

Bowen Gas Project

EPBC Species Impact Management Plan

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Cover Page

EPBC Number: EPBC 2012/6377

Project Name: Arrow Bowen Gas Project

Proponent and ABN: Arrow Energy Pty Ltd (ABN: 73 078 521 936)

Approved Action: To develop, operate and decommission a coal seam gas field in the Bowen Basin, Queensland referred under the EPBC Act on 9 May 2012; and as described in the Arrow Bowen Gas Project Environmental Impact Statement (December 2012) and Supplementary Report (June 2014).

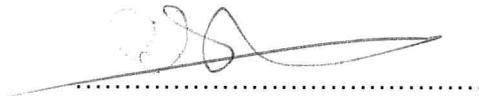
Location of the Action: The Project covers an area of approximately 8,000 km² and located approximately 150 km south-west of Mackay in Queensland's Bowen Basin. The project development area extends from near the township of Glenden in the north and near Blackwater in the south.

Date of preparation of this Plan: 11 October 2018

Signed Declaration of Accuracy:

In making this declaration, I am aware that section 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or *Environment Protection and Biodiversity Conservation Regulation (2000)* (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed:



Full name:

GRAHAM SHAW

Organisation:

Arrow Energy Pty Ltd

Date:

11/10/18

Executive Summary

Background and Purpose

- On 27 October 2014 Arrow Energy Pty Ltd (Arrow) received approval from the Australian Government to proceed with the Bowen Gas Project (BGP) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC 2012/6377).
- On 5 May 2017 a 'Request to Vary Conditions of Bowen Gas Expansion Project' was submitted to the Department of the Environment and Energy (the Department) and approved on 25 March 2018. The variation authorised a staged delivery of a high level offset strategy followed by a more detailed offset plan within 12 months of project commencement.
- The purpose of this document is to satisfy the BGP approval conditions relevant to the requirement to develop and implement an EPBC Species Impact Management Plan for the BGP (i.e. Condition 9). The conditions of approval that relate to this EPBC Species Impact Management Plan (SIMP) are summarised in Table 1.1.
- The first version of this plan was submitted to the Department on 13 July 2018. This version addresses feedback received from the Department on 19 September 2018.

Key Elements

- This SIMP has been prepared by suitably qualified ecologists, with evidence of the authors' qualifications and experience provided in Appendix A.
- Arrow has undertaken comprehensive seasonal ecological surveys to gain a detailed understanding of EPBC listed threatened species and EPBC communities within the BGP area. These are summarised in the Environmental Impact Statement (EIS) (Arrow, 2012) and Supplementary Report to EIS (SREIS) (Arrow, 2014). Additional subsequent flora and fauna surveys have also been completed in the vicinity of the Project Phase 1 area in November-December 2014 (dry season survey) and March 2015 (post wet season survey). Arrow will continue to undertake flora and fauna surveys of areas proposed for development.
- This SIMP details how Arrow will meet Conditions 9a-e of the BGP approval conditions including describing the management measures and monitoring program that will be implemented to avoid, track and further minimise impacts to EPBC Act species and communities through the life of the BGP.
- As per Condition 10, Arrow will not commence Project Phase 1 until this SIMP has been approved by the Minister in writing. Once approved Arrow will implement this SIMP. This SIMP will be reviewed at least every five years (for each Project Phase) and updated if required. Any such updates will again be subject to approval by the Department/Minister.

Recommendation

That the Minister or delegate approves this Bowen Gas Project EPBC Species Impact Management Plan.

Abbreviations and Acronyms

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

Abbreviations and Acronyms

| Acronym | Meaning |
|----------|---|
| ATP | Authority to Prospect |
| BGP | Bowen Gas Project |
| BGP area | The areas that consist of the following Authorities to Prospect (ATPs): 1103, 1031, 1025, 749, 742 and 759 |
| CEMP | Construction Environmental Management Plan |
| DotEE | Department of the Environment and Energy (Australia) |
| DES | Department of Environment and Science (Queensland) |
| EA | Environmental Authority |
| EIS | Environmental Impact Statement |
| EPBC Act | <i>Environment Protection and Biodiversity Conservation Act 1999</i> |
| ESA | Environmentally Sensitive Area as described in the <i>Environmental Protection Regulation 2008</i> (Qld) |
| EVNT | Flora and fauna species listed under the EPBC Act as well as species listed as extinct in the wild, endangered, vulnerable or near threatened under the <i>Nature Conservation Act 1992</i> (Qld) |
| FSC | Fauna spotter-catcher will be at the site on the day of clearing. The spotter-catcher will be a suitably qualified ecologist as per the definition provided in EPBC 2012/6377. |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| HSE | Health, Safety and Environment |
| MNES | Matters of National Environmental Significance as listed under the EPBC Act |
| RE | Regional Ecosystem |
| RoW | Right of Way |
| SIMP | EPBC Species Impact Management Plan |
| SMP | Arrow Energy Species Management Program for Tampering with Animal Breeding Places (which was developed for the State Department of Environment and Science (DES) in March 2018) |
| SREIS | Supplementary Report to the Environmental Impact Statement |
| TEC | Threatened Ecological Community under the EPBC Act |

Definitions

| Term | Definition |
|----------------------------------|---|
| Bowen Gas Project | Bowen Gas Project is limited to a maximum of 4,000 coal seam gas production wells and associated infrastructure. The action must not occur outside of the Authorities to Prospect (ATPs) 1103, 1031, 1025, 749, 742 and 759. |
| Commenced/Project Commencement | Any physical disturbance, including clearance of native vegetation, new road work and the establishment of well sites to develop the gas field project area. Commencement does not include: a) minor physical disturbance necessary to undertake pre-clearance surveys or establish monitoring programs or geotechnical investigations; or b) activities that are critical to commencement that are associated with mobilisation of plant and equipment, materials, machinery and personnel prior to the start of development only if such activities will have no adverse impact on matters of national environmental significance. |
| Core Habitat Known | Core habitat for a species known from recent records (since 1980) or confirmed sightings, generally buffered by a one kilometre radius. Core habitat known may also include remnant or regrowth vegetation within areas where known sightings have occurred (as defined in the rules for habitat mapping provided in Appendix B). |
| Core Habitat Possible | Areas of potential habitat with a number of features or values known to contribute to, or be important for the occupation of the species (as defined in the rules for habitat mapping for individual species in Appendix B). |
| Department | The Australian Government Department administering the EPBC Act |
| EPBC Act species and communities | Flora and fauna species listed as 'threatened' and vegetation communities listed as 'threatened ecological communities' under the EBPC Act at the time of the EPBC Act approval for the BGP (EPBC 2012/6377) |
| EPBC Act fauna species | Fauna species listed as extinct, extinct in the wild, critically endangered, endangered or vulnerable under Section 178 of the EBPC Act at the time of the EPBC Act approval for the BGP (EPBC 2012/6377) |
| Pre-clearance surveys | Surveys that are undertaken for flora and fauna species and communities for all areas of the project area that are to be disturbed by project activities |
| Project Phase | The development phases of the project which are to be a duration of no more than 5 years and confirmed by the approval holder prior to the completion of each Project Phase (as per BGP EPBC Definition). |
| Project Phase 1 | The period of no more than 5 years from commencement (as per BGP EPBC Definition). |
| Significant impact | An impact that is 'significant' in accordance with the <i>Significant Impact Guidelines 1.1 – Matters of National Environmental Significance</i> (DEWHA, 2013) |
| Suitably Qualified Person | A person who has professional qualifications, training or skills or experience relevant to the nominated subject matters and can give authoritative assessment, advice and analysis about performance relevant to the subject matters using relevant protocols, standards, methods or literature (as per BGP EPBC Definition). |

1. Introduction

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

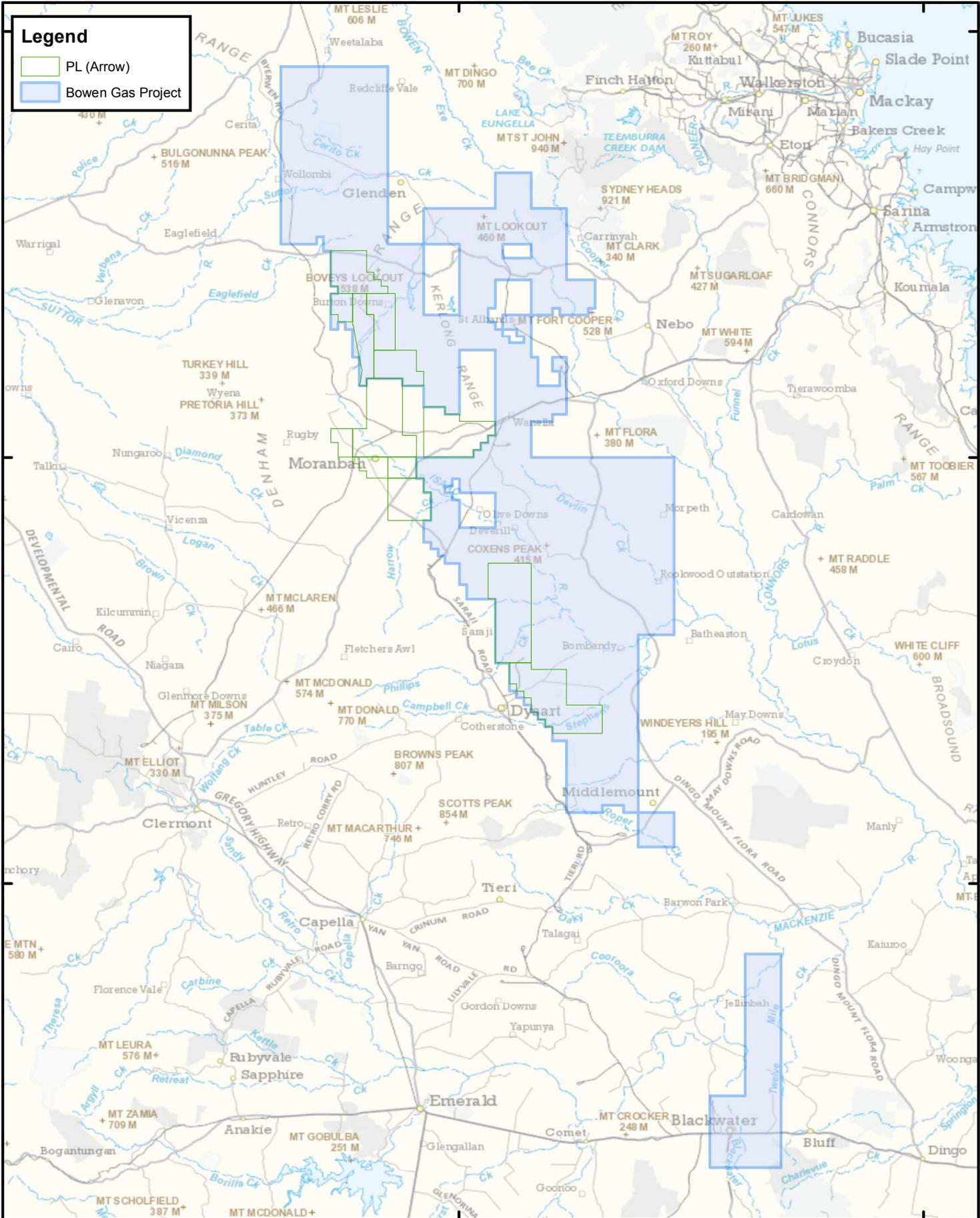
The Bowen Gas Project (BGP) was granted approval from the Queensland Government in September 2014 and the Australian Government in October 2014 for development of up to 4,000 coal seam gas production wells and associated infrastructure. The BGP covers an area of approximately 8,000 km², and is located south-west of Mackay, extending from Glenden in the north to Blackwater in the south (see Figure 1).

The EPBC Act approval for the BGP (EPBC 2012/6377) specifies that “*prior to the commencement of Project Phase 1, the approval holder must prepare and submit an EPBC Species Impact Management Plan for the Minister’s written approval*” and that the plan must include a number of matters (Condition 9 (a) – (e) of the EPBC Act approval; refer Table 1.1 of this SIMP). The purpose of this SIMP is to satisfy these conditions.

The EPBC Act approval also identifies those EPBC Act listed species and communities (listed at the date of approval for the BGP) where a significant impact is likely, and specifies disturbance limits for each (Condition 4, Table 1 of the EPBC approval; shown in Table 1.2 of this SIMP). This SIMP addresses all of these EPBC species and communities.

For completeness, this SIMP also addresses two recently listed EPBC Act species which have been identified as having the potential to be impacted by the BGP (i.e. *Petauroides volans* (Greater Glider) and *Grantiella picta* (Painted Honeyeater)). These two species were listed under the EPBC Act subsequent to the BGP’s EPBC Act approval. Although these species are discussed in this SIMP, they do not form part of the EPBC Act approval.

Table 1.1 identifies the sections within this SIMP that addresses each of the Condition 9 requirements.



Legend

- PL (Arrow)
- Bowen Gas Project

Based on or contains data provided by the State of Queensland (Department of Environment and Resource Management). In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.

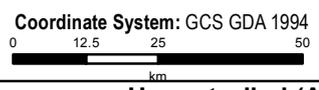
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Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no warranty is given that the information contained on this map is free from error or omission. Any reliance placed on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

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

BGP Overview



Date: 17/05/2018

Table 1.1 Cross-reference for Approval Condition 9 requirements and relevant sections within this SIMP

| Condition Number | Condition 9 requirement | Section of this SIMP |
|------------------|---|--------------------------|
| 9 | Prior to the commencement of Project Phase 1, the approval holder must prepare and submit an EPBC Species Impact Management Plan for the Minister's written approval. The EPBC Species Impact Management Plan must include: | |
| 9 (a) | Measures that will be taken to avoid, mitigate and manage impacts to EPBC listed threatened species and their habitat during clearance of vegetation, including the involvement of a suitably qualified person at all times during clearance of vegetation. | Section 3 and Appendix C |
| 9 (b) | Measures that will be taken to avoid, mitigate and manage impacts to EPBC listed threatened species and their habitat and to EPBC communities during construction, operation and decommissioning of the action. | Section 4 and Appendix C |
| 9 (c) | A monitoring program to determine the success of mitigation and management measures to ensure adaptive management for the duration of this approval. | Section 5 and Appendix C |
| 9 (d) | A discussion of relevant conservation advice, recovery plans and threat abatement plans and how measures proposed in the EPBC SIMP are consistent with the measures in these documents. | Section 6 |
| 9 (e) | Details of how the approval holder has addressed any residual significant impacts to any EPBC listed threatened species and its habitat and/or EPBC communities not identified in Table 1, to be offset in accordance with the EPBC Act Environmental Offsets Policy. | Section 7 |

Table 1.2 Whole of project maximum disturbance limits (source: Table 1 of EPBC Act approval)

| Matter of National Environmental Significance | Maximum disturbance (hectares) to core habitat known and core habitat possible |
|--|--|
| Threatened Species | |
| Black Ironbox (<i>Eucalyptus raveretiana</i>) | 258.32 |
| Bluegrass (<i>Dichanthium setosum</i>) | 809.59 |
| King Bluegrass (<i>Dichanthium queenslandicum</i>) | 1,161.23 |
| Ornamental Snake (<i>Denisonia maculata</i>) | 1,030.31 |
| Squatter Pigeon (<i>Geophaps scripta scripta</i>) | 1,415.44 |
| Red Goshawk (<i>Erythrotriorchis radiatus</i>) | 187.14 |
| Koala (<i>Phascolarctos cinereus</i>) (combined populations of Queensland, New South Wales and the Australian Capital Territory) | 2,466.04 |
| South-eastern Long-eared Bat (<i>Nyctophilus corbeni</i>) | 2,282.57 |
| Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>) | 1,451.44 |
| Threatened Ecological Communities (TECs) | |
| Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant) | 781.16 |
| Weeping Myall Woodlands | 198.48 |
| Natural Grasslands of the Queensland Central highlands and the northern Fitzroy Basin | 871.10 |
| Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions | 107.42 |

2. Management of EPBC Species and Communities

2.1 Management hierarchy

Coal Seam Gas developments apply an iterative process in terms of locating wells and gathering lines. This is required because there are several competing constraints when it comes to locating the infrastructure on the surface. These constraints include ecological values, landholder preferences, geological features, existing infrastructure and access tracks. Planning and management of surface activities and ground disturbance is undertaken utilising a set of hierarchical management principles used to avoid, minimise and mitigate impacts to ecological values. These principles are:

- **Avoid:** Arrow's first preference is to avoid EPBC Act listed threatened ecological communities and the habitat of EPBC listed threatened species
- **Minimise:** where other competing constraints or the scale / location of EPBC communities or species habitat dictate that avoidance is not possible (e.g. where there is long linear strips of Brigalow that need to be crossed or large areas of suitable habitat for wide ranging species such as the Koala or Squatter Pigeon), Arrow will preferentially locate infrastructure in a manner that minimises the impact to these values (e.g. cross the Brigalow at the narrowest or most degraded part or where practicable on the edge of suitable habitat for listed species so as not to bisect good quality habitat)
- **Mitigate:** implement mitigation measures to further minimise the direct and indirect impacts on ecological values
- **Remediate and rehabilitate:** actively remediate and rehabilitate impacted areas to promote and maintain long term recovery
- **Offset:** Arrow will offset unavoidable significant residual impacts to MNES as per the BGP Offset Strategy.

2.2 Application of the management hierarchy

Sections 3 and 4 of this document provide considerable detail of Arrow's commitments to avoid, minimise and mitigate impacts to MNES. The following steps will be undertaken to implement the above mentioned management hierarchy:

- Pre-clearance surveys
- Framing trade-offs
- On-site management and reporting
- Annual reporting.

Pre-clearance surveys

Arrow has already completed ecological surveys within the areas of proposed activities. However, additional pre-clearance surveys will be undertaken when the BGP activities proceed through the detailed design and planning phase and secondary approvals are required (e.g. an Environmental Authority, Clearing Permit or a landholder agreement).

At this point in time, a field inspection of the specified disturbance footprint will be undertaken by a suitably qualified ecologist. The pre-clearance survey will confirm the presence, absence and extent of environmental values (including EPBC Act species habitats and TECs) and these will be mapped in the field via GIS. The results of this step will be recorded within Geocortex (Arrow's GIS based mapping system) and the Arrow Sharepoint site (Arrow's data compilation software used by the Access and Approvals Team).

Framing trade-offs

Following the pre-clearance surveys, a framing trade-offs meeting will be held with the project engineers, planners, ecologists, land liaison officer and an archaeologist. The purpose of this meeting is for each specialist to discuss the proposed location of the infrastructure and the opportunities and constraints based on the findings of their field assessment. It is at this meeting where the ecologist will be reiterating Arrow's management hierarchy for MNES and aiming to avoid and minimise impacts to MNES. The outcome of the framing trade-offs meeting is an agreed location for the surface infrastructure after taking into consideration each competing constraint. The results of this step will be recorded within the Arrow Sharepoint database.

On-site management and reporting

Where the framing trade-offs meeting has identified that impacts to MNES are unavoidable, the following will be undertaken so that the actual area cleared will be surveyed to quantify the impacts (in addition to the detailed measures outlined in Table 3.1):

- Record GPS coordinates of the boundary of the MNES in relation to the proposed clearing boundaries and ensure the limits of the area to be cleared are clearly marked on the ground (e.g. high visibility flagging tape, hazard netting or similar).
- Complete a Habitat Quality Assessment as per the Queensland Government Department of Environment and Heritage Protection's *Guide to determining terrestrial habitat quality – A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy* (2017).
- Ensure a fauna spotter-catcher is present during clearing. The spotter-catcher will be a suitably qualified ecologist. The number of fauna spotter-catchers on site at the time of clearing will depend on the number of machines being used at any given time.
- Record the coordinates and total area of MNES habitats and communities cleared.
- Ensure the success of on-site mitigation measures by review and assurance against this EPBC Species Impact Management Plan and the accompanying BGP EPBC Phase 1 Offset Strategy.

Annual reporting

- The field data collected above will be provided to the Environment Team at the completion of site disturbance activities and tracked monthly against approved Stage 1 maximum disturbance limits.
- This data, together with other reporting requirements specified in this plan and the accompanying BGP EPBC Offset Strategy will be collated for annual compliance reporting as per Condition 30 of the BGP EPBC approval.

2.3 Supporting Arrow documents

Arrow has been installing and operating coal seam gas infrastructure since 2005. We have numerous guiding documents relevant to the monitoring of activities that may impact species and vegetation communities; namely:

- Operations Environmental Management Plan (ORG-ARW-AOP-PLA-00016) – this document identifies the relevant procedures and other control mechanisms that are used to minimise potential environmental impacts of production operations activities and ensures the requirements of relevant legislation are met.
- Biodiversity Standard (ORG-ARW-HSM-STA-00034) – the intent of this document is to ensure the protection of biodiversity (flora, fauna and natural habitats) in the areas in which Arrow operates in recognition of the value of healthy and functioning terrestrial and aquatic natural systems. The Standard places a responsibility on all Arrow line managers and contractors to monitor potential biodiversity impacts and controls.
- HSE Incident Management Standard (ORG-ARW-HSM-STA-00007) and the Incident Management Procedure (ORG-ARW-HSM-PRO-00089) – these documents specify the process for reporting, recording, classifying, notifying and investigating unplanned events and incidents that have resulted in damage to the environment.

Beyond the above mentioned overarching documents, two Arrow procedures are particularly relevant:

- Ecological Impact Assessment Procedure (ORG-ARW-HSM-PRO-00070) – this document provides the step by step process implemented for all Arrow development activities that involve significant disturbance to land, including the requirement to record the GPS coordinates and maps of all vegetated areas that have required clearing. Clearing extents will also be input into an Arrow database to track EPBC Act species and community disturbance against approved limits on a monthly basis.
- Fauna Management Procedure (ORG-ARW-HSM-PRO-00067) – this document informs all Arrow staff and contractors of their obligations to protect and manage native fauna whilst operating on Arrow controlled works sites. It includes the requirements to:
 - Record and report all interactions with fauna to the Arrow Ecologist (notification within 24 hours using the Fauna Incident Notification (FIN) form is required for listed

threatened (including EPBC Act listed species), near threatened and special least concern fauna).

- Record and report all interactions with fauna to the regulator, under their own permit, as required (but not before reporting to the Arrow Ecologist).
- Regularly monitor mitigation measures that have been constructed and/or implemented (e.g. fauna exclusion fences) and report their effectiveness to the Site Supervisor.
- Provide clear communications on any ongoing action requirements (e.g. monitoring and maintenance) during site handover processes, and these must be implemented, monitored and their effectiveness reported.

3. Mitigation measures during clearance of vegetation

Condition 9(a): Measures that will be taken to avoid, mitigate and manage impacts to EPBC listed threatened species and their habitat during clearance of vegetation, including the involvement of a suitably qualified person at all times during clearance of vegetation.

Many of the mitigation measures that will be undertaken to avoid or reduce impacts to EPBC species and communities during clearance of vegetation are consistent with relevant BGP EIS mitigation commitments (see Appendix O of the Supplementary EIS for the full list of Arrow's mitigation commitments for the BGP). The relevant commitments are listed in Table 3.1 (with the BGP EIS commitment number provided in parenthesis).

Further to the commitments provided within the BGP EIS and reproduced below, a number of other mitigation measures included within the Arrow Energy Species Management Program for Tampering with Animal Breeding Places (which was developed for the State Department of Environment and Science (DES) in March 2018) are of relevance and have been included in the list below. These measures are marked 'SMP'.

The particular mitigation measures that relate to each individual EPBC Act species and community are identified in the individual species and community profiles provided as Appendix C.

Measures that will be implemented by Arrow to address Condition 9(a) are presented in Table 3.1.

Table 3.1 Description of mitigation measures / commitments for clearing activities

| Mitigation | Commitment | Intended outcome | Responsible manager/s |
|--|--|---|---|
| Pre-construction clearance surveys / minimise clearing | <ul style="list-style-type: none"> • When the project activities proceed through the detailed planning phase, a field inspection of the specified disturbance footprint (this is specified by a surveyor in the field) will be undertaken by a suitably qualified ecologist and the presence, absence and extent of environmental values will be verified and mapped in the field via GIS. The results of this step will be recorded within Geocortex and the Arrow Sharepoint database (new commitment). • Where environmental values are confirmed, a ‘framing trade-offs’ session will be held with the project engineers, planners and ecologists to determine if the location of the activities can be modified to avoid and/or reduce the impact to environmental values. In the event that EPBC species or community habitat cannot be avoided, the actual area to be cleared will be surveyed to quantify the impacts. This data will be recorded and cumulative impact areas tracked (new commitment). • The disturbance footprint and vegetation clearing will be minimised (B017). • The land cleared for construction purposes will be kept to the minimum necessary, especially during the drier months of the year (B018). • Land disturbance will be minimised with the smallest practical area of land being disturbed in the shortest practicable time (B047). • All operations will be planned to ensure minimal damage on any vegetation, cropping or pasture areas outside the limits to be cleared (B050). • Disturbance within the following areas will be avoided where possible (part of B131): <ul style="list-style-type: none"> – Endangered EPBC Act TECs: Brigalow Ecological Community; Natural Grasslands Ecological Community; Semi-evergreen Vine Thicket Ecological Community; Weeping Myall Woodlands). – Core habitat for EVNT species. • Pre-clearance surveys will be conducted to identify any additional areas that need to be avoided. As a minimum, these will include (B132): <ul style="list-style-type: none"> – vegetation mapping at a scale suitable for site-specific planning. – identification of core habitats for EVNT species. – identification of site-specific sensitive areas (e.g. ESAs) that require avoidance or buffers. • Wells, gathering lines and access tracks will be located within previous clearings or non-remnant vegetation if possible (B133). | <ul style="list-style-type: none"> • To identify opportunities where the residual impacts to MNES matters can be further reduced | <ul style="list-style-type: none"> • BGP Pre-execution (i.e. Planning) Manager (Arrow) |

BGP EPBC Species Impact Management Plan

| Mitigation | Commitment | Intended outcome | Responsible manager/s |
|------------|--|------------------|-----------------------|
| | <ul style="list-style-type: none"> • Infrastructure will be designed to avoid undisturbed tracts of remnant vegetation, where practical. Where collection and gathering infrastructure is to be placed within contiguous vegetation, collection networks will be designed to avoid dissection (B134). • Access track location will avoid the repeated isolation of small parcels of remnant vegetation from more continuous tracts (B135). • Vegetation disturbance will be minimised wherever practical. Corridors for linear infrastructure will be as narrow as practical, particularly when crossing linear corridors of vegetation (e.g. Isaac River and Suttor Creek). Areas cleared for field development will be as small as practical (B136). • Habitat trees will be retained where practicable (B137). • Removal of riparian vegetation will be avoided where practical by use of directional drilling and/or reduction of right of ways (B138). • Access tracks and pipelines will deviate around sensitive vegetation where practicable (B140). • Sensitive infrastructure design principles will be applied to avoid watercourse, drainage lines and riparian areas where practicable (B142). • Pre-clearance surveys will be undertaken to determine the likelihood of the species (including weeds) occurring (B155). • Where EVNT species are identified in proposed development areas, consideration will be given to mitigation measures such as translocation and/or propagation of flora species. Progress of any translocation programs will be monitored in accordance with the relevant translocation management plans (B169). • The width of construction RoWs will be minimised within areas of sensitivity to the greatest extent practicable without compromising the safety of workers (B192). • Buffer zones will be adopted for Project activities (with the exception of required creek crossings), in different areas of constraint, as defined by the project's constraints mapping (outlined in Section 7 and detailed in Constraints Mapping (Appendix BB of the EIS) (B196). • Tracks will be restricted in riparian zones and durations of impacts minimised, except in the immediate vicinity of creek crossings (B199). • During the design and construction of waterway crossings, care will be taken to minimise the footprint of the structure and to avoid unnecessary disturbance to stream beds and banks (B201). • Where practical the width of the easement will also be narrowed at these points, further reducing impacts on stream banks, beds and riparian zones by restricting the area of waterway that would be disturbed (B204). | | |

BGP EPBC Species Impact Management Plan

| Mitigation | Commitment | Intended outcome | Responsible manager/s |
|---|--|--|--|
| | <ul style="list-style-type: none"> Gathering line and access road creek crossings will be kept to a minimum where possible (B206). Watercourse crossings will be minimised, where practicable, during route selection. Where required, crossing locations will be selected to avoid or minimise disturbance to aquatic flora, waterholes, watercourse junctions and watercourses with steep banks (B220). Watercourse crossings will be designed to enable passage of flows resulting from a 1 in 100 year average recurrence interval flood event, as a minimum (B226). Gathering lines and tracks will be designed to avoid watercourses, drainage lines and riparian areas (particularly permanent watercourses or perennial aquatic habitat), where practicable (B227). Pipeline RoWs widths will be designed to be narrower at watercourse crossings, where practicable (B228). | | |
| Construction activities as per plan (no-go areas) | <ul style="list-style-type: none"> Delineation of disturbance boundary limits of works will be clearly established prior to commencement of clearing and soil stripping (B049). Disturbance exclusion zones (or management buffers) will be established and managed during construction and operations to effectively protect ESAs as defined by the project's constraints mapping (B145). Trees will be felled away from existing vegetation not identified for removal where practicable (B150). Damage to trees (e.g. through scraping of tree trunk or breaking of limbs by equipment) not identified for removal will be avoided where practicable (B151). Avoidance boundaries will be clearly delineated prior to clearing (B166). Audits/checks will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167). Construction activities in sensitive areas will be supervised to ensure appropriate methods (e.g., narrowing of RoW) are being implemented, where required (B182). Construction that will potentially affect waterways will occur during dry months (periods of low rainfall and low flow) where possible. The use of machinery and vehicles on stream beds and banks will be avoided wherever possible (B202). Buffer zones and the Project footprint will be regularly monitored using satellite imagery (B215). Watercourse crossings will be constructed in a manner that minimises sediment release to watercourses, stream bed scouring, obstruction of water flows and disturbance of stream banks and riparian vegetation (i.e., the crossing location will be at a point of low velocity, and straight sections will be targeted, with the pipeline or road orientated as near to perpendicular to water flow as practicable) (B221). | <ul style="list-style-type: none"> To ensure that no unplanned impacts occur on MNES as a result of construction activities | <ul style="list-style-type: none"> BGP Construction Manager (Arrow) |

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| Mitigation | Commitment | Intended outcome | Responsible manager/s |
|------------------------|---|---|--|
| | <ul style="list-style-type: none"> • Transport of equipment across watercourses will be avoided unless an appropriate crossing that minimises disturbance to the watercourse bed and banks and to riparian vegetation is available (B225). • Construction and maintenance activities will be planned to minimise movement of plant and equipment between properties or areas with weed infestations (B230). | | |
| Protection of topsoils | <ul style="list-style-type: none"> • Soil will be stripped according to designated profile depths, subject to further field investigations during stripping (B051). • Where practicable, stripped material will be placed directly onto area to be rehabilitated and spread immediately (if rehabilitation sequences and weather conditions permit) to avoid the requirement for stockpiling (B052). • Soils will be separated into windrows for later collection or re-spreading to minimise compression effects of heavy equipment (B053). • Soil transported by dump trucks may be placed directly into storage. Soil transported by scrapers will be pushed to form stockpiles by other equipment (e.g. dozer) to avoid tracking over previously laid soil to minimise compaction (B054). • Surface of soil stockpiles will be left in as coarsely structured a condition as possible to promote infiltration and minimise erosion until vegetation is established or suitable erosion controls have been applied, and to prevent anaerobic zones from forming (B055). • Pipeline construction will be conducted in a manner that limits the duration of exposure of soils. Stripped and salvaged soil will be re-used within a short period of time (i.e. 28 days) in areas where rehabilitation immediately follows the installation of pipelines (B063). • Erosion and Sediment Control Plans will be developed and maintained in accordance with the International Erosion Control Association (IECA) (2008) Best Practice Erosion and Sediment Control guidelines. All proposed erosion and sediment control measures will be implemented in advance of, or in conjunction with clearing activities (B066). • Topsoil will be stripped, salvaged and stockpiled separately from subsoils (B068). • Appropriate sediment and erosion control structures will be installed and maintained at work sites (B160). | <ul style="list-style-type: none"> • To ensure that natural vegetation including EPBC Act listed plants and TECs will be able to re-establish. | <ul style="list-style-type: none"> • BGP Construction Managers (Arrow and Third Party Contractor) |
| Fauna spotter catcher | <ul style="list-style-type: none"> • Suitably qualified fauna spotter-catcher (FSC) or ecologist will capture injured wildlife, where possible. Injured wildlife resultant from land clearing will be taken to a qualified veterinary surgeon or carer where practical (B153). The FSC will be at the site on the day of clearing. The FSC will be suitably qualified as per the definition provided in EPBC 2012/6377. The number of FSCs on site at the time of clearing will depend on the number of machines being used at any given time (new commitment). | <ul style="list-style-type: none"> • To ensure that no unplanned impacts occur on the Ornamental Snake, Squatter Pigeon, Red Goshawk, | <ul style="list-style-type: none"> • BGP Construction Managers (Arrow and Third Party Contractor) |

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| Mitigation | Commitment | Intended outcome | Responsible manager/s |
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| | <ul style="list-style-type: none"> Trees will be assessed for potential nesting hollows prior to felling. If hollows are identified, trees will be felled in the presence of a qualified FSC and rolled so that the hollows are facing upwards, allowing fauna to escape (B189). Key Koala trees will be identified and visually inspect prior to clearing to ensure that they are free of Koalas. If Koalas are located, the tree will be retained until the animals have moved on, typically overnight (B190). Checks for identified EPBC Act fauna species breeding places will be undertaken immediately prior to commencing vegetation clearing (SMP). Potential breeding places will be clearly marked in the field with spray paint, coloured flagging tape (unless not permitted by land owners, e.g. some cattle properties), or by other suitable methods (SMP). | Koala, South-eastern Long-eared Bat, Large-eared Pied Bat, Greater Glider, or Painted Honeyeater | |
| Ornamental Snake management | <ul style="list-style-type: none"> Where practicable, disturbance will be avoided in areas known or assessed to be suitable habitat for Ornamental Snake during the breeding season (September to April) (SMP). The management hierarchy described in Section 2 will be applied in these situations. If Ornamental Snake breeding activity is observed, an exclusion zone (30 m radius) will be enforced until the breeding place is vacated (SMP). Soil cracks within potential Ornamental Snake habitat that could harbour snakes will be marked with spray paint. A borescope, or similar equipment, will be used to determine the presence of a snake. If a snake is found, the spotter-catcher will attempt to dig up the soil crack and remove the animal (SMP). Spotlighting will be completed in line with Arrow's Ornamental Snake Guideline (ORG-ARW-HSM-GUI-00101, Section 8) when the following are met: <ul style="list-style-type: none"> Prior to commencing construction activities that involve significant ground disturbance, and Within the breeding and high activity period of September to April (SMP). Ornamental Snakes captured will be retained by a licensed FSC for the duration of the day's construction activities and released in a suitable habitat in close proximity to the site boundaries that evening (i.e. within 24 hours), or retained and released in line with the FSC's permits if construction is ongoing (SMP). | <ul style="list-style-type: none"> To minimise impacts and risk of impacts on Ornamental Snake as a result of construction activities | <ul style="list-style-type: none"> BGP Construction Managers (Arrow and Third Party Contractor) |
| Squatter Pigeon specific management | <ul style="list-style-type: none"> If Squatter Pigeon breeding activity is observed, an exclusion zone (50 m radius) will be enforced until the breeding place is vacated (SMP). Removal or relocation of individual Squatter Pigeon's, young or eggs will only be undertaken after measures have been taken to avoid and minimise impacts on the identified active breeding place as per the management hierarchy described in Section 2. (SMP). | <ul style="list-style-type: none"> To minimise impacts and risk of impacts on Squatter Pigeon as a result of construction activities | <ul style="list-style-type: none"> BGP Construction Managers (Arrow and Third Party Contractor) |

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| Mitigation | Commitment | Intended outcome | Responsible manager/s |
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| | <ul style="list-style-type: none"> As a last resort, Squatter Pigeon eggs or young would be removed and placed with a licensed wildlife carer/facility for incubation of eggs and/or raising of the young for subsequent release (SMP). | | |
| Red Goshawk specific management | <ul style="list-style-type: none"> The probability of Red Goshawk nesting in the BGP is considered low. However, should a potential nest be identified in proximity to existing or proposed project activities Arrow (with Construction Contractor) would: <ul style="list-style-type: none"> Stop work at the location. Notify Arrow so that Arrow may notify the relevant authorities (i.e. DotEE and DES). Seek approval from DotEE for additional disturbance if any impact is 'significant' and unavoidable. Manage the species or community in accordance with the mitigation measures listed in Appendix C and all applicable conditions of approval including the Offset Strategy for the relevant Project phase. Tag/barricade the identified species/community in an appropriate manner to ensure protection. Cease clearing works in the immediate area. Record GPS coordinates so that it may be incorporated into the Site Environmental Map as a 'no-go zone' or recorded as an impact area. Provide all relevant information to Arrow for monthly tracking of EPBC Act species and community impacts for annual reporting (SMP). | <ul style="list-style-type: none"> To minimise impacts and risk of impacts on Red Goshawk as a result of construction activities | <ul style="list-style-type: none"> BGP Construction Managers (Arrow and Third Party Contractor) |
| Koala specific management | <ul style="list-style-type: none"> If a Koala is found within the clearing footprint; a minimum exclusion zone of 100 m will be established for a female Koala with obvious young and 50 m for all other Koala, until the animal has moved of its own accord. No vehicles are to enter the buffer (exclusion) zone at any time. Vehicle operators will be made aware of the presence of the Koala and a reduced speed limit established until the animal has moved on of its own accord (SMP). | <ul style="list-style-type: none"> To minimise impacts and risk of impacts on Koala as a result of construction activities | <ul style="list-style-type: none"> BGP Construction Managers (Arrow and Third Party Contractor) |
| South-eastern Long-eared Bat specific management | <ul style="list-style-type: none"> All reasonable and practicable attempts (if safe to do so) will be made to check hollow bearing trees, hollow logs, peeling bark and splits in tree trunks for the presence of South-eastern Long-eared Bat (SMP). If breeding activity of South-eastern Long-eared Bat is observed, an exclusion zone (30 m radius) will be enforced until the breeding place is vacated. As a last resort, South-eastern Long-eared Bat young would be removed and placed with a licensed wildlife carer/facility for incubation of eggs and/or raising of the young for subsequent release. Where hollows containing South-eastern Long-eared Bat maternity sites have been identified that are inactive and unavoidable, the FSC is to determine whether it is to be relocated or left in situ. | <ul style="list-style-type: none"> To minimise impacts and risk of impacts on South-eastern Long-eared Bat as a result of construction activities | <ul style="list-style-type: none"> BGP Construction Managers (Arrow and Third Party Contractor) |

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| Mitigation | Commitment | Intended outcome | Responsible manager/s |
|------------|--|------------------|-----------------------|
| | <ul style="list-style-type: none"> • Where relocation of South-eastern Long-eared Bat in tree hollows is required, an elevated work platform or cherry-picker may be used in conjunction with a chainsaw operator and the FSC (or a FSC who holds a current training qualification in use of chainsaws) to attempt to remove the hollow. The following step-by-step process (modified from Nottidge, 2012) will be considered if safe to do so: <ul style="list-style-type: none"> – The FSC (with chainsaw operator unless the FSC is a qualified chainsaw operator) will inspect each visible hollow or potential breeding place (e.g. nest) identified in each tree using the cherry picker. This is usually carried out by simply looking into hollows and nests (with the assistance of a small torch); however, fibrescopes may also be useful for deep hollows. – If bats are located within a hollow, a piece of towel or rag would be firmly placed in the entrance to prevent the wildlife from escaping, as they may attempt to flee the nesting/denning hollow. – Once the hollow entrance has been secured, the chainsaw operator will remove the entire hollow limb below the cavity where the branch remains solid. In circumstances where a hollow continues into the main stem of the tree, the chainsaw operator would carefully cut a small window into the hollow, allowing the FSC to plug the hollow above and below the window, then the hollow limb is removed and lowered to the ground in sections. – When the bats have been safely secured within its hollow, the entire limb would then be placed in the cherry-picker bucket or lowered to the ground using ropes (depending on the size of the limb). – This limb would be placed in a cool, quiet location until translocation to the recipient habitat site, when at dusk of the same day the hollow entrance will be reopened to allow the bats to emerge of their own accord. • All reasonable and practicable attempts (if safe to do so) will be made to check suitable caves for the presence of Large-eared Pied Bat. | | |

In addition to the mitigation measures listed in Table 3.1, Arrow's response to, and reporting of, injury or mortality of EPBC Act fauna is described in Sections 3.1 and 3.2.

3.1 Arrow response to fauna mortality and injury

In the case of animal mortality/injury, the suitably qualified ecologist/spotter/catcher would inspect the animal to determine the extent of injury and the following would occur:

- If injured, temporary first-aid shall be applied (e.g. stopping blood-flow or binding a wound or broken limb). For superficial scratch wounds, antibiotic ointment, spray or powder shall be applied prior to release.
- Sickness usually takes the form of cold stress during winter (this is alleviated during trapping by providing insulated material within any traps). An animal which appears to be suffering from cold-stress will be placed in a warm holding container in a quiet area until it recovers. Holding containers are always carried as part of the survey equipment and comprise tins or appropriate wooden or plastic boxes/ carriers.
- If successful recovery does not appear to be occurring, or the injury requires further treatment, the animal will be transported in a holding container to the nearest veterinarian or to a local wildlife carer.
- Fauna will not be contained for longer than four hours. If prolonged containment is necessary due to difficulty accessing storage facilities (i.e. veterinary surgery, wildlife carers premises), food and water shall be provided.
- The final aim of the response is to release the recovered animal back into the area where it was originally captured. Once assessed by a veterinary surgeon, injured or sick fauna shall be transported to an authorised wildlife carer if it is to be rehabilitated. If the fauna is to be released into the wild, the animal will be released in the location where it was originally captured.
- If it is necessary to euthanize an animal, humane procedures will be used. These procedures will be reliable, avoid distress and produce rapid loss of consciousness without pain until death occurs. It is important to recognise that whilst some physical methods of euthanasia (e.g. stunning followed by exsanguinations) are not aesthetically pleasant, they may be humane as they ensure immediate insensitivity to pain. The choice of technique will be made based on the sensibilities of the animal to be euthanized rather than the sensitivities of the observer or personnel involved.
- Spotter/catchers used by Arrow receive instruction of humane methods of euthanasia prior to entering the field. Should a situation arise where the spotter/catcher is not suitable or comfortable then works will stop and not proceed until assistance from another suitably qualified spotter/catcher can attend the site and deal with the situation. During this time no further works are permitted to occur.

- Animals that are euthanized or found dead will be disposed of humanely and at or near the site where they were found.

3.2 Reporting on fauna mortality and injury

Regular reporting for the BGP will be included in the annual report provided to the Department.

With regards to exceptional events, such as mortality to an EPBC listed species as a result of the BGP activities, the following information is collected:

- During vegetation clearing, information on all fauna impacted by the clearing works (i.e. instances that have involved the spotter/catcher) are recorded.
- Photographs of the fauna and habitat features will be communicated through various methods (e.g. posters, presentations, etc.) to assist site staff with the identification of fauna and their required habitats.
- Data/information must be provided to the Arrow permit holder or authorised representative and include the following:
 - Fauna sighted, relocated, injured and/or euthanized
 - Fauna breeding places identified and actions taken
 - Notable actions
 - GPS co-ordinates for any species that was captured, relocated or euthanized. The co-ordinate should be of the capture point and the release point, where relevant.

With regards to exceptional events, such as mortality to an EPBC listed species as a result of BGP activities, the following reporting to the Department will occur:

- Reporting of such an exceptional event will be carried out in writing to the Secretary of DotEE within a short period (e.g. 7 days) of Arrow becoming aware of the incident (contact details used will be as per the Department's webpage: <http://www.environment.gov.au/biodiversity/threatened/listed-species-and-ecological-communities-notification>).
- All such incidents will be reported on an Arrow incident report form and registered in an electronic database.
- The information provided to the Secretary will include the listed threatened species, the date on which the incident took place, the activity being undertaken at the time of the incident, and the immediate actions taken as a result of the death.

- Incidents will be assessed and tracked to ensure that the appropriate investigation, corrective actions and measures are taken to prevent the incident from reoccurring.
- Incidents will be reviewed by Arrow on a monthly and annual basis to determine incident trends, which will enable targeting of areas that require further adaptive management to assist in preventing future incidents. While the review of incidents will occur monthly, the reporting of such trends will be annual.
- The annual reporting required by Condition 30 will also include information pertaining to mortalities of any listed threatened species.

4. Mitigation measures during construction, operation and decommissioning

Condition 9(b): Measures that will be taken to avoid, mitigate and manage impacts to EPBC listed threatened species and their habitat and to EPBC communities during construction, operation and decommissioning of the action.

Table 3.1 in the preceding section described the mitigation measures relevant to the construction phase and particularly in relation to clearing activities. This section does not repeat those measures but rather describes measures additional to those provided in Table 3.1.

Many of the mitigation measures that will be undertaken to avoid or reduce impacts to EPBC species and communities during construction, operation and decommissioning are consistent with relevant BGP EIS mitigation commitments (see Appendix O of the Supplementary EIS for the full list of Arrow's mitigation commitments for the BGP). These are included in Table 4.1 (with the BGP EIS commitment number provided in parenthesis).

Further to the commitments provided within the BGP EIS and reproduced below, a number of other mitigation measures included within the Arrow Energy Species Management Program for Tampering with Animal Breeding Places (which was developed for the State Department of Environment and Science (DES) in March 2018) are of relevance and have been included in the list below. These measures are marked 'SMP'.

The particular mitigation measures that relate to each individual EPBC Act species and community are identified in the individual species and community profiles provided as Appendix C. Measures that are proposed by Arrow to address Condition 9(b) beyond those listed in Table 3.1 are listed in Table 4.1. In addition to the mitigation measures listed in Table 4.1, Arrow's response to, and reporting of, injury or mortality of EPBC Act fauna during construction, operation and decommissioning is as described previously in Sections 3.1 and 3.2.

Table 4.1 Description of additional mitigation measures / commitments

| Mitigation | Commitment | Intended outcome | Responsible manager/s |
|---|---|--|--|
| Construction - clearing | <ul style="list-style-type: none"> • See Table 3.1 | | |
| Construction - Open trench management | <ul style="list-style-type: none"> • Trenches will be inspected and monitored as per the APIA Code of Environmental Practice (B159) and will be checked within two hours of sunrise and trapped fauna released. Additional monitoring will be undertaken following rainfall events (SMP). • The time a trench is left open will be minimised. Fauna exit points will be incorporated when construction is within 1 km of native vegetation, using appropriate material. Fauna refuges, such as sawdust-filled bags, will be provided regularly through areas of high fauna activity (B173). • As soon as practical following pipe laying, the trench will be backfilled with excavated material, compacted and topsoil replaced and erosion controls implemented (B299). | <ul style="list-style-type: none"> • To ensure that no unplanned impacts occur on Ornamental Snake, Koala or Greater Glider | <ul style="list-style-type: none"> • BGP Construction Managers (Arrow and Third Party Contractor) |
| Construction - Reduce light spill | <ul style="list-style-type: none"> • Lighting will be designed in a manner that limits disruption on landscape character, views and visual amenity and lighting will be directed into the infrastructure siting rather than dispersed into native vegetation when sites are adjacent to intact habitat (B099). | <ul style="list-style-type: none"> • To ensure that no unplanned impacts occur on the Red Goshawk, Koala, South-eastern Long-eared Bat, Large-eared Pied Bat and Greater Glider | <ul style="list-style-type: none"> • BGP Construction Managers (Arrow and Third Party Contractor) |
| Construction - Reduce project traffic speed | <ul style="list-style-type: none"> • Speed limits on Project controlled roads will be developed with due consideration to reduce the potential for vehicle collisions with wildlife (B154). | <ul style="list-style-type: none"> • To ensure that no unplanned impacts occur on Ornamental Snake, Squatter Pigeon or Koala | <ul style="list-style-type: none"> • BGP Construction Managers (Arrow and Third Party Contractor) |
| Construction - Bushfire | <ul style="list-style-type: none"> • Fire management plans will be developed for production facilities (B471). • Radiation exclusion zones around flares will be designed according to API standard (B485). • Enclosed spaces where flammable gas may accumulate will be minimised (B487). • Fire-fighting equipment will be installed, inspected and serviced in accordance with risk assessments and relevant legislation and standards (B499). • Gathering lines will be buried at a minimum depth of 600 mm. Where gathering lines are present above the ground (at wellheads and at vents or drains), a clear area will be maintained. The size of the cleared area will be determined on a site-by-site basis with | <ul style="list-style-type: none"> • To avoid degradation of TECs • To avoid reduction in the condition of listed threatened species habitat | <ul style="list-style-type: none"> • BGP Construction Managers (Arrow and Third Party Contractor) |

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| Mitigation | Commitment | Intended outcome | Responsible manager/s |
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| | <p>consideration of the site-specific risk of bushfire (B503).</p> <ul style="list-style-type: none"> • Fire-safety equipment will be commissioned in the early phase of the construction period (B505). • All buildings and production facilities will be fitted with smoke or fire alarms (B506). • Fire and gas detection systems will be installed to shutdown compressors (B508). • Protocols will be developed for the control of operational activities during extreme fire danger periods, e.g., flaring or shutdowns (B533). • Regular patrols and inspections of pipeline easements will be conducted, including status of signposting subsidence and of fire breaks (B536). • Vegetation surrounding production facilities and wellheads will be maintained in a manner that limits the amount of combustible material in the area. The size of the cleared area will be determined on a site-by-site basis with consideration of the site-specific risk of bushfire (B544). • Access tracks to well sites will be kept clear of dry grass and combustible material wherever practicable and where there is a higher risk of bushfire (to minimise the risk of dry grass being ignited by hot components of vehicles accessing the sites) (B547). • Daily operations will be managed with consideration of the fire danger current at that time (B548). | | |
| <p>Construction / Operation / Decommissioning - Weed control</p> | <ul style="list-style-type: none"> • A detailed pest management plan will be developed to mitigate and manage the potential spread of pest flora and fauna species (B152). This plan will include requirements for machinery washdown procedures to be followed during all clearing activities (new commitment). • Weed monitoring and targeted weed control measures will be undertaken within sensitive EVNT habitats (particularly threatened communities such as Brigalow and native grasslands) (B158). Weed control methods within EVNT habitats will be selected on the basis of minimising the risk of adverse impacts on EVNT species or communities (new commitment). • In accordance with the Pest Management Plan regular inspections for pest flora and evidence of pest fauna will be undertaken within Project disturbed areas (B171). • Washdown facilities will be designed to ensure that runoff is contained on site and does not transfer weed seeds, spores or infected soils to adjacent areas (B172). | <ul style="list-style-type: none"> • To avoid degradation of TECs • To avoid reduction in the condition of listed threatened species habitat • Successful implementation of Arrow's Vehicle and Machinery Hygiene Procedure (ORG-ARW-HSM-PRO-00138) and Weed Management Procedure (ORG-ARW-HSM-PRO-00139) | <ul style="list-style-type: none"> • BGP Managers (Arrow and Third Party Contractor) |

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| Mitigation | Commitment | Intended outcome | Responsible manager/s |
|---|--|---|---|
| | <ul style="list-style-type: none"> When sourcing maintenance materials, materials such as bedding sand, topsoil, straw bales and sand bags will be brought to site only after it is ascertained that the materials are not contaminated with weeds and plant or animal pathogens. A weed hygiene declaration form will be requested from the supplier where there is possible risk of contamination in products (B180). All relevant personnel will be made aware of the location and extent of weed infestations in the vicinity of the work area and the risks involved in moving from one site or property to another (B188). A declared weed and pest management plan will be developed in accordance with the Petroleum Industry – Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008). Species-specific management will be undertaken for identified key weed species at risk of spread through Project activities (Mesquite, Parthenium Weed, African Lovegrass and Lippia). Weed control efforts will be increased in areas particularly sensitive to invasion. The pest management plan will include, as a minimum, training, management of pest spread, management of pest infestations and monitoring effectiveness of control measures (B191). | | |
| Construction / Operation / Decommissioning – Pest control | <ul style="list-style-type: none"> Arrow will manage food, waste and other project activities to prevent or minimise the potential for these to transport or attract pest animals which may then impact MNES (new commitment). | <ul style="list-style-type: none"> Successful implementation of Arrow’s Pest Management Procedure (ORG-ARW-HSM-PRO-00096) | <ul style="list-style-type: none"> BGP Managers (Arrow and Third Party Contractor) |
| Operation - Grazing | <ul style="list-style-type: none"> Grazing activities will be excluded from all Arrow gas and water processing and well head infrastructure sites. | <ul style="list-style-type: none"> To avoid degradation of TECs To avoid reduction in the condition of listed threatened species habitat | <ul style="list-style-type: none"> BGP Operations Managers (Arrow) |
| Operation / decommissioning - Appropriate rehabilitation | <ul style="list-style-type: none"> The cleared areas and stockpiles will be progressively rehabilitated through revegetation and/or mulching (B021). Areas will be cleared progressively and rehabilitation implemented as soon as practicable following construction and decommissioning activities (B033). Rehabilitation timeframes will be compliant with applicable Environmental Authority conditions and consider any landholder requirements/expectations (new commitment) Rehabilitation plans will be developed addressing ground preparation requirements, natural and constructed drainage patterns, soil erodibility, contamination, slope | <ul style="list-style-type: none"> To ensure that no unplanned impacts occur on MNES as a result of construction activities To return the area to pre-disturbed condition (or better) as agreed with the landholder and as required | <ul style="list-style-type: none"> BGP Managers (Arrow and Third Party Contractor) |

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| Mitigation | Commitment | Intended outcome | Responsible manager/s |
|------------|---|---|-----------------------|
| | <p>steepness and length, vegetation cover, land use and landowner requirements (B064). Partial rehabilitation of gathering lines and other linear infrastructure will be undertaken to reduce edge effects (including weed invasion) and maintain movement rates (B156).</p> <ul style="list-style-type: none"> • Rehabilitation of available areas will be undertaken that is consistent with pre-clearance habitats, to increase the rate of recovery (B157). • Woody debris, logs and rocks will be retained for use in rehabilitation. Where practical, these will be piled along the edge of the cleared corridor. Where possible these features will be spread over all or part of the corridor to provide refugia for crossing fauna. Systematic removal of surface debris will be avoided and cleared timber will never be burnt (B161). • Data collection, particularly of EVNT species identified during pre-clearance surveys, during trench checking or in other Project related activities, will be ongoing until rehabilitation is complete (B163). • Site planning, preparation and management requirements will be implemented in accordance with a decommissioning and rehabilitation plan (B175). • After decommissioning, rehabilitation areas will be inspected for regrowth similar to the surrounding environment (B177). • Regular monitoring of rehabilitation success will be carried out (B183). • During rehabilitation works, care will be taken when moving stockpiled logs and vegetation to avoid fauna mortality (B186). • Excavations, particularly pipeline trenches and drilling sumps, will be backfilled and rehabilitated. Backfilling will be conducted in a manner that will promote successful rehabilitation, including capping of exposed subsoil with topsoil and replacement of the land surface to preconstruction levels to reduce trench subsidence and concentration of flow. Soils will be mounded where required to allow for settling. However, in laser-levelled paddocks, this may not be practicable, and backfilling will be carried out in consultation with the landowner (B233). • A rehabilitation management plan for decommissioning will be developed and implemented which includes monitoring and maintenance of rehabilitated areas until rehabilitation sign off criteria are met (B339). | <p>by DES in order to grant progressive rehabilitation certification and EA surrender</p> | |

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| Mitigation | Commitment | Intended outcome | Responsible manager/s |
|--|--|--|---|
| | <ul style="list-style-type: none"> Monitoring of the rehabilitated areas will be undertaken to identify whether the general objectives of the rehabilitation strategy are being met, and whether a sustainable and stable landform has been achieved. Monitoring will be conducted by suitably skilled and qualified persons at representative locations. Annual reviews of monitoring data will be conducted during operations, and post closure, to assess trends and performance (B591). A final rehabilitation report and a decommissioning plan, including a contaminated land assessment where required, landowner commitments and agreements, and rehabilitation status, will be prepared and submitted to the appropriate authorities for approval where required (B592). The area disturbed within the pipeline corridor during the laying of the pipelines will be progressively rehabilitated as soon as practicable after completion of the pipeline installation. Fences, roads and tracks and other existing infrastructure impacted during construction of the pipeline will be repaired and/or replaced as required (B594). At decommissioning, a suitable vegetation cover will be re-established to enable natural vegetation progression and minimal weed invasion (B606). Final ground conditions will be rehabilitated to a state that is conducive to support further natural regeneration at project closure (B607). | | |
| Construction / Operation / Decommissioning - Documentation | <ul style="list-style-type: none"> A Water Management Plan, Erosion and Sediment Control Plan, and Waste Management Plan will be designed to avoid or minimise the potential impacts of Project (B207). Corrective actions will be undertaken in accordance with the outcomes of incident investigations, audits, monitoring results or advice given by the relevant regulatory authority (B593). Arrow will develop emergency response plans in consultation with emergency services organisations that includes a list of required equipment, training and other resources, and foreseeable emergency and crisis situations (including escapes, blowouts, gas fire, bushfire, critical equipment failure, trapped or missing people, flooding, cyclones, power failure, security incidents and threats, and transport incidents). The plans will include safe evacuation procedures, communication protocols (internal and to emergency services, including the Petroleum and Gas Inspectorate), accounting for personnel and visitors, roles and responsibilities, and requirements for training (B480). | <ul style="list-style-type: none"> To ensure that the planned (and actual) impacts to MNES are accurately documented and offset | <ul style="list-style-type: none"> Environment Manager (Arrow) |

BGP EPBC Species Impact Management Plan

| Mitigation | Commitment | Intended outcome | Responsible manager/s |
|---|---|--|--|
| | <ul style="list-style-type: none"> Any residual impacts to EPBC Act species and communities will be offset. A detailed BGP Phase 1 Offset Strategy and additional offset strategies for the subsequent phases will be developed and implemented to add value rather than just compensating for impact (new commitment). | | |
| Construction / Operation / Decommissioning - Hazardous materials management | <ul style="list-style-type: none"> Appropriate international, Australian and industry standards and codes of practice will be applied for the handling and storage of hazardous materials, such as chemicals, fuels and lubricants (B078). Appropriate spill response equipment including containment and recovery equipment will be available onsite (B079). Staff will be trained on appropriate handling, storage and containment practices for chemical, fuels and other potential chemicals as relevant (B083). | <ul style="list-style-type: none"> To avoid degradation of TECs To avoid reduction in the condition of listed threatened species habitat | <ul style="list-style-type: none"> BGP Managers (Arrow and Third Party Contractor) |
| Ornamental Snake management | <ul style="list-style-type: none"> Where practicable, disturbance will be avoided in areas known or assessed to be suitable habitat for Ornamental Snake during the breeding season (September to April) (SMP). If Ornamental Snake breeding activity is observed, an exclusion zone (30 m radius) will be enforced until the breeding place is vacated (SMP). Soil cracks within potential Ornamental Snake habitat that could harbour snakes will be marked with spray paint. A borescope, or similar equipment, will be used to determine the presence of a snake. If a snake is found, the spotter-catcher will attempt to dig up the soil crack and remove the animal (SMP). Spotlighting will be completed in line with Arrow's Ornamental Snake Guideline (ORG-ARW-HSM-GUI-00101, Section 8) when the following are met: <ul style="list-style-type: none"> Prior to commencing construction activities that involve significant ground disturbance, and Within the breeding and high activity period of September to April (SMP). Ornamental Snakes captured will be retained by a licensed FSC for the duration of the day's construction activities and released in a suitable habitat in close proximity to the site boundaries that evening (i.e. within 24 hours), or retained and released in line with the FSC's permits if construction is ongoing (SMP). | <ul style="list-style-type: none"> To minimise impacts and risk of impacts on Ornamental Snake as a result of construction activities | <ul style="list-style-type: none"> BGP Construction Managers (Arrow and Third Party Contractor) |

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| Mitigation | Commitment | Intended outcome | Responsible manager/s |
|-------------------------------------|---|---|--|
| Squatter Pigeon specific management | <ul style="list-style-type: none"> • If Squatter Pigeon breeding activity is observed, an exclusion zone (50 m radius) will be enforced until the breeding place is vacated (SMP). • Removal or relocation of individual Squatter Pigeon's, young or eggs will only be undertaken after measures have been taken to avoid and minimise impacts on the identified active breeding place as per the management hierarchy described in Section 2. (SMP). • As a last resort, Squatter Pigeon eggs or young may be removed and placed with a licensed wildlife carer/facility for incubation of eggs and/or raising of the young for subsequent release (SMP). | <ul style="list-style-type: none"> • To minimise impacts and risk of impacts on Squatter Pigeon as a result of construction activities | <ul style="list-style-type: none"> • BGP Construction Managers (Arrow and Third Party Contractor) |
| Red Goshawk specific management | <ul style="list-style-type: none"> • The probability of Red Goshawk nesting in the BGP is considered low. However, should a potential nest be identified in proximity to existing or proposed project activities Arrow (with Construction Contractor) would: <ul style="list-style-type: none"> – Stop work at the location. – Notify Arrow so that Arrow may notify the relevant authorities (i.e. DotEE and DES). – Seek approval from DotEE for additional disturbance if any impact is 'significant' and unavoidable. – Manage the species or community in accordance with the mitigation measures listed in Appendix C and all applicable conditions of approval including the Offset Strategy for the relevant Project phase. – Tag/barricade the identified species/community in an appropriate manner to ensure protection. – Cease clearing works in the immediate area. – Record GPS coordinates so that it may be incorporated into the Site Environmental Map as a 'no-go zone' or recorded as an impact area. – Provide all relevant information to Arrow for monthly tracking of EPBC Act species and community impacts for annual reporting (SMP). | <ul style="list-style-type: none"> • To minimise impacts and risk of impacts on Red Goshawk as a result of construction activities | <ul style="list-style-type: none"> • BGP Construction Managers (Arrow and Third Party Contractor) |

BGP EPBC Species Impact Management Plan

| Mitigation | Commitment | Intended outcome | Responsible manager/s |
|--|---|--|--|
| Koala specific management | <ul style="list-style-type: none"> • If a Koala is found within the clearing footprint; a minimum exclusion zone of 100 m will be established for a female Koala with obvious young and 50 m for all other Koala, until the animal has moved of its own accord. No vehicles are to enter the buffer (exclusion) zone at any time. Vehicle operators will be made aware of the presence of the Koala and a reduced speed limit established until the animal has moved on of its own accord (SMP). | <ul style="list-style-type: none"> • To minimise impacts and risk of impacts on Koala as a result of construction activities | <ul style="list-style-type: none"> • BGP Construction Managers (Arrow and Third Party Contractor) |
| South-eastern Long-eared Bat specific management | <ul style="list-style-type: none"> • All reasonable and practicable attempts (if safe to do so) will be made to check hollow bearing trees, hollow logs, peeling bark and splits in tree trunks for the presence of South-eastern Long-eared Bat (SMP). • If breeding activity of South-eastern Long-eared Bat is observed, an exclusion zone (30 m radius) will be enforced until the breeding place is vacated (SMP). • As a last resort, South-eastern Long-eared Bat young may be removed and placed with a licensed wildlife carer/facility for incubation of eggs and/or raising of the young for subsequent release (SMP). • Where hollows containing South-eastern Long-eared Bat maternity sites have been identified that are inactive and unavoidable, the FSC will determine whether it is to be relocated or left in situ (SMP). • Where relocation of South-eastern Long-eared Bat in tree hollows is required, an elevated work platform or cherry-picker may be used in conjunction with a chainsaw operator and the FSC (or a FSC who holds a current training qualification in use of chainsaws) to attempt to remove the hollow. The following step-by-step process (modified from Nottidge, 2012) will be considered if safe to do so: <ul style="list-style-type: none"> – The FSC (with chainsaw operator unless the FSC is a qualified chainsaw operator) will inspect each visible hollow or potential breeding place (e.g. nest) identified in each tree using the cherry picker. This is usually carried out by simply looking into hollows and nests (with the assistance of a small torch); however, fibrescopes may also be useful for deep hollows. – If bats are located within a hollow, a piece of towel or rag would be firmly placed in the entrance to prevent the wildlife from escaping, as they may attempt to flee the nesting/denning hollow. – Once the hollow entrance has been secured, the chainsaw operator will remove the entire hollow limb below the cavity where the branch remains | <ul style="list-style-type: none"> • To minimise impacts and risk of impacts on South-eastern Long-eared Bat as a result of construction activities | <ul style="list-style-type: none"> • BGP Construction Managers (Arrow and Third Party Contractor) |

BGP EPBC Species Impact Management Plan

| Mitigation | Commitment | Intended outcome | Responsible manager/s |
|--|--|--|--|
| | <p>solid. In circumstances where a hollow continues into the main stem of the tree, the chainsaw operator would carefully cut a small window into the hollow, allowing the FSC to plug the hollow above and below the window, then the hollow limb is removed and lowered to the ground in sections.</p> <ul style="list-style-type: none"> - When the bats have been safely secured within its hollow, the entire limb would then be placed in the cherry-picker bucket or lowered to the ground using ropes (depending on the size of the limb). - This limb would be placed in a cool, quiet location until translocation to the recipient habitat site, when at dusk of the same day the hollow entrance will be reopened to allow the bats to emerge of their own accord. | | |
| Large-eared Pied Bat specific management | <ul style="list-style-type: none"> • All reasonable and practicable attempts (if safe to do so) will be made to check suitable caves for the presence of Large-eared Pied Bat (new commitment). | <ul style="list-style-type: none"> • To minimise impacts and risk of impacts on Large-eared Pied Bat as a result of construction activities | <ul style="list-style-type: none"> • BGP Construction Managers (Arrow and Third Party Contractor) |

5. Monitoring program

Condition 9(c): A monitoring program to determine the success of mitigation and management measures to ensure adaptive management for the duration of this approval.

Monitoring will be undertaken to determine the success of the mitigation and management measures identified within this SIMP and to identify whether the general objectives of the rehabilitation strategy are being met, and whether a sustainable and stable landform has been achieved. The monitoring program will focus on those sensitive ecological values at risk of a high to extremely high level of residual impact and will be based on review and assurance of the environmental management plan active for the site. The active plan will include reference to the relevant environmental impact management processes and procedures, assurance methods and incident response procedures.

Monitoring will be conducted by suitably skilled and qualified persons at representative locations. Annual reviews of monitoring data will be conducted during operations, and post closure, to assess trends and performance. Corrective actions will be undertaken based on the outcomes of incident investigations, audits, monitoring results and advice given by the relevant regulatory authority.

Table 5.1 sets out the monitoring program which will be undertaken which relate specifically to EPBC Act species and communities. The table describes the location, methods and proposed timing as well as identifying responsible parties, reporting formats, trigger values for corrective actions to be initiated and describes adaptive management responses and / or how they will be determined. Where relevant, existing BGP EIS commitments are identified by commitment numbers in parenthesis. The particular monitoring activities that relate to each individual EPBC Act species and community are identified in Appendix C.

Note that Geocortex and the Arrow Sharepoint database, referred to in Table 5.1 is a web-based collaborative platform that integrates with Microsoft Office and allows multiple users to enter and view project data.

Table 5.2 identifies the indicators of success and corrective actions that correlate to each of the mitigation measures identified in Tables 3.1 and 4.1.

Table 5.1 Monitoring program components for EPBC Act species and communities

| Monitoring Activities | Methods / commitments | Locations | Timing | Who | Reporting format | Corrective action trigger values | Adaptive management responses |
|---|--|------------------------------------|---|---|--|---|---|
| Review of compliance with approval conditions and SIMP mitigation measure commitments | <p>The coordinates and total area of cleared EPBC Act species and community habitat will be recorded and tracked monthly against approved maximum disturbance limits and used for annual compliance reporting.</p> <p>All confirmed cases of non-compliance (and remedial actions) will be reported on the Arrow website.</p> <p>Monitoring and inspection of avoidance, mitigation and management measures will be implemented to ensure the impacts and residual risks continue to be low throughout the lifetime of the Project (B640).</p> | BGP activity areas | Annual | Arrow | Annual Compliance Report | Non - compliances | As determined by Annual Compliance Reports |
| Pre- clearance surveys | <p>Surveys to identify any additional areas that need to be avoided (B132) and quantify areas of EPBC Act species, species habitat or TEC which are unavoidable and will be cleared.</p> <p>As a minimum, these will include:</p> <ul style="list-style-type: none"> • vegetation mapping at a scale suitable for site-specific planning. • identification of core habitats for EVNT species. | Proposed vegetation clearing sites | Prior to all vegetation clearing Reported annually | Supervised by a suitably qualified person | Annual Pre - clearance Survey Report provided on the Arrow website | Clearances proposed which would result in the project exceeding the maximum disturbance limit for any EPBC Act species or communities | <p>A more detailed assessment will be undertaken to identify if the EPBC Act species, habitat or community can be avoided or impacts minimised.</p> <p>Information on the findings and potential impacts will be prepared and notification provided to DotEE and Department</p> |

BGP EPBC Species Impact Management Plan

| Monitoring Activities | Methods / commitments | Locations | Timing | Who | Reporting format | Corrective action trigger values | Adaptive management responses |
|-----------------------|--|------------------------------------|--|---|--|--|---|
| | <ul style="list-style-type: none"> identification of site-specific sensitive areas (e.g. ESAs) that require avoidance or buffers (B132). <p>Quantification will be based on field recording of GPS coordinates of the boundary of the core habitat within proposed clearing boundaries. These surveys will also be used to ensure that the limits of the area to be cleared are clearly marked on the ground (i.e. high visibility flagging tape, hazard netting or similar) in accordance with the construction limits shown on construction drawings.</p> | | | | | including any residual significant impact to any of these that are not included in Table 1 of the EPBC approval. | <p>of Environment and Science (DES).</p> <p>Approval for additional unavoidable residual significant impacts to any EPBC Act species or community (including any of these which were not in Table 1 of the EPBC approval) will be sought. Arrow also commits to providing offsets for any such additional residual significant impacts.</p> <p>See Section 6 for further details on Arrow's process for addressing impacts to EPBC species or communities not identified in Table 1 of the EPBC approval.</p> |
| | Key Koala trees will be identified and visually inspected prior to clearing to ensure that they are free of Koalas (B190). | Proposed vegetation clearing sites | Prior to vegetation clearing and daily during clearing works | Supervised by a suitably qualified person | <p>Koala presence recorded within Geocortex and the Arrow Sharepoint database.</p> <p>Spotter-catcher daily activity records</p> | Koalas located | Trees containing Koalas retained until the animals have moved on (B190). |

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| Monitoring Activities | Methods / commitments | Locations | Timing | Who | Reporting format | Corrective action trigger values | Adaptive management responses |
|-----------------------|--|---|--|---|--|---|---|
| | Hollow-bearing tree locations and patches of vegetation with a distinct canopy and a dense cluttered shrub layer will be recorded. | Proposed vegetation clearing areas within core habitat for the South-eastern Long-eared Bat | Prior to vegetation clearing | Supervised by a suitably qualified person | Hollow-bearing trees and preferred habitat patches recorded within Geocortex and the Arrow Sharepoint database | Hollow-bearing tree and preferred habitat patches identified | Spotter-catcher present and search for this species in these areas during clearing. |
| | Record Painted Honeyeater individuals and dense stands of mistletoe. | Proposed vegetation clearing areas within core habitat for the Painted Honeyeater | Prior to vegetation clearing | Supervised by a suitably qualified person | Individuals and preferred habitat patches recorded within Geocortex and the Arrow Sharepoint database | Individuals or preferred habitat patches identified | Spotter-catcher present and search for this species during clearing. |
| | Trees will be assessed for potential nesting hollows prior to felling (B189). | Proposed vegetation clearing sites | Prior to clearing | Supervised by a suitably qualified person | Nesting hollows recorded within Geocortex and the Arrow Sharepoint database. Spotter-catcher daily activity records. | Nesting hollows identified | Trees will be felled in the presence of a FSC and rolled so that the hollows are facing upwards, allowing fauna to escape (B189). |
| | Data collection, particularly of EVNT species identified during pre-clearance surveys, during trench checking or in other BGP related activities, will be ongoing until rehabilitation is complete (B163). Pre-clearance surveys will include searches for EVNT species and communities. | Predicted and known EVNT species locations | During pre-clearance surveys and checking of open trenches | Arrow | Recorded within Geocortex and the Arrow Sharepoint database | Clearances proposed which would result in the BGP exceeding the maximum disturbance limit for any | A more detailed assessment will be undertaken to identify if the EPBC Act species, habitat or community can be avoided or impacts minimised before the clearing takes place. Information on the |

BGP EPBC Species Impact Management Plan

| Monitoring Activities | Methods / commitments | Locations | Timing | Who | Reporting format | Corrective action trigger values | Adaptive management responses |
|--------------------------------------|---|---------------------------|--|--|--|---|--|
| | | | | | | EPBC Act species or communities including any residual significant impact to any of these which are not included in Table 1 of the EPBC approval. | findings and potential impacts will be prepared and notification provided to DotEE and DES. Approval for additional unavoidable residual significant impacts to any EPBC Act species or community (including any of these which were not in Table 1 of the EPBC approval) will be sought. Arrow also commits to providing offsets for any such additional residual significant impacts. See Section 6 for further details on Arrow's process for addressing impacts to EPBC species or communities not identified in Table 1 of the EPBC approval. |
| Monitoring for unauthorised clearing | Audits/checks will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167). Buffer zones and the Project footprint will be regularly monitored using satellite imagery (B215). | Vegetation clearing areas | At least daily during clearing and at the completion of clearing | Construction contractor (environmental representative) | The Construction Contractor is required to report any unauthorised clearing to the Arrow Environment Manager within 24hrs of becoming aware. | Unauthorised Clearing | Review of CEMP with Construction Contractor and amendment as required. |

BGP EPBC Species Impact Management Plan

| Monitoring Activities | Methods / commitments | Locations | Timing | Who | Reporting format | Corrective action trigger values | Adaptive management responses |
|----------------------------------|--|----------------------------------|------------------------------|--|---|--|--|
| Fauna spotter-catcher monitoring | A FSC will be at the site on the day of clearing. The number of FSCs on site at the time of clearing will depend on the number of machines being used at any given time. | Active vegetation clearing areas | At all times during clearing | Suitably qualified FSCs as per the definition provided in EPBC 2012/6377 | All human/wildlife interactions or incidents involving EVNT Act fauna species will be reported to Arrow via the Fauna Incident Notification Form (FIN) within 24 hours, and will be detailed in the FSC report to be provided to Arrow at the completion of habitat clearing activities (or weekly if clearing activities are ongoing). The FSC report will also detail all human/wildlife interactions or incidents with any species irrespective of their conservation status. Interactions are defined as observations of the species on the work site, captures, removals and | Injury to or mortality of individuals of EPBC Act species. | An investigation into possible root causes would be undertaken as well as a review of relevant mitigation measures and the CEMP and refinement of these where necessary. |

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| Monitoring Activities | Methods / commitments | Locations | Timing | Who | Reporting format | Corrective action trigger values | Adaptive management responses |
|--|---|--|---|---|--|---|--|
| | | | | | relocations. Incidents are defined as any injury or death. | | |
| Inspection for fauna entrapment | Trenches will be inspected and monitored as per the APIA Code of Environmental Practice (B159) and will be checked within two hours of sunrise and trapped fauna released. Additional inspections will be undertaken after rainfall events. | All open trenches | At least daily whenever trenches are open | Suitably qualified person | Fauna rescue records | Injury to or mortality of individuals of EPBC Act species | Construction of additional fauna exit ramps / ladders; installation of additional trench plugs; increased frequency of inspections. |
| EPBC fauna presence and frequency monitoring | Data collection, particularly of EVNT species identified during pre-clearance surveys, during trench checking or in other Project related activities, will be ongoing until rehabilitation is complete (B163). Consideration will be given to conducting targeted monitoring in co-operation with the proponents of overlapping Projects. Particularly suited species to such monitoring include Ornamental Snake and Koala (B165). | Representative habitat areas in proximity to project disturbed areas or infrastructure | Annual | Supervised by a suitably qualified person | Annual EPBC Monitoring Report | Statistically significant reduction in EPBC fauna frequency attributable to the BGP | An investigation into possible root causes would be undertaken as well as a review of relevant mitigation measures and the CEMP and refinement of these where necessary. |
| Analysis of EPBC Act fauna species mortality records | EVNT fauna mortality (e.g. road kill) record database will be maintained and analysed. | All BGP areas | Incident based throughout the life of the project | Arrow | Recorded within Geocortex and the Arrow Sharepoint database and reported in Annual Compliance Report | Any EVNT fauna mortalities caused by BGP activities | Dependence on the cause of mortality responses could include installation of warning signs or fencing and reduction in speed limits in specific locations. |

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| Monitoring Activities | Methods / commitments | Locations | Timing | Who | Reporting format | Corrective action trigger values | Adaptive management responses |
|--|---|--|---|---|-------------------------------|--|---|
| King Bluegrass presence and frequency and habitat condition monitoring | Inspections for King Bluegrass presence and frequency and habitat condition will be undertaken in accordance with the Queensland Government Department of Environment and Heritage Protection's Guide to determining terrestrial habitat quality – A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy (2017). | Representative areas of known occupancy in proximity to project disturbed areas or infrastructure | Annual | Supervised by a suitably qualified person | Annual EPBC Monitoring Report | Statistically significant reduction in frequency or a whole number fall in average habitat quality score | An investigation into possible root causes would be undertaken within 3 months of a corrective action trigger as well as a review of relevant mitigation measures and the CEMP and refinement of these where necessary. |
| EPBC Act community condition monitoring | Inspections for EPBC community health will be undertaken in accordance with the Queensland Government Department of Environment and Heritage Protection's Guide to determining terrestrial habitat quality – A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy (2017). | Representative TEC areas in proximity to project disturbed areas or infrastructure | Annual | Supervised by a suitably qualified person | Annual EPBC Monitoring Report | A whole number fall in average habitat quality score for a TEC | An investigation into possible root causes would be undertaken within 3 months of a corrective action trigger as well as a review of mitigation measures and CEMP and refinement where necessary. |
| Weed and pest monitoring | Weed surveys (and targeted weed control measures) will be undertaken within sensitive EVNT habitats (particularly threatened communities such as Brigalow and native grasslands) (B158). In accordance with the Pest Management Plan regular inspections for pest flora and | Representative Project disturbance areas within areas known to contain Black Ironbox, Bluegrass, King Bluegrass, | At least quarterly and reported at least annually | Arrow | Annual EPBC Monitoring Report | New weeds recorded. Higher weed cover within disturbed areas relative to adjoining areas. | Additional weed management measures at problem locations. Review of Weed and Pest Management Plan. |

BGP EPBC Species Impact Management Plan

| Monitoring Activities | Methods / commitments | Locations | Timing | Who | Reporting format | Corrective action trigger values | Adaptive management responses |
|---------------------------|---|--|---|---|-------------------------------|---|--|
| | <p>evidence of pest fauna will be undertaken within Project disturbed areas (B171).</p> <p>Weed surveys will include searches for <i>Prosopis glandulosa</i> (Mesquite), <i>Parthenium hysterophorus</i> (Parthenium Weed), <i>Eragrostis curvula</i> (African Lovegrass) and <i>Lippia alba</i> (Lippia) presence and cover (B191).</p> <p>Surveys will also search for any new weed and pest species being introduced to an area (new commitment).</p> | Squatter Pigeon, Brigalow TEC, Weeping Myall TEC, Native Grassland TEC and SEVT TEC. | | | | | |
| Rehabilitation monitoring | <p>Pipeline RoWs will be regularly inspected until ground stabilisation and natural revegetation or pasture grasses or crops are established (B095).</p> <p>After decommissioning, rehabilitation areas will be inspected for regrowth similar to the surrounding environment (B177).</p> <p>Regular checks of rehabilitation success will be carried out (B183).</p> <p>A rehabilitation management plan for decommissioning will be developed and implemented which includes inspections and maintenance of rehabilitated areas</p> | All Project disturbed areas | Post-construction, at least quarterly and reported annually | Supervised by a suitably qualified person | Annual EPBC Monitoring Report | Rehabilitation data trending away from, and prior to, non-achievement of rehabilitation completion criteria | An investigation into possible root causes would be undertaken within 3 months of the corrective action trigger including a review of the suitability of rehabilitation methods being applied. |

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| Monitoring Activities | Methods / commitments | Locations | Timing | Who | Reporting format | Corrective action trigger values | Adaptive management responses |
|------------------------|--|--------------|-------------------------------------|-------|--|---|--|
| | <p>until rehabilitation sign off criteria are met (B339).</p> <p>Surveys/inspections of the rehabilitated areas will be undertaken to identify whether the general objectives of the rehabilitation strategy are being met, and whether a sustainable and stable landform has been achieved. Surveys/inspections will be conducted by suitably skilled and qualified persons at representative locations. Annual reviews of surveys/inspection data will be conducted during operations, and post closure, to assess trends and performance.</p> | | | | | | |
| Offset area monitoring | <p>As per Condition 13 of the Variations to Conditions Attached to Approval (25/03/2018) for the BGP (EPBC 2012/6377), no Project Phases will commence until an Offset Strategy addressing offset obligations for that Project Phase has been developed by Arrow and approved by the Minister.</p> <p>Each Strategy will set out a program for monitoring and reporting on the effectiveness of the management measures, and identify the performance and completion criteria to be tracked</p> | Offset areas | During the life of each offset area | Arrow | Offset progress reports which will feed into the Offset Strategies for subsequent Project Phases | These will be identified within each strategy / offset area management plan | These will be identified within each strategy / offset area management plan. |

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| Monitoring Activities | Methods / commitments | Locations | Timing | Who | Reporting format | Corrective action trigger values | Adaptive management responses |
|-----------------------|-----------------------|-----------|--------|-----|------------------|----------------------------------|-------------------------------|
| | for the offset areas. | | | | | | |

Table 5.2 Description of mitigation measures, indicators of success and corrective actions

| Mitigation | Commitment | Indicator of success | Corrective action |
|--|---|---|---|
| Pre-construction clearance surveys / minimise clearing | <ul style="list-style-type: none"> When the project activities proceed through the detailed planning phase, a field inspection of the specified disturbance footprint (this is specified by a surveyor in the field) will be undertaken by a suitably qualified ecologist and the presence, absence and extent of environmental values will be verified and mapped in the field via GIS. The results of this step will be recorded within Geocortex and the Arrow Sharepoint database (new commitment). Where environmental values are confirmed, a ‘framing trade-offs’ session will be held with the project engineers, planners and ecologists to determine if the location of the activities can be modified to avoid and/or reduce the impact to environmental values. In the event that EPBC species or community habitat cannot be avoided, the actual area to be cleared will be surveyed to quantify the impacts. This data will be recorded and cumulative impact areas tracked (new commitment). The disturbance footprint and vegetation clearing will be minimised (B017). The land cleared for construction purposes will be kept to the minimum necessary, especially during the drier months of the year (B018). Land disturbance will be minimised with the smallest practical area of land being disturbed in the shortest practicable time (B047). All operations will be planned to ensure minimal damage on any vegetation, cropping or pasture areas outside the limits to be cleared (B050). Disturbance within the following areas will be avoided where possible (part of B131): <ul style="list-style-type: none"> Endangered EPBC Act TECs: Brigalow Ecological Community; Natural Grasslands Ecological Community; Semi-evergreen Vine Thicket Ecological Community; Weeping Myall Woodlands). Core habitat for EVNT species. | <ul style="list-style-type: none"> Preconstruction clearance surveys by a suitably qualified ecologist are conducted at every site of proposed activities in areas mapped as core habitat known and core habitat possible for MNES There is documented evidence that the management hierarchy described in Section 2 has been implemented at every site of proposed activities in areas mapped as core habitat known and core habitat possible for MNES Linear infrastructure easements (right-of-way) will be within the limits authorised by the Environmental Authority (EA) The MNES impact areas are equal to or less than the impact areas shown in Tables 1.2 of this document | <ul style="list-style-type: none"> Undertake preconstruction clearance surveys by suitably qualified ecologist Investigate the cause of non-conformance with the management hierarchy and amend the relevant processes / procedures to avoid future non-conformance Investigate the cause of non-conformance with EA conditions and amend the relevant processes / procedures to avoid future non-conformance Notify the Department of the Environment and Energy of impacts beyond those shown in Table 1.2 and make the necessary adjustment in |

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| Mitigation | Commitment | Indicator of success | Corrective action |
|------------|---|----------------------|--|
| | <ul style="list-style-type: none"> • Pre-clearance surveys will be conducted to identify any additional areas that need to be avoided. As a minimum, these will include (B132): <ul style="list-style-type: none"> – vegetation mapping at a scale suitable for site-specific planning. – identification of core habitats for EVNT species. – identification of site-specific sensitive areas (e.g. ESAs) that require avoidance or buffers. • Wells, gathering lines and access tracks will be located within previous clearings or non-remnant vegetation if possible (B133). • Infrastructure will be designed to avoid undisturbed tracts of remnant vegetation, where practical. Where collection and gathering infrastructure is to be placed within contiguous vegetation, collection networks will be designed to avoid dissection (B134). • Access track location will avoid the repeated isolation of small parcels of remnant vegetation from more continuous tracts (B135). • Vegetation disturbance will be minimised wherever practical. Corridors for linear infrastructure will be as narrow as practical, particularly when crossing linear corridors of vegetation (e.g. Isaac River and Suttor Creek). Areas cleared for field development will be as small as practical (B136). • Habitat trees will be retained where practicable (B137). • Removal of riparian vegetation will be avoided when directional drilling and reduction of right of ways where practical (B138). • Access tracks and pipelines will deviate around sensitive vegetation where practicable (B140). • Sensitive infrastructure design principles will be applied to avoid watercourse, drainage lines and riparian areas where practicable (B142). • Pre-clearance surveys will be undertaken to determine the likelihood of the species (including weeds) occurring (B155). • Where EVNT species are identified in proposed development areas, consideration will be given to mitigation measures such as translocation and/or propagation of flora species. Progress of any translocation programs will be monitored in accordance with the relevant translocation management plans (B169). • The width of construction RoWs will be minimised within areas of sensitivity to the | | <p>the Offset Strategy / Plan for the subsequent phase</p> |

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| Mitigation | Commitment | Indicator of success | Corrective action |
|---|--|---|---|
| | <p>greatest extent practicable without compromising the safety of workers (B192).</p> <ul style="list-style-type: none"> • Buffer zones will be adopted for Project activities (with the exception of required creek crossings), in different areas of constraint, as defined by the project's constraints mapping (outlined in Section 7 and detailed in Constraints Mapping (Appendix BB of the EIS) (B196). • Tracks will be restricted in riparian zones and durations of impacts minimised, except in the immediate vicinity of creek crossings (B199). • During the design and construction of waterway crossings, care will be taken to minimise the footprint of the structure and to avoid unnecessary disturbance to stream beds and banks (B201). • Where practical the width of the easement will also be narrowed at these points, further reducing impacts on stream banks, beds and riparian zones by restricting the area of waterway that would be disturbed (B204). • Gathering line and access road creek crossings will be kept to a minimum where possible (B206). • Watercourse crossings will be minimised, where practicable, during route selection. Where required, crossing locations will be selected to avoid or minimise disturbance to aquatic flora, waterholes, watercourse junctions and watercourses with steep banks (B220). • Watercourse crossings will be designed to enable passage of flows resulting from a 1 in 100 year average recurrence interval flood event, as a minimum (B226). • Gathering lines and tracks will be designed to avoid watercourses, drainage lines and riparian areas (particularly permanent watercourses or perennial aquatic habitat), where practicable (B227). • Pipeline RoWs widths will be designed to be narrower at watercourse crossings, where practicable (B228). | | |
| Construction activities as per plan (no-go areas) | <ul style="list-style-type: none"> • Delineation of disturbance boundary limits of works will be clearly established prior to commencement of clearing and soil stripping (B049). • Disturbance exclusion zones (or management buffers) will be established and managed during construction and operations to effectively protect ESAs as defined by the project's constraints mapping (B145). | <ul style="list-style-type: none"> • There is documented evidence that the management hierarchy described in Section 2 has been implemented at every site of proposed activities in areas mapped as core habitat known | <ul style="list-style-type: none"> • Investigate the cause of non-conformance with the management hierarchy and amend the relevant processes / procedures to avoid |

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| Mitigation | Commitment | Indicator of success | Corrective action |
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| | <ul style="list-style-type: none"> Trees will be felled away from existing vegetation not identified for removal where practicable (B150). Damage to trees (e.g. through scraping of tree trunk or breaking of limbs by equipment) not identified for removal will be avoided where practicable (B151). Avoidance boundaries will be clearly delineated prior to clearing (B166). Audits/checks will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167). Construction activities in sensitive areas will be supervised to ensure appropriate methods (e.g., narrowing of RoW) are being implemented, where required (B182). Construction that will potentially affect waterways will occur during dry months (periods of low rainfall and low flow) where possible. The use of machinery and vehicles on stream beds and banks will be avoided wherever possible (B202). Trenching will be perpendicular to the creek where the gathering line crosses waterways (B203). Where possible trenching within or in the vicinity of watercourses will occur during the drier months of the year, which will reduce the potential for water quality decline as a result of sediment mobilisation (B205). Buffer zones and the Project footprint will be regularly monitored using satellite imagery (B215). Watercourse crossings will be constructed in a manner that minimises sediment release to watercourses, stream bed scouring, obstruction of water flows and disturbance of stream banks and riparian vegetation (i.e., the crossing location will be at a point of low velocity, and straight sections will be targeted, with the pipeline or road orientated as near to perpendicular to water flow as practicable) (B221). Transport of equipment across watercourses will be avoided unless an appropriate crossing that minimises disturbance to the watercourse bed and banks and to riparian vegetation is available (B225). Construction and maintenance activities will be planned to minimise movement of plant and equipment between properties or areas with weed infestations (B230). | <ul style="list-style-type: none"> and core habitat possible for MNES Fauna spotter catcher will be on site during clearing of any MNES As constructed impact areas (i.e. the actual area in which clearing of any MNES has occurred) are accurately documented The MNES impact areas are equal to or less than the impact areas shown in Tables 1.2 of this document Significant disturbance to watercourses will occur when there is no or low flow High risk weeds are managed as per Arrow's Weed Management Procedure (ORG-ARW-HSM-PRO-00139) | <ul style="list-style-type: none"> future non-conformance Ensure fauna spotter catcher is on site during clearing of any MNES Ensure site works / clearing boundaries are accurately marked in the field Early and clear communication of the tracking of actual versus authorised MNES impact areas and relocate future infrastructure to avoid MNES if actual impact is expected to exceed authorised impact Revise plans of significant disturbance to watercourses to occur when there is no or low flow or improve erosion and sediment controls when such works occur during conditions of water flow Reinforce the requirement to follow Arrow's Weed Management Procedure |
| Clear Communication | <ul style="list-style-type: none"> Harassment of wildlife and the unauthorised collection of flora or fauna will be prohibited, unless directed by a suitably qualified and experienced person (B149). | <ul style="list-style-type: none"> Records of preconstruction 'tool box' sessions / advices | <ul style="list-style-type: none"> Investigate the cause of non-conformance and |

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| Mitigation | Commitment | Indicator of success | Corrective action |
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| | | provided to construction crews demonstrating compliance | amend the relevant processes / procedures to avoid future non-conformance or apply appropriate measures if deemed a significant breach of conduct rules |
| Protection of topsoils | <ul style="list-style-type: none"> • Soil will be stripped according to designated profile depths, subject to further field investigations during stripping (B051). • Where practicable, stripped material will be placed directly onto area to be rehabilitated and spread immediately (if rehabilitation sequences and weather conditions permit) to avoid the requirement for stockpiling (B052). • Soils will be separated into windrows for later collection or re-spreading to minimise compression effects of heavy equipment (B053). • Soil transported by dump trucks may be placed directly into storage. Soil transported by scrapers will be pushed to form stockpiles by other equipment (e.g. dozer) to avoid tracking over previously laid soil to minimise compaction (B054). • Surface of soil stockpiles will be left in as coarsely structured a condition as possible to promote infiltration and minimise erosion until vegetation is established or suitable erosion controls have been applied, and to prevent anaerobic zones from forming (B055). • Pipeline construction will be conducted in a manner that limits the duration of exposure of soils. Stripped and salvaged soil will be re-used within a short period of time (i.e. 28 days) in areas where rehabilitation immediately follows the installation of pipelines (B063). • Erosion and Sediment Control Plans will be developed and maintained in accordance with the International Erosion Control Association (IECA) (2008) Best Practice Erosion and Sediment Control guidelines. All proposed erosion and sediment control measures will be implemented in advance of, or in conjunction with clearing activities (B066). • Topsoil will be stripped, salvaged and stockpiled separately from subsoils (B068). • Appropriate sediment and erosion control structures will be installed and maintained at work sites (B160). | <ul style="list-style-type: none"> • Erosion and Sediment Control Plans (inclusive of topsoil management specifications) in place and implemented prior to all clearing activities. | <ul style="list-style-type: none"> • Development and implementation of Plans |

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| Mitigation | Commitment | Indicator of success | Corrective action |
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| | <ul style="list-style-type: none"> Best practice erosion and sediment control measures will be implemented during decommissioning works in accordance with the requirements of the IECA (2008) Best Practice Erosion and Sediment Control manual (B337). | | |
| Open trench management | <ul style="list-style-type: none"> Trenches will be inspected and monitored as per the APIA Code of Environmental Practice (B159) and will be checked within two hours of sunrise and trapped fauna released. Additional inspections will be undertaken following rainfall events (SMP). The time a trench is left open will be minimised. Fauna exit points will be incorporated when construction is within 1 km of native vegetation, using appropriate material. Fauna refuges, such as sawdust-filled bags, will be provided regularly through areas of high fauna activity (B173). Harm to fauna from entrapment during construction and operation of dams will be prevented (B184). As soon as practical following pipe laying, the trench will be backfilled with excavated material, compacted and topsoil replaced and erosion controls implemented (B299). | <ul style="list-style-type: none"> Site records / photographs demonstrating compliance | <ul style="list-style-type: none"> Investigate the cause of non-conformance and amend the relevant processes / procedures to avoid future non-conformance |
| Fauna spotter catcher | <ul style="list-style-type: none"> Suitably qualified fauna spotter-catcher (FSC) or ecologist will capture injured wildlife, where possible. Injured wildlife resultant from land clearing will be taken to a qualified veterinary surgeon or carer where practical (B153). The FSC will be at the site on the day of clearing. The FSC will be suitably qualified as per the definition provided in EPBC 2012/6377. The number of FSCs on site at the time of clearing will depend on the number of machines being used at any given time (new commitment). Trees will be assessed for potential nesting hollows prior to felling. If hollows are identified, trees will be felled in the presence of a qualified FSC and rolled so that the hollows are facing upwards, allowing fauna to escape (B189). Key Koala trees will be identified and visually inspected prior to clearing to ensure that they are free of Koalas. If Koalas are located, the tree will be retained until the animals have moved on, typically overnight (B190). Checks for identified EPBC Act fauna species breeding places will be undertaken immediately prior to commencing vegetation clearing (SMP). Potential breeding places will be clearly marked in the field with spray paint, coloured flagging tape (unless not permitted by land owners, e.g. some cattle properties), or by other suitable methods (SMP). | <ul style="list-style-type: none"> Review of spotter/catcher records / notes demonstrates compliance Potential breeding places will be clearly marked in the field | <ul style="list-style-type: none"> Reinforce the requirement to follow Arrow's Fauna Spotter/Catcher Work Instruction document (ORG-ARW-AND-WOI-00001) Investigate the cause of non-conformance and amend the relevant processes / procedures to avoid future non-conformance |
| Appropriate | <ul style="list-style-type: none"> The cleared areas and stockpiles will be progressively rehabilitated through revegetation | <ul style="list-style-type: none"> Inspection of site during and | <ul style="list-style-type: none"> Early and clear |

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| Mitigation | Commitment | Indicator of success | Corrective action |
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| rehabilitation | <p>and/or mulching (B021).</p> <ul style="list-style-type: none"> • Areas will be cleared progressively and rehabilitation implemented as soon as practicable following construction and decommissioning activities (B033). • Rehabilitation timeframes will be compliant with applicable Environmental Authority conditions and consider any landholder requirements/expectations (new commitment) • Rehabilitation plans will be developed addressing ground preparation requirements, natural and constructed drainage patterns, soil erodibility, contamination, slope steepness and length, vegetation cover, land use and landowner requirements (B064). Partial rehabilitation of gathering lines and other linear infrastructure will be undertaken to reduce edge effects (including weed invasion) and maintain movement rates (B156). • Rehabilitation of available areas will be undertaken that is consistent with pre-clearance habitats, to increase the rate of recovery (B157). • Woody debris, logs and rocks will be retained for use in rehabilitation. Where practical, these will be piled along the edge of the cleared corridor. Where possible these features will be spread over all or part of the corridor to provide refugia for crossing fauna. Systematic removal of surface debris will be avoided and cleared timber will never be burnt (B161). • Data collection, particularly of EVNT species identified during pre-clearance surveys, during trench checking or in other Project related activities, will be ongoing until rehabilitation is complete (B163). • Site planning, preparation and management requirements will be implemented in accordance with a decommissioning and rehabilitation plan (B175). • After decommissioning, rehabilitation areas will be inspected for regrowth similar to the surrounding environment (B177). • Regular monitoring of rehabilitation success will be carried out (B183). • During rehabilitation works, care will be taken when moving stockpiled logs and vegetation to avoid fauna mortality (B186). • Excavations, particularly pipeline trenches and drilling sumps, will be backfilled and rehabilitated. Backfilling will be conducted in a manner that will promote successful rehabilitation, including capping of exposed subsoil with topsoil and replacement of the land surface to preconstruction levels to reduce trench subsidence and concentration of flow. Soils will be mounded where required to allow for settling. However, in laser- | <p>after installation of infrastructure demonstrates compliance</p> <ul style="list-style-type: none"> • That the area has been returned to pre-disturbed condition (or better) as agreed with the landholder and as required by DES in order to grant progressive rehabilitation certification and EA surrender. • Progressive rehabilitation certification is granted by the Department of Environment and Science (DES) when requested. • The EA surrender application including the Final Rehabilitation Report and landholder signoff is granted by the DES. | <p>communication with the construction crew if inspections are not demonstrating compliance</p> <ul style="list-style-type: none"> • Continued remediation and rehabilitation of the disturbed areas until the progressive rehabilitation certification is granted • Continued remediation and rehabilitation of the disturbed areas until the EA surrender application is granted |

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| Mitigation | Commitment | Indicator of success | Corrective action |
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| | <p>levelled paddocks, this may not be practicable, and backfilling will be carried out in consultation with the landowner (B233).</p> <ul style="list-style-type: none"> • A rehabilitation management plan for decommissioning will be developed and implemented which includes monitoring and maintenance of rehabilitated areas until rehabilitation sign off criteria are met (B339). • Monitoring of the rehabilitated areas will be undertaken to identify whether the general objectives of the rehabilitation strategy are being met, and whether a sustainable and stable landform has been achieved. Monitoring will be conducted by suitably skilled and qualified persons at representative locations. Annual reviews of monitoring data will be conducted during operations, and post closure, to assess trends and performance (B591). • A final rehabilitation report and a decommissioning plan, including a contaminated land assessment where required, landowner commitments and agreements, and rehabilitation status, will be prepared and submitted to the appropriate authorities for approval where required (B592). • The area disturbed within the pipeline corridor during the laying of the pipelines will be progressively rehabilitated as soon as practicable after completion of the pipeline installation. Fences, roads and tracks and other existing infrastructure impacted during construction of the pipeline will be repaired and/or replaced as required (B594). • At decommissioning, a suitable vegetation cover will be re-established to enable natural vegetation progression and minimal weed invasion (B606). • Final ground conditions will be rehabilitated to a state that is conducive to support further natural regeneration at project closure (B607). | | |
| Reduce light spill | <ul style="list-style-type: none"> • Lighting will be designed in a manner that limits disruption on landscape character, views and visual amenity and lighting will be directed into the infrastructure siting rather than dispersed into native vegetation when sites are adjacent to intact habitat (B099). | <ul style="list-style-type: none"> • No lighting directed towards intact Red Goshawk, Koala, South-eastern Long-eared Bat, Large-eared Pied Bat or Greater Glider habitat | <ul style="list-style-type: none"> • Lighting redirected or shielded away from intact habitat |
| Reduce project traffic speed | <ul style="list-style-type: none"> • Speed limits on Project controlled roads will be developed with due consideration to reduce the potential for vehicle collisions with wildlife (B154). | <ul style="list-style-type: none"> • Review reports generated from Arrow's In-Vehicle Monitoring System (IVMS) | <ul style="list-style-type: none"> • Clear communication and warning for any IVMS breaches |
| Weed control | <ul style="list-style-type: none"> • A detailed pest management plan will be developed to mitigate and manage the potential spread of pest flora and fauna species (B152). This plan will include | <ul style="list-style-type: none"> • Inspection of site after installation of infrastructure | <ul style="list-style-type: none"> • Reinforce the requirement to follow |

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| Mitigation | Commitment | Indicator of success | Corrective action |
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| | <p>requirements for machinery washdown procedures to be followed during all clearing activities (new commitment).</p> <ul style="list-style-type: none"> • Weed monitoring and targeted weed control measures will be undertaken within sensitive EVNT habitats (particularly threatened communities such as Brigalow and native grasslands) (B158). Weed control methods within EVNT habitats will be selected on the basis of minimising the risk of adverse impacts on EVNT species or communities (new commitment). • In accordance with the Pest Management Plan regular inspections for pest flora and evidence of pest fauna will be undertaken within Project disturbed areas (B171). • Washdown facilities will be designed to ensure that runoff is contained on site and does not transfer weed seeds, spores or infected soils to adjacent areas (B172). • When sourcing maintenance materials, materials such as bedding sand, topsoil, straw bales and sand bags will be brought to site only after it is ascertained that the materials are not contaminated with weeds and plant or animal pathogens. A weed hygiene declaration form will be requested from the supplier where there is possible risk of contamination in products (B180). • All relevant personnel will be made aware of the location and extent of weed infestations in the vicinity of the work area and the risks involved in moving from one site or property to another (B188). • A declared weed and pest management plan will be developed in accordance with the Petroleum Industry – Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008). Species-specific management will be undertaken for identified key weed species at risk of spread through Project activities (Mesquite, Parthenium Weed, African Lovegrass and Lippia). Weed control efforts will be increased in areas particularly sensitive to invasion. The pest management plan will include, as a minimum, training, management of pest spread, management of pest infestations and monitoring effectiveness of control measures (B191). | <p>demonstrates compliance</p> <ul style="list-style-type: none"> • High risk weeds are managed as per Arrow’s Weed Management Procedure (ORG-ARW-HSM-PRO-00139) | <p>Arrow’s Vehicle and Machinery Hygiene Procedure (ORG-ARW-HSM-PRO-00138) and Weed Management Procedure</p> |
| Grazing | <ul style="list-style-type: none"> • Grazing activities will be excluded from all Arrow gas and water processing and well head infrastructure sites (new commitment) | <ul style="list-style-type: none"> • Livestock absent from infrastructure sites | <ul style="list-style-type: none"> • Reinstate integrity of exclusion fencing |
| Documentation | <ul style="list-style-type: none"> • A Water Management Plan, Erosion and Sediment Control Plan, and Waste Management Plan will be designed to avoid or minimise the potential impacts of Project (B207). | <ul style="list-style-type: none"> • Water Management Plan, Erosion and Sediment Control | <ul style="list-style-type: none"> • Develop and implement required plans |

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| Mitigation | Commitment | Indicator of success | Corrective action |
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| | <ul style="list-style-type: none"> • Corrective actions will be undertaken in accordance with the outcomes of incident investigations, audits, monitoring results or advice given by the relevant regulatory authority (B593). • Arrow will develop emergency response plans in consultation with emergency services organisations that includes a list of required equipment, training and other resources, and foreseeable emergency and crisis situations (including escapes, blowouts, gas fire, bushfire, critical equipment failure, trapped or missing people, flooding, cyclones, power failure, security incidents and threats, and transport incidents). The plans will include safe evacuation procedures, communication protocols (internal and to emergency services, including the Petroleum and Gas Inspectorate), accounting for personnel and visitors, roles and responsibilities, and requirements for training (B480). • Any residual impacts to EPBC Act species and communities will be offset. A detailed BGP Phase 1 Offset Strategy and additional offset strategies for the subsequent phases will be developed and implemented to add value rather than just compensating for impact (new commitment). | <p>Plan, and Waste Management Plan in place for the Project and Offset Strategy in place for relevant phase of the Project</p> | <ul style="list-style-type: none"> • Investigate the cause of non-conformance and amend the relevant processes / procedures to avoid future non-conformance |
| Hazardous materials management | <ul style="list-style-type: none"> • Appropriate international, Australian and industry standards and codes of practice will be applied for the handling and storage of hazardous materials, such as chemicals, fuels and lubricants (B078). • Appropriate spill response equipment including containment and recovery equipment will be available onsite (B079). • Staff will be trained on appropriate handling, storage and containment practices for chemical, fuels and other potential chemicals as relevant (B083). | <ul style="list-style-type: none"> • Records of training provided to construction crews demonstrating compliance | <ul style="list-style-type: none"> • Undertake and record evidence of such training • Investigate the cause of non-conformance and amend the relevant processes / procedures to avoid future non-conformance |
| Bushfire | <ul style="list-style-type: none"> • Fire management plans will be developed for production facilities (B471). • Radiation exclusion zones around flares will be designed according to API standard (B485). • Enclosed spaces where flammable gas may accumulate will be minimised (B487). • Fire-fighting equipment will be installed, inspected and serviced in accordance with risk assessments and relevant legislation and standards (B499). • Gathering lines will be buried at a minimum depth of 600 mm. Where gathering lines are present above the ground (at wellheads and at vents or drains), a clear area will be | <ul style="list-style-type: none"> • Fire management plans in place and implemented prior for all production facilities | <ul style="list-style-type: none"> • Development and implementation of required plans • Investigate the cause of non-conformance and amend the relevant processes / procedures to avoid future non-conformance |

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| Mitigation | Commitment | Indicator of success | Corrective action |
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| | <p>maintained. The size of the cleared area will be determined on a site-by-site basis with consideration of the site-specific risk of bushfire (B503).</p> <ul style="list-style-type: none"> • Fire-safety equipment will be commissioned in the early phase of the construction period (B505). • All buildings and production facilities will be fitted with smoke or fire alarms (B506). • Fire and gas detection systems will be installed to shutdown compressors (B508). • Protocols will be developed for the control of operational activities during extreme fire danger periods, e.g., flaring or shutdowns (B533). • Regular patrols and inspections of pipeline easements will be conducted, including status of signposting subsidence and of fire breaks (B536). • Vegetation surrounding production facilities and wellheads will be maintained in a manner that limits the amount of combustible material in the area. The size of the cleared area will be determined on a site-by-site basis with consideration of the site-specific risk of bushfire (B544). • Access tracks to well sites will be kept clear of dry grass and combustible material wherever practicable and where there is a higher risk of bushfire (to minimise the risk of dry grass being ignited by hot components of vehicles accessing the sites) (B547). • Project vehicles will not be driven or parked off-track in situations that are a high risk of igniting a grass fire (new commitment). • Daily operations will be managed with consideration of the fire danger current at that time (B548). | | |
| Ornamental Snake management | <ul style="list-style-type: none"> • Where practicable, disturbance will be avoided in areas known or assessed to be suitable habitat for Ornamental Snake during the breeding season (September to April) (SMP). • If Ornamental Snake breeding activity is observed, an exclusion zone (30 m radius) will be enforced until the breeding place is vacated (SMP). • Soil cracks within potential Ornamental Snake habitat that could harbour snakes will be marked with spray paint. A borescope, or similar equipment, will be used to determine the presence of a snake. If a snake is found, the spotter-catcher will attempt to dig up the soil crack and remove the animal (SMP). • Spotlighting will be completed in line with Arrow's Ornamental Snake Guideline (ORG-ARW-HSM-GUI-00101, Section 8) when the following are met: | <ul style="list-style-type: none"> • Review of spotter/catcher records / notes demonstrates compliance | <ul style="list-style-type: none"> • Reinforce the requirement to follow Arrow's Ornamental Snake Guideline (ORG-ARW-HSM-GUI-00101) |

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| Mitigation | Commitment | Indicator of success | Corrective action |
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| | <ul style="list-style-type: none"> – Prior to commencing construction activities that involve significant ground disturbance, and – Within the breeding and high activity period of September to April (SMP). <ul style="list-style-type: none"> • Ornamental Snakes captured will be retained by a licensed FSC for the duration of the day's construction activities and released in a suitable habitat in close proximity to the site boundaries that evening (i.e. within 24 hours), or retained and released in line with the FSC's permits if construction is ongoing (SMP). | | |
| Squatter Pigeon specific management | <ul style="list-style-type: none"> • If Squatter Pigeon breeding activity is observed, an exclusion zone (50 m radius) will be enforced until the breeding place is vacated (SMP). • Removal or relocation of individual Squatter Pigeon's, young or eggs will only be undertaken after measures have been taken to avoid and minimise impacts on the identified active breeding place as per the management hierarchy described in Section 2. (SMP). • As a last resort, Squatter Pigeon eggs or young would be removed and placed with a licensed wildlife carer/facility for incubation of eggs and/or raising of the young for subsequent release (SMP). | <ul style="list-style-type: none"> • Review of spotter/catcher records / notes demonstrates compliance | <ul style="list-style-type: none"> • Reinforce the requirement to follow Arrow's SMP commitments relating to Squatter Pigeon |
| Red Goshawk specific management | <ul style="list-style-type: none"> • The probability of Red Goshawk nesting in the BGP is considered low. However, should a potential nest be identified in proximity to existing or proposed project activities Arrow (with Construction Contractor) would: <ul style="list-style-type: none"> – Stop work at the location. – Notify Arrow so that Arrow may notify the relevant authorities (i.e. DotEE and DES). – Seek approval from DotEE for additional disturbance if any impact is 'significant' and unavoidable. – Manage the species or community in accordance with the mitigation measures listed in Appendix C and all applicable conditions of approval including the Offset Strategy for the relevant Project phase. – Tag/barricade the identified species/community in an appropriate manner to ensure protection. – Cease clearing works in the immediate area. – Record GPS coordinates so that it may be incorporated into the Site | <ul style="list-style-type: none"> • Review of spotter/catcher records / notes demonstrates compliance | <ul style="list-style-type: none"> • Reinforce the requirement to follow Arrow's SMP commitments relating to Red Goshawk |

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| Mitigation | Commitment | Indicator of success | Corrective action |
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| | <p>Environmental Map as a 'no-go zone' or recorded as an impact area.</p> <ul style="list-style-type: none"> – Provide all relevant information to Arrow for monthly tracking of EPBC Act species and community impacts for annual reporting (SMP). | | |
| Koala specific management | <ul style="list-style-type: none"> • If a Koala is found within the clearing footprint; a minimum exclusion zone of 100 m will be established for a female Koala with obvious young and 50 m for all other Koala, until the animal has moved of its own accord. No vehicles are to enter the buffer (exclusion) zone at any time. Vehicle operators will be made aware of the presence of the Koala and a reduced speed limit established until the animal has moved on of its own accord (SMP). | <ul style="list-style-type: none"> • Review of spotter/catcher records / notes demonstrates compliance | <ul style="list-style-type: none"> • Reinforce the requirement to follow Arrow's SMP commitments relating to the Koala |
| South-eastern Long-eared Bat specific management | <ul style="list-style-type: none"> • All reasonable and practicable attempts (if safe to do so) will be made to check hollow bearing trees, hollow logs, peeling bark and splits in tree trunks for the presence of South-eastern Long-eared Bat (SMP). • If breeding activity of South-eastern Long-eared Bat is observed, an exclusion zone (30 m radius) will be enforced until the breeding place is vacated (SMP). • As a last resort, South-eastern Long-eared Bat young may be removed and placed with a licensed wildlife carer/facility for incubation of eggs and/or raising of the young for subsequent release (SMP). • Where hollows containing South-eastern Long-eared Bat maternity sites have been identified that are inactive and unavoidable, the FSC will determine whether it is to be relocated or left in situ (SMP). • Where relocation of South-eastern Long-eared Bat in tree hollows is required, an elevated work platform or cherry-picker may be used in conjunction with a chainsaw operator and the FSC (or a FSC who holds a current training qualification in use of chainsaws) to attempt to remove the hollow. The following step-by-step process (modified from Nottidge, 2012) will be considered if safe to do so: <ul style="list-style-type: none"> – The FSC (with chainsaw operator unless the FSC is a qualified chainsaw operator) will inspect each visible hollow or potential breeding place (e.g. nest) identified in each tree using the cherry picker. This is usually carried out by simply looking into hollows and nests (with the assistance of a small torch); however, fibrescopes may also be useful for deep hollows. – If bats are located within a hollow, a piece of towel or rag would be firmly placed in the entrance to prevent the wildlife from escaping, as they may attempt to flee the nesting/denning hollow. | <ul style="list-style-type: none"> • Review of spotter/catcher records / notes demonstrates compliance | <ul style="list-style-type: none"> • Reinforce the requirement to follow Arrow's SMP commitments relating to the South-eastern Long-eared Bat |

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| | <ul style="list-style-type: none"> - Once the hollow entrance has been secured, the chainsaw operator will remove the entire hollow limb below the cavity where the branch remains solid. In circumstances where a hollow continues into the main stem of the tree, the chainsaw operator would carefully cut a small window into the hollow, allowing the FSC to plug the hollow above and below the window, then the hollow limb is removed and lowered to the ground in sections. - When the bats have been safely secured within its hollow, the entire limb would then be placed in the cherry-picker bucket or lowered to the ground using ropes (depending on the size of the limb). - This limb would be placed in a cool, quiet location until translocation to the recipient habitat site, when at dusk of the same day the hollow entrance will be reopened to allow the bats to emerge of their own accord. | | |
| Large-eared Pied Bat specific management | <ul style="list-style-type: none"> • All reasonable and practicable attempts (if safe to do so) will be made to check suitable caves for the presence of Large-eared Pied Bat (new commitment). | <ul style="list-style-type: none"> • Review of spotter/catcher records / notes demonstrates compliance | <ul style="list-style-type: none"> • Reinforce the requirement to check any suitable caves for Large-eared Pied Bats |

6. Consistencies with relevant documents

Condition 9(d): A discussion of relevant conservation advice, recovery plans and threat abatement plans and how measures proposed in the EPBC SIMP are consistent with the measures in these documents.

Table 6.1 identifies existing Conservation Advice, Recovery Plans and Threat Abatement Plan relating to each EPBC Act species and community and describes how this SIMP is consistent with these documents.

Table 6.1 Relevant documents for each EPBC Act species and community

| EPBC Act species / communities | Conservation Advice | Recovery Plan | Threat Abatement Plan | SIMP Consistency and Threats Addressed |
|--|---|--|--|---|
| Black Ironbox | <ul style="list-style-type: none"> Advice dated November 2008 (DEWHA, 2008a) Manage Habitat disturbance, smothering by <i>Cryptostegia grandiflora</i> (Rubber Vine), increased fire frequency from fuel associated with weeds and introduced grasses, increased stream bank erosion. | <ul style="list-style-type: none"> Not required – see conservation advice | <ul style="list-style-type: none"> No Plan has been identified as being relevant for this species (DotEE, 2018a) Key threats are provided in the conservation advice | <ul style="list-style-type: none"> Appendix C provides a species profile that identifies the proposed management measures for addressing key threats. The species specific mitigation measures described in Appendix C are grouped and have been selected on the basis that they address the following threats, as identified in the conservation advice: <ul style="list-style-type: none"> Inadvertent clearing and habitat disturbance Weeds (particularly Rubber Vine) Fire Increased stream-bank erosion |
| Bluegrass (<i>Dichanthium setosum</i>) | <ul style="list-style-type: none"> Advice dated March 2008 (DEWHA, 2008b) Manage livestock grazing, habitat clearing, frequent fires, introduced grasses and road widening. | <ul style="list-style-type: none"> Not required – see conservation advice | <ul style="list-style-type: none"> The <i>Threat abatement plan for competition and land degradation by rabbits</i> (DotEE, 2016) is identified as relevant | <ul style="list-style-type: none"> Appendix C provides a species profile that identifies the proposed management measures for addressing key threats. The species specific mitigation measures described in Appendix C are grouped and have been selected on the basis that they address the following threats, as identified in the conservation advice: <ul style="list-style-type: none"> Habitat loss, fragmentation and disturbance Grazing Weeds and feral herbivores Fire Mitigation measures are also described for an additional identified project specific threat; namely, soil compaction and mixing |

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| EPBC Act species / communities | Conservation Advice | Recovery Plan | Threat Abatement Plan | SIMP Consistency and Threats Addressed |
|--------------------------------|--|---|--|--|
| King Bluegrass | <ul style="list-style-type: none"> Advice dated January 2013 (DSEWPAC, 2013) Manage loss of habitat, (through agricultural and mining activities, road construction and other infrastructure developments), cultivation for crop production, grazing and invasion from weeds such as Parthenium Weed and <i>Parkinsonia aculeata</i> (Parkinsonia) | <ul style="list-style-type: none"> Required (being prepared) – see conservation advice | <ul style="list-style-type: none"> No Plan has been identified as being relevant for this species (DotEE, 2018d) Key threats are provided in the conservation advice | <ul style="list-style-type: none"> Appendix C provides a species profile that identifies the proposed management measures for addressing key threats. The species specific mitigation measures described in Appendix C are grouped and have been selected on the basis that they address the following threats, as identified in the conservation advice: <ul style="list-style-type: none"> Habitat loss and disturbance Grazing Weeds. Mitigation measures are also described for an additional identified project specific threat; namely, soil compaction and mixing. |
| Ornamental Snake | <ul style="list-style-type: none"> Advice dated Apr 2014 (DoE, 2014) Feeds almost exclusively on frogs Associated with periodically or permanently inundated areas Manage habitat loss and degradation, destruction of wetlands and frog habitats (including by pigs), poisoning by Cane Toads | <ul style="list-style-type: none"> Not required – see conservation advice | <ul style="list-style-type: none"> No Plan has been identified as being relevant for this species (DotEE, 2018e) Key threats are provided in the conservation advice | <ul style="list-style-type: none"> Appendix C provides a species profile that identifies the proposed management measures for addressing key threats. The species specific mitigation measures described in Appendix C are grouped and have been selected on the basis that they address the following threats, as identified in the conservation advice: <ul style="list-style-type: none"> Habitat loss and degradation, including destruction of wetlands and frog habitats Pigs and cane toad abundance Mitigation measures are also described for an additional identified project specific threat; namely, direct injury or mortality including through entrapment in open trenches and during dam construction |

BGP EPBC Species Impact Management Plan

| EPBC Act species / communities | Conservation Advice | Recovery Plan | Threat Abatement Plan | SIMP Consistency and Threats Addressed |
|--------------------------------|--|---|--|--|
| Squatter Pigeon | <ul style="list-style-type: none"> Advice dated Oct 2015 (TSSC, 2015a) Nests on the ground Manage habitat loss and fragmentation, overgrazing by livestock and rabbits, weeds, inappropriate fire regimes, predation by feral cats and fox and illegal shooting | <ul style="list-style-type: none"> Not required – see conservation advice | <ul style="list-style-type: none"> The <i>Threat abatement plan for predation by cats</i> (DoE, 2015a) is identified as relevant The <i>threat abatement plan for competition and land degradation by rabbits</i> (DotEE, 2016) is identified as relevant The <i>Threat abatement plan for predation by European red fox</i> (DEWHA, 2008c) is identified as relevant Squatter Pigeon identified as a species being affected by rabbits (through habitat degradation) and by feral cats (through predation). | <ul style="list-style-type: none"> Appendix C provides a species profile that identifies the proposed management measures for addressing key threats. The species specific mitigation measures described in Appendix C are grouped and have been selected on the basis that they address the following threats, as identified in the conservation advice: <ul style="list-style-type: none"> Habitat loss, fragmentation and disturbance Grazing Increased abundance of rabbits, feral cats, foxes and weeds Fire Illegal shooting Mitigation measures are also described for an additional identified project specific threat; namely, direct injury or mortality |
| Red Goshawk | <ul style="list-style-type: none"> Advice dated October 2015 (TSSC, 2015b) Manage habitat loss (including loss of wetlands and hollow-bearing tree , where prey breed), fragmentation and degradation (including through overgrazing by livestock and feral herbivores and altered fire regimes) | <ul style="list-style-type: none"> National recovery plan for the red goshawk (DNRM, 2012) Manage habitat loss and fragmentation, threats to prey base and paucity of information | <ul style="list-style-type: none"> No Plan has been identified as being relevant for this species (DotEE, 2018g) Key threats are provided in the conservation advice | <ul style="list-style-type: none"> Appendix C provides a species profile that identifies the proposed management measures for addressing key threats. The species specific mitigation measures described in Appendix C are grouped and have been selected on the basis that they address the following threats, as identified in the conservation advice: <ul style="list-style-type: none"> Habitat loss, fragmentation and disturbance |

BGP EPBC Species Impact Management Plan

| EPBC Act species / communities | Conservation Advice | Recovery Plan | Threat Abatement Plan | SIMP Consistency and Threats Addressed |
|--------------------------------|--|---|--|--|
| | | | | <ul style="list-style-type: none"> - Grazing - Increase feral herbivore numbers - Fire • Mitigation measures are also described for an additional identified project specific threat; namely, direct injury or mortality |
| Koala | <ul style="list-style-type: none"> • Advice dated April 2012 (DSEWPAC, 2012a) • Manage habitat loss and fragmentation, vehicle strike, disease and predation by dogs | <ul style="list-style-type: none"> • Multiple National and State-based plans | <ul style="list-style-type: none"> • Multiple National and State-based plans | <ul style="list-style-type: none"> • Appendix C provides a species profile that identifies the proposed management measures for addressing key threats. The species specific mitigation measures described in Appendix C are grouped and have been selected on the basis that they address the following threats, as identified in the conservation advice: <ul style="list-style-type: none"> - Habitat loss and fragmentation - Direct injury or mortality (including by vehicle strike) - Disease - Predation by dogs |
| South-eastern Long-eared Bat | <ul style="list-style-type: none"> • Advice dated October 2015 (TSSC, 2015) • Manage habitat loss and fragmentation, reduction in hollow availability, fire, exposure to agrichemicals, grazing and predation by feral animals | <ul style="list-style-type: none"> • Required – included on the ‘Commenced’ list • Recovery objectives are to increase understanding of basic ecology and to clarify distribution and abundance | <ul style="list-style-type: none"> • No Plan has been identified as being relevant for this species (DotEE, 2018i) • Key threats are provided in the conservation advice | <ul style="list-style-type: none"> • Appendix C provides a species profile that identifies the proposed management measures for addressing key threats. The species specific mitigation measures described in Appendix C are grouped and have been selected on the basis that they address the following threats, as identified in the conservation advice: <ul style="list-style-type: none"> - Habitat loss, fragmentation and reduction of hollow availability - Fire - Exposure to agrichemicals |

BGP EPBC Species Impact Management Plan

| EPBC Act species / communities | Conservation Advice | Recovery Plan | Threat Abatement Plan | SIMP Consistency and Threats Addressed |
|--------------------------------|--|---|---|--|
| | | | | <ul style="list-style-type: none"> - Grazing - Predation by feral animals • Mitigation measures are also described for an additional identified project specific threat; namely, direct injury or mortality |
| Large-eared Pied Bat | <ul style="list-style-type: none"> • There is no approved Conservation Advice for this species • Key threats are provided in the Commonwealth Listing Advice (TSSC, 2010) • Manage disturbance and damage at primary nursery roosts by animals and humans (recreational activities associated with cliffs), loss of foraging habitat and predation by foxes and other predators | <ul style="list-style-type: none"> • National recovery plan for the large-eared pied bat <i>Chalinolobus dwyeri</i> (DERM, 2011). • Minimise impacts associated with the destruction of, and interference with maternity and other roosts | <ul style="list-style-type: none"> • No Plan has been identified as being relevant for this species (DotEE, 2018j) • Key threats are provided in the Commonwealth Listing Advice (TSSC, 2010) | <ul style="list-style-type: none"> • Appendix C provides a species profile that identifies the proposed management measures for addressing key threats. The species specific mitigation measures described in Appendix C are grouped and have been selected on the basis that they address the following threats, as identified in the conservation advice: <ul style="list-style-type: none"> - Habitat loss, fragmentation and disturbance - Predation by foxes and other predators - Disturbance and damage to primary nursery roosts by animals and humans • Mitigation measures are also described for an additional identified project specific threat; namely, direct injury or mortality |
| Greater Glider | <ul style="list-style-type: none"> • Advice dated May 2016 • Cumulative effects of clearing and logging activities, current burning regimes and the impacts of climate change are a major threat to large hollow-bearing trees on which the species relies | <ul style="list-style-type: none"> • Required – see conservation advice | <ul style="list-style-type: none"> • No Plan has been identified as being relevant for this species (DotEE, 2018k) • Key threats are provided in the conservation advice | <ul style="list-style-type: none"> • Appendix C provides a species profile that identifies the proposed management measures for addressing key threats. The species specific mitigation measures described in Appendix C are grouped and have been selected on the basis that they address the following threats, as identified in the conservation advice: <ul style="list-style-type: none"> - Habitat loss, fragmentation and degradation (including reduction of hollow availability) |

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| EPBC Act species / communities | Conservation Advice | Recovery Plan | Threat Abatement Plan | SIMP Consistency and Threats Addressed |
|--|--|--|--|---|
| | | | | <ul style="list-style-type: none"> - Fire • Mitigation measures are also described for an additional identified project specific threat; namely, direct injury or mortality |
| Painted Honeyeater | <ul style="list-style-type: none"> • Advice dated July 2015 • Habitat loss is the key threat to this species. | <ul style="list-style-type: none"> • Required– see conservation advice | <ul style="list-style-type: none"> • No Plan has been identified as being relevant for this species (DotEE, 2018) • Key threats are provided in the conservation advice | <ul style="list-style-type: none"> • Appendix C provides a species profile that identifies the proposed management measures for addressing key threats. The species specific mitigation measures described in Appendix C are grouped and have been selected on the basis that they address the following threats, as identified in the conservation advice: <ul style="list-style-type: none"> - Habitat loss and degradation - Vehicle strike • Mitigation measures are also described for an additional identified project specific threat; namely, direct injury or mortality |
| Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant) | <ul style="list-style-type: none"> • Advice dated December 2013 (DoE, 2013) • Qld Government <i>Brigalow and Other Lands Development Act 1962</i> and <i>Brigalow Development Scheme</i> encouraged and funded the clearing of Brigalow to increase cattle stocking rates • Key threats to remaining populations are clearing, fire, weeds, feral animals and grazing | <ul style="list-style-type: none"> • Required – see conservation advice | <ul style="list-style-type: none"> • The <i>Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads</i> (DSEWPAC, 2011) is identified as relevant. | <ul style="list-style-type: none"> • Appendix C provides a TEC profile that identifies the proposed management measures for addressing key threats. The TEC specific mitigation measures described in Appendix C are grouped and have been selected on the basis that they address the following threats, as identified in the conservation advice: <ul style="list-style-type: none"> - Habitat loss, fragmentation and disturbance - Fire - Weeds and feral animals - Grazing |

BGP EPBC Species Impact Management Plan

| EPBC Act species / communities | Conservation Advice | Recovery Plan | Threat Abatement Plan | SIMP Consistency and Threats Addressed |
|---|---|--|---|--|
| Weeping Myall Woodlands | <ul style="list-style-type: none"> Advice dated December 2008 (DEWHA, 2008d) Manage clearing and degradation for agriculture and from overgrazing, weed invasion and herbivory by caterpillars of the Bag-shelter Moth | <ul style="list-style-type: none"> Required – see conservation advice | <ul style="list-style-type: none"> The <i>Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads</i> (DSEWPAC, 2011) is identified as relevant | <ul style="list-style-type: none"> Appendix C provides a TEC profile that identifies the proposed management measures for addressing key threats. The TEC specific mitigation measures described in Appendix C are grouped and have been selected on the basis that they address the following threats, as identified in the conservation advice: <ul style="list-style-type: none"> Habitat loss and disturbance Grazing Weeds |
| Natural Grasslands of the Queensland Central Highlands and the Northern Fitzroy Basin | <ul style="list-style-type: none"> Advice dated December 2008 (DEWHA, 2008f) Manage grazing, cropping and pasture improvement, weeds and pest animals, mining activities and construction of roads and other infrastructure | <ul style="list-style-type: none"> Required – see conservation advice | <ul style="list-style-type: none"> The <i>Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads</i> (DSEWPAC, 2011) is identified as relevant | <ul style="list-style-type: none"> Appendix C provides a TEC profile that identifies the proposed management measures for addressing key threats. The TEC specific mitigation measures described in Appendix C are grouped and have been selected on the basis that they address the following threats, as identified in the conservation advice: <ul style="list-style-type: none"> Habitat loss, fragmentation and disturbance Weeds and feral animals Grazing Mitigation measures are also described for an additional identified project specific threat; namely, soil compaction and mixing |
| Semi-evergreen vine thickets of the Brigalow Belt (North and | <ul style="list-style-type: none"> There is no approved Conservation Advice for this species Key threats are provided in the EPBC Act Species Profile and | <ul style="list-style-type: none"> Required – see conservation advice | <ul style="list-style-type: none"> The <i>Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads</i> (DSEWPAC, 2011) is | <ul style="list-style-type: none"> Appendix C provides a TEC profile that identifies the proposed management measures for addressing key threats. The TEC specific mitigation measures described in Appendix C are grouped and have been selected on the basis that they address the |

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| EPBC Act species / communities | Conservation Advice | Recovery Plan | Threat Abatement Plan | SIMP Consistency and Threats Addressed |
|--------------------------------|---|---------------|--|---|
| South) and Nandewar Bioregions | <p>Threats Database (DotEE, 2018n)</p> <ul style="list-style-type: none"> • Manage clearing, fragmentation, fire, weeds, feral animals and inappropriate grazing | | <p>identified as relevant.</p> <ul style="list-style-type: none"> • The <i>Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (Sus scrofa)</i> (DotEE, 2017) is identified as relevant. | <p>following threats, as identified in the conservation advice:</p> <ul style="list-style-type: none"> - Habitat loss, fragmentation and disturbance - Fire - Weeds and feral animals - Grazing |

7. Process for addressing impacts to EPBC species or communities not identified in Table 1 of the BGP approval

Condition 9(e): Details of how the approval holder has addressed any residual significant impacts to any EPBC listed threatened species and its habitat and/or EPBC communities not identified in Table 1, to be offset in accordance with the EPBC Act Environmental Offsets Policy.

Infrastructure location planning and post-EIS flora and fauna surveys completed to date have not identified any unavoidable residual significant impacts that are additional to those identified in Table 1 of the BGP approval.

Nonetheless, the following sets out Arrow's process for address any such additional impacts should they be identified as unavoidable during the BGP's ongoing planning, construction, operation and decommissioning activities:

- When the BGP activities proceed through the detailed design and planning phase and secondary approvals are required (e.g. an Environmental Authority or a landholder agreement) a field inspection of the specified disturbance footprint (this is specified by a surveyor in the field) will be undertaken by a suitably qualified ecologist. The pre-clearance survey will confirm the presence, absence and extent of environmental values (including EPBC Act species habitats) and these will be mapped in the field via GIS. The results of this step will be recorded within Geocortex and the Arrow Sharepoint.
- If the above survey identifies an EPBC Act species not listed in Table 1 of the EPBC approval, this information will be collated and reported to Arrow Environment Manager within 24hrs of identification. A more detailed assessment will then be undertaken to identify if the new EPBC Act species can be avoided or the extent to which impacts can be minimised. Information on the finding and potential impacts will be prepared and notification provided to DotEE and DES.
- Arrow will notify the Department of potential non-compliance with any condition of approval as soon as practical and within no later than 10 business days of becoming aware of the potential non-compliance.
- Approval for additional unavoidable residual significant impacts to any EPBC Act species or community (including any of these which were not in Table 1 of the EPBC approval) will be sought.
- Any residual impacts to EPBC species or communities not identified in Table 1 of the BGP approval will be offset in accordance with the approval granted through the previous dot point and the EPBC Act Environmental Offsets Policy. A detailed BGP Phase 1 Offset Strategy and additional offset strategies for the subsequent phases

will be developed and implemented to add value rather than just compensating for impacts.

- Prior to any ground disturbance activities, Arrow will appoint a Construction Contractor and will include in the relevant contract document the requirement for:
 - A CEMP to be prepared and submitted to Arrow for approval prior to any construction activities.
 - A key values Management Plan specific to 'Clearing' (a Clearing Management Plan).
 - The Clearing Management Plan is to include a process for an unplanned encounter with an EPBC listed threatened species or EPBC community. The plan is to commit the Construction Contractor to the following process as a minimum:
 - Stop work at site where unplanned disturbance to an EPBC listed threatened species, its core habitat, or TEC is encountered.
 - Notify Arrow that an EPBC Act species or community has been identified in a new area so that Arrow may, where appropriate, notify the relevant authorities (i.e. DotEE and DES).
 - Seek approval from DotEE for additional disturbance if impacts are 'significant' and unavoidable.
 - Manage the species or community in accordance with all applicable conditions of approval including the Offset Strategy for the relevant Project Phase.
 - Tag/barricade the identified species/community in an appropriate manner to ensure protection.
 - Cease clearing works in the immediate area to protect the identified species/community.
 - Record species/community GPS coordinates so that it may be incorporated into the Site Environmental Map as a 'no-go zone' or recorded as an impact area.
 - Provide all relevant information to Arrow for monthly tracking of EPBC Act species and community impacts for annual reporting.

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APPENDIX A

Curriculum vitae of the suitably qualified ecologists that prepared this SIMP

Summary

| Name | Qualifications | Years of Experience | Experience |
|---|--------------------------------|---------------------|--|
| Dr Michael Ryan (Co-author) | B. App. Sc; PhD (Ecology) | 28 | <ul style="list-style-type: none"> 80 EIAs 30 EPBC Referrals 23 years of fauna field surveys |
| Dr Paul Finn (Technical Authority for SIMP Review) | B. Sc (Hons); PhD (ecology) | 19 | <ul style="list-style-type: none"> Detailed fauna and flora surveys Targeted threatened species surveys and management plans Migratory shorebird specialist |
| Steve Fox (Co-author) | B. App. Sc (Hons) | 20 | <ul style="list-style-type: none"> 40 EIAs 20 years of flora field surveys Numerous threatened species and community management plans |
| David Stanton (Flora surveys lead) | B. Sc (Hons) | 24 | <ul style="list-style-type: none"> Professional and academic award winner Extensive flora experience |
| Mark Sanders (Fauna surveys lead) | B. Sc (Hons) | 20 | <ul style="list-style-type: none"> One of Australia's most respected field ecologists |
| Peter Hall (Future pre-clearance surveys) | B.Sc | 20 | <ul style="list-style-type: none"> Flora surveys Ecosystem assessment and validation Habitat assessments Land zone and soil classification |



Dr Michael Ryan

Approvals Manager - Arrow Energy

Expertise

- Management of complex multi-disciplinary projects
- Advising and leading teams to deliver environmental impact and risk assessments
- Environmental legislation and approval processes

Summary

Dr Ryan is an experienced manager / director, having supervised and authored more than 80 environmental impact and risk assessments for development projects. Michael has an excellent working knowledge of Commonwealth and Queensland environmental approvals legislation for development projects (both primary and secondary approvals). For the last three years Michael has been the Approvals Manager for Arrow Energy and guest lecturer to post-graduate students at Bond University in Environmental Impact Assessment.

Michael sought and attained the collaboration of the Australian Government, the Queensland Government and the Western Australian Government in delivering joint half day pre-conference workshops on 'How to prepare a good EIS'. He is passionate about sharing knowledge and published the *Essentials Package for Successful Environmental Consulting*, a practical guidebook to assist practitioners on how to manage Environmental Impact Assessments, influence decision-makers and deliver agreed environmental outcomes.

He has excellent communication skills, both written and verbal, and has used these skills in negotiations and conflict resolution across all levels of government and non-government organizations.

Michael was selected by BHP Billiton to manage and author the Environmental Impact Statement (EIS) for the multi-billion dollar Olympic Dam mining and processing plant expansion in South Australia. He was also the Director and principal author for BHP Billiton's proposed Yeelirrie uranium mine in Western Australia. Michael was appointed as the Lead Environmental Consultant for Xstrata Copper (now Glencore) for the proposed Mount Isa Mines Open Pit Project in Queensland and the Tampakan Off Lease Linear Infrastructure Project in the Philippines.

Michael is innovative in his application of management standards to help organizations maximise socio-economic benefits, minimise impacts; comply with applicable laws and regulations; and develop frameworks for continual improvement via succinct guidelines, standards, management plans and monitoring programs.

Michael has extensive experience with the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* having been an invited speaker on the EPBC Act for the Queensland Environmental Law Association, Environmental Protection Agency and the Queensland Resources Council. In October 2009, Michael was an invited speaker on achieving the balance between environmental legislation and company leadership at the China Mining 2010 Conference in Tianjin, China.

Qualifications

Bachelor of Applied Science, Queensland University of Technology, 1989
Doctor of Philosophy, Ecology, University of Queensland, 1996

**Projects as
Gamut Consulting**

Olympic Dam Expansion Investigation Phase Study Reports

Year: 2013 - 2014

Location: Semi-arid central South Australia (Roxby Downs)

Client: BHP Billiton

Main project features: BHP Billiton is re-investigating the mining and processing options for the previously approved expansion project.

Position held: Lead Environmental Consultant

Activities performed: Michael is assisting the BHP Billiton Environment Group with their Investigation Phase Study by developing the following:

- a Legal and Regulatory Approvals Register
- initial HSEC risk assessments and a Risk Register
- to document the likely process, scope and requirements of a future whole-of-project Environmental and Social Impact Assessment (ESIA)
- a global benchmarking study report on heap leach facilities
- a strategy for the timing, purpose and key messages for engagement with the Australian and South Australian governments in relation to five different water supply options.

Olympic Dam Mine Expansion Environmental and Social Impact Assessment

Year: 2004 - 2011

Location: Semi-arid central South Australia (Roxby Downs)

Client: BHP Billiton

Main project features: Major expansion of an existing mine to increase production from 200,000 tonnes/annum (tpa) copper cathodes to 350,000 tpa copper cathodes, 1.6 Mtpa copper concentrate, 1M ounces of silver, 270,000 ounces of gold and 17,000 tpa of uranium oxide. Also included 72 Mtpa of ore processing; 280 mega litre (ML)/day coastal desalination plant; 320 km water supply pipeline; 50 ML groundwater wellfield; 270 km electrical transmission line; 400 km gas pipeline; on-site 550 MW gas power station; 105 km rail line; airport, 90,000 t copper concentrate handling and ship loading facility; rail/road intermodal freight terminal; 10,000 person camp and 6,000 person expansion to existing township.

Position held: Manager and Author

Activities performed: I was a hands on manager of a core team of 20 people to deliver all environmental, social and cultural heritage assessments; developed the scope of works for 17 work packages; managed and understood technical inputs from more than 300 specialists from 75 different environmental and engineering companies; conducted stakeholder engagement and consultation; and authored the EIS and Supplementary EIS.

Projects as
Gamut Consulting

**Tampakan Copper-Gold Mine Development – Off-Lease Infrastructure
Environmental and Social Impact Assessment (ESIA)**

Year: 2011 - 2014

Location: Southern Island of Mindanao, the Philippines

Client: Xstrata Copper (now Glencore Xstrata)

Main project features: 105 km copper-gold concentrate pipeline; 100 km electrical transmission line; copper-gold concentrate filtration plant.

Position held: Manager and Author

Activities performed: Manager for all environmental, social and cultural heritage disciplines and author of the Supplementary Report to address the International Finance Corporation (IFC) requirements and Equator Principles for an international ESIA.

**415 MW Coal-fired Power Station and Copper Concentrate Loading Port Facility
ESIA**

Year: 2012 - 2013

Location: Southern Island of Mindanao, the Philippines

Client: Sagittarius Mines Inc. (SMI)

Main project features: 415 MW power station; coal unloading and copper concentrate loading port facilities.

Position held: Peer Reviewer and Advisor on Commercial Risk

Activities performed: Peer reviewer for an ESIA developed by in-country consultants to ensure it is developed in accordance with IFC requirements / Equator Principles; provision of advice regarding additional third party studies required to reduce commercial risk (and the subsequent scoping and management of air quality modelling, noise modelling and thermal plume modelling technical specialist studies). This project entailed liaison with SMI senior management regarding the outcomes of the commercial risk assessment to ensure SMI met their international and corporate responsibilities.

Mount Isa Open Pit Project (MIOP) Pre-Feasibility Study Environmental Studies

Year: 2011 - 2013

Location: Mount Isa, Queensland

Client: Xstrata Copper (now Glencore Xstrata)

Main project features: Major expansion of existing underground and small open pits into a single large open pit, expansion of copper, lead and zinc processing facilities and port facilities.

Position held: Lead Consultant, Manager, Peer Reviewer and Author

Activities performed: Authored the Pre-Feasibility Study environmental technical reports for the Project Description, Stakeholder Engagement Strategy, Surface Water, Closure and Environmental Design Criteria. Managed and peer reviewed technical reports from Amec (Ecology and Cultural Heritage), Klohn Crippen Berger (Groundwater and Geochemistry), SLR (Noise), PAEHolmes (Air Quality) and Arup (Traffic).

**Projects as
Gamut Consulting**

Yeelirrie Uranium Mine Environmental Review and Management Plan (ERMP)

Year: 2010 - 2011

Location: Perth, Western Australia

Client: BHP Billiton

Main project features: New greenfield uranium mine and associated infrastructure.

Position held: Lead Consultant, Project Director, Peer Reviewer and Author

Activities performed: Lead consultant to manage URS and SKM to a successful delivery of the ERMP for the proposed uranium mine in Western Australia. For this project, Michael was appointed the ERMP Project Director and Principal Author. In this role I reviewed all environmental, social and heritage technical reports and draft ERMP chapters and provided a technical review for the ERMP as Principal Author.

Essentials Package for Successful Environmental Consultants

Year: 2013

Location: Brisbane, Australia

Client: None – published to enhance general capacity building and skills

Main project features: Published practical guide to better influence key decisions and environmental outcomes for mining developments.

Positions held: Author / Publisher

Activities performed: I authored this publication to teach environmental practitioners and clients how to more efficiently manage an impact and risk assessment and put themselves and the mining company environmental representatives in a position to influence key decisions that promote better environmental outcomes. The book outlines the key steps in delivering an environmental and social assessment, and includes clear guidance on how to appropriately apply the two separate, but integrated, approaches to impact and risk assessments. The publication provides many of the management tools that I developed over the last 20 years to deliver projects on time and on budget.

Olympic Dam Closure Plan – Risk Assessment

Year: 2013

Location: Adelaide, South Australia

Client: BHP Billiton

Main project features: BHP Billiton reviews its Olympic Dam copper, gold, silver and uranium mine closure plan annually. For the current review, BHP Billiton has been requested by the South Australian Government to include a detailed environmental risk assessment for closure.

Positions held: Author/facilitator for the closure plan risk assessment

Activities performed: I have developed and authored the risk assessment component of the annual update to the Olympic Dam Closure Plan. This required liaison with numerous technical specialists from varying mining disciplines to identify and assess risk events/situations for the decommissioning and closure phase. Detailed tables were prepared for each risk event, identifying the source, pathway, receptor, initial risk rating, control / contingency measures and residual risk rating. Proposed closure outcomes, closure criteria and monitoring requirements were then identified for each risk event with a high or moderate residual risk rating.

**Projects as
Gamut Consulting**

Gladstone Steel Making Facility EIS

Year: 2012 - 2013

Location: Gladstone, Queensland

Client: Boulder Steel (CQG Consulting)

Main project features: 5 Mtpa integrated steel plant, 17 km private haul road, rail loop and import/export port facilities.

Positions held: Advice and chapter author

Activities performed: Gamut was commissioned by CQG Consulting on behalf of Boulder Steel to assist in the timely delivery of this EIS. We authored the executive summary, hazard and risk assessment, nature conservation, traffic impact assessment, environmental management framework and cumulative effects chapters and provided peer review on all other EIS chapters and technical appendices.

**Projects prior to
forming Gamut
Consulting**

Gateway Motorway EIS Project

Michael was appointed as the environmental advisor to the Queensland Government (Main Roads) to assist in the determination of the preferred Federal and State legislative process under which to develop an EIS for the \$1.6 billion Gateway Motorway Upgrade Project. Michael also developed the Initial Advice Statement to accompany the request for State Significant Project status and developed the Draft Terms of Reference for the EIS. Michael was also commissioned to undertake the technical review for the EIS and provide advice regarding the direction and compliance of the EIS as per Commonwealth and State legislation.

Enertrade North Queensland Gas Pipeline EIS Project

This was an EIS for a 400 km gas pipeline. This project was a controlled action under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and a Project of State Significance under the Queensland Department of State Development's *State Development and Public Works Organisation Act 1971*. Michael completed the development of targeted ecological documents and presentations for the then Commonwealth Department of Environment and Heritage and the Queensland Environmental Protection Agency in relation to endangered ecological communities, threatened species and migratory species. Michael also successfully negotiated environmental approvals and compliance for the project.

Tamil Nadu Road Sector Project, India

Michael was the author of the physical (Climate, Geology and Soils, Land Use) and biological (fauna, flora, water quality, air quality, noise, heritage) environmental components of the Feasibility Study and Sectoral Environmental Assessment reports assessing the potential impacts associated with upgrading 3,328 km of roads in south-eastern India. Michael also authored the project's Environmental Management Plan. All deliverables were written under the guidelines of, and gained the approval of, the World Bank.

Reef Cove Resort, False Cape

Michael was the Manager of the environmental assessments for this major coastal development in Cairns. The site is adjacent to the Great Barrier Reef World Heritage Area, Fish Habitat Reserve and the ecologically significant Trinity Inlet. The project was deemed a controlled action under the EPBC Act and Michael negotiated the environmental approvals for the project under both Commonwealth and State legislation.

Projects prior to forming Gamut Consulting

Port of Brisbane Motorway - Environmental Review

Michael completed a review of all the environmental documentation compiled for the Port of Brisbane Motorway, undertaking a gap analysis with regards to recently introduced and amended environmental legislation, and providing reports to promote environmental compliance of this major road infrastructure project. Environmental approvals were gained for this project in a timely manner and as such avoided potential construction delays.

Cerito Road Review of Environmental Factors (REF) and EMP

Michael was the Manager and completed the legislative review and fauna assessment for the new 22 km road link between the Mt Coolon - Collinsville Road and the Glenden – Newlands Road. This project included the assessment of all environmental aspects and provided mitigation measures to minimise impacts on Commonwealth endangered ecological communities and State listed threatened species.

Brisbane City Council Ecological Corridors Project

Michael was appointed as an ecological specialist to assist Brisbane City Council and Chenoweth & Associates to identify appropriate civil structures to maintain fauna movement along corridors throughout Brisbane City. A detailed case study was also completed for fauna movement across the Logan Motorway for safe passage between the Greenbank Military Training Area and Karawatha Forest.

Federal Government Legislative Reviews

Michael was commissioned to negotiate the implications of the Federal Government's environmental protection legislation on behalf of the Queensland Department of Main Roads. Following presentations to the Main Roads Senior Management Group, he was commissioned to review all projects being constructed on state-controlled roads for the period 2000 - 2002 and in the Brisbane Metropolitan District from 2000 - 2005. This was more than 160 projects, resulting in presentations to DEWHA (then DEH) regarding referrals for 80 projects.

WMC Fertilizers Ltd

Michael completed the ecological assessment for the High Analysis Fertilizer Plant at Phosphate Hill, north-west Queensland. This assessment included comprehensive field surveys of fauna and flora to determine potential impacts on ecosystems and to provide appropriate mitigation strategies to ameliorate identified impacts.

Rockhampton Airport EIS and EMP

Michael was the Manager and author of the EIS for a proposed runway extension to the Rockhampton Airport. The risk of bird strikes was the key issue to be resolved for this project, given the surrounding environs being dominated by wetlands.

Rationalisation of Council and State Government Vegetation Mapping

Michael undertook an assessment of the methodology employed for vegetation mapping as a means of assigning State and local ecological significance to freehold, leasehold and state controlled land. This project enabled Dr Ryan to identify the 'building blocks' of both the EPA's Regional Ecosystem mapping and Local Government mapping and determined the advantages and disadvantages of each, with an objective of identifying appropriate mechanisms to identify and conserve significant vegetation communities.

**Projects /
employment prior
to forming Gamut
Consulting**

Road Corridor Environmental Assessment (RCEA)

Michael wrote the GIS compatible methodology that enabled the collection and storage of data on ecological assets and corridor management issues within the road reserve for the 33,500 km of Queensland State-controlled roads. Michael subsequently implemented this methodology via field surveys for more than 3,500 km of these roads.

Townsville Field Training Area (TFTA) EIS and EMP

Michael was the Manager and author of the EIS and EMP for a road upgrade, airstrip extension and two major creek crossings within the TFTA. Detailed investigations were completed at Keelbottom Creek and Star River.

Environmental Impact Assessments / Review of Environmental Factors

Michael has been the Manager and author of more than 20 additional linear infrastructure assessments including the following studies: Townsville Port Access, Ipswich Motorway, Mt Lindsay Highway, Smith Street Extension, Hope Island Road, Mt Tamborine - The Sentinel, Gregory Developmental Road, Kuralboo Creek and Gilmore Pipeline (Cheepie to Adavale).

PRINCIPAL ADVISOR (ENVIRONMENT AND PLANNING) QUEENSLAND DEPARTMENT OF MAIN ROADS (MAY 1999 TO NOVEMBER 2000)

Dr Ryan's principal role was to manage the \$1.2 M Technical Environment Program within the Department. This required the program management of over thirty-five road-related environmental projects, mentoring of graduate staff and direct project supervision of ten projects. Michael was also the Main Roads representative on several inter-government environmental committees including the Ministerial Committee on Net Gain 2010 and the Ministerial Committee that investigated the implications of the then soon to be enacted *Environment Protection and Biodiversity Conservation Act 1999*. Projects managed and/or supervised included:

Review of the Department's Road Project Environmental Management Processes Manual: This manual discusses the environmental documents to be prepared throughout the planning, design, construction and maintenance of a road project.

Compensatory Habitat Policy: Management of a project that identified the advantages and disadvantages of existing compensatory habitat policies so as to provide guidance to Main Road's Senior Management Group as to whether a similar policy should be adopted by Main Roads.

Revision of the Main Roads Environmental Legislation Register: This manual discusses all Commonwealth and State legislation relevant to road planning, design and construction. It provides a comprehensive reference guide for all legislative, permit and license requirements for Main Roads activities.

Revision of the Main Roads Cultural Heritage Manual: This manual discusses the preferred process for cultural heritage assessments for Main Roads. The revised manual was reviewed by the Environmental Protection Agency and accepted as appropriate for use by Main Roads in Queensland.

Waterways Guideline: This project aims to develop collaboration with the Department of Natural Resources in relation to permits under the *Water Act 2000*. Benchmarks were established so as to clearly identify and streamline the process for obtaining permits and licenses for construction activities.

**Projects /
employment prior
to forming Gamut
Consulting**

Review of the Main Roads Environmental Management Specification: This specification (MRS11.51) represents the standard environmental specification for all Main Roads construction projects. Michael managed the review of this specification in an attempt to refine contractor's costing of environmental works.

Road Drainage Manual: Michael was on the management and technical committees for the development of this manual. The aim of the manual is to design and construct cross and longitudinal drainage structures in a practical, cost effective and environmentally sustainable manner.

Road Planning and Design Manual: Michael was the author of the Environmental Considerations chapter of this manual and technically reviewed the engineering and design chapters to ensure consistent and effective environmental outcomes in road design.

KBR (FORMERLY KINHILL), BRISBANE (SEPTEMBER 1996 TO MAY 1999)

As the Brisbane office's specialist fauna ecologist, Dr Ryan was involved in the following projects:

Kopps Road - Smith Street Extension

Michael was the manager and author for the Review of Environmental Factors for the proposed construction of a major connecting road between Smith Street and Kopps Road to the west of the Pacific Motorway.

Vegetation and Ecological Assessments, Ipswich City Council

Manager for two projects that provide ecological assessments and recovery plans to guide future Council management practices and land acquisitions.

Brisbane Technology Park, Eight Miles Plains

Principal author of an environmental assessment and rehabilitation programme for the proposed Stage II of the Brisbane Technology Park.

Mary River Sand and Gravel Extraction, Maryborough

Investigating the potential impacts associated with sand and gravel extraction in the Mary River on fauna.

Snapper Creek Dredging

Investigating the potential impacts on wader bird species associated with dredging in Snapper Creek.

Donnybrook, Caboolture Shire, Environmental Management Plans

Developing Environmental Management Plans for a vulnerable amphibian species and mammal species to mitigate impacts of a proposed development in an ecologically sensitive location.

Coolum Ridges, Maroochy Shire, Queensland

Designing and conducting a complete fauna survey in an area of proposed private subdivision.

**Projects /
employment prior
to forming Gamut
Consulting**

Fauna Sensitive Road Design Publication

Michael was the author of the State Government publication: Fauna Sensitive Road Design - Volume 1 - Past and Existing Practices. This publication includes assessments of fauna movement pathways and provides recommendations to reduce highway impacts on native fauna.

PGT Pipeline, from south-central Queensland to North Brisbane

An extensive investigation of the proposed impact with respect to the environment associated with disturbance along a 480 km pipeline route.

CONSULTANT ECOLOGIST (1995 TO 1996)

Subconsultant for WBM Oceanics Australia on two projects. The first involved collation and review of existing information on and development of a sampling methodology for a Koala survey of the Buderim Mountain region. The second project involved mammal trapping and field identification of birds, mammals, reptiles and amphibians for a 4 week fauna survey of a site at Reedy Creek, Mudgeraba.

UNIVERSITY OF QUEENSLAND (1993 TO 1995)

Dr Ryan was employed as Research Assistant on the following projects:

Revegetation advice for mining operations (Dr Clive Bell, Dr David Mulligan, the then Agriculture Department – now Centre for Mined Land Rehabilitation): Advice for environmental officers of Queensland's coal and bauxite mining operations (Weipa and Bowen Basin) on procedures for maximising forest revegetation following above-ground mining.

Green vegetable bug (Dr Gimme Walter, Entomology Department): Planning, experimental design and analysis of research on the ecology of the bug. Also assisted with practical classes in ecology, behaviour and genetics.

Queensland rainforest mites (Dr David Walter, Entomology Department): Field research to assess the biodiversity of mites in rainforest.

SELECT PUBLICATIONS

Ryan, M.A. and G.H. Walter (1992) Sound communication in *Nezara viridula* (L.) (Heteroptera: Pentatomidae): further evidence that signal communication is substrate-borne. *Experientia* **48**: 1112-1115.

Ryan, M.A. (1994) Damage to papaw trees by the banana-spotting bug, *Amblypelta lutescens lutescens* (Distant) (Hemiptera: Coreida), in north Queensland. *International Journal of Pest Management* **40(3)**: 280-282.

Ryan, M.A., C.J. Moore and G.H. Walter (1995) Individual variation in pheromone composition in *Nezara viridula* (Hemiptera: Pentatomidae): how valid is the basis for designating "pheromone strains"? *Comparative Biochemistry and Physiology* **111B(2)**: 189-193.

Ryan, M.A., A. Cokl and G.H. Walter (1996) Differences in vibratory sound communication between a Slovenian and an Australian population of *Nezara viridula* (L.) (Heteroptera: Pentatomidae). *Behavioural Processes* **36(2)**: 183-193.

Ryan, M.A. (1996) An investigation of discontinuities in the sexual behaviour of green vegetable bugs, *Nezara viridula* (Linnaeus) (Heteroptera: Pentatomidae). Doctor of Philosophy Thesis. University of Queensland. Australia.

Kinhill (1997) Brisbane Technology Park Stage II: Environmental Assessment and Rehabilitation Programme. Prepared for Brisbane City Council. Principal Author: Dr Michael Ryan.

Kinhill (1998) Koppas Road – Smith Street Extension Review of Environmental Factors. Prepared for the Queensland Department of Main Roads. Principal Author: Dr Michael Ryan.

Queensland Department of Main Roads (1999) *Environmental Legislation Register – Version 2*. Principal Author: Dr Michael Ryan.

Queensland Department of Main Roads (2000) *Road Project Environmental Management Processes Manual – Version 2*. Principal Author: Dr Michael Ryan.

Queensland Department of Main Roads (2000) *Fauna Sensitive Road Design: Volume 1 – Past and Existing Practices*. Queensland Department of Main Roads, Technology and Environment Division. Brisbane. Principal Author: Dr Michael Ryan.

Kinhill (2001) Townsville Port Access Review of Environmental Factors. Prepared for the Queensland Department of Main Roads. Principal Author: Dr Michael Ryan.

Kinhill (2001) Ipswich Motorway Review of Environmental Factors. Prepared for the Queensland Department of Main Roads. Principal Author: Dr Michael Ryan

Kinhill (2001) Tamil Nadu Road Sector Project, India: Feasibility Study and Sectoral Environmental Assessment. Prepared for the Government of India under World Bank funding. Principal Author of the Climate, Geology, Soils, Land Use, Fauna, Flora, Water Quality, Air Quality, Noise and Heritage sections: Dr Michael Ryan

Kinhill (2002) Mt Lindsay Highway Review of Environmental Factors. Prepared for the Queensland Department of Main Roads. Principal Author: Dr Michael Ryan

HLA-Envirosciences (2002) Gregory Developmental Road Review of Environmental Factors. Prepared for the Queensland Department of Main Roads. Principal Author: Dr Michael Ryan

HLA-Envirosciences (2003) Smith Street Extension Review of Environmental Factors. Prepared for the Queensland Department of Main Roads. Principal Author: Dr Michael Ryan

HLA-Envirosciences (2003) Townsville Field Training Area (TFTA) Keelbottom Creek and Star River: Environmental Impact Statement and Environmental Management Plan. Prepared for the Department of Defence. Principal Author: Dr Michael Ryan

HLA-Envirosciences (2003) Rockhampton Airport Environmental Impact Statement and Environmental Management Plan. Prepared for the Rockhampton Regional Council. Principal Author: Dr Michael Ryan

HLA-Envirosciences (2004) Hope Island Road Review of Environmental Factors. Prepared for the Queensland Department of Main Roads. Principal Author: Dr Michael Ryan

HLA-Envirosciences (2004) Mt Tamborine - The Sentinel Review of Environmental Factors. Prepared for the Queensland Department of Main Roads. Principal Author: Dr Michael Ryan

BHP Billiton (2009) Olympic Dam Expansion: Draft Environmental Impact Statement. Principal Author: Dr Michael Ryan

Ryan, M.A. (2009) Environmental Protection Through Leadership and Law. Presentation. China Mining 2010 Conference. Tianjin. China.

Ryan, M.A. (2010) The Expanding Role of an EIS Project Manager. Presentation. EIS For Resource Projects Conference. Brisbane. Queensland.

Wilkinson, L. and M.A. Ryan (2010) What Makes a Good Environmental Impact Statement: A Government Perspective / A Consultant's Perspective. Presentation. Environment Institute of Australia and New Zealand Conference. Wellington. New Zealand.

BHP Billiton (2011) Olympic Dam Expansion: Supplementary Environmental Impact Statement. Principal Author: Dr Michael Ryan

Ryan, M.A. (2011) Managing Environmental Impact Assessment Requirements. Presentation and Pre-conference Workshop. Environmental Management in Resources Conference. Perth. Western Australia.

BHP Billiton (2011) Proposed Yeelirrie Development: Environmental Review and Management Programme. Draft. Principal Author: Dr Michael Ryan

Gamut Consulting (2012) Uranium Projects Approval Process Guideline. Prepared for BHP Billiton. Principal Author: Dr Michael Ryan

Gamut Consulting (2012) Olympic Dam EPBC Act Assessment Report – Pre-commitments. Prepared for BHP Billiton. Principal Author: Dr Michael Ryan

Gamut Consulting (2012) Mount Isa Open Pit Pre-Feasibility Study: Environment Stakeholder Engagement Strategy. Prepared for Xstrata Copper. Principal Author: Dr Michael Ryan

Gamut Consulting (2012) Mount Isa Open Pit Pre-Feasibility Study: Environmental Design Criteria. Prepared for Xstrata Copper. Principal Author: Dr Michael Ryan

Gamut Consulting (2012) Draft Terms of Reference for the Mount Isa Open Pit Project Environmental Impact Statement. Prepared for Xstrata Copper. Principal Author: Dr Michael Ryan

Sagittarius Mines Incorporated and Gamut Consulting (2012) Tampakan Off-Lease Linear Infrastructure Project: Environmental and Social Impact Assessment. Prepared for Xstrata Copper. Principal Author: Dr Michael Ryan

CQG Environmental (2013) Environmental Impact Statement: Gladstone Steel Plant Project. Prepared for Boulder Steel Limited. Principal Author of the Executive Summary, Hazard and Risk Assessment, Nature Conservation, Traffic Impact Assessment, Environmental Management Framework and Cumulative Effects chapters: Dr Michael Ryan

Ryan, M.A. (2013) *Essentials Package for Successful Environmental Consulting*. ISBN (hardcopy): 978-0-9874942-1-4. ISBN (electronic copy): 978-0-9874942-0-7

Ryan, M.A. (2013) How to Develop and Effective EIS. Presentation and Pre-Conference Workshop. Permit Approvals Queensland Conference. Brisbane. Queensland.

Gamut Consulting (2013) Olympic Dam Expansion Investigation Phase Study: Environmental Inputs. Prepared for BHP Billiton. Principal Author: Dr Michael Ryan

Gamut Consulting (2013) Tampakan Copper-Gold Mine Off-Lease Infrastructure (OLI) Project: Addressing International Environmental and Social Sustainability Standards. Prepared for Xstrata Copper. Principal Author: Dr Michael Ryan

Gamut Consulting (2014) Olympic Dam Heap Leach Processing Environmental Benchmarking Study. Prepared for BHP Billiton. Principal Author: Dr Michael Ryan

Gamut Consulting (2014) Olympic Dam Water Supply Government Engagement Strategy. Prepared for BHP Billiton. Principal Author: Dr Michael Ryan

Paul Gerard Finn

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ACADEMIC QUALIFICATIONS

Doctor of Philosophy (2009)

Griffith School of Environment and Centre for Innovative Conservation Strategies
Griffith University
Scholarship: Strategic Partnerships with Industry, Research and Training (SPIRT); funded by Griffith University and The Federal Government (Environment Australia).

Bachelor of Science with First Class Honours (1996)

Australian School of Environmental Studies
Griffith University
Undergraduate major: Ecology and its Applications.

EMPLOYMENT HISTORY and WORK EXPERIENCE

Paul is a CEnvP (Ecology Specialist) with over 18 years' experience in project management, community consultation, research, environmental monitoring, experimental and statistical design, data management, analysis and interpretation, ecological and biodiversity assessment, fauna and flora surveys, and GIS mapping.

Paul has a background in ornithological research, obtaining his PhD in 2009, and has published a number of refereed and popular articles (including a chapter in a CSIRO book on shorebird feeding ecology and habitat selection), and presented his research at local and international conferences, workshops and public lectures. Paul has collaborated on many research projects, taking responsibility for experimental design, field work, data analysis and publishing on a diverse range of projects incorporating population biology, community ecology and conservation of birds.

Paul's consulting experience includes targeted threatened species surveys, significant species management plans, ecological impact assessment, legislation and environmental authority interpretation and negotiation with government agencies. He is a skilled consultant and field ecologist, and is experienced in leading teams to undertake fauna and flora surveys. Paul has a particular interest in natural resource management, conservation, terrestrial and coastal ecology, coastal management, animal behaviour, and ornithology.

Currently Paul is working as a biodiversity technical advisor and ecology subject matter expert in the coal seam gas industry, managing ecological assessments, providing clarity on federal and state legislated species impact management and offsets, and delivering reports to support various approvals.

Principal Ecologist, Arrow Energy Pty Ltd (June 2013–present)

Employed by Arrow as a Principal Ecologist, I am accountable for the delivery of technical advice and maintaining ecology standards in order to service exploration and appraisal, well delivery and the production of domestic gas. This position involves the management of ecology resources (internal staff and external contractors) across Arrow's tenements within both the Surat and Bowen Basins to deliver compliance and best practice ecology standards and work practices. The responsibilities of this position include:

- Promoting Health, Safety and Environment (HSE) standards;
- Managing a team by planning, coordinating and scheduling work to be completed;
- Recruiting, mentoring, training and developing personnel, and associated performance management;
- Providing technical advice, appropriate ecological survey methods, work scopes and reporting to solve compliance issues;
- Liaising and engaging with leadership personnel, external clients, contractors, and government regulators; and,
- Developing lean initiatives to increase quality and productivity of the ecology function, and improve profitability of projects.

Senior Ecologist, Sinclair Knight Merz (May 2012–May 2013)

Employed by Sinclair Knight Merz (SKM) as a Senior Ecologist and Project Manager, I delivered projects for clients in both the private and government sectors, related to infrastructure, energy and resources, environment and urban growth. This role included leading teams of ecologists in the field and actively training and mentoring junior staff in the field and the office, to ensure professional outcomes and effective project delivery. Key skill areas include: project management, stakeholder engagement, research, environmental monitoring, experimental and statistical design, data management, analysis and interpretation, review of scientific papers and reports, ecological and biodiversity assessment, fauna and flora surveys, significant species management and interpreting government legislation.

Selected project experience:

- **New Acland Coal Mine Stage 3 Expansion (New Hope Group)** – Targeted Koala (*Phascolarctos cinereus*) surveys for EPBC Act advice/referral including habitat assessments and Spot Assessment Technique (SAT), groundtruthing of threatened flora (*Bothriochloa biloba*, *Digitaria porrecta*, *Homopholis belsonii*, and *Stemmacantha australis*).
- **Surat Pipeline Header (Arrow Energy Pty Ltd)** – Detailed ecological assessment including fauna trapping, nocturnal fauna surveys including harp trapping for bats, bird surveys, targeted threatened species searches and micro-habitat assessments.
- **Nathan Dam Ecological Assessment (SunWater)** – Targeted Koala (*Phascolarctos cinereus*) surveys for EPBC Act advice/referral including habitat assessments, line-transect searches and SAT, groundtruthing of a threatened ecological community (Coolibah - Black Box Woodlands), and wetland assessments.
- **New Parallel Runway (Brisbane Airport Corporation)** – Project management, monitoring birdlife and associated habitat use, data analysis and interpretation, environmental management.

- **Pumicestone Road Interchange Upgrade (Department of Transport and Main Roads)** – Environmental assessment, ecological advice on detailed design, environmental management plan, and significant species management plan.
- **Roma Flood Levee (Maranoa Regional Council)** – Groundtruthing of EPBC Act MNES and NC Act listed species and breeding places, detailed assessment of a threatened ecological community (Weeping Myall Woodlands), regional ecosystems and high value regrowth verification, and EPBC Act referral advice.
- **Sibelco Taragoora Limestone Project (Sibelco Australia Limited)** – Property vegetation management plan (PVMP), and negotiation with the Queensland Department of Environment and Heritage Protection (DEHP).

Technical Advisor, Holcim Australia Pty Ltd (July 2005–February 2013)

Employed by Holcim as a Shorebird Expert on the Technical Advisory Panel (TAP) for a sand extraction operation at Donnybrook, Queensland. The formation and use of the TAP (consisting of three experts in their fields) was a requirement of the operation, triggered by the *Environment Protection and Biodiversity Conservation Act 1999* and imposed by the Department of the Environment. The main aim of the TAP is to ensure the maintenance of Ramsar wetland values and includes:

- Assisting with the design and implementation of intertidal wetland monitoring programs; and,
- Reviewing subsequent data collected by independent environmental consultants.

Senior Ecologist, RPS Group (February 2010–April 2012)

Employed by RPS Australia East Pty Ltd as a Senior Ecologist and Project Manager, I delivered projects for clients in both the private and government sectors, related to infrastructure, energy and resources, environment and urban growth. This role included leading teams of ecologists in the field and actively training and mentoring junior staff in the field and the office, to ensure professional outcomes and effective project delivery. Key skill areas include: project management, stakeholder engagement, research, environmental monitoring, experimental and statistical design, data management, analysis and interpretation, review of scientific papers and reports, ecological and biodiversity assessment, fauna and flora surveys, vegetation offsets, landscape rehabilitation, bushfire management, interpreting government legislation and GIS mapping.

Selected project experience:

- **Coal Seam Gas Exploration Gunnedah Basin (Santos)** – Detailed ecological assessment including fauna trapping, nocturnal surveys, habitat assessments and bird surveys, targeted threatened species searches, EPBC Act referral for a threatened ecological community (Box Gum Woodland).
- **Ecological Scouting in South-west QLD (Origin Energy)** – Undertaking pre-clearance ecological surveys for future coal seam gas infrastructure in cooperation with other team members including surveyors, cultural heritage monitors, geologists and Origin Energy staff.
- **New Parallel Runway (Brisbane Airport Corporation)** – Project management, monitoring birdlife and associated habitat use, data analysis and interpretation, environmental management.

- **GLNG Facility, Curtis Island, Gladstone (Bechtel)** – Significant species management plan including spotter-catcher procedures for the construction phase.
- **Queensland to South Australia / New South Wales Link Gas Pipeline (QSN Link) Looping Project (Epic Energy Queensland Pty Ltd)** – Targeted surveys for weeds of national significance and other declared pest plants.
- **QCLNG Pipeline, Curtis Island (Queensland Gas Company)** – Targeted Water Mouse (*Xeromys myoides*) surveys for EPBC Act clearance including habitat assessment, diurnal searches and nocturnal trapping.
- **Moranbah to Peak Downs and Goonyella Mines, Transmission and Water Lines (BMA – BHP-Mitsubishi Alliance Coal Operations Pty Ltd)** – Regional ecosystems verification, targeted threatened species searches, tertiary vegetation assessment, vegetation offset calculations and EPBC Act advice.
- **Pinkenba Review of Environmental Factors (Port of Brisbane Pty Ltd)** – Project management, ecological assessment, detailed fauna and flora surveys, regional ecosystems verification, vegetation mapping.
- **Sewage Pipeline (Redlands Water and Waste)** – Vegetation assessment and management plan, development approvals processing, consultation.
- **Bald Hills Quarry (Nielsen’s Quality Gravels Pty Ltd)** – Ecological impact assessment, detailed fauna survey, vegetation survey and management plan, riparian condition assessments, rehabilitation planning, GIS mapping, consultation.
- **Redlands land developments (Harridan Pty Ltd and Sentinel Pty Ltd)** – Field surveys of Koala habitat including identification of food trees and SAT, desktop assessments of corridor connectivity and SPRP Koala habitat mapping, GIS mapping, reporting in regards to legislative requirements, environmental management plans, bushfire management plans.
- **Brisbane north shore development, Hamilton (Urban Land Development Authority)** – Project management, marine vegetation management plan, consultation.
- **Ipswich land developments ‘Paradise Waters’ (Stocklands Developments)** – Project management, environmental assessment, property map of assessable vegetation (PMAV), vegetation management plan, detailed tree survey, targeted searches for threatened species, GIS mapping.
- **Benaraby landfill expansion (Gladstone Regional Council)** – Species management plan, detailed fauna and flora surveys, GIS mapping.
- **The Village at Redcliffe (Hardev Property Development)** – Environmental offsets, habitat offset packaging, rehabilitation planning, GIS mapping.
- **Deception Bay land development ‘Brolga Lakes’ (Erneve Pty Ltd)** – Monitoring birdlife and associated habitat use, data analysis and interpretation, environmental management.
- **Willawong land development (Maximus Industrial Pty Ltd)** – Vegetation management plan, detailed tree survey, rehabilitation planning, GIS mapping, environmental approvals processing.
- **Murrarie land development (Incitec Pivot Limited)** – Due diligence environmental assessment, fauna and flora surveys, GIS mapping.

Conservation Officer / Program Coordinator, Seagrass-Watch, Moreton Bay Marine Park (October 2002–December 2009)

Employed by the Department of Environment and Resource Management's, Queensland Parks and Wildlife Service, the Wildlife Preservation Society of Queensland and the Queensland Conservation Council to set up and coordinate 'Seagrass-Watch', a community-based habitat monitoring program, in Moreton Bay.

The responsibilities of this position included:

- assisting with writing grant applications;
- establishing and maintaining effective volunteer involvement;
- locating suitable survey sites and coordinating the collection, collation, evaluation, analysis and interpretation of data;
- preparing a range of multi-media extension material including newsletters, public presentations, technical and administrative reports, and scientific conference and journal papers;
- training new volunteers (on-site and through workshops) and assisting volunteers with field work;
- maintaining and servicing equipment used in the sampling program;
- liaison, consultation and negotiation with government agencies, local stakeholders and interest groups;
- working with various legislative documents including, but not limited to: the *Nature Conservation Act 1992*, *Environmental Protection Act 1994*, *Coastal Protection and Management Act 1995*, *Environment Protection and Biodiversity Conservation Act 1999* and *Marine Parks Act 2004*;
- managing staff and university students on industrial placement; and,
- undertaking various administrative, budgeting and financial duties.

Doctor of Philosophy Candidate, Consultant Ecologist, Research Assistant and Tutor, Griffith University (January 1994–December 2009)

- **Doctor of Philosophy Candidate:** My research covered many aspects of habitat selection and feeding ecology with Eastern Curlews (*Numenius madagascariensis*) in Moreton Bay, Queensland. The aim of my research was to identify characteristics of important habitats for conservation of the Eastern Curlew on its non-breeding grounds. During my PhD I gained skills in many areas including: project management, logistical planning, working within a budget (approx. \$30,000), experimental design, data management, statistical analyses and targeted dissemination of results through scientific reports, conference papers, journal articles and community consultation. I developed good analytical and practical ecological skills and employed various ecological methods including: population census, behavioural observations of focal individuals, benthic invertebrate sampling and GIS mapping.
- **Consultant Ecologist:** Employed to conduct monthly surveys of all birds at the Luggage Point wetland reserve for the Brisbane City Council (May 2001–April 2003) and at the Fisherman Islands reclamation area for the Port of Brisbane Corporation (March 2001–June 2002). The focus of these consultancies was to assess and monitor the habitat use by shorebirds. Thereby facilitating the ecologically sustainable management of the focal areas by identifying threats to the birds' long term survival and making recommendations for their long term protection and management.

- **Research Assistant:** I have collaborated on many research projects, assisting with experimental design, field work, data analysis and publishing on a diverse range of projects incorporating population biology, community ecology and conservation of birds, and biodiversity assessments of remnant vegetation. My collaborators included but were not limited to: Prof. Carla Catterall, Dr. Peter Driscoll, Prof. Jane Hughes, Dr. Darryl Jones, Prof. Roger Kitching, Dr. Jeff Miller, Mr. Clive Minton and Dr. Kees Hulsman. Projects included: **Shorebird ecology** (surveying, cannon netting, banding and biometrics) in Moreton Bay, The Great Sandy Strait, Mackay and the Swaines Reefs; **Landscape ecology** (distribution, abundance and dynamics of mixed species foraging flocks within a large habitat matrix) of birds in south-east Queensland, involving mist-netting, banding, seasonal surveys and behavioural observations; **Population assessment and monitoring** of seabird breeding colonies over five years on all coral cays throughout the Capricorn and Bunker Island groups; **Biodiversity** studies at Eungella National Park, north Queensland, incorporating vegetation survey and invertebrate sampling techniques; and, Seabird research on Raine and neighbouring Islands as the 1995 recipient of the **Brian R. King Research Award** for seabird research (administered by the Raine Island Corporation).
- **Tutor:** Employed as an avian ecology tutor by Griffith University for a 3rd-year field course in tropical ecology conducted in Danum Valley, Borneo (2 weeks in January 2007). Also employed as an ecology tutor by Griffith University for 1st-3rd year field and laboratory courses (1994–2002).

PUBLICATIONS

Journal Articles

1. **Finn, P.G.** and Catterall, C.P. Does foraging success explain choice of feeding sites by a deep-probing shorebird on its non-breeding grounds? Manuscript in preparation.
2. **Finn, P.G.**, Udy, N.S., Baltais, S.J., Price, K. and Coles, L. 2010. Assessing the quality of seagrass data collected by community volunteers in Moreton Bay Marine Park, Australia. Environmental Conservation. 37, 83-89.
3. **Finn, P.G.**, Catterall, C.P. and Driscoll, P.V. 2008. Prey versus substrate as determinants of habitat choice in a feeding shorebird. Estuarine, Coastal and Shelf Science. 80, 381-390.
4. **Finn, P.G.**, Catterall, C.P. and Driscoll, P.V. 2007. Determinants of preferred intertidal feeding habitat for Eastern Curlew: A study at two spatial scales. Austral Ecology. 32, 131-144.
5. **Finn, P.G.**, Driscoll, P.V. and Catterall, C.P. 2002. Eastern Curlew numbers at high tide roosts versus low tide feeding grounds: a comparison at three spatial scales. Emu. 102, 233-239.
6. **Finn, P.G.**, Catterall, C.P. and Driscoll, P.V. 2001. The low tide distribution of Eastern Curlew on feeding grounds in Moreton Bay, Queensland. Stilt. 38, 9-17.
7. **Finn, P.G.** and Hughes, J.M. 2001. Helping Behaviour in Australian Magpies, *Gymnorhina tibicen*. Emu. 101, 57-63.
8. Jones, N.D. and **Finn, P.G.** 1999. Translocation of aggressive Australian Magpies: a preliminary assessment of a potential management action. Wildlife Research. 26, 271-279.

Book Chapter

9. **Finn, P.G.** 2007. Feeding ecology and habitat selection. Pp. 51-59 in Geering, A., Agnew, L. and Harding, S. (eds.) Shorebirds of Australia. CSIRO Publishing, Victoria.

Theses

10. **Finn, P.G.** 2009. Habitat selection, foraging ecology and conservation of Eastern Curlews on their non-breeding grounds. PhD Thesis. Griffith University, Brisbane.
11. **Finn, P.G.** 1996. Why do helpers help, in cooperatively breeding Australian Magpies?: a test of the indirect fitness benefits hypothesis using microsatellite DNA. BSc (Honours) Thesis. Griffith University, Brisbane.

Major Reports

12. **Finn, P.G.**, Catterall, C.P. and Driscoll, P.V. 2002. Key habitats for conservation of the Eastern Curlew on its feeding grounds. PhD report prepared for the Wetlands Unit, Biodiversity Group, Environment Australia (Commonwealth of Australia, Department of the Environment), Canberra. 100 pp.
13. Jones, D.N. and **Finn, P.G.** 1998. Translocation of Aggressive Australian Magpies as a Potential Management Option: A Preliminary Assessment. Report prepared for the Suburban Wildlife Research Group, Australian School of Environmental Studies, Griffith University, Brisbane. 35 pp.

CONFERENCE PRESENTATIONS

1. **Finn, P.G.** and Catterall, C.P. 2009. Choice of feeding sites by Eastern Curlews (*Numenius madagascariensis*) on their non-breeding grounds. Australasian Shorebird Conference, Hobart, September. (Spoken).
2. **Finn, P.G.** and Catterall, C.P. 2009. Choice of feeding sites by a global migrant shorebird on its austral wintering grounds. International Congress of Ecology, Brisbane, August. (Spoken).
3. **Finn, P.**, Udy, N., Baltais, S., Price, K. and Maxwell, P. 2007. Distribution and status of seagrasses in Moreton Bay and an evaluation of community based monitoring (Seagrass-Watch). Queensland Coastal Conference, Bundaberg, September. (Poster).
4. **Finn, P.**, Udy, N., Baltais, S., Price, K. and Maxwell, P. 2007. Seagrass-Watch Moreton Bay: Community based monitoring of seagrass resources. Australian Marine Sciences Association Conference, Melbourne, July. (Spoken).
5. **Finn, P.G.**, Catterall, C.P. and Driscoll, P.V. 2005. Relationship between Eastern Curlew predation and intertidal prey availability on wintering grounds in subtropical eastern Australia. Ecological Society of Australia Conference, Brisbane, December. (Spoken).
6. **Finn, P.G.**, Catterall, C.P. and Driscoll, P.V. 2002. Characteristics of key feeding habitat for Eastern Curlew at two spatial scales in subtropical eastern Australia. Ecological Society of Australia Conference, Cairns, December. (Spoken).
7. **Finn, P.G.**, Catterall, C.P. and Driscoll, P.V. 2000. Feeding Distribution of Eastern Curlew in Moreton Bay. Griffith University Ecology and Evolution Postgraduate Symposium, Brisbane, October. (Spoken).
8. **Finn, P.G.**, Catterall, C.P. and Driscoll, P.V. 2000. Distribution and site selection in Eastern Curlew at feeding grounds in Moreton Bay. Southern Hemisphere

- Ornithological Congress and Australasian Shorebird Conference, Brisbane, July. (Spoken).
9. **Finn, P.G.**, Driscoll, P.V. and Catterall, C.P. 1999. The low tide distribution of Eastern Curlew at feeding grounds in Moreton Bay. Griffith University Ecology and Evolution Postgraduate Symposium, Brisbane, October. (Spoken).
 10. **Finn, P.G.**, Driscoll, P.V. and Catterall, C.P. 1999. The low tide distribution of Eastern Curlew at feeding grounds in Moreton Bay. Australasian Shorebird Conference, Victoria, June. (Spoken).
 11. **Finn, P.G.** and Hughes, J.M. 1996. Do Australian Magpie ‘Helpers’ Gain Indirect Benefits? Griffith University Ecological Review Postgraduate Symposium, Brisbane, November. (Spoken).
 12. **Finn, P.G.** and Hughes, J.M. 1996. Helping Behaviour in the Australian Magpie (*Gymnorhina tibicen*). Australasian Society for the Study of Animal Behaviour Conference, Canberra, September. (Spoken).
 13. **Finn, P.G.** and Hughes, J.M. 1995. Relationship of Helpers to Offspring in the Australian Magpie (*Gymnorhina tibicen*). Australasian Society for the Study of Animal Behaviour Conference, Brisbane, April. (Poster).

LICENCES and ATTAINMENTS

- Manual C- and R-class open driver’s and recreational shipmaster’s licences.
- Construction Industry White Card.
- GIQ Coal (Standard 11) and Coal Board Medical.
- Origin Energy Modules 0 and 1 HSE Leadership Programs.
- Arrow Energy, Epic Energy, Santos, Queensland Gas Company, BHP-Mitsubishi Alliance, Macarthur Coal and New Hope Coal safety inductions for contractors.
- APPEA Introduction to the Petroleum Industry.
- ASIC authority for working airside at the Brisbane Airport.
- Fauna Handling (Spotter/Catcher) and Venomous Snake Handling training.
- National accreditations include: ‘SAIEMS604A - Conduct and Environmental Management Systems Audit’; ‘SAIEMS605A - Evaluate an Organisation’s Environmental Management Systems Audit’; and, ‘AHCFAU301A - Respond to Wildlife Emergencies’.
- Australian Bat Lyssavirus vaccination.
- QLD Herbarium training courses including: Vegetation Structure; Regional Ecosystems; Plant Identification; and, BioCondition Version 2.1.
- Department of Environment and Heritage Protection approved suitably qualified person under the *Flora Survey Guideline – Protected Plants*.
- Senior First Aid and Remote Area First Aid qualifications.
- Defensive four-wheel driving qualifications including: ‘PMASUP236B - Operate vehicles in the field’; ‘RIIVEH201B - Operate light vehicle’; and, ‘AHCMOM211 - Operate side by side utility vehicles’.

- ‘Elements of Shipboard Safety’ qualification and the accrual of a total of 21 ‘days at sea’ as a ‘deckhand’ operating various commercial vessels from 5 to 12 m in length and 37 to 232 kW in power, within ‘smooth’ and ‘partially smooth’ waters of Moreton Bay.

PROFESSIONAL MEMBERSHIPS

- Certified Environmental Practitioner (CEnvP) Scheme: Ecology Specialist since 2014.
- Environment Institute of Australia and New Zealand: member since 2012.
- Ecological Society of Australia: member since 2000.
- BirdLife Australia and Threatened Bird Network: member since 1999, on the management committee of BirdLife Australia Southern Queensland from 2010-2012.
- Australasian Wader Studies Group: member since 1999.
- Queensland Wader Study Group: member since 1993, on the management committee from 1996-2005 and 2015-present.

ADDITIONAL SKILLS

Bird banding: I hold a current A-class bird banding authority with the Australian Bird and Bat Banding Scheme and have had experience banding all types of birds from small passerines to large seabirds and using various catching techniques (trapping, mist- and cannon-netting).

Field skills: I have well-developed skills in animal identification, trapping and handling. I am experienced in a wide range of sampling/trapping techniques for both plants and animals. I have very good field knowledge of birds, particularly shorebirds. I have extensive experience working in urban and rural landscapes, forests, coral cays and intertidal wetlands.

Computer skills: I have developed a high level of computer literacy, using computers extensively for data analyses, word processing and desktop publishing during the writing of scientific papers, presentations, theses and reports. Additionally, I am skilled in the application of computers for data management and a wide range of statistical analyses. I am familiar with several statistical packages including SAS, PATN, SPSS and PRIMER, and GIS programs such as ‘ArcMap’ and ‘MapInfo’.

Laboratory skills: I have experience sorting and identifying benthic marine fauna and flora. I have a good understanding of, and practical experience in, a wide range of genetic techniques, especially allozyme electrophoresis and mini- and micro-satellite DNA analysis. I am proficient in general laboratory and equipment maintenance.

REFEREES

Available on request.

Curriculum Vitae- David James Stanton

Date of Birth: 10/ 04/ 1970

Business Address:

44 Henzell Terrace, Greenslopes, Qld, 4120.

Mob: 044 7822119

Email: davidstanton@3denvironmental.com.au

CURRENT POSITION

Principal Landscape Ecologist - 3D Environmental

ACADEMIC QUALIFICATIONS

BSc Hons: Geology / Biology/ Geomorphology (Hons Class 1-Geology) completed at James Cook University, 1993.

PROFESSIONAL CERTIFICATIONS

MEIANZ: Certified Environmental Practitioner – Ecology Specialist (Certification Number: 0906E)

PROFESSIONAL AWARDS

Planning Institute of Australia, Queensland Division (2005) '*Award of Excellence*' for the Caboolture Shire Councils Bushfire and Hazard Assessment Study. The award was given in the categories of Disaster Mitigation and Biodiversity Conservation and Planning in recognition of work completed in the Caboolture Shire Vegetation Mapping Project, 2004.

Planning Institute of Australia, National Division (2006) '*National Award of Excellence*' for the Caboolture Shire Councils Vegetation Mapping Project. National winner in the category of 'Biodiversity and Conservation Planning'

ACADEMIC AWARDS

Geological Society of Australia Gold Medallion (1993) for outstanding academic achievement in studies of earth science.

PROFESSIONAL SUMMARY

David has a professional career that spans 24 years, which including 3 years' working as regional exploration geologist in the Louisiade Archipelago of PNG, He has extensive experience in the disciplines of resource mapping (geology and geomorphology), floristic assessment, groundwater and dependent ecosystems, conservation planning and impact and ecological risk assessment. His expertise has been utilised across several industry sectors which include mining, infrastructure as well as a consultant to government and indigenous organisations throughout Queensland, the Northern Territory, north-Western Australia and Papua New Guinea. David has particular expertise in landscape scale ecology and ecological processes including the relationships between vegetation geology, geomorphology, hydrology and hydrogeology. David has published vegetation mapping for the Wet Tropics World Heritage area and the Torres Strait Island's on behalf of the Australian Government and has worked extensively on the management of terrestrial biodiversity in northern Australia, co-authoring a number of technical papers on issues relating to landscape ecology and fire management.

PROJECT SUMMARY

ENVIRONMENTAL IMPACT ASSESSMENT FOR LINEAR INFRASTRUCTURE AND WATER

- **Northern Australia – Northern Territory**
 - **PNG to Queensland Gas Pipeline Project, Weipa to Gove Pipeline Lateral Biophysical Assessment:** Preparation of floristic mapping (1:25 000 scale), landform and geomorphic analysis and threatened flora assessment of the proposed Weipa (Qld) to Gove (NT) Lateral sections of the proposed pipeline. Included assessment of several pipeline landfall options in the Gove Peninsula / Nhulunbuy region of the Northern Territory. Enesar 2006.

- **AGL Petronas Corporation –PNG to Queensland Gas Pipeline Project:** Provision of botanical and landform assessments along sections of the proposed pipeline easement. Large sections were completed using helicopter survey with foot survey at selected localities. The subsequent reports for these sections provided the information necessary for incorporation into a broader environmental impact assessment. Enesar, 2005, 2006. Sections investigated included:
 - Landfall on Cape York to the Jardine River
 - Charters Towers to Muttaburra.
 - Stonehenge to Windorah
 - South-west of Windorah to Cameron's Corner on the QLD/ SA / NT junction.
- **TRIP Weir Project, Flinders River:** Floristic surveys over the 200 km² TRIP Weir Project inundation area and associated pipelines. Flinders River in the Gulf Plains Bioregional Area. Studies included assessment of potential threatened flora, review of RE Mapping and general floristic survey for the purpose of Environmental Impact Assessment. Stanbroke Holdings Ltd, November 2014 to May 2015.
- **Copperstring EIS:** Comprehensive floristic mapping (regional ecosystems and threatened ecological communities) at 1:40 000 scale of a 150 km² section of the Copperstring Powerline in the Mt Isa, Cloncurry and Selwyn Ranges sections of the proposed 1km wide study easement. Survey also included a flora and mapping survey of the Charters Towers, Pentland, Hughendon and Cloncurry sections of the proposed powerline alignment.
- **Wet Tropics – North-east Queensland**
 - **Ella Bay Integrated Resort Development:** Floristic baseline assessment of the proposed Ella Bay Integrated Resort development site within the Wet Tropics World Heritage Area.
 - **False Cape Development:** A detailed aerial photographic interpretation and classification of vegetation communities and regional ecosystems, including rare and threatened species search on the False Cape development site to the east of Cairns. HLA Envirosciences Pty Ltd, 2004.
 - **Powerlink –Cardstone Powerline Easement Study:** In conjunction with Peter Stanton, carried out an ecological and botanical assessment of the Cardstone – Kareeya powerline easement to determine the environmental impact of a proposed powerline upgrade. The study included a detailed aerial photographic interpretation and map at 1:25 000 scale. This formed part of a broader impact assessment commissioned by Powerlink through C&B Consultants. 2003.
 - **Main Roads Southern Access Planning:** Alongside Peter Stanton, mapped in detail the vegetation communities within the proposed access corridor south of Cairns using 1:7500 scale aerial photographs. The project assessed the presence of rare and threatened plant species and vegetation communities. Sub-contracted to Sinclair Knight Merz, 1997, 1998.
 - **Chevron Asiatic Gas Pipeline Project:** An aerial photographic interpretation of the botany of the Northern Cape York region. The project assisted in the location of a route for a proposed gas pipeline. Sub contracted to NSR consulting group through Peter Stanton. NSR Consulting Pty Ltd, 1997.
- **Central Queensland**
 - **Queensland Nitrates Pipeline Project:** Floristic survey along the 18 km length of the proposed Queensland Nitrates Gas Pipeline near Moura, southern Bowen Basin. Survey focused specifically on assessment of EPBC Act significance of vegetation communities encountered along the pipeline route as well as intensive searches for Protected Plants (following Protected Plants Survey Guidelines) within the project impact area. Contracted to Queensland Nitrates Pty Ltd (September 2014).
 - **Connors River Dam and Pipelines Environmental Impact Assessment:** Provision 1:20 000 scale vegetation mapping, baseline floristic assessment and environmental impact assessment of the proposed Connors River Dam inundation area and proposed pipelines. Brigalow Belt North Bioregion. Contracted to Sunwater, 2009-2012.
- **South-east Queensland**
 - **Gateway Motorway Assets and Expansion Project:** Floristic mapping and assessment of habitats potentially impacted by the Gateway Expansion Project, Brisbane, over a 12 km stretch of road alignment (September 2014).
 - **Traveston Crossing Dam –Terrestrial Flora Survey:** Provision of baseline floristic assessment and supplementary 1:10 000 scale vegetation mapping for the purpose of assessment of environmental impact. Queensland Water, 2006-2009.
 - **Wyaralong Dam –Terrestrial Flora Survey:** Provision of baseline floristic assessment and supplementary 1:10 000 scale vegetation mapping for the purpose of assessment of environmental impact. Sub-contracted to BAAM Pty Ltd on behalf of Queensland Water, 2006-2009.
 - **Emu Swamp Dam and Pipelines – Terrestrial Flora Survey:** Terrestrial floristic assessment of the proposed inundation area and pipeline routes. Emu Swamp on the Severne River, Stanthorpe.

ENVIRONMENTAL IMPACT ASSESSMENT AND CONSTRAINTS PLANNING FOR MINING

- **Northern Australia / Northern Territory**
 - **Ergon Energy – Mua Island Floristic Analysis:** Preparation of dossiers for 18 threatened flora species recorded on Mua Island (Torres Strait) to assist infrastructure planning and facilitate protected plant surveys. The report required comprehensive review of databases, compilation of ecological information and species photographs (contracted to Ergon Energy, 2016).
 - **MMG Century – Phantom Hills Prospect Floristic Baseline Survey:** Baseline floristic survey and vegetation mapping over the 150 km² Phantom Hills Prospect. North-west Highlands Bioregion (2014 Ongoing), 50 km east of the Queensland / Northern Territory border. Prepared for MMG Century.

- **Brigalow Belt**
 - **Arrow Surat Basin Advanced Exploration Project – Ecological Surveys:** Intensive floristic and vegetation mapping surveys over Arrow Energy's advanced project tenements in the region between Miles and Cecil Plains. Assessments were undertaken over a 2500 km² assessment area (contracted to Arrow Energy, 2016 – 2017).
 - **Arrow Bowen Basin Advanced Development Project – Ecological Surveys:** Intensive floristic and vegetation mapping surveys over Arrow Energy's advanced project tenements to the north of Moranbah. Detailed surveys were completed over a 450 km study area including the Roy's Hill and Lancewood gasfield development areas which are contiguous with the North Goonyella Mine ML boundary. Survey included comprehensive desktop assessments as well as the provision of both dry season and wet season survey reports. Contracted to Aecom Pty Ltd and GHD Pty Ltd on behalf of Arrow Energy (November 2014 to June 2015).
 - **Arrow Energy – Daandine Lease (PL230):** An assessment of EPBC values as they relate to flora and threatened ecological communities for Arrow's Daandine Lease (PL230) in the Surat Basin. Sub-contracted to Ecosmart Ecology 2014.
 - **Arrow –Surat Gas Project Supplementary EIS Study:** Preparation of a supplementary terrestrial ecology study including bio-condition assessments at selected sites and habitat mapping for the 80 flora and fauna species listed under state and federal legislation. Habitat mapping was undertaken for the purpose of biodiversity offset planning. Prepared for Coffey Environments, June 2013.
 - **Supplementary EIS Assessment of Arrow Energy's LNG Facility Site, Curtis Island (SEQ):** Review of EIS chapter and terrestrial ecology assessment of the proposed site facility to inform requests for supplementary information. Included assessment of terrestrial flora and fauna on mainland and island portions of the project. Prepared for Coffey Environments, June 2013.
 - **Acacia Coal / EPC1230:** Floristic baseline survey, preparation of 1:50 000 scale regional ecosystem and EIS assessment of the EPC 890 Resource Area to the south of Blackwater. Mapping was undertaken to accurately identify the distribution of regional ecosystems across the EPC to inform requirements for ecological offset (October 2013).
 - **Coffey Environments / Moultrie ESA Mapping:** Preparation of 1:50 000 scale regional ecosystem mapping over the Hillalong Resource Area, north-west of Nebo. Mapping was undertaken to accurately identify the distribution of Environmentally Sensitive Areas over the Mineral Development Lease (Coal). Revised mapping facilitated ecologically sensitive planning for a forthcoming exploratory drilling project (August 2013).
 - **Arrow Bowen Gas Project:** Floristic impact assessment including detailed baseline ecological assessment of the Arrow Energy's 7800 km² petroleum lease and exploration tenements in the Northern Brigalow Belt, Queensland. The project involved revision of regional ecosystem mapping over a selected 1 000 km² area at a scale of 1: 40 000 for the purposes of constraint analysis. Contracted to Arrow Energy, 2012.
 - **Surat Gas Project EIS - Arrow Energy:** Floristic impact assessment including detailed baseline ecological survey of the Arrow Energy's 8200 km² petroleum lease and exploration tenements in the Southern Brigalow Belt, Queensland. The project involved revision of regional ecosystem mapping over a selected 1 800 km² area at a scale of 1: 40 000 for the purposes of constraint analysis. Contracted to Coffey Environments, 2009 -2013.
 - **Byerwen Coal:** Floristic survey and mapping assessment of the Byerwen Coal exploration lease including project 1:50 000 scale revision of mapping over the 60km² site. Byerwen Property in the Northern Brigalow Belt. Unidel 2010, 2012.

- **Curragh North Coal Development Project:** Provision of baseline floristic assessment, 1: 25 000 scale vegetation mapping and environmental impact assessment of the proposed Jellinbah development area (November, 2011).
- **MCG Resources:** Floristic survey and mapping assessment of the MCG Groups MLA's in the Blackwater area, the Brigalow Belt South Bioregion of central Queensland. The study area covered approximately 25 km² as smaller sections of the larger MDL 152 (Curragh Extended and Curragh South). Contracted to Tecsol (2012).
- **Papua New Guinea**
 - **PNG Biomass Project:** Assessment of the 250km² PNG Biomass (Markham Valley- Morobe Province) project for the purpose of forestry plantation. Assessment included detail floristic analysis, vegetation mapping and assessment of impacts against IFC Standards (BAAM P/L, Aligned Energy)
 - **Wafi-Golpu Gold-Copper Mine Project Terrestrial Flora and Fauna Assessment:** Floristic baseline assessment and environmental impact assessment for the Wafi-Golpu advanced exploration project. Contracted to BAAM Pty Ltd on behalf of Morobe Mining JV (February 2015 ongoing).
 - **Marengo PNG – Yandera Prospect Floristic Environmental Impact Assessment:** Ecological baseline study and Environmental Impact Assessment of habitats and species affected by development of the proposed Yandera Prospect, Bismarck Ranges, Marengo Province PNG. Included comprehensive analysis of ethnobotanical and faunal resources. Coffey Environments, 2012.
 - **Kantobo to Mubi River Road Project:** A survey of significant floristic values along an 11km section of proposed road alignment. The survey required assessment of floristic values associated with virgin lowland rainforest in the Southern Highlands/ Gulf Province, Papua New Guinea. Subcontracted to Coffey Environments, 2010.
 - **Solwara Project – East New Britain PNG:** Habitat assessment, floristic analysis and mapping of the 80km² lease area on the East New Britain Coast-Papua New Guinea. Included comprehensive analysis of ethnobotanical and faunal resources. Contracted to Coffey Natural Systems, 2008.
- **Central Queensland Coast**
 - **McFarlane Oil Shale Project-Central Queensland:** Detailed baseline botanical assessment and environmental impact assessment of the 252km² mineral lease area in the central Queensland Coast Bioregion. The project included 1:40 000 scale aerial photographic interpretation of regional ecosystems and vegetation communities. Contracted to URS Australia (2008 – 2009).
 - **Supplementary EIS Assessment of Arrow Energy's LNG Facility Site, Curtis Island (SEQ):** Review of EIS chapter and terrestrial ecology assessment of the proposed site facility to inform requests for supplementary information. Included assessment of terrestrial flora and fauna on mainland and island portions of the project. Prepared for Coffey Environments, June 2013.
 - **Stuart Oil Shale Floristic Impact Assessment:** Baseline floristic assessment, vegetation community/ regional ecosystem mapping and floristic impact assessment of the Stuart Oil Shale Project Area, Gladstone. Revision of RE mapping undertaken over a 120 km² area at 1:25 000 scale. Queensland Energy Resources (QER), 2012.
 - **Red Mud Dams Vegetation Assessment:** Completion of an RE and vegetation community assessment of the Red Mud Dams area, Boyne Island. The map and complementary report was an aid to planning for future tailings disposal in the area. QAL (sub-contracted through BAAM Pty Ltd), 2005.
- **Desert Uplands**
 - **Eromanga Basin / Desert Uplands vegetation and floristic constraints analysis:** Provision of floristic and landform constraints analysis and mapping over a 5000km² ATP area to assist sensitive location of a proposed comprehensive seismic survey (500km of proposed survey line). Galilee Energy, 2010.

BIODIVERSITY OFFSET PLANNING AND ASSESSMENT

- **MMG Century – Lawn Hill Station Biodiversity Offsets Project:** Habitat biocondition and vegetation mapping assessment of a 6km stretch of river frontage on Lawn Hill Creek contiguous with Lawn Hill National Park on the Queensland / Northern Territory border. The assessment provided baseline information to assist preparation of a biodiversity offset plan for Lawn Hill Station (July 2014).
- **Exco Resources Biodiversity Offsets Project:** Habitat bio-condition, ecological equivalence assessment, vegetation mapping and general floristic survey of a 42 km² portion of Lawn Hill Station to identify suitable habitat for Purple-necked Rock Wallaby.

MINESITE REHABILITATION MONITORING AND ASSESSMENT

- **MMG Century Rehabilitation Monitoring Project:** Implementation of a baseline monitoring program to assess rehabilitation progress on stabilised waste rock dumps. Prepared to identify trends in vegetation development toward the meeting of mine closure criteria. North-West Highlands (March 2014 ongoing).
- **Arrow Energy - Review of Environmental Authority Conditions for Rehabilitation, ATP 676:** A review of EA conditions for ATP 676 to assess the achievability of current EA requirements for vegetation rehabilitation. The review report was utilised for internal Arrow Energy purposes. Prepared with assistance from Vegetation Management Science (March 2014).

CONSERVATION PLANNING

- **North-eastern Australia**

- **Wet Tropics Management Authority Vegetation Mapping Project:** A 1: 25 000 scale aerial photographic interpretation and complementary 1:50 000 map of the structural characteristics, vegetation communities and geology of the Wet Tropics Bioregion, an area of over 30 000 km². The project required the detailed classification of both remnant and non- remnant vegetation communities and the completion of 38 resource management reports for various regions within the project area. During this time, expert advice was provided to the authority in regard to management aspects of the World Heritage Reserve. The completed mapping product forms the basis for RE mapping and assessment within the Wet Tropics Bioregion (incorporated into Version 5.2 digital RE data produced by EPA). (1997 – 2012, work is ongoing to date of publication expected in August 2012)
- **Upper Bridge Creek Conservation Area Timber Assessment Report:** Provided an assessment of timber resources within the 160 km² Upper Bridge Creek Conservation Area to the north of Hopevale. Project facilitated negotiations between Traditional Owners and the Queensland Government to agree to terms of transfer to Conservation Reserve. Contracted to DATSIMA (Old Govt, April 2015).
- **Mandingalbay Yidinji Lands Biodiversity Planning and Management Project:** Development of biodiversity and land management profile for the Mandingalbay – Yidinji Lands, Wet Tropics World Heritage Area. Biodiversity profile has been applied to guide land management programs for the 'Working on Country' ranger program. Contracted to Djunbunji Ltd. June 2013 ongoing.
- **Torres Strait Island Biodiversity Planning Project:** Development of biodiversity and land management profiles for 14 selected islands in the Torres Strait, Northern Australia. Biodiversity profiles are being applied to guide land management programs for the 'Working on Country' ranger program. Contracted to Torres Strait Regional Authority, Australian Government). November 2010 to December 2012.
- **Torres Strait Islands Regional Ecosystem and Vegetation Community Mapping:** A 1:25 000 aerial photographic interpretation of the vegetation, structural associations and regional ecosystems of the islands of the Torres Strait. Spatial data produced during the vegetation survey has been successfully incorporated into the Version 6.0 RE digital database produced by DERM. The survey and mapping project assessed a total land area of 860 km² within the Cape York Peninsula Bioregion (Contracted to Torres Strait Regional Authority, Australian Government).
- **Queensland Herbarium – Wet Tropics Bioregion Regional Ecosystems Classification:** Expert advice provided to the Queensland Herbarium concerning descriptions and classification of regional ecosystems in the Wet Tropics Bioregion. Advice was specific to the release of revised regional ecosystem mapping throughout the state relevant to the implementation of Queensland's "Vegetation Management Act". Queensland Herbarium, 2009.
- **Queensland Herbarium Non Remnant Vegetation Classification:** An assessment of the remnant status of highly disturbed vegetation communities within the Wet Tropics Bioregional zone, relevant to the implementation of Queensland's "Vegetation Management Act" EPA, 2004- 2005.
- **Wet Tropics Management Authority Timber Resource Assessment Project (2004):** A resource and timber assessment of freehold tenure within the World Heritage area to provide a means to adequately assess landowner compensation claims. Wet Tropics Management Authority, 2004.
- **Dawnvale Station Vegetation Mapping Project:** A land management report and detailed aerial photographic interpretation of vegetation within the Dawnvale Grazing Leasehold. The study was commissioned to assist traditional owners in their application for leasehold renewal. Centre for Appropriate Technology, 2001.
- **Mt Molloy Vegetation and Land Systems Mapping:** Report on the environs of the Mt Molloy Wetlands including a 1:25 000 aerial photographic interpretation of landform, geomorphology and vegetation. Mitchell River Catchment Management Group, 1999.

- **Brigalow Belt / Central Queensland**
 - **Newlands Nature Refuge / Wollumbi Brigalow Conservation Reserve ecological assessment:** Detailed vegetation mapping and floristic analysis of vegetation communities and regional ecosystems on the Newland Nature Refuge and Wollumbi Brigalow Conservation Reserve, Brigalow Belt North Bioregion (total area of 100km²). The study was commissioned for compliance with EPBC offset requirements. XStrata Coal / Footprints Ecology, 2009.
- **South-east Queensland**
 - **Seqwater Advanced Offsets Project:** Identification of suitable advanced habitat offsets within Seqwater's water infrastructure estate in south-east Queensland. Assessment included the identification habitats suitable for offset at Ewan Maddock, North Pine and Hinze Dam sites to the north and south of Brisbane (contracted to GHD, 2017).
 - **Caboolture Shire Council Vegetation Mapping Project:** Detailed 1:25 000 scale and 1:10 000 scale mapping of vegetation communities, land zones, and regional ecosystems of the Caboolture Shire Council (SEQ) using aerial photograph analysis. Total project area of 1200 km². The project included detailed floristic sampling of all intact communities identified and the development of a classification scheme to allow assessment of highly disturbed vegetation types. Contracted to Rob Friend and Associates, 2004.
 - **Reedy Creek Conservation Area (Agnes Waters):** Detailed 1:10 000 scale aerial photographic interpretation and map of the vegetation communities in the Reedy Creek Conservation Area relevant to conservation and fire management with a proposed eco-development site (Bush Heritage Trust, 2005).

FIRE / ECOLOGICAL MONITORING PROJECTS

- **Mandingalbay Yidinji / Djunbunji Aboriginal Corporation Fire Monitoring Project:** Implementation of a fire monitoring program to assess the ecological impacts of both wildfire and traditional burning practice on MY Lands. Wet Tropics Bioregion, Yarrabah, Cairns (January 2014 ongoing).
- **East Trinity Monitoring / Wetlands Rehabilitation Project:** Completion of a detailed mapping and flora survey on reclaimed estuarine wetland, including mapping and categorisation of secondary vegetation communities. The study was based aerial photograph interpretation (1:10 000 scale aerial photography). Department of Environment and Resource Management (DERM), 2002 to 2009.
- **Wet Tropics Phytophthora Mapping / Monitoring Project:** Contracted to map rainforest die back resulting from Phytophthora outbreak within the wet tropics rainforest communities. The study was completed with detailed 1:25000 aerial photographic interpretation over 'at risk' areas. James Cook University/Rainforest CRC (1999 - 2001).

FIRE PLANNING PROJECTS

- **Mandingalbay Yidinji / Djunbunji Aboriginal Corporation Fire Management Planning:** Development of a fire management strategy for Mandingalbay Yidinji Lands within the Wet Tropics World Heritage Area. Prepared for the purpose of engaging traditional owners in the on ground management of traditional lands (October 2013 ongoing) and direct ecologically sensitive application of fire to the landscape.
- **Reedy Creek Conservation Reserve Fire Management:** Five-year review of the endorsed fire plan for the Reedy Creek Conservation Reserve, Agnes Water. Included recommendations to accommodate changes in the surrounding urban landscape whilst considering the results and lessons from the previous management period. Bush Heritage Trust 2014.
- **Torres Strait Island Fire Management Project:** Development of fire management plans for biodiversity conservation on Badu, Mua, Saibai, Boigu, Dauan, Mabuig, Mer and Erub Islands in the Torres Strait. Work was completed in conjunction with Peter Stanton. Contracted to Torres Strait Regional Authority (2012 -2013).
- **Cape York Fire Project:** A fire scar and floristic structural mapping project to assess changes in vegetation communities that have resulted from shifting fire regimes over the past 30 years. Project utilised current and historical aerial photography for interpretation. Balkanu Cape York Land Development Agency (April to June 2003).

GROUNDWATER DEPENDENT ECOSYSTEMS / GAS MIGRATION ASSESSMENT AND MONITORING

- **GDE Site Characterisation – Arrow Surat Gas Project:** Implementation of GDE assessment execution plan involving characterisation of chosen GDE localities through drilling and bore construction (Sonic), isotope analysis of soil and xylem water and leaf water potential. Arrow Energy 2017 / 2018.

- **GDE Study Execution Plan – Arrow Surat Gas Project:** Execution plan for detailed characterisation of GDE's throughout the Surat Gas Project Area including plans for groundwater assessment, ecological characterisation, leaf, soil and groundwater sampling.
- **Groundwater Dependent Ecosystem (GDE) Assessment – Arrow Energy Surat Gas Project:** Detailed description, characterisation and mapping of GDEs throughout the Surat Gas Project assessment area. Study was commissioned to assist development of the Water Monitoring and Management Plan (WWMP). Contracted to Arrow Energy 2016 and 2017.
- **Banksia Beach Borefield – Groundwater Dependent Ecosystem (GDE) Monitoring:** Monitoring of wet coastal heath to detect impacts of groundwater drawdown on vegetation composition, structure and ecology. Biannual reporting includes an analysis of NDVI datasets to support assessments of vegetation condition. Seqwater (2016 ongoing).
- **Condamine River Gas Seeps Vegetation Monitoring:** Assessment of the impacts of gas migration into soil on the health and vigour of intact riparian vegetation on the Condamine River frontage. Required assessment of the current condition and status of vegetation as well as implementation of a long-term vegetation monitoring program.
- **Groundwater Dependent Ecosystem (GDE) Assessment – Arrow Energy Surat Gas Project:** An assessment of the potential groundwater dependency of ecosystems in Arrow Energy's Surat Project tenements to inform federal requirements for a Groundwater and GDE Management Plan . The project required detailed assessment and integration of groundwater, geology and ecological databases, spring characterisation and recommendations for an ongoing monitoring program (Arrow Energy 2016 ongoing).
- **Groundwater Dependent Ecosystem (GDE) Assessment – Arrow Energy Bowen Gas Project Development Area:** An assessment of the potential groundwater dependency of ecosystems in Arrow Energy's Bowen Gas Project tenements to inform federal requirements for a Groundwater and GDE Management Plan . The assessment focused on the potential groundwater dependency of ecosystems in areas contiguous with the North Goonyella, Suraji, Newlands and Suttor Creek Mining Lease areas with the focus on developing an ecological assessment program to monitor the effects of groundwater drawdown on vegetation condition (Coffey Environments 2015).
- **Sunshine Coast Regional Airport – GDE Assessment:** Assessment of the effects of altered groundwater hydrology on the ecology of wet heath and associated populations of the Endangered *Allocasuarina emuina*. Preliminary review of environmental conditions for the Sunshine Coast Airport Upgrade. Sub-contracted to BMT – WBM (June 2010).

LANDFORM / SOIL AND GEOMORPHOLOGY PROJECTS AND ASSESSMENTS

- **Mornington Wildlife Sanctuary Landform, Geology and Vegetation Community Mapping Project:** A 1: 50 000 aerial photograph interpretation and descriptive landform, soils geological and floristic mapping assessment of the Mornington Wildlife Sanctuary, Kimberley Region, North Western Australia. The report and complementary map provided a baseline study into the factors influencing the area's ecology and diversity. Assisted with preparation of vegetation maps for the property as well as preparation of a floristic inventory. Total survey and mapping area of 3 200 km². Contracted to Australian Wildlife Conservancy (2004).
- **Mt Zero Wildlife Sanctuary Landform and Geological Mapping Project:** A 1:25 000 scale aerial photographic interpretation, map, and descriptive report on land systems soils and geology of the Mt Zero/Taravale Wildlife Sanctuary, North Queensland. Total survey and mapping project area of 650 km².
- **Agnes Water Geomorphic and Land Zone analysis:** Provision of a geomorphic and soil assessment of a 300ha site south of Agnes Water. The study formed the basis for appraisal of regional ecosystems in the study area. EPA certified regional ecosystem mapping was successfully challenged. Mariner Awaken/ Midell Joint Venture, September 2009.
- **Geomorphological assessments on major river crossings on the proposed PNG to Queensland gas pipeline for the purpose of assessing crossing stability.**

GENERAL ECOLOGY, REHABILITATION AND VEGETATION MANAGEMENT ASSESSMENTS FOR DEVELOPMENT

- **Property Map of Assessable Vegetation:** Preparation of and application for a PMAV over the 250km² Burdekin Downs property in the Einasleigh Uplands. Includes detailed field site survey, historical aerial photographic interpretation, preparation of supporting material and submission to DNRM. Burdekin Downs Pastoral Ltd, Charters Towers, 2017.
- **Ecological Assessment Report – Seton College, Brisbane:** Assessment of development impacts on the ecology of remnant woodland mapped as having High Ecological Sensitivity. Response to an information request by Brisbane City Council.

- **Vegetation Management Plan – Rehabilitation Plan, Hymix Concrete Batching Site, North Pine River:** Vegetation and Rehabilitation Management Plan for the 250 Bald Hills Road, a 10 ha former industrial site adjacent to the North Pine River to be rehabilitated under court order. Duggan and Hede Pty Ltd for Hymix Australia.
- **Ecological Assessment Report – Yandina Waste Disposal Facility (Sunshine Coast Regional Council):** Floristic survey and assessment of vegetation condition at proposed waste disposal facility, Yandina on the Sunshine Coast. Prepared for Sunshine Coast Regional Council on behalf of Duggan and Hede Pty Ltd (August 2014).
- **Ecological Assessment Report – Warwick Landfill:** Floristic survey and general ecological assessment of the proposed extension of the Warwick Landfill Site. Prepared for Duggan and Hede Pty Ltd (November 2013).
- **Wooyung Developments, NSW –** Ecological assessment of a proposed Eco-Tourism Facility at Wooyung Beach, Northern NSW. Assessment of a 100ha development site including mapping and assessment of Critically Endangered Littoral Rainforest communities, listed under the Federal and State (NSW) legislation.

WATERWAYS MANAGEMENT PROJECTS

- **Redlands Waterways Reach Management and Riparian Condition Assessment:** A reach and catchment characterisation including riparian habitat assessment, for waterways in the Redland Shire Council area (SEQ). The project involved aerial photograph classification of reach, and field assessment of riparian habitats (Hydrobiology, 2011).
- **Caboolture Waterways Management Project:** Provided a reach and catchment characterisation, including riparian habitat assessment, for waterways in the Caboolture Shire area (SEQ). The project involved aerial photograph classification of reach, and field assessment of riparian habitats (Natural Systems, 2006 - 2007).

EXPERT WITNESS

- Provision of expert advice to Rob Friend and Associates / Iwasaki Resorts in regard to charged breaches against the Vegetation Management Act. Evidence was presented for the defence in Queensland Planning and Environment Court Proceedings.
- Expert witness duties for the case of Queensland Government versus Strathmore Station in regard to charged breaches against the Vegetation Management Act. Contracted to Preston Law, Cairns. Trial is ongoing.

OTHER RELEVANT PROFESSIONAL EXPERIENCE

Feb. 1995 - August 1997

Regional Exploration Geologist – Louisade Archipelago P.N.G: The position required the development of remote epithermal gold prospects on Placer Dome's (now Barrick Gold Corporation) exploration tenements on Misima Island and regional areas. Major tasks included detailed geological mapping, remote sensing and reconnaissance drilling (diamond core). The supervision of exploratory drilling on advanced gold prospects, including resource delineation drilling in the mine vicinity, was also required on a regular basis.

Feb. 1994 - February 1995

Exploration Geologist - Osborne Gold Mine: The major task was to supervise the Osborne regional exploration program during the construction phase of the Osborne Cu-Au Mine (Mt Isa Inlier). Project requirements included the planning and implementation of exploratory drilling programs to test geophysical targets, supervision of RC and Diamond Core drilling rigs, logging of RC chips and diamond core. Project management tasks included the planning of a regional exploration program around a budget of \$350K.

PEER REVIEWED PUBLICATIONS

Stanton J. P., Stanton D.J., Stott M. & Parsons M. (2014). Fire Exclusion and the Changing Landscape of Queensland's Wet Tropics Bioregion 1. The Extent and Pattern of Transition. Australian Forestry V77 No.1 51 – 57.

Stanton J. P., Parsons M., Stanton D.J.& Stott M. (2014). Fire Exclusion and the Changing Landscape of Queensland's Wet Tropics Bioregion 2. The Dynamics of Transition Forests and Implications for Management. Australian Forestry V77 No.1 58 – 68.

Fell D.G., Stanton D. J (2015). Vegetation and Flora of Mabuyag Island, Torres Strait, Queensland. Memoirs of the Queensland Museum, Volume 8, Part 1.

Stephenson PJ, Burch AT, Stanton DJ & Whitehead PW (1998). *Three long lava flows in north Queensland*. *Journal of Geophysical Research-Space Physics*, 103, 27359 – 27370.

SPECIALIST TECHNICAL TRAINING

Australian Groundwater School: Four-day intensive training course dealing with technical and management aspects of groundwater in an Australian context. Flinders University, Canberra, 2017.

PUBLISHED VEGETATION MAPPING

Stanton J. P and Stanton D. J (2005) '*Vegetation of the Wet Tropical Bioregion of North Queensland*', published at 1:50 000 scale in co-operation with the Wet Tropics Management Authority, Cairns, Queensland.

Stanton D.J, Fell D. F, Gooding D. O (2009). '*Vegetation of the Torres Strait and Kaurareg Islands*': 1:25 000 scale vegetation mapping produced in co-operation with Torres Strait Regional Authority, Australian Government.

PRESENTATIONS

IAVCEI (International Association of Volcanology and Chemistry of the Earths Interior) conference, Canberra 1993, "*Using Remote Sensing to Detect Geochemical Heterogeneity within the Kinrara Lava Flow, McBride Lava Province, N.Q.*"

EIANZ conference '*Achieving Real Biodiversity Outcomes during the EIS Process*', April 2010. The presentation was titled '*The Importance of Accurate Regional Ecosystem and Vegetation Mapping in the Assessment of Impact to Biodiversity*'.

ADDITIONAL RELEVANT SKILLS, INTERESTS and CERTIFICATIONS

- Proficient in the Tok Pisin PNG language
- Professional experience as a Lifeguard for Queensland Surf Life Saving Association;
- Former Queensland representative swimmer and current record holder for the Magnetic Island to Townsville swimming race.
- Senior First Aid Certificate Current.
- Above Ground Coal Core and Coal Seam Gas inductions
- Advanced 4wd training certification current.

REFERENCES

Steven Goosem: Principal Scientist, Wet Tropics Management Authority. Ph: 07 4052 0563: Email: steve.goosem@wetma.qld.gov.au

Barton Napier: Principal - Coffey Environments. Trenerry Crescent, Melbourne. Ph: 03 9473 1450. Email: Barton.Napier@coffey.com

Dale Mundraby: CEO Mandingalbay Yidinji Aboriginal Corporation. Ph: 07 4056 8283. Email: dale@djunbunji.com.au

MARK SANDERS

Position: Director/Principal Ecologist, EcoSmart Ecology Pty Ltd
Qualifications: Bachelor of Advanced Science (Zoology) (First Class Honours)

Areas of Expertise

- Environmental planning and constraints analysis
- Vertebrate fauna survey and identification
- Rapid assessment of terrestrial habitats
- Design and implementation of research projects, particularly monitoring programs
- Threatened species survey and assessment
- Wildlife management
- Biodiversity planning and offset management
- Scientific communication

Overview

Mark Sanders is a highly respected and well known ecologist with over 20 years field expertise and first-hand knowledge of more than 1600 of Australia's terrestrial vertebrate species. His enthusiasm for natural history has led to surveys in every state and territory within the Australian continent from across a vast range of habitats.

Mark combines his ecological knowledge and experience with strong industry understanding and management skills. His project-related experience has included linear infrastructure (roadways, rail corridors, transmission lines etc), mining (inc metalliferous and coal), oil and gas, energy and transport projects, and small and large scale infrastructure (town development, master plan projects, airports etc). He has also prepared management plans for threatened species and offset areas, and provided detailed assessment for regulatory review. His broad industry experience enables him to evaluate ecological resources and make effective strategy recommendations based on scientific understanding and industry knowledge.

Marks recent work has included a large-scale airport development located on the Sunshine Coast of Queensland. The work involved rapid ecological assessment to identify potential ecological constraints, targeted long-term (12+ months) research on high conservation taxa, and baseline (inventory) surveys. Multidisciplinary understanding has been fundamental in developing environmentally sustainable solutions, which has included evaluation and identification of offset priorities and targets. Due to the sensitive location and nature of the works, Mark has been required to regularly liaise with government bodies, research institutions and community groups, often requiring the communication of complex ecological issues.

Mark has extensive experience in remote area work, four-wheel drive training and maintenance skills and has worked with traditional land owners. His photography skills are renown, and his highly sort after images have been used in a variety of publications.

Professional History

| | |
|-----------------------|--|
| 2009 - present | Director/Principal Ecologist EcoSmart Ecology Pty Ltd |
| 2008 | Principal Ecologist Matrixplus Consulting Pty Ltd |
| 2005 - 2008 | Senior Ecologist BAAM Pty Ltd |
| 2001 – 2005 | Senior Ecologist Australasian Resource Consultants Pty Ltd, Brisbane Qld. |
| 2000 | Environmental Scientist Blue Mountains Wilderness Trust, Sydney NSW. |

Selected Project Experience

- Baseline (seasonal) inventory survey of terrestrial fauna at MMG Century, located near Lawn Hill National Park in north-west QLD, 2013-14,
- Fauna assessment and community fauna awareness project within the Mandingalby Yidinji IPA, Yarrabah, Cairns. Surveys involved teaching survey methods and sharing information with local Traditional Owners, 2013-14.
- Baseline (seasonal) inventory survey for terrestrial fauna on Curtis Island for Arrow Energy CSG, 2012/13. Works included the survey of mangrove communities, intertidal communities, headlands and coastal dune vegetation (e.g., littoral rainforest),
- Baseline terrestrial fauna survey at Pisolite Hills, north of Weipa, QLD, 2012-2013
- Baseline vertebrate assessment of the Red Mud Dam area, Boyne Island for QAL (2005). Works included coastal dune complex with littoral rainforest.
- Team leader for the (fauna) assessment of Arrow Energies Surat basin CSG tenements. Works included high-level assessment to establish areas of primary conservation value, and the development of a risk-based approach to infrastructure planning. 2010 to present
- Fauna survey for South Murrin Murrin mining operations, WA. 2012.
- Pest Management Action Plan – Feral Pig and Red Fox. Action Plan prepared for Redland Shire Council. June 2005.
- Team Leader for two successive flora and fauna surveys (2001 and 2003) for the North Curragh Coal Project, Central Queensland. The project included assessing and managing impacts on three Nationally Vulnerable species along a proposed transport corridor.
- A 6 day (5 night) survey in a remote area for Matrix Metals near Kajabbi in far north-west Queensland. The survey found several threatened species and added small range extensions for several common species.
- Project Manager and Team Leader for a comprehensive survey and assessment of environmental values of Tarong State Forest in south-eastern Queensland.
- Flora and fauna assessment of coastal vegetation in north-eastern NSW. The survey located eight threatened fauna species.
- Survey of flora and fauna species on a 400ha site near Mt Glorious, south-east Queensland. Habitats surveyed include rainforest, wet sclerophyll forest and dry sclerophyll forest.
- Team Leader for an intensive 10-day survey of an area north of Clermont, Central Queensland. Confirmed the presence of several Endangered Regional Ecosystems and Threatened species.
- An extensive 8 day baseline survey study for Selwyn Mines in the Selwyn Ranges. During the study, *Pseudantechinus mimulus* was discovered. This species has been seen on the mainland of Australia only five times since its description in 1906.

Targeted Surveys

- Ground Parrot Research (2012-2014 and 2017) at the Sunshine Coast Airport. Monthly works to establish habitat use and population size,
- Targeted Purple-necked Rock-wallaby research and monitoring; MMG Dugald River. Ongoing works,
- Targeted survey, including trapping and active searches, for the vulnerable Water Mouse (*Xeromys myoides*) around Port Curtis (Gladstone) including Curtis Island (2012). The works located a number of nesting holes and increased local knowledge/distribution of the species.
- Targeted survey and assessment of the distribution of the Brigalow Scalyfoot on Boyne Island (for Queensland Alumina) (2006).
- Targeted survey and management plan for the federally Vulnerable Black-breasted Button-quail, Boyne Island Gladstone (QAL, 2006). This work was commissioned following baseline surveys which rediscovered the species within littoral rainforest on coastal dunes. Prior to the discovery the species had only been known in the local area from records in the early 1900's.

- Team leader for the survey of threatened wallum frogs (particularly Wallum Sedgefrog) near Caloundra, south-east Queensland (2012 – ongoing). Work included sampling tadpoles and water parameters to evaluate breeding success across a variety of pools located in a variegated and disturbed landscape.
- Assistant to field ecologist on a study into the population, distribution and abundance of Plains Wanderers (*Pedionomus torquatus*) in grasslands of southern central NSW.
- Field Team Leader in the assessment of the presence and extent of Black-breasted Button-quails (*Turnix melanogaster*) in Tarong State Forest, south-east Queensland.
- Microchiropteran bat fauna of Clermont Coal Project north of Emerald. The survey was designed to determine the presence/absence and distribution of the Little Pied Bat (*Chalinolobus picatus*) and Greater Long-eared Bat (*Nyctophilus timoriensis*).
- Team Leader for an assessment of the presence/absence of the Threatened *Delma torquata* in south-east Queensland.

Research and Monitoring

- Carpentarian Pseudantechinus (*Pseudantechinus mimulus*) research to establish best survey methods and evaluate their distribution. Co-supervisory role with the University of Sunshine Coast.
- Team leader for the twelve month monitoring to determine area of occupancy and habitat preference of the vulnerable Ground Parrot, Sunshine Coast Airport, Marcoola.
- Research into the methods of habitat utilisation and differentiation between four sympatric species of low-foliage gleaning bird species (White-browed Scrubwren, Superb and Variegated Fairy Wren and the Southern Emu-wren).
- Leader of the team that developed a biannual monitoring program for Pacific Coal's Kestrel Project in central Queensland. The aims of the program are to determine the affect of cattle grazing and subsidence on biodiversity values of natural grasslands and riparian ecosystems. The program was specifically designed so that later publication of results would be possible.
- Design and implementation of biannual monitoring program to document the success of rehabilitation strategies at Peak Downs Coal Mine.
- Comprehensive 8 day fauna study for the Ernest Henry Copper/Gold Mine as part of their yearly monitoring program. Aims of the program are to statistically show the effect of rehabilitation techniques on facilitating recolonisation by fauna.
- Heavy metal accumulation in aquatic macro invertebrates at Ernest Henry Copper/Gold Mine.
- Development of a monitoring program of the Vulnerable Ornamental Snake (*Denisonia maculata*) including population estimates (micro-chips) and radio-tracking. In particular, the program was designed to determine the effect of a road through a known population and if specifically designed underpasses facilitated movement and flow within the population. The program was accepted by the Department of Environment and Heritage.
- Research into shelter site characteristics of the Purple-necked Rock-wallaby (*Petrogale purpureicollis*) during summer.

Selected Technical Papers

- McNab, A., and **Sanders, M.G.** (2014). Consumption of exotic grass seeds (Poaceae: *Cynodon dactylon*) by the Eastern Ground Parrot (*Pezoporus wallicus*). *The Queensland Naturalist* Vol 52, 82-84.
- McNab, A., **Sanders, M.G.**, and Vanderduys, E. (2014). New records of blind snakes resembling the Robust Blind Snake *Anilius ligatus* (Peters 1879), on Cape York Peninsula, *Memoirs of the Queensland Museum*. 59, 8.
- McNab, A., and **Sanders, M.G.** (2014). An occasional carnivore, Diadem Leaf-nosed Bat (*Hipposideros diadema reginae*). *The Australasian Bat Society Newsletter*.

Lloyd, P., **Sanders, M. G.**, Reis, T. and Abbott, A. (2013). Targeted trapping surveys shed new light on the distribution and habitat requirements of the Carpentarian Pseudantechinus (*Pseudantechinus mimulus*), a threatened dasyurid marsupial. *Australian Mammology*. **35**: 220-223.

Sanders, M. G., Filewood, L. W. and Fox, B. J. (2005). Differential use of habitat aids local coexistence of three species of wrens (Maluridae) and the White-browed Scurbwren *Sericornis frontalis*: Pardalotidae in Myall Lakes National Park. *The Australian Zoologist*. **33**: 223-232

Sanders, M.G. (2004). Notes on a mass aggregation of *Illyria burkei* (Goding & Froggatt) (Hemiptera: Cicadidae) in central Queensland. *The Australian Entomologist*. 31 (2):79-80

Sanders, M.G., and Slater, L. (2004) New habitat and distributional data for the Vulnerable *Pseudantechinus mimulus*. *Memoirs of the Queensland Museum* **49**: 740.

Macey P. C., McKiernan, C. and **Sanders M. G.** (2002). Is there any science in the Environmental Protection and Biodiversity Conservation Act 1999? A review of the Migratory Species List. Presentation for the 4th Environmental Engineering Conference, May 2002, Brisbane.

A full CV can be provided upon request.

RESUME

Name: Peter Thomas Hall

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Qualifications: Bachelor of Applied Science (Biology)
Central Queensland University
Completed 1995.

Certificate IV in Investigations.
June 2003 Moreton Institute of TAFE

**Other skills and
Qualifications.**

DSEWPac Accredited Ecologist. (Terrestrial Flora and
Fauna) 2012

Construction Industry OH&S Induction (White Card)

Experience in using GIS programs, (principally ESRI
ArcGIS and GBM), and GPS technology.

Heavy Vehicle Driver's Licence

Agricultural Chemical Distribution and
Control Act, Operator's Licence (Restricted).

Level 2 Chainsaw Operator.
Computer and word processing skills.

Workplace Trainer Qualifications 2000

Advanced First Aid Remote Area Operations (refresher
training) 2014

In Service Training: Communications Skills 1984

Fire Training 1986

Supervisor Training 1987

Law Enforcement School 1989

Forest Interpretation Workshop 1993

Recreation Training workshop 1994

Customer Service Training 1994

Summer School of Park Management
Canberra University 1995.

Public Speaking Course through Toastmasters
International 1998.

Aboriginal Cultural Heritage Awareness 1999 and 2004

Regional Ecosystem Training 1999 and 2002.

Map Amendment Request Training 2003

Tactical Communications 2004.

Detecting Deception 2004.

Decision Making Training 2005

Technical Report Writing 2005.

Acid Sulphate Soils Training 2005

QGC Induction 2011

4WD training and defensive driving 2011

Vehicle washdown and weed hygiene
certification (Certificate II in Conservation and Land
Management –National Code RTD20102) 2011

Origin Energy induction 2012

All Terrain Vehicle drivers' course. 2012

Remote area first aid 2012

Helicopter landing officer 2012

Erosion and Sediment Control Training 2012

Laing O'Rourke Induction 2013

WDS Induction 2013

Origin Energy Foundation Training 2014

Most Recent Salary: \$100K including superannuation or \$60/hour plus costs for contract work.

Employment History

January 2016 to present.

Contract Ecologist with Naturecall Environmental Pty Ltd.

This a contract position. Naturecall engages my services when they require specialised ecological advice.

I have worked on two projects in this role,

One was determining and mapping the extent of threatened grasslands on the Army Aviation Base at Oakey. The job included other ecological surveys as well.

The second job was mapping the occurrence of an endangered plant, *Melaleuca irbyana* on a sports reserve in Logan City Council.

April 2015 to present.

Consulting Ecologist with First Steps Environmental (employed on a casual basis).

Duties and responsibilities; principally conducting field surveys of native vegetation in North, West New South Wales under various codes relating to clearing for agricultural purposes under the *Native Vegetation Act 2003*.

June 2014 to April 2015

Field Environmental Advisor with Origin Energy.

Duties and role description; refer to my time in the same role January 2012 – September 2013

September 2013 to June 2014

Senior Vegetation Management Officer, Central West NRW Region.

Duties and role description; refer to my time in the same role January 2008 – March 2011

November 2012 until March 2014

Ecologist and expert witness with First Steps Environmental Pty Ltd, for the Turnbull Case, Croppa Creek. (This work was undertaken concurrently with other employment).

This case involved preparing an ecological report to address the federal *Environmental Protection and Biodiversity Protection Act (EPBC)* requirements of a tree clearing application over a large farming property near Moree in NSW.

Additionally, the case involved preparing an affidavit and giving evidence in the Sydney Land and Environment Court in the capacity of an expert witness ecologist for the Defence, in a tree clearing prosecution under the *Native Vegetation Act 2003*. The case was heard in March 2014.

The case had a favourable outcome for the client in that the Court considerably reduced the fine that the Office of Environment and Heritage (OEH) originally sought. Also, based on my affidavit, potential charges under the EPBC Act and for clearing an Endangered Ecological Community under *The National Parks and Wildlife Act 1974* were not pursued.

Details of the Land and Environment Court Judgement are available at the web address below.

<http://www.caselaw.nsw.gov.au/decision/54a63ede3004de94513dc50f>

In June 2014 an appeal against the Remediation Directions imposed on the landholders by NSW Office and Heritage were also heard in the Sydney Land and Environment Court.

The Court directed that the expert witnesses for the Prosecution and Defence should agree on a compromise Remediation Plan. This plan formed the basis for the eventual Remediation Direction that was imposed by the Court.

Based on my evidence and negotiations with OEH, the Court agreed that rather than order remediation of the entire cleared area, the property owners should be allowed to restore offset areas to high ecological condition and continue to farm some of the unlawfully cleared areas in order to meet the costs of implementing the remediation plan.

The judgement is available at the link below.

<http://www.caselaw.nsw.gov.au/decision/54a63ed53004de94513dc23c>

January 2012 to present until September 2013

Field Environmental Advisor with First Steps Environmental Pty Ltd, contracted full time to Origin Energy.

Duties included;

- Conducting reports and pre-clearance surveys for properties where Origin intended to locate CSG gathering infrastructure.
- Field scouting disturbance footprints for infrastructure associated with the upstream gathering network for the Australia Pacific Liquefied Natural Gas (APLNG) project in SW Queensland.

- Field scouting disturbance footprints for infrastructure associated with exploration wells for APLNG.
- Skills required for field scouting and ecology/pre-clearance reports are, the ability to recognize plant and animal species, including weeds, in the field, ability to conduct watercourse assessments, the ability to recognise regional ecosystems and a basic knowledge of gas field design.
- Ability to recognise soil and geology types, together with a basic knowledge of gas field infrastructure construction and to use this knowledge to identify potential soil erosion issues.
- Writing and reviewing Environmental Constraints Assessments (ECA) capturing the results of field scouting assessed against the various bits of legislation pertaining to the APLNG project. These pieces of legislation and policy include, Queensland Government Environmental Approvals, The Co-ordinator General's Report, Federal Government Approvals, APLNG Environmental Management Plans and miscellaneous pieces of legislation and codes such as those pertaining to land access and Strategic Cropping Land.
- Writing and reviewing ecology reports and pre-clearance survey reports for individual properties.
- Carrying targeted species surveys for rare and threatened plants occurring within development areas as well as complete botanical assessments for disturbance sites.
- Conducting surveys to ground truth regional ecosystems and threatened ecological communities (as described in federal legislation)
- Delivering accredited Regional Ecosystem and Vegetation structure Training to Origin environmental staff.

While working in this role I consistently met Key Practice Indicator targets for the project.

March 2011 until January 2012

Land access consultant with Flinders Group, contracted to the Queensland Gas Corporation (GGC).

Duties included;

- Negotiating Consent to Enter Agreements with landholders on behalf of QGC, to allow coal seam gas exploration on their properties.
- Negotiating Compensation Agreements with landholders to ensure the interests of both landholders and QGC are addressed when determining compensation amounts.
- Ensuring all negotiations are consistent with the Qld Government Land Access Code – November 2010.
- Attending field operations to assess seismic, clear vegetation and carry out seismic operations to ensure compliance with landholder access rules, including certifying weed washdown procedures.
- Attending pegging parties to locate potential appraisal well sites to ensure landholder interests are addressed.
- Assisting in the preparation of Notices of Preliminary Activity and Notice of Intent to negotiate under the *Petroleum and Gas (Production and Safety) Act 2004* where a voluntary agreement with a landholder cannot be achieved.

- Serving as a contact for landholders to address issues with QGC.
- Acting as an advocate for landholders in their dealings with QGC.

January 2008 until March 2011

Senior Vegetation Management Officer, Central West NRW Region.

Duties included,

- Managing the technical, personnel management and training aspects of the Vegetation Management Program within the CW Region.
- The Vegetation Management Program assesses applications made under the *Vegetation Management Act 1999* and *The Integrated Planning Act 1995* for developments that involve the clearing, or potential clearing, of native vegetation. These applications include requests to clear for operational works, weed control, livestock fodder, and material change of use and reconfiguration of properties. The Vegetation Management Unit also assesses and provides comment on major projects, e.g. gas pipelines and major water infrastructure projects. The unit also assesses application for property maps of assessable vegetation (PMAVs), where landholders can produce individual maps showing the vegetation on their properties.
- Training and mentoring staff involved in vegetation management assessment.
- Undertaking desktop and field assessment of major project application through the use of GIS programs, aerial photographs satellite imagery and field observations.
- Providing policy advice and serving on policy development forums
- Answering queries from interested groups and individuals, including delivering addresses to industry groups.
- Dealing with complex inquiries and difficult clients.
- Drafting replies for ministerial correspondence on vegetation management issues.
- Assisting with budget preparation and forward planning.

January 2007 until January 2008.

Senior Vegetation Management Officer, Property Map of Assessable Vegetation (PMAV) Project. This project involves clearing a backlog of PMAV applications in a short period of time.

Duties included

- managing and motivating staff involved in the project,
- monitoring progress of the project and preparing reports,
- Providing policy advice on PMAVs.

During this period I also relieved in the Vegetation Policy Unit in Brisbane.

Duties in this relieving period included,

- providing policy advice to staff throughout Queensland
- answering ministerial inquiries
- Developing policy positions for, and interpreting vegetation legislation.

January 2005 until January 2007.

Senior Natural Resource Officer (Regional Ecosystems) with the Queensland Department of Natural Resources & Mines, Vegetation Management Unit.

My duties under this position included;

1. Undertaking Regional Ecosystem Map amendments.

This is done by;

- conducting field assessments of species present,
- sampling and measuring vegetation height and percentage crown cover using Queensland Herbarium guidelines to determine whether the vegetation in question is remnant or non-remnant as defined under *The Vegetation Management Act 199*,
- assessing aerial photos and satellite imagery to determine the clearing history of the vegetation in question. (Sometimes the imagery and or air photos can be used to determine the remnant status of an area without the need for a field survey).
- After gathering the evidence I prepare an assessment report to forward to the Queensland Herbarium. Part of the report process involves using a GIS program to prepare maps.

2. Managing the RE map amendment program within the Central West Region of Natural Resources. The Central West Region covers 28 shires and is roughly defined in the south by a line running from Gladstone to Birdsville, and in the north by a line running from Proserpine through Winton to the NT border.

Management duties included;

- maintaining a database of RE map amendment requests,
- checking assessment reports submitted by other officers,
- training other staff in vegetation structure, species identification and report preparation,
- preparing and supervising work programs to complete RE map amendments.

3. Providing expert advice to the public and other sections of the department on vegetation issues.

Examples of such advice;

- checking EI Statements for major projects and advising the assessment manager whether or not vegetation issues have been sufficiently addressed,
- assisting vegetation officers with RE and plant identification when assessing tree clearing permit applications,
- reporting on vegetation issues that arise from applications under *Integrated Planning Act* for subdivision or Material Change of Use,
- preparing statements and giving evidence in court hearings for prosecutions under vegetation legislation.
- Answering phone and counter queries from the public in regard to complex vegetation issues.
- Meeting with consultants and project managers for large development operations to discuss vegetation issues.
- Giving expert advice on plant identification and monitoring techniques for the Mount Morgan mine rehabilitation project.
- For my work on this project, I received a ‘Highly Commended’ award from the Director General of the Department of Mines and Energy.

June 2001 until January 2005

Regional Investigator, Natural Resources & Mines Compliance Unit.

Duties included;

- Investigate suspected breaches of the *Vegetation Management Act 1999*, *The Land Act 1994*, *and The Integrated Planning Act 1995*, *The Water Act 2000*, *The Aboriginal Cultural Heritage Act 2003* and *Land Protection (Pest and Stock Route Management) Act 2002*.
- Undertaking site inspections and surveys, taking out warrants, interviewing suspected offenders, taking witness statements and preparing court briefs in the course of investigations.
- Acting as a prosecutor in Magistrate's Court callovers.
- Assisting Crown Law solicitors to prepare cases for hearings and giving evidence at such hearings.
- Prioritising, managing timelines and maintaining case files. Collecting and managing evidence that may be used as exhibits.
- Preparing rehabilitation plans and restoration orders for areas cleared illegally. Monitoring the rehabilitation of these areas.

During my time in this role I investigated and prosecuted some major contested cases.

Hall v Glasgow was an investigation into one of the largest area of illegally cleared endangered vegetation to be prosecuted under the *Vegetation Management 1999*. This case attracted media interest and was attended by Senator Len Harris.

All of the cases I investigated that proceeded to court resulted in a successful prosecution.

As well as the above mentioned legislation, I have gained familiarity with a number of other acts through gathering evidence as an ex officio investigator. These include the federal *Environmental Protection and Biodiversity Conservation Act*, and the Queensland *Environment Protection and Nature Conservation Acts*.

April 1999 until June 2001

Forestry Environmental Management Officer.

The purpose of this position was to monitor and audit logging operations and quarry sales on state land as per the Commonwealth National Forests Policy.

Specific tasks included;

- Conducting surveys prior to logging operations to identify rare, endangered and vulnerable species, cultural heritage sites, potential weed and pest animal infestation, potential threats to the interests of other operators and lessees and identifying threats to the aesthetic and recreational qualities of the land in question. These surveys were done by both field inspections and desktop analysis, i.e consulting EPA databases and maps.
- Conducting environmental audits of ongoing operations to ensure that they complied with various industry codes. The codes stipulate how the operation should meet guidelines relating to soil erosion, watercourse protection, habitat tree retention, safety, cultural heritage, endangered, rare and vulnerable species, waste management, fire protection and protection of the remaining forest from logging damage.

- Preparing management plans for specific species. An example is a management plan I prepared for a vulnerable plant, *Acacia gittinsii*. The plan dictated measures that would allow logging operations in areas where this plant occurred, at the same time ensuring that the species was preserved. This plan was endorsed by EPA.
- Contributing to the development of industry codes under ISO 14001 standards.
- Conducting fauna and flora surveys on state forests.
- Reporting sightings of vulnerable, rare and threatened species for inclusion in the EPA database.

March 1993 until April 1999

Forest Ranger Recreation and Extension, Byfield.

This position involved the management of three camping and day use areas on Byfield State Forest, as well as other sites in the Central Queensland Region.

Byfield State Forest averaged 20,000 visitors per year.

Specific tasks included;

- Managing staff and contractors involved in construction, maintenance and servicing.
- Conducting patrols and law enforcement.
- Budgeting and planning.
- Managing capital works projects.
- Providing advisory services to landowners on forestry issues.
- Delivering talks to school and tertiary students and other interested groups.
- Writing a regular column for a local newspaper.
- In this position I spoke on behalf of the department in several television and radio interviews.

February 1979 until March 1993.

Forest Officer in various parts of Queensland.

During this time I was employed in North, South and Central Queensland in both native forests and plantations.

Among the tasks I performed in this role;

- Site design and preparation, weed control, pruning, planting, harvesting, control burning and fire protection in exotic pine and hoop pine plantations.
- Timber assessment, tree marking, log assessment, sale preparation and site rehabilitation in native forests including North Queensland rainforests.
- Supervising sales of round timber and quarry material, floral and seed harvesting, and grazing permits on state forests and other crown land.
- Forest inventory studies in plantations and native forests.
- Seed and pollen collections in plantations and native forests. Managing an artificial pollination program in exotic pines.
- Soil surveys to determine suitability for plantation establishment.

- Surveying.
- Prescribed burning and fire fighting.
- Law enforcement.

In 1991 I designed, implemented and supervised a program to monitor the harvesting of *Bowenia serrulata*, a plant used for floral arrangement.

The data gathered in this study is still used to determine harvesting levels for this resource.

Prior to 1979.

Grew up on rural properties near Clermont Qld and on Queensland's Sunshine Coast.

Worked as a stockman and sharefarmer during high school and afterward.

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APPENDIX B

BGP EPBC Act species and community core habitat mapping rules

The following table sets out the core habitat mapping rules that have been applied to EPBC Act species and communities for the BGP area. The areas identified for each species and community are illustrated in Appendix D.

| MNES | Core Habitat Known | Core Habitat Possible |
|---|--|---|
| <p>All Regional Ecosystem (RE) mapping has been applied in the following order of priority:</p> <ol style="list-style-type: none"> 1. Ecosmart ground-truthed REs (Phase 1 area) 2. Queensland Government RE mapping (V10) 3. Queensland Government Mature Regrowth (EPA) (as a proxy for regrowth > 15yrs) | | |
| Black Ironbox (<i>Eucalyptus raveretiana</i>) | Any RE polygon that contains a species record (recent (1980+) and accurate (\pm 500m). | <ul style="list-style-type: none"> • Remnant vegetation on land zone 3 within 200m of watercourse • REs: 11.3.4 and 11.3.25 • Remnant vegetation should be from 0-300m AHD |
| Bluegrass (<i>Dicanthium setosum</i>) | Species records (recent (1980+) and accurate (\pm 500m)) should be buffered by a 1 km diameter. This includes remnant and non-remnant habitats. | <ul style="list-style-type: none"> • REs: 11.3.2, 11.3.3, 11.3.4, 11.3.21, 11.4.4, 11.4.11, 11.8.11 and 11.9.3 |
| King Bluegrass (<i>Dichanthium queenslandicum</i>) | Species records (recent (1980+) and accurate (\pm 500m)) should be buffered by a 1 km diameter. This includes remnant and non-remnant habitats. | <ul style="list-style-type: none"> • REs: 11.3.21, 11.4.4, 11.4.11, 11.8.5, 11.8.11 and 11.9.3 |
| Ornamental Snake (<i>Denisonia maculata</i>) | All land within 1km of a species record (recent (1980+) and accurate (\pm 500m)) | <ul style="list-style-type: none"> • All remnant vegetation on land zone 3, 4, 8 and 9 • Also, remnant RE11.5.16 |
| Squatter Pigeon (Southern) (<i>Geophaps scripta scripta</i>) | All land (remnant or non-remnant), within 1 km of a recent (1980+) and accurate (\pm 500 m) record | <p>Woodlands, native grasslands and derived native grasslands REs consisting of:</p> <p>11.3.2, 11.3.3, 11.3.4, 11.3.14, 11.3.17, 11.3.18, 11.3.19, 11.3.21, 11.3.25, 11.3.26, 11.4.4, 11.4.11, 11.4.12, 11.5.1, 11.5.4, 11.5.20, 11.7.4c, 11.8.2a, 11.8.11, 11.9.3, 11.9.9, 11.9.10)</p> <p>Mature Regrowth (EHP 2012b) is also included in the mapping assessment</p> |
| Red Goshawk (<i>Erythrotriorchis radiatus</i>) | Species records (<500 m precision) should be buffered by a 1 km diameter and classed as 'core habitat known'. This includes only remnant habitats. | <p>Remnant woodland within 1 km of permanent water. Permanent water is stream order 3 and above. Following REs were excluded:</p> <p>11.1.1, 11.1.3, 11.2.2, 11.3.21, 11.3.24, 11.3.31, 11.4.11, 11.4.4, 11.5.14, 11.5.6, 11.8.10, 11.8.11, 11.9.12, 11.9.3, and 11.11.17.</p> |
| Koala (<i>Phascolarctos cinereus</i>) | All core habitat possible within 1km of a species record (<500 m precision). | REs: 11.3.2, 11.3.3, 11.3.4, 11.3.14, 11.3.17, 11.3.18, 11.3.25, 11.3.26, 11.3.27d and 11.3.27f |
| South-eastern Long-Eared Bat (<i>Nyctophilus corbeni</i>) | Any RE polygon containing a recent (1980+), accurate (\pm 500 m). unless it is a heterogeneous polygon that includes >65% grasslands (i.e RE11.3.21 + 11.4.4 + 11.4.11 + 11.8.11 | All remaining remnant vegetation (except REs 11.3.21, 11.4.4, 11.4.11, 11.8.11 and 11.9.3) |

BGP EPBC Species Impact Management Plan

| | | |
|---|--|--|
| | + 11.9.3). Such areas should be excluded. Note that no accurate sightings currently recorded in BGP | |
| Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>) | Any RE polygon containing a recent (1980+), and accurate (± 500 m) record. Note that no accurate sightings currently recorded in BGP | Any RE polygon within 10km of a recent, accurate record is classed as core habitat Possible (Note there are no records currently). Cliffs (and surrounding REs) within 10 km of remnant or regrowth vegetation should be classed as core habitat possible (including vegetation) |
| Greater Glider (<i>Petauroides volans</i>) | All 'General Habitat' (i.e. REs: 11.3.6, 11.3.9, 11.4.13, 11.5.9, 11.5.12, 11.7.4, 11.8.4, 11.8.14, 11.9.1, 11.10.4, 11.10.5, 11.10.7, 11.11.1, 11.12.1, 11.12.2) and 'Core Habitat Possible' within 1km of a recent (1980+), accurate (± 500 m) record. Note that no formal sightings currently recorded in BGP | REs: 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.25, 11.3.27 (in fringing woodlands), 11.3.36, 11.3.37, 11.4.2, 11.4.7, 11.4.8, 11.5.2, 11.5.3, 11.5.17, 11.7.6, 11.8.15, 11.9.2, 11.9.7, 11.9.9, 11.9.10, 11.9.13, 11.10.1, 11.12.12, 11.10.13, 11.11.9, 11.11.16, and 11.12.3. |
| Painted Honeyeater (<i>Grantiella picta</i>) | All "General Habitat" (i.e. REs: 11.5.11 and 11.7.2) and "Core Habitat Possible" within 2km of a recent (1980+), accurate (± 500 m) record is classed as "Core Habitat Known". Note that no sightings currently recorded in BGP | REs and regrowth >15yrs: 11.3.1, 11.4.1, 11.4.7 and 11.4.8, 11.4.9, 11.5.16, 11.7.1, 11.8.3, 11.8.13, 11.9.1, 11.9.4, 11.9.5, 11.9.10, 11.10.3, 11.11.13, and 11.11.16 |
| Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant) | Ground-truthed REs: 11.3.1, 11.4.7, 11.4.8, 11.4.9, 11.5.16, 11.9.1, 11.9.5. Use remnant and regrowth. | State Govt mapped REs: 11.3.1, 11.4.7, 11.4.8, 11.4.9, 11.5.16, 11.9.1, 11.9.5. Use remnant and regrowth. |
| Weeping Myall Woodlands | All core habitat possible within 1km of a TEC record. Note that no Weeping Myall Woodland TEC areas currently known in BGP | REs: 11.3.2, 11.3.28 Remnant only |
| Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin | Ground-truthed REs: 11.3.21, 11.8.11, 11.4.4, 11.4.11 and 11.9.3 (where ground-truthed use Best and Good) | State Govt mapped REs: 11.3.21, 11.8.11, 11.4.4, 11.4.11 and 11.9.3 |
| Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions | Ground-truthed REs: 11.5.15, 11.8.3, 11.8.13, 11.3.11, 11.4.1, 11.9.4, 11.11.18, 11.7.1x1 Remnant only | State Govt REs: 11.5.15, 11.8.3, 11.8.13, 11.3.11, 11.4.1, 11.9.4, 11.11.18, 11.7.1x1 Remnant only |

APPENDIX C

EPBC Act species and communities profiles

| Black Ironbox – <i>Eucalyptus raveretiana</i> | |
|---|--|
|  |  |
| <p>Black Ironbox distribution map (DotEE, 2018a) Photo: 2018 Reef Catchments</p> | |
| Status | |
| <p>Vulnerable (EPBC Act); Least Concern (Qld Nature Conservation Act)</p> | |
| Distribution and Habitat | |
| <p>Black Ironbox is endemic to central coastal and sub-coastal Queensland and occurs in scattered and disjunct populations, from Charters Towers and Ayr, and south to Rockhampton (Qld Govt, 2018a). It is restricted to the banks of ephemeral and permanent creek and rivers, or in coastal areas may also be an emergent to rainforest on alluvium.</p> | |
| Records relevant to BGP | |
| <p>Black Ironbox was recorded within a number of watercourses in the north-east of the BGP area during the EIS, including along Bee Creek, Blenheim Creek and Hail Creek. Likewise, the Qld Govt (2018a) sighting records show several locations within or adjoining the north-east of the BGP area.</p> | |
| Presence of habitat within BGP area | |
| <p>The Queensland Government’s potential habitat modelling for the species shows modelled potential habitat is limited to the north-eastern portions of the BGP Area (Butler and Laidlaw, 2012a). Core habitat for the species within the BGP has been mapped and is illustrated in the figure at Appendix D.1. However it will be relatively easy for the preclearance surveys to confirm the presence of this obvious (tree) species. As such, the results of ongoing pre-clearance surveys will be taken into account in confirming and calculating actual areas of impact to core habitat within the BGP area (if any). The BGP Area only includes a small proportion of the known distribution of the species.</p> | |

| |
|--|
| General threats |
| <p>The main threats to Black Ironbox are habitat disturbance and smothering by Rubber Vine, increased fire frequency from fuel associated with weeds and introduced grasses and increased stream bank erosion (DEWHA, 2008a). Besides Rubber Vine, other creek bank weeds capable of inhibiting seeding establishment include <i>Lantana camara</i> (Lantana), <i>Jatropha gossypifolia</i> (Bellyache Bush), <i>Ziziphus mauritiana</i> (Chinee Apple) and robust introduced grasses, such as <i>Megathyrsus maximus</i> (Green Panic) (Arrow Energy, 2014).</p> |
| BGP specific threats |
| <p>Disturbance of up to a maximum of 258.32 ha of core habitat for this species is included in EPBC Act decision (EPBC 2012/6377). This area was based on the area of Regional Ecosystems that were identified by the EIS as having suitable structural characteristics to support the species. However, impacts upon habitat actually supporting the species (if any) are likely to be much less and will be confirmed and quantified by preclearance survey.</p> <p>In the absence of appropriate mitigation measures, the BGP would have the potential to inadvertently remove Black Ironbox individuals and disturb habitat, increase the distribution of Rubber Vine, Lantana, Bellyache Bush, Chinee Apple and other weeds and introduced grasses and contribute to changed fire frequency and increased stream bank erosion.</p> |
| BGP specific mitigation measures (Arrow BGP SREIS 2014 – commitment number in parenthesis) |
| <p><i>Inadvertent Black Ironbox clearing and habitat disturbance</i></p> <ul style="list-style-type: none"> • When the project activities proceed through the detailed planning phase, a field inspection of the specified disturbance footprint (this is specified by a surveyor in the field) will be undertaken by a suitably qualified ecologist and the presence, absence and extent of environmental values will be verified and mapped in the field via GIS. The results of this step will be recorded within Geocortex and the Arrow Sharepoint database • Where environmental values are confirmed, a ‘framing trade-offs’ session will be held with the project engineers, planners and ecologists to determine if the location of the activities can be modified to avoid and/or reduce the impact to environmental values. In the event that Black Ironbox habitat cannot be avoided, the actual area to be cleared will be surveyed to quantify the impacts. This data will be recorded and cumulative impact areas tracked • Delineation of disturbance boundary limits of works will be clearly established prior to commencement of clearing and soil stripping (B049) • Disturbance within core habitat for EVNT species will be avoided where possible (B131) • Pre-construction / pre-clearance surveys will be conducted to identify any additional areas that need to be avoided (B132) • Infrastructure will be designed to avoid undisturbed tracts of remnant vegetation, where practical. Where collection and gathering infrastructure is to be placed within contiguous vegetation, collection networks will be designed to avoid dissection (B134) • Removing riparian vegetation will be avoided when directional drilling and right of ways will be reduced where practical (B138) • Access tracks and pipelines will deviate around sensitive vegetation where |

practicable (B140)

- Sensitive infrastructure design principles will be applied to avoid watercourse, drainage lines and riparian areas where practicable (B142)
- Monitoring will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- Construction activities in sensitive areas will be supervised to ensure appropriate methods (e.g., narrowing of RoW) are being implemented, where required (B182)
- Any residual impacts to Black Ironbox (as confirmed by pre-clearance survey) will be offset. A detailed BGP Phase 1 Offset Strategy and additional offset strategies for the subsequent phases will be developed and implemented to add value rather than just compensating for impacts (if any)

Weeds (particularly Rubber Vine)

- A declared weed and pest management plan will be developed in accordance with the Petroleum Industry – Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008). Species-specific management will be undertaken for identified key weed species at risk of spread through project activities (Mesquite, Parthenium Weed, African Lovegrass and Lippia). Weed control efforts will be increased in areas particularly sensitive to invasion. The pest management plan will include, as a minimum, training, management of pest spread, management of pest infestations and monitoring effectiveness of control measures (B191)
- When sourcing maintenance materials, such materials such as bedding sand, topsoil, straw bales and sand bags will be brought to site only after it is ascertained that the materials are not contaminated with weeds and plant or animal pathogens. A weed hygiene declaration form will be requested from the supplier where there is possible risk of contamination in products (B180)
- All relevant personnel will be made aware of the location and extent of weed infestations in the vicinity of the work area and the risks involved in moving from one site or property to another (B188)
- Construction and maintenance activities will be planned to minimise movement of plant and equipment between properties or areas with weed infestations (B230)
- Weed monitoring (and targeted weed control measures) will be undertaken within sensitive EVNT habitats (particularly threatened communities such as Brigalow and native grasslands) (B158)

Fire

- Project infrastructure and facilities will be designed and constructed in accordance with applicable codes and standards (B477)
- Fire management plans will be developed for production facilities (B471)
- Arrow will develop emergency response plans in consultation with emergency services organisations that includes a list of required equipment, training and other resources, and foreseeable emergency and crisis situations (including escapes, blowouts, gas fire, bushfire, critical equipment failure, trapped or missing people, flooding, cyclones, power failure, security incidents and threats, and transport incidents). The plans will include safe evacuation procedures, communication protocols (internal and to emergency services, including the Petroleum and Gas Inspectorate), accounting for personnel and visitors, roles

and responsibilities, and requirements for training (B480)

- Radiation exclusion zones around flares will be designed according to API standard (B485)
- Enclosed spaces where flammable gas may accumulate will be minimised (B487)
- Fire-fighting equipment will be installed, inspected and serviced in accordance with risk assessments and relevant legislation and standards (B499)
- Gathering lines will be buried at a minimum depth of 600 mm. Where gathering lines are present above the ground (at wellheads and at vents or drains), a clear area will be maintained. The size of the cleared area will be determined on a site-by-site basis with consideration of the site-specific risk of bushfire (B503)
- Fire-safety equipment will be commissioned in the early phase of the construction period (B505)
- All buildings and production facilities will be fitted with smoke or fire alarms (B506)
- Fire and gas detection systems to shutdown compressors will be installed (B508)
- Protocols for the control of operational activities during extreme fire danger periods, e.g., flaring or shutdowns, will be developed (B533)
- Regular patrols and inspections of pipeline easements will be conducted, including assessment of the status of signposting subsidence and of fire breaks (B536)
- Vegetation surrounding production facilities and wellheads will be maintained in a manner that limits the amount of combustible material in the area. The size of the cleared area will be determined on a site-by-site basis with consideration of the site-specific risk of bushfire (B544)
- Access tracks to well sites will be kept clear of dry grass and combustible material wherever practicable and where there is a higher risk of bushfire (to minimise the risk of dry grass being ignited by hot components of vehicles accessing the sites) (B547)
- Daily operations will be managed with consideration of the fire danger current at that time (B548)

Increased streambank erosion

- Buffer zones will be adopted for Project activities (with the exception of required creek crossings), in different areas of constraint, as defined by the Project's constraints mapping (outlined in Section 7 and detailed in Constraints Mapping (Appendix BB of the EIS) (B196)
- Tracks will be restricted in riparian zones and durations of impacts minimised, except in the immediate vicinity of creek crossings (B199)
- During the design and construction of waterway crossings, care will be taken to minimise the footprint of the structure and to avoid unnecessary disturbance to stream beds and banks (B201)
- Construction that will potentially affect waterways will occur during dry months (periods of low rainfall and low flow) where possible. The use of machinery and vehicles on stream beds and banks will be avoided wherever possible (B202)
- Trenching will be perpendicular to the creek where the gathering line crosses waterways (B203)
- Where practical the width of the easement will also be narrowed at these points, further

reducing impacts on stream banks, beds and riparian zones by restricting the area of waterway that would be disturbed (B204)

- Where possible trenching within or in the vicinity of watercourses will occur during the drier months of the year, which will reduce the potential for water quality decline as a result of sediment mobilisation (B205)
- Gathering line and access road creek crossings will be kept to a minimum where possible (B206)
- A Water Management Plan, Erosion and Sediment Control Plan, and Waste Management Plan will be designed to avoid or minimise the potential impacts of Project (B207)
- Watercourse crossings will be minimised, where practicable, during route selection. Where required, crossing locations will be selected to avoid or minimise disturbance to aquatic flora, waterholes, watercourse junctions and watercourses with steep banks (B220)
- Watercourse crossings will be constructed in a manner that minimises sediment release to watercourses, stream bed scouring, obstruction of water flows and disturbance of stream banks and riparian vegetation (i.e., the crossing location will be at a point of low velocity, and straight sections will be targeted, with the pipeline or road orientated as near to perpendicular to water flow as practicable) (B221)
- Transport of equipment across watercourses will be avoided unless an appropriate crossing that minimises disturbance to the watercourse bed and banks and to riparian vegetation is available (B225)
- Watercourse crossings will be designed to enable passage of flows resulting from a 1 in 100 year average recurrence interval flood event, as a minimum (B226)
- Gathering lines and tracks will be designed to avoid watercourses, drainage lines and riparian areas (particularly permanent watercourses or perennial aquatic habitat), where practicable (B227)
- Pipeline RoWs widths will be designed to be narrower at watercourse crossings, where practicable (B228)

Monitoring

Arrow will implement the following:

- Ecological Impact Assessment Procedure (ORG-ARW-HSM-PRO-00070) – this document provides the step by step process implemented for all Arrow development activities that involve significant disturbance to land, including the requirement to record the GPS coordinates and maps of all vegetated areas that have required clearing
- As per Condition 13 of the *Variations to Conditions Attached to Approval (25/03/2018)* for the BGP (EPBC 2012/6377), no Project Phases will commence until an Offset Strategy addressing offset obligations for that Project Phase has been developed by Arrow and approved by the Minister. Each Strategy will set out a program for monitoring and reporting on the effectiveness of the management measures, and identify the performance and completion criteria to be tracked for the offset areas
- For areas mapped as core habitat for the Black Ironbox, the pre-clearance survey will include searches for individual plants
- Based on the presence of any Black Ironbox individuals (rather than solely on the basis of

potential core habitat areas (as mapped in the EIS), the coordinates and total area of cleared habitat will be recorded and tracked monthly against approved maximum disturbance limits and used for annual compliance reporting

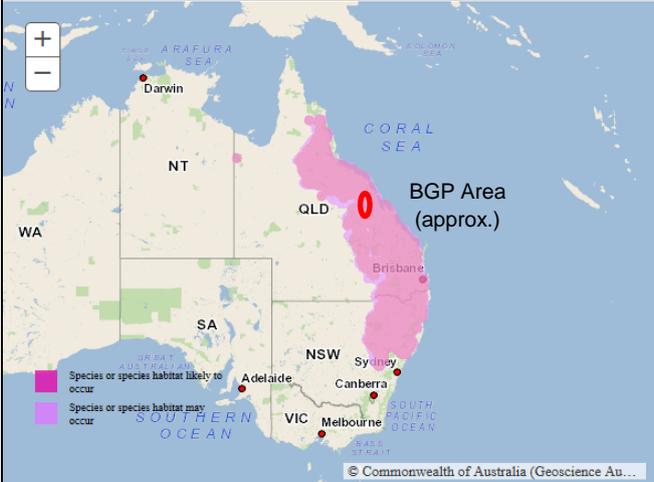
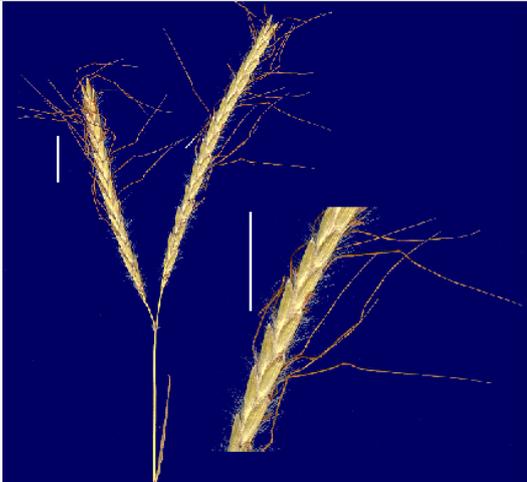
- Pipeline RoWs will be routinely inspected until ground stabilisation and natural revegetation or pasture grasses or crops are established (B095)
- Weed monitoring and targeted weed control measures will be implemented within sensitive EVNT habitats (particularly threatened communities such as Brigalow and native grasslands) (B158)
- Data collection, particularly of EVNT species identified during pre-clearance surveys, during trench checking or in other Project related activities, will be ongoing until rehabilitation is complete (B163)
- Monitoring will be conducted during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- In accordance with the Pest Management Plan routine inspections will be conducted for pest flora and evidence of pest fauna within Project disturbed areas (B171)
- After decommissioning, rehabilitation areas will be inspected for regrowth similar to the surrounding environment (B177)
- Routine monitoring of rehabilitation success will be undertaken (B183)
- Buffer zones and the Project footprint will be routinely monitored using satellite imagery (B215)
- Monitoring of the rehabilitated areas will be undertaken to identify whether the general objectives of the rehabilitation strategy are being met, and whether a sustainable and stable landform has been achieved. Monitoring will be conducted by suitably skilled and qualified persons at representative locations. Annual reviews of monitoring data will be conducted during operations, and post closure, to assess trends and performance (B591)
- Monitoring and inspection of avoidance, mitigation and management measures will be implemented to ensure the impacts and residual risks continue to be low throughout the lifetime of the Project (B640)

References

- Arrow Energy (2014). Supplementary Report to the Surat Gas Project Environmental Impact Statement. Section 9.3.1.3 of Appendix J Matters of National Environmental Significance Report.
- Butler, D. and Laidlaw, M. (2012a). Potential habitat model for *Eucalyptus raveretiana* black ironbox. Map date 31/08/2012. Queensland Department of Science, Information Technology, Innovation and the Arts (DSITIA). Sourced from <https://environment.ehp.qld.gov.au/species-search/details/?id=14554#> on 27 March 2018.
- DotEE (2014). Approval – Arrow Bowen Gas Project (EPBC 2012/6377). Signed 27 October 2014.
- DotEE (2018a). Species Profile and Threats Database – *Eucalyptus raveretiana* Black Ironbox. SPRAT Profile. Sourced from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=16344 on 27 March 2018.
- DotEE (2018b). Variation to Conditions Attached to Approval – Arrow Bowen Gas Project

(EPBC 2012/6377). Signed 25 March 2018.

- DEWHA (2008a). *Approved Conservation Advice for Eucalyptus raveretiana (Black Ironbox)*. Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/16344-conservation-advice.pdf>. In effect under the EPBC Act from 16-Dec-2008.
- Queensland Government (Qld Govt) (2018a). Sighting data associated with the Species profile – *Eucalyptus raveretiana* (Myrtaceae) sourced from <https://environment.ehp.qld.gov.au/species-search/details/?id=14554#> on 27 March 2018.

| Bluegrass – <i>Dichanthium setosum</i> | |
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| Bluegrass distribution map (DotEE, 2018c) | Photo: AusGrass2, 2016a |
| Status | |
| Vulnerable (EPBC Act); Least Concern (Qld Nature Conservation Act) | |
| Distribution and Habitat | |
| <p>Bluegrass occurs in northern NSW, particularly between Armidale and Narrabri and in Queensland it has been recorded within Leichhardt, Moreton, North Kennedy and Port Curtis regions (DEWHA, 2008b). DotEE (2018c) maps the species as potentially occurring in areas within 500km of the coast from Sydney in the south to Cooktown in the north.</p> <p>Bluegrass is associated with heavy basaltic black soils and stony red-brown hard-setting loam with clay subsoil (Ayers <i>et al.</i>, 1996 as cited in DEWHA, 2008b). Specimens appear tolerate of disturbance having been collected from highly disturbed and cleared pasture land.</p> <p>Bluegrass can be locally common and dominant or found as scattered clumps within broader populations (OEH, 2017). Predicting suitable habitat is difficult due to its extensive distribution and breadth of environmental tolerances (OEH, 2017).</p> <p>The Queensland Government’s potential habitat modelling for the species shows modelled potential habitat extending throughout large portions of the BGP area (Butler and Laidlaw, 2012b).</p> | |
| Records relevant to BGP | |
| Bluegrass is known to occur in the BGP area having been recorded during the EIS in open ironbark, bloodwood and mountain coolabah woodlands (Arrow Energy, 2014) | |
| Presence of habitat within BGP area | |
| Predicting suitable habitat is difficult due to its extensive distribution and breadth of environmental tolerances (OEH, 2017). The Queensland Government’s potential habitat modelling for the species shows modelled potential habitat extending throughout large portions of the BGP area (Butler and Laidlaw, 2012b). | |

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| <p>Core habitat for the species within the BGP has been mapped and is illustrated in the figure at Appendix D.2.</p> |
| <p>General threats</p> |
| <p>Heavy grazing by livestock (and introduced animals, e.g. rabbits (DotEE 2018c)), loss of habitat through clearing for pasture improvement and cropping, road widening, too frequent fires and invasion by introduced herbs, such as Lippia, and grasses, such as <i>Hyparrhenia hirta</i> (Coolatai Grass) and African Lovegrass, are identified threats (DEWHA, 2008b).</p> |
| <p>BGP specific threats</p> |
| <p>Disturbance of up to a maximum of 809.59 ha of core habitat for this species is included in EPBC Act decision (EPBC 2012/6377).</p> <p>Without adequate mitigation measures in place, BGP activities would have the potential to remove, fragment and disturb additional habitat, alter fire frequency, introduce new weeds and increase weed frequency. Both Coolatai Grass and African Lovegrass occur in the BGP area, so there is potential for these and other invasive grasses to be spread. BGP activities also have to potential to impact this species through soil compaction (to cracking clay soils) and mixing.</p> |
| <p>BGP specific mitigation measures (Arrow BGP SREIS 2014 – commitment number in parenthesis)</p> |
| <p><i>Habitat loss, fragmentation and disturbance</i></p> <ul style="list-style-type: none"> • When the project activities proceed through the detailed planning phase, a field inspection of the specified disturbance footprint (this is specified by a surveyor in the field) will be undertaken by a suitably qualified ecologist and the presence, absence and extent of environmental values will be verified and mapped in the field via GIS. The results of this step will be recorded within Geocortex and the Arrow Sharepoint database • Where environmental values are confirmed, a ‘framing trade-offs’ session will be held with the Project engineers, planners and ecologists to determine if the location of the activities can be modified to avoid and/or reduce the impact to environmental values. In the event that Bluegrass habitat cannot be avoided, the actual area to be cleared will be surveyed to quantify the impacts. This data will be recorded and cumulative impact areas tracked • Disturbance within core habitat for EVNT species will be avoided where possible (B131) • Pre-construction / pre-clearance surveys will be conducted to identify any additional areas that need to be avoided (B132) • Infrastructure will be designed to avoid undisturbed tracts of remnant vegetation, where practical. Where collection and gathering infrastructure is to be placed within contiguous vegetation, collection networks will be designed to avoid dissection (B134) • Access track location will avoid the repeated isolation of small parcels of remnant vegetation from more continuous tracts (B135) • Vegetation disturbance will be minimised wherever practical. Corridors for linear infrastructure will be as narrow as practical, particularly when crossing linear corridors of vegetation (e.g. Isaac River and Suttor Creek). Areas cleared for field development will be as small as practical (B136) • Access tracks and pipelines will deviate around sensitive vegetation where |

practicable (B140)

- Trees will be felled away from existing vegetation not identified for removal where practicable (B150)
- Construction activities in sensitive areas will be supervised to ensure appropriate methods (e.g., narrowing of RoW) are being implemented, where required (B182)
- Delineation of disturbance boundary limits of works will be clearly established prior to commencement of clearing and soil stripping (B049)
- Monitoring will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- A rehabilitation management plan for decommissioning will be developed and implemented which includes monitoring and maintenance of rehabilitated areas until rehabilitation sign off criteria are met (B339)
- Any residual impacts to Bluegrass (as confirmed by pre-clearance survey) will be offset. A detailed BGP Phase 1 Offset Strategy and additional offset strategies for the subsequent phases will be developed and implemented to add value rather than just compensating for impacts

Grazing

- Grazing activities will be excluded from all Arrow gas and water processing and well head infrastructure sites
- See also mitigation measures for pest animals below (which address the potential for the project to contribute to an increase in feral herbivores (e.g. rabbits).

Weeds and feral herbivores

- A declared weed and pest management plan will be developed in accordance with the Petroleum Industry – Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008). Species-specific management will be undertaken for identified key weed species at risk of spread through Project activities (Mesquite, Parthenium Weed, African Lovegrass and Lippia). Weed control efforts will be increased in areas particularly sensitive to invasion. The pest management plan will include, as a minimum, training, management of pest spread, management of pest infestations and monitoring effectiveness of control measures (B191)
- When sourcing maintenance materials, such materials such as bedding sand, topsoil, straw bales and sand bags will be brought to site only after it is ascertained that the materials are not contaminated with weeds and plant or animal pathogens. A weed hygiene declaration form will be requested from the supplier where there is possible risk of contamination in products (B180)
- All relevant personnel will be made aware of the location and extent of weed infestations in the vicinity of the work area and the risks involved in moving from one site or property to another (B188)
- Construction and maintenance activities will be planned to minimise movement of plant and equipment between properties or areas with weed infestations (B230)
- Weed monitoring (and targeted weed control measures) will be undertaken within sensitive EVNT habitats (particularly threatened communities such as brigalow and native grasslands) (B158)

Fire

- Project infrastructure and facilities will be designed and constructed in accordance with applicable codes and standards (B477)
- Fire management plans will be developed for production facilities (B471)
- Arrow will develop emergency response plans in consultation with emergency services organisations that includes a list of required equipment, training and other resources, and foreseeable emergency and crisis situations (including escapes, blowouts, gas fire, bushfire, critical equipment failure, trapped or missing people, flooding, cyclones, power failure, security incidents and threats, and transport incidents). The plans will include safe evacuation procedures, communication protocols (internal and to emergency services, including the Petroleum and Gas Inspectorate), accounting for personnel and visitors, roles and responsibilities, and requirements for training (B480)
- Radiation exclusion zones around flares will be designed according to API standard (B485)
- Enclosed spaces where flammable gas may accumulate will be minimised (B487)
- Fire-fighting equipment will be installed, inspected and serviced in accordance with risk assessments and relevant legislation and standards (B499)
- Gathering lines will be buried at a minimum depth of 600 mm. Where gathering lines are present above the ground (at wellheads and at vents or drains), a clear area will be maintained. The size of the cleared area will be determined on a site-by-site basis with consideration of the site-specific risk of bushfire (B503)
- Fire-safety equipment will be commissioned in the early phase of the construction period (B505)
- All buildings and production facilities will be fitted with smoke or fire alarms (B506)
- Fire and gas detection systems to shutdown compressors will be installed (B508)
- Protocols for the control of operational activities during extreme fire danger periods, e.g., flaring or shutdowns, will be developed (B533)
- Regular patrols and inspections of pipeline easements will be conducted, including assessment of the status of signposting subsidence and of fire breaks (B536)
- Vegetation surrounding production facilities and wellheads will be maintained in a manner that limits the amount of combustible material in the area. The size of the cleared area will be determined on a site-by-site basis with consideration of the site-specific risk of bushfire (B544)
- Access tracks to well sites will be kept clear of dry grass and combustible material wherever practicable and where there is a higher risk of bushfire (to minimise the risk of dry grass being ignited by hot components of vehicles accessing the sites) (B547)
- Daily operations will be managed with consideration of the fire danger current at that time (B548)

Soil compaction and mixing

- Stripped and salvaged soil will be re-used within a short period of time in areas where rehabilitation immediately follows installation of low key infrastructures (B040)
- Topsoil and associated vegetation will be appropriately stockpiled separately for

rehabilitation prior to excavation or earthworks (B042)

- Soil will be stripped according to designated profile depths, subject to further field investigations during stripping (B051)
- Where practicable, stripped material will be placed directly onto area to be rehabilitated and spread immediately (if rehabilitation sequences and weather conditions permit) to avoid the requirement for stockpiling (B052)
- Soils will be separated into windrows for later collection or re-spreading to minimise compression effects of heavy equipment (B053)
- Soil transported by dump trucks may be placed directly into storage. Soil transported by scrapers will be pushed to form stockpiles by other equipment (e.g. dozer) to avoid tracking over previously laid soil to minimise compaction (B054)
- Surface of soil stockpiles will be left in as coarsely structured a condition as possible to promote infiltration and minimise erosion until vegetation is established or suitable erosion controls have been applied, and to prevent anaerobic zones from forming (B055)
- Pipeline construction will be conducted in a manner that limits the duration of exposure of soils. Stripped and salvaged soil will be re-used within a short period of time (i.e. 28 days) in areas where rehabilitation immediately follows the installation of pipelines (B063)
- Rehabilitation plans will be developed addressing ground preparation requirements, natural and constructed drainage patterns, soil erodibility, contamination, slope steepness and length, vegetation cover, land use and landowner requirements (B064)
- Topsoil will be stripped, salvaged and stockpiled separately from subsoils (B068)

Monitoring

Arrow will implement the following:

- Ecological Impact Assessment Procedure (ORG-ARW-HSM-PRO-00070) – this document provides the step by step process implemented for all Arrow development activities that involve significant disturbance to land, including the requirement to record the GPS coordinates and maps of all vegetated areas that have required clearing
- As per Condition 13 of the *Variations to Conditions Attached to Approval (25/03/2018)* for the BGP (EPBC 2012/6377), no Project Phases will commence until an Offset Strategy addressing offset obligations for that Project Phase has been developed by Arrow and approved by the Minister. Each Strategy will set out a program for monitoring and reporting on the effectiveness of the management measures, and identify the performance and completion criteria to be tracked for the offset areas
- For areas mapped as core habitat for the Bluegrass, the pre-clearance survey will include searches for individual plants
- The coordinates and total area of cleared habitat will be recorded and tracked monthly against approved maximum disturbance limits and used for annual compliance reporting
- Pipeline RoWs will be routinely inspected until ground stabilisation and natural revegetation or pasture grasses or crops are established (B095)
- Weed monitoring and targeted weed control measures will be implemented within sensitive EVNT habitats (particularly threatened communities such as Brigalow and native

grasslands) (B158)

- Data collection, particularly of EVNT species identified during pre-clearance surveys, during trench checking or in other Project related activities, will be ongoing until rehabilitation is complete (B163)
- Monitoring will be conducted during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- In accordance with the Pest Management Plan routine inspections will be conducted for pest flora and evidence of pest fauna within Project disturbed areas (B171)
- After decommissioning, rehabilitation areas will be inspected for regrowth similar to the surrounding environment (B177)
- Routine monitoring of rehabilitation success will be undertaken (B183)
- Buffer zones and the Project footprint will be routinely monitored using satellite imagery (B215)
- Monitoring of the rehabilitated areas will be undertaken to identify whether the general objectives of the rehabilitation strategy are being met, and whether a sustainable and stable landform has been achieved. Monitoring will be conducted by suitably skilled and qualified persons at representative locations. Annual reviews of monitoring data will be conducted during operations, and post closure, to assess trends and performance (B591)
- Monitoring and inspection of avoidance, mitigation and management measures will be implemented to ensure the impacts and residual risks continue to be low throughout the lifetime of the Project (B640)

References

- Arrow Energy (2014). Supplementary Report to the Bowen Gas Project Environmental Impact Statement.
- AusGrass2 – Grasses of Australia (2016a). Online resource accessed via <http://ausgrass2.myspecies.info/> on 29 March 2018.
- Butler, D. and Laidlaw, M. (2012b). Potential habitat model for *Dichanthium setosum*. Map date 31/08/2012. Queensland Department of Science, Information Technology, Innovation and the Arts (DSITIA). Sourced from <https://environment.ehp.qld.gov.au/species-search/details/?id=10401#!lightbox-uid-0> on 29 March 2018.
- DotEE (2014). Approval – Arrow Bowen Gas Project (EPBC 2012/6377). Signed 27 October 2014.
- DotEE (2018c). Species Profile and Threats Database – *Dichanthium setosum* – bluegrass. SPRAT Profile. Sourced from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=14159 on 29 March 2018.
- DEWHA (2008b). *Approved Conservation Advice for Dichanthium setosum*. Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/14159-conservation-advice.pdf>. In effect under the EPBC Act from 26-Mar-2008.
- Office of Environment and Heritage (OEH) (2017). Bluegrass – profile. Sourced from <http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10221> on 29 March 2018. NSW Government.

| King Bluegrass – <i>Dichanthium queenslandicum</i> | |
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| <p>King Bluegrass distribution map (DotEE, 2018d) Photo: AusGrass2, 2016b</p> | |
| Status | |
| <p>Vulnerable (EPBC Act); Vulnerable (Qld Nature Conservation Act)</p> | |
| Distribution and Habitat | |
| <p>King Bluegrass occurs only in Queensland where it occurs from the Darling Downs to around Hughenden. Three disjunct populations have been identified at Hughenden district; Nebo to Monto and west to Clermont and Rolleston; and around Dalby (DSEWPAC, 2013). DotEE (2018d) maps the species as potentially occurring in areas within 300km of the coast.</p> <p>King Bluegrass occurs on heavy clay soils derived from a range of sources including alluvium and basalt. The species occurs in association with native grasslands and grassy woodlands, although it may also occur in disturbed or non-remnant habitats.</p> | |
| Records relevant to BGP | |
| <p>Bluegrass is known to occur in the BGP area, with robust populations recorded as the dominant species within some native grassland habitats and associated woodlands (RE 11.8.11 and RE 11.8.5) (Arrow Energy, 2014).</p> | |
| Presence of habitat within BGP area | |
| <p>The Queensland Government’s potential habitat modelling for the species shows modelled potential habitat extending throughout large portions of the BGP area (Butler and Laidlaw, 2012c).</p> <p>Core habitat for the species within the BGP has been mapped and is illustrated in the figure at Appendix D.3.</p> | |
| General threats | |
| <p>Threats to King Bluegrass include loss of habitat (through agricultural and mining activities, road construction and other infrastructure developments), cultivation for crop production, grazing and invasion from weeds such as Parthenium Weed and <i>Parkinsonia aculeata</i> (Parkinsonia)</p> | |

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| (DSEWPAC, 2013). |
| BGP specific threats |
| <p>Disturbance of up to a maximum of 1161.23 ha of core habitat for this species is included in EPBC Act decision (EPBC 2012/6377).</p> <p>Without adequate mitigation measures in place, BGP activities would have the potential to remove and disturb additional habitat, introduce new weeds and increase weed frequency. They also have to potential to impact this species through soil compaction (to cracking clay soils) and mixing.</p> |
| BGP specific mitigation measures (Arrow BGP SREIS 2014 – commitment number in parenthesis) |
| <p><i>Habitat loss and disturbance</i></p> <ul style="list-style-type: none"> • When the project activities proceed through the detailed planning phase, a field inspection of the specified disturbance footprint (this is specified by a surveyor in the field) will be undertaken by a suitably qualified ecologist and the presence, absence and extent of environmental values will be verified and mapped in the field via GIS. The results of this step will be recorded within Geocortex and the Arrow Sharepoint database • Where environmental values are confirmed, a ‘framing trade-offs’ session will be held with the project engineers, planners and ecologists to determine if the location of the activities can be modified to avoid and/or reduce the impact to environmental values. In the event that King Bluegrass habitat cannot be avoided, the actual area to be cleared will be surveyed to quantify the impacts. This data will be recorded and cumulative impact areas tracked • Disturbance within core habitat for EVNT species will be avoided where possible (B131) • Pre-construction / pre-clearance surveys will be conducted to identify any additional areas that need to be avoided (B132) • Infrastructure will be designed to avoid undisturbed tracts of remnant vegetation, where practical. Where collection and gathering infrastructure is to be placed within contiguous vegetation, collection networks will be designed to avoid dissection (B134) • Access track location will avoid the repeated isolation of small parcels of remnant vegetation from more continuous tracts (B135) • Vegetation disturbance will be minimised wherever practical. Corridors for linear infrastructure will be as narrow as practical, particularly when crossing linear corridors of vegetation (e.g. Isaac River and Suttor Creek). Areas cleared for field development will be as small as practical (B136) • Trees will be felled away from existing vegetation not identified for removal where practicable (B150) • Access tracks and pipelines will deviate around sensitive vegetation where practicable (B140) • Construction activities in sensitive areas will be supervised to ensure appropriate methods (e.g., narrowing of RoW) are being implemented, where required (B182) • Delineation of disturbance boundary limits of works will be clearly established prior to commencement of clearing and soil stripping (B049) • Monitoring will be undertaken during and after clearing activities to ensure no unauthorised |

encroachment has occurred (B167)

- A rehabilitation management plan for decommissioning will be developed and implemented which includes monitoring and maintenance of rehabilitated areas until rehabilitation sign off criteria are met (B339)
- Any residual impacts to King Bluegrass (as confirmed by pre-clearance survey) will be offset. A detailed BGP Phase 1 Offset Strategy and additional offset strategies for the subsequent phases will be developed and implemented to add value rather than just compensating for impacts

Grazing

- Grazing activities will be excluded from all Arrow gas and water processing and well head infrastructure sites

Weeds

- A declared weed and pest management plan will be developed in accordance with the Petroleum Industry – Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008). Species-specific management will be undertaken for identified key weed species at risk of spread through Project activities (Mesquite, Parthenium Weed, African Lovegrass and Lippia). Weed control efforts will be increased in areas particularly sensitive to invasion. The pest management plan will include, as a minimum, training, management of pest spread, management of pest infestations and monitoring effectiveness of control measures (B191)
- When sourcing maintenance materials, such materials such as bedding sand, topsoil, straw bales and sand bags will be brought to site only after it is ascertained that the materials are not contaminated with weeds and plant or animal pathogens. A weed hygiene declaration form will be requested from the supplier where there is possible risk of contamination in products (B180)
- All relevant personnel will be made aware of the location and extent of weed infestations in the vicinity of the work area and the risks involved in moving from one site or property to another (B188)
- Construction and maintenance activities will be planned to minimise movement of plant and equipment between properties or areas with weed infestations (B230)
- Weed monitoring (and targeted weed control measures) will be undertaken within sensitive EVNT habitats (particularly threatened communities such as Brigalow and native grasslands) (B158)

Soil compaction and mixing

- Stripped and salvaged soil will be re-used within a short period of time in areas where rehabilitation immediately follows installation of low key infrastructures (B040)
- Topsoil and associated vegetation will be appropriately stockpiled separately for rehabilitation prior to excavation or earthworks (B042)
- Soil will be stripped according to designated profile depths, subject to further field investigations during stripping (B051)
- Where practicable, stripped material will be placed directly onto area to be rehabilitated and spread immediately (if rehabilitation sequences and weather conditions permit) to avoid the requirement for stockpiling (B052)
- Soils will be separated into windrows for later collection or re-spreading to minimise

compression effects of heavy equipment (B053)

- Soil transported by dump trucks may be placed directly into storage. Soil transported by scrapers will be pushed to form stockpiles by other equipment (e.g. dozer) to avoid tracking over previously laid soil to minimise compaction (B054)
- Surface of soil stockpiles will be left in as coarsely structured a condition as possible to promote infiltration and minimise erosion until vegetation is established or suitable erosion controls have been applied, and to prevent anaerobic zones from forming (B055)
- Pipeline construction will be conducted in a manner that limits the duration of exposure of soils. Stripped and salvaged soil will be re-used within a short period of time (i.e. 28 days) in areas where rehabilitation immediately follows the installation of pipelines (B063)
- Rehabilitation plans will be developed addressing ground preparation requirements, natural and constructed drainage patterns, soil erodibility, contamination, slope steepness and length, vegetation cover, land use and landowner requirements (B064)
- Topsoil will be stripped, salvaged and stockpiled separately from subsoils (B068)

Monitoring

Arrow will implement the following:

- Ecological Impact Assessment Procedure (ORG-ARW-HSM-PRO-00070) – this document provides the step by step process implemented for all Arrow development activities that involve significant disturbance to land, including the requirement to record the GPS coordinates and maps of all vegetated areas that have required clearing
- As per Condition 13 of the *Variations to Conditions Attached to Approval (25/03/2018)* for the BGP (EPBC 2012/6377), no Project Phases will commence until an Offset Strategy addressing offset obligations for that Project Phase has been developed by Arrow and approved by the Minister. Each Strategy will set out a program for monitoring and reporting on the effectiveness of the management measures, and identify the performance and completion criteria to be tracked for the offset areas
- For areas mapped as core habitat for the King Bluegrass, the pre-clearance survey will include searches for individual plants
- The coordinates and total area of cleared habitat will be recorded and tracked monthly against approved maximum disturbance limits and used for annual compliance reporting
- Pipeline RoWs will be routinely inspected until ground stabilisation and natural revegetation or pasture grasses or crops are established (B095)
- Weed monitoring and targeted weed control measures will be implemented within sensitive EVNT habitats (particularly threatened communities such as Brigalow and native grasslands) (B158)
- Data collection, particularly of EVNT species identified during pre-clearance surveys, during trench checking or in other Project related activities, will be ongoing until rehabilitation is complete (B163)
- Monitoring will be conducted during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- In accordance with the Pest Management Plan routine inspections will be conducted for pest

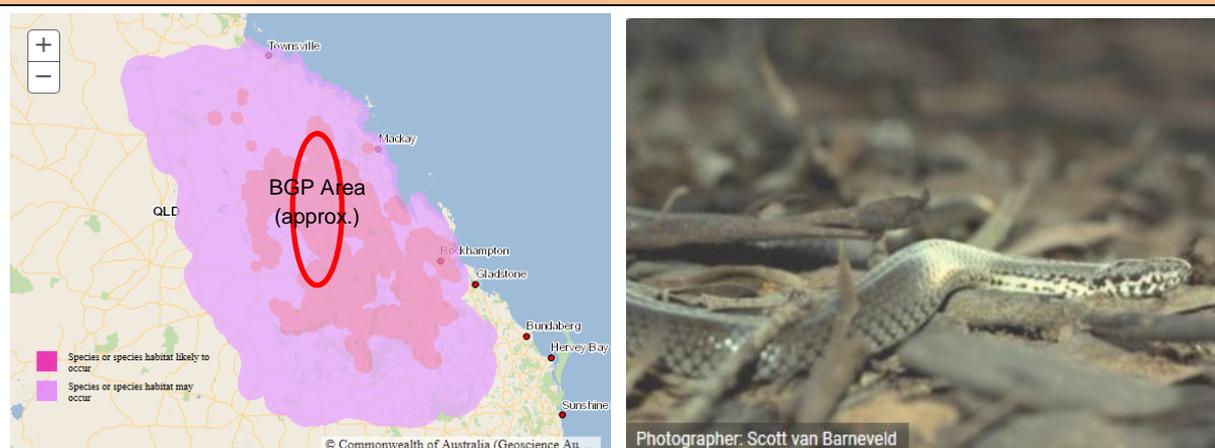
flora and evidence of pest fauna within Project disturbed areas (B171)

- After decommissioning, rehabilitation areas will be inspected for regrowth similar to the surrounding environment (B177)
- Routine monitoring of rehabilitation success will be undertaken (B183)
- Buffer zones and the Project footprint will be routinely monitored using satellite imagery (B215)
- Monitoring of the rehabilitated areas will be undertaken to identify whether the general objectives of the rehabilitation strategy are being met, and whether a sustainable and stable landform has been achieved. Monitoring will be conducted by suitably skilled and qualified persons at representative locations. Annual reviews of monitoring data will be conducted during operations, and post closure, to assess trends and performance (B591)
- Monitoring and inspection of avoidance, mitigation and management measures will be implemented to ensure the impacts and residual risks continue to be low throughout the lifetime of the Project (B640)

References

- Arrow Energy (2014). Supplementary Report to the Bowen Gas Project Environmental Impact Statement.
- AusGrass2 – Grasses of Australia (2016b). Online resource accessed via <http://ausgrass2.myspecies.info/content/dichanthium-queenslandicum> on 11 April 2018.
- Butler, D. and Laidlaw, M. (2012c). Potential habitat model for *Dichanthium queenslandicum*. Map date 31/08/2012. Queensland Department of Science, Information Technology, Innovation and the Arts (DSITIA). Sourced from <https://environment.ehp.qld.gov.au/species-search/details/?id=11064> on 11 April 2018.
- DotEE (2014) Approval – Arrow Bowen Gas Project (EPBC 2012/6377). Signed 27 October 2014.
- DotEE (2018d). Species Profile and Threats Database – *Dichanthium queenslandicum* – King Blue-grass. SPRAT Profile. Sourced from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=5481 on 11 April 2018.
- DSEWPAC (2013). *Approved Conservation Advice for Dichanthium queenslandicum*. Canberra: Department of Sustainability, Environment, Water, Populations and Communities. Available from: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/5481-conservation-advice.pdf>. In effect under the EPBC Act from 26-Feb-2013.

Ornamental Snake – *Denisonia maculata*



Ornamental Snake distribution map (DotEE, 2018e) Photo: Scott van Barneveld (Sourced from ALA, 2018)

Status

Vulnerable (EPBC Act); Vulnerable (Qld Nature Conservation Act)

Distribution and Habitat

The Ornamental Snake is endemic to central Queensland where it is known from south of Townsville in the north to around Moura in the south. Shoalwater Bay near Rockhampton in the north to near Ulladulla in the south. It has been recorded up to 300km from the coast.

Feeding almost exclusively on frogs, Ornamental Snake occur on floodplains, undulating clay pans (including gilgai formations), wetlands and watercourses (DoE, 2014).

Records relevant to BGP

The Ornamental Snake was recorded at one location to the south-east of Moranbah during the field surveys for the EIS (Arrow, 2014). This individual was recorded within a *Eucalyptus coolabah* (Coolabah) woodland with shallow gilgai development and groundcover dominated by *Eleocharis pallens* (Pale Spike-rush).

Numerous specimens have previously been recorded within and in close proximity to the BGP area. In addition to widespread scattered records, large numbers were captured within open trenches associated with the construction of the Moranbah Gas Pipeline in 2004 and the Burdekin – Moranbah Gas Pipeline in 2006 (Qld Govt, 2018b). These records indicate that the Ornamental Snake occurs in both remnant and cleared (non-remnant) areas within the tenements.

Presence of habitat within BGP area

DotEE (2018e) shows that the BGP area is located within the central area of likely habitat. Likewise, the Queensland Government’s potential habitat modelling for the species shows the modelled potential habitat extending across the BGP area (Butler and Laidlaw, 2012d).

Core habitat for the species within the BGP has been mapped and is illustrated in the figure at

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| Appendix D.4. |
| General threats |
| Habitat loss and degradation, destruction of wetlands and frog habitats (including by pigs) and poisoning by cane toads are identified threats (WWF-Australia/QMDC as cited in DoE, 2014). |
| BGP specific threats |
| Disturbance of up to a maximum of 1030.31 ha of core habitat for this species is included in EPBC Act decision (EPBC 2012/6377). Without adequate mitigation measures in place, BGP activities would have the potential to remove and disturb additional habitat (including wetlands), increase abundance of pigs and cane toads and directly cause fatalities and injuries to individuals including through entrapment in open trenches and during dam construction. |
| BGP specific mitigation measures (Arrow BGP SREIS 2014 – commitment number in parenthesis) |
| <p><i>Habitat loss and degradation, including destruction of wetlands and frog habitats</i></p> <ul style="list-style-type: none"> • When the project activities proceed through the detailed planning phase, a field inspection of the specified disturbance footprint (this is specified by a surveyor in the field) will be undertaken by a suitably qualified ecologist and the presence, absence and extent of environmental values will be verified and mapped in the field via GIS. The results of this step will be recorded within Geocortex and the Arrow Sharepoint database • Where environmental values are confirmed, a ‘framing trade-offs’ session will be held with the project engineers, planners and ecologists to determine if the location of the activities can be modified to avoid and/or reduce the impact to environmental values. In the event that Ornamental Snake habitat cannot be avoided, the actual area to be cleared will be surveyed to quantify the impacts. This data will be recorded and cumulative impact areas tracked • Disturbance within core habitat for EVNT species will be avoided where possible (B131) • Pre-construction / pre-clearance surveys will be conducted to identify any additional areas that need to be avoided (B132) • Infrastructure will be designed to avoid undisturbed tracts of remnant vegetation, where practical. Where collection and gathering infrastructure is to be placed within contiguous vegetation, collection networks will be designed to avoid dissection (B134) • Vegetation disturbance will be minimised wherever practical. Corridors for linear infrastructure will be as narrow as practical, particularly when crossing linear corridors of vegetation (e.g. Isaac River and Suttor Creek). Areas cleared for field development will be as small as practical (B136) • Access tracks and pipelines will deviate around sensitive vegetation where practicable (B140) • Sensitive infrastructure design principles will be applied to avoid watercourse, drainage lines and riparian areas where practicable (B142) • Construction activities in sensitive areas will be supervised to ensure appropriate methods |

(e.g., narrowing of RoW) are being implemented, where required (B182)

- Delineation of disturbance boundary limits of works will be clearly established prior to commencement of clearing and soil stripping (B049)
- Monitoring will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- Erosion and Sediment Control Plans will be developed and maintained in accordance with the International Erosion Control Association (IECA) (2008) Best Practice Erosion and Sediment Control guidelines. All proposed erosion and sediment control measures will be implemented in advance of, or in conjunction with clearing activities (B066)
- Watercourse crossings will be minimised, where practicable, during route selection. Where required, crossing locations will be selected to avoid or minimise disturbance to aquatic flora, waterholes, watercourse junctions and watercourses with steep banks (B220)
- Watercourse crossings will be constructed in a manner that minimises sediment release to watercourses, stream bed scouring, obstruction of water flows and disturbance of stream banks and riparian vegetation (i.e., the crossing location will be at a point of low velocity, and straight sections will be targeted, with the pipeline or road orientated as near to perpendicular to water flow as practicable) (B221)
- Gathering lines and tracks will be designed to avoid watercourses, drainage lines and riparian areas (particularly permanent watercourses or perennial aquatic habitat), where practicable (B227)
- Any residual impacts to Ornamental Snake Core Habitat will be offset. A detailed BGP Phase 1 Offset Strategy and additional offset strategies for the subsequent phases will be developed and implemented to add value rather than just compensating for impacts

Pig and cane toad abundance

- A declared weed and pest management plan will be developed in accordance with the Petroleum Industry – Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008). The pest management plan will include, as a minimum, training, management of pest spread, management of pest infestations and monitoring effectiveness of control measures (B191)
- In accordance with the Pest Management Plan routine inspections for pest flora and evidence of pest fauna will be undertaken within Project disturbed areas (B171)

Direct injury or mortality including through entrapment in open trenches and during dam construction

- Harassment of wildlife and the unauthorised collection of flora or fauna will be prohibited, unless directed by a suitably qualified and experienced person (B149)
- Suitably qualified animal handler or ecologist will be used to capture injured wildlife, where possible. Injured wildlife resultant from land clearing will be taken to a qualified veterinary surgeon or carer where practical (B153) The FSC will be at the site on the day of clearing. The FSC will be a suitably qualified ecologist as per the definition provided in EPBC 2012/6377. The number of FSCs on site at the time of clearing will depend on the number of machines being used at any given time
- Where practicable, disturbance will be avoided in areas known or assessed to be suitable habitat during the breeding season (September to April)

- Where practicable, if breeding activity is observed, an exclusion zone (30 m radius) will be enforced until the breeding place is vacated
- Soil cracks within potential habitat that could harbour snakes will be marked with spray paint. A borescope, or similar equipment, will be used to determine the presence of a snake. If a snake is found, the spotter-catcher will attempt to dig up the soil crack and remove the animal
- Spotlighting will be completed in line with Arrow's Ornamental Snake Guideline (ORG-ARW-HSM-GUI-00101, Section 8) when the following are met:
 - Prior to commencing construction activities that involve significant ground disturbance; and
 - Within the breeding and high activity period of September to April
- Snakes captured will be retained by a licensed spotter-catcher for the duration of the day's construction activities and released in a suitable habitat in close proximity to the site boundaries that evening (i.e. within 24 hours), or retained and released in line with the spotter-catcher's permits if construction is ongoing
- Speed limits will be developed for Project controlled roads with due consideration to reduce the potential for vehicle collisions with wildlife (B154)
- Trenches will be inspected and monitored as per the APIA Code of Environmental Practice (B159) and will be checked within two hours of sunrise and trapped fauna released. Additional monitoring will be undertaken following rainfall events
- Minimise the time a trench is left open. Construct exit points when construction is within 1 km of native vegetation, using appropriate material. Provide fauna refuges, such as sawdust-filled bags, regularly through areas of high fauna activity (B173)
- Harm to fauna from entrapment during construction and operation of dams will be prevented-(B184)
- During rehabilitation works, care will be taken when moving stockpiled logs and vegetation to avoid fauna mortality (B186)
- As soon as practical following pipe laying, the trench will be backfilled with excavated material, compacted and topsoil replaced and erosion controls implemented (B299)

Monitoring

Arrow will implement the following:

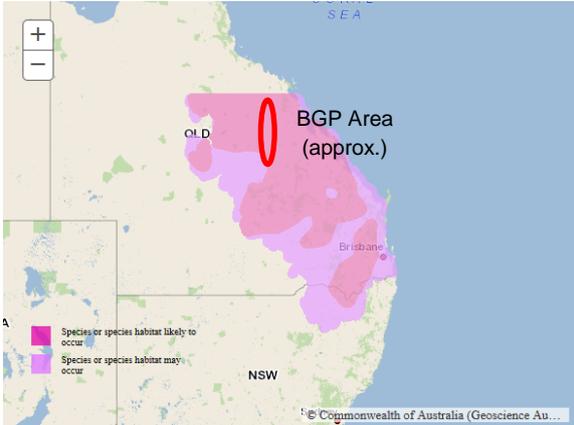
- Ecological Impact Assessment Procedure (ORG-ARW-HSM-PRO-00070) – this document provides the step by step process implemented for all Arrow development activities that involve significant disturbance to land, including the requirement to record the GPS coordinates and maps of all vegetated areas that have required clearing
- Fauna Management Procedure (ORG-ARW-HSM-PRO-00067) – this document informs all Arrow staff and contractors of their obligations to protect and manage native fauna whilst operating on Arrow controlled works sites. It includes the requirements to:
 - Record and report all interactions with fauna to the Arrow Ecologist (notification within 24 hours using the Fauna Incident Notification (FIN) form is required for listed threatened, near threatened and special least concern fauna)

- Record and report all interactions with fauna to the regulator, under their own permit, as required (but not before reporting to the Arrow Ecologist)
- Mitigation measures that have been constructed and implemented (e.g. fauna exclusion fences) must be monitored regularly and their effectiveness reported by the Site Supervisor
- Any ongoing actions required (e.g. monitoring and maintenance) are to be clearly communicated during site handover processes, and must be implemented, monitored and their effectiveness reported
- Ornamental Snake Guideline (ORG-ARW-HSM-GUI-00101) – this document sets out, among other things, how pre-clearance surveys will include active searches to confirm presence of microhabitat features including gilgai, soil cracks and ground litter and spotlighting in areas mapped as core habitat
- As per Condition 13 of the *Variations to Conditions Attached to Approval (25/03/2018)* for the BGP (EPBC 2012/6377), no Project Phases will commence until an Offset Strategy addressing offset obligations for that Project Phase has been developed by Arrow and approved by the Minister. Each Strategy will set out a program for monitoring and reporting on the effectiveness of the management measures, and identify the performance and completion criteria to be tracked for the offset areas
- A FSC will be at the site on the day of clearing. The FSC will be a suitably qualified ecologist as per the definition provided in EPBC 2012/6377. The number of FSCs on site at the time of clearing will depend on the number of machines being used at any given time
- The coordinates and total area of cleared habitat will be recorded and tracked monthly against approved maximum disturbance limits and used for annual compliance reporting
- Trenches will be inspected and monitored as per the APIA Code of Environmental Practice (B159) and will be checked within two hours of sunrise and trapped fauna released. Additional monitoring will be undertaken following rainfall events
- Data collection, particularly of EVNT species identified during pre-clearance surveys, during trench checking or in other Project related activities, will be ongoing until rehabilitation is complete (B163)
- Consideration will be given to conducting targeted monitoring in co-operation with the proponents of overlapping Projects. Particularly suited species to such monitoring include Ornamental Snake and Koala (B165)
- All human/wildlife interactions or incidents involving EVNT Act fauna species will be reported to Arrow via the Fauna Incident Notification Form (FIN) within 24 hours, and will be detailed in the FSC report to be provided to Arrow at the completion of habitat clearing activities (or weekly if clearing activities are ongoing). The FSC report will also detail all human/wildlife interactions or incidents with any species irrespective of their conservation status. Interactions are defined as observations of the species on the work site, captures, removals and relocations. Incidents are defined as any injury or death.
- In accordance with the Pest Management Plan routine inspections will be conducted for pest flora and evidence of pest fauna within Project disturbed areas (B171)
- After decommissioning, rehabilitation areas will be inspected for regrowth similar to the surrounding environment (B177)
- Routine monitoring of rehabilitation success will be undertaken (B183)

- Buffer zones and the Project footprint will be routinely monitored using satellite imagery (B215)
- Monitoring of the rehabilitated areas will be undertaken to identify whether the general objectives of the rehabilitation strategy are being met, and whether a sustainable and stable landform has been achieved. Monitoring will be conducted by suitably skilled and qualified persons at representative locations. Annual reviews of monitoring data will be conducted during operations, and post closure, to assess trends and performance (B591)
- Monitoring and inspection of avoidance, mitigation and management measures will be implemented to ensure the impacts and residual risks continue to be low throughout the lifetime of the Project (B640)

References

- ALA (2018a). *Denisonia maculata* (Steindachner, 1867) Ornamental Snake. Sourced from Atlas of Living Australia at: <https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd:taxon:1a330354-5599-4646-94e2-057a1b4422dc> on 11 April 2018.
- Butler, D. and Laidlaw, M. (2012d). Potential habitat model for *Denisonia maculata* ornamental snake. Map date 30/08/2012. Queensland Department of Science, Information Technology, Innovation and the Arts (DSITIA). Sourced from <https://environment.ehp.qld.gov.au/species-search/details/?id=483#> on 11 April 2018.
- DoE (2014). *Approved Conservation Advice for Denisonia maculata (Ornamental Snake)*. Canberra: Department of the Environment. Available from: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/1193-conservation-advice.pdf>. In effect under the EPBC Act from 29-Apr-2014.
- DotEE (2014). Approval – Arrow Bowen Gas Project (EPBC 2012/6377). Signed 27 October 2014.
- DotEE (2018e). Species Profile and Threats Database – *Denisonia maculata* – Ornamental Snake. SPRAT Profile. Sourced from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1193 on 11 April 2018.
- Qld Govt (2018b). Sighting data associated with the Species profile – *Denisonia maculata* (Elapidae) sourced from <https://environment.ehp.qld.gov.au/species-search/details/?id=483#> on 11 April 2018.

| Squatter Pigeon – <i>Geophaps scripta scripta</i> | |
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|  |  |
| <p>Squatter pigeon distribution map (DotEE, 2018f) Photo: Steven Dew; sourced from ALA, 2018b.</p> | |
| Status | |
| <p>Vulnerable (EPBC Act); Vulnerable (Qld Nature Conservation Act)</p> | |
| Distribution and Habitat | |
| <p>The distribution of Squatter Pigeon extends from Collinsville in the north south into northern NSW and from the coast to as far west as Longreach and Charleville (TSSC, 2015a). It is rarer in the southern portions of this range.</p> <p>It is principally associated with open eucalypt woodlands with a grassy understorey and savannahs, usually near permanent water (including dams) (TSSC, 2015a).</p> | |
| Records relevant to BGP | |
| <p>Records of Squatter Pigeon are widespread in close proximity to the BGP area and include 10 records within the BGP area itself (Qld Govt, 2018c).</p> | |
| Presence of habitat within BGP area | |
| <p>DotEE (2018f) shows that the BGP area lies within likely habitat areas and the Queensland Government’s potential habitat modelling for the species shows modelled Squatter Pigeon habitat throughout large portions of the BGP area (Butler and Laidlaw, 2012e).</p> <p>Core habitat for the species within the BGP has been mapped and is illustrated in the figure at Appendix D.5.</p> | |
| General threats | |
| <p>Identified threats include habitat loss and fragmentation, overgrazing by livestock and rabbits, weeds, inappropriate fire regimes, predation by feral cats and foxes and illegal shooting (Garnett and Crowley, 2000 and Stewart, pers. comm. as cited in TSSC, 2015a).</p> | |

| BGP specific threats |
|---|
| <p>Disturbance of up to a maximum of 1,415.44 ha of core habitat for this species is included in EPBC Act decision (EPBC 2012/6377).</p> <p>Without adequate mitigation measures in place, BGP activities would have the potential to remove, fragment and disturb additional habitat, contribute to increased abundance of rabbits, feral cats, foxes or weeds and contribute to altered fire regimes or increased illegal shooting. They also have the potential to cause direct injury or mortality.</p> |
| BGP specific mitigation measures (Arrow BGP SREIS 2014 – commitment number in parenthesis) |
| <p><i>Habitat loss, fragmentation and disturbance</i></p> <ul style="list-style-type: none"> • When the project activities proceed through the detailed planning phase, a field inspection of the specified disturbance footprint (this is specified by a surveyor in the field) will be undertaken by a suitably qualified ecologist and the presence, absence and extent of environmental values will be verified and mapped in the field via GIS. The results of this step will be recorded within Geocortex and the Arrow Sharepoint database • Where environmental values are confirmed, a ‘framing trade-offs’ session will be held with the project engineers, planners and ecologists to determine if the location of the activities can be modified to avoid and/or reduce the impact to environmental values. In the event that Squatter Pigeon habitat cannot be avoided, the actual area to be cleared will be surveyed to quantify the impacts. This data will be recorded and cumulative impact areas tracked • Disturbance within core habitat for EVNT species will be avoided where possible (B131) • Pre-construction / pre-clearance surveys will be conducted to identify any additional areas that need to be avoided (B132) • Infrastructure will be designed to avoid undisturbed tracts of remnant vegetation, where practical. Where collection and gathering infrastructure is to be placed within contiguous vegetation, collection networks will be designed to avoid dissection (B134) • Access track location will avoid the repeated isolation of small parcels of remnant vegetation from more continuous tracts (B135) • Vegetation disturbance will be minimised wherever practical. Corridors for linear infrastructure will be as narrow as practical, particularly when crossing linear corridors of vegetation (e.g. Isaac River and Suttor Creek). Areas cleared for field development will be as small as practical (B136) • Habitat trees will be retained where practicable (B137) • Access tracks and pipelines will deviate around sensitive vegetation where practicable (B140) • Trees will be felled away from existing vegetation not identified for removal where practicable (B150) • Construction activities in sensitive areas will be supervised to ensure appropriate methods (e.g., narrowing of RoW) are being implemented, where required (B182) • Delineation of disturbance boundary limits of works will be clearly established prior to |

commencement of clearing and soil stripping (B049)

- Monitoring will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- Any residual impacts to Squatter Pigeon Core Habitat will be offset. A detailed BGP Phase 1 Offset Strategy and additional offset strategies for the subsequent phases will be developed and implemented to add value rather than just compensating for impacts

Grazing

- Grazing activities will be excluded from all Arrow gas and water processing and well head infrastructure sites

Increased abundance of rabbits, feral cats, foxes and weeds

- A declared weed and pest management plan will be developed in accordance with the Petroleum Industry – Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008). Species-specific management will be undertaken for identified key weed species at risk of spread through project activities (Mesquite, Parthenium Weed, African Lovegrass and Lippia). Weed control efforts will be increased in areas particularly sensitive to invasion. The pest management plan will include, as a minimum, training, management of pest spread, management of pest infestations and monitoring effectiveness of control measures (B191)
- When sourcing maintenance materials, such materials such as bedding sand, topsoil, straw bales and sand bags will be brought to site only after it is ascertained that the materials are not contaminated with weeds and plant or animal pathogens. A weed hygiene declaration form will be requested from the supplier where there is possible risk of contamination in products (B180)
- All relevant personnel will be made aware of the location and extent of weed infestations in the vicinity of the work area and the risks involved in moving from one site or property to another (B188)
- Construction and maintenance activities will be planned to minimise movement of plant and equipment between properties or areas with weed infestations (B230)
- Weed monitoring (and targeted weed control measures) will be undertaken within sensitive EVNT habitats (particularly threatened communities such as Brigalow and native grasslands) (B158)

Fire

- Project infrastructure and facilities will be designed and constructed in accordance with applicable codes and standards (B477)
- Fire management plans will be developed for production facilities (B471)
- Arrow will develop emergency response plans in consultation with emergency services organisations that includes a list of required equipment, training and other resources, and foreseeable emergency and crisis situations (including escapes, blowouts, gas fire, bushfire, critical equipment failure, trapped or missing people, flooding, cyclones, power failure, security incidents and threats, and transport incidents). The plans will include safe evacuation procedures, communication protocols (internal and to emergency services, including the Petroleum and Gas Inspectorate), accounting for personnel and visitors, roles and responsibilities, and requirements for training (B480)
- Radiation exclusion zones around flares will be designed according to API standard (B485)

- Enclosed spaces where flammable gas may accumulate will be minimised (B487)
- Fire-fighting equipment will be installed, inspected and serviced in accordance with risk assessments and relevant legislation and standards (B499)
- Gathering lines will be buried at a minimum depth of 600 mm. Where gathering lines are present above the ground (at wellheads and at vents or drains), a clear area will be maintained. The size of the cleared area will be determined on a site-by-site basis with consideration of the site-specific risk of bushfire (B503)
- Fire-safety equipment will be commissioned in the early phase of the construction period (B505)
- All buildings and production facilities will be fitted with smoke or fire alarms (B506)
- Fire and gas detection systems to shutdown compressors will be installed (B508)
- Protocols for the control of operational activities during extreme fire danger periods, e.g., flaring or shutdowns, will be developed (B533)
- Regular patrols and inspections of pipeline easements will be conducted, including assessment of the status of signposting subsidence and of fire breaks (B536)
- Vegetation surrounding production facilities and wellheads will be maintained in a manner that limits the amount of combustible material in the area. The size of the cleared area will be determined on a site-by-site basis with consideration of the site-specific risk of bushfire (B544)
- Access tracks to well sites will be kept clear of dry grass and combustible material wherever practicable and where there is a higher risk of bushfire (to minimise the risk of dry grass being ignited by hot components of vehicles accessing the sites) (B547)
- Daily operations will be managed with consideration of the fire danger current at that time (B548)

Illegal shooting

- Harassment of wildlife and the unauthorised collection of flora or fauna will be prohibited, unless directed by a suitably qualified and experienced person (B149)

Direct injury or mortality

- Harassment of wildlife and the unauthorised collection of flora or fauna will be prohibited, unless directed by a suitably qualified and experienced person (B149)
- During rehabilitation works, care will be taken when moving stockpiled logs and vegetation to avoid fauna mortality (B186)
- Suitably qualified animal handler or ecologist will be used to capture injured wildlife, where possible. Injured wildlife resultant from land clearing will be taken to a qualified veterinary surgeon or carer where practical (B153) The FSC will be at the site on the day of clearing. The FSC will be a suitably qualified ecologist as per the definition provided in EPBC 2012/6377. The number of FSCs on site at the time of clearing will depend on the number of machines being used at any given time
- Where practicable, disturbance will be avoided in areas known or assessed to be suitable habitat during breeding season (varies, mostly early dry season)
- Checks for identified potential breeding places will be undertaken immediately prior to

commencing vegetation clearing

- Where practicable, if breeding activity is observed, an exclusion zone (50 m radius) will be enforced until the breeding place is vacated
- Removal or relocation of individuals, young or eggs will only be undertaken where all practicable measures have been taken to avoid and minimise impacts on the identified active breeding place
- As a last resort, eggs or young may be removed and placed with a licensed wildlife carer/facility for incubation of eggs and/or raising of the young for subsequent release
- Speed limits will be developed for Project controlled roads with due consideration to reduce the potential for vehicle collisions with wildlife (B154)

Monitoring

Arrow will implement the following:

- Ecological Impact Assessment Procedure (ORG-ARW-HSM-PRO-00070) – this document provides the step by step process implemented for all Arrow development activities that involve significant disturbance to land, including the requirement to record the GPS coordinates and maps of all vegetated areas that have required clearing
- Fauna Management Procedure (ORG-ARW-HSM-PRO-00067) – this document informs all Arrow staff and contractors of their obligations to protect and manage native fauna whilst operating on Arrow controlled works sites. It includes the requirements to:
 - Record and report all interactions with fauna to the Arrow Ecologist (notification within 24 hours using the Fauna Incident Notification (FIN) form is required for listed threatened, near threatened and special least concern fauna)
 - Record and report all interactions with fauna to the regulator, under their own permit, as required (but not before reporting to the Arrow Ecologist)
 - Mitigation measures that have been constructed and implemented (e.g. fauna exclusion fences) must be monitored regularly and their effectiveness reported by the Site Supervisor
 - Any ongoing actions required (e.g. monitoring and maintenance) are to be clearly communicated during site handover processes, and must be implemented, monitored and their effectiveness reported
- As per Condition 13 of the *Variations to Conditions Attached to Approval (25/03/2018)* for the BGP (EPBC 2012/6377), no Project Phases will commence until an Offset Strategy addressing offset obligations for that Project Phase has been developed by Arrow and approved by the Minister. Each Strategy will set out a program for monitoring and reporting on the effectiveness of the management measures, and identify the performance and completion criteria to be tracked for the offset areas
- For areas mapped as core habitat for the Squatter Pigeon, the pre-clearance survey will include searches for individual birds
- A FSC will be at the site on the day of clearing. The FSC will be a suitably qualified ecologist as per the definition provided in EPBC 2012/6377. The number of FSCs on site at the time of clearing will depend on the number of machines being used at any given time
- The coordinates and total area of cleared habitat will be recorded and tracked monthly

against approved maximum disturbance limits and used for annual compliance reporting

- Weed monitoring and targeted weed control measures will be implemented within sensitive EVNT habitats (particularly threatened communities such as Brigalow and native grasslands) (B158)
- Data collection, particularly of EVNT species identified during pre-clearance surveys, during trench checking or in other Project related activities, will be ongoing until rehabilitation is complete (B163)
- Monitoring will be conducted during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- In accordance with the Pest Management Plan routine inspections will be conducted for pest flora and evidence of pest fauna within Project disturbed areas (B171)
- After decommissioning, rehabilitation areas will be inspected for regrowth similar to the surrounding environment (B177)
- Routine monitoring of rehabilitation success will be undertaken (B183)
- Buffer zones and the Project footprint will be routinely monitored using satellite imagery (B215)
- Monitoring of the rehabilitated areas will be undertaken to identify whether the general objectives of the rehabilitation strategy are being met, and whether a sustainable and stable landform has been achieved. Monitoring will be conducted by suitably skilled and qualified persons at representative locations. Annual reviews of monitoring data will be conducted during operations, and post closure, to assess trends and performance (B591)
- Monitoring and inspection of avoidance, mitigation and management measures will be implemented to ensure the impacts and residual risks continue to be low throughout the lifetime of the Project (B640)

References

- ALA (2018b). *Geophaps (Geophaps) scripta scripta* (Temminck, 1821). Sourced from Atlas of Living Australia at: <https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:d5c52cd0-6d21-4322-a5c5-bc11a94d8c3a> on 11 April 2018.
- Butler, D. and Laidlaw, M. (2012e). Potential habitat model for *Geophaps scripta scripta* squatter pigeon. Map date 30/08/2012. Queensland Department of Science, Information Technology, Innovation and the Arts (DSITIA). Sourced from <https://environment.ehp.qld.gov.au/species-search/details/?id=1785#> on 11 April 2018.
- DotEE (2014). Approval – Arrow Bowen Gas Project (EPBC 2012/6377). Signed 27 October 2014.
- DotEE (2018f). Species Profile and Threats Database – *Geophaps scripta scripta* – Squatter Pigeon. SPRAT Profile. Sourced from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64440 on 11 April 2018.
- Qld Govt (2018c). Sighting data associated with the Species profile – *Geophaps scripta scripta* (Columbidae) sourced from: <https://environment.ehp.qld.gov.au/species-search/details/?id=1785#> on 11 April 2018.
- TSSC (2015a). Threatened Species Scientific Committee (2015). *Conservation Advice*

Geophaps scripta scripta *squatter pigeon (southern)*. Canberra: Department of the Environment. Available from: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/64440-conservation-advice-31102015.pdf>. In effect under the EPBC Act from 27-Oct-2015.

Red Goshawk – *Erythrotriorchis radiatus*



Red Goshawk distribution map (DotEE, 2018g)

Photo: Hansch, R. (Sourced from IBC, 2018)

Status

Vulnerable (EPBC Act); Endangered (Qld Nature Conservation Act)

Distribution and Habitat

Red Goshawk is believed to be patchily distributed in coastal and sub-coastal regions of northern and eastern Australia although there are less recent records in southern portions of its range (TSSC, 2015b).

In central Queensland it is known to occupy tall open forests and woodlands and the edges of rainforests, and is associated with gorge and escarpment country (Czechura and Hobson, 2000 and Czechura *et al.*, 2009 as cited in TSSC, 2015b). The species hunts within a home range of up to 200km² but rarely breeds in areas with fragmented native vegetation (TSSC, 2015b).

Red Goshawk prefers forest and woodland with a mosaic of vegetation types, large prey populations (birds), and permanent water. The vegetation types include eucalypt woodland, open forest, tall open forest, gallery rainforest, swamp sclerophyll forest and rainforest margins.

Records relevant to BGP

The species was not recorded during the EIS studies but Qld Govt (2018g) has three records in close proximity to northern portions of the BGP area. The latest of these records is from 2013.

Presence of habitat within BGP area

DotEE (2018g) shows that the BGP area is within likely habitat. The Queensland Government’s potential habitat modelling for the species shows the modelled potential habitat generally lies to the east of the eastern edge of the BGP area (Butler and Laidlaw, 2012d).

Core habitat for the species within the BGP has been mapped and is illustrated in the figure at Appendix D.6.

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| General threats |
| Vegetation clearing, habitat fragmentation and degradation (including loss of wetlands and hollow-bearing tree (where prey breed) and through overgrazing by livestock and feral herbivores and altered fire regimes) are identified threats or potential threats (TSSC, 2015b). |
| BGP specific threats |
| Disturbance of up to a maximum of 187.14 ha of core habitat for this species is included in EPBC Act decision (EPBC 2012/6377). Without adequate mitigation measures in place, BGP activities would have the potential to remove, fragment and disturb additional habitat and contribute to increased feral herbivore numbers (e.g. rabbits) and altered fire frequency. They also have the potential to cause direct injury or mortality. |
| BGP specific mitigation measures (Arrow BGP SREIS 2014 – commitment number in parenthesis) |
| <p><i>Habitat loss, fragmentation and disturbance</i></p> <ul style="list-style-type: none"> • When the project activities proceed through the detailed planning phase, a field inspection of the specified disturbance footprint (this is specified by a surveyor in the field) will be undertaken by a suitably qualified ecologist and the presence, absence and extent of environmental values will be verified and mapped in the field via GIS. The results of this step will be recorded within Geocortex and the Arrow Sharepoint database • Where environmental values are confirmed, a ‘framing trade-offs’ session will be held with the project engineers, planners and ecologists to determine if the location of the activities can be modified to avoid and/or reduce the impact to environmental values. In the event that Red Goshawk habitat cannot be avoided, the actual area to be cleared will be surveyed to quantify the impacts. This data will be recorded and cumulative impact areas tracked • Disturbance within core habitat for EVNT species will be avoided where possible (B131) • Pre-construction / pre-clearance surveys will be conducted to identify any additional areas that need to be avoided (B132) • Infrastructure will be designed to avoid undisturbed tracts of remnant vegetation, where practical. Where collection and gathering infrastructure is to be placed within contiguous vegetation, collection networks will be designed to avoid dissection (B134) • Access track location will avoid the repeated isolation of small parcels of remnant vegetation from more continuous tracts (B135) • Vegetation disturbance will be minimised wherever practical. Corridors for linear infrastructure will be as narrow as practical, particularly when crossing linear corridors of vegetation (e.g. Isaac River and Suttor Creek). Areas cleared for field development will be as small as practical (B136) • Habitat trees will be retained where practicable (B137) • Removing riparian vegetation will be avoided when directional drilling and right of ways will be reduced where practical (B138) • Access tracks and pipelines will deviate around sensitive vegetation where practicable (B140) |

- Sensitive infrastructure design principles will be applied to avoid watercourse, drainage lines and riparian areas where practicable (B142)
- Trees will be felled away from existing vegetation not identified for removal where practicable (B150)
- Construction activities in sensitive areas will be supervised to ensure appropriate methods (e.g., narrowing of RoW) are being implemented, where required (B182)
- Damaging trees (e.g. through scraping of tree trunk or breaking of limbs by equipment) not identified for removal will be avoided where practicable (B151)
- Delineation of disturbance boundary limits of works will be clearly established prior to commencement of clearing and soil stripping (B049)
- Monitoring will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- Lighting will be designed in a manner that limits disruption on landscape character, views and visual amenity and direct lighting into the infrastructure siting rather than dispersed into native vegetation when sites are adjacent to intact habitat (B099)
- Any residual impacts to Red Goshawk (as confirmed by pre-clearance and spotter-catcher surveys) will be offset. A detailed BGP Phase 1 Offset Strategy and additional offset strategies for the subsequent phases will be developed and implemented to add value rather than just compensating for impacts (if any)

Grazing

- Grazing activities will be excluded from all Arrow gas and water processing and well head infrastructure sites

Increased feral herbivore numbers

- A declared weed and pest management plan will be developed in accordance with the Petroleum Industry – Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008). The pest management plan will include, as a minimum, training, management of pest spread, management of pest infestations and monitoring effectiveness of control measures (B191)
- In accordance with the Pest Management Plan routine inspections for pest flora and evidence of pest fauna will be undertaken within Project disturbed areas (B171)

Fire

- Project infrastructure and facilities will be designed and constructed in accordance with applicable codes and standards (B477)
- Fire management plans will be developed for production facilities (B471)
- Arrow will develop emergency response plans in consultation with emergency services organisations that includes a list of required equipment, training and other resources, and foreseeable emergency and crisis situations (including escapes, blowouts, gas fire, bushfire, critical equipment failure, trapped or missing people, flooding, cyclones, power failure, security incidents and threats, and transport incidents). The plans will include safe evacuation procedures, communication protocols (internal and to emergency services, including the Petroleum and Gas Inspectorate), accounting for personnel and visitors, roles and responsibilities, and requirements for training (B480)

- Radiation exclusion zones around flares will be designed according to API standard (B485)
- Enclosed spaces where flammable gas may accumulate will be minimised (B487)
- Fire-fighting equipment will be installed, inspected and serviced in accordance with risk assessments and relevant legislation and standards (B499)
- Gathering lines will be buried at a minimum depth of 600 mm. Where gathering lines are present above the ground (at wellheads and at vents or drains), a clear area will be maintained. The size of the cleared area will be determined on a site-by-site basis with consideration of the site-specific risk of bushfire (B503)
- Fire-safety equipment will be commissioned in the early phase of the construction period (B505)
- All buildings and production facilities will be fitted with smoke or fire alarms (B506)
- Fire and gas detection systems to shutdown compressors will be installed (B508)
- Protocols for the control of operational activities during extreme fire danger periods, e.g., flaring or shutdowns, will be developed (B533)
- Regular patrols and inspections of pipeline easements will be conducted, including assessment of the status of signposting subsidence and of fire breaks (B536)
- Vegetation surrounding production facilities and wellheads will be maintained in a manner that limits the amount of combustible material in the area. The size of the cleared area will be determined on a site-by-site basis with consideration of the site-specific risk of bushfire (B544)
- Access tracks to well sites will be kept clear of dry grass and combustible material wherever practicable and where there is a higher risk of bushfire (to minimise the risk of dry grass being ignited by hot components of vehicles accessing the sites) (B547)
- Daily operations will be managed with consideration of the fire danger current at that time (B548)

Direct injury or mortality

- Harassment of wildlife and the unauthorised collection of flora or fauna will be prohibited, unless directed by a suitably qualified and experienced person (B149)
- Suitably qualified animal handler or ecologist will be used to capture injured wildlife, where possible. Injured wildlife resultant from land clearing will be taken to a qualified veterinary surgeon or carer where practical (B153) The FSC will be at the site on the day of clearing. The FSC will be a suitably qualified ecologist as per the definition provided in EPBC 2012/6377. The number of FSCs on site at the time of clearing will depend on the number of machines being used at any given time
- The probability of Red Goshawk nesting in the BGP is considered low. However, should a potential nest be identified in proximity to existing or proposed project activities the Construction Contractor would be required, as a minimum, to:
 - Stop work at the location
 - Notify Arrow so that Arrow may notify the relevant authorities (i.e. DotEE and DES)
 - Seek approval from DotEE for additional disturbance if any impact is 'significant' and unavoidable

- Manage the species or community in accordance with the mitigation measures listed and all applicable conditions of approval including the Offset Strategy for the relevant Project Phase
- Tag/barricade the identified species/community in an appropriate manner to ensure protection
- Cease clearing works in the immediate area
- Record GPS coordinates so that it may be incorporated into the Site Environmental Map as a 'no-go zone' or recorded as an impact area
- Provide all relevant information to Arrow for monthly tracking of EPBC Act species and community impacts for annual reporting

Monitoring

Arrow will implement the following:

- Ecological Impact Assessment Procedure (ORG-ARW-HSM-PRO-00070) – this document provides the step by step process implemented for all Arrow development activities that involve significant disturbance to land, including the requirement to record the GPS coordinates and maps of all vegetated areas that have required clearing
- Fauna Management Procedure (ORG-ARW-HSM-PRO-00067) – this document informs all Arrow staff and contractors of their obligations to protect and manage native fauna whilst operating on Arrow controlled works sites. It includes the requirements to:
 - Record and report all interactions with fauna to the Arrow Ecologist (notification within 24 hours using the Fauna Incident Notification (FIN) form is required for listed threatened, near threatened and special least concern fauna)
 - Record and report all interactions with fauna to the regulator, under their own permit, as required (but not before reporting to the Arrow Ecologist)
 - Mitigation measures that have been constructed and implemented (e.g. fauna exclusion fences) must be monitored regularly and their effectiveness reported by the Site Supervisor
 - Any ongoing actions required (e.g. monitoring and maintenance) are to be clearly communicated during site handover processes, and must be implemented, monitored and their effectiveness reported
- As per Condition 13 of the *Variations to Conditions Attached to Approval (25/03/2018)* for the BGP (EPBC 2012/6377), no Project Phases will commence until an Offset Strategy addressing offset obligations for that Project Phase has been developed by Arrow and approved by the Minister. Each Strategy will set out a program for monitoring and reporting on the effectiveness of the management measures, and identify the performance and completion criteria to be tracked for the offset areas
- For areas mapped as core habitat for the Red Goshawk, the pre-clearance survey will include searches for individual birds
- A FSC will be at the site on the day of clearing. The FSC will be a suitably qualified ecologist as per the definition provided in EPBC 2012/6377. The number of FSCs on site at the time of clearing will depend on the number of machines being used at any given time
- The coordinates and total area of cleared habitat will be recorded and tracked monthly

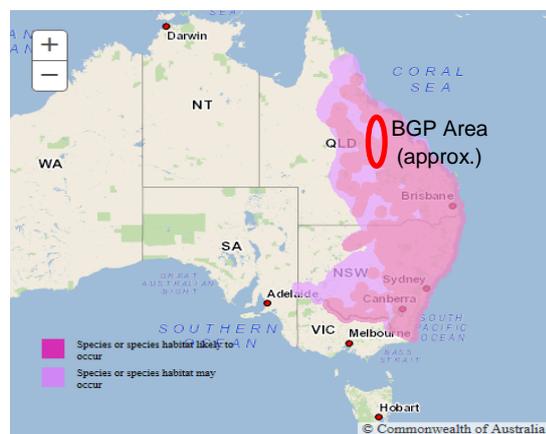
against approved maximum disturbance limits and used for annual compliance reporting

- Data collection, particularly of EVNT species identified during pre-clearance surveys, during trench checking or in other Project related activities, will be ongoing until rehabilitation is complete (B163)
- Monitoring will be conducted during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- In accordance with the Pest Management Plan routine inspections will be conducted for pest flora and evidence of pest fauna within Project disturbed areas (B171)
- After decommissioning, rehabilitation areas will be inspected for regrowth similar to the surrounding environment (B177)
- Routine monitoring of rehabilitation success will be undertaken (B183)
- Buffer zones and the Project footprint will be routinely monitored using satellite imagery (B215)
- Monitoring of the rehabilitated areas will be undertaken to identify whether the general objectives of the rehabilitation strategy are being met, and whether a sustainable and stable landform has been achieved. Monitoring will be conducted by suitably skilled and qualified persons at representative locations. Annual reviews of monitoring data will be conducted during operations, and post closure, to assess trends and performance (B591)
- Monitoring and inspection of avoidance, mitigation and management measures will be implemented to ensure the impacts and residual risks continue to be low throughout the lifetime of the Project (B640)

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- Butler, D. and Laidlaw, M. (2012f). Potential habitat model for *Erythrotriorchis radiatus* red goshawk. Map date 30/08/2012. Queensland Department of Science, Information Technology, Innovation and the Arts (DSITIA). Sourced from <https://environment.ehp.qld.gov.au/species-search/details/?id=1728#> on 26 March 2018.
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Koala – *Phascolarctos cinereus*



Koala distribution map (DotEE, 2018h)



Photo: Herald Sun

Status

Vulnerable (EPBC Act); Vulnerable (Qld Nature Conservation Act)

Distribution and Habitat

Endemic to eastern Australia, the Koala is a solitary species that is widespread across coastal and inland areas from Cooktown, Queensland to the Mt. Lofty ranges, South Australia (Martin *et al.*, 2008). It is restricted to altitudes below 800m elevation (Munks *et al.*, 1996).

Koalas occur in a diversity of habitats including temperate, sub-tropical and tropical forest, woodland and semi-arid communities, and sclerophyll forest, on foothills, plains and in coastal areas (Martin and Handasyde, 1999; Martin *et al.*, 2008). Koalas on the western side of the Great Dividing Range at the western edges of their range are often associated with watercourses though are not restricted to them (Melzer *et al.*, 2000; Sullivan *et al.* 2003). Favoured feed tree species in these areas include *Eucalyptus camaldulensis* (River Red Gum), Coolabah and *E. populnea* (Poplar Box).

In the western extent of their range, including the project area, Koalas inhabit Eucalypt-dominated forests and woodlands, particularly in the vicinity of riparian environments, and Acacia-dominated forests, woodlands and shrublands, Arrow (2014).

Records relevant to the BGP

In comparison to coastal districts, the Koala population density is low within the BGP area and the wider Bowen Basin. There are a relatively small number of sightings in the BGP area within the Qld Govt (2018d) records database.

Presence of habitat within BGP area

DotEE (2018h) shows that the BGP area is within likely habitat. DotEE (2018h) shows that the BGP area is within likely habitat. Core habitat for the species within the BGP has been mapped and is

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| illustrated in the figure at Appendix D.7. |
| General threats |
| Habitat loss and fragmentation, vehicle strike, disease, and predation by dogs (DSEWPAC, 2012a). |
| SGP specific threats |
| Disturbance of up to a maximum of 2,466.04 ha of core habitat for this species is included in EPBC Act decision (EPBC 2012/6377). Without adequate mitigation measures in place, BGP activities would have the potential to remove, and fragment additional habitat and contribute to increased injury and mortality including through vehicle strike, increased incidence of disease and predation by dogs. |
| SGP specific mitigation measures (Arrow SGP SREIS 2013 – commitment number in parenthesis) |
| <p><i>Habitat loss and fragmentation</i></p> <ul style="list-style-type: none"> • When the project activities proceed through the detailed planning phase, a field inspection of the specified disturbance footprint (this is specified by a surveyor in the field) will be undertaken by a suitably qualified ecologist and the presence, absence and extent of environmental values will be verified and mapped in the field via GIS. The results of this step will be recorded within Geocortex and the Arrow Sharepoint database • Where environmental values are confirmed, a ‘framing trade-offs’ session will be held with the project engineers, planners and ecologists to determine if the location of the activities can be modified to avoid and/or reduce the impact to environmental values. In the event that Koala habitat cannot be avoided, the actual area to be cleared will be surveyed to quantify the impacts. This data will be recorded and cumulative impact areas tracked • Disturbance within core habitat for EVNT species will be avoided where possible (B131) • Pre-construction / pre-clearance surveys will be conducted to identify any additional areas that need to be avoided (B132) • Infrastructure will be designed to avoid undisturbed tracts of remnant vegetation, where practical. Where collection and gathering infrastructure is to be placed within contiguous vegetation, collection networks will be designed to avoid dissection (B134) • Access track location will avoid the repeated isolation of small parcels of remnant vegetation from more continuous tracts (B135) • Vegetation disturbance will be minimised wherever practical. Corridors for linear infrastructure will be as narrow as practical, particularly when crossing linear corridors of vegetation (e.g. Isaac River and Suttor Creek). Areas cleared for field development will be as small as practical (B136) • Habitat trees will be retained where practicable (B137) • Trees will be felled away from existing vegetation not identified for removal where practicable (B150) • Access tracks and pipelines will deviate around sensitive vegetation where practicable (B140) • Construction activities in sensitive areas will be supervised to ensure appropriate methods (e.g., narrowing of RoW) are being implemented, where required (B182) |

- Damaging trees (e.g. through scraping of tree trunk or breaking of limbs by equipment) not identified for removal will be avoided where practicable (B151)
- Delineation of disturbance boundary limits of works will be clearly established prior to commencement of clearing and soil stripping (B049)
- Monitoring will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- A rehabilitation management plan for decommissioning will be developed and implemented which includes monitoring and maintenance of rehabilitated areas until rehabilitation sign off criteria are met (B339)
- Lighting will be designed in a manner that limits disruption on landscape character, views and visual amenity and direct lighting into the infrastructure siting rather than dispersed into native vegetation when sites are adjacent to intact habitat (B099)
- Any residual impacts to Koala Core Habitat (as confirmed by pre-clearance survey) will be offset. A detailed BGP Phase 1 Offset Strategy and additional offset strategies for the subsequent phases will be developed and implemented to add value rather than just compensating for impacts (if any)

Direct injury or mortality

- Where practicable, avoid disturbance in areas known or assessed to be suitable habitat during breeding season (October to May)
- Key Koala trees will be identified and visually inspect prior to clearing to ensure that they are free of Koalas. If Koalas are located, the tree will be retained until the animals have moved on, typically overnight (B190)
- If a Koala is found within the clearing footprint; a minimum exclusion zone of 100 m will be established for a female Koala with obvious young and 50 m for all other Koala, until the animal has moved of its own accord. No vehicles are to enter the buffer (exclusion) zone at any time. Vehicle operators will be made aware of the presence of the Koala and a reduced speed limit established until the animal has moved on of its own accord
- Harassment of wildlife and the unauthorised collection of flora or fauna will be prohibited, unless directed by a suitably qualified and experienced person (B149)
- Suitably qualified animal handler or ecologist will be used to capture injured wildlife, where possible. Injured wildlife resultant from land clearing will be taken to a qualified veterinary surgeon or carer where practical (B153) The FSC will be at the site on the day of clearing. The FSC will be a suitably qualified ecologist as per the definition provided in EPBC 2012/6377. The number of FSCs on site at the time of clearing will depend on the number of machines being used at any given time
- Speed limits will be developed for Project controlled roads with due consideration to reduce the potential for vehicle collisions with wildlife (B154)
- Trenches will be inspected and monitored as per the APIA Code of Environmental Practice (B159) and will be checked within two hours of sunrise and trapped fauna released. Additional monitoring will be undertaken following rainfall events
- Minimise the time a trench is left open. Construct exit points when construction is within 1 km of native vegetation, using appropriate material. Provide fauna refuges, such as sawdust-filled bags, regularly through areas of high fauna activity (B173)

- Harm to fauna from entrapment during construction and operation of dams will be prevented- (B184)
- As soon as practical following pipe laying, the trench will be backfilled with excavated material, compacted and topsoil replaced and erosion controls implemented (B299)
- During rehabilitation works, care will be taken when moving stockpiled logs and vegetation to avoid fauna mortality (B186)

Disease

- Suitably qualified animal handler or ecologist will be used to capture injured wildlife, where possible. Injured wildlife resultant from land clearing will be taken to a qualified veterinary surgeon or carer where practical (B153) The FSC will be at the site on the day of clearing. The FSC will be a suitably qualified ecologist as per the definition provided in EPBC 2012/6377. The number of FSCs on site at the time of clearing will depend on the number of machines being used at any given time

Predation by dogs

- A declared weed and pest management plan will be developed in accordance with the Petroleum Industry – Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008). The pest management plan will include, as a minimum, training, management of pest spread, management of pest infestations and monitoring effectiveness of control measures (B191)
- In accordance with the Pest Management Plan routine inspections for pest flora and evidence of pest fauna will be undertaken within Project disturbed areas (B171)

Monitoring

Arrow will implement the following:

- Ecological Impact Assessment Procedure (ORG-ARW-HSM-PRO-00070) – this document provides the step by step process implemented for all Arrow development activities that involve significant disturbance to land, including the requirement to record the GPS coordinates and maps of all vegetated areas that have required clearing
- Fauna Management Procedure (ORG-ARW-HSM-PRO-00067) – this document informs all Arrow staff and contractors of their obligations to protect and manage native fauna whilst operating on Arrow controlled works sites. It includes the requirements to:
 - Record and report all interactions with fauna to the Arrow Ecologist (notification within 24 hours using the Fauna Incident Notification (FIN) form is required for listed threatened, near threatened and special least concern fauna)
 - Record and report all interactions with fauna to the regulator, under their own permit, as required (but not before reporting to the Arrow Ecologist)
 - Mitigation measures that have been constructed and implemented (e.g. fauna exclusion fences) must be monitored regularly and their effectiveness reported by the Site Supervisor
 - Any ongoing actions required (e.g. monitoring and maintenance) are to be clearly communicated during site handover processes, and must be implemented, monitored and their effectiveness reported
- As per Condition 13 of the *Variations to Conditions Attached to Approval (25/03/2018)* for the BGP (EPBC 2012/6377), no Project Phases will commence until an Offset Strategy

addressing offset obligations for that Project Phase has been developed by Arrow and approved by the Minister. Each Strategy will set out a program for monitoring and reporting on the effectiveness of the management measures, and identify the performance and completion criteria to be tracked for the offset areas

- A FSC will be at the site on the day of clearing. The FSC will be a suitably qualified ecologist as per the definition provided in EPBC 2012/6377. The number of FSC on site at the time of clearing will depend on the number of machines being used at any given time
- Monitoring will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- Key Koala trees will be identified and visually inspect prior to clearing to ensure that they are free of Koalas. If Koalas are located, the tree will be retained until the animals have moved on, typically overnight (B190)
- The coordinates and total area of cleared habitat will be recorded and tracked monthly against approved maximum disturbance limits and used for annual compliance reporting.
- Data collection, particularly of EVNT species identified during pre-clearance surveys, during trench checking or in other Project related activities, will be ongoing until rehabilitation is complete (B163)
- Targeted monitoring effort conducted in co-operation with the proponents of overlapping Projects will be considered. Particularly suited species to such monitoring include Ornamental Snake and Koala (B165)
- Monitoring will be conducted during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- In accordance with the Pest Management Plan routine inspections will be conducted for pest flora and evidence of pest fauna within Project disturbed areas (B171)
- After decommissioning, rehabilitation areas will be inspected for regrowth similar to the surrounding environment (B177)
- Routine monitoring of rehabilitation success will be undertaken (B183)
- Buffer zones and the Project footprint will be routinely monitored using satellite imagery (B215)
- Monitoring of the rehabilitated areas will be undertaken to identify whether the general objectives of the rehabilitation strategy are being met, and whether a sustainable and stable landform has been achieved. Monitoring will be conducted by suitably skilled and qualified persons at representative locations. Annual reviews of monitoring data will be conducted during operations, and post closure, to assess trends and performance (B591)
- Monitoring and inspection of avoidance, mitigation and management measures will be implemented to ensure the impacts and residual risks continue to be low throughout the lifetime of the Project (B640)

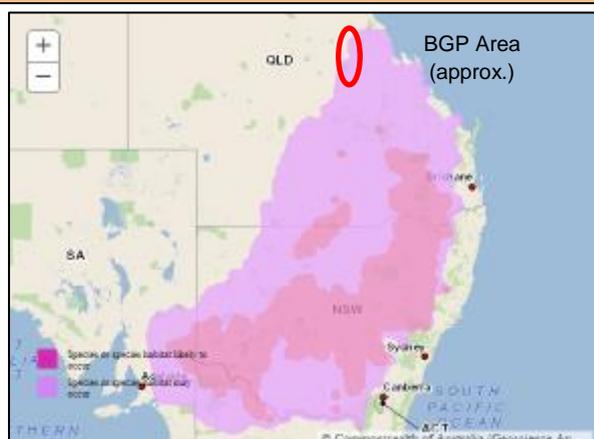
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South-eastern Long-eared Bat – *Nyctophilus corbeni*



N. corbeni distribution map (DotEE, 2018i)

Photo: Leard Frontline Action

Status

Vulnerable (EPBC Act); Vulnerable (Qld Nature Conservation Act)

Distribution and Habitat

Nyctophilus corbeni is largely restricted to the Murray-Darling Basin (Churchill, 2008), with its stronghold in the Pilliga forests of central New South Wales (Turbill and Ellis, 2006). In Queensland, the species is mainly recorded in the southern areas of the Brigalow Belt (Reardon, 2012). The distributional limits in Queensland are uncertain. McFarland and others (1999) state that the species is found north to near Duaringa, and Venz *et. al.* (2002) consider that the Dawson River area is at, or close to, its northern range limit. However, Parnaby (2009), in a taxonomic review of Australian greater long-eared bats previously known as *N. timoriensis*, states that the most northerly record of the species is from 80km west of Taroom. It is unknown if possible misidentifications of the species have resulted in the uncertainty attached to its distribution.

The Queensland Government’s potential habitat modelling for the species shows all modelled potential habitat being south of the BGP area (Butler and Laidlaw, 2012g).

The species is most common in box/ironbark/cypress pine woodland on sandy soils (Turbill and Ellis, 2006; Churchill, 2008; Turbill *et al.*, 2008), though it also occurs in *Allocasuarina luehmannii* (Bulloak), Brigalow and *Casuarina cristata* (Belah) communities (Turbill *et al.*, 2008), dry sclerophyll forests with *Corymbia citriodora*, and semi-evergreen vine thickets. The species prefers areas with a distinct canopy and a dense understorey (Churchill, 2008). Most records are from large tracts of vegetation, approximately 5,000+ ha in size (e.g. Southwood National Park) (EPA, 2008), although the species can be occasionally recorded from smaller vegetation tracts of 600 ha (e.g. Erringibba National Park). Field observations and published literature also suggests it may use riparian habitats, though these habitats may be more important for providing roosting sites (hollow-bearing trees) and water.

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| Records relevant to BGP |
| <p>The South-eastern Long-eared Bat was not recorded during the recent detailed surveys within the BGP area or during previous EIS ecological studies.</p> <p>The nearest reliable record is approximately 170km south of the BGP area (Butler and Laidlaw, 2012g and Qld Govt, 2018f).</p> |
| Presence of habitat within BGP area |
| <p>DotEE (2018i) shows potential habitat as possibly extending as far north as the BGP area and Core habitat for the species within the BGP has been mapped and is illustrated in the figure at Appendix D.8. However it is considered that there is a low likelihood that the South-eastern Long-eared Bat actually occurs in the area given:</p> <ul style="list-style-type: none"> • the absence of records during the BGP EIS and subsequent detailed assessments with the area • lack of records of this species within 170km the BGP area (Qld Govt,2018f), and • the Queensland Government’s potential habitat modelling showing all habitat as being to the south of the BGP area (Butler and Laidlaw, 2012g). <p>As such, the results of ongoing pre-clearance surveys, spotter-catcher findings and monitoring results will be taken into account in confirming and calculating actual areas of impact to core habitat within the BGP area (if any).</p> |
| General threats |
| <p>Habitat loss and fragmentation, fire, reduction in hollow availability, exposure to agrichemicals, grazing and predation by feral animals (TSSC, 2015).</p> |
| BGP specific threats |
| <p>Disturbance of up to a maximum of 2,282.57 ha of core habitat for this species is included in EPBC Act decision (EPBC 2012/6377). This area was based on the area of Regional Ecosystems that were identified by the EIS as having suitable structural characteristics to support the species. However, impacts upon habitat actually supporting the species (if any) are likely to be much less and will be confirmed and quantified by preclearance survey.</p> <p>BGP activities will require clearing of hollow-bearing trees and, in the absence of appropriate mitigation measures, would also have the potential to fragment habitat, contribute to changed fire frequency and pest animal populations and increase exposure to agrichemicals. They also have the potential to cause direct injury or mortality.</p> |
| BGP specific mitigation measures (Arrow BGP SREIS 2014 – commitment number in parenthesis) |
| <p><i>Habitat loss, fragmentation and reduction of hollow availability</i></p> <ul style="list-style-type: none"> • When the project activities proceed through the detailed planning phase, a field inspection of the specified disturbance footprint (this is specified by a surveyor in the field) will be undertaken by a suitably qualified ecologist and the presence, absence and extent of environmental values will be verified and mapped in the field via GIS. The results of this step |

will be recorded within Geocortex and the Arrow Sharepoint database

- Where environmental values are confirmed, a ‘framing trade-offs’ session will be held with the project engineers, planners and ecologists to determine if the location of the activities can be modified to avoid and/or reduce the impact to environmental values. In the event that impacts to *N. corbeni* habitat cannot be avoided, the actual area to be cleared will be surveyed to quantify the impacts. This data will be recorded and cumulative impact areas tracked
- Disturbance within core habitat for EVNT species will be avoided where possible (B131)
- Pre-construction / pre-clearance surveys will be conducted to identify any additional areas that need to be avoided (B132)
- Infrastructure will be designed to avoid undisturbed tracts of remnant vegetation, where practical. Where collection and gathering infrastructure is to be placed within contiguous vegetation, collection networks will be designed to avoid dissection (B134)
- Access track location will avoid the repeated isolation of small parcels of remnant vegetation from more continuous tracts (B135)
- Vegetation disturbance will be minimised wherever practical. Corridors for linear infrastructure will be as narrow as practical, particularly when crossing linear corridors of vegetation (e.g. Isaac River and Suttor Creek). Areas cleared for field development will be as small as practical (B136)
- Habitat trees will be retained where practicable (B137)
- Trees will be felled away from existing vegetation not identified for removal where practicable (B150)
- Access tracks and pipelines will deviate around sensitive vegetation where practicable (B140)
- Construction activities in sensitive areas will be supervised to ensure appropriate methods (e.g., narrowing of RoW) are being implemented, where required (B182)
- Damaging trees (e.g. through scraping of tree trunk or breaking of limbs by equipment) not identified for removal will be avoided where practicable (B151)
- Trees will be assessed for potential nesting hollows prior to felling. If hollows are identified, trees will be felled in the presence of a qualified FSC and rolled so that the hollows are facing upwards, allowing fauna to escape (B189)
- Delineation of disturbance boundary limits of works will be clearly established prior to commencement of clearing and soil stripping (B049)
- Monitoring will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- Lighting will be designed in a manner that limits disruption on landscape character, views and visual amenity and direct lighting into the infrastructure siting rather than dispersed into native vegetation when sites are adjacent to intact habitat (B099)
- Any residual impacts to South-eastern Long-eared Bat Core Habitat (as confirmed by pre-clearance survey) will be offset. A detailed BGP Phase 1 Offset Strategy and additional offset strategies for the subsequent phases will be developed and implemented to add value rather than just compensating for impacts (if any)

Fire

- Project infrastructure and facilities will be designed and constructed in accordance with applicable codes and standards (B477)
- Fire management plans will be developed for production facilities (B471)
- Arrow will develop emergency response plans in consultation with emergency services organisations that includes a list of required equipment, training and other resources, and foreseeable emergency and crisis situations (including escapes, blowouts, gas fire, bushfire, critical equipment failure, trapped or missing people, flooding, cyclones, power failure, security incidents and threats, and transport incidents). The plans will include safe evacuation procedures, communication protocols (internal and to emergency services, including the Petroleum and Gas Inspectorate), accounting for personnel and visitors, roles and responsibilities, and requirements for training (B480)
- Radiation exclusion zones around flares will be designed according to API standard (B485)
- Enclosed spaces where flammable gas may accumulate will be minimised (B487)
- Fire-fighting equipment will be installed, inspected and serviced in accordance with risk assessments and relevant legislation and standards (B499)
- Gathering lines will be buried at a minimum depth of 600 mm. Where gathering lines are present above the ground (at wellheads and at vents or drains), a clear area will be maintained. The size of the cleared area will be determined on a site-by-site basis with consideration of the site-specific risk of bushfire (B503)
- Fire-safety equipment will be commissioned in the early phase of the construction period (B505)
- All buildings and production facilities will be fitted with smoke or fire alarms (B506)
- Fire and gas detection systems to shutdown compressors will be installed (B508)
- Protocols for the control of operational activities during extreme fire danger periods, e.g., flaring or shutdowns, will be developed (B533)
- Regular patrols and inspections of pipeline easements will be conducted, including assessment of the status of signposting subsidence and of fire breaks (B536)
- Vegetation surrounding production facilities and wellheads will be maintained in a manner that limits the amount of combustible material in the area. The size of the cleared area will be determined on a site-by-site basis with consideration of the site-specific risk of bushfire (B544)
- Access tracks to well sites will be kept clear of dry grass and combustible material wherever practicable and where there is a higher risk of bushfire (to minimise the risk of dry grass being ignited by hot components of vehicles accessing the sites) (B547)
- Daily operations will be managed with consideration of the fire danger current at that time (B548)

Exposure to agrichemicals

- Appropriate international, Australian and industry standards and codes of practice will be applied for the handling of hazardous materials, such as chemicals, fuels and lubricants (B078)

- Staff training will be provided on appropriate handling, storage and containment practices for chemical, fuels and other potential chemicals as relevant (B083)

Grazing

- Grazing activities will be excluded from all Arrow gas and water processing and well head infrastructure sites

Predation by feral animals

- A declared weed and pest management plan will be developed in accordance with the Petroleum Industry – Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008). The pest management plan will include, as a minimum, training, management of pest spread, management of pest infestations and monitoring effectiveness of control measures (B191)
- In accordance with the Pest Management Plan routine inspections for pest flora and evidence of pest fauna will be undertaken within Project disturbed areas (B171)

Direct injury or mortality

- Harassment of wildlife and the unauthorised collection of flora or fauna will be prohibited, unless directed by a suitably qualified and experienced person (B149)
- Suitably qualified animal handler or ecologist will be used to capture injured wildlife, where possible. Injured wildlife resultant from land clearing will be taken to a qualified veterinary surgeon or carer where practical (B153) The FSC will be at the site on the day of clearing. The FSC will be a suitably qualified ecologist as per the definition provided in EPBC 2012/6377. The number of FSCs on site at the time of clearing will depend on the number of machines being used at any given time
- Potential breeding places will be clearly marked in the field with spray paint, coloured flagging tape (unless not permitted by land owners, e.g. some cattle properties), or by other suitable methods
- Further checks of identified potential nests will be undertaken immediately prior to commencing vegetation clearing
- All reasonable and practicable attempts (if safe to do so) will be made to check hollow bearing trees, hollow logs, peeling bark and splits in tree trunks for the presence of this species
- Where practicable, if breeding activity is observed, an exclusion zone (30 m radius) will be enforced until the breeding place is vacated
- As a last resort, young may be removed and placed with a licensed wildlife carer/facility for incubation of eggs and/or raising of the young for subsequent release
- Where hollows containing microbat maternity sites have been identified that are inactive and unavoidable, the FSC is to determine whether it is to be relocated or left in situ
- Where relocation of animals in tree hollows is required, an elevated work platform or cherry-picker may be used in conjunction with a chainsaw operator and the FSC (or a FSC who holds a current training qualification in use of chainsaws) to attempt to remove the hollow. The following step-by-step process (modified from Nottidge, 2012) will be considered if safe to do so:
 - The FSC (with chainsaw operator unless the FSC is a qualified chainsaw operator) will inspect each visible hollow or potential breeding place (e.g. nest) identified in each tree

using the cherry picker. This is usually carried out by simply looking into hollows and nests (with the assistance of a small torch); however, fibrescopes may also be useful for deep hollows

- If bats are located within a hollow, a piece of towel or rag would be firmly placed in the entrance to prevent the wildlife from escaping, as they may attempt to flee the nesting/denning hollow
- Once the hollow entrance has been secured, the chainsaw operator will remove the entire hollow limb below the cavity where the branch remains solid. In circumstances where a hollow continues into the main stem of the tree, the chainsaw operator would carefully cut a small window into the hollow, allowing the FSC to plug the hollow above and below the window, then the hollow limb is removed and lowered to the ground in sections
- When the bats have been safely secured within its hollow, the entire limb would then be placed in the cherry-picker bucket or lowered to the ground using ropes (depending on the size of the limb)
- This limb would be placed in a cool, quiet location until translocation to the recipient habitat site, when at dusk of the same day the hollow entrance will be re-opened to allow the bats to emerge of their own accord
- Speed limits will be developed for Project controlled roads with due consideration to reduce the potential for vehicle collisions with wildlife (B154)
- During rehabilitation works, care will be taken when moving stockpiled logs and vegetation to avoid fauna mortality (B186)

Monitoring

Arrow will implement the following:

- Ecological Impact Assessment Procedure (ORG-ARW-HSM-PRO-00070) – this document provides the step by step process implemented for all Arrow development activities that involve significant disturbance to land, including the requirement to record the GPS coordinates and maps of all vegetated areas that have required clearing
- Fauna Management Procedure (ORG-ARW-HSM-PRO-00067) – this document informs all Arrow staff and contractors of their obligations to protect and manage native fauna whilst operating on Arrow controlled works sites. It includes the requirements to:
 - Record and report all interactions with fauna to the Arrow Ecologist (notification within 24 hours using the Fauna Incident Notification (FIN) form is required for listed threatened, near threatened and special least concern fauna)
 - Record and report all interactions with fauna to the regulator, under their own permit, as required (but not before reporting to the Arrow Ecologist)
 - Mitigation measures that have been constructed and implemented (e.g. fauna exclusion fences) must be monitored regularly and their effectiveness reported by the Site Supervisor
 - Any ongoing actions required (e.g. monitoring and maintenance) are to be clearly communicated during site handover processes, and must be implemented, monitored and their effectiveness reported

- As per Condition 13 of the *Variations to Conditions Attached to Approval (25/03/2018)* for the BGP (EPBC 2012/6377), no Project Phases will commence until an Offset Strategy addressing offset obligations for that Project Phase has been developed by Arrow and approved by the Minister. Each Strategy will set out a program for monitoring and reporting on the effectiveness of the management measures, and identify the performance and completion criteria to be tracked for the offset areas
- For areas mapped as core habitat for the South-eastern Long-eared Bat, the pre-clearance survey will include observations of hollow-bearing tree branches and patches of vegetation with a distinct canopy and a dense cluttered shrub layer (i.e. habitat in which this species is most abundant; DEHP 2013)
- A FSC will be at the site on the day of clearing. The FSC will be a suitably qualified ecologist as per the definition provided in EPBC 2012/6377. The number of FSCs on site at the time of clearing will depend on the number of machines being used at any given time
- Based on the detection of any South-eastern Long-eared Bats in the locality of proposed works or adjoining areas (rather than solely on the basis of potential core habitat areas (as mapped in the EIS), the coordinates and total area of cleared their habitat will be recorded and tracked monthly against approved maximum disturbance limits and used for annual compliance reporting
- Data collection, particularly of EVNT species identified during pre-clearance surveys, during trench checking or in other Project related activities, will be ongoing until rehabilitation is complete (B163)
- Monitoring will be conducted during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- In accordance with the Pest Management Plan routine inspections will be conducted for pest flora and evidence of pest fauna within Project disturbed areas (B171)
- After decommissioning, rehabilitation areas will be inspected for regrowth similar to the surrounding environment (B177)
- Routine monitoring of rehabilitation success will be undertaken (B183)
- Buffer zones and the Project footprint will be routinely monitored using satellite imagery (B215)
- Monitoring of the rehabilitated areas will be undertaken to identify whether the general objectives of the rehabilitation strategy are being met, and whether a sustainable and stable landform has been achieved. Monitoring will be conducted by suitably skilled and qualified persons at representative locations. Annual reviews of monitoring data will be conducted during operations, and post closure, to assess trends and performance (B591)
- Monitoring and inspection of avoidance, mitigation and management measures will be implemented to ensure the impacts and residual risks continue to be low throughout the lifetime of the Project (B640)

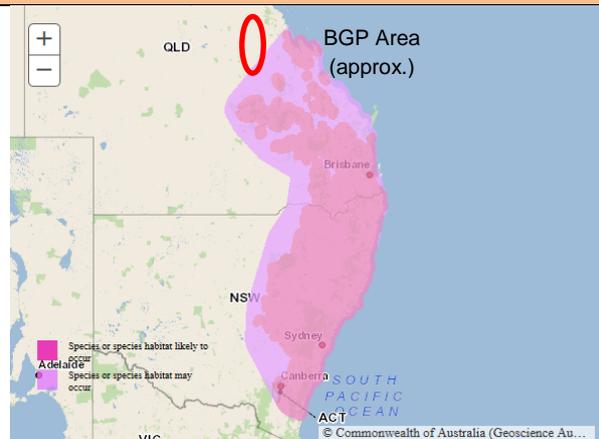
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Large-eared Pied Bat – *Chalinolobus dwyeri*



C. dwyeri distribution map (DotEE, 2018j) Photo: Hogan, L., Queensland Herbarium, DSITIA, 2001

Status

Vulnerable (EPBC Act); Vulnerable (Qld Nature Conservation Act)

Distribution and Habitat

The current distribution of *Chalinolobus dwyeri* is poorly known with records from Shoalwater Bay near Rockhampton in the north to near Ulladulla in the south (TSSC, 2010). Much of the known distribution is in NSW (EPA, 2007 as cited in TSSC, 2010), however, the species has also been record in Queensland from the Blackdown Tablelands, the Carnarvon and the Expedition Ranges and south to the border at Wilson’s Peak and Girraween. Hoye (2005), as cited in TSSC (2010) surmises that the populations in north-eastern New South Wales and south-east Queensland, Shoalwater Bay and Blackdown Tablelands are likely to be isolated with little interaction with other populations.

The Queensland Government’s potential habitat modelling for the species shows all modelled potential habitat extends southwards from the southern tip of the BGP area on the Blackdown Tablelands or is well to the east (Butler and Laidlaw, 2012h). However, Fly by Night Surveys Pty Ltd (2005), as cited in DERM (2011), identify areas north or the Blackdown Tablelands as “potential areas of occurrence requiring further investigation”.

The species requires a combination of sandstone cliff/escarpment with suitable caves to provide roosting habitat that is adjacent to higher fertility sites particularly box gum woodlands or river/rainforest corridors which are used for foraging (Pennay, pers. comm. as cited in TSSC, 2010). Most records are within several kilometres of cliffs or rocky terrain (DERM, 2011).

Nursery roosts structure appears to be specific (including requirements for arch caves of adequate depth with indented dome roofs) and these physical requirements are a limiting factor. Connectivity between roost sites and remnant vegetation is likely to be an important factor (DECC, 2007; Pennay, 2008; Pennay, pers. comm. as cited in TSSC, 2010). The majority of records are from canopied habitat, suggesting a sensitivity to clearing, although narrow connecting riparian strips in otherwise cleared habitat are sometimes quite heavily used (DECC 2007, as cited in DERM, 2011).

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| Records relevant to BGP |
| <p>The Large-eared Pied Bat was not recorded during the recent detailed surveys within the BGP area or during previous EIS ecological studies.</p> <p>There is one record from the Blackdown Tablelands near the southern boundary of the BGP area (Butler and Laidlaw, 2012h and Qld Govt, 2018g).</p> |
| Presence of habitat within BGP area |
| <p>DotEE (2018j) shows potential habitat as possibly extending as far north as the south-eastern corner of the BGP area and Fly by Night Surveys Pty Ltd (2005), as cited in DERM (2011), identify areas north or the Blackdown Tablelands as “potential areas of occurrence requiring further investigation”. As such, Core habitat for the species within the BGP has been mapped and is illustrated in the figure at Appendix D.9.</p> <p>However it is considered that there is a low likelihood that the Large-eared Pied Bat actually occurs in all but the extreme south-eastern corner of the tenement (the Blackdown Tableland plateau extends 3km into the tenement). The likelihood beyond this corner is considered low based on:</p> <ul style="list-style-type: none"> • the absence of records during the BGP EIS and subsequent detailed assessments with the area • lack of records of this species the BGP area (Qld Govt,2018g) • the species highly specific habitat requirements (i.e. proximity to arch caves of adequate depth), and • the Queensland Government’s potential habitat modelling showing all habitat as being to the south or further east of the BGP area (Butler and Laidlaw, 2012h). <p>As such, the results of ongoing pre-clearance surveys, spotter-catcher findings and monitoring results will be taken into account in confirming and calculating actual areas of impact to core habitat within the BGP area (if any).</p> |
| General threats |
| <p>Disturbance and damage at primary nursery roosts by animals and humans (recreational activities associated with cliffs), loss of foraging habitat (which must be adjacent to roosting sites) and predation by foxes and other predators (DERM 2011 and Pennay, pers comm. as cited in TSSC, 2010).</p> |
| BGP specific threats |
| <p>Disturbance of up to a maximum of 1,451.44 ha of core habitat for this species is included in EPBC Act decision (EPBC 2012/6377). This area was based on the area of Regional Ecosystems that were identified by the EIS as having suitable structural characteristics to support the species. However, impacts upon habitat actually supporting the species (if any) are likely to be much less and will be confirmed and quantified by preclearance survey.</p> <p>BGP activities will avoid suitable roosting caves but, in the absence of appropriate management measures, have the potential to disturb and fragment adjacent foraging habitat and contribute to changes in pest animal population characteristics. They also have the potential to cause direct injury or mortality.</p> |

BGP specific mitigation measures (Arrow BGP SREIS 2014 – commitment number in parenthesis)

Habitat loss, fragmentation and disturbance

- When the project activities proceed through the detailed planning phase, a field inspection of the specified disturbance footprint (this is specified by a surveyor in the field) will be undertaken by a suitably qualified ecologist and the presence, absence and extent of environmental values will be verified and mapped in the field via GIS. The results of this step will be recorded within Geocortex and the Arrow Sharepoint database
- Where environmental values are confirmed, a ‘framing trade-offs’ session will be held with the project engineers, planners and ecologists to determine if the location of the activities can be modified to avoid and/or reduce the impact to environmental values. In the event that any occupied roosting caves are present these will be excluded from the developable footprint and buffered (buffer distance to be determined by an suitably qualified person to ensure no disturbance of bats) Impacts to *C. dwyeri* foraging habitat (habitat that is contiguous with occupied roosts) cannot be avoided, the actual area to be cleared will be surveyed to quantify the impacts. This data will be recorded and cumulative impact areas tracked
- Disturbance within core habitat for EVNT species will be avoided where possible (B131)
- Pre-construction / pre-clearance surveys will be conducted to identify any additional areas that need to be avoided (B132)
- Infrastructure will be designed to avoid undisturbed tracts of remnant vegetation, where practical. Where collection and gathering infrastructure is to be placed within contiguous vegetation, collection networks will be designed to avoid dissection (B134)
- Access track location will avoid the repeated isolation of small parcels of remnant vegetation from more continuous tracts (B135)
- Vegetation disturbance will be minimised wherever practical. Corridors for linear infrastructure will be as narrow as practical, particularly when crossing linear corridors of vegetation (e.g. Isaac River and Suttor Creek). Areas cleared for field development will be as small as practical (B136)
- Habitat trees will be retained where practicable (B137)
- Trees will be felled away from existing vegetation not identified for removal where practicable (B150)
- Access tracks and pipelines will deviate around sensitive vegetation where practicable (B140)
- Construction activities in sensitive areas will be supervised to ensure appropriate methods (e.g., narrowing of RoW) are being implemented, where required (B182)
- Damaging trees (e.g. through scraping of tree trunk or breaking of limbs by equipment) not identified for removal will be avoided where practicable (B151)
- Delineation of disturbance boundary limits of works will be clearly established prior to commencement of clearing and soil stripping (B049)
- Monitoring will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- Lighting will be designed in a manner that limits disruption on landscape character, views

and visual amenity and direct lighting into the infrastructure siting rather than dispersed into native vegetation when sites are adjacent to intact habitat (B099)

- Any residual impacts to Large-eared Pied Bat Core Habitat (as confirmed by pre-clearance survey) will be offset A detailed BGP Phase 1 Offset Strategy and additional offset strategies for the subsequent phases will be developed and implemented to add value rather than just compensating for impacts (if any)

Predation by foxes and other predators

- A declared weed and pest management plan will be developed in accordance with the Petroleum Industry – Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008). The pest management plan will include, as a minimum, training, management of pest spread, management of pest infestations and monitoring effectiveness of control measures (B191)
- In accordance with the Pest Management Plan routine inspections for pest flora and evidence of pest fauna will be undertaken within Project disturbed areas (B171)

Disturbance and damage to primary nursery roosts by animals and humans

- As per the above two dot points a declared weed and pest management plan will be developed and implemented for the Project which will addressing pest animal management (B171 and B191)
- Noise control techniques will be implemented in accordance with the noise and vibration commitments and standard industry noise suppression techniques (B146)
- Harassment of wildlife and the unauthorised collection of flora or fauna will be prohibited, unless directed by a suitably qualified and experienced person (B149)

Direct injury or mortality

- Harassment of wildlife and the unauthorised collection of flora or fauna will be prohibited, unless directed by a suitably qualified and experienced person (B149)
- Suitably qualified animal handler or ecologist will be used to capture injured wildlife, where possible. Injured wildlife resultant from land clearing will be taken to a qualified veterinary surgeon or carer where practical (B153) The FSC will be at the site on the day of clearing. The FSC will be a suitably qualified ecologist as per the definition provided in EPBC 2012/6377. The number of FSCs on site at the time of clearing will depend on the number of machines being used at any given time
- All reasonable and practicable attempts (if safe to do so) will be made to check suitable caves for the presence of this species
- Potential breeding places will be clearly marked in the field with spray paint, coloured flagging tape (unless not permitted by land owners, e.g. some cattle properties), or by other suitable methods
- Further checks of identified potential nests will be undertaken immediately prior to commencing vegetation clearing
- Speed limits will be developed for Project controlled roads with due consideration to reduce the potential for vehicle collisions with wildlife (B154)
- During rehabilitation works, care will be taken when moving stockpiled logs and vegetation to avoid fauna mortality (B186)

Monitoring

Arrow will implement the following:

- Ecological Impact Assessment Procedure (ORG-ARW-HSM-PRO-00070) – this document provides the step by step process implemented for all Arrow development activities that involve significant disturbance to land, including the requirement to record the GPS coordinates and maps of all vegetated areas that have required clearing
- Fauna Management Procedure (ORG-ARW-HSM-PRO-00067) – this document informs all Arrow staff and contractors of their obligations to protect and manage native fauna whilst operating on Arrow controlled works sites. It includes the requirements to:
 - Record and report all interactions with fauna to the Arrow Ecologist (notification within 24 hours using the Fauna Incident Notification (FIN) form is required for listed threatened, near threatened and special least concern fauna)
 - Record and report all interactions with fauna to the regulator, under their own permit, as required (but not before reporting to the Arrow Ecologist)
 - Mitigation measures that have been constructed and implemented (e.g. fauna exclusion fences) must be monitored regularly and their effectiveness reported by the Site Supervisor
 - Any ongoing actions required (e.g. monitoring and maintenance) are to be clearly communicated during site handover processes, and must be implemented, monitored and their effectiveness reported
- As per Condition 13 of the *Variations to Conditions Attached to Approval (25/03/2018)* for the BGP (EPBC 2012/6377), no Project Phases will commence until an Offset Strategy addressing offset obligations for that Project Phase has been developed by Arrow and approved by the Minister. Each Strategy will set out a program for monitoring and reporting on the effectiveness of the management measures, and identify the performance and completion criteria to be tracked for the offset areas
- For areas mapped as core habitat for the Large-eared Pied Bat, the pre-clearance survey will include observations for arch caves of adequate depth and adjoining patches of vegetation
- A FSC will be at the site on the day of clearing. The FSC will be a suitably qualified ecologist as per the definition provided in EPBC 2012/6377. The number of FSCs on site at the time of clearing will depend on the number of machines being used at any given time
- Based on the detection of any Large-eared Pied Bats in the locality of proposed works or adjoining areas (rather than solely on the basis of potential core habitat areas (as mapped in the EIS), the coordinates and total area of cleared their habitat will be recorded and tracked monthly against approved maximum disturbance limits and used for annual compliance reporting
- Data collection, particularly of EVNT species identified during pre-clearance surveys, during trench checking or in other Project related activities, will be ongoing until rehabilitation is complete (B163)
- Monitoring will be conducted during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- In accordance with the Pest Management Plan routine inspections will be conducted for pest

flora and evidence of pest fauna within Project disturbed areas (B171)

- After decommissioning, rehabilitation areas will be inspected for regrowth similar to the surrounding environment (B177)
- Routine monitoring of rehabilitation success will be undertaken (B183)
- Buffer zones and the Project footprint will be routinely monitored using satellite imagery (B215)
- Monitoring of the rehabilitated areas will be undertaken to identify whether the general objectives of the rehabilitation strategy are being met, and whether a sustainable and stable landform has been achieved. Monitoring will be conducted by suitably skilled and qualified persons at representative locations. Annual reviews of monitoring data will be conducted during operations, and post closure, to assess trends and performance (B591)
- Monitoring and inspection of avoidance, mitigation and management measures will be implemented to ensure the impacts and residual risks continue to be low throughout the lifetime of the Project (B640)

References

- Butler, D. and Laidlaw, M. (2012h). Potential habitat model for *Chalinolobus dwyeri* large-eared pied bat. Map date 30/08/2012. Queensland Department of Science, Information Technology, Innovation and the Arts (DSITIA). Sourced from <https://environment.ehp.qld.gov.au/species-search/details/?id=971#> on 26 March 2018.
- DERM (2011). *National recovery plan for the large-eared pied bat* *Chalinolobus dwyeri*. Report to the Department of Sustainability, Environment, Water, Population and Communities, Canberra. Available from: <http://www.environment.gov.au/biodiversity/threatened/recovery-plans/national-recovery-plan-large-eared-pied-bat-chalinolobus-dwyeri>. In effect under the EPBC Act from 10-Feb-2012.
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- Qld Govt (2018g). Sighting data associated with the Species profile – *Chalinolobus dwyeri* (Vespertilionidae) sourced from: <https://environment.ehp.qld.gov.au/species-search/details/?id=9371#> on 26 March 2018.
- TSSC (2010). Commonwealth Listing Advice on *Chalinolobus dwyeri* (Large-eared Pied Bat). Canberra, ACT: Department of Sustainability, Environment, Water, Population and Communities. Available from: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/183-listing-advice.pdf> In effect under the EPBC Act from 29-Jun-2012.

Greater Glider – *Petauroides volans*



P. volans distribution map (DotEE 2018k)

Photo: Australian Photography

Status

Vulnerable (EPBC Act); Vulnerable (Qld Nature Conservation Act)

Distribution and Habitat

The Greater Glider (*Petauroides volans*) is the largest gliding possum in Australia. Its distribution extends from the Windsor Tableland in north Queensland, south to Wombat State Forest in central Victoria (Woinarski *et al.*, 2014). Inland isolated subpopulations are also known from the Gregory Range (west of Townsville) (Winter *et al.*, 2004), and another in the Einasleigh Uplands bioregion of Queensland (Vanderduys *et al.*, 2012).

The species is predominately restricted to eucalypt forests and woodlands. Greater gliders occur in highest abundance in taller, montane, moist eucalypt forests with larger, relatively old trees and abundant hollows (Andrews *et al.*, 1994; Kavanagh, 2000; Eyre, 2004; van der Ree *et al.*, 2004; Vanderduys *et al.*, 2012). In areas west of the Great Dividing Range, they are found in low woodlands (McKay, 2008). The species prefers forests with a diverse range of eucalypt species, due to seasonal variation in favoured tree species (usually one or two species of eucalypt in any particular area) (Kavanagh, 1984). Even in suitable habitat, the distribution may be patchy (Kavanagh, 2000).

Home ranges are usually 1 – 4 ha in size (Henry, 1984; Kehl and Borsboom, 1984; Comport *et al.*, 1996; Gibbons and Lindenmayer, 2002; Pope *et al.*, 2005), however in lower productivity forest and more open woodland habitats home ranges can be up to 16 ha (Eyre, 2004; Smith *et al.*, 2007). Males have a larger home range size than females and sexes usually share a den when the breeding season commences (Kavanagh and Wheeler, 2004; Pope *et al.*, 2005; McKay, 2008).

Records relevant to the BGP

Although the Qld Govt (2018h) database does not hold any records of the species from within the BGP, these records do occur in the vicinity of, and surrounding, the BGP. There are also unverified records from within the northern portions of the BGP and the species is considered likely to be present to at least a limited extent. The Qld Govt (2018h) records are particularly associated with

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| larger tracks of native vegetation. |
| Presence of habitat within BGP area |
| The figure at Appendix D.10 shows the location of core habitat possible within the BGP as mapped by Arrow based on REs identified as being potentially suitable for the species. |
| General threats |
| <p>Cumulative effects of clearing and logging activities, current burning regimes and the impacts of climate change are a major threat to large hollow-bearing trees on which the species relies (TSSC, 2016). In particular:</p> <ul style="list-style-type: none"> • Major habitat loss and fragmentation, mostly through clearing, clear fell logging and the loss of senescent trees due to prescribed fire regimes (Eyre, 2004; Lindenmayer <i>et al.</i>, 2000; Taylor and Goldingay, 2009) • Inappropriate fire regimes (Lindenmayer <i>et al.</i>, 2013) • Effects from climate change such as range contraction (particularly in northern parts of its range) and declines in the health of eucalypt trees (Kearney <i>et al.</i>, 2010; Matusick <i>et al.</i>, 2013) • Hyper-predation by owls (McKay, 2008; Bilney <i>et al.</i>, 2010; Lindenmayer <i>et al.</i>, 2011) • Increased competition for hollows from other species (e.g. sulphur-crested cockatoos) |
| BGP specific threats |
| BGP activities will require clearing of hollow-bearing trees and, in the absence of appropriate mitigation measures, would also have the potential to cause unnecessary loss, fragmentation and degradation of habitat as well as influence burning regimes. They also have the potential to cause direct injury or mortality. |
| BGP specific mitigation measures (Arrow BGP SREIS 2014 – commitment number in parenthesis) |
| <p><i>Habitat loss, fragmentation and degradation</i></p> <ul style="list-style-type: none"> • When the project activities proceed through the detailed planning phase, a field inspection of the specified disturbance footprint (this is specified by a surveyor in the field) will be undertaken by a suitably qualified ecologist and the presence, absence and extent of environmental values will be verified and mapped in the field via GIS. The results of this step will be recorded within Geocortex and the Arrow Sharepoint database • Where environmental values are confirmed, a ‘framing trade-offs’ session will be held with the project engineers, planners and ecologists to determine if the location of the activities can be modified to avoid and/or reduce the impact to environmental values. In the event that impacts to Greater Glider habitat cannot be avoided, the actual area to be cleared will be surveyed to quantify the impacts. This data will be recorded and cumulative impact areas tracked • Disturbance within core habitat for EVNT species will be avoided where possible (B131) • Pre-construction / pre-clearance surveys will be conducted to identify any additional areas that need to be avoided (B132) • Infrastructure will be designed to avoid undisturbed tracts of remnant vegetation, where practical. Where collection and gathering infrastructure is to be placed within contiguous |

vegetation, collection networks will be designed to avoid dissection (B134)

- Access track location will avoid the repeated isolation of small parcels of remnant vegetation from more continuous tracts (B135)
- Vegetation disturbance will be minimised wherever practical. Corridors for linear infrastructure will be as narrow as practical, particularly when crossing linear corridors of vegetation (e.g. Isaac River and Suttor Creek). Areas cleared for field development will be as small as practical (B136)
- Habitat trees will be retained where practicable (B137)
- Trees will be felled away from existing vegetation not identified for removal where practicable (B150)
- Access tracks and pipelines will deviate around sensitive vegetation where practicable (B140)
- Construction activities in sensitive areas will be supervised to ensure appropriate methods (e.g., narrowing of RoW) are being implemented, where required (B182)
- Damaging trees (e.g. through scraping of tree trunk or breaking of limbs by equipment) not identified for removal will be avoided where practicable (B151)
- Trees will be assessed for potential nesting hollows prior to felling. If hollows are identified, trees will be felled in the presence of a qualified FSC and rolled so that the hollows are facing upwards, allowing fauna to escape (B189)
- Delineation of disturbance boundary limits of works will be clearly established prior to commencement of clearing and soil stripping (B049)
- Monitoring will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- Lighting will be designed in a manner that limits disruption on landscape character, views and visual amenity and direct lighting into the infrastructure siting rather than dispersed into native vegetation when sites are adjacent to intact habitat (B099)

Fire

- Project infrastructure and facilities will be designed and constructed in accordance with applicable codes and standards (B477)
- Fire management plans will be developed for production facilities (B471)
- Arrow will develop emergency response plans in consultation with emergency services organisations that includes a list of required equipment, training and other resources, and foreseeable emergency and crisis situations (including escapes, blowouts, gas fire, bushfire, critical equipment failure, trapped or missing people, flooding, cyclones, power failure, security incidents and threats, and transport incidents). The plans will include safe evacuation procedures, communication protocols (internal and to emergency services, including the Petroleum and Gas Inspectorate), accounting for personnel and visitors, roles and responsibilities, and requirements for training (B480)
- Radiation exclusion zones around flares will be designed according to API standard (B485)
- Enclosed spaces where flammable gas may accumulate will be minimised (B487)
- Fire-fighting equipment will be installed, inspected and serviced in accordance with risk assessments and relevant legislation and standards (B499)
- Gathering lines will be buried at a minimum depth of 600 mm. Where gathering lines are present

above the ground (at wellheads and at vents or drains), a clear area will be maintained. The size of the cleared area will be determined on a site-by-site basis with consideration of the site-specific risk of bushfire (B503)

- Fire-safety equipment will be commissioned in the early phase of the construction period (B505)
- All buildings and production facilities will be fitted with smoke or fire alarms (B506)
- Fire and gas detection systems to shutdown compressors will be installed (B508)
- Protocols for the control of operational activities during extreme fire danger periods, e.g., flaring or shutdowns, will be developed (B533)
- Regular patrols and inspections of pipeline easements will be conducted, including assessment of the status of signposting subsidence and of fire breaks (B536)
- Vegetation surrounding production facilities and wellheads will be maintained in a manner that limits the amount of combustible material in the area. The size of the cleared area will be determined on a site-by-site basis with consideration of the site-specific risk of bushfire (B544)
- Access tracks to well sites will be kept clear of dry grass and combustible material wherever practicable and where there is a higher risk of bushfire (to minimise the risk of dry grass being ignited by hot components of vehicles accessing the sites) (B547)
- Daily operations will be managed with consideration of the fire danger current at that time (B548)

Direct injury or mortality

- Harassment of wildlife and the unauthorised collection of flora or fauna will be prohibited, unless directed by a suitably qualified and experienced person (B149)
- Suitably qualified animal handler or ecologist will be used to capture injured wildlife, where possible. Injured wildlife resultant from land clearing will be taken to a qualified veterinary surgeon or carer where practical (B153) The FSC will be at the site on the day of clearing. The FSC will be a suitably qualified ecologist as per the definition provided in EPBC 2012/6377. The number of FSCs on site at the time of clearing will depend on the number of machines being used at any given time
- All reasonable and practicable attempts (if safe to do so) will be made to check suitable hollows for the presence of this species
- Potential breeding places will be clearly marked in the field with spray paint, coloured flagging tape (unless not permitted by land owners, e.g. some cattle properties), or by other suitable methods
- Further checks of identified potential nests will be undertaken immediately prior to commencing vegetation clearing
- Speed limits will be developed for Project controlled roads with due consideration to reduce the potential for vehicle collisions with wildlife (B154)
- During rehabilitation works, care will be taken when moving stockpiled logs and vegetation to avoid fauna mortality (B186)

Monitoring

Arrow will implement the following:

- Ecological Impact Assessment Procedure (ORG-ARW-HSM-PRO-00070) – this document provides the step by step process implemented for all Arrow development activities that involve significant disturbance to land, including the requirement to record the GPS coordinates and maps of all vegetated areas that have required clearing
- Fauna Management Procedure (ORG-ARW-HSM-PRO-00067) – this document informs all Arrow staff and contractors of their obligations to protect and manage native fauna whilst operating on Arrow controlled works sites. It includes the requirements to:
 - Record and report all interactions with fauna to the Arrow Ecologist (notification within 24 hours using the Fauna Incident Notification (FIN) form is required for listed threatened, near threatened and special least concern fauna)
 - Record and report all interactions with fauna to the regulator, under their own permit, as required (but not before reporting to the Arrow Ecologist)
 - Mitigation measures that have been constructed and implemented (e.g. fauna exclusion fences) must be monitored regularly and their effectiveness reported by the Site Supervisor
 - Any ongoing actions required (e.g. monitoring and maintenance) are to be clearly communicated during site handover processes, and must be implemented, monitored and their effectiveness reported
- For areas mapped as core habitat for the Greater Glider, the pre-clearance survey will include observations of tree hollows
- A FSC will be at the site on the day of clearing. The FSC will be a suitably qualified ecologist as per the definition provided in EPBC 2012/6377. The number of FSCs on site at the time of clearing will depend on the number of machines being used at any given time
- Based on the detection of any Greater Gliders in the locality of proposed works or adjoining areas (rather than solely on the basis of potential core habitat areas (as mapped in the EIS), the coordinates and total area of cleared their habitat will be recorded and tracked
- Data collection, particularly of EVNT species identified during pre-clearance surveys, during trench checking or in other Project related activities, will be ongoing until rehabilitation is complete (B163)
- Monitoring will be conducted during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- After decommissioning, rehabilitation areas will be inspected for regrowth similar to the surrounding environment (B177)
- Routine monitoring of rehabilitation success will be undertaken (B183)
- Buffer zones and the Project footprint will be routinely monitored using satellite imagery (B215)
- Monitoring of the rehabilitated areas will be undertaken to identify whether the general objectives of the rehabilitation strategy are being met, and whether a sustainable and stable landform has been achieved. Monitoring will be conducted by suitably skilled and qualified persons at representative locations. Annual reviews of monitoring data will be conducted

during operations, and post closure, to assess trends and performance (B591)

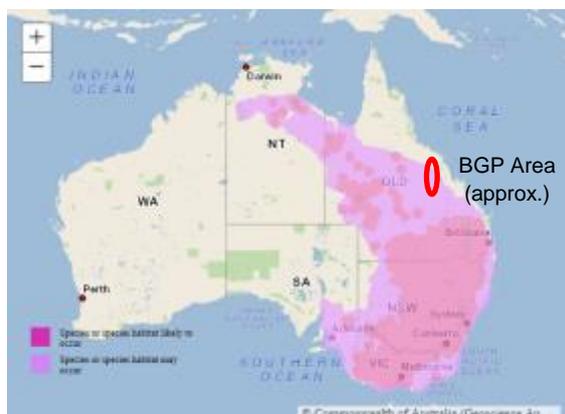
- Monitoring and inspection of avoidance, mitigation and management measures will be implemented to ensure the impacts and residual risks continue to be low throughout the lifetime of the Project (B640)

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Painted Honeyeater – *Grantiella picta*



G. picta distribution map (DotEE 2018I)

Photo: Australian Wildlife Conservancy

Status

Vulnerable (EPBC Act); Vulnerable (Qld Nature Conservation Act)

Distribution and Habitat

Endemic to Australia, the Painted Honeyeater (*Grantiella picta*) may be found from the eastern section of the Northern Territory to Victoria and southern regions of South Australia (Pizzey and Knight, 2007). Rare in the Northern Territory, they are widespread throughout Queensland, absent only from Cape York and high rainfall areas.

Painted Honeyeaters occur mainly in dry open woodlands and forests, particularly box-ironbark woodlands. They may also be located in riparian forest, on plains with scattered eucalypts, and in remnant trees on farmland. Their occurrence is strongly associated with mistletoe, on which they feed (Higgins *et al.*, 2001) and fragmented or disturbed Acacia communities often have the highest density of mistletoe. More advanced stands of Acacia regrowth may also have abundant mistletoe.

Painted Honeyeaters feed almost exclusively on mistletoe fruit, but may also collect nectar and invertebrates (Oliver *et al.*, 2003). Most foraging is undertaken within the canopy of trees (Higgins *et al.*, 2001).

Nesting occurs during spring-summer (September to February), predominantly in the south-east of its range north to and around Brisbane. The breeding season is determined by photoperiod to coincide with warmer summer months, but actual breeding is cued in relation to the progression of mistletoe fruiting. This ensures that breeding is matched by peak resource availability, avoiding temporal variation inherent in unpredictable environments (Barea and Watson, 2007).

Small, frail cup-shape nests with narrow sides are constructed in the outer foliage and branchlets of eucalypts, casuarinas and acacias. However, a disproportionately large number of nests are placed in mistletoe clumps in taller trees (Whitemore and Eller, 1983; Beruldsen, 2003; Barea, 2008).

While not well understood, movement patterns are generally described as a north-south migration (Keast, 1968). Populations move north during winter and return south of approximately 26° during

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| spring-summer to breed (Higgins <i>et al.</i> , 2001). |
| Records relevant to the BGP |
| There are no Painted Honeyeater records within the BGP area in the Qld Govt (2018I) database. The nearest record is approximately 20km south of the southern edge of the BGP area (south of the Blackdown Tablelands). |
| Presence of habitat within BGP area |
| The figure at Appendix D.10 shows the location of core habitat possible within the BGP as mapped by Arrow based on REs identified as being potentially suitable for the species. This mapping does not take into account the occurrence of dense mistletoe. |
| General threats |
| Habitat loss, competition with the noisy miner (<i>Manorina melanocephala</i>); predation by invasive species (e.g. <i>Rattus rattus</i>); deliberate destruction of mistletoe in production forests; exacerbation of tree decline through pasture improvement activities; collision with road vehicles; and nest predation by pied currawongs (<i>Strepera graculina</i>), pied and grey butcherbirds (<i>Cracticus nigrogularis</i> and <i>Cracticus torquatus</i>), and crows and ravens (Corvidae) (DoE, 2015b). |
| SGP specific threats |
| In the absence of appropriate mitigation measures, BGP activities have the potential to cause unnecessary loss of habitat as well as increase the incidence of collisions with road vehicles and otherwise cause direct injury or mortality. |
| SGP specific mitigation measures (Arrow BGP SREIS 2014 – commitment number in parenthesis) |
| <p>Habitat loss and degradation</p> <ul style="list-style-type: none"> • When the project activities proceed through the detailed planning phase, a field inspection of the specified disturbance footprint (this is specified by a surveyor in the field) will be undertaken by a suitably qualified ecologist and the presence, absence and extent of environmental values will be verified and mapped in the field via GIS. The results of this step will be recorded within Geocortex and the Arrow Sharepoint database • Where environmental values are confirmed, a ‘framing trade-offs’ session will be held with the project engineers, planners and ecologists to determine if the location of the activities can be modified to avoid and/or reduce the impact to environmental values. In the event that impacts to Painted Honeyeater habitat cannot be avoided, the actual area to be cleared will be surveyed to quantify the impacts. This data will be recorded and cumulative impact areas tracked • Disturbance within core habitat for EVNT species will be avoided where possible (B131) • Pre-construction / pre-clearance surveys will be conducted to identify any additional areas that need to be avoided (B132) • Infrastructure will be designed to avoid undisturbed tracts of remnant vegetation, where practical. Where collection and gathering infrastructure is to be placed within contiguous vegetation, collection networks will be designed to avoid dissection (B134) |

- Access track location will avoid the repeated isolation of small parcels of remnant vegetation from more continuous tracts (B135)
- Vegetation disturbance will be minimised wherever practical. Corridors for linear infrastructure will be as narrow as practical, particularly when crossing linear corridors of vegetation (e.g. Isaac River and Suttor Creek). Areas cleared for field development will be as small as practical (B136)
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- Delineation of disturbance boundary limits of works will be clearly established prior to commencement of clearing and soil stripping (B049)
- Monitoring will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)

Direct injury or mortality (including vehicle strike)

- Harassment of wildlife and the unauthorised collection of flora or fauna will be prohibited, unless directed by a suitably qualified and experienced person (B149)
- Suitably qualified animal handler or ecologist will be used to capture injured wildlife, where possible. Injured wildlife resultant from land clearing will be taken to a qualified veterinary surgeon or carer where practical (B153) The FSC will be at the site on the day of clearing. The FSC will be a suitably qualified ecologist as per the definition provided in EPBC 2012/6377. The number of FSCs on site at the time of clearing will depend on the number of machines being used at any given time
- All reasonable and practicable attempts (if safe to do so) will be made to check suitable hollows for the presence of this species
- Potential breeding places will be clearly marked in the field with spray paint, coloured flagging tape (unless not permitted by land owners, e.g. some cattle properties), or by other suitable methods
- Further checks of identified potential nests will be undertaken immediately prior to commencing vegetation clearing
- Speed limits will be developed for Project controlled roads with due consideration to reduce the potential for vehicle collisions with wildlife (B154)
- During rehabilitation works, care will be taken when moving stockpiled logs and vegetation to avoid fauna mortality (B186)

Monitoring

Arrow will implement the following:

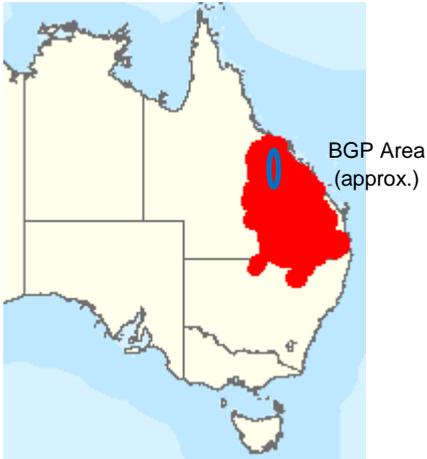
- Ecological Impact Assessment Procedure (ORG-ARW-HSM-PRO-00070) – this document provides the step by step process implemented for all Arrow development activities that involve significant disturbance to land, including the requirement to record the GPS coordinates and maps of all vegetated areas that have required clearing
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 - Record and report all interactions with fauna to the Arrow Ecologist (notification within 24 hours using the Fauna Incident Notification (FIN) form is required for listed threatened, near threatened and special least concern fauna)
 - Record and report all interactions with fauna to the regulator, under their own permit, as required (but not before reporting to the Arrow Ecologist)
 - Mitigation measures that have been constructed and implemented (e.g. fauna exclusion fences) must be monitored regularly and their effectiveness reported by the Site Supervisor
 - Any ongoing actions required (e.g. monitoring and maintenance) are to be clearly communicated during site handover processes, and must be implemented, monitored and their effectiveness reported
- For areas mapped as core habitat for the Painted Honeyeater, the pre-clearance survey will include observations for areas of dense mistletoe
- A FSC will be at the site on the day of clearing. The FSC will be a suitably qualified ecologist as per the definition provided in EPBC 2012/6377. The number of FSCs on site at the time of clearing will depend on the number of machines being used at any given time
- Based on the detection of any Painted Honeyeaters in the locality of proposed works or adjoining areas (rather than solely on the basis of potential core habitat areas (as mapped in the EIS), the coordinates and total area of cleared their habitat will be recorded and tracked
- Data collection, particularly of EVNT species identified during pre-clearance surveys, during trench checking or in other Project related activities, will be ongoing until rehabilitation is complete (B163)
- Monitoring will be conducted during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- After decommissioning, rehabilitation areas will be inspected for regrowth similar to the surrounding environment (B177)
- Routine monitoring of rehabilitation success will be undertaken (B183)
- Buffer zones and the Project footprint will be routinely monitored using satellite imagery (B215)
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during operations, and post closure, to assess trends and performance (B591)

- Monitoring and inspection of avoidance, mitigation and management measures will be implemented to ensure the impacts and residual risks continue to be low throughout the lifetime of the Project (B640)

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- Whitmore, M. J. and Eller, C. M. (1983). Observations at a nest of Painted Honeyeaters. *Emu* 83. 199-202.

| Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant) | |
|---|--|
|  <p>BGP Area (approx.)</p> |  |
| <p>Brigalow distribution map (DotEE, 2018m) Photo: KBR</p> | |
| EPBC Act Status | |
| <p>Endangered</p> | |
| Communities relevant to the BGP | |
| <p>The Brigalow TEC is relatively common in the BGP area with a number of well-preserved habitats surveyed as part of the EIS (Arrow, 2014) in more extensive areas of intact remnant vegetation supporting the following Regional Ecosystems (REs), although the majority of habitats exists as scattered, poorly preserved fragments (Arrow, 2014). The following REs which equate to the Brigalow TEC have been recorded in the BGP area:</p> <ul style="list-style-type: none"> • RE11.3.1 - <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains • RE11.4.7 - <i>Eucalyptus populnea</i> with <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest to woodland on Cainozoic clay plains • RE11.4.8 - <i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains • RE11.4.9 - <i>Acacia harpophylla</i> shrubby woodland with <i>Terminalia oblongata</i> on Cainozoic clay plains • RE11.5.16 - <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest in depressions on Cainozoic sand plains and remnant surfaces • RE11.9.1 - <i>Acacia harpophylla</i>-<i>Eucalyptus cambageana</i> woodland to open forest on fine-grained sedimentary rocks • RE11.9.5 - <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on fine-grained sedimentary rocks <p>This TEC also includes advanced (>15 yrs) Brigalow regrowth communities.</p> | |

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| Presence of habitat within BGP area |
| Core habitat for the TEC within the BGP has been mapped and is illustrated in the figure at Appendix D.10. |
| General threats |
| Clearing, fire, weeds, feral animals and inappropriate grazing (DoE, 2013). |
| SGP specific threats |
| Disturbance of up to a maximum of 781.16 ha of core habitat for this TEC is included in EPBC Act decision (EPBC 2012/6377). Without adequate mitigation measures in place, BGP activities would have the potential to remove and disturb additional habitat and contribute to altered fire frequency and increased weeds and feral animals. |
| SGP specific mitigation measures (Arrow SGP SREIS 2013 – commitment number in parenthesis) |
| <p><i>Habitat loss, fragmentation and disturbance</i></p> <ul style="list-style-type: none"> • When the project activities proceed through the detailed planning phase, a field inspection of the specified disturbance footprint (this is specified by a surveyor in the field) will be undertaken by a suitably qualified ecologist and the presence, absence and extent of environmental values will be verified and mapped in the field via GIS. The results of this step will be recorded within Geocortex and the Arrow Sharepoint database • Where environmental values are confirmed, a ‘framing trade-offs’ session will be held with the project engineers, planners and ecologists to determine if the location of the activities can be modified to avoid and/or reduce the impact to environmental values. In the event that areas of Brigalow TEC cannot be avoided, the actual area to be cleared will be surveyed to quantify the impacts. This data will be recorded and cumulative impact areas tracked • Disturbance within TECs will be avoided where possible (B131) • Pre-construction / pre-clearance surveys will be conducted to identify any additional areas that need to be avoided (B132) • Infrastructure will be designed to avoid undisturbed tracts of remnant vegetation, where practical. Where collection and gathering infrastructure is to be placed within contiguous vegetation, collection networks will be designed to avoid dissection (B134) • Access track location will avoid the repeated isolation of small parcels of remnant vegetation from more continuous tracts (B135) • Vegetation disturbance will be minimised wherever practical. Corridors for linear infrastructure will be as narrow as practical, particularly when crossing linear corridors of vegetation (e.g. Isaac River and Suttor Creek). Areas cleared for field development will be as small as practical (B136) • Trees will be felled away from existing vegetation not identified for removal where practicable (B150) • Access tracks and pipelines will deviate around sensitive vegetation where practicable (B140) |

- Plant species used for rehabilitation will be specific to the original ecosystem and local provenance, wherever possible unless the area has been cropped or contains improved pasture to be reinstated (B162)
- Construction activities in sensitive areas will be supervised to ensure appropriate methods (e.g., narrowing of RoW) are being implemented, where required (B182)
- Damaging trees (e.g. through scraping of tree trunk or breaking of limbs by equipment) not identified for removal will be avoided where practicable (B151)
- Delineation of disturbance boundary limits of works will be clearly established prior to commencement of clearing and soil stripping (B049)
- Monitoring will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- A rehabilitation management plan for decommissioning will be developed and implemented which includes monitoring and maintenance of rehabilitated areas until rehabilitation sign off criteria are met (B339)
- Any residual impacts to Brigalow TEC will be offset. A detailed BGP Phase 1 Offset Strategy and additional offset strategies for the subsequent phases will be developed and implemented to add value rather than just compensating for impacts (if any)

Fire

- Project infrastructure and facilities will be designed and constructed in accordance with applicable codes and standards (B477)
- Fire management plans will be developed for production facilities (B471)
- Arrow will develop emergency response plans in consultation with emergency services organisations that includes a list of required equipment, training and other resources, and foreseeable emergency and crisis situations (including escapes, blowouts, gas fire, bushfire, critical equipment failure, trapped or missing people, flooding, cyclones, power failure, security incidents and threats, and transport incidents). The plans will include safe evacuation procedures, communication protocols (internal and to emergency services, including the Petroleum and Gas Inspectorate), accounting for personnel and visitors, roles and responsibilities, and requirements for training (B480)
- Radiation exclusion zones around flares will be designed according to API standard (B485)
- Enclosed spaces where flammable gas may accumulate will be minimised (B487)
- Fire-fighting equipment will be installed, inspected and serviced in accordance with risk assessments and relevant legislation and standards (B499)
- Gathering lines will be buried at a minimum depth of 600 mm. Where gathering lines are present above the ground (at wellheads and at vents or drains), a clear area will be maintained. The size of the cleared area will be determined on a site-by-site basis with consideration of the site-specific risk of bushfire (B503)
- Fire-safety equipment will be commissioned in the early phase of the construction period (B505)
- All buildings and production facilities will be fitted with smoke or fire alarms (B506)
- Fire and gas detection systems to shutdown compressors will be installed (B508)
- Protocols for the control of operational activities during extreme fire danger periods, e.g.,

flaring or shutdowns, will be developed (B533)

- Regular patrols and inspections of pipeline easements will be conducted, including assessment of the status of signposting subsidence and of fire breaks (B536)
- Vegetation surrounding production facilities and wellheads will be maintained in a manner that limits the amount of combustible material in the area. The size of the cleared area will be determined on a site-by-site basis with consideration of the site-specific risk of bushfire (B544)
- Access tracks to well sites will be kept clear of dry grass and combustible material wherever practicable and where there is a higher risk of bushfire (to minimise the risk of dry grass being ignited by hot components of vehicles accessing the sites) (B547)
- Daily operations will be managed with consideration of the fire danger current at that time (B548)

Weeds and feral animals

- A declared weed and pest management plan will be developed in accordance with the Petroleum Industry – Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008). Species-specific management will be undertaken for identified key weed species at risk of spread through project activities (Mesquite, Parthenium Weed, African Lovegrass and Lippia). Weed control efforts will be increased in areas particularly sensitive to invasion. The pest management plan will include, as a minimum, training, management of pest spread, management of pest infestations and monitoring effectiveness of control measures (B191)
- When sourcing maintenance materials, such materials such as bedding sand, topsoil, straw bales and sand bags will be brought to site only after it is ascertained that the materials are not contaminated with weeds and plant or animal pathogens. A weed hygiene declaration form will be requested from the supplier where there is possible risk of contamination in products (B180)
- All relevant personnel will be made aware of the location and extent of weed infestations in the vicinity of the work area and the risks involved in moving from one site or property to another (B188)
- Construction and maintenance activities will be planned to minimise movement of plant and equipment between properties or areas with weed infestations (B230)
- Weed monitoring (and targeted weed control measures) will be undertaken within sensitive EVNT habitats (particularly threatened communities such as Brigalow and native grasslands) (B158)

Grazing

- Grazing activities will be excluded from all Arrow gas and water processing and well head infrastructure sites

Monitoring

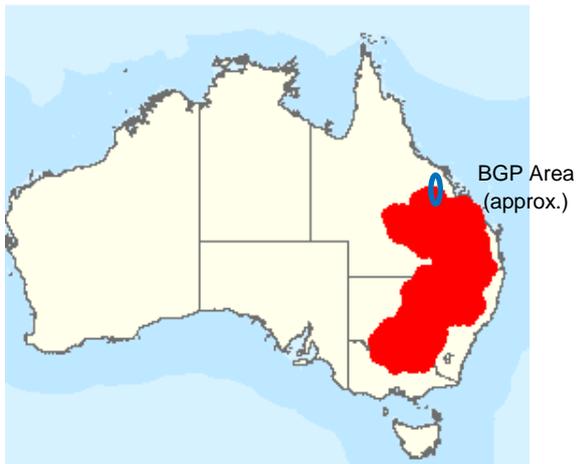
Arrow will implement the following:

- Ecological Impact Assessment Procedure (ORG-ARW-HSM-PRO-00070) – this document provides the step by step process implemented for all Arrow development activities that involve significant disturbance to land, including the requirement to record the GPS coordinates and maps of all vegetated areas that have required clearing

- As per Condition 13 of the *Variations to Conditions Attached to Approval (25/03/2018)* for the BGP (EPBC 2012/6377), no Project Phases will commence until an Offset Strategy addressing offset obligations for that Project Phase has been developed by Arrow and approved by the Minister. Each Strategy will set out a program for monitoring and reporting on the effectiveness of the management measures, and identify the performance and completion criteria to be tracked for the offset areas
- Pipeline RoWs will be routinely inspected until ground stabilisation and natural revegetation or pasture grasses or crops are established (B095)
- Weed monitoring and targeted weed control measures will be implemented within sensitive EVNT habitats (particularly threatened communities such as Brigalow and native grasslands) (B158)
- Monitoring will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- The coordinates and total area of cleared habitat will be recorded and tracked monthly against approved maximum disturbance limits and used for annual compliance reporting.
- In accordance with the Pest Management Plan routinely inspect for pest flora and evidence of pest fauna within Project disturbed areas (B171)
- After decommissioning, rehabilitation areas will be inspected for regrowth similar to the surrounding environment (B177)
- Routine monitoring of rehabilitation success will be undertaken (B183)
- Buffer zones and the Project footprint will be routinely monitored using satellite imagery (B215)
- Monitoring of the rehabilitated areas will be undertaken to identify whether the general objectives of the rehabilitation strategy are being met, and whether a sustainable and stable landform has been achieved. Monitoring will be conducted by suitably skilled and qualified persons at representative locations. Annual reviews of monitoring data will be conducted during operations, and post closure, to assess trends and performance (B591)
- Monitoring and inspection of avoidance, mitigation and management measures will be implemented to ensure the impacts and residual risks continue to be low throughout the lifetime of the Project (B640)

References

- Arrow Energy (2014). Supplementary Report to the Bowen Gas Project Environmental Impact Statement.
- DoE (2013). Approved Conservation Advice for the Brigalow (*Acacia harpophylla* dominant and co-dominant) ecological community. Canberra: Department of the Environment. Available from: <http://www.environment.gov.au/biodiversity/threatened/communities/pubs/028-conservation-advice.pdf>. In effect under the EPBC Act from 17-Dec-2013.
- DotEE (2014). Approval – Arrow Bowen Gas Project (EPBC 2012/6377). Signed 27 October 2014.
- DotEE (2018m). Species Profile and Threats Database – Brigalow (*Acacia harpophylla* dominant and co-dominant). SPRAT Profile. Sourced from: <http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=28> on 12

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|---|--|
| April 2018. | |
| Weeping Myall (<i>Acacia pendula</i>) Woodlands | |
|  <p style="text-align: right; margin-right: 50px;">BGP Area (approx.)</p> |  |
| Weeping Myall Woodlands distribution map (DotEE, 2018n) | Photo: OEH (2018) |
| EPBC Act Status | |
| Endangered | |
| Communities relevant to the BGP | |
| <p>The Weeping Myall Woodland TEC has not been confirmed within the BGP area. However, the TEC is restricted to small patches within two REs in Queensland (TSSC, 2009) namely:</p> <ul style="list-style-type: none"> • RE 11.3.2 <i>Eucalyptus populnea</i> woodland on alluvial plains • RE 11.3.28 <i>Casuarina cristata</i> +/- <i>Eucalyptus collabah</i> open woodland on alluvial plains <p>and these two REs are associated with watercourse alluviums throughout the BGP area (see figure at Appendix D.11).</p> | |
| Presence of habitat within BGP area | |
| <p>The distribution of the Weeping Myall Woodland TEC, as shown by DotEE (2018I) and the more detailed map from DEWHA (2008e), is outside of almost all of the BGP area. The southern portion around Blackwater is the only part of the BGP area that is coincident with the mapped distribution for this TEC.</p> <p>Although Arrow have included all areas mapped as containing either RE 11.3.2 or RE 11.3.28 as core habitat possible (as illustrated in the figure at Appendix D.11), the results of ongoing pre-clearance surveys will be taken into account in confirming and calculating actual areas of impact to this TEC within the BGP area (if any).</p> | |
| General threats | |
| Clearing and degradation for agriculture and from overgrazing, weed invasion and herbivory by caterpillars of the Bag-shelter Moth (DEWHA, 2008d). | |

SGP specific threats

Disturbance of up to a maximum of 79.68 ha of core habitat for this TEC is included in EPBC Act decision (EPBC 2012/6377).

Without adequate mitigation measures in place, BGP activities would have the potential to remove and disturb additional habitat and contribute to an increase in weeds.

SGP specific mitigation measures (Arrow SGP SREIS 2013 – commitment number in parenthesis)

Habitat loss and disturbance

- When the project activities proceed through the detailed planning phase, a field inspection of the specified disturbance footprint (this is specified by a surveyor in the field) will be undertaken by a suitably qualified ecologist and the presence, absence and extent of environmental values will be verified and mapped in the field via GIS. The results of this step will be recorded within Geocortex and the Arrow Sharepoint database
- Where environmental values are confirmed, a ‘framing trade-offs’ session will be held with the project engineers, planners and ecologists to determine if the location of the activities can be modified to avoid and/or reduce the impact to environmental values. In the event that areas of Weeping Myall Woodland TEC cannot be avoided, the actual area to be cleared will be surveyed to quantify the impacts. This data will be recorded and cumulative impact areas tracked
- Disturbance within TECs will be avoided where possible (B131)
- Pre-construction / pre-clearance surveys will be conducted to identify any additional areas that need to be avoided (B132)
- Infrastructure will be designed to avoid undisturbed tracts of remnant vegetation, where practical. Where collection and gathering infrastructure is to be placed within contiguous vegetation, collection networks will be designed to avoid dissection (B134)
- Access track location will avoid the repeated isolation of small parcels of remnant vegetation from more continuous tracts (B135)
- Vegetation disturbance will be minimised wherever practical. Corridors for linear infrastructure will be as narrow as practical, particularly when crossing linear corridors of vegetation (e.g. Isaac River and Suttor Creek). Areas cleared for field development will be as small as practical (B136)
- Trees will be felled away from existing vegetation not identified for removal where practicable (B150)
- Access tracks and pipelines will deviate around sensitive vegetation where practicable (B140)
- Plant species used for rehabilitation will be specific to the original ecosystem and local provenance, wherever possible unless the area has been cropped or contains improved pasture to be reinstated (B162)
- Construction activities in sensitive areas will be supervised to ensure appropriate methods (e.g., narrowing of RoW) are being implemented, where required (B182)
- Damaging trees (e.g. through scraping of tree trunk or breaking of limbs by equipment) not identified for removal will be avoided where practicable (B151)

- Delineation of disturbance boundary limits of works will be clearly established prior to commencement of clearing and soil stripping (B049)
- Monitoring will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- A rehabilitation management plan for decommissioning will be developed and implemented which includes monitoring and maintenance of rehabilitated areas until rehabilitation sign off criteria are met (B339)
- Any residual impacts to Weeping Myall TEC (if any) will be offset. A detailed BGP Phase 1 Offset Strategy and additional offset strategies for the subsequent phases will be developed and implemented to add value rather than just compensating for impacts (if any)

Grazing

- Grazing activities will be excluded from all Arrow gas and water processing and well head infrastructure sites

Weeds

- A declared weed and pest management plan will be developed in accordance with the Petroleum Industry – Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008). Species-specific management will be undertaken for identified key weed species at risk of spread through project activities (Mesquite, Parthenium Weed, African Lovegrass and Lippia). Weed control efforts will be increased in areas particularly sensitive to invasion. The pest management plan will include, as a minimum, training, management of pest spread, management of pest infestations and monitoring effectiveness of control measures (B191)
- When sourcing maintenance materials, such materials such as bedding sand, topsoil, straw bales and sand bags will be brought to site only after it is ascertained that the materials are not contaminated with weeds and plant or animal pathogens. A weed hygiene declaration form will be requested from the supplier where there is possible risk of contamination in products (B180))
- All relevant personnel will be made aware of the location and extent of weed infestations in the vicinity of the work area and the risks involved in moving from one site or property to another (B188)
- Construction and maintenance activities will be planned to minimise movement of plant and equipment between properties or areas with weed infestations (B230)
- Weed monitoring (and targeted weed control measures) will be undertaken within sensitive EVNT habitats (particularly threatened communities such as Brigalow and native grasslands) (B158)

Monitoring

Arrow will implement the following:

- Ecological Impact Assessment Procedure (ORG-ARW-HSM-PRO-00070) – this document provides the step by step process implemented for all Arrow development activities that involve significant disturbance to land, including the requirement to record the GPS coordinates and maps of all vegetated areas that have required clearing
- As per Condition 13 of the *Variations to Conditions Attached to Approval (25/03/2018)* for the BGP (EPBC 2012/6377), no Project Phases will commence until an Offset Strategy

addressing offset obligations for that Project Phase has been developed by Arrow and approved by the Minister. Each Strategy will set out a program for monitoring and reporting on the effectiveness of the management measures, and identify the performance and completion criteria to be tracked for the offset areas

- Based on the detection of any Weeping Myall Woodland TEC in the locality of proposed works (rather than solely on the basis of potential core habitat areas (as illustrated in the figure at Appendix D.11)), the coordinates and total area of cleared TEC will be recorded and tracked monthly against approved maximum disturbance limits and used for annual compliance reporting
- Pipeline RoWs will be routinely inspected until ground stabilisation and natural revegetation or pasture grasses or crops are established (B095)
- Weed monitoring and targeted weed control measures will be implemented within sensitive EVNT habitats (particularly threatened communities such as Brigalow and native grasslands) (B158)
- The coordinates and total area of cleared habitat will be recorded and tracked monthly against approved maximum disturbance limits and used for annual compliance reporting.
- Monitoring will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- In accordance with the Pest Management Plan routine inspections will be conducted for pest flora and evidence of pest fauna within Project disturbed areas (B171)
- After decommissioning, rehabilitation areas will be inspected for regrowth similar to the surrounding environment (B177)
- Routine monitoring of rehabilitation success will be undertaken (B183)
- Buffer zones and the Project footprint will be routinely monitored using satellite imagery (B215)
- Monitoring of the rehabilitated areas will be undertaken to identify whether the general objectives of the rehabilitation strategy are being met, and whether a sustainable and stable landform has been achieved. Monitoring will be conducted by suitably skilled and qualified persons at representative locations. Annual reviews of monitoring data will be conducted during operations, and post closure, to assess trends and performance (B591)
- Monitoring and inspection of avoidance, mitigation and management measures will be implemented to ensure the impacts and residual risks continue to be low throughout the lifetime of the Project (B640)

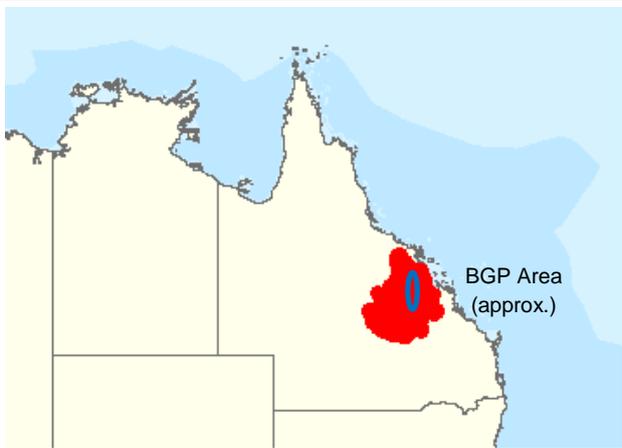
References

- Arrow Energy (2014). Supplementary Report to the Bowen Gas Project Environmental Impact Statement.
- DEWHA (2008d). *Approved Conservation Advice for Weeping Myall Woodlands ecological community*. Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: <http://www.environment.gov.au/biodiversity/threatened/communities/pubs/98-conservation-advice.pdf>. In effect under the EPBC Act from 07-Jan-2009.
- DEWHA (2008e). Area in which remnants of the Weeping Myall Woodlands ecological

community may occur. Accessed from:

<http://www.environment.gov.au/biodiversity/threatened/communities/maps/pubs/98-map.pdf> on 12 April 2018.

- DotEE (2014). Approval – Arrow Bowen Gas Project (EPBC 2012/6377). Signed 27 October 2014.
- DotEE (2018n). Species Profile and Threats Database – Weeping Myall Woodlands. SPRAT Profile. Sourced from:
<http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=98> on 12 April 2018.
- OEH (2018). Photo sourced from Hunter Valley Weeping Myall Woodland in Sydney Basin Bioregion – profile at:
<http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=20030>. Accessed on 12 April 2018.
- TSSC (2009). *Commonwealth Listing Advice on Weeping Myall Woodlands*. Department of the Environment, Water, Heritage and the Arts. Available from:
<http://www.environment.gov.au/biodiversity/threatened/communities/pubs/98-listing-advice.pdf>. In effect under the EPBC Act from 07-Jan-2009.

| Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin | |
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|  |  |
| Native Grassland distribution (DotEE, 2018o) | Photo: Steve Fox (KBR) |
| EPBC Act Status | |
| Endangered | |
| Communities relevant to the BGP | |
| <p>The Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin (Native Grassland) TEC is endemic to Queensland and broadly occurs where the Fitzroy River Basin and the Brigalow Belt North coincide. The natural grassland TEC extends from Collinsville in the north to Carnarvon National Park in the south (DEWHA, 2008f).</p> <p>The TEC is relatively common in the BGP area and is represented by (Arrow, 2014):</p> <ul style="list-style-type: none"> • RE 11.3.21 – <i>Dichanthium sericeum</i> and/or <i>Astrelba</i> spp. Grassland on alluvial plains. Cracking clay soils. • RE 11.4.4 – <i>Dichanthium</i> spp., <i>Astrelba</i> spp. Grassland on Cainozoic clay plains • RE 11.4.11 – <i>Dichanthium sericeum</i>, <i>Astrelba</i> spp. And patchy <i>Acacia harpophylla</i>, <i>Eucalyptus coolabah</i> on Cainozoic clay plains • 11.8.11 – <i>Dichanthium sericeum</i> grassland on Cainozoic igneous rocks • 11.9.3 – <i>Dichanthium</i> spp., <i>Astrelba</i> spp. Grassland on fine-grained sedimentary rocks. | |
| Presence of habitat within BGP area | |
| <p>The most extensive, best quality areas of this TEC run in a broad belt trending in an east-west direction between Glenden and Moranbah in the north of the BGP area, although fragmented remnants persist as far south as Middlemount.</p> <p>Core habitat for the TEC within the BGP has been mapped and is illustrated in the figure at Appendix D.12.</p> | |

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| General threats |
| Grazing, cropping and pasture improvement, weeds and pest animals, mining activities and construction of roads and other infrastructure are the main identified threats (DEWHA, 2008f, DSEWPAC, 2012b). |
| SGP specific threats |
| Disturbance of up to a maximum of 871.10 ha of core habitat for this species is included in EPBC Act decision (EPBC 2012/6377). Without adequate mitigation measures in place, BGP activities would have the potential to remove and disturb additional habitat and contribute to increased weeds and feral animals. They also have to potential to impact this species through soil compaction (to cracking clay soils) and mixing. |
| SGP specific mitigation measures (Arrow SGP SREIS 2013 – commitment number in parenthesis) |
| <p><i>Habitat loss, fragmentation and disturbance</i></p> <ul style="list-style-type: none"> • When the project activities proceed through the detailed planning phase, a field inspection of the specified disturbance footprint (this is specified by a surveyor in the field) will be undertaken by a suitably qualified ecologist and the presence, absence and extent of environmental values will be verified and mapped in the field via GIS. The results of this step will be recorded within Geocortex and the Arrow Sharepoint database • Where environmental values are confirmed, a ‘framing trade-offs’ session will be held with the project engineers, planners and ecologists to determine if the location of the activities can be modified to avoid and/or reduce the impact to environmental values. In the event that areas of Natural Grassland TEC cannot be avoided, the actual area to be cleared will be surveyed to quantify the impacts. This data will be recorded and cumulative impact areas tracked • Disturbance within TECs will be avoided where possible (B131) • Pre-construction / pre-clearance surveys will be conducted to identify any additional areas that need to be avoided (B132) • Infrastructure will be designed to avoid undisturbed tracts of remnant vegetation, where practical. Where collection and gathering infrastructure is to be placed within contiguous vegetation, collection networks will be designed to avoid dissection (B134) • Access track location will avoid the repeated isolation of small parcels of remnant vegetation from more continuous tracts (B135) • Vegetation disturbance will be minimised wherever practical. Corridors for linear infrastructure will be as narrow as practical, particularly when crossing linear corridors of vegetation (e.g. Isaac River and Suttor Creek). Areas cleared for field development will be as small as practical (B136) • Access tracks and pipelines will deviate around sensitive vegetation where practicable (B140) • Plant species used for rehabilitation will be specific to the original ecosystem and local provenance, wherever possible unless the area has been cropped or contains improved pasture to be reinstated (B162) • Construction activities in sensitive areas will be supervised to ensure appropriate methods |

(e.g., narrowing of RoW) are being implemented, where required (B182)

- Delineation of disturbance boundary limits of works will be clearly established prior to commencement of clearing and soil stripping (B049)
- Monitoring will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- A rehabilitation management plan for decommissioning will be developed and implemented which includes monitoring and maintenance of rehabilitated areas until rehabilitation sign off criteria are met (B339)
- Any residual impacts to Native Grassland TEC will be offset. A detailed BGP Phase 1 Offset Strategy and additional offset strategies for the subsequent phases will be developed and implemented to add value rather than just compensating for impacts (if any)

Weeds and feral animals

- A declared weed and pest management plan will be developed in accordance with the Petroleum Industry – Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008). Species-specific management will be undertaken for identified key weed species at risk of spread through project activities (Mesquite, Parthenium Weed, African Lovegrass and Lippia). Weed control efforts will be increased in areas particularly sensitive to invasion. The pest management plan will include, as a minimum, training, management of pest spread, management of pest infestations and monitoring effectiveness of control measures (B191)
- When sourcing maintenance materials, such materials such as bedding sand, topsoil, straw bales and sand bags will be brought to site only after it is ascertained that the materials are not contaminated with weeds and plant or animal pathogens. A weed hygiene declaration form will be requested from the supplier where there is possible risk of contamination in products (B180)
- All relevant personnel will be made aware of the location and extent of weed infestations in the vicinity of the work area and the risks involved in moving from one site or property to another (B188)
- Construction and maintenance activities will be planned to minimise movement of plant and equipment between properties or areas with weed infestations (B230)
- Weed monitoring (and targeted weed control measures) will be undertaken within sensitive EVNT habitats (particularly threatened communities such as Brigalow and native grasslands) (B158)

Grazing

- Grazing activities will be excluded from all Arrow gas and water processing and well head infrastructure sites

Soil compaction and mixing

- Stripped and salvaged soil will be re-used within a short period of time in areas where rehabilitation immediately follows installation of low key infrastructures (B040)
- Topsoil and associated vegetation will be appropriately stockpiled separately for rehabilitation prior to excavation or earthworks (B042)
- Soil will be stripped according to designated profile depths, subject to further field investigations during stripping (B051)

- Where practicable, stripped material will be placed directly onto area to be rehabilitated and spread immediately (if rehabilitation sequences and weather conditions permit) to avoid the requirement for stockpiling (B052)
- Soils will be separated into windrows for later collection or re-spreading to minimise compression effects of heavy equipment (B053)
- Soil transported by dump trucks may be placed directly into storage. Soil transported by scrapers will be pushed to form stockpiles by other equipment (e.g. dozer) to avoid tracking over previously laid soil to minimise compaction (B054)
- Surface of soil stockpiles will be left in as coarsely structured a condition as possible to promote infiltration and minimise erosion until vegetation is established or suitable erosion controls have been applied, and to prevent anaerobic zones from forming (B055)
- Pipeline construction will be conducted in a manner that limits the duration of exposure of soils. Stripped and salvaged soil will be re-used within a short period of time (i.e. 28 days) in areas where rehabilitation immediately follows the installation of pipelines (B063)
- Rehabilitation plans will be developed addressing ground preparation requirements, natural and constructed drainage patterns, soil erodibility, contamination, slope steepness and length, vegetation cover, land use and landowner requirements (B064)
- Topsoil will be stripped, salvaged and stockpiled separately from subsoils (B068)

Monitoring

Arrow will implement the following:

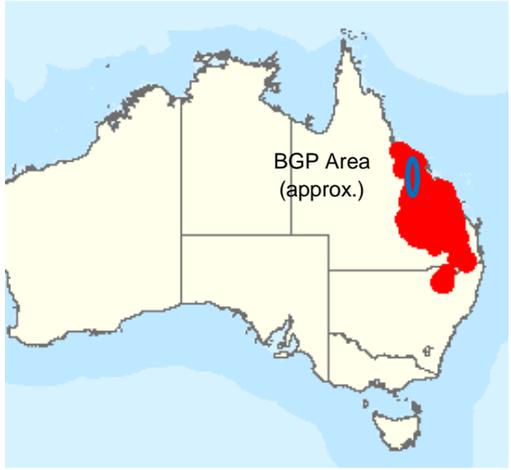
- Ecological Impact Assessment Procedure (ORG-ARW-HSM-PRO-00070) – this document provides the step by step process implemented for all Arrow development activities that involve significant disturbance to land, including the requirement to record the GPS coordinates and maps of all vegetated areas that have required clearing
- As per Condition 13 of the *Variations to Conditions Attached to Approval (25/03/2018)* for the BGP (EPBC 2012/6377), no Project Phases will commence until an Offset Strategy addressing offset obligations for that Project Phase has been developed by Arrow and approved by the Minister. Each Strategy will set out a program for monitoring and reporting on the effectiveness of the management measures, and identify the performance and completion criteria to be tracked for the offset areas
- Pipeline RoWs will be routinely inspected until ground stabilisation and natural revegetation or pasture grasses or crops are established (B095)
- Weed monitoring and targeted weed control measures will be implemented within sensitive EVNT habitats (particularly threatened communities such as Brigalow and native grasslands) (B158)
- Monitoring will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- The coordinates and total area of cleared habitat will be recorded and tracked monthly against approved maximum disturbance limits and used for annual compliance reporting.
- In accordance with the Pest Management Plan routinely inspect for pest flora and evidence of pest fauna within Project disturbed areas (B171)
- After decommissioning, rehabilitation areas will be inspected for regrowth similar to the

surrounding environment (B177)

- Routine monitoring of rehabilitation success will be undertaken (B183)
- Buffer zones and the Project footprint will be routinely monitored using satellite imagery (B215)
- Monitoring of the rehabilitated areas will be undertaken to identify whether the general objectives of the rehabilitation strategy are being met, and whether a sustainable and stable landform has been achieved. Monitoring will be conducted by suitably skilled and qualified persons at representative locations. Annual reviews of monitoring data will be conducted during operations, and post closure, to assess trends and performance (B591)
- Monitoring and inspection of avoidance, mitigation and management measures will be implemented to ensure the impacts and residual risks continue to be low throughout the lifetime of the Project (B640)

References

- Arrow Energy (2014). Supplementary Report to the Bowen Gas Project Environmental Impact Statement.
- DotEE (2014). Approval – Arrow Bowen Gas Project (EPBC 2012/6377). Signed 27 October 2014.
- DotEE (2018o). Species Profile and Threats Database – Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin. SPRAT Profile. Sourced from: <http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=99> on 16 April 2018.
- DEWHA (2008f). *Approved Conservation Advice for Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin*. Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: <http://www.environment.gov.au/biodiversity/threatened/communities/pubs/99-conservation-advice.pdf>. In effect under the EPBC Act from 07-Jan-2009.
- DSEWPAC (2012b). *Nationally Threatened Ecological Communities: Natural Grasslands on Basalt and Fine-textured Alluvial Plains of the Northern New South Wales and Southern Queensland, and Natural Grasslands of the Queensland Central Highlands and the Northern Fitzroy Basin*. Commonwealth of Australia. Canberra. Available from <http://www.environment.gov.au/system/files/resources/347c5d4e-cef8-411c-b53c-bed3ed1d3e1c/files/bio237-0512-natural-grasslands-guide.pdf>. Sourced 16 April 2018.

| Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (SEVT) | |
|--|--|
|  <p>BGP Area (approx.)</p> |  |
| SEVT distribution map (DotEE, 2018p) | Photo: KBR |
| EPBC Act Status | |
| Endangered | |
| Communities relevant to the BGP | |
| <p>The SEVT TEC in the BGP area includes the following REs:</p> <ul style="list-style-type: none"> • RE 11.3.11 – Semi-evergreen vine thicket on alluvial plains • RE 11.4.1 – Semi-evergreen vine thicket ± <i>Casuarina cristata</i> on Cainozoic clay plains • RE 11.5.15 – Semi-evergreen vine thicket on Cainozoic sand plains/remnant surfaces • RE 11.7.1x1 – Semi-evergreen vine thicket (as part of <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> and <i>Eucalyptus thozetiana</i> or <i>E. microcarpa</i> woodland on lower scarp slopes on Cainozoic lateritic duricrust) • RE 11.8.3 – Semi-evergreen vine thicket on Cainozoic igneous rocks • RE 11.8.13 – Semi-evergreen vine thicket and microphyll vine forest on Cainozoic igneous rocks • RE 11.9.4 – Semi-evergreen vine thicket on Cainozoic fine-grained sedimentary rocks • RE 11.11.18 – Semi-evergreen vine thicket on old sedimentary rocks with varying degrees of metamorphism and folding. | |
| Presence of habitat within BGP area | |
| <p>Field studies have identified good quality examples consistent with RE 11.8.3 on basaltic terrains north of Newlands Mine (Arrow, 2014).</p> <p>Core habitat for the TEC within the BGP has been mapped and is illustrated in the figure at</p> | |

| |
|---|
| Appendix D.13. |
| General threats |
| Clearing and fragmentation, fire, weeds, feral animals and inappropriate grazing (McDonald, 2010, DECCW, 2010 and DotEE, 2018p). |
| SGP specific threats |
| Disturbance of up to a maximum of 107.42 ha of core habitat for this species is included in EPBC Act decision (EPBC 2012/6377). Without adequate mitigation measures in place, BGP activities would have the potential to remove and disturb additional habitat and contribute to altered fire frequency and increased weeds and feral animals. |
| SGP specific mitigation measures (Arrow SGP SREIS 2013 – commitment number in parenthesis) |
| <p><i>Habitat loss, fragmentation and disturbance</i></p> <ul style="list-style-type: none"> • When the project activities proceed through the detailed planning phase, a field inspection of the specified disturbance footprint (this is specified by a surveyor in the field) will be undertaken by a suitably qualified ecologist and the presence, absence and extent of environmental values will be verified and mapped in the field via GIS. The results of this step will be recorded within Geocortex and the Arrow Sharepoint database • Where environmental values are confirmed, a ‘framing trade-offs’ session will be held with the project engineers, planners and ecologists to determine if the location of the activities can be modified to avoid and/or reduce the impact to environmental values. In the event that areas of SEVT TEC cannot be avoided, the actual area to be cleared will be surveyed to quantify the impacts. This data will be recorded and cumulative impact areas tracked • Disturbance within TECs will be avoided where possible (B131) • Pre-construction / pre-clearance surveys will be conducted to identify any additional areas that need to be avoided (B132) • Infrastructure will be designed to avoid undisturbed tracts of remnant vegetation, where practical. Where collection and gathering infrastructure is to be placed within contiguous vegetation, collection networks will be designed to avoid dissection (B134) • Access track location will avoid the repeated isolation of small parcels of remnant vegetation from more continuous tracts (B135) • Vegetation disturbance will be minimised wherever practical. Corridors for linear infrastructure will be as narrow as practical, particularly when crossing linear corridors of vegetation (e.g. Isaac River and Suttor Creek). Areas cleared for field development will be as small as practical (B136) • Trees will be felled away from existing vegetation not identified for removal where practicable (B150) • Access tracks and pipelines will deviate around sensitive vegetation where practicable (B140) • Construction activities in sensitive areas will be supervised to ensure appropriate methods (e.g., narrowing of RoW) are being implemented, where required (B182) |

- Damaging trees (e.g. through scraping of tree trunk or breaking of limbs by equipment) not identified for removal will be avoided where practicable (B151)
- Delineation of disturbance boundary limits of works will be clearly established prior to commencement of clearing and soil stripping (B049)
- Plant species used for rehabilitation will be specific to the original ecosystem and local provenance, wherever possible unless the area has been cropped or contains improved pasture to be reinstated (B162)
- Monitoring will be undertaken during and after clearing activities to ensure no unauthorised encroachment has occurred (B167)
- A rehabilitation management plan for decommissioning will be developed and implemented which includes monitoring and maintenance of rehabilitated areas until rehabilitation sign off criteria are met (B339)
- Any residual impacts to SEVT TEC will be offset. A detailed BGP Phase 1 Offset Strategy and additional offset strategies for the subsequent phases will be developed and implemented to add value rather than just compensating for impacts (if any)

Fire

- Project infrastructure and facilities will be designed and constructed in accordance with applicable codes and standards (B477)
- Fire management plans will be developed for production facilities (B471)
- Arrow will develop emergency response plans in consultation with emergency services organisations that includes a list of required equipment, training and other resources, and foreseeable emergency and crisis situations (including escapes, blowouts, gas fire, bushfire, critical equipment failure, trapped or missing people, flooding, cyclones, power failure, security incidents and threats, and transport incidents). The plans will include safe evacuation procedures, communication protocols (internal and to emergency services, including the Petroleum and Gas Inspectorate), accounting for personnel and visitors, roles and responsibilities, and requirements for training (B480)
- Radiation exclusion zones around flares will be designed according to API standard (B485)
- Enclosed spaces where flammable gas may accumulate will be minimised (B487)
- Fire-fighting equipment will be installed, inspected and serviced in accordance with risk assessments and relevant legislation and standards (B499)
- Gathering lines will be buried at a minimum depth of 600 mm. Where gathering lines are present above the ground (at wellheads and at vents or drains), a clear area will be maintained. The size of the cleared area will be determined on a site-by-site basis with consideration of the site-specific risk of bushfire (B503)
- Fire-safety equipment will be commissioned in the early phase of the construction period (B505)
- All buildings and production facilities will be fitted with smoke or fire alarms (B506)
- Fire and gas detection systems to shutdown compressors will be installed (B508)
- Protocols for the control of operational activities during extreme fire danger periods, e.g., flaring or shutdowns, will be developed (B533)
- Regular patrols and inspections of pipeline easements will be conducted, including

assessment of the status of signposting subsidence and of fire breaks (B536)

- Vegetation surrounding production facilities and wellheads will be maintained in a manner that limits the amount of combustible material in the area. The size of the cleared area will be determined on a site-by-site basis with consideration of the site-specific risk of bushfire (B544)
- Access tracks to well sites will be kept clear of dry grass and combustible material wherever practicable and where there is a higher risk of bushfire (to minimise the risk of dry grass being ignited by hot components of vehicles accessing the sites) (B547)
- Daily operations will be managed with consideration of the fire danger current at that time (B548)

Weeds and feral animals

- A declared weed and pest management plan will be developed in accordance with the Petroleum Industry – Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008). Species-specific management will be undertaken for identified key weed species at risk of spread through project activities (Mesquite, Parthenium Weed, African Lovegrass and Lippia). Weed control efforts will be increased in areas particularly sensitive to invasion. The pest management plan will include, as a minimum, training, management of pest spread, management of pest infestations and monitoring effectiveness of control measures (B191)
- When sourcing maintenance materials, such materials such as bedding sand, topsoil, straw bales and sand bags will be brought to site only after it is ascertained that the materials are not contaminated with weeds and plant or animal pathogens. A weed hygiene declaration form will be requested from the supplier where there is possible risk of contamination in products (B180)
- All relevant personnel will be made aware of the location and extent of weed infestations in the vicinity of the work area and the risks involved in moving from one site or property to another (B188)
- Construction and maintenance activities will be planned to minimise movement of plant and equipment between properties or areas with weed infestations (B230)
- Weed monitoring (and targeted weed control measures) will be undertaken within sensitive EVNT habitats (particularly threatened communities such as Brigalow and native grasslands) (B158)

Grazing

- Grazing activities will be excluded from all Arrow gas and water processing and well head infrastructure sites

Monitoring

Arrow will implement the following:

- Ecological Impact Assessment Procedure (ORG-ARW-HSM-PRO-00070) – this document provides the step by step process implemented for all Arrow development activities that involve significant disturbance to land, including the requirement to record the GPS coordinates and maps of all vegetated areas that have required clearing
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- Monitoring and inspection of avoidance, mitigation and management measures will be implemented to ensure the impacts and residual risks continue to be low throughout the lifetime of the Project (B640)

References

- Arrow Energy (2014). Supplementary Report to the Bowen Gas Project Environmental Impact Statement.
- DECCW (2010). Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar bioregions. State of NSW and Department of Environment, Climate Change and Water NSW. Accessed from: <http://www.environment.nsw.gov.au/resources/threatenedspecies/SvetEECweb.pdf> on 16 April 2018.
- DotEE (2014). Approval – Arrow Bowen Gas Project (EPBC 2012/6377). Signed 27 October 2014.
- DotEE (2018p). Species Profile and Threats Database – Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions. SPRAT Profile. Sourced from:

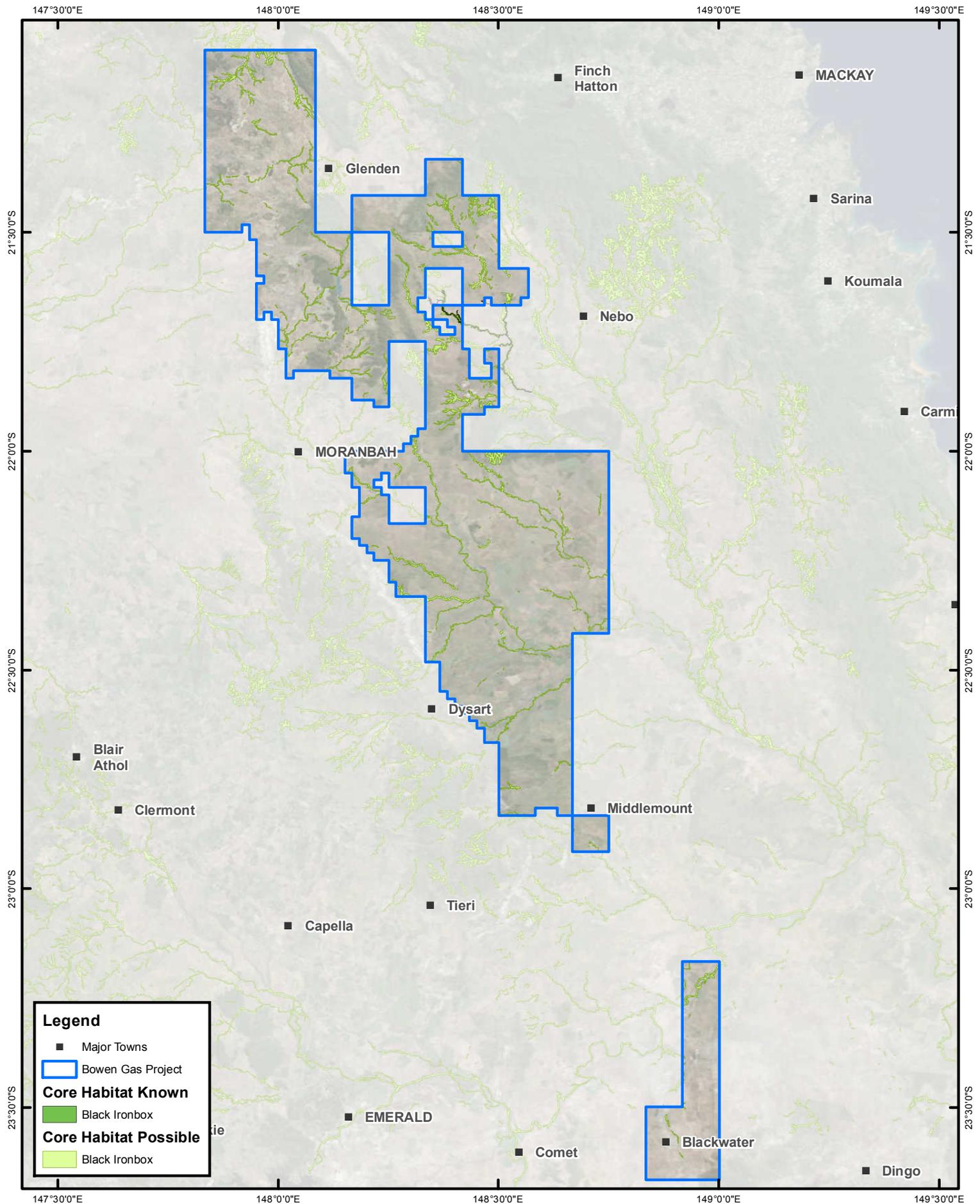
<http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=24> on 12 April 2018.

- McDonald, W.J.F (2010). *National recovery plan for the "Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions" ecological community*. Report to Department of the Environment, Water, Heritage and the Arts, Canberra. Queensland Department of Environment and Resource Management, Brisbane. Available from: <http://www.environment.gov.au/resource/national-recovery-plan-semi-evergreen-vine-thickets-brigalow-belt-north-and-south-and>. In effect under the EPBC Act from 12-Mar-2010.
- TSSC (2001). *Commonwealth Listing Advice on Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions*. Available from: <http://www.environment.gov.au/biodiversity/threatened/communities/sevt.html>. In effect under the EPBC Act from 04-Apr-2001.

APPENDIX D

Figures D1-12

Core habitat areas for EPBC Act Species and Communities



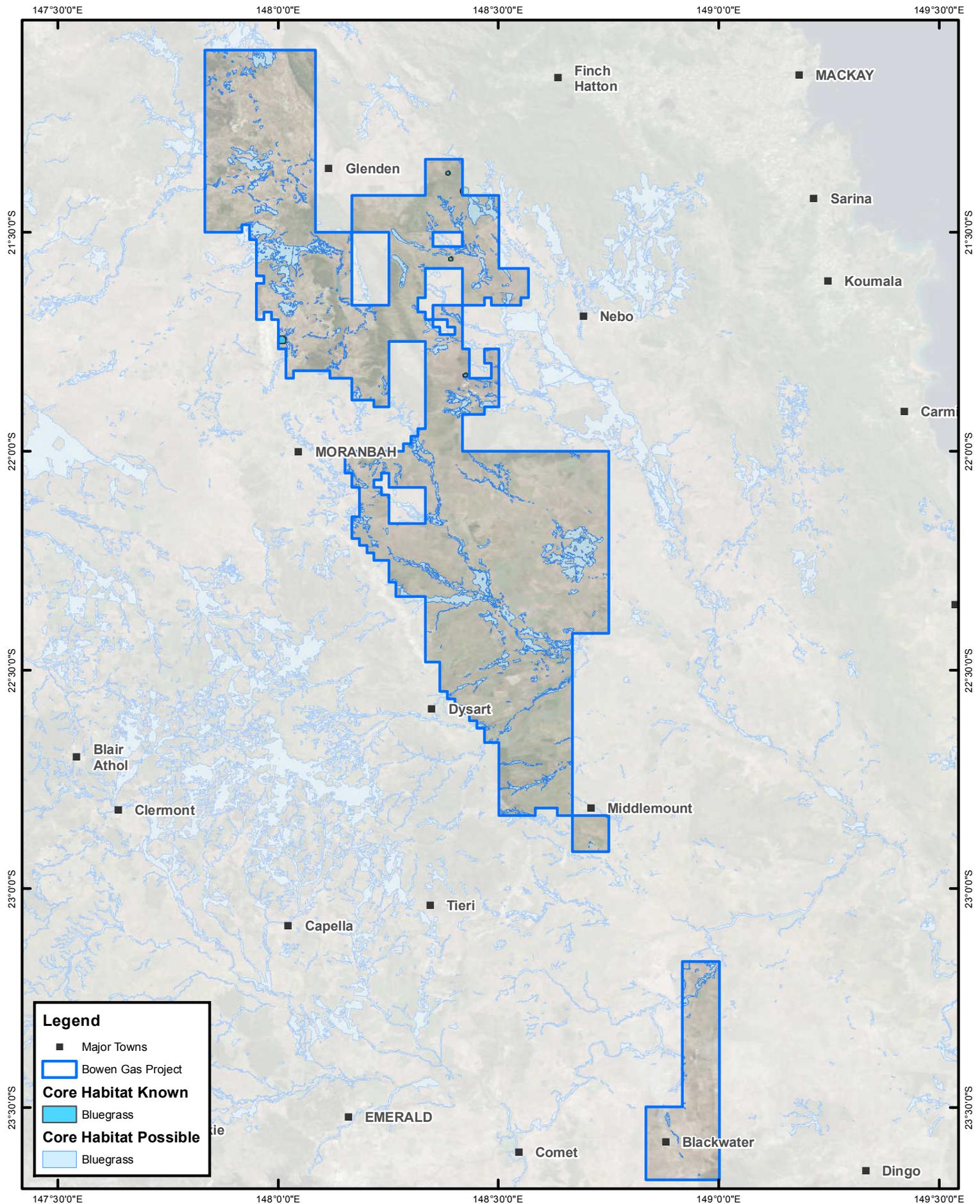
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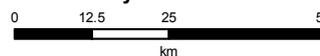
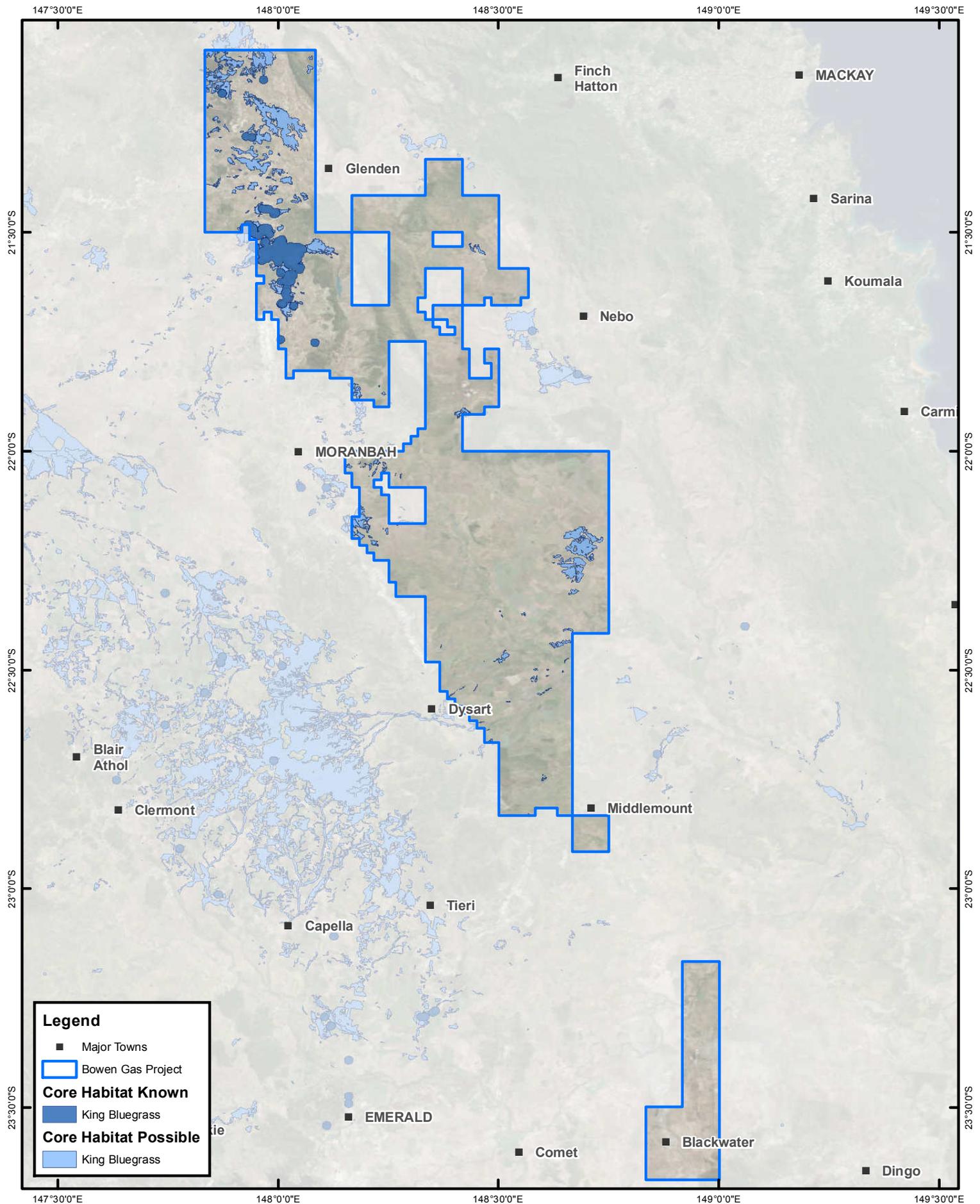


Figure D.2 Bowen Gas Project

**Bluegrass
Core Habitat Known and Possible**



Date: 26/04/2018



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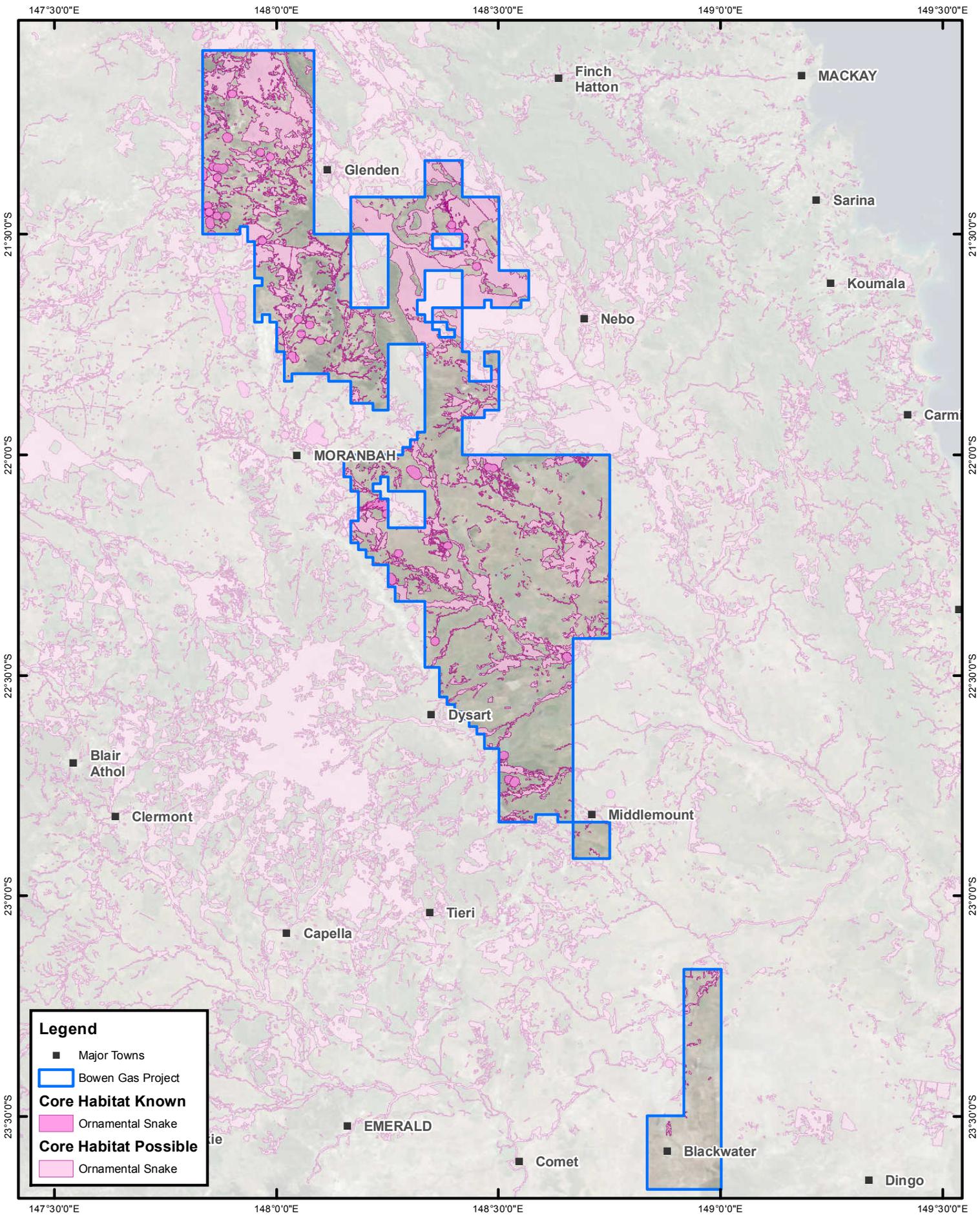
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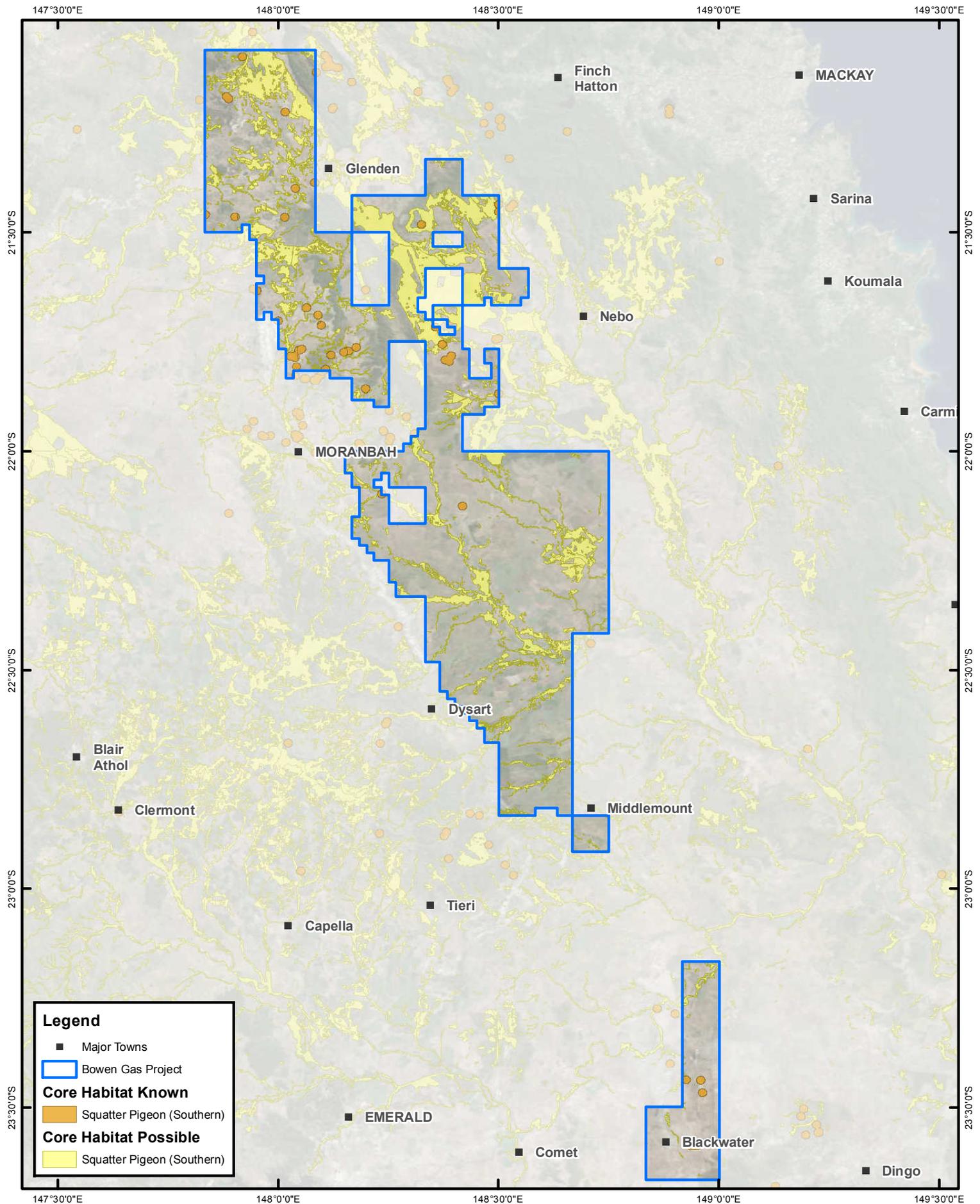
0 12.5 25 50
km

Figure D.4 Bowen Gas Project

**Ornamental Snake
Core Habitat Known and Possible**



Date: 26/04/2018



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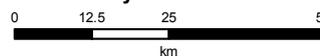
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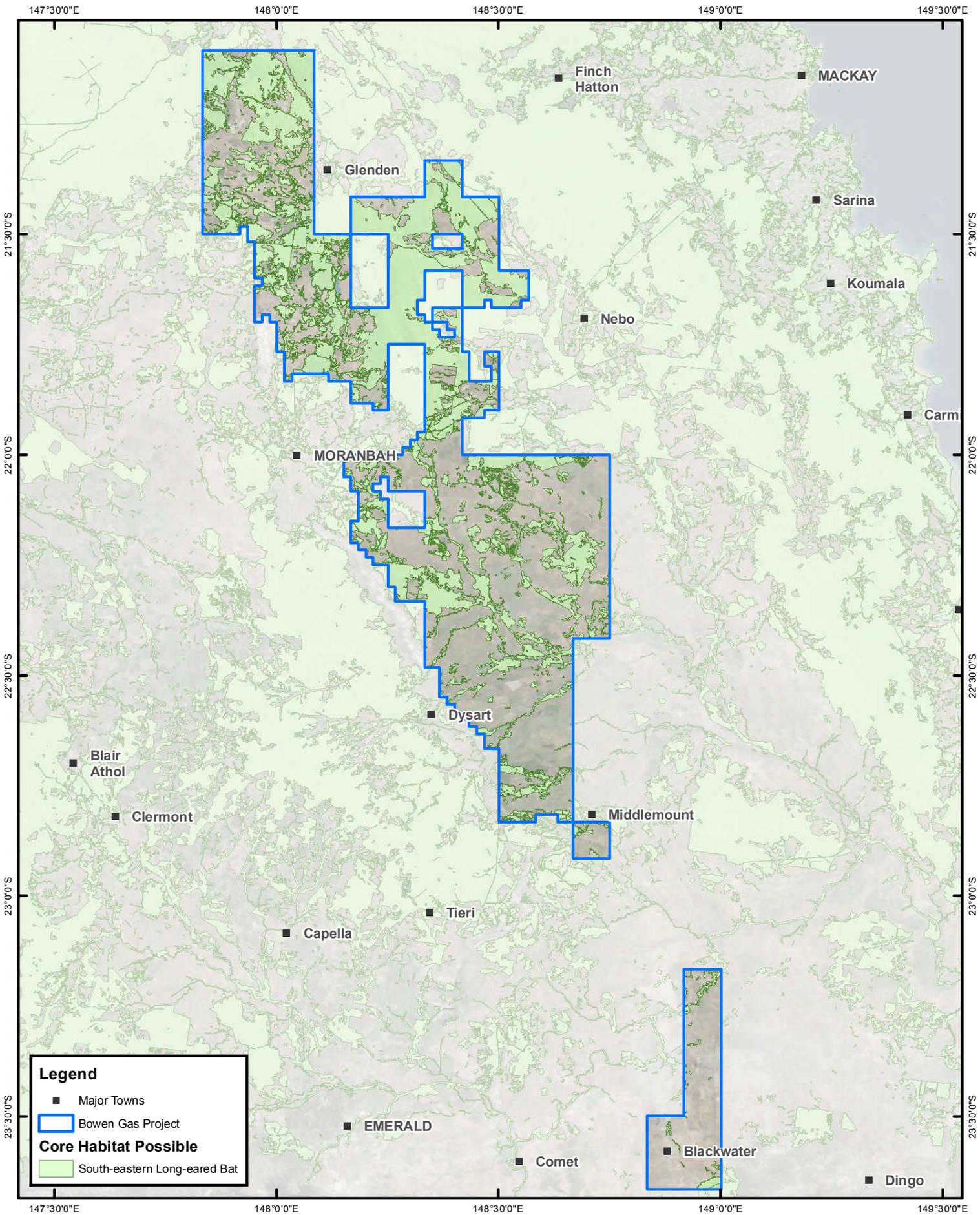
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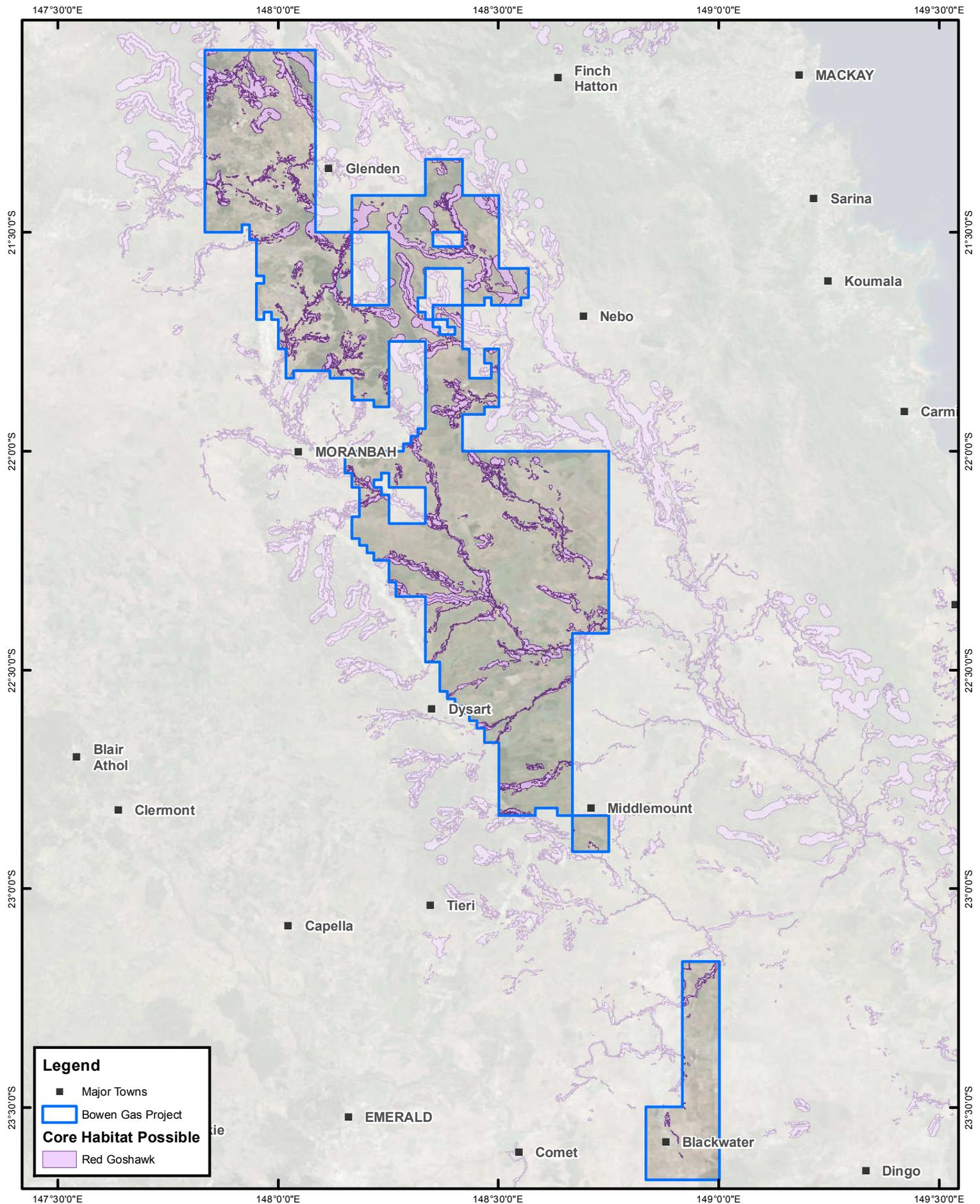
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**Figure D.8 Bowen Gas Project
South-eastern Long-eared Bat
Core Habitat Possible**



Date: 26/04/2018



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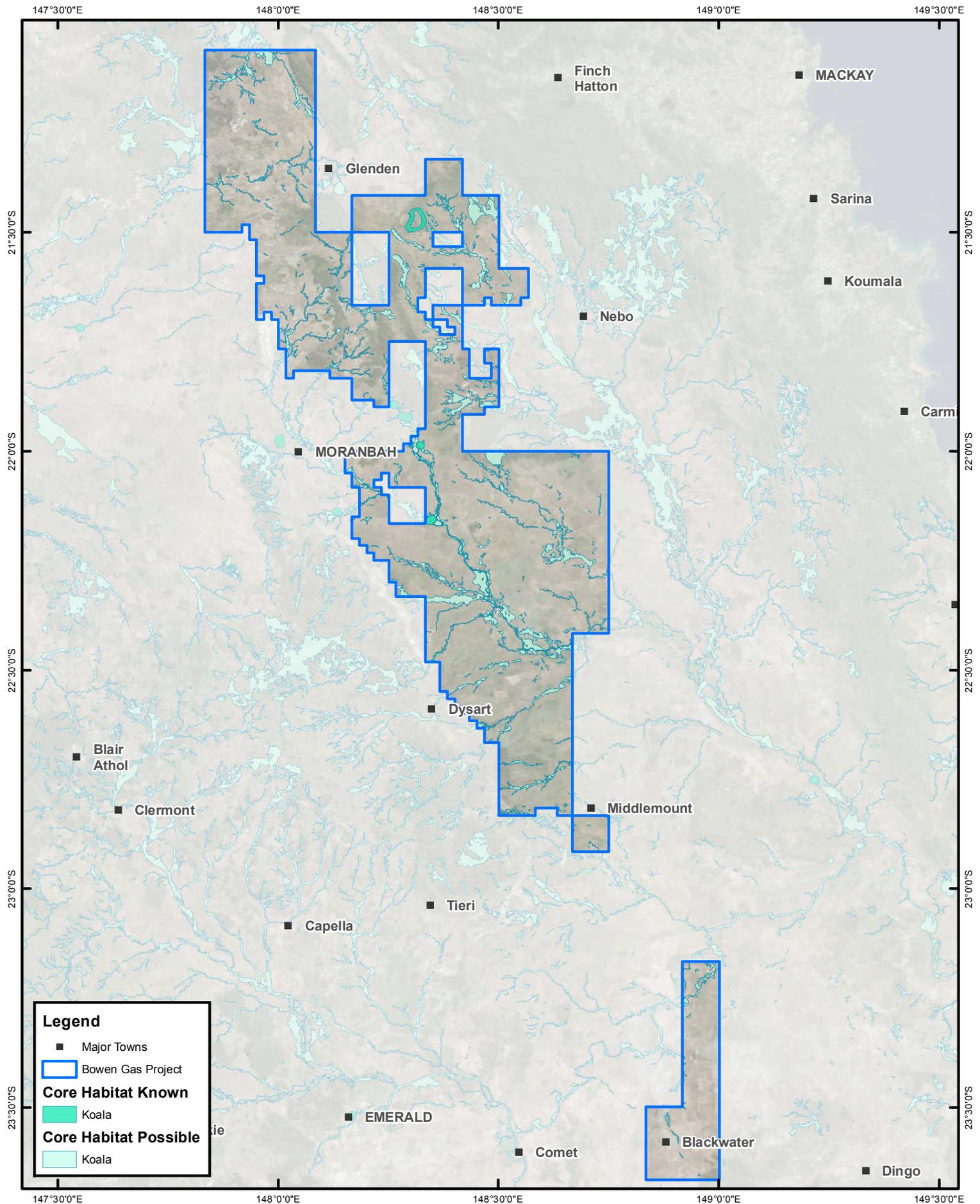
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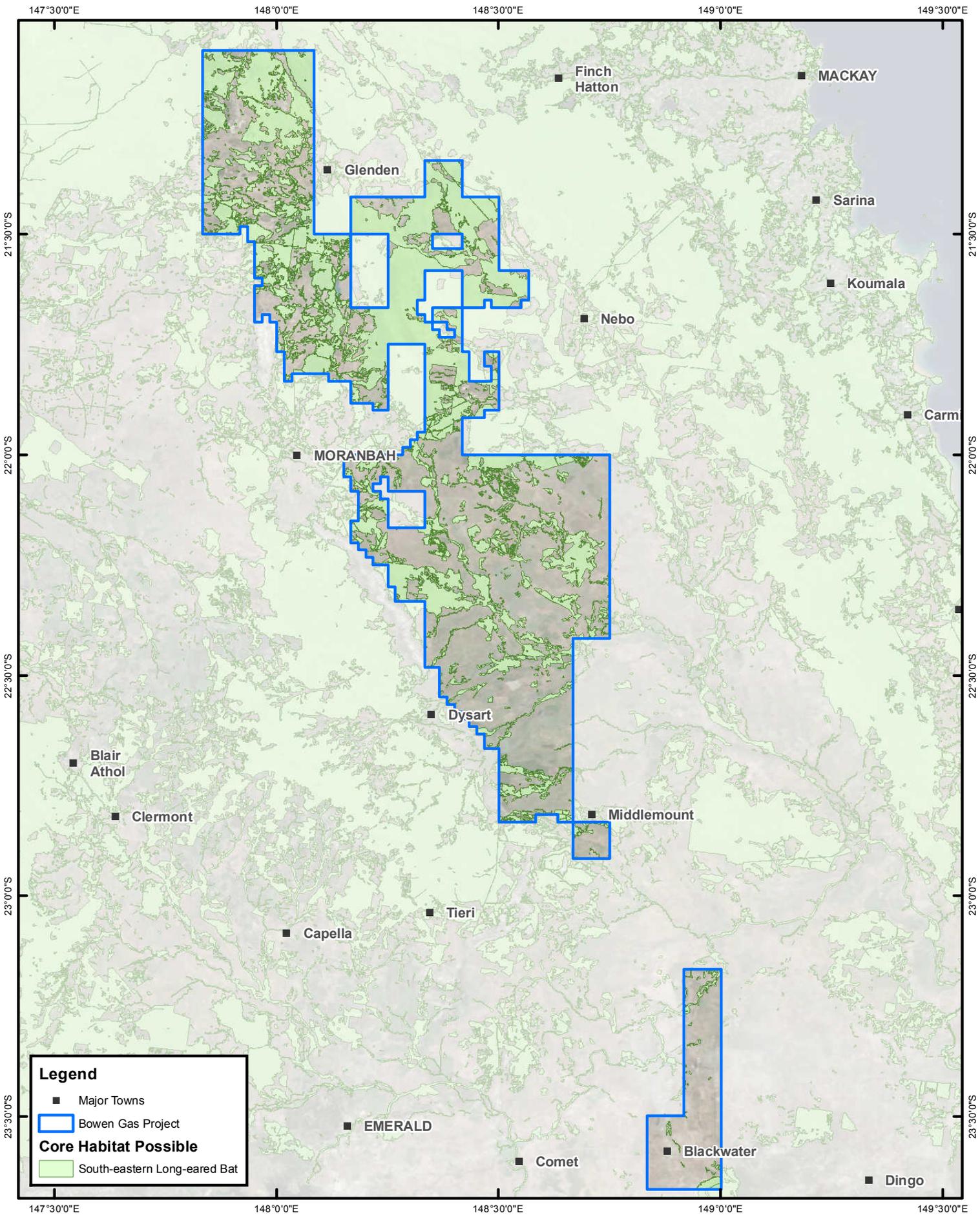
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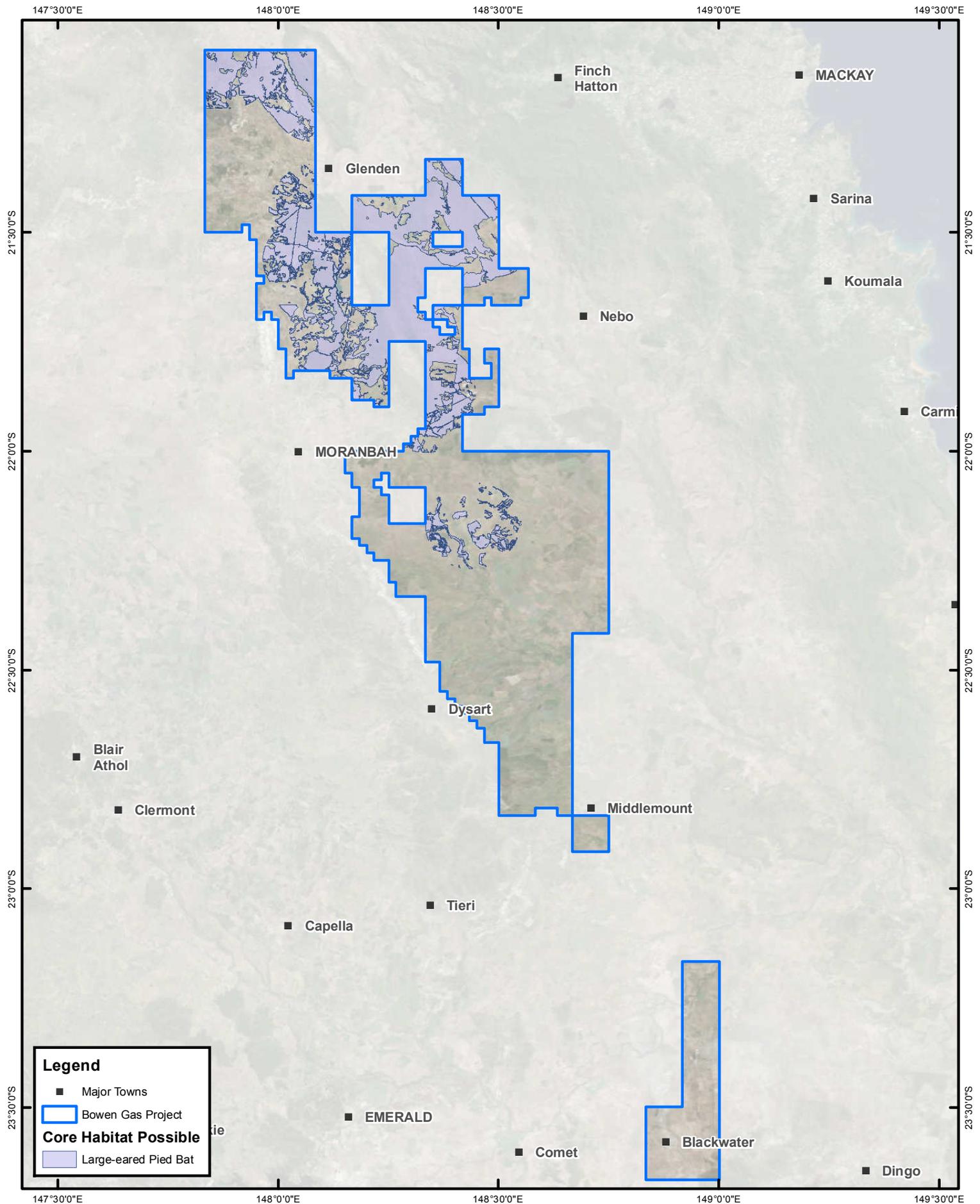
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South-eastern Long-eared Bat
Core Habitat Possible**



Date: 26/04/2018



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Coordinate System: GCS GDA 1994

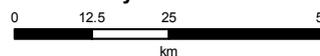
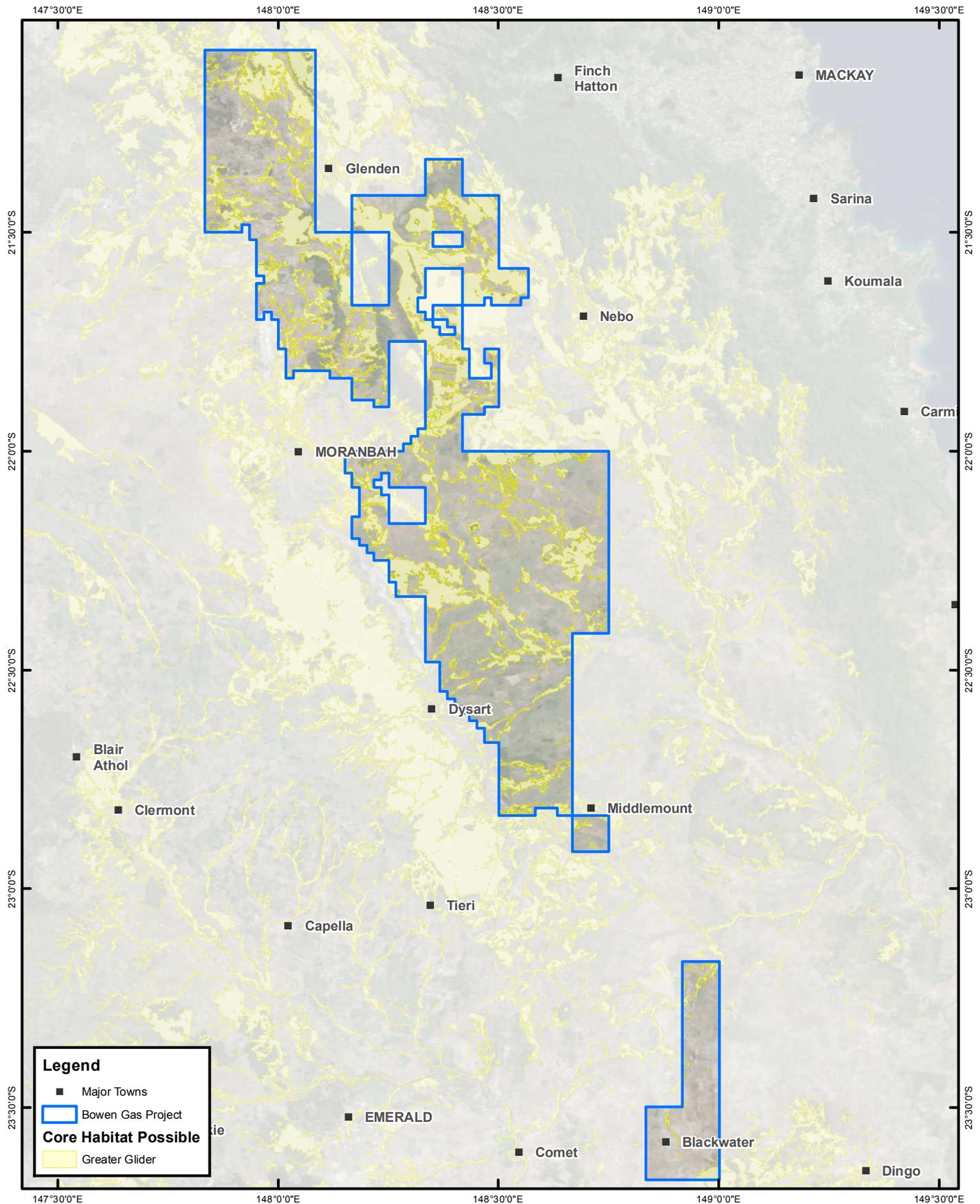


Figure D.9 Bowen Gas Project

**Large-eared Pied Bat
Core Habitat Possible**



Date: 30/04/2018



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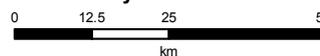
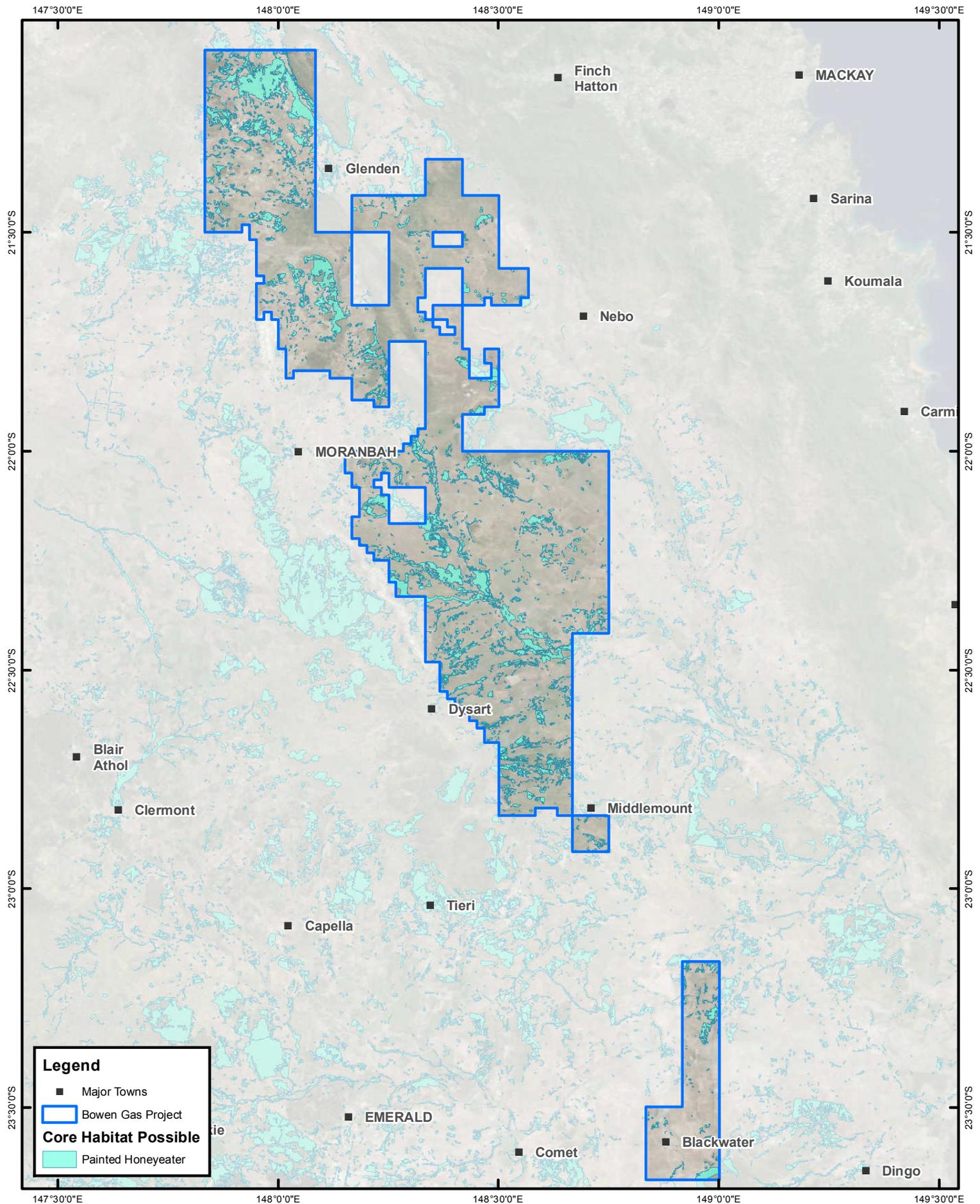


Figure D.10 Bowen Gas Project

**Greater Glider
Core Habitat Possible**



Date: 26/04/2018



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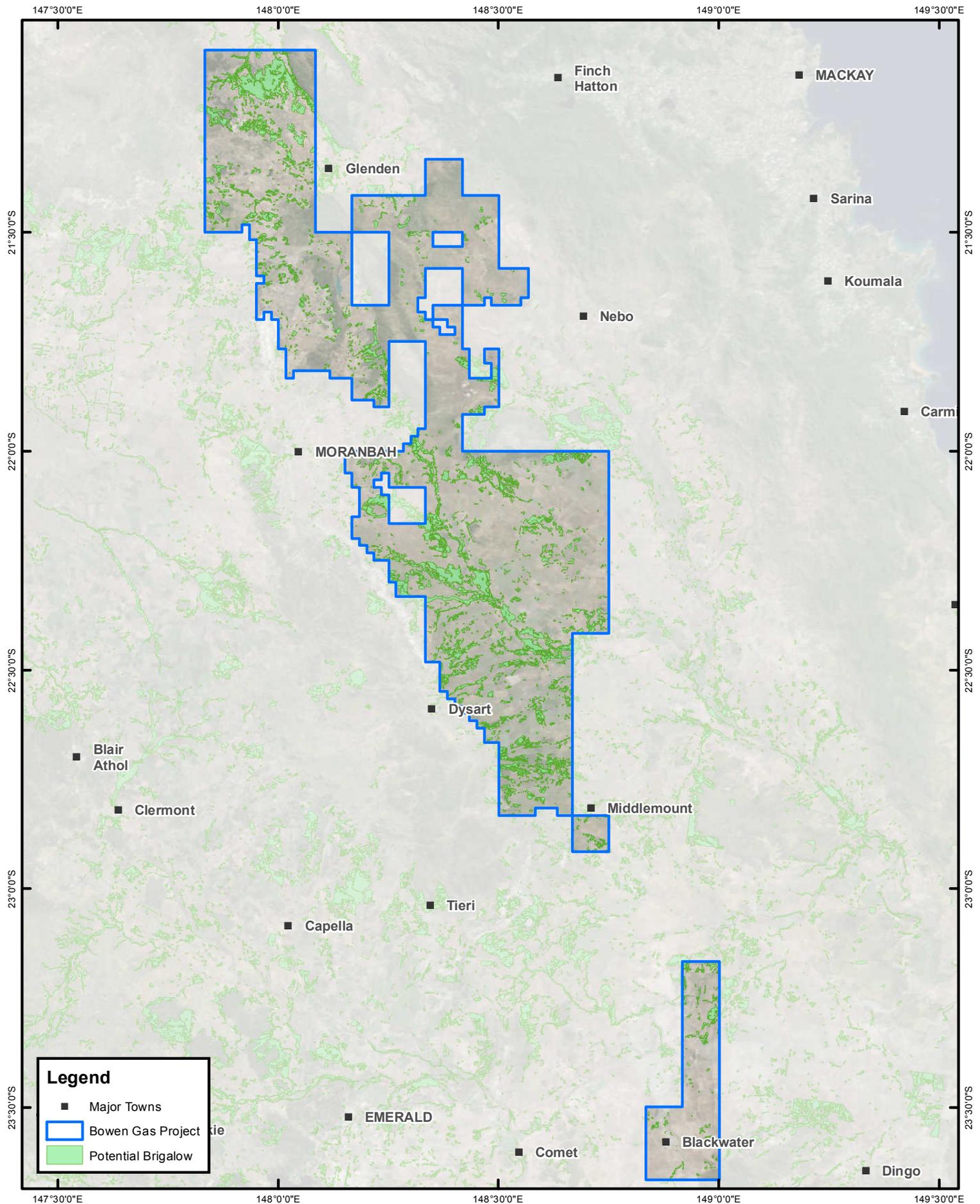


Figure D.12 Bowen Gas Project

Potential Brigalow TEC

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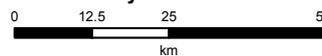
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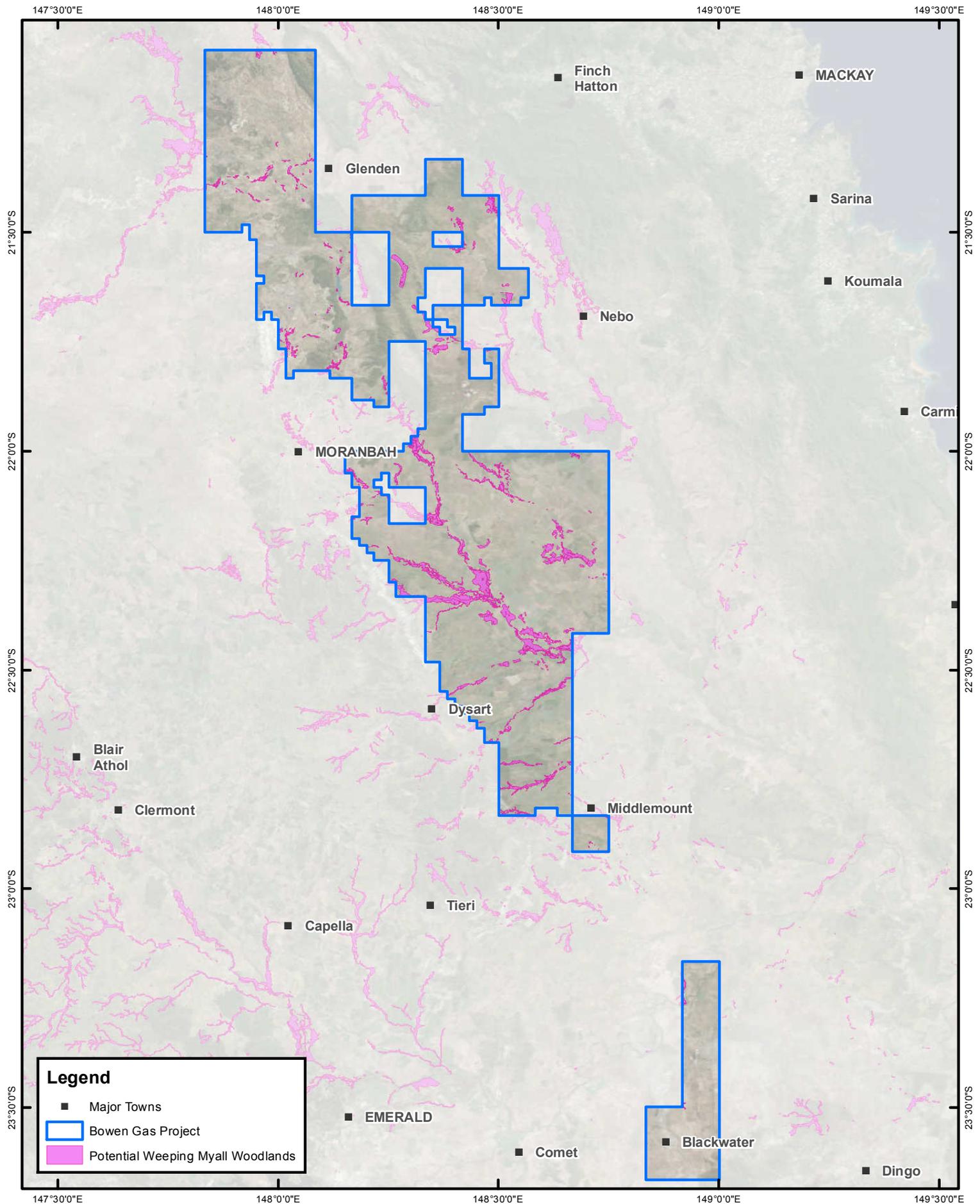
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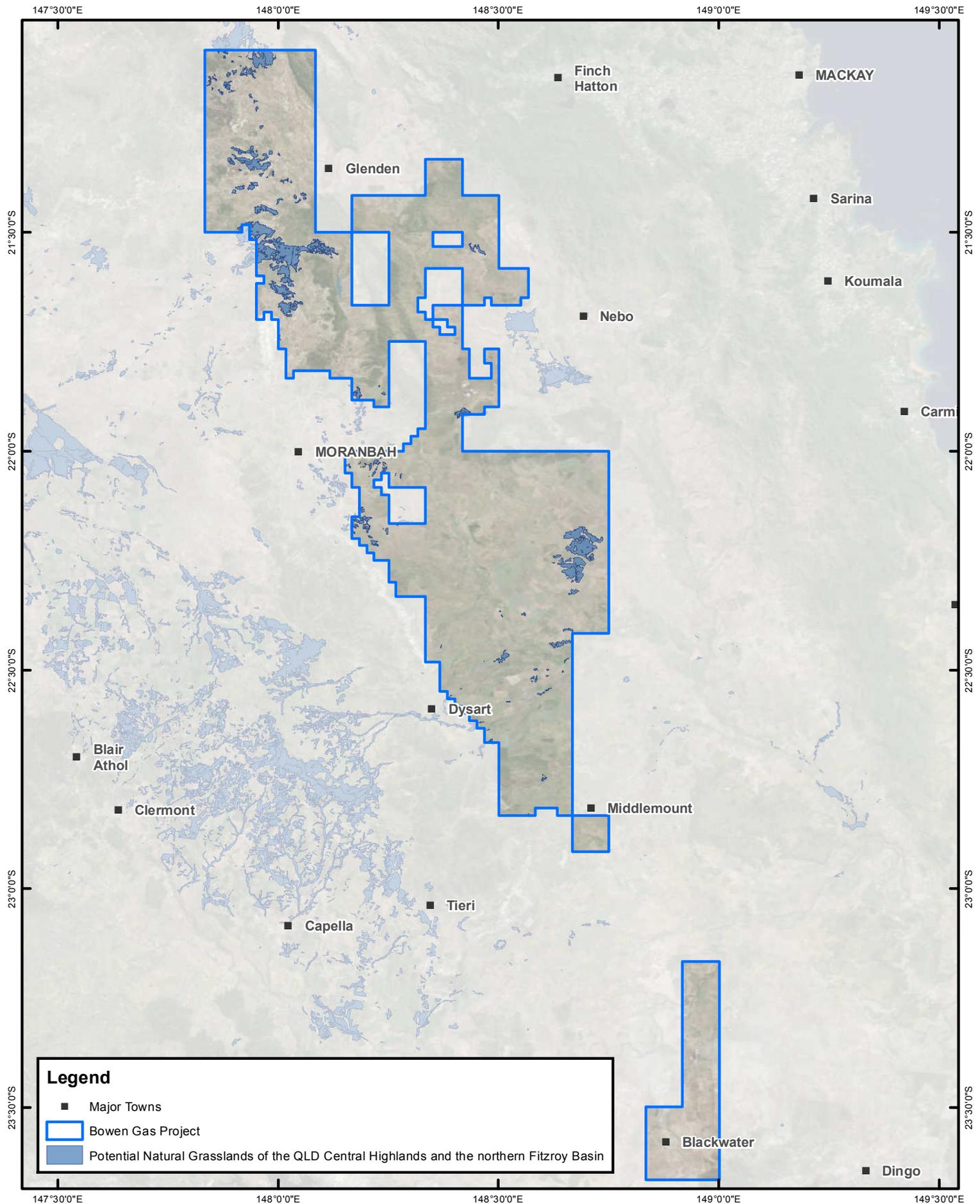


Coordinate System: GCS GDA 1994
0 12.5 25 50
km



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Figure D.13 Bowen Gas Project
Potential Weeping Myall Woodlands TEC



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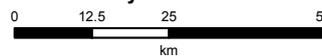
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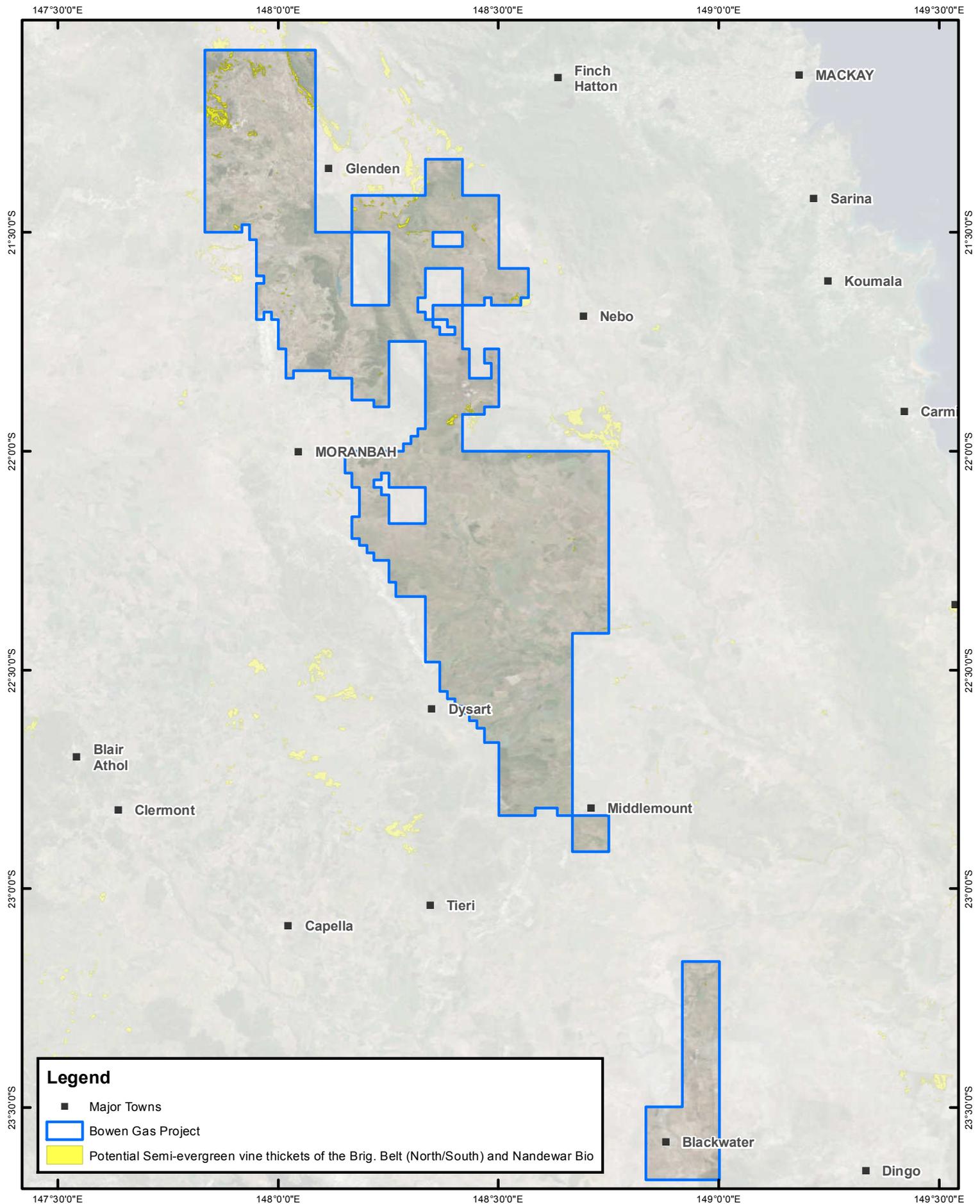
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Legend

- Major Towns
- Bowen Gas Project
- Potential Semi-evergreen vine thickets of the Brig. Belt (North/South) and Nandewar Bio

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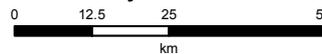
Figure D.15 Bowen Gas Project

Potential Semi-evergreen vine thickets of the Brig. Belt (North/South) and Nandewar Bio TEC

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