																				
Area of habitat	Yes	443.59	Adjusted hectares	Stage 1 Offset Area Moray Downs West MARGINAL HABITAT as defined by ELA January 2016	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	2970.79	Risk of loss (%) without offset	40%	Risk of loss (%) with offset	20%	594.16	90%	534.74	421.24	116.36	116.40%	Yes	
									Future area without offset (adjusted hectares)	1782.5	Future area with offset (adjusted hectares)	2376.6								
					Time until ecological benefit	10	Start quality (scale of 0-10)	6	Future quality without offset (scale of 0-10)	5	Future quality with offset (scale of 0-10)	7	2.00	70%	1.40	1.24				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	443.592	516.36	116.40%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**

8 HABITAT QUALITY SCORES FOR THE IMPACT AREA

Stage 1 Impact Area - Summary of BioCondition Scores			
Assessment unit	BTF habitat value	Area (ha)	BioCondition score
2	Critical	26.92894987	65.2
3	Critical	24.83179732	57.7
4	Critical	5007.905075	64.5
4	Core	328.9035378	64.5
5	Marginal	526.7798003	62.3
6	Critical	129.3673988	56.3

Stage 1 Impact Area - Habitat Condition and Context Scores			
BTF habitat value	Total area (ha)	Weighted score	Habitat condition and context input
Critical	5189.03	64.27	6.43
Core	328.90	64.50	6.45
Marginal	526.78	62.30	6.23

Stage 1 Impact Area - Habitat Quality Scores				
BTF habitat value	Area (ha)	Habitat condition and context (60%)	Species stocking rate (40%)	FINAL SCORE
Critical	5189.03	6.43	10	**7.86**
Core	328.90	6.45	8.25	**7.17**
Marginal	526.78	6.23	6.5	**6.34**

9 HABITAT QUALITY SCORES FOR THE OFFSET AREA

Stage 1 Offset Area - Summary of BioCondition Scores			
Assessment unit	**BTF habitat value**	**Area (ha)**	**BioCondition score**
1	Critical	8160.67	64.4
1	Core	6063.12	64.4
2*	Critical	1346.24	51.8
2 *	Core	4.73	51.8
3	Marginal	2758.35	64.4
4	Critical	126.40	64.5
4	Core	41.84	64.5
9	Critical	449.17	64.3
9	Core	253.83	64.3
12	Critical	481.53	69.8
12	Core	388.40	69.8
13	Marginal	212.80	66.3

*Note that the BioCondition Score for AU2 (51.8) has been corrected from ELA report where it was incorrectly denoted as 15.8

Stage 1 Offset Area - Habitat Condition and Context Scores			
BTF habitat value	**Total area (ha)**	**Weighted score**	**Habitat condition and context input**
Critical	10564.00	63.04	6.30
Core	6751.92	64.70	6.47
Marginal	2971.15	64.54	6.45

Stage 1 Offset Area - Habitat Quality Scores				
BTF habitat value	**Area (ha)**	**Habitat condition and context (60%)**	**Species stocking rate (40%)**	**FINAL SCORE**
Very High	10564.00	6.30	10	**7.78**
High	6751.92	6.47	8.25	**7.18**
Medium	2971.15	6.45	6.5	**6.47**

REFERENCES

BTFRT 2007, *National recovery plan for the black-throated finch southern subspecies Poephila cincta cincta*.

DEE 2016, *Threat abatement plan for competition and land degradation by rabbits*, Canberra.

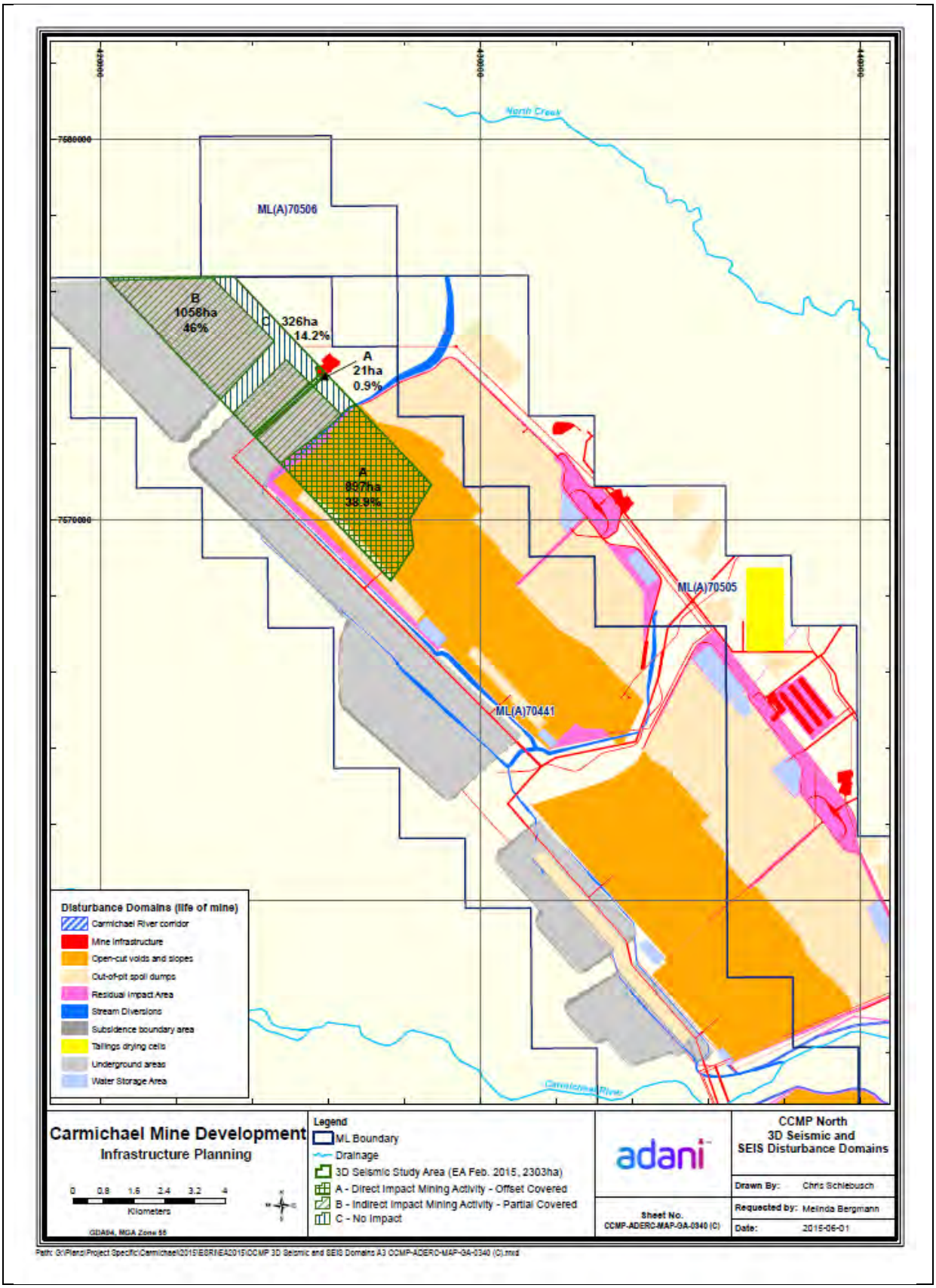
EcoLogical Australia 2014a, *Carmichael Coal Mine Ecological Equivalence Assessment Stage 2. Prepared for Adani Mining Pty Ltd.*

EcoLogical Australia 2014b, *Moray Downs West Ecological Equivalence Assessment Report. Prepared for Adani Mining Pty Ltd.*

EcoLogical Australia 2019, *Black-throated Finch Management Plan Carmichael Coal Mine and Offsite Infrastructure*, <https://www.adaniaustralia.com/projects-businesses/mine-environment-reporting#environmental>.

APPENDIX J 3D SEISMIC EXPLORATION PROGRAM

Memo


North Creek
ML(A)70506
B
1058ha
46%
C
326ha
14.2%
A
21ha
0.9%
A
897ha
38.9%
ML(A)70505
ML(A)70441
Carmichael River
Disturbance Domains (life of mine)
Carmichael River corridor
Mine Infrastructure
Open-cut voids and slopes
Out-of-pit spoil dumps
Residual Impact Area
Stream Diversions
Subsidence boundary area
Tailings drying cells
Underground areas
Water Storage Area
Carmichael Mine Development
Infrastructure Planning
0 0.8 1.6 2.4 3.2 4
Kilometers
GDA94, MGA Zone 55
Legend
ML Boundary
Drainage
3D Seismic Study Area (EA Feb. 2015, 2303ha)
A - Direct Impact Mining Activity - Offset Covered
B - Indirect Impact Mining Activity - Partial Covered
C - No Impact
adani
Sheet No.
CCMP-ADERC-MAP-GA-0340 (C)
CCMP North
3D Seismic and
SEIS Disturbance Domains
Drawn By: Chris Schlebusch
Requested by: Melinda Bergmann
Date: 2015-06-01