

Date : 19/12/2018 4:33:02 PM

From : [Redacted]oved at External Re

To : "WELLS Melissa"

Cc : "MCCOSKER Juliana"

Subject : Carmichael Coal Black-throated finch management plan

Attachment : Letter QLD DES BTFMP 191218 Final.pdf;image001.gif;

Dear Melissa,

Please see attached Adani's response to the Department's letter from the 18th December 2018 regarding the Black-throated finch management plan.

Kind regards,

[Redacted]
Removed at External Review

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19 December 2018

Ms. Melissa Wells
Executive Director
Coal and Central Queensland Compliance
Environmental Services and Regulation
Department of Environment and Science

Via email: melissa.wells@des.qld.gov.au

Carmichael Coal Mine and Rail Project – Black-throated Finch Management Plan

Dear Ms. Wells,

On the 18th December 2018 Adani Mining Pty Ltd (Adani) received a letter from the Department of Environment and Science (the department) about the Black-throated Finch Management Plan (BTFMP) submitted to the department on the 2nd November 2018. That letter advised that the department has decided to engage the National Director of the National Environmental Science Program's Threatened Species Recovery Hub to lead an independent scientific panel review of the BTFMP.

As you would be aware, the submission of the BTFMP was the culmination of a comprehensive body of work, commencing with the first lodgement of the BTFMP in May 2017. During this period, there have been over 15 rounds of feedback ensuring the BTFMP meets the strict environmental conditions in the Carmichael Mine Environmental Authority.

This review process has involved a range of officers from your department who we understand have relevant professional qualifications and experience (some of which are or have been members of the Black-throated finch recovery team), and also included consultation with the department's Threatened Species Unit which has expertise specifically on the Black-throated finch. At no point during this review period has the department ever provided any indication that there was a need for an independent review or even that it was contemplating undertaking an independent review.

In fact, our understanding and experience through this process and based on the evidence and feedback provided, is that the department has been satisfied with the quality of the experts preparing and reviewing this plan on Adani's behalf and that we were at the culmination of this process, the next step being plan approval.

Now, after 18 months of working proactively, collaboratively and respectfully with the department, and following submission of what was anticipated to be the final version of the BTFMP before approval, we are advised that an additional review process is required, a process that would take an additional 8 weeks.

Adani asks that the department urgently provide a copy of its reasons for this decision, identifying:

- (a) why the proposed review has been triggered at this point in the process;
- (b) why there had been no indication previously that such a review would be required; and
- (c) given such a review is not prescribed by the Environmental Authority conditions, the basis for requiring it.

Requirements under the Environmental Authority

As noted above, the proposed "independent scientific panel review" is not required by the conditions of the Environmental Authority, which is the appropriate regulatory framework against which the Department should be proceeding. Condition 16 of the Environmental Authority states "The holder of this environmental authority must submit a Black-throated finch (BTF) Species Management Plan (SMP) prepared and certified by a suitably qualified person to the administering authority for approval prior to commencement of Project Stage 2".

This requirement has been satisfied, meaning the only next step required, as contemplated by the department's own approval conditions after lengthy consultation and engagement, is approval of the plan.

Purpose and intent of the independent scientific panel review

It is unclear what questions the department proposes to ask the National Environmental Science Program's Threatened Species Recovery Hub (the Hub) in regard to the BTFMP. Adani notes that this project has one of the most scrutinised and comprehensively reviewed environmental impact statement processes in Queensland's history. As well as being considered by Commonwealth and Queensland regulators, the predicted impacts to the Black-throated finch were one of the matters considered by the Queensland Land Court, and a number of recommendations were made with regards to the conditions associated with the monitoring and management of the Black-throated finch. Those recommendations did not include a further independent scientific panel review of the BTFMP.

The Commonwealth and Queensland Governments have approved the project, subject to mitigation of impacts to the Black-throated finch, and Adani has a correspondingly rigorous set of conditions to meet. Further, the Commonwealth Government has now approved the BTFMP for the purposes of its approach. The proposed additional review process compromises the integrity of these approval processes and undermines confidence in Australian and Queensland environmental legal systems.

Should the independent scientific panel review proceed, Adani asks that the Department provide information about individuals reviewing the BTFMP as soon as possible, to allow Adani to consider:

- (a) their relevant qualifications and experience;
- (b) whether they have been personally or professionally involved in any anti-Adani or Carmichael Mine articles, activities or communications which would compromise their independence.

Precedent

Adani is not aware of any other proponent's management plans being subject to a third party external review, and asks the department to confirm as a matter of urgency whether this decision is exclusive to Adani.

As formally communicated on many occasions, Adani is acutely aware of its legal obligations to not commence project stage 2 activities under the Environmental Authority, until the BTFMP and the Groundwater Dependent Ecosystem Management Plan are approved.

If you have any questions, please do not hesitate to contact me on (07) 32234800. We would appreciate a response by close of business 20 December 2018.

Yours sincerely

sch4p4(6) Personal information

Removed at External Review

CC

Mr. Jamie Merrick, Director General
Mr. Dean Elwood, Deputy Director General
Ms. Juliana McCosker, Director, Business Coal Centre

Date : 3/12/2018 3:54:42 PM

From : [REDACTED]

To : "BENNINK Kate"

Cc : "MCCOSKER Juliana", [REDACTED]

Subject : RE: Black-throated Finch Management Plan and Research Program

Attachment : BTF Management Plan_v7A 20181203 updated FINAL w FIG.pdf; BTF Management Plan_v7A 20181203 updated TRACK CHANGES.docx; image001.jpg;

COMMERCIAL IN CONFIDENCE

Good afternoon Kate

Adani reviewed the Black-throated Finch Management Plan and Research Program and found some minor wording errors that have now been corrected. These are not material changes to the document.

As such, I attach version 7a to replace version 7 of the document submitted on 2 November 2018, for your consideration.

Also attached is a Word [REDACTED] tracked changes [REDACTED] version showing where changes have been made.

Regards

[REDACTED]

From: [REDACTED]

Sent: Friday, 2 November 2018 5:15 PM

To: kate.bennink@des.qld.gov.au

Cc: MCCOSKER Juliana <Juliana.Mccosker@des.qld.gov.au>; [REDACTED] sch4p4(6) Personal information

Subject: Black-throated Finch Management Plan and Research Program

Importance: High

COMMERCIAL IN CONFIDENCE

Good morning

Please find attached correspondence from [REDACTED] about the Black-throated Finch Management Plan and Research Program.

Is the department able to please confirm receipt via return email?

If you have any questions, please do not hesitate to contact me on [REDACTED] (6) Personal info

Regards

[REDACTED]

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Black-throated Finch Management Plan

Carmichael Coal Mine and Offsite Infrastructure

Prepared for
Adani Mining Pty Ltd

November 2018



DOCUMENT TRACKING

Item	Detail
Project Name	Black-throated Finch Management Plan – Carmichael Coal Mine and Offsite Infrastructure
Project Number	4887
Status	Final
Version Number	7a
Date	30 November 2018

This report should be cited as 'Eco Logical Australia 2018. *Black-throated Finch Management Plan – Carmichael Coal Mine and Offsite Infrastructure* Prepared for Adani Mining Pty Ltd.'

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Niche Environment and Heritage Consultants.

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Template 08/05/2014

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Abbreviations

Abbreviation	Description
Adani	Adani Mining Pty Ltd
BioCondition	A vegetation condition assessment tool which provides a measure of how well a terrestrial ecosystem is functioning for the maintenance of biodiversity values at a local or property scale.
BOS	Biodiversity Offset Strategy
BTF	Black-throated Finch
CEMP	Construction Environmental Management Plan
CG	Coordinator-General
DES	Queensland Department of Environment and Science (formerly known as the Department of Environment and Heritage Protection (DEHP))
DoE	Commonwealth Department of the Environment
EA	Environmental Authority issued under the <i>Environmental Protection Act 1994</i>
EIS	Environmental Impact Statement
ELA	Eco Logical Australia Pty Ltd
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
EPBC Approval	Approval granted by the Commonwealth under the EPBC Act
ER	Environmental Representative
MNES	Matters of National Environmental Significance, as defined under the EPBC Act
MNESMP	Matters of National Environmental Significance plan/s for the management of direct and indirect impacts of mining operations
NC Act	<i>Queensland Nature Conservation Act 1992</i>
NGBR	North Galilee Basin Rail Project; a 311 km section of the Carmichael Rail Network located between Mistake Creek and the Port of Abbot Point
OEMP	Operations Environmental Management Plan
RE	Regional Ecosystem
SDPWO Act	<i>State Development and Public Works Organisation Act 1971</i> (Queensland).
SEIS	Supplementary Environmental Impact Statement, prepared in response to comments on the draft EIS.
SMP	Species Management Plan
SP1	Separable Portion 1; a 77 km section of the Carmichael Rail Network located between the Carmichael Mine and Mistake Creek
TEC	Threatened Ecological Community as defined under the EPBC Act
VMP	Vegetation Management Plan

1 Introduction

1.1 Background

Eco Logical Australia (ELA) has been engaged by Adani Mining Pty Ltd (Adani) to develop a Black-throated Finch (BTF) Management Plan for the construction and operation of the Carmichael Coal Mine and Rail Infrastructure Project in the Galilee Basin of central Queensland. The Carmichael Coal Mine and Rail Infrastructure Project is one of two components of the overall project proposed by Adani, which includes:

1. Carmichael Coal Mine and Rail Infrastructure Project, comprising the Carmichael Coal Mine (open cut and underground coal mine) and 189 km of rail link and associated infrastructure; and
2. North Galilee Basin Rail (NGBR) Project, comprising 310 km of rail from approximately 70 km east of the Carmichael Mine, to the Port of Abbot Point.

The Carmichael Coal Mine and Rail Project and the NGBR Project have been assessed by the Commonwealth and Queensland governments through separate Environmental Impact Statement (EIS) processes. Conditional approval of the Carmichael Coal Mine and Rail Project was granted by the Queensland Coordinator-General on 8 May 2014 and the Commonwealth Minister for the Environment on 14 October 2015 (EPBC 2010/5736). Conditional approval of the NGBR Project was granted by the Queensland Coordinator-General on 12 August 2014 and the Commonwealth Minister for the Environment on 14 October 2015 (EPBC 2013/6885).

The development of a BTF Management Plan is a requirement of the Commonwealth and Queensland approval conditions (refer to **Section 1.5** of this document), to protect BTF and its habitat from avoidable impacts associated with the mine and rail projects.

1.2 Scope and purpose of management plan

This BTF Management Plan is specific to the Carmichael Coal Mine and associated infrastructure component of Adani's overall mine and rail project. This document is a BTF Management Plan for the Carmichael Coal Mine (which includes open cut and underground mining) and required associated infrastructure which includes workers' accommodation, an airport, and water supply infrastructure. These combined components of the development are hereafter referred to as the Project (**Figure 1**). This management plan describes the proposed management of direct and indirect impacts of mining operations on BTF which will be implemented throughout the Project.

The management of the BTF for the rail link component of the Carmichael Coal Mine and Rail Project and the NGBR are addressed in separate documents. Additionally, Species Management Plans for other threatened species and ecological communities, groundwater dependent ecosystems are also addressed in separate documents.

The purpose of the BTF Management Plan is to meet the conditions of approval granted by the Queensland and Commonwealth governments, and commitments made by Adani in securing these approvals. The BTF Management Plan is consistent with relevant guidelines and policies on the protection of Matters of National Environmental Significance (MNES) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and the management of threatened species listed under the Queensland *Nature Conservation Act 1992* (NC Act).

The BTF Management Plan details the management actions and monitoring requirements for the Carmichael Mine to minimise and mitigate impacts prior to and during construction. Management and monitoring actions apply to mining-related activities across the Project area, including those conducted on ML70505, ML70506 and ML70441. Conceptually, the adaptive management approach to be implemented applies to areas that will be disturbed by mining activities, areas of mining leases where no mining impacts are proposed, and offset areas where BTF habitat will be improved (**Figure 1**).

However, in relation to the management of offset areas, it should be noted that a detailed Offset Area Management Plan: Moray Downs West (OAMP; C02 2017), has been developed with specific management actions to achieve offsets for a range of environmental values, including BTF. While the BTF management plan includes some reference to management of the offset area, reference should be made to the OAMP for details of specific management actions.

Objectives of the BTF Management Plan are as follows:

- Describe management objectives, performance criteria and practical measures (management actions) to mitigate impacts of the Project on BTF
- Describe monitoring measures that will be implemented to assess the effectiveness of mitigation measures, and inform adaptive management actions
- Describe triggers for the implementation of adaptive management and corrective actions
- Provide a consistent framework across the Project for the mitigation of risks to BTF
- Collate relevant Project commitments relating to mitigation and monitoring of BTF ecological values, to assist in streamlining their implementation, the monitoring of compliance and reporting
- Achieve consistency with other management plans for the Project, related to biodiversity offsets, groundwater dependent ecosystems, construction activities and operations
- Achieve compliance with relevant Commonwealth and Queensland approval conditions (**Appendix D**).

As required under Condition 16a) to c) and 18 of the EA the BTF Management Plan includes a BTF Research Program (**Appendix C**). The purpose of the BTF Research Program is to increase the knowledge of the ecological requirements of BTF populations within and adjacent to the Carmichael Coal Mine and by doing so, inform and improve management of the local populations. The Research Program outlines the studies to be undertaken to identify:

- Specific nesting and feeding requirements of the species
- Whether BTF in the Project Area are sedentary, local migratory or regionally migratory
- Any changes in of classification and / or impact on BTF habitat
- The relationship between water sources, woody habitat and food sources
- Population dynamics, including dietary requirements, home range, nesting requirements
- Responses of the BTF and its habitat to grazing management practices, fire management practices and water body locations

The Research Program will primarily focus on studies that will provide results and information that facilitate improving suitable BTF habitat within the Moray Downs West offset area as well as habitat within ML70506 where no impacts from mining are proposed.

1.3 Relationship with other management plans

Other plans and strategies have been developed and there will be some interaction among the outputs during construction and operation, as illustrated in **Figure 2**.

This BTF Management Plan has been prepared to be consistent, where appropriate, with the following management plans:

- Biodiversity Offset Strategy for the Carmichael Coal Mine and Rail Project
- Moray Downs West Offset Area Management Plan
- Species Management Plan for the Carmichael Coal Mine
- Environment Management Plan for the Carmichael Coal Mine (Mine; for both construction and operations)
- Groundwater Dependent Ecosystems Management Plan for the Carmichael Coal Mine.

Other management plans will also be developed and implemented where required as part of the mine and offsite infrastructure construction and operation, and align with this plan.

This BTF Management Plan should not be confused with a Species Management Program required under the *Nature Conservation Act 1992*, for tampering with a protected animal breeding place in Queensland. A Species Management Program authorises activities that will impact on breeding places of animals protected under the *Nature Conservation Act 1992*. Adani will undertake a survey of animal breeding places prior to clearing activities and develop a Species Management Program for approval, consistent with guidelines provided by the Queensland Department of Environment and Science (DES).

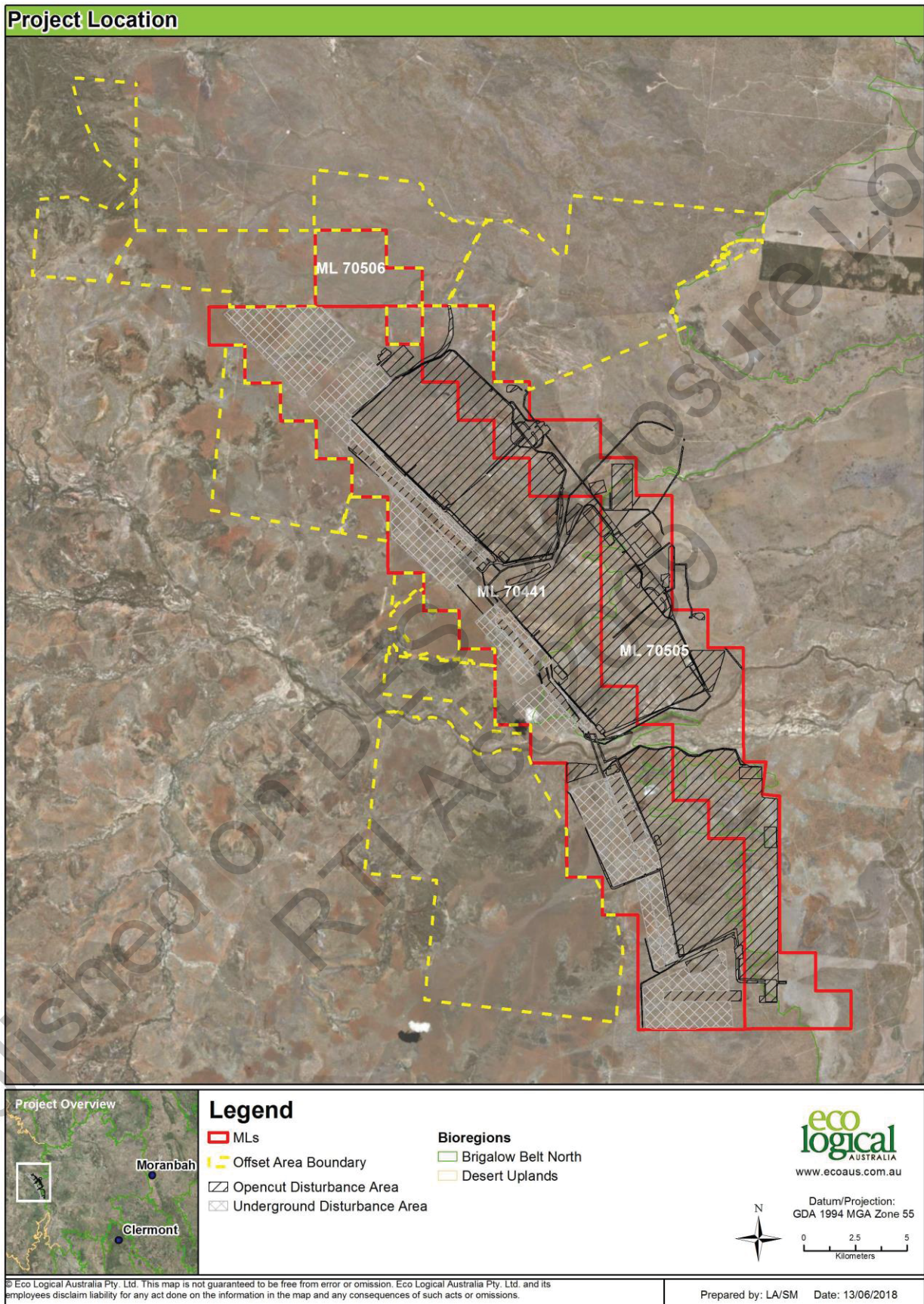


Figure 1 Project Location

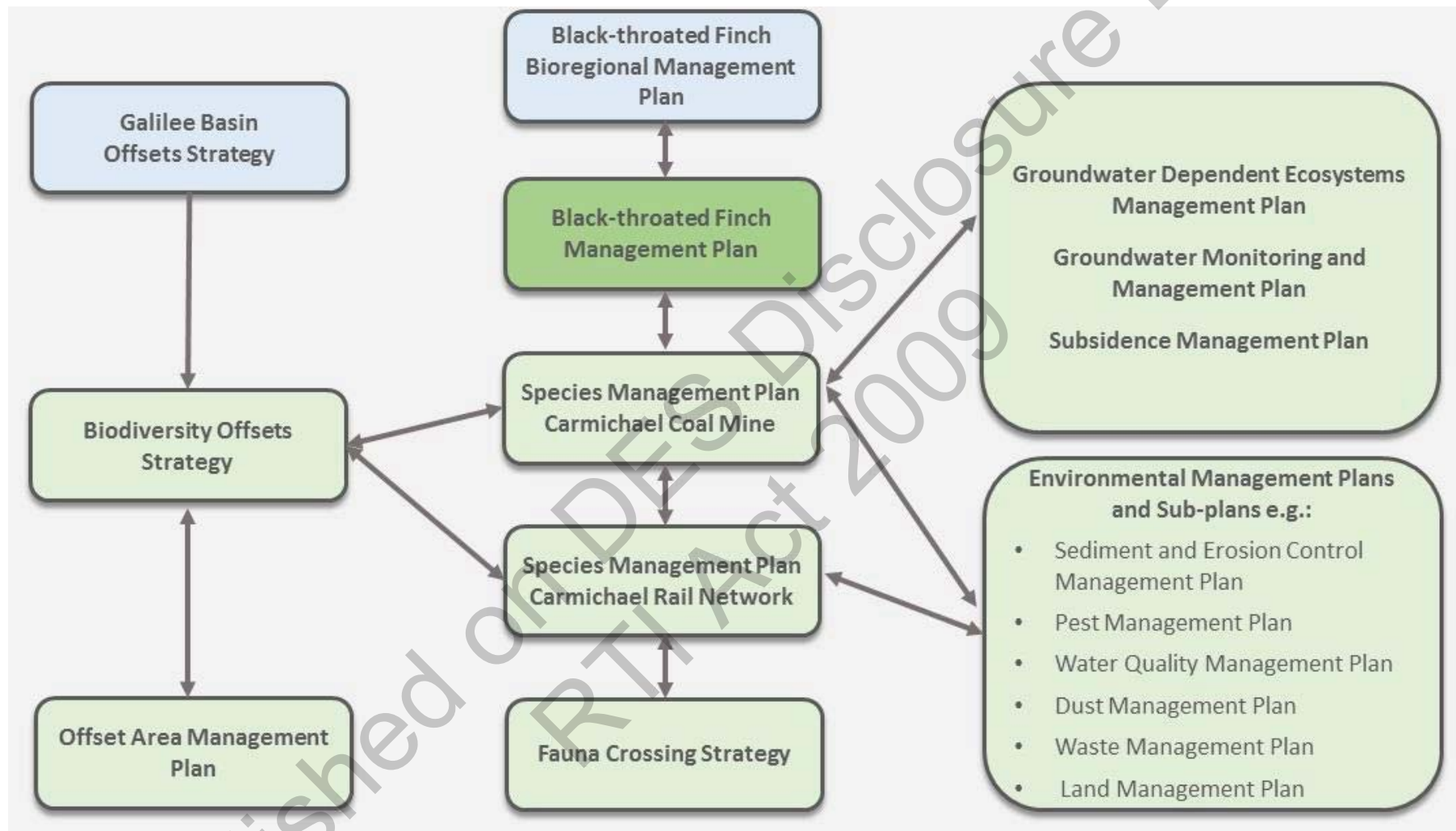


Figure 2 Flow chart showing the interactions among examples of key management plans and sub-plans for the Carmichael Coal Mine. The BTF Management Plan is shaded green, with regional plans and strategies covering multiple projects shaded blue.

1.4 Structure of this report

This report has been structured to address the requirements of relevant approval conditions and to facilitate practical implementation of management measures ‘on the ground’. A summary of key sections is provided below:

- A contextual description of the Project (**Section 2**)
- Overview of the legislative framework and approval conditions to be addressed within the BTF Management Plan (**Section 3**)
- General description of BTF ecology and known threats to the sub-species (**Section 4**)
- Adaptive management framework (**Section 5**)
- Mitigation and management measures for BTF (**Section 6**)
- Monitoring Program for BTF (**Section 7**)
- A discussion of the key outcomes of the management planning process (**Section 8**)
- Arrangements for reporting and monitoring compliance with Species Management Plan actions (**Section 9**)
- A register of key mitigation and monitoring commitments within the Species Management Plan (**Section 10**)

Appendix A provides an overview of project management plans, **Appendix B** shows the location of sites where monitoring will be conducted during BTF surveys and the BTF Research Program is provided in **Appendix C**. **Appendix E** provides a summary of the results of baseline research on BTF nesting and foraging habitat. **Appendix F** provides a summary of baseline groundcover characteristics to assist with future management of grazing.

1.5 Compliance with approval conditions

Compliance matrices indicating where approval conditions and commitments relevant to the BTF Management Plan have been addressed within this report are outlined in **Appendix D**.

1.6 Environmental setting

The Carmichael Coal Mine is located in central Queensland within the Burdekin catchment. It covers the boundary of the Brigalow Belt and Desert Uplands bioregions of Queensland. The Brigalow Belt North and Desert Uplands bioregions are semi-arid, and located in the tropics where summer rainfall dominates, with distinct wet and dry seasons.

The Brigalow Belt North Bioregion is a large and complex area characterised by clay soils with forests and woodlands dominated by Brigalow (*Acacia harpophylla*), eucalypts and grasslands. The general land types include undulating rugged ranges to alluvial plains (at External Review, Bastin 2008). The Desert Uplands Bioregion is characterised by sandstone ranges and sand plains, with thick eucalypt and acacia woodlands, often with a spinifex understory (at External Review, 2008). Each of these bioregions is further divided into subregions based on land forms.

The Project Area is located in the Belyando Downs subregion of the Brigalow Belt North Bioregion, and the Alice Tableland subregion of the Desert Uplands. The dominant vegetation communities in these subregions are Silver-leaved Ironbark (*Eucalyptus melanophloia*) and Poplar Box (*E. populnea*) woodlands on alluvial deposits, and Lancewood (*Acacia shirleyi*) and Bendee (*A. catenulata*) woodlands on rocky hills and sandstone ranges (removed at External Review, 1999). The Brigalow Belt North Bioregion is also dominated by Brigalow and Gidgee (*A. cambagei*) woodlands on fine soils, and Queensland Bluegrass (*Dichanthium sericeum*) grasslands on alluvial deposits; whilst the northern reaches of the

Alice Tablelands are dominated by White's Ironbark (*E. whitei*) and Reid River Box (moved at External Review 1999).

The predominant land use of the region is beef cattle grazing, which covers over 90% of the total area (at External Review 2008). Other land uses include conservation and minimal use, forestry, dryland agriculture, horticulture, mining, and urban centres (at External Review 2009). There are few major urban centres in the region, with the largest being Bowen, Barcaldine, Collinsville, Alpha, Clermont, and Pentland (at External Review 2008).

The mine is located within the Carmichael River sub-catchment of the Belyando Basin in the Burdekin Catchment. The Belyando Basin is characterised by generally low relief floodplains drained by braided channels and surrounded by wide alluvial plains (at External Review 2009).

1.7 Method

Utilising outcomes of previous monitoring surveys conducted during and post the EIS, a team of experienced ecologists was established with local knowledge of the Project Area to develop an effective approach to BTF management (this document). The BTF Management Plan was developed with guidance from relevant Commonwealth and State approval conditions, other legislative requirements for native flora and fauna, relevant species recovery plans occurring within the Project Area, and best-practice approaches to species management. The following key steps were taken to develop the management plan for BTF:

- A review of the ecological requirements relating to BTF was conducted, drawing upon the EIS studies, surveys completed after the EIS, published literature and relevant database searches
- The impacts from a range of activities associated with construction and operation of the Project were considered, including vegetation clearing, subsidence, mine dewatering, earthworks, the generation of noise and vibration, emissions such as dust, light spill and other visual impacts, stream diversion and flood levees and the spread of weed and pest species.
- Measures to mitigate the impacts of the Project on BTF were described, including at locations adjacent to areas of direct disturbance. Mitigation measures were informed by commitments within the EIS and associated Project approvals, and the technical knowledge and experience of ecologists developing this management plan.
- An approach to monitoring BTF was developed for a variety of project stages. These included before the commencement of work (baseline monitoring and pre-clearance surveys), monitoring of impacts during construction, assessing recovery post-construction and monitoring the impacts of ongoing operations.
- Goals, triggers and corrective actions were developed for mitigation measures, to establish a framework of adaptive management for BTF with the potential to be affected by the Project.
- An ongoing system of monitoring was described to determine the effectiveness of the mitigation measures.

Consideration was also given to the potential for impacts at a landscape level and groups of similar species, as Project impacts may not necessarily be manifested on individual BTF or species in isolation.

2 Project Description

2.1 Project overview

The Project involves construction of a greenfield coal mine in the Galilee Basin over Mining Leases 70441, 70505 and 70506. The mine site is located approximately 160 km north-west of Clermont, with mining to be conducted using both open cut and underground mining methods. Offsite infrastructure to support the mine will include a workers accommodation village, a permanent airport site and water supply infrastructure (associated infrastructure). The total disturbance area will be approximately 28,000 ha for the mine and 1,300 ha for the offsite infrastructure. Coal will be transported by rail to the Port of Abbot Point for export. The operational mine life will be approximately 60 years, with a production rate peaking at 60 Mtpa.

The open cut mine will have a capacity of 40 Mtpa and will be located along the eastern section of Mining Lease 70441. The open cut mine will be operated primarily using truck shovel/excavator methods. A series of open cut pits will be progressively mined. During the early stages of developing each mine pit, overburden will be transported to pit dumps, where it will be profiled and rehabilitated. A proportion of this material will be used to re-profile the high-wall of the final voids (Adani 2012).

The underground mine will operate concurrently with the open cut pits, to provide for coal blending and ensure continuity of production. The underground mine will comprise independent underground longwall mines, producing approximately 20 Mtpa of product. Each underground mine will be serviced by above ground infrastructure.

All run of mine coal will be transported by truck and/or overland conveyor to a centralised coal handling facility, where the high-ash portion will be washed for blending with the bypass coal (un-washed coal). Coal will be stockpiled prior to loading on trains for transportation by rail. The channel and riparian zone of the Carmichael River will be preserved and the adjacent pits protected from flooding events by a levee (Adani 2012).

All offsite infrastructure to support the operation of the mine will be located on the Moray Downs Pastoral Lease (Lot 662 on SP282172) to the east of the mine. The workers accommodation village will be located approximately 12 km east of the Mine and accessed via the upgraded Moray-Carmichael Road. The village will accommodate construction and operational workforces for the Mine. All recreational, health and safety requirements to support workers will be provided at the village.

The permanent airport will be located approximately 5 km west of the workers accommodation village and will provide access for fly-in-fly-out workers. Offsite water supply infrastructure will enable the extraction, storage and delivery of water during the construction and operation phases of the mine.

2.2 Mine staging

The Project will be implemented in several stages. An understanding of the project stages and their relative timing is important for developing appropriate management and mitigation measures to address potential impacts of the Project on BTF and their habitat. The total Project Area (Mining Lease Area) is about 45,000 Ha out of which 28,016 Ha (62%) will be disturbed in several stages for open cut mining, underground mining and mine infrastructure (including, water storage, tailings drying cells, diversion drains and levees). The initial areas of disturbance will be required for opening up of box cut areas for open cut and underground mining and areas required for mine infrastructure. The details of the staged disturbance are provided in **Table 1**. It is evident from **Table 1** that areas will be disturbed in a phased

manner and will only be cleared commensurate with development of the project within each stage. Some areas of the mining lease will not be impacted by mining activities as evident from **Figure 3**. Where BTF habitat occurs in these areas, management will be to maintain and/or aim to improve the habitat condition.

Key elements of the Project and their relative timing are summarised in the following sections.

Table 1 Details of staged disturbance areas (note: relates to all areas – not only BTF habitat)

Disturbance domain	Area (Ha)	Disturbance Areas (Ha)		
		Year 1-10	Year 11-20	Year 21-30
Open cut Mining (Including pits, slopes voids and out of pit spoil dumps)	16,640.24	10332.66	3682.75	2624.83
Underground Mining(subsidence areas)	7786.76	1931.95	3030.16	2824.65
Infrastructure Area (including, water storage, tailings drying cells, diversion drains and levees)	3589.93	3403.89	174.82	11.22
Total	28,016.93	15,668.50	6,887.73	5,460.70
% disturbance		56%	25%	19%

2.2.1 Open cut Mining Operations

Open cut Mining operations include extraction of coal from the ground as well as any immediately associated activities, including initial clearing of vegetation, removal and storage of overburden, storage of coal and dewatering, but not including exploratory surveys or the construction or operation of transport, accommodation or power generation infrastructure.

- The Open cut mines consist of six pits from North to south of the Mining Lease area
- Pits B, C, D and E are located to the north of the Carmichael River.
- Pits F and G are located to the south of the Carmichael River.

Open cut mining activities will be carried out in three stages of the project across 60 years of life of the project. Stage 1 of Open cut mining is defined as year 1-10 and includes all associated activities such as box cut excavation, formation of haul roads, forming of out of pit spoil dumps and building mine related infrastructure like CHPP, ROM, Product coal storage areas, water infrastructure and waste storage facilities.

Activities associated with mining operations north of the Carmichael River are anticipated to commence in Year 1 (early stages of the Project). In this area open cut Pits D and E will be opened up initially during the first year of the start of mining. During later years, additional Pits B and C will be opened up to the north of the Mining Lease area. As shown in **Figure 3**, there is minimal BTF habitat in areas immediately north of Carmichael River (Pits D and E), which will be the focus of early stages of the Project. This delay in the disturbance of BTF habitat will coincide with improvements to BTF habitat in the offset area, minimising Project impacts on BTF habitat values overall.

Mining operations south of the Carmichael River are anticipated to commence in Year 8 (i.e., 7 years after the commencement of mining operations north of the Carmichael River). In this area open cut Pits F and G will be opened up and will continue till the end of project life.

2.2.2 Underground Mining

Underground mining will be completed in three stages across the 60 year life of the Project. Stage 1 of underground mining is defined as Years 1-10 and includes all associated activities including box cut excavation, portal construction, long wall construction and longwall panel mining. Multi seam mining within the first underground mine will occur during this time. Stage 2 of underground mining will occur from approximately Year 11-23 and Stage 3 will occur from approximately Year 24 and beyond.

2.3 Moray Downs West

The Moray Downs West offset area has been identified in the approved BOS as a priority offset to acquit most of the Project's offset requirements, including those required for BTF (CO2 2016). The offset area for offset delivery stage 1 is located on the western portion of the Moray Downs property (Lot 662 on SP282172; **Figure 1**).

Parts of Moray Downs West are mapped as priority 1 areas in the Queensland Government's Galilee Basin Offset Strategy (DEHP 2013). Priority 1 areas contain high levels of conservation value and are likely to have the lowest risk of future development through mining. Moray Downs West also borders priority 1, 2 and 3 Galilee Basin Offset Strategy areas.

The offset area includes 20,274 ha of BTF habitat. It is anticipated that the management objectives will be achieved within the 20 year management period through the implementation of adaptive management. However, if required additional management will be considered at the end of the management period should any of the objectives not be met (CO2 2016). Monitoring is likely to be required beyond 20 years to clearly demonstrate the effectiveness of the offset, and to achieve compliance with EPBC Act approval conditions, which require monitoring for the life of the project.

3 Legislative and Regulatory Framework

3.1 Project approval conditions

The Project Area provides habitat for a variety of threatened species, listed under the EPBC Act or the NC Act. State and Commonwealth approval conditions require the development of management plans for those species and ecological communities that were considered most likely to be affected by the Project.

For the Commonwealth approval, these species and communities are as follows:

- Black-throated Finch (southern; *Poephila cincta cincta*) - Endangered
- Squatter Pigeon (southern; *Geophaps scripta scripta*) - Vulnerable
- Ornamental Snake (*Denisonia maculata*) - Vulnerable
- Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC - Endangered
- Yakka Skink (*Egernia rugosa*) - Vulnerable
- Waxy Cabbage Palm (*Livistona lanuginosa*) - Vulnerable
- Doongmabulla Springs Complex – Nationally Important Wetland and a community of native species dependent on natural discharge of groundwater from the Great Artesian Basin TEC - Endangered

For the State approval, the Coordinator-General recommended in Section 2 of Appendix 2 of its report that a Species Management Plan be prepared for all threatened species known, or likely to, occur within the Project Area. Within the mining lease, Adani has committed to a range of environmental management measures to reduce impacts on threatened species.

3.2 Approval conditions relevant to BTF management plan

There are multiple Commonwealth and Queensland approval conditions that require Adani to prepare a BTF Management Plan, describing how potential impacts of the Project on ecological values will be mitigated and monitored. This report addresses the requirements of these conditions for both Commonwealth and Queensland legislation. This document is specific to the Carmichael Coal Mine and associated infrastructure and addresses the approval conditions relating to BTF for this component of Adani's overall mine and rail project. Conditions relevant to the rail components of the Carmichael Coal Mine and Rail Project have been addressed separately (ELA 2015c; ELA 2015d).

An inventory of all relevant Commonwealth and State approval conditions is provided in **Appendix D**, with a description of the location within this report where each condition has been addressed.

3.3 Key legislation

Assessment of the Project by the Commonwealth Government occurred through the EIS process under the Commonwealth EPBC Act. This assessment considered potential impacts of the Project on MNES, such as federally-listed threatened species, migratory species, and threatened ecological communities.

Assessment of the Project by the Queensland Government occurred through the EIS process under the *State Development and Public Works Organisation Act 1971* (SDPWO Act). This act provides for the assessment of 'coordinated projects' by the Coordinator-General, while considering other Queensland legislation relevant to the proposed activity, including the:

- *Environmental Protection Act 1994*

- *Nature Conservation Act 1992*
- *Vegetation Management Act 1999*

Adani began formal environmental assessment of the Carmichael Coal Mine and Rail Project in 2010, through preparation of an EIS, to address the Commonwealth and Queensland government approval requirements. The Project was declared a 'significant project' under the SDPWO Act requiring an EIS and was assessed to be a 'controlled action' requiring assessment and approval under the EPBC Act.

An EIS was prepared in accordance with the bilateral agreement between the Commonwealth of Australia and the State of Queensland, with the objective of avoiding or mitigating potentially adverse impacts on environmental, social and economic values and enhancing positive impacts. Where there were unavoidable residual impacts, offsets were proposed in accordance with State and Federal government policies.

Adani prepared an SEIS in accordance with Section 35 (2) of the SDPWO Act and the bilateral agreement between the Commonwealth of Australia and the State of Queensland. The SEIS provided revised and additional environmental studies undertaken to reflect the amendments made to the Project since the EIS publication and to address matters raised in submissions. It included revised technical studies, impact assessment and management plans for a range of project issues.

The Carmichael Coal Mine and Rail Project was subsequently approved by the Queensland Coordinator-General on 8 May 2014, subject to conditions. The project was approved by DoE on 14 October 2015, subject to conditions (EPBC 2010/5736).

Adani was granted an Environmental Authority (EA) EPML01470513 for the Carmichael Coal Mine on 2 February 2016 in which conditions relating to the Black-throated Finch were also imposed. These conditions require a management plan and research program.

In addition to State and Federal approval conditions, Adani made commitments in regards to the management of BTF within the Coordinator-General report. **Appendix D** describes the relevant approval conditions and / or commitment relating to the monitoring and management of BTF and where the condition is addressed within this management plan.

3.4 Other guiding documents

In accordance with the Environmental Authority (EA) Condition I6 and Adani company commitment P6.54 the BTF Management Plan has been developed to align with the following references:

- National recovery plan for the Black-throated Finch southern subspecies *Poephila cincta cincta*. Report to the Department of the Environment and Water Resources, Canberra (Black-throated Finch Recovery Team, 2007)
- Significant impact guidelines for the Endangered Black-throated Finch (southern; *Poephila cincta cincta*) - EPBC Act policy statement 3.13 (Department of the Environment, Water, Heritage and the Arts (DEWHA), 2009)
- Threat abatement plan for competition and land degradation by rabbits (DEWHA, 2008),
- Commonwealth Listing Advice on Southern Black-throated Finch (*Poephila cincta cincta*; Department of the Environment, 2005), and
- Queensland Government Bio-regional BTF Management Plan as required under the Coordinator-General's report about the Project, currently under development by DES.

4 Black-throated Finch (southern) Ecology

EPBC Condition 6a) requires that all MNES management plans include a description of the environmental values for each particular MNES.

4.1 Status

The Black-throated Finch (southern; BTF) is listed as endangered under the EPBC Act and the NC Act. The primary reason for the listing is the decline in size and extent of the population of the southern subspecies.

4.2 Regional populations

The southern subspecies of the BTF lives in the Brigalow Belt North and Desert Uplands bioregions of Queensland, which cover 135,500 km² and include the towns of Townsville, Bowen, Emerald, Clermont and Collinsville (at External 2011).

Based on mapping of all records of BTF up to 2010 and a comparison with post-2000 records, the distribution of BTF is estimated to have contracted by 50-80% of its historical range and is now rarely recorded south of Clermont (160 km south of the Project Area; at External 011). BTF have also disappeared from several sites around Townsville (at External et al. 2011).

4.3 Habitat requirements

A summary of baseline research on the characteristics of BTF nesting and foraging habitat within the project area is provided in **Appendix D**. Black-throated Finch habitat typically consists of grassy eucalypt woodlands adjacent to water or riparian corridors (Removed at External Review).

Removed at External Review

Preferred habitat consists of patches with suitable grasses, low vegetation density or bare ground to allow access to the seed bank and an open tree layer that does not have a continuously dense shrubby understorey (Removed at External Review). It is noted that the southern subspecies requires a mosaic of different habitats during the wet season in which to find seed. This subspecies has also been recorded in degraded habitats, including cultivated areas near woodlands and heavily grazed paddocks (DoE 2016).

The species can be found in a range of woody plant communities with records known from at least 21 Regional Ecosystems (moved at External Review et al. 2016). Woodland vegetation typically consists of ironbark (e.g. *Eucalyptus melanophloia*, *E. crebra* and *E. drepanophylla*), bloodwood (*Corymbia dallachiana*, *C. erythrophloia* and *C. clarksoniana*) and gums (*E. platyphylla* and *E. brownii*). Records from other vegetation communities includes wetlands, riparian paperbark woodlands and native grasslands (ved at External et al. 2016). Approximately 78% of records within the Galilee Basin region are associated with Broad Vegetation Group (BVG) 17b which is described as 'woodlands to open woodlands dominated by *Eucalyptus melanophloia* (Silver-leaved ironbark; or *E. shirleyi*; Shirley's silver-leaved ironbark) on sand plains and footslopes of hills and ranges' (Dreis unpublished).

In the Project Area, grassy open-woodland communities dominated by *Eucalyptus melanophloia* (RE 10.5.5a) are preferred, though the species is not restricted to this community (ELA 2017a, Niche 2015a, Niche 2015b, Niche 2016a, Niche 2016b). Other habitats where BTF have been recorded on multiple occasions include *Eucalyptus brownii* open-woodland (RE 10.3.6ax1), and less commonly in *Eucalyptus similis* and *Corymbia brachycarpa* open-woodland (RE 10.5.1a) and *Corymbia setosa* open-woodland

(RE 10.5.1d; ELA 2017a). **Table 2** lists all REs identified in the Project Area that are considered as potential habitat.

BTF habitat within the Project Area generally consists of an open-woodland (approximately 17 % canopy cover) with moderately low canopy (approximately 12 m) and low canopy species richness. The shrub layer is typically low (2 to 2.5 m) and sparse (less than 10 % cover) but a moderately high species diversity. The ground cover is dominated by native grasses (approximately 35% cover and 8 species) with moderate bare ground (34% cover). Exotic grass and herb / forb cover are typically low (less than 5%; **Appendix E**).

Table 2 Regional Ecosystem associations for the BTF within the Project Area

RE	Description	Habitat Code
10.5.5a	<i>Eucalyptus melanophloia</i> dominates the very sparse canopy. <i>Corymbia plena</i> and <i>C. dallachiana</i> are occasionally co-dominants in the canopy. <i>Petalostigma pubescens</i> and <i>Acacia spp.</i> occasionally occur as dominants or as scattered trees in the very sparse to mid-dense low tree layer. <i>Carissa lanceolata</i> , <i>Psydrax oleifolia</i> and <i>Denhamia cunninghamii</i> frequently occur in the very sparse to sparse shrub layer. <i>Triodia pungens</i> is often dominant in the very sparse to mid-dense ground layer. <i>Aristida spp.</i> , <i>Bothriochloa ewartiana</i> , <i>Eriachne mucronata</i> , <i>Eragrostis lacunaria</i> and <i>Heteropogon contortus</i> occasionally occur as dominant or codominant graminoids. Occurs on sandplain.	<i>Eucalyptus melanophloia</i> dominant
10.3.6ax1	<i>Eucalyptus brownii</i> dominates the very sparse tree layer with scattered shrubs and very sparse ground layer frequently dominated by <i>Aristida contorta</i> . Occurs on flat to gently undulating sandplain.	<i>Eucalyptus brownii</i> dominant
10.3.13a	Riverine wetland or fringing riverine wetland. <i>Eucalyptus camaldulensis</i> dominates the very sparse to sparse canopy. <i>E. coolabah</i> , <i>Casuarina cunninghamiana</i> and <i>Melaleuca leucadendra</i> are frequently present in the canopy. <i>Corymbia tessellaris</i> is occasionally present. <i>Melaleuca spp.</i> are frequently present in the mostly very sparse low tree layer. Graminoid <i>Lomandra longifolia</i> is commonly present in the very sparse to sparse ground layer. Occurs along watercourses.	Riverine
10.5.1a	<i>Eucalyptus similis</i> dominates the usually very sparse canopy. <i>Corymbia brachycarpa</i> is frequently present in the canopy. <i>Eucalyptus drepanophylla</i> can occasionally occur as a codominant. The low tree layer is very sparse or composed of scattered small trees including <i>Bursaria incana</i> , <i>Acacia sericophylla</i> , <i>Alphitonia excelsa</i> and <i>Grevillea glauca</i> . A very sparse to mid-dense tall shrub layer is often present and dominated by <i>Acacia spp.</i> <i>Petalostigma pubescens</i> and <i>Persoonia falcata</i> are commonly present. A low shrub layer is usually present and dominated by <i>Carissa lanceolata</i> . <i>Triodia pungens</i> usually dominates the very sparse to mid-dense ground layer. Occurs on sandplains.	<i>Eucalyptus</i> or <i>Corymbia spp.</i> dominant with shrub layer
10.5.1d	<i>Corymbia setosa</i> dominates the very sparse canopy. <i>Melaleuca nervosa</i> , <i>Acacia sericophylla</i> , <i>A. elachantha</i> , <i>Bursaria incana</i> , <i>Grevillea glauca</i> and <i>Petalostigma pubescens</i> are frequently present in the very sparse low trees layer or occur as scattered small trees. <i>Acacia spp.</i> and <i>Carissa lanceolata</i> dominate the very sparse shrub layer. The ground layer is usually dominated by <i>Triodia pungens</i> . Occurs on sandplains.	

Grazing and fire are important drivers of the composition and structure of both the woody and ground layers of the vegetation (at Extern 2011, NRA 2007). Details on how grazing and fire impact the structure and composition of vegetation relevant to the BTF are provided in **Sections 4.6.4** and **4.6.5** respectively. Managing these factors is therefore important for the maintenance and management of BTF habitat. The optimal grazing and fire regimes required to maintain or improve habitat quality for the BTF are yet to be determined. Trials to determine the appropriate management of habitat with grazing and fire are proposed

as part of the Carmichael Coal Mine BTF Research Program (**Appendix C**), the results of which will feed back into the BTF Management Plan.

Permanent water is critical for the BTF as it provides refuge during dry periods and because they need to drink every day (at Extern 2011, NRA 2007). This water may be in the form of natural springs, perennial streams, waterholes in ephemeral creeks or man-made water sources such as farm dams and troughs. Therefore water must be within an accessible distance from their foraging and nesting habitat, and nests within the Townsville Coastal Plains populations are typically constructed in trees within 400 m of water sources (at Extern 2011, NRA 2007). However BTF monitoring results from the Project Area have identified a mean distance of approximately 2.5 km between nests and known permanent water sources, with the closest nest 280 m from water and the furthest almost 7 km from water (**Appendix E**).

Foraging habitat must provide suitable seeds, principally of grasses (at Extern 2011, NRA 2007). There must be an appropriate density and diversity of grasses, with seeds available and accessible on the surface as the birds predominantly feed on fallen seeds. A mix of grass species that seed at different times is important to provide year round food supply as BTF can experience food shortages particularly in the lead up to the wet season (at Extern 2011). The ground layer of the vegetation is ideally dominated by a diversity of annual and perennial grasses with sufficient inter-tussock spacing to allow the birds to forage efficiently for grass seeds present on the soil surface. Studies in the Project Area have identified a ground layer containing a mosaic of approximately 37% native grass cover and 34% bare ground as well as at least 8 native grass species and less than 5% exotic grass cover is preferred. BTF have not been recorded foraging in areas with more than 50% exotic grass cover (**Appendix E**).

Grass seed abundance usually peaks around the early dry season (May to June) and gradually declines through until the next wet season. Consequently, BTF can experience food shortages at particular times of year. The onset of wet season rains causes any remaining seed to germinate or rot, resulting in a significant food shortage (at Extern 2011) that can cause BTF to forage for longer in order to meet their needs. **Table 3** lists preferred grass species for the BTF based on research and studies in the Townsville Coastal Plains, Cape York Peninsula and Mareeba. Most are derived from observations of where BTF individuals were seen foraging. A summary of baseline groundcover and grass species at selected monitoring sites across the Project Area is provided in **Appendix F**.

Table 3: Grass species preferred by Black-throated Finches

Grass species	Location	Method	Reference
Favoured			
<i>Setaria surgens</i> *	Cape York Peninsula Mareeba West of Townsville	Direct observation of feeding by <i>P. c. atropygialis</i> and <i>P. c. cincta</i>	Zann (1976)
<i>Digitaria ciliaris</i> *			
<i>Stylosanthes humilis</i> *			
<i>Dactyloctenium radulans</i> *			
<i>Setaria surgens</i> *	Cape York Peninsula Mareeba West of Townsville	Observed to be dominant at sites used by Black-throated finches	Zann (1976)
<i>Melinis repens</i>			
<i>Schizachyrium fragile</i>			
<i>Panicum seminudum</i>			
<i>Aristida superpendens</i>			
<i>Aristida ingrata</i>			
<i>Aristida calycina</i>			

<i>Urochloa mosambicensis</i>	Townsville Coastal Plain	Direct observation of feeding birds	Mitchell (1996)
<i>Digitaria ciliaris</i>*			
<i>Alloteropsis cimicina</i>	Townsville Coastal Plain	Abundant on plots where Black-throated finches were foraging	Isles (2007)
<i>Alloteropsis semialata</i>			
<i>Chloris</i> spp.			
<i>Setaria apiculata</i>			
<i>Urochloa mosambicensis</i>	Townsville Coastal Plain	Abundant on plots where BTF were foraging	Rechetelo (2015)
<i>Chrysopogon fallax</i>			
<i>Eragrostis</i> spp.			
<i>Setaria surgens</i>*			

Bold species indicate those that have been recorded in the Project Area

* Indicates species which BTF have been observed foraging on in the Project Area

Within the Project Area BTF have been observed foraging on similar species as indicated in **Table 3**, as well as additional grasses including:

- *Enteropogon ramosus* (GHD 2012)
- *Paspalidium rarum* (GHD 2012 and Niche 2016)
- *Schizachyrium fragile* (GHD 2012)
- *Cymbopogon bombycinus* (ELA 2017)
- *Triodia pungens* (ELA 2017)
- *Eriachne mucronata* (ELA 2017 and E2M 2018)
- *Bothriochloa ewartiana* (E2M 2018)
- *Panicum effusum* (E2M 2018)
- *Enneapogon polyphyllus* (E2M 2018)
- *Sehima nervosum* (E2M 2018)
- *Digitaria brownii* (E2M 2018).

During the 2016 dry season survey BTF were observed foraging on the seeds of the introduced woody herb *Stylosanthes scabra* (ELA 2017a).

The BTF monitoring surveys for the Project Area have indicated some differences with grass species that have been previously identified as being avoided in research undertaken on the Townsville Coastal Plains. In particular, the “avoided” species *Heteropogon contortus* and *Aristida* spp. have been commonly found at foraging sites in the Project Area, at varying percentage cover. At this stage the nature and scale of these differences are unknown, with monitoring programs currently underway to provide further clarity. In this regard, there remains ecological behaviours that are not fully understood for the local BTF population and their foraging requirements. Further surveys dedicated to analysing foraging behaviours of BTF within the Project Area, and comparison of the data, are required to identify the key factors that define preferred foraging habitat for the local BTF population and form part of the Research Program (ELA, 2017b). Initial findings from baseline monitoring are provided in **Appendix E** and **Appendix F**.

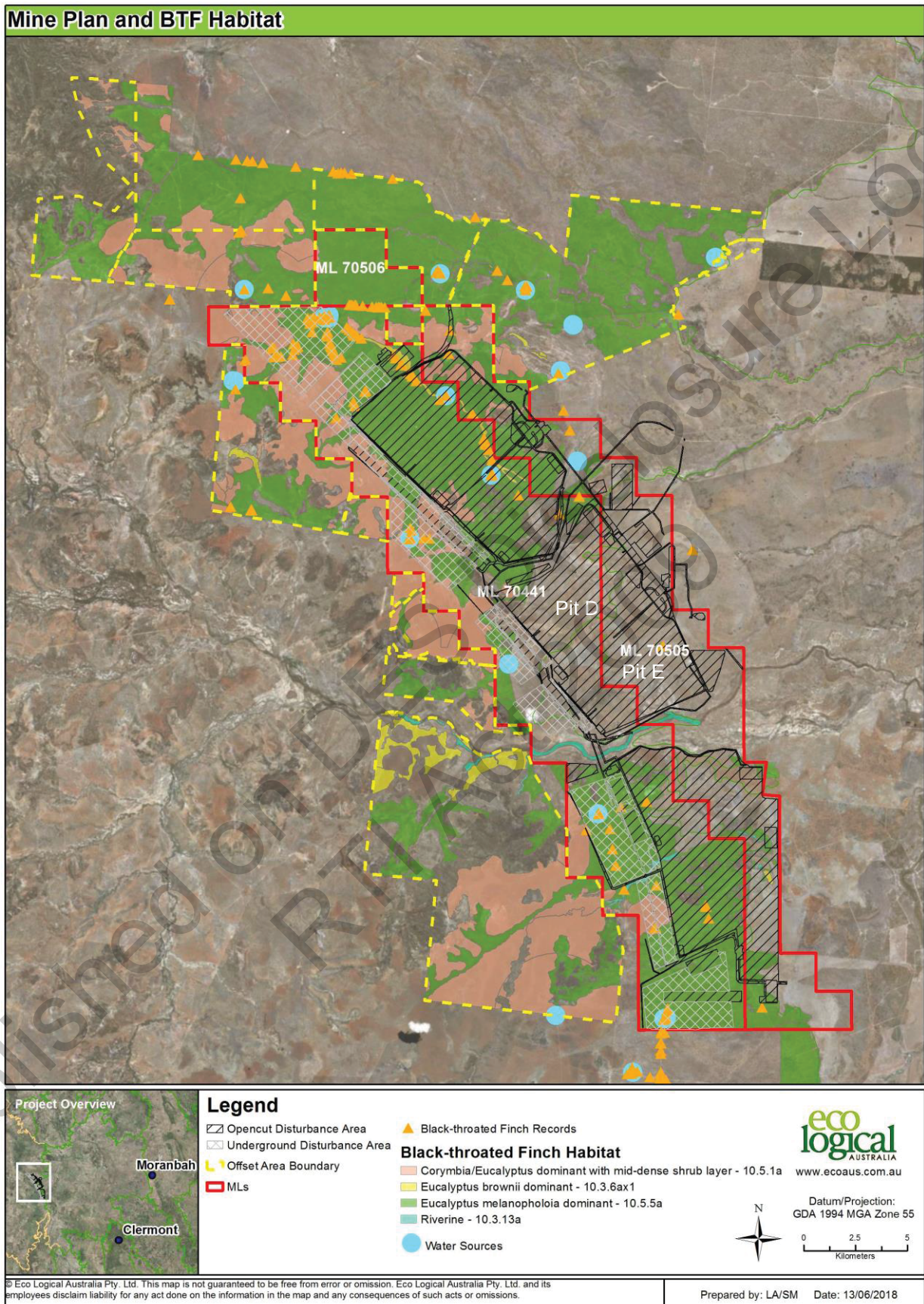


Figure 3 Black-throated Finch Habitat within the Project Area and adjacent areas (note this plan does not cover the Moray Downs West Offset Area, which is regulated by the OAMP)

4.4 Breeding ecology

BTF breeding season is from October to April, with seasonal and geographic variations (at External 2011). The timing and duration of the breeding season appears to be contingent on food resources and is therefore likely to vary annually and geographically according to rainfall patterns, temperature and land condition. Commencement of the wet season is the likely trigger for breeding.

Around Townsville, breeding tends to occur from December to May, which generally encompasses the wet season and the period of most prolific seeding of grasses (at External pers. comm.), but there is considerable variation in this timing throughout the bird's range. Breeding will continue throughout grass seeding generated by the wet season.

NRA (2005a) recorded BTFs breeding in Townsville from January to July; analysis of data contained in (at External 1996) recorded breeding in Townsville from March to May; and (at External 1970) recorded breeding on the Atherton Tableland from September to January. Although under optimal conditions the species can probably breed continuously throughout the year, the core breeding season around Townsville is believed to begin sometime after the onset of the wet season and continue until ground-stored food resources (fallen grass seed) fall below an undetermined threshold (c. February to June). Usually five or six eggs are laid at one time (at External 2011).

There is little published information regarding the timing of the breeding cycle of this species. In a study of relatively few captive individuals (at External 1976) observed the timing of the breeding cycle of this species to be 15 days for incubation, 22 days from hatching to fledging and 18 days from fledging to independence. This indicates they are 40 days old at independence. With respect to independence, (at External 2011) notes that BTF juveniles may remain with their parents for a number of months after fledging.

Nests are mostly built high in the outer branches of trees and tall shrubs, in tree-hollows, in mistletoes, and in the base of raptor nests (BTFRT 2007). However, nests have also been recorded in large shrubs within 1 m of the ground. Occasionally nests are constructed beneath active raptor nests, of species such as Wedge-tailed Eagle (*Aquila audax*), Whistling Kite (*Haliastur sphenurus*), Swamp Harrier (*Circus approximans*) and Collared Sparrowhawk (*Accipiter cirrocephalus*; (at External R 2006). Nests may also be built in neighbouring trees within the colony, usually less than 50 m from other nest trees (at External F al. 2006; NRA 2006) and on occasion an outlier may be up to 250 m from the main colony (at External 2007; NRA 2007).

Within the Project Area, BTF nests have been recorded in various vegetation strata and species, with an apparent preference for the tall shrub layer dominated by *Acacia sericophylla*, typically at 2 to 4 m in height. Other nests have been recorded in the canopy layer at 7 m in height. BTF nests were most commonly found in *Acacia sericophylla* (12 records), followed by *Grevillea parallela* (2 records) and *Eucalyptus melanophloia* (1 record; E2M 2018; **Appendix E**).

The minimum area of nesting habitat required to sustain a viable breeding colony is unknown (NRA 2007). Most known nesting colonies are connected to larger areas of remnant vegetation. Following observations of a single colony, it has been suggested that a minimum remnant habitat patch of 40 to 50 ha within 500 m of a nesting colony may be required for that colony to remain viable, at least in the short-term (NRA 2006; NRA 2007). Nests are typically constructed from grass stems with feathers or plant down lining (at External et al. 2006; NRA 2006), and are used for breeding and roosting (NRA 2007).

The breeding season is an opportunity for BTF populations to recover from losses sustained during the dry season / early wet season (when resource bottlenecks occur as grass seed supply is low). During the breeding season, parents first need to gain sufficient body condition to breed and, then, once the young have hatched, be in a condition in which they can forage for both themselves and their young. Activities

or events that reduce resource availability during this time may reduce reproductive success. If breeding success is unable to off-set mortality over consecutive years then population declines and, ultimately, local extinctions will occur (at Exterr 2011).

4.5 Carmichael population

Over a period of nine years (2010 to 2018), Adani has commissioned 13 surveys and associated reports assessing the habitat preferences, ecology and population presence of BTF with the Project Area. The most recent BTF surveys undertaken within the Project Area were in March 2015 (Niche 2015a), August 2015 (Niche 2016a), April 2016 (Niche 2016a), October 2016 (ELA 2017a), November 2017 (E2M 2017) and April 2018 (E2M 2018), and have included surveys within the Moray Downs West offset area. Prior to that, surveys had focussed on the mining lease.

The methodology adopted in the most recent monitoring surveys consisted of timed fixed point water source watches; habitat searches in the immediate vicinity of the water sources (600 m radius); slow drive line transects with defined call playback stations; and opportunistic observations gathered whilst traversing the Project Area. The key findings from the monitoring surveys include:

- Aggregate BTF totals have ranged from 84 to 1,145 with an average of 480. Dry season surveys have generally yielded the largest aggregate totals (1,145, 846 and 610 in 2015, 2018 and 2016 respectively), although a wet season survey in 2015 yielded records of 600 BTF.
- Surveys to date have focused on the mining lease where the greatest aggregates have been recorded, in particular in the northern area of the mining lease and around Four Mile and Ten Mile Bores.
- The 2016 dry season survey included the greatest survey effort within the Moray Downs West offset area to date where an aggregate total of 151 BTF were recorded from 14 locations
- Monitoring surveys have identified a strong association between BTF records and vegetation communities dominated by remnant RE 10.5.5a *Eucalyptus melanophloia* open woodland on sand plains (Niche 2016a; ELA 2017a). BTF have also been recorded in four other REs (Table 2).
- A majority of BTF records have been identified during waterhole surveys with this survey method accounting for 37% of the aggregate total in the October 2016 dry season survey (ELA 2017a).
- Foraging BTF have been predominantly observed in woodland or open woodland dominated by *E. melanophloia* with a mean canopy height of 12 m. Areas used for foraging were characterised by sparse to mid-dense ground cover with a mean ground cover recorded of 40%. Grass species diversity at foraging sites was high with a mean grass species richness of 8. Exotic grass cover is typically less than 5 % (Appendix E). The species recorded are typical of grassy woodlands of the bioregion, of which the Project Area supports some high quality examples (Niche 2015a).
- Based on the data available for dry season surveys, it appears that in dry conditions records are concentrated in the central-north and central-south areas of the Project Area where large stretches of suitable habitat area are present and water sources were available at the time of survey (Niche 2016a; ELA 2017a). In particular, large numbers were recorded during the August 2015 BTF monitoring survey in the vicinity of the large dam on the Lignum property (CWAT111), the dam at CWAT03, Four Mile Bore (CWAT99), #2 Dam (CWAT117), the Turkey Nest dam at Ten Mile Bore (CWAT01B) and troughs at Lignum (CWAT110B) and Carmichael Bore (CWAT118; Niche 2016a).
- A total of 60 BTF nests have been identified during monitoring surveys to date. This includes 15 nests that were identified during the 2018 dry season survey which is the largest number to date (E2M 2018).

- A pair of BTF were observed during the 2016 dry season surveys preparing a nest within the outer-branches of a Silver-leaved Ironbark. This tree was approximately 14m in height and within remnant RE 11.5.5.a.
- Surveys have identified preferred foraging habitat to consist of a grassy understorey with a mosaic of patches of dense grass with open bare patches containing a diversity of native grasses.
- BTF have directly observed foraging on seeds of at least nine grass species as well as the woody shrub *Stylosanthes scabra* within the Project Area (GHD 2012; Niche 2016; ELA 2017a). Another two grasses have been identified as potential foraging species (GHD 2012).

BTF are most regular and most abundant in the northern third and the southern quarter of the Project Area (**Figure 4**). The area around Ten Mile Bore (CWAT01B; in the north-west of the mining lease area) appears especially favourable, possibly due to the combination of open grassy *Eucalyptus melanophloia* woodland and the water that it provides. In general, this area has a low shrub cover in the understorey. Areas north of the Carmichael Road in the far west of the Project Area (Four Mile Bore and surrounds) are also favourable, though the numbers of birds are generally lower than around Ten Mile Bore. The Four Mile Bore (CWAT99) area tends to have reasonably extensive patches of understorey shrubs, particularly just north of the Carmichael Road. In addition, large numbers of BTF have been recorded between 2015 and 2018 at a large dam and surrounding habitats on Lignum Station. The floristic composition and structure representative of the area surrounding this large dam is also consistent with the vegetation assemblages shown to support BTF foraging and nesting habitat.

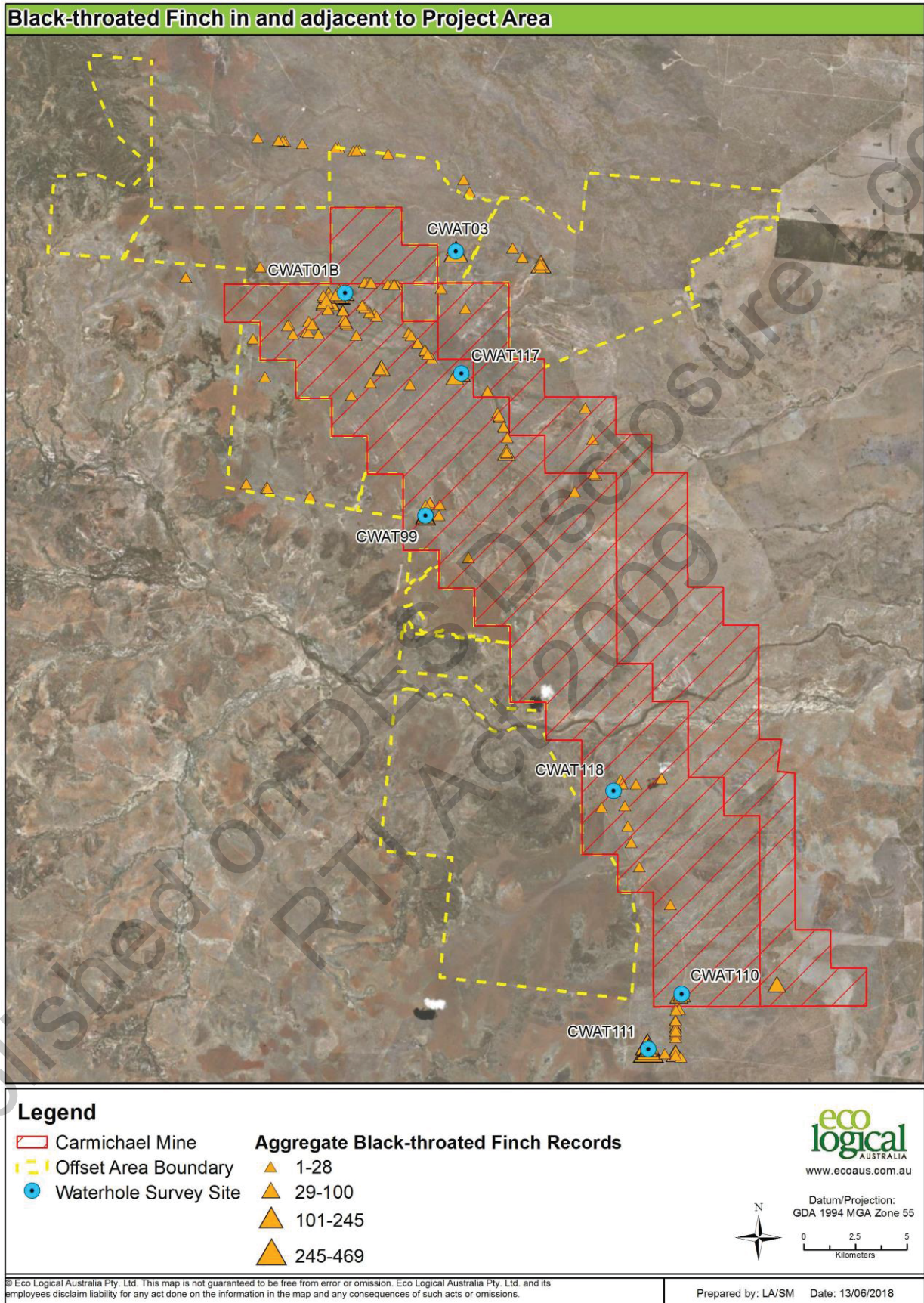


Figure 4 BTF Records – 2012 to 2016 (GHD 2012, GHD 2013a, GHD 2013b, Niche 2015a, Niche 2015b, Niche 2016a, Niche 2016b and ELA 2016)

4.6 Threats, potential direct / indirect project impacts

Threats and potential direct / indirect project impacts that are required to be addressed as they apply to the BTF on the Project Area are:

- threats to the BTF as identified in **Table 4** and the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007; BTF Recovery Plan)
- direct and indirect project impacts outlined in the EIS (GHD 2012a; Adani 2012)
- matters outlined in Condition 6 of the EPBC Approval (2010/5736).

EPBC Condition 6c) and EA Condition 16d) require details for all impacts and threats MNES to be included in this plan. Known threats to BTF from the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007) are listed in **Table 4**.

The potential sedentary lifestyle of the BTF may make it vulnerable to any loss, disturbance or modification to any of the three key resources of water sources, grass seeds and trees providing suitable nesting habitat (DEWHA 2009). Particularly, the synergistic effects of pastoralism, drought and fire are thought to have the greatest impact on the species by increasing the period of resource shortage and decreasing the quality and availability of breeding habitat (at External *et al.* 2011). However, some aspects of pastoralism may also benefit the species (e.g. stocking rates, fire fuel management and artificial water sources).

Other potential threats to the BTF (southern) are illegal trapping, hybridisation with escapees of the northern subspecies, resource bottlenecks associated with drought and changes in land management practices and impacts on seasonal breeding success from cyclonic activity (i.e. destruction of nests; BTF Recovery Team, DECC & NPWS 2007; DoE 2015).

Whilst there is information available helping to identify likely threats to BTF, there are still gaps in the knowledge of how these threats operate, and how they may vary in their impact in different geographical areas that the species inhabits, and how the threats interact with each other.

Impacts resulting directly from the removal of coal include initial clearing of vegetation, removal and storage of topsoil, overburden, coal, rejects and dry tailings, dewatering, and clearing and construction of haul roads. Key impacts on BTF from these activities will be the loss of suitable habitat, direct loss of birds, loss of water sources and uncontrolled fires. As required by Condition 6 of the EPBC approval (2010/5736), potential impacts including area of impact to BTF must be addressed in this plan.

Indirect impacts as a result of clearing and construction for mining and associated activities include weed spread (especially of grass species that are unpalatable to BTF and / or tend to form monocultures), change in species diversity and composition of the grass layer, potential for contamination of water sources and habitat degradation through light spill, noise and dust. Threats, potential direct and indirect project impacts to the BTF are described in detail in the following sections.

Table 4 BTF threats, potential direct / indirect project impacts and matters required to be addressed by conditions

#	Potential Threat or Impact	Threat identified in the BTF Recovery Plan	Potential direct project impact identified in SEIS	Potential indirect threat or impact identified in SEIS	EPBC Approval, condition 6	Project Phase/s	Description of threat and potential project impact	Impact addressed
1	Vegetation clearing / habitat loss, including fragmentation of key habitat areas and potential fatalities from clearing	Yes	Yes	-	(c)(i)	Construction	Section 4.6.1	Table 8
2	Habitat alteration through subsidence	-	Yes	-	-	Operations	Section 4.6.2	Table 8
3	Increased exotic pasture and weed invasion of key habitat areas	Yes	-	Yes	(c)(ix)	Construction Operations	Section 4.6.3	Table 9
4	Grazing in key habitat areas that changes the ground cover composition	Yes	-	Yes	-	Construction Operations	Section 4.6.4	Table 9
5	Wildfire or inappropriate fire management to key habitat areas that changes the ground cover composition	Yes	-	Yes	-	Construction Operations	Section 4.6.5	Table 9
6	Feral animal impacts	Yes	-	Yes	-	Construction Operations	Section 4.6.6	Table 9
7	Loss or degradation of water sources	Yes	-	Yes	(c)(ii)	Construction Operations	Section 4.6.7	Table 10
8	Mine dewatering	-	-	-	(c)(if)	Operations	Section 4.6.8	Table 10
9	Earthworks	-	-	-	(c)(iv)	Construction	Section 4.6.9	Table 10
10	Noise and vibration	-	-	-	(c)(v)	Construction	Section 4.6.10	Table 10
11	Emissions (including dust)	-	-	-	(c)(vi)	Construction	Section 4.6.11	Table 10
12	Light spill and other visual impacts	-	-	-	(c)(vii)	Construction	Section 4.6.12	Table 10
13	Stream diversion and flood levees	-	-	-	(c)(vii)	Construction	Section 4.6.13	Table 10

Each of the threats to BTF, potential direct / indirect project impacts and matters required to be addressed by EPBC Approval, Condition 6 are described in detail in the following sections.

4.6.1 #1: Vegetation clearing / habitat loss, including fragmentation of key habitat areas

Clearing of vegetation is the primary threat that would affect the availability of breeding and foraging habitat for the BTF. Habitat loss, fragmentation and degradation are the main threats to the BTF (at External ed at External 2000; Department of the Environment 2005; BTFRT 2007).

The most probable cause of decline from the southern parts of the historic range are overgrazing and habitat clearing (at External 1999; Department of the Environment 2005). Declines have been less severe in the northern part of the subspecies range where clearing is not yet as widespread and grazing is predominately by cattle (moved at External Revi 2000; BTFRT 2007).

A total of 9,492 ha of identified BTF habitat are proposed to be impacted by vegetation clearing over the life of the Project (CO2 2016). This represents 0.16 percent of the total potential habitat within the Desert Uplands and Brigalow Belt bioregions within which the Project occurs. Details of habitat disturbance across the project stages are summarised in **Table 5**, with the sum of critical, core and marginal habitat disturbance totalling 9,492 ha.

Table 5 Summary of disturbance to BTF habitat at the Mine, off lease and Rail West aspects of the project over Stage 1 and 2 (CO2 2016)

BTF Habitat type	Stage 1 (ha)	Stage 2 (ha)	Total (ha)
Very High (Critical)	4,628	3,080	7,708
High (Core)	726	288	1,014
Marginal	739	31	770
Low	344	634	978

The area of direct impact has been minimised as far as possible throughout the design and development of the mine plan. Through relocation of the out of pit stockpiles, the area of direct impact was reduced by approximately 7,000 ha. This change to the mine plan resulted in an approximately 40% reduction in the potential area of direct impact (GHD, 2013).

High quality BTF habitat within the mining lease area is considered to be located generally in the northern third and the southern quarters of the Project Area (**Figure 3** and **Figure 4**). While delivery of the Project will be a staged process, each stage covers large areas of remnant vegetation and will have effects on the behaviour and movements of the local BTF population, reducing areas of suitable habitat.

Fragmentation of woodland and grassland vegetation associated with the Project development may reduce habitat availability due to the sedentary nature of the BTF as well as causing an alteration in grass species composition or seed availability, affecting the ability of the BTF to find food throughout the seasons. Fragmentation within 5 km of water sources may also reduce habitat availability due to loss of critical resources.

Planning and development of the mine will aim to minimise vegetation clearing in areas considered to be higher value habitat and where high concentrations of BTF occur. The approach of underground mining has been adopted in areas of *Eucalyptus melanophloia* dominant vegetation communities (RE 10.5.5a) and *Eucalyptus brownii* dominant vegetation communities (RE 10.3.6ax1), where possible, to minimise impacts to habitat known to be utilised by BTF in the Project Area (**Figure 3**).

It is anticipated that approximately 20,230 ha of vegetation will be cleared within the open cut mine footprint which includes open cut mining (including pits, slopes, voids and out of sit spoil dumps) and Infrastructure Area (including water storage, tailings drying cells, diversion drains and levees), of which approximately 9,492 ha is BTF habitat. This clearing is expected to occur over a period of life of open cut pits (approximately 40 years). A mine plan and schedule has been developed for the Project. The mine schedule is broken into 13 time periods, with a mine life of approximately 50 years. Periods 1- 5 are on a yearly basis and periods 6 – 13 are based on 5 years.

As shown in **Table 1**, the area required for clearing of vegetation in the first 10 years of the project life is only approximately 56% of the total disturbance area. As the open cut pit workings proceed towards the midlife (approximately 10-15 years), the rehabilitation of spoil dump areas will commence and hence the net disturbance areas will be reduced.

Portions of the Project Area will also be cleared for storage of earthen materials such as topsoil, overburden, coal, and tailings. An area of approximately 9,200 ha will be impacted by the placement of top soil and overburden. This area extends from the north-eastern to south-eastern corner of the mine footprint, along its eastern edge, over an area approximately 32 km long by 3 km wide. This will result in some direct loss of BTF habitat, particularly in the north-eastern section of the Project Area where large groups of BTF were recorded (Niche 2015a and Niche 2015b).

The proposed mine plan in relation to BTF habitat and records is shown in **Figure 3**.

Management objectives about the threat and impacts include minimising habitat loss and fauna death during vegetation clearing, progressive habitat restoration of disturbed areas and improving awareness of BTF by site personnel. **Table 8** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.2 #2: Habitat alteration through subsidence

Habitat alteration through subsidence as a result of underground mining at Carmichael Mine has the potential to degrade BTF habitat. Subsidence can cause surface movement, cracking and hydrological changes and lead to tree slumping, root damage, vegetation stress and dieback and ultimately alter grass species diversity and composition to those that may be unpalatable to BTF (Adani 2013).

A subsidence assessment was undertaken in 2013 and describes impacts to vegetation and fauna (Adani 2013). The assessment determined:

- Surface movement due to subsidence may lead to areas of destabilisation causing vegetation slumping, tree falls, erosion and root exposure
- Localised variable impacts for mine sites may occur under native vegetation, but were difficult to predict
- Tension cracks may leave soil vulnerable to erosion, leading to damage to root systems
- Impacts to changes in hydrology include loss or changes to the flow and direction through the subsurface, and depression of the surface may lead to water ponding after rain.

The study determined that ponding duration was predicted to range from less than a day to several months. The assessment was based on a typical wet year. The study detailed the subsidence impact area for each environmental value which intersected with the total cumulative layer of subsidence. The study determined the rankings for impacts for assessment of subsidence in **Table 6**.

Table 6 Ranking of impacts for subsidence, cracking, ponding and infrastructure

Impacts	Ranking of impacts
Subsidence	High: slope change of more than 2% (>5 m) Low: slope change of less than 2% (<5 m)
Cracking	High: > 100 mm (width) Low: < 100 mm (width)
Ponding	High: duration of ponding greater than 2 days Low: duration of ponding less than 2 days
Infrastructure	High: impacted by infrastructure Low: not impacted by infrastructure

The following quantity of subsidence impacts were predicted for BTF habitat (Adani 2013):

- High impact – 163.32 hectares
- Low impact – 6,145.39 hectares
- No impact – 574 hectares.

A management objective under this plan is to minimise habitat alteration through subsidence. **Table 8** describes how the management objective will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.3 #3: Increased exotic pasture and weed invasion of key habitat areas

The main non-native grass present in the Project Area is Buffel Grass which tends to form a monoculture and is associated with a depleted diversity of grasses. This grass dominates cleared areas in the east of the Project Area but is less prevalent in the intact woodlands favoured by BTF in the Project Area. BTF are not known to eat the seeds of Buffel Grass. A monoculture of any species will not provide quality foraging habitat as it reduces the diversity of species whose seeds can collectively provide continuity of supply through the year and during different seasons. The introduced forage legume *Stylosanthes* spp., especially *S. scabra*, is also likely to be detrimental if it becomes a common component of the ground layer of the vegetation, as it has a negative impact on native plant species richness and diversity (DSITIA 2014).

The introduction and / or spread of weeds is acknowledged as a threat to BTF (BTF Recovery Team, DECC & NPWS 2007). Buffel Grass is the primary existing threat to BTF habitat degradation in the Project Area. However other weeds, such as Parthenium, Prickly Acacia and other exotic grasses that are also known from the Project Area (Adani 2015) also have the potential to degrade BTF habitat if allowed to spread through mining activities. Vehicles and machinery also have the potential to import new weeds into the Project Area, with detrimental effects on BTF habitat.

A management objective under this plan is to reduce weed competition within BTF habitat. **Table 9** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.4 #4: Grazing in key habitat areas that changes the ground cover composition

The most probable cause of BTF decline from the southern parts of the historic range are overgrazing and habitat clearing (data External 1999; Department of the Environment 2005). Pastoralism was typically concentrated in areas containing suitable habitat for the southern BTF subspecies, such as grassy, riparian woodlands on alluvial plains (NRA 2007). Declines have been less severe in the northern part of

the subspecies range, where clearing is not yet as widespread and grazing is predominately by cattle (moved at External Review 2000; BTFRT 2007).

BTF are known to persist in pastoral landscapes due to the prevalence of open eucalypt woodlands with suitable water resources and grasses (DEWHA 2009). The abundance of BTF and the viability of their populations in the landscape are influenced by the grazing regime that is in place (DEWHA 2009).

The grazing regime influences the composition and structure of the herbaceous layer of the vegetation. Long-term heavy grazing will selectively remove perennial grass species that are less tolerant of grazing (at External Review 2011). This is likely to increase the prevalence of species such as *Aristida* spp. (Wire grasses), *Cenchrus ciliaris* (Buffel Grass) and *Bothriochloa pertusa* (Indian Bluegrass), annual grasses in general, and unpalatable weeds. Grass species richness is also likely to decrease under long-term heavy grazing.

Currently, the Project Area is being predominantly used for cattle grazing. The Project activities do not specifically include grazing, however, parts of the mining leases not being used for the construction and operation of the mine will be used for grazing. Long-term heavy grazing is likely to decrease the grass species richness and increase the prevalence of annual grasses and unpalatable weeds, and therefore decrease habitat quality for BTF (at External Review 2011). Strategically managed grazing can 'open up' the grass layer, increasing the amount of bare ground on which BTF often forage as well as prevent thickening of a woody shrub layer. Particular cattle grazing regimes can also be used to manipulate the grass layer and manage fire by reducing fuel loads and therefore fire intensity. Grazing by cattle can be used strategically to reduce fuel loads in order to reduce the risk of hot extensive fires.

Sustainable grazing practices will be used in the Project Area as a management tool to manage threats to BTF habitat. Grazing will be used to decrease the abundance and presence of weeds, including Buffel Grass and other exotic pasture grasses, and control fuel loads so as to reduce the risk of an uncontrolled fire.

A management objective under this plan is to use strategic and sustainable grazing to manipulate the grass layer and manage fire by reducing fuel loads and therefore fire intensity. However, the objective is to also ensure grazing itself does not become a threat. **Table 9** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.5 #5: Wildfire or inappropriate fire management to key habitat areas that changes the ground cover composition

Fire is inevitable in the grassy woodlands of central Queensland and a natural component of these ecosystems. Historically, ignition sources include lightning-strike, low intensity wet season fires, or under traditional indigenous management (DEWHA 2009). Changes in the fire regimes can alter the habitat and food resource availability for the subspecies (at External Review 1999); season-dependent diets have been documented in related finch species such as the Gouldian Finch (*Erythrura gouldiae*), Long-tailed Finch (*Poephila acuticauda*) and Masked Finch (*Poephila personata*; moved at External Review 2002).

Fire frequency can have the biggest impact on ecological function. High frequency, low intensity, patchy fire regimes can be beneficial to BTF by reducing the thickness of the shrub layer (moved at External Review 2001). However, European settlement has caused a shift towards frequent, extensive and high intensity fires in the dry season resulting in large uniform areas being subject to fire (Rechetelo 2015). Inappropriate fire regimes can impact on the quality of habitat for the BTF by affecting the production of seeds and the diversity of grass species impacting on food availability. Fire will generally not reduce densities of *Eucalyptus* spp., such as Silver-leaved Ironbark, though it can change canopy structure.

Alternatively, fire exclusion can also lead to thickening of woody shrubs, decreasing the quality of BTF habitat.

BTF tend to favour habitat with a sparse cover (less than 5%) of shrubs (**Appendix E**). Short-lived *Acacia* spp. or dense areas of *Carissa ovata* and / or *C. lanceolata* will suppress the grass layer and grazing, and an altered fire regime will also increase woody thickening, diminishing both the forage supply and the quality of foraging habitat (Ludwig 2000; DSITIA 2014).

BTF require open patches between grass tussocks to feed on fallen grass seed. If the understorey is shrubby, the supply of grass seeds is likely to be diminished. Extensive areas of dense shrubs are likely to be detrimental to the species as the shrubs suppress grass growth and the exclusion of fire can facilitate the development of these areas (Removed at External Review *et al.* 2001). Small patches of shrubs and low trees may be used to rest and for shelter.

Fires in woodlands of the type that occur in the Project Area are fuelled principally by grass biomass rather than by woody material. Fire intensity will be greater with high fuel biomass, continuity of the fuel layer, a high degree of curing (drying) of the grassy fuel and ambient conditions, including high temperatures, low humidity and high wind speeds. Lower intensity fires will occur when fuel biomass is low and / or discontinuous, fuel moisture levels are high, ambient temperatures and wind speeds are low and atmospheric humidity is high.

Fire frequency, scale and intensity may also impact on habitat quality for BTF through numerous mechanisms. Large uncontrolled wildfires have the potential to destroy large areas of BTF habitat with consequential long recovery times. Fire frequency can also affect BTF habitat with inappropriate fire regimes impacting on the quality by affecting the production of seeds and the diversity of grass species and food availability (in the case of overly frequent fires) or by causing thickening of woody shrubs where fire is excluded from the landscape.

Management objectives under this plan are to reduce the risk of bushfire ignition, maintain a mosaic of fire history in BTF habitat and reduce the risk of bushfire spread. **Table 9** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.6 #6: Feral animal impacts

Domestic stock and rabbits can degrade habitat through grazing, trampling and altering the fuel loads (Removed at External Review 2007). Woodland bird communities often feed in mixed flocks which is a predator vigilance and avoidance behaviour (Vanderduys 2012; Adani 2012). Flocks may be reduced in size when the abundance of seeding grasses is low, and as a consequence can increase predation on bird species through loss of predator vigilance when feeding (Removed at External Review *et al.* 2011).

Invasive animals are known to occur in the Brigalow Belt North and Desert Uplands bioregions. Feral cats (*Felis catus*), were recorded in the Project Area in 2010 and 2011 and are likely to prey on BTF (GHD 2012a). There are currently no data on cat presence or predation rates within Moray Downs West or the Project Area. Studies near Townsville found that nests were abandoned or became inactive when they were destroyed by predators (NRA 2005 in DoE 2016). Foraging and watering areas may also be disturbed by wallowing and uprooting of feral pigs.

Management objectives under this plan are to reduce habitat degradation from grazing by introduced herbivores, minimise predation risk by invasive mammals and use adaptive management of weed and

pest controls to minimise threats to BTF and their habitat. **Table 9** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.7 #7: Loss or degradation of water sources

BTF need to drink water on at least a daily basis and drink more frequently during the drier times of the year. The importance of water to BTF is highlighted by the fact that they typically nest and breed near water. The species is thought to undertake local movements in response to rainfall patterns, with some populations utilising seasonally (wet season) available water to access breeding grounds then contracting back to permanent water sources during the dry season (observed at External Reservoirs).

Activities that reduce the availability (location and duration) of water or detrimentally alter water quality in areas of BTF habitat may negatively impact on the species. This impact will be greatest in breeding areas and / or dry season refugia. The availability of vegetation in the immediate vicinity of the water is important, to provide shelter for perching prior to drinking, and trees through which they can travel to and from the water are important. Pressures on the availability of water will be most pronounced during periods of drought. Conversely, the creation of water sources in certain parts of the landscape may create habitat for the BTF.

Numerous occurrences of BTF drinking from water troughs were recorded within the Project Area during surveys completed in the period 2013 to 2018 (GHD 2012; Niche 2015a and 2015b, ELA 2017a, E2M 2018). Vegetation in close proximity to water sources is important as it provides shelter for birds (observed at External Reservoirs 2011). It is likely that additional anthropogenic water sources in BTF habitat will assist the species in drought conditions by providing a more reliable and permanent source of water.

Within areas to be open cut mined, existing natural and artificial surface water sources will be lost. There are six dams within the Project Area where BTF have been identified (Niche 2015a, Niche 2015b, Niche 2015c and ELA 2017a) that will be lost due to mining activities (**Figure 3**). BTF have been recorded consistently utilising some of these water sources, in particular #1 Dam and #2 Dam. Removal of these permanent water sources from the Project Area will decrease the overall availability of water for the BTF across the broader landscape.

Availability of drinking water in proximity to good quality habitat is critical for BTF persistence. Contamination of potential BTF water resources surrounding the mine from sources such as hydrocarbon leaks or spills, spoil disposal, release of sediments through clearing and earthworks, or draining of low quality water from existing farm dams, could impact on the species. These impacts are unlikely to occur due to the alignment and location of mining activities and the implementation of adequate control measures. Such changes to water quality may reduce the suitability of aquatic and riparian habitats for terrestrial species.

Management objectives under this plan are to:

- ensure water quality in known BTF water sources outside disturbance footprint remain within acceptable limits
- reduce degradation of suitable water sources
- protect environmental values within waterways of the receiving environment
- minimise siltation of water resources
- maintain access to water, with no net loss of suitable permanent water sources
- reduce the risk of contamination of BTF habitat by chemicals, fuel, heavy metals

Table 10 describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.8 #8: Mine dewatering

Mine dewatering has the potential to negatively impact on groundwater-fed BTF watering sources. Drawdown may reduce the temporal and spatial availability of water by restricting or removing the base flow that persists in the Carmichael River during the dry season or increase the low flow periods as well as impacting spring wetland areas which BTF may use (ELA, 2015b). However, it should be noted that BTF have not been observed to utilise the Carmichael River (**Figure 4**).

A management objective under this plan is to manage the impacts of mine dewatering. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.9 #9: Earthworks

Earthworks carried out as a part of mine construction will lead to increased exposure to light, noise, dust, vehicles and people. Animals may also become more vulnerable to predation, because of increased light making it easier for predators to locate prey or noise levels making it harder for prey to detect approaching predators (Adani 2012).

Increased exposure to light, noise, dust, vehicles and people are dealt with in other sections. The other possible impact to BTF as a result of earthworks are the mortality and injury of individuals due to machinery strike.

Vehicles and machinery used to undertake land clearing have the potential to lead to direct mortality of fauna in the event that individuals are struck. Those animals that are unable to disperse away from areas under active clearing are also particularly susceptible to injury or death. This includes amphibians, reptiles, small ground-dwelling mammals, arboreal mammals and nocturnal species that are inactive during daylight hours.

Other potential causes of mortality include animals becoming trapped in excavations, and carrion eaters being struck when feeding on road kill. However, as the BTF are able to disperse away from areas subject to earthworks, fauna mortality and injury to individuals due to machinery strike is not expected to be a common occurrence (Adani 2012).

A management objective under this plan is to minimise the risk of light vehicle and machinery strike during earthworks and operations. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.10#10: Noise and vibration

As the Project Area is currently exposed to some disturbance as a working cattle property, the BTF that occur there exhibit a degree of disturbance tolerance. BTF are known to inhabit areas exposed to anthropogenic disturbance (peri-urban Townsville including habitat directly adjacent to military training areas and numerous towns in central Queensland).

The BTF may exhibit initial fright behaviour in response to the increased intensity of disturbance at the Project Area, and will either adapt to the disturbance levels, or move away from the areas of activity into

similar habitat that is extensively available in the adjacent landscape. Dispersal will be facilitated by active management and where possible enhancement of habitats occurring onsite (outside the mine footprint) and offsite (offset areas; Adani 2012).

The project will use standard construction equipment, general trade equipment and specialised equipment as required. Some blasting will be required to prepare overburden for removal and also coal extraction (Adani 2012).

Noise and vibration disturbance from coal transport may reduce the quality of resources for BTF, both within the Project Area and in adjacent areas. Noise from mining operations may increase BTF stress and flushing responses, change foraging behaviours, reduce reproductive success and communication at External (2012).

A management objective under this plan is to minimise habitat modification as a result of noise and vibration. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.11#11: Emissions (including dust)

Vegetation clearing has the potential to facilitate erosion (by water and wind). This can have a localised impact on species and habitat suitability by reducing the quality and abundance of refuges, microhabitats and food availability through the smothering of native vegetation with sediment.

Earthworks will result in dust emissions. Excessive dust settling on vegetation could also suppress vegetation growth by limiting the photosynthesis potential of plants in close proximity to the construction area (Adani 2012). Plants with dust on leaves may also be less palatable as a food source for animals. Dust deposition associated with earthwork activities will generally occur relatively close to areas of disturbance and hence, plants within 50 m – 100 m of construction activities may be affected by dust. As construction activities are temporary, effects will be short lived, and rainfall will generally remove dust from plants (Adani 2012).

Dust emissions from coal transport may reduce the quality of resources for BTF, both within the Project Area and in adjacent areas. Dust may also affect plant health and palatability, particularly for native grasses within foraging habitat.

A management objective under this plan is to minimise emissions, particularly dusts. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.12#12: Light spill and other visual impacts

Development of the project will necessitate the installation of lighting for safety and security of operations as the proposed mine will operate 24 hours per day. Impacts from lighting will involve static floodlights associated with mine operations, lighting around the mine infrastructure area, workshops and ancillary buildings, vehicle lights moving around the site. Artificial night lighting levels are expected to be very low indeed, if present at all, and this is considered to be an impact of minor significance on fauna generally, including the BTF (Adani 2012).

A management objective under this plan is to minimise light spill and other visual impacts. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.13 #13: Stream diversion and flood levees

Existing hydrology will be altered as a result of the mine operations through realignment of watercourses as well as removal of some existing farm dams and cattle troughs. Diversion drains around the perimeter of the mine site as well as areas of ponding and drainage management within the subsidence area provide water sources. The provision and security of surface water in those potential habitat areas may provide additional localised access to drinking water for the subspecies.

A management objective under this plan is to reduce the impact of stream diversion and flood levees. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

5 Adaptive Management Framework

This section describes the adaptive management framework that will be applied to the management of BTF, as originally outlined in the BTF Management Plan prepared during the environmental impact assessment process (Adani 2014).

Adaptive management is a process that deals with uncertainty and incomplete knowledge by using systematic monitoring to reduce uncertainty and improve management actions over time. The monitoring program that will provide data to inform and improve the management actions in this plan are outlined in **Section 7** and **Appendix C**. In general, the monitoring framework will:

- Address key questions regarding BTF ecology and distribution. The new knowledge will be systematically reviewed and used to refine the monitoring and management of BTF in the Project Area. Improved knowledge about BTF ecology and distribution will allow understanding of the potential project impacts to be further refined.
- Employ appropriate regular review and analysis of the monitoring data to refine the monitoring program and refine management actions.

Adaptive management emphasises the iterative feedback between the implementation of management actions and the assessment of their effectiveness via continuous improvement of knowledge via monitoring and evaluation of the monitoring data (at Extern *et al.* 2012). In particular, the results of the BTF Research Program and monitoring completed under the BTF Management Plan will provide a basis for review of the management actions, and ensure that mitigation measures are appropriately targeted and based on the best available science.

The key management actions are outlined in **Section 6**. Management actions, and the monitoring that provides information for the management, will be based largely on the main themes within **Section 6**, and may be expanded as new knowledge of BTF at the Project Area becomes available. Specific management objectives, performance criteria, management actions, monitoring, triggers for adaptive management, and corrective actions have been established (see **Table 8** to **Table 10**), consistent with the framework for adaptive management outlined in **Figure 5**. The monitoring program will inform the management actions over time, which in turn will help develop more effective monitoring programs. All of these steps will allow ongoing revision and improvement of the BTF Management Plan.

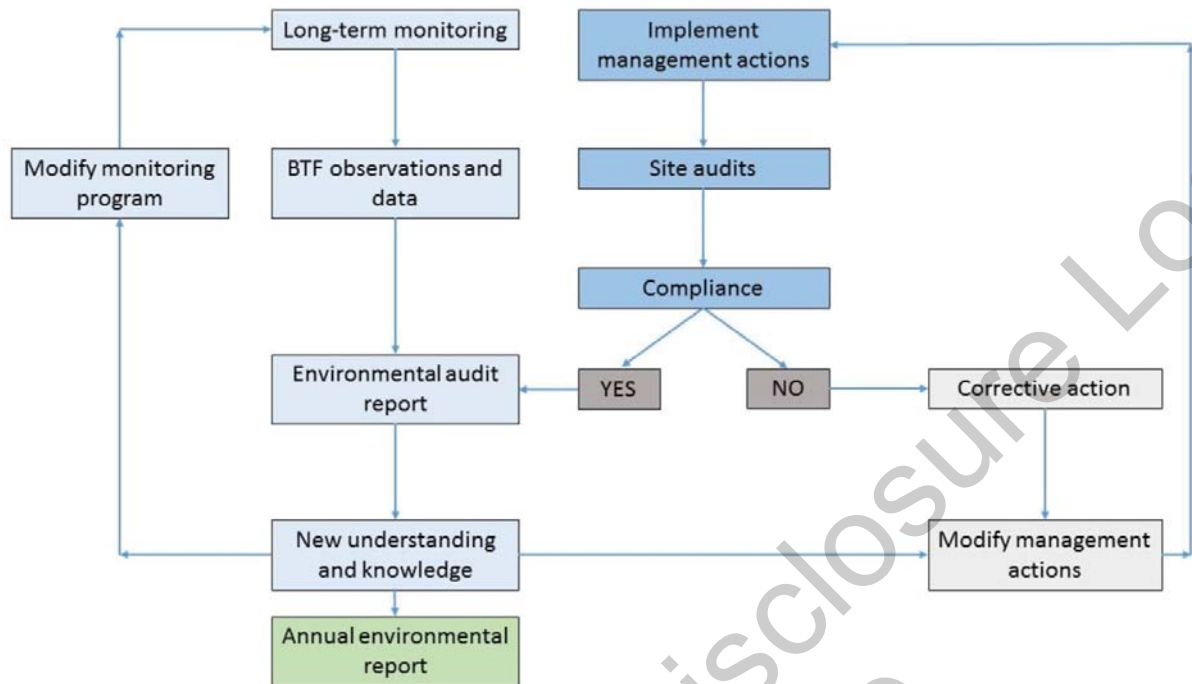


Figure 5 Adaptive management framework

6 Mitigation and Management Measures

The mitigation and management measures are required under EPBC conditions 6d) to f) and EA condition 16e) and have been developed in accordance with relevant guidance documents and best available knowledge regarding BTF ecology and habitat use within the Project Area.

An adaptive management approach will also be implemented where:

1. monitoring identifies that mitigation and management measures are not achieving the performance criteria
2. in response to triggers identified by the monitoring process and from information gathered in the field from the pre-clearance survey and fauna spotter-catchers, and
3. implementation of the BTF Research Program.

Measures intended to mitigate and / or manage the potential impacts to BTF are described in **Section 6.1**. As per EPBC Act approval condition 6j) and EA condition 16k), monitoring will be undertaken by a suitably qualified person (see **Section 9.3** for details), to determine the effectiveness of mitigation measures. This process is referred to as the adaptive management loop. The results of monitoring, and associated assessments of the effectiveness of mitigation measures, will be reported to DoE and DES.

6.1 Mitigation measures

Mitigation measures described are either those specific to BTF or for other ecological values of significance (i.e. TECs and other threatened species) of relevance to the BTF occurring in the Project Area. Generic mitigation measures are included as they provide an important approach to whole of ecosystem protection, which will also enable management of impacts to specific species, such as BTF.

Pre-clearance surveys are a collective mitigation measure proposed across this and other management plans as the surveys will provide information on the composition and area of vegetation and habitat to be disturbed prior to construction works. These surveys provide opportunities for avoidance of further impacts, as well as enabling accurate determination of disturbance areas to ensure these are not greater than approved disturbance limits.

A description of the generic mitigation measures that are applicable to the management of BTF is provided in **Table 7**.

Table 7 Generic mitigation measures to be implemented across the Project Area

Objectives	Actions
Educate site personnel and contractors about the presence and identification of threatened species, and maintain awareness during construction and operations.	Education <ul style="list-style-type: none"> • Induction program for site personnel and contractors about threatened species, their habitats and identification. • Identification posters in prominent work locations to maintain awareness. • Implement sound land management practices.
Reduce the magnitude of disturbance to threatened communities and threatened species within the Project Area where possible.	<ul style="list-style-type: none"> • There will be some discretion in the precise location of some infrastructure. Where possible, such infrastructure will be located in areas which avoid disturbance to threatened species habitat.

Objectives	Actions
Determine the environmental condition, immediately prior to construction activities. Monitor compliance with approval conditions as required by Condition 6g) of EPBC2010/5736.	Undertake pre-clearance surveys <ul style="list-style-type: none"> Conduct surveys of vegetation and threatened species habitat extent and condition, prior to the commencement of any clearing or disturbance activities. Define the area (hectares) of threatened ecological communities and threatened species habitat to be cleared.
Minimise impacts of construction on threatened communities and species.	Use licensed fauna spotter-catchers during vegetation clearing <ul style="list-style-type: none"> Fauna to be recorded and translocated to suitable habitat adjacent to the disturbance area, where practical. Fauna spotter-catchers are qualified professionals trained in competencies to handle animals, minimise capture myopathy and shock in birds and reptiles. Under the <i>Nature Conservation Act 1992</i> (Qld), fauna spotter-catchers hold permits for dispersing, removing and relocating wildlife. Fauna deaths and injuries to be recorded, and managed in accordance with relevant guidelines.
Minimise impacts on threatened communities and species, and their habitat. Promote post-construction recovery of the natural ecosystem.	Rehabilitate all temporarily disturbed areas (e.g. lay down areas and turning circles) <ul style="list-style-type: none"> All temporarily disturbed areas will be rehabilitated as soon as possible following completion of use, where such activity does not compromise the ongoing operation of the project (e.g. increase bushfire risk). The timing of rehabilitation actions after disturbance will be outlined in the Plan of Operations, developed in accordance with the EA. The ongoing program of rehabilitation works will be developed on the basis of environmental objectives, local site conditions and logistical requirements.
No net loss of threatened communities and species. Maintain the integrity of ecological habitats within the region.	Implement environmental offsets (for selected species and ecological communities) <ul style="list-style-type: none"> Offset the habitat values of threatened ecological communities and used by threatened species, within the Project Area by securing ecologically equivalent areas elsewhere. Monitor BTF habitat values through annual groundcover assessments during May to maintain and where possible enhance BTF habitat within the Mining Lease. Maintain BTF habitat values in non-mined areas
Reduce the impact of lighting on threatened species during construction and operation.	Manage light pollution <ul style="list-style-type: none"> Use directional lighting and strategic timing and placement of lights to minimise light spill into known threatened species habitat and TECs.

The results of all mitigation actions will be recorded as specified in approval condition 6g) of EPBC2010/5736. Further details of such reporting are provided in **Section 9**. A register of all commitments arising from the management planning process is provided in **Section 10**.

Tables 8 to 10 summarise the proposed mitigation and management measures specific to BTF which will be implemented during planning, pre-construction, construction, operation and decommissioning phases of the Project that address potential impacts specific to BTF. They include management actions for Ten Mile Bore, and the management of water sources. Within the approved level of disturbance, if there are management practices that can be taken to avoid, or reduce impacts to BTF and their habitat, such practices will be implemented.

6.2 Impact mitigation and management

In accordance with EPBC conditions 6d) to f) and EA condition 16e), measures will be implemented to mitigate and manage impacts to BTF during the Project.

To address the impacts to important BTF habitat in the northern section of the Project Area, Adani altered the mine plan during the EIS process to access coal reserves in this northern section via underground mining, thereby reducing the clearing requirements in this area. Where possible, associated mining infrastructure and disturbances (such as linear infrastructure, spoil and / or stockpiling) have been located in locations where there is no confirmed BTF habitat. In particular, this applies to the northern section of the Project Area where stockpiling and chemical storage will be within and / or adjoining locations where BTF have been recorded.

Mitigation measures associated with clearing will be implemented strategically in accordance with the staging of Project activities (**Section 2.2**). Prior to any clearing commencing, clearing requirements for mine and other infrastructure will be reviewed in order to identify opportunities to reduce clearing of native vegetation and utilise existing cleared areas wherever possible. Spoil and topsoil stockpiling will be avoided in areas where BTF have been recorded or within known or potential habitat, where possible.

Threatened species and vegetation mapping will be consulted prior to planning spoil pile placement to minimise the potential for impacts to BTF habitat. Rehabilitation of BTF habitat will occur in areas that are subject to temporary disturbance, and in areas that are no longer required for mining operations. Offsets are in place for areas of BTF habitat that can't be rehabilitated (see **Section 6.5**). Management activities for areas subject to offsets are described in the OAMP, and include the provision of water supplies to support BTF. At the completion of the Project, parts of the Project Area are likely to be utilised for pastoral activities, providing similar habitat values for BTF that existed prior to the Project commencing, including the provision of water for cattle grazing.

6.3 Impact minimisation measures

In accordance with EPBC conditions 6d) to f) and EA condition 16e), measures will be implemented to minimise impacts to BTF during the Project.

6.3.1 Vegetation clearing protocols

Planning phase – whole-of-project staging

The development of the Project will be a staged process throughout the life of the Project and is expected to result in impacts of up to 9,492 ha of BTF habitat (CO2 2016). In order to mitigate these impacts, the development and clearing will be staged (see **Table 1** for different Project stages causing disturbance).

Generally, clearing will commence from the middle of the Project Area which largely consists of non-remnant vegetation that does not provide habitat for BTF, before gradually progressing towards the north and south, respectively. Clearing of important habitat located in the northern third (i.e. between Four Mile Bore and Ten Mile Bore) and the southern quarter (south from Carmichael Bore) of the Project Area, will occur as late as possible during the construction and operational phases. The rationale behind this staged approach is:

- The existing breeding population of BTF within the Project Area will be protected for as long as possible, allowing for ongoing recovery and redistribution of the population;
- Clearing disturbed areas first will allow birds to remain in areas of good habitat rather than be directed into the mid-sections of the Project Area, where habitats are less favourable; and

- Staging will allow time for BTF habitat in the surrounding offset areas to improve such that birds may be attracted to these areas prior to clearing impacts occurring and / or have areas of suitable habitat to move into during construction.

Clearing will be minimised as far as practicable during the wet season, which is the known breeding season for BTF. The wet season is nominally December to March each year, and Adani will use its best endeavours to plan and implement clearing activities to occur outside the breeding season. However, the actual timing of the wet season will be determined on an annual basis depending on local weather conditions.

Management measures to achieve the clearing outcome will be through long term planning process according to the stages of mine plan that will allow these timing restrictions to be adhered to. However, if operational constraints (particularly in the early stages of the mine construction) necessitate clearing during the wet season, additional measures will be required and will be implemented during the pre-construction phase (see below).

Pre-construction phase – stage scale planning for vegetation clearing

A range of measures will be implemented prior to vegetation clearing for each stage, in order to further avoid and / or reduce impacts to BTF. Collectively, these measures are aimed at encouraging birds still present in the clearing zone to leave the area without human intervention.

A clearing plan will be developed for each stage. The development of this plan will require up-to-date information on the habitat quality and utilisation of the area by BTF. This information will be gathered during baseline and pre-clearance surveys, to be undertaken by suitably qualified ecologists, with demonstrated experience in the survey and management of BTF. Additional information gathered during the monitoring and research components of the Project must also be utilised.

The clearing plan for each stage will be developed and must consider/include:

- Mapping depicting disturbed areas, vegetated areas that are not potential BTF habitat, potential BTF habitat, areas where there have been sightings of BTF within the last five years, and areas showing breeding records.
- Structuring works in a way that specifies daily clearing extents within BTF habitats to allow BTF to fly to other habitat areas while habitat is cleared. Currently, it is conservatively assumed that BTF are able to travel at least 0.5 km in one day to escape clearing activities (BTF may travel several km in a day to access water). However these clearing limits will need to be tested as part of the on-going monitoring and adaptive management process.
- Structuring clearing so that wherever possible habitat connectivity can be maintained by providing stepping stones of habitat the BTF can travel through when escaping the clearing front.
- Site plans and maps depicting exclusion zones for vegetation clearance and machinery within areas of BTF habitat. Access to these zones must be restricted in order to prevent any unnecessary damage to BTF habitat.

Prior to the commencement of site works, any conditions listed in the “Permit to Disturb” must be implemented (e.g. clearing extents clearly marked and trees / areas requiring protection clearly marked).

Construction phase – clearing

Vegetation clearing will be undertaken in accordance with the clearing plan for each stage. All BTF habitat clearing operations will be monitored for compliance by suitably qualified fauna spotter-catchers during clearing activities (see below).

6.3.2 Fauna spotter-catcher

The use of fauna spotter-catchers prior to and during vegetation clearing activities within BTF habitat will be implemented to ensure impacts on BTF are minimised. This role is not specific to the BTF and will be implemented in accordance with the requirements of the overarching Species Management Plan and relevant approvals to protect fauna during clearing activities. The fauna spotter-catcher will instruct contractors on the most appropriate technique for felling habitat trees to minimise harm to undetected fauna and also inspect felled vegetation for fauna and relocate individuals as required.

If clearing is to occur during the wet season (to be avoided where possible), the role of the fauna spotter-catcher with respect to the BTF is to:

- Identify active nests not picked up by the pre-clearance surveys;
- Assess whether breeding places (i.e. nests) contain eggs or young;
- Establish and implement relocation requirements.

The fauna spotter-catcher will utilise expert advice from a BTF specialist to assist in the development of fauna handling/relocation plans to ensure consideration of life-cycle or ecological constraints. In circumstances where avoidance has been assessed but impacts on an isolated nest are unavoidable during the clearing process, with relevant approval from authorities for tampering with the breeding place of a threatened species, the fauna spotter-catcher would be responsible for removing the nest and placing young / eggs into care in captivity.

6.3.3 Summary of mitigation and management measures

The threats to the BTF relevant to the Project and potential project impacts and actions minimising impacts to the BTF are summarised in **Tables 8 to 10**. The tables address the following:

- management objectives
- performance criteria
- management actions
- monitoring
- triggers for adaptive management and corrective actions
- specific, measurable and time-bound corrective actions.

When adaptive management and corrective actions are triggered, the first step is to investigate the cause of the trigger. The investigation will be carried out as soon as possible, but within 2 days, after the trigger is identified and will focus on the reasons and causes of the triggers, and identify appropriate corrective actions in a timely way. The investigation will be:

- Carried out in accordance with the Environmental Management System (certified ISO 14001)
- Assessing actual or potential, short and long term impacts
- Determining the root and contributing causes
- Recording details on approved templates

- Identifying appropriate corrective actions, as per the last column in **Tables 8 to 10**. Notification of relevant managing agencies and a revision to the BOS will be proposed if an increased impact cannot be avoided.

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Table 8 Management objectives, performance criteria, adaptive management triggers and corrective actions – Vegetation clearing / habitat loss, including fragmentation of key habitat areas

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
Minimise habitat loss	No unnecessary clearing	<p>No-go zones for vegetation clearance and machinery will be developed for areas of BTF habitat outside of the clearing footprint and will be depicted on site plans and maps to restrict access and prevent unapproved clearing.</p> <p>Prior to the commencement of site works, any conditions listed in the "Permit to Disturb" must be implemented (e.g. clearing extents clearly marked, trees/areas requiring protection clearly marked).</p>	<p>Regular site inspections in accordance with the Environmental Management Plan and System.</p> <p>Close out report for the Permit to Disturb process includes check for compliance with:</p> <ul style="list-style-type: none"> clearing only in the approved footprint no clearing in the no-go zone/s. 	<p>Clearing in BTF habitat:</p> <ul style="list-style-type: none"> outside approved clearing footprint in no-go zone/s without a "Permit to Disturb" issued 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> When clearing outside approved clearing footprint, no go zones or without a "Permit to Disturb Permit" issued, <ul style="list-style-type: none"> Environment Manager ensure that all clearing activities cease immediately Area assessed by a suitably qualified ecologist/person within 15 business days of investigation Reviewing and modifying "Permit to Disturb" process and no-go zone identification and communication protocols
	Clearing of BTF habitat does not exceed 9,492 ha as approved in EIS and referral documentation	<p>Prior to the commencement of site works, any conditions listed in the "Permit to Disturb" must be implemented (e.g. clearing extents clearly marked, trees/areas requiring protection clearly marked).</p>	<p>Monitoring of vegetation proposed to be cleared by the Environmental Manager, via the Permit to Disturb process.</p> <p>Ongoing monitoring and reporting on the amount of BTF habitat that is cleared annually, and predicted to be cleared.</p>	<p>Reach 75% of the clearing BTF habitat approved area for stage 1</p>	<p>The trigger of reaching 75% of clearing BTF habitat does not require correction as the clearing is approved to be carried out, however the following actions will be triggered:</p> <ul style="list-style-type: none"> Contact with nominated representatives from compliance teams of DoE and DES under the EPBC and Environmental Protection Acts when clearing reaches 75% of approved area for stage 1 Provision of maps and data showing clearing in approved impact areas, and calculations showing quantity of approved clearing Provide advice demonstrating how the clearing will not exceed approved limits. <p>If the assessment finds that the actual area of impact differs from the area of impact as detailed in the BOS, within 30 days of this determination the BOS will be revised and submitted to the Department. If an increased offset is required by the revised BOS, this will be delivered within 12 months of the revised BOS being submitted to the Department.</p>

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
	Minimise habitat fragmentation	<p>The area of direct impact has been minimised as far as possible throughout the design and development of the mine plan. In 2012, the relocation of the out of pit stockpiles was reduced by approximately 7,000 ha. This change to the mine plan resulted in approximately 40 percent reduction in the potential area of direct impact.</p> <p>Where practical, spoil and / or stockpiling will be preferentially located in areas of previously disturbed environment or areas of future disturbance, rather than within BTF habitat. The assessment of practicality will consider issues such as the proximity and accessibility of alternative areas, safety of personnel and logistical requirements of transporting spoil.</p> <p>Manage non-mined and offset areas to maintain and improve BTF habitat values. This work will be guided by results from annual vegetation assessments, annual BTF surveys and the BTF Research Program. Ensure the pre-disturbance condition of BTF habitat adjacent to the development is maintained</p>	<p>Monitoring of vegetation proposed to be cleared by the Environmental Manager, via the Permit to Disturb process.</p> <p>Annual vegetation assessments, annual BTF surveys and the BTF Research Program.</p>	Direct impacts occur outside of approved impact areas particularly in non-mined areas.	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Impacts assessed by a suitably qualified ecologist/person within 15 business days of investigation Reviewing and modifying "Permit to Disturb" process and no-go zone identification and communication protocols Review of activities with respect to potential direct and indirect impacts outside of approved areas. Rehabilitation of the impacted area. <p>If the assessment finds that the actual area of impact differs from the area of impact as detailed in the BOS, within 30 days of this determination the BOS will be revised and submitted to the Department. If an increased offset is required by the revised BOS, this will be delivered within 12 months of the revised BOS being submitted to the Department.</p>
	Minimise the impacts of habitat alteration through subsidence	<p>Ameliorate impacts of ponding and cracking in subsidence areas to mitigate any negative impacts on BTF habitat values, in accordance with the Subsidence Management Plan.</p> <p>Establish exclusion zones and remove cattle from underground mining footprint, when subsidence is predicted. Construct fences outside subsidence footprint to keep cattle from the subsided area.</p>	<p>Develop a numerical model based on the geological data to refine predicted cracking and subsidence impacts. Modelling to inform detailed monitoring methodologies.</p> <p>Use of baseline habitat quality for comparison during monitoring, including control monitoring points.</p> <p>Conduct annual monitoring of the condition of BTF habitat in subsidence areas, using methodologies identified in the Subsidence Management Plan.</p>	<p>Impacts to BTF habitat, including ponding and cracking, found in subsidence areas.</p> <p>Weeds found in subsidence cracking and ponding areas.</p>	<p>The appropriate corrective actions will commence within 2 days of identification of cause and may include:</p> <ul style="list-style-type: none"> Reviewing and redesigning the monitoring program, increasing monitoring events, changing monitoring methodology Rectifying impacts (e.g. pumping out ponds) Re designing and implementing and water diversions Actively control weeds to maintain and enhance BTF habitat values in the cracking and ponding areas.

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
Minimise fauna death during vegetation clearing	BTF living near the clearance zone have time to move out of the areas of disturbance without human intervention	<p>Stages will be structured in a way that limits clearing extents to allow BTF to fly to other habitat areas when habitat is cleared.</p> <p>Clearing limits are untested and will be developed based on the likely ability of the BTF to travel a conservative minimum of 0.5 km in one day to escape clearing impacts to where suitable habitat is present in adjoining areas to be retained.</p> <p>Where possible, the overall direction of sequential vegetation clearance will be away from threatening processes (i.e. mining operations/roads cleared land) to direct fauna towards areas of retained native vegetation.</p> <p>The general progress of clearance will be towards habitat to be retained in the north and/or west of the Project Area for areas north of the Carmichael River and towards habitat to be retained in the south and/or west of the Project Area for areas south of the Carmichael River.</p>	<p>Record the areas of occupancy for all BTF prior to clearing activities that occur within the Project Area, adjacent to Project Area and areas for suitable BTF habitat rehabilitation.</p> <p>Confirm and identify the spatial extent and condition of BTF habitat to be disturbed prior to any clearing or disturbance commencing, through pre-clearance surveys. BTF surveys will focus on confirming species presence throughout the Project Area, identifying species presence in proximity, but outside (adjacent to) Project Area and identifying areas of potential rehabilitation for BTF habitat values inside the Project Area, but outside the disturbance footprint.</p> <p>Record observed BTF fatality, including suspected nests / eggs of BTF.</p>	<ul style="list-style-type: none"> Insufficient adjacent habitat within 500m from clearance areas to allow refuge from impacts. Fauna spotter-catchers and monitoring results indicating that BTF are not able to move away from cleared areas in sufficient time. BTF death or injury during vegetation clearing. 	<p>The appropriate corrective actions will commence within 2 days of identification of cause and may include:</p> <ul style="list-style-type: none"> Redesign of activities associated with observed mortality to avoid causal and contributing factors Re-planning / adjusting clearing progression timeframes and locations with respect to refuge availability Third party review by suitably qualified ecologist/person of management and monitoring actions to provide input on effectiveness Modifying the strategic grazing regime, or fire management measures, to better support enhancement of values Divert clearing to other habitat to provide time for BTF to adjust Re-evaluate the suitability of the relevant management and monitoring actions in this plan The installation and maintenance of additional artificial watering points for the black-throated finch.
	No injury or death to BTF individuals, nests or their young during vegetation clearing	<p>Pre-clearance surveys will be conducted by a suitably qualified ecologist throughout BTF habitat prior to the commencement of each stage of clearing to identify and map significant areas for the BTF.</p> <p>Where active nests or other sensitive habitat areas are identified during the pre-clearing</p>	<p>Confirm and identify the spatial extent and condition of BTF habitat to be disturbed prior to any clearing or disturbance commencing, through pre-clearance surveys.</p> <p>BTF surveys will focus on confirming species presence throughout the Project Area, identifying species presence in</p>	<ul style="list-style-type: none"> Vegetation clearance undertaken without a pre-clearance survey. Clearance of vegetation does not follow vegetation clearance protocols with no progressive clearing plan developed prior to each stage of clearing. 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Depending on the extent of any injuries, injured BTFs will either immediately be taken to the nearest qualified veterinary practitioner or wildlife carer, or humanely euthanized on site by an authorised and trained person Rectifying impacts of vegetation loss Review and re design to avoid reoccurrence and address actual cause

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
		<p>surveys specific actions will be implemented to address these areas.</p> <p>Suitably qualified and experienced fauna spotter-catchers will be present during vegetation clearance works within areas of BTF habitat and remnant vegetation.</p> <p>No tampering with BTF breeding places is to occur without the relevant approvals / permits. Any removal of nests will be required to be undertaken in accordance with the requirements of approvals.</p> <p>BTF deaths and injuries will be recorded, and managed in accordance with relevant guidelines.</p> <p>Record the areas of occupancy for all BTF prior to clearing activities that occur within the Project Area, adjacent to Project Area and areas suitable for BTF habitat rehabilitation.</p>	<p>proximity, but outside (adjacent to) Project Area and identifying areas of potential rehabilitation for BTF habitat values inside the Project Area, but outside the disturbance footprint.</p> <p>After BTF habitat clearing, a search for remaining BTF will be conducted as soon as practicable.</p>	<ul style="list-style-type: none">BTF death or injury during vegetation clearingVegetation clearance undertaken without a qualified fauna spotter-catcher present during BTF habitat clearing	<ul style="list-style-type: none">Communication with personnel involved and across all site team members (for example, via toolbox meetings)Incidents will be reported to DES and DoE within 24 hours by the Environmental Manager as per Species Management Program conditions.
	No entangled BTFs	No mine-related equipment or infrastructure with the potential to entangle fauna (e.g. bundled mesh fencing) will be left in sensitive areas such as near water bodies or potential BTF foraging areas.	Regular site inspections in accordance with the Environmental Management Plan and System.	Notification of BTF found entangled. BTF death or injury	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none">Depending on the extent of any injuries, injured BTFs will be either taken to the nearest qualified veterinary practitioner or wildlife carer, or humanely euthanized on site by an authorised and trained personReviewing procedures and fencing protocolsActions to avoid entanglement re occurrenceIncidents will be reported to DES and DoE within 24 hours by the Environmental Manager as per Species Management Program conditions.
Areas for BTF to relocate to are available during clearing	<p>Ensure the pre-disturbance condition of BTF habitat adjacent to the development is maintained and condition of Offset Areas is being improved as per the OAMP.</p> <p>Offset Area condition adjacent to the mining leases is being improved as per the OAMP.</p>	<p>Deliver the Moray Downs West Offset Area Management Plan, as approved.</p> <p>The monitoring methods included in the <i>Moray Downs West Offset Area Management Plan</i> for the offset area are as follows:</p> <ul style="list-style-type: none">method for determining monitoring locations is to apply the Guide to Determining Terrestrial Habitat Quality to calculate habitat quality scoresFor the species stocking rate component, the monitoring method for BTF as outlined in this planFor sites being monitored under the BTFMP within the offset area, use survey results to inform the habitat quality scoring under the OAMP (rather than duplicating survey effort at these sites).	At 12 months after commencement of specified component of the action, no progress in legally securing an offset area.	Submission of application for alternative legal security with the Queensland and Commonwealth Governments, within the 12 months of trigger.	

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
Progressive habitat restoration of disturbed areas	All temporarily disturbed areas rehabilitated within 12 months of activity	The time between clearing BTF habitat, and the next construction activity will be as short as possible. However, the time between BTF habitat clearing and next activities will be a maximum of 12 months. All temporarily disturbed areas will be rehabilitated as soon as possible following completion of use, where such activity does not compromise the ongoing operation of the project (e.g. increase bushfire risk).	Regular site inspections in accordance with the Environmental Management Plan and System. Measure the effectiveness of mitigation measures involving rehabilitation. Compare to relevant control sites or benchmarks for RE. Identify areas where rehabilitation effectiveness needs to be improved to achieve environmental objectives. Targeted searches during monitoring events for rehabilitation areas.	Cleared BTF habitat area exposed for 11 months. Temporary disturbance areas that are no longer required not rehabilitated, leading to excessive dust or other environmental nuisance or disturbance triggers.	When cleared BTF habitat area exposed for 11 months, rehabilitation of the impacted area. The appropriate corrective actions for disturbance triggers, will be in accordance with the Environmental Management System, implemented and may include: <ul style="list-style-type: none"> Review of process for temporary disturbance and monitoring to improve response time Rehabilitation activities to be undertaken in areas of temporary disturbance.
	Rehabilitation of disturbed areas that are no longer required for operations	Progressive rehabilitation of disturbed areas will commence as soon as possible and generally within 6 months of the completion of operations activities in each area, in accordance with the Rehabilitation Management Plan. Rehabilitation will only commence later than 6 months if there will be benefits in coinciding commencement with the wet season. Rehabilitated areas must include food and water resources, and open foraging areas.	Monitoring surveys will be conducted biannually for a 10 year period by suitably qualified ecologists in accordance with standard methodology to identify changes in BTF population size and movements over time. Banding and re-sighting techniques will provide a basis for assessing movement patterns and assessment of population dynamics. Targeted searches for BTFs in each rehabilitated area.	Annual rehabilitation monitoring report determines rehabilitated areas do not achieve outcomes as specified in Environmental Authority conditions.	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Delivering recommendations by a suitably qualified ecologist/expert for the reason for rehabilitation not achieving outcomes Review of weather conditions / seasons and timing of rehabilitation activities Trials of new rehabilitation methods.
	Disturbed habitat is restored or enhanced as soon as practicable (See also Performance Criterion "All temporarily disturbed areas rehabilitated within 12 months of activity")	Management of habitat within the Project and offset areas will occur concurrently. The management will increase the carrying capacity of the adjoining habitat and provide refuge to BTF no longer able to utilise cleared areas. Rehabilitated areas must include food and water resources, and open foraging areas. A combination of short-term fast acting habitat modification activities (such as shrub layer reductions and grass layer improvements) to improve habitat qualities for BTF foraging, and longer-term activities such as weed management replanting programs to rehabilitate heavily disturbed areas over time.	Monitoring measures as shown on previous page (same row of table)	Disturbance areas that are no longer required not rehabilitated, leading to excessive dust or other environmental nuisance or disturbance triggers. (See also Triggers for Performance Criterion for "All temporarily disturbed areas rehabilitated within 12 months of activity")	The appropriate corrective actions in accordance with the Environmental Management System will be implemented and may include: <ul style="list-style-type: none"> Review of process for temporary disturbance and monitoring to improve response time Rehabilitation activities to be undertaken in areas of temporary disturbance.

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
Improve awareness of site personnel	All site personnel aware of management requirements with respect to BTF	<p>Incorporate information regarding BTF (such as map of habitat areas within the Project Area) and BTF management requirements into site inductions, toolboxes and pre-starts, particularly where working in or around BTF habitat.</p> <p>Identification posters for all threatened species with the potential to occur in the Project Area will be displayed in prominent positions.</p>	Records kept as a part of the Environmental Management System of inductions, training and toolbox meetings to ensure site personnel receive the appropriate environmental training.	Environmental harm to BTF or their habitat as a result of site personnel activities.	<p>The appropriate corrective actions in accordance with the Environmental Management System will be implemented and may include:</p> <ul style="list-style-type: none"> Depending on the extent of any injuries, injured BTFs will be either taken to the nearest qualified veterinary practitioner or wildlife carer, or humanely euthanized on site by an authorised and trained person Rectifying impacts of vegetation loss Review of induction information and implementation processes to ensure BTF management requirements are addressed and distributed to all site team members Additional educational awareness training for site personnel Incidents will be reported to DES and DoE within 24 hours by the Environmental Manager as per Species Management Program conditions.

Table 9 Management objectives, performance criteria, adaptive management triggers and corrective actions – Potential indirect project impacts

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
3	Increased exotic pasture and weed invasion of key habitat areas	Reduce weed competition	<p>No introduction of pest plants, invasive understorey species into BTF habitat.</p> <p>No significant increase in the abundance of weeds across the Project Area and into / from adjacent habitat.</p>	<p>Weed control will focus on managing declared pest plants and invasive species during construction and operations, in accordance with the project pest management plan.</p> <p>Weed hygiene controls, including the use of weed wash down stations, will be implemented in accordance with the project pest management plan to prevent the introduction and spread of declared pest plants and other invasive weeds.</p> <p>Weed free areas within sensitive BTF habitat will be identified and mapped with strict weed control requirements for entering weed free areas.</p> <p>The establishment of new tracks through BTF habitat outside of the clearing areas will be minimised to prevent transport of weed seeds into BTF management areas.</p> <p>Provide weed wash-down stations at all Project Area entry and exit points, and tracks through known weed-infested areas.</p> <p>Enforce the use of weed wash-down stations at all times.</p> <p>Adaptive management of weed controls to minimise threats to BTF and their habitat.</p>	<p>Monitoring of weeds will be conducted yearly (including photo monitoring) or as per the project pest management plan. Monitoring will be for pest plants in BTF habitat in, and adjacent to, the Project Area (consistent with the OAMP).</p> <p>Monitoring will occur at the optimal time for detecting and identifying pest plant species.</p> <p>Monitoring will include for the presence of declared weeds, and abundance of environmental weeds.</p>	<ul style="list-style-type: none"> • Introduction or establishment of declared pest plants, and invasive species into previously unaffected areas. • Results of weed monitoring indicate a degradation of BTF habitat values, due to a proliferation of weeds. • A significant increase in the abundance of weeds, or pests or identification of new infestations. • Infestation of new weed species. 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> • Eliminate potential sources or reasons that may have attributed to an increase in species richness and/or relative abundance of weeds • Amending weed hygiene restrictions • Providing additional educational awareness training for site personnel to ensure weed hygiene restrictions are adhered to • Revising weed control methods in accordance with the <i>Biosecurity Act 2014</i> • Take action to protect and restore BTF habitat values through implementation of site-specific measures such as weed control, fire management or grazing • Actively manage weeds to maintain and enhance BTF habitat values • Increasing the frequency and intensity of weed controls • Updating weed control methods in targeted weed control programs and plans.

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
4	Grazing of key habitat areas that changes the ground cover composition	Strategic use of grazing to manipulate the grass layer and manage fire by reducing fuel loads and therefore fire intensity. Do not allow grazing itself to become a threat.	Grass load is managed to reduce fire risk in accordance with controlled grazing methods. Grazing does not become an impact to grass layers and grass composition	The management of grazing within non-mined areas will be based on existing pastoral management practices under land agistment agreements, pastoral holding lease conditions and associated legislation. Management actions will seek to maintain and where possible enhance BTF habitats and populations (e.g. pest control, water source, grazing and fire management) in unmined parts of the Mine Area, as well as in offset areas.	Native perennial ground cover and ground composition assessed annually against the baseline data Monitor the condition of BTF habitat adjacent to the development and the Offsets Area. This will be undertaken using standard BioCondition monitoring surveys (see Eyre <i>et al.</i> 2011 for details) and species habitat index. The quality of known BTF water sources will be monitored. Annual BTF habitat vegetation assessments will occur during May within 2 ha plots at the following locations: CHAB02, CHAB03, CHAB22, CHAB23, CHAB24, CHAB25, CHAB37, CHAB45, CHAB47, CHAB48, CHAB52 (Open cut disturbance areas) and CHAB01, CHAB04, CHAB05, CHAB09, CHAB10, HAB44 and CHAB46 (Underground disturbance areas). Vegetation assessments will use methodologies described within baseline 'Report for Black Throated Finch On-site Monitoring Survey' dated 12 July 2013 to assess ground cover and ground composition based on Queensland BioCondition Framework (Eyre <i>et al.</i> 2011) and the Queensland Herbarium flora survey methods (Neldner <i>et al.</i> 2005).	<ul style="list-style-type: none"> Annual vegetation assessment demonstrates a loss of native perennial species and / or cover from baseline conditions A significant increase in the abundance of non-native species such as Buffel Grass Incidence of uncontrolled bushfire 	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Additional fencing Spelling of paddocks to control grazing Additional controlled grazing to reduce biomass levels Additional pest controls Further fire management.

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
					<p>Moray Downs West Offset Area The monitoring methods included in the <i>Moray Downs West Offset Area Management Plan</i> for the offset area are as follows:</p> <ul style="list-style-type: none"> method for determining monitoring locations is to apply the Guide to Determining Terrestrial Habitat Quality to calculate habitat quality scores For the species stocking rate component, the monitoring method for BTF as outlined in this plan For sites being monitored under the BTFMP within the offset area, use survey results to inform the habitat quality scoring under the OAMP (rather than duplicating survey effort at these sites) <p>Further monitoring methods for BTF in the offset area are consistent with this plan, such as:</p> <ul style="list-style-type: none"> water source watches active searches incidental observations remote cameras vegetation condition assessments foraging plot assessments. 		

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
5	Wildfire or inappropriate fire management of key habitat areas that changes ground cover composition	Maintain a mosaic of fire history in BTF habitat. Reduce the risk of bushfire spread	No uncontrolled fires (bushfires) in the Project Area. Fire management is conducted in accordance with the Bushfire Management Plan	Where possible, planned burns within BTF habitat will be undertaken outside of the BTF breeding season. This will depend on seasonal conditions from year to year. The fire regime will be managed to utilise a patchwork of areas of different fire frequencies and times but biased toward low intensity fires. This regime would also help to reduce the risk of widespread hot fires by reducing fuel loading at the landscape scale. Higher intensity fires can be used strategically to reduce dense stands of <i>Acacia</i> spp., which may affect BTF foraging habitat. Two fires, approximately 2-3 years apart, could reduce the abundance of these species but it would be important to then allow several years for recovery of the community. The existing network of roads and tracks will be used to manage fire, rather than establishing additional firebreaks. This will help reduce the risk of weed incursion through movement of traffic into intact grasslands. Avoid the planning of scheduled burns in BTF habitat during the wet season where possible. Any planned burns during the breeding season that cannot be avoided will be carefully managed with respect to location relative to water sources and preferred breeding areas so as to seek opportunity to exclude these areas.	Monitoring of fuel load levels and native perennial ground cover and ground composition will be assessed at least annually against the baseline data. Additional monitoring actions as per the Bushfire Management Plan.	<ul style="list-style-type: none"> Unplanned burn during the breeding season. Dense shrub layers forming in BTF habitat due to fire promoted germination. Incidence of uncontrolled bushfire 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Review of fire regime based on monitoring results and aim to achieve appropriate balance of groundcover/shrub layer management without degrading foraging habitat Increasing the frequency of biomass monitoring Amending the strategic grazing regime Reviewing effectiveness of firebreaks, and establishment of additional fire breaks Modifying the timing and/or intensity of controlled burns.

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
		Reduce the risk of bushfire ignition	No bushfires sparked by project activities.	<p>Prior to site entry, all relevant site personnel, including contractors, will be made aware of fire safety and risks, including compliance with the Fire Management Plan.</p> <p>Bushfire mitigation measures will be specified in the Bushfire Management Plan and will include but not be limited to:</p> <ul style="list-style-type: none"> Monitoring of weather conditions to identify high fire risk days, with controls upgraded on these days Restrictions on vehicles being left idling with the exhaust in contact with dry grass Designation of smoking areas Development of bushfire fuel management practices in the Project Area Minimise the residency time of accumulated coal around coal handling facilities to reduce the risk of spontaneous combustion Ensure all crews are equipped to deal with fires. This includes both fire-fighting equipment and training Monitor pasture biomass at the beginning of the wet season Work sites will be provided with adequate fire-fighting equipment (water cart) and training implement actions to prevent and suppress the spread of fire, should bushfire be ignited. 	<p>Monitoring of fuel load levels and native perennial ground cover and ground composition will be assessed at least annually against the baseline data.</p> <p>Additional monitoring actions as per the Fire Management Plan.</p>	<ul style="list-style-type: none"> Bushfire sparked by project activities. 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Mitigate the established source, arising from the investigation, as to why and how the bushfire was sparked by project activities Review existing Bushfire Management Plan, ensuring consideration of ecological values and Rural Fire Service recommendations Greater monitoring of adherence to fire management measures Amending the strategic grazing regime Modifying the timing and/or intensity of controlled burns Re-training of site team members Delayed additional BTF habitat clearing Assess the benefits of strategic burning prior to the storm season to address pasture biomass that is unfavourable to BTF.
6	Feral animal impacts	<p>Reduce habitat degradation from grazing by introduced herbivores</p> <p>Minimise predation risk by invasive mammals</p> <p>Adaptive management of weed and pest controls to minimise threats to BTF and their habitat.</p>	No measured increase in rabbit, goat, fox and / or cat numbers in the Project Area.	<p>Adaptive management of pest controls to minimise threats to BTF and their habitat.</p> <p>A project pest management plan will be developed and implemented prior to construction and operations, including measures for controlling rabbits, goats, foxes, cats and weeds. The project pest management plan will be developed in conjunction with neighbouring land owners, and will focus on tracks, waterways and habitat edges.</p> <p>Feral cat control outlined in the project pest management plan will focus on areas where BTF will be exposed and vulnerable to predation including on the interface of the clearing front and remnant vegetation and at water sources where BTF are vulnerable to attack while drinking.</p>	Monitor the presence and population abundance of invasive fauna will be yearly as per the project pest management plan.	<ul style="list-style-type: none"> Significant increase in the population of any invasive predator species from baseline scores. Observed (or evidence of) predation of BTF by pest species Observed habitat degradation attributed to threatening pest species 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Increasing the frequency and intensity of pest animal control. Revising methods of pest animal control in accordance with Queensland Department of Agriculture and Fisheries (DAF) guidelines, and coordinate with neighbouring land owners to ensure a consistent approach Reviewing actions and methods included in the project pest management plan Updating pest animal control methods in targeted pest animal control programs Increase feral herbivore management efforts, in conjunction with neighbouring land owners Increase invasive predator management efforts, in conjunction with neighbouring land owners.

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
				Feral cat control, as specified in the project pest management plan will focus on areas where BTF will be exposed and vulnerable to predation including on the interface of the clearing front and remnant vegetation and at water sources where BTF are vulnerable to attack while drinking.		>Significant increase in the population of any invasive predator species from baseline scores.	
				Domestic animals will not be permitted into the Project Area, except for cattle and, when required for mustering, horses and dogs.	Regular site inspections in accordance with the Environmental Management Plan and System.	Domestic animals not permitted are observed in the Project Area	<p>The appropriate corrective actions in accordance with the Environmental Management System will be implemented and may include:</p> <ul style="list-style-type: none"> Rectifying impacts Communication with personnel involved and across all site team members (for example, via toolbox meetings) Review the project pest management plan.

Table 10 Management objectives, performance criteria, adaptive management triggers and corrective actions – Matters required to be addressed under EPBC Approval, condition 6

#	Matters under EPBC Approval, condition 6	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
7	Loss or degradation of water sources	<p>Ensure water quality in known BTF water sources outside disturbance footprint remain within acceptable limits.</p> <p>Reduce degradation of suitable water sources</p>	<p>Emissions (i.e. dust, coal and heavy metals) do not degrade water source quality in BTF habitat.</p> <p>Water sources not disturbed by other processes, such as overuse by cattle</p>	<p>Project impacts like, dust and cattle access will be minimised by the implementation of the Environment Management Plan, using standard procedures typical of large infrastructure projects.</p> <p>Maintain the required condition of water sources.</p> <p>Erosion and sediment control measures will be implemented where required, to reduce the potential for contamination of water sources prior to commencement of construction activities.</p>	<p>Annual monitoring, including photo monitoring, of water source availability, in the driest season</p> <p>Water and sediment samples will be collected in areas with the potential to be impacted by mining activities to test for the presence of heavy metals and chemical contaminants (annually during the dry season).</p>	<p>Physical evidence of dust degradation to water sources outside active mining areas.</p> <p>Water and sediment samples of water quality do not meet guideline triggers.</p>	<p>The appropriate corrective actions in accordance with the Environmental Management System will be implemented and may include:</p> <ul style="list-style-type: none"> • More frequent chemistry testing to confirm water quality against relevant standards, in the event that visual inspection of dust impacts fails • Review and re design to avoid reoccurrence and address actual cause • Review adherence to control procedures to ensure compliance • Take remedial action where compliance has not been adhered to • Communication with personnel involved and across all site team members (for example, via toolbox meetings) • Reporting to DES as per statutory and project requirements where incidents trigger reporting thresholds.
		<p>Protection of environmental values within waterways of the receiving environment.</p> <p>Minimise siltation of water resources</p>	<p>No contamination of surface waters by effluent outside the active Mining Areas</p> <p>No degradation by siltation of permanent water sources.</p>	<p>Sewage waste for the operation workforce will be treated in a package treatment plant to a Class A standard. All effluent will be recycled onsite for reuse or controlled discharge.</p> <p>Vegetation clearing near, or within ephemeral waterways will be avoided when rain is falling, or imminent.</p> <p>Management of erosion and sedimentation will be undertaken in accordance with a Project Erosion and Sediment Management Plan. This plan will identify all practices to be implemented prior to, during, and post-construction to minimise the potential for erosion to occur, including (but not limited to) timing of clearing activities, sediment and erosion control measures to be implemented, performance criteria and corrective actions.</p> <p>Implement dust control measures.</p> <p>Erosion and sediment control measures will be implemented where required, to reduce the potential for contamination of water sources prior to commencement of construction activities.</p>	<p>Monitor the efficacy of erosion control measures (at least monthly), such that measures can be constantly improved throughout life of Mine.</p> <p>Water and sediment samples will be collected in areas with the potential to be impacted by mining activities to test for the presence of heavy metals and chemical contaminants (annually during the dry season).</p>	<p>Monitoring results record exceedance and contamination of surface water.</p>	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> • Review and re design to avoid reoccurrence and address actual cause • Review adherence to control procedures to ensure compliance • Take remedial action where compliance has not been adhered to • Communication with personnel involved and across all site team members (for example, via toolbox meetings) • Reporting to DES as per statutory and project requirements where incidents trigger reporting thresholds.

#	Matters under EPBC Approval, condition 6	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
		Maintain access to water	No net loss of suitable permanent water sources.	<p>Permanent water sources in retained suitable BTF habitat in the Project Area will not be drained or lost as a result of drought unless suitable alternative water supplies (such as permanent water with gently sloping, bare ground at the edge) are available within suitable habitat within 3 km, or connected habitat outside of the ML. This includes permanent water sources in waterways and dams.</p> <p>Maintain water troughs for BTF within undisturbed areas and surface areas of underground mining footprint and repair where necessary troughs, pipes and tanks to a standard that maintains a constant source of water.</p> <p>Known water sources will be avoided, or alternative water sources established outside the disturbance footprint, if avoidance is not possible.</p>	<p>Weekly inspections of water infrastructure at Ten Mile Bore, to maintain water supply available to BTF.</p> <p>Monitoring of water levels and availability across all water sources (fortnightly inspections at all sites other than Ten Mile Bore).</p>	Draining of suitable permanent water source in retained BTF habitat, without an offset water source provided.	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Review and re design to avoid reoccurrence and address actual cause Review adherence to control procedures to ensure compliance Undertake chemical testing of any water source that fails a visual inspection or increased monitoring events Take remedial action where compliance has not been adhered to; including repairs where necessary troughs, pipes and tanks to a standard that maintains a constant source of water Implement remedial actions to provide supplementary water sources, where possible.
		Reduce the risk of contamination of BTF habitat by chemicals, fuel, heavy metals etc.	No pollution of BTF habitat by contaminants (e.g. chemicals, fuel etc.).	<p>Any sites used for chemical and fuel storage will be located a safe distance away from BTF habitat, with bunding or other raised barrier, resistant to normal flood events, between chemicals and habitat.</p> <p>All vehicles and machinery will be cleaned and maintained to minimise the introduction of contaminants such as oil and fuel.</p>	<p>Design and implement a monitoring program, in accordance with the Water Management Plan. The monitoring program will target key areas with low flow, and water sources of known BTF locations.</p> <p>Water and sediment samples will be collected in areas with the potential to be impacted by mining activities to test for the presence of heavy metals and chemical contaminants (annually during the dry season).</p> <p>Erosion and sediment control measures will be implemented where required, to reduce the potential for contamination of water sources prior to commencement of construction activities.</p>	Pollution of BTF habitat by contaminants.	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Minimising and rectifying impacts Training and / or communication with personnel involved and across all site team members Reporting to DES as per statutory and project requirements where incidents trigger reporting thresholds.

#	Matters under EPBC Approval, condition 6	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
8	Mine dewatering	Manage the impacts of mine dewatering	Permanent water sources in retained suitable BTF habitat in the Project Area not drained or lost as a result of changes in hydrology, unless suitable alternative water supplies (such as permanent water with gently sloping, bare ground at the edge) are available within suitable habitat within 3 km, or connected habitat outside of the MLA. This includes permanent water sources in waterways and dams.	Maintain water troughs for BTF within undisturbed areas and surface areas of underground mining footprint and repair where necessary troughs, pipes and tanks to a standard that maintains a constant source of water. Known water sources will be avoided, or alternative water sources established outside the disturbance footprint, if avoidance is not possible. Erosion and sediment control measures will be implemented where required, to reduce the potential for contamination of water sources prior to commencement of construction activities.	Design and implement a monitoring program, in accordance with the Water Management Plan. The monitoring program will target key areas with low flow, and water sources of known BTF locations. Water and sediment samples will be collected in areas with the potential to be impacted by mining activities to test for the presence of heavy metals and chemical contaminants (annually during the dry season).	Draining of suitable permanent water source in retained BTF habitat, without an offset water source provided.	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Review and re design to avoid reoccurrence and address actual cause Review adherence to control procedures to ensure compliance Undertake chemical testing of any water source that fails a visual inspection or increased monitoring events Take remedial action where compliance has not been adhered to; including repairs where necessary troughs, pipes and tanks to a standard that maintains a constant source of water Implement remedial actions to provide supplementary water sources, where possible.
9	Earthworks	Minimise the risk of light vehicle and machinery strike during earthworks and operations	Vehicles only drive on designated access tracks, and the access tracks are defined in relevant overarching management plans (e.g. Environmental Management Plan).	All relevant site personnel, including contractors, will be made aware of the locations of BTF populations and the potential for birds to be foraging adjacent road sides. Vehicles and plant will drive on pre-determined roads only, and adhere to all speed limits, which will be clearly communicated.	Monitoring surveys will be conducted biannually for a 10 year period by suitably qualified ecologists in accordance with standard methodology to identify changes in BTF population size and movements over time. Banding and re-sighting techniques will provide a basis for assessing movement patterns and assessment of population dynamics. Fauna spotter-catcher observations and results during the BTF habitat clearing progress will be fed into the monitoring results and adaptive management of clearing progression plans.	<ul style="list-style-type: none"> Vehicles observed driving outside designated areas Light vehicle or machinery strike during other activities 	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Rectifying impacts Review and re design to avoid reoccurrence and address actual cause Communication with personnel involved and across all site team members (for example, via toolbox meetings).
10	Noise and vibration	Minimise habitat modification	No abandonment of BTF nests due to noise, and vibration disturbance	Project impacts like noise, dust and lighting will be minimised by the implementation of the Environment Management Plan, using standard procedures typical of large infrastructure projects.	During the breeding season the Environment Manager will monitor verified BTF nests within 1 km of active operational areas (weekly at a minimum) Any signs of possible abandonment will be verified by a suitably qualified ecologist, who will consider the role of noise and vibration in the abandonment.	Abandonment of a BTF nest without signs of predation, which is likely to have been caused by noise and vibration.	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Assessment to establish (a) abandonment of a BTF nest was without signs of predation; and (b) determine the root and contributing causes as being likely caused by noise and vibration Review and re design to avoid reoccurrence and address actual cause Communication with personnel involved where appropriate and across all site team members (for example, via toolbox meetings).

#	Matters under EPBC Approval, condition 6	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
11	Emissions, including dust	Minimise emissions (dusts)	The photosynthetic ability of grasses in BTF habitat are not inhibited by dust emissions from the Project Area.	Regular watering of project areas in accordance with procedures under the Environmental Management Plan. Vehicles will be cleaned regularly and are not to be overloaded. Coal dust will be managed in accordance with the Environmental Management Plan	Regular site inspections in accordance with the Project Environmental Management Plan and Management System. Emissions and dust monitoring undertaken under the construction and Environmental Management Plan.	Growth of grasses in known BTF habitat in, and adjacent to, the Project Area are inhibited due to dust emissions.	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Where monitoring shows a reduction in habitat condition due to dust, mitigate source of dust Review and re design to avoid reoccurrence and reduce dust emissions impacts on habitat. Communication with personnel involved and across all site team members (for example, via toolbox meetings).
12	Light spill and other visual impacts	Minimise light spill	Light disturbance in known BTF habitat adjacent to works limited to <100 m.	Install light controlling devices to deflect lighting away from adjacent habitats. Avoid using unnecessary lighting.	Regular site inspections in accordance with the Environmental Management System.	Direct light spill >100 m into known BTF breeding habitat.	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Review and re design of light controlling devices, or adjust location of light, to reduce light spill and lighting levels below trigger levels Communication with personnel involved and across all site team members (for example, via toolbox meetings).
13	Stream diversion and flood levees	Reduce the impact of stream diversion and flood levees	All suitable permanent water sources are maintained.	As per the management actions included in items 9 to 12.	Annual monitoring, including photo monitoring, of water source availability, in the driest season	Draining of suitable permanent water source in retained BTF habitat, without an offset water source provided.	The appropriate corrective actions in accordance with the Environmental Management System will be implemented and may include: <ul style="list-style-type: none"> Review and re design to avoid reoccurrence and address actual cause Review adherence to control procedures to ensure compliance Take remedial action where compliance has not been adhered to; including repairs where necessary troughs, pipes and tanks to a standard that maintains a constant source of water Implement remedial actions to provide supplementary water sources, where possible.

6.4 Habitat management measures

In accordance with EPBC conditions 6d) to f) and EA condition 16e), measures will be implemented to manage BTF habitat to prevent further decline and, in the case of the offsets area, improve the condition. These management actions are also required to address potential Project impacts identified in EPBC condition 6c).

Managing BTF habitat requires management of three broad elements: the woody layer of the vegetation, the herbaceous layer of the vegetation and water sources. Grazing and fire are important drivers of the composition and structure of both woody and ground layers of the vegetation and managing grazing and fire is important for the maintenance and management of habitat quality for the BTF (at Extern2011). While useful tools, these factors cannot be used to shift from one vegetation community to another as the vegetation community that occupies a particular location is largely driven by soil type and rainfall regime. Management measures are described below in relation to the threats outlined in **Section 4**.

6.4.1 Grazing management

Grazing will be used in the Project Area as a management tool to manage threats to BTF habitat. Grazing will be used to decrease the abundance and presence of weeds, including Buffel Grass and other exotic pasture grasses, and control fuel loads so as to reduce the risk of an uncontrolled fire.

The management of grazing within non-mined areas will be based on existing pastoral management practices under land agistment agreements, pastoral holding lease conditions and associated legislation. Sustainable grazing guides such as the 'Sustainable management of the Burdekin grazing lands' (at Extern2012) will also guide the management of grazing activities. The following actions will be delivered under the legislation, agreements and conditions:

- Adani will complete annual BTF habitat vegetation assessments at approved monitoring locations during May to maintain and where possible enhance BTF habitat
- The baseline groundcover and native perennial species composition at 23 established baseline monitoring sites are included in Appendix F. Baseline characteristics are:
 - o 34% cover native perennial grass cover (minimum). Baseline standard deviation is 12.1%
 - o 27% bare ground
 - o four native grass species per site (minimum)
 - o 2.4% native perennial forb cover
 - o 1.8% native annual grass and forbs
- Vegetation assessments will use methodologies described within the 'Carmichael Coal Mine and Rail SEIS Report for Black-throated finch On-site Monitoring Survey 2' dated February 2014 to assess native perennial groundcover and ground composition based on Queensland BioCondition Framework (at Extern et al. 2011) and the Queensland Herbarium flora survey methods (at Externa et al. 2005)
- Groundcover and species composition will be assessed annually against the baseline data (established in 2012/13) from when this Management Plan commences (each May)
- If the annual vegetation assessment demonstrates a loss of native perennial species and cover from baseline conditions, an investigative review will be completed and relevant corrective management actions will be taken to ensure the maintenance or enhance of these perennial pasture species
- Corrective actions may include additional fencing or spelling of paddocks to control grazing, controlled grazing to maintain biomass levels, pest control (e.g. rabbits, weed eradication) and fire management.

Since BTF have been shown to access a range of artificial water sources, including drinking at troughs visited by cattle, it would not be necessary to restrict cattle from existing troughs or watering points. However, in accordance with EA Condition I8, water troughs for BTF must be maintained within undisturbed areas and surface areas of the underground mining footprint. Also, the condition includes a requirement to repair, where necessary, troughs, pipes and tanks to a standard that maintains a constant source of water. The retention or provision of some trees / shrubs within a suitable distance to water may increase utilisation of water sources, by providing shelter for birds if they are disturbed by the arrival of large groups of cattle, allowing them to return to drink when the cattle depart.

6.4.2 Fire management

Fire and grazing can be considered competitors of one another for the available grass fuel / forage. In considering the use of cattle grazing to manipulate the grass fuel load and distribution it is also important to address other aspects of the herbaceous layer that will be affected by grazing, namely species composition and seed production. Breeding of BTF must be monitored in terms of location and timing so that breeding locations are not burnt when birds are nesting (constructing breeding nests, incubating and feeding nestlings).

Given the uncertainty around and complexity of the relationship between fire and habitat quality, it is important that all parts of a landscape being managed for BTF are not subject to the same fire regime. In general, the overall fire regime of the Project Area will aim to be one of periodic, small scale, low intensity fires being used to target areas that are developing a shrubby understorey. However, the outcomes of the BTF Research Program will also study the relationship between fire and habitat quality. The outcomes of that research will inform fire management in the Project Area and this plan, once finalised.

Low intensity fires will temporarily open up the grass layer but generally are not known to kill tussocks. These types of fires will create foraging patches by improving accessibility to the grass seed that is present. Burning should not be carried out too soon after seed set, though BTF may forage on recently burnt land (at External 2016).

Fire will reduce the density of the shrub layer by killing obligate seeders and removing stems from re-sprouting species. Fire may also promote the germination of obligate seeders and other species, particularly *Acacia* spp. Currently there are areas of the Project Area that have dense stands of short-lived *Acacia* spp. as a result of fire-stimulated germination. BTF tend to avoid extensive areas of woodlands with a dense shrubby understorey, though they do use patches of shrubs or smaller trees for resting and shelter (at External 2011). Dense shrubby understoreys also tend to have fewer grasses and so are less productive in terms of the seeds upon which BTF forage.

Dense stands of these species can be reduced by fire frequencies shorter than the time between germination and seed production. Some of these species probably produce seeds within 3 to 4 years of germination (e.g. *Acacia holosericea*).

The existing network of roads and tracks will be used to manage fire, rather than establishing additional firebreaks. This will help reduce the risk of weed incursion through movement of traffic into intact understorey. The numerous existing tracks that were created during mine exploration and development, especially in the northern sector of the Project Area, provide firebreaks that can help ensure that prescribed fires are not extensive. The value of maintaining these tracks as firebreaks needs to be weighed up against the value of minimising the risk they present in terms of weed incursion and as useful foraging habitat. It is worth noting that BTF often forage on or in close proximity to tracks and other surfaces with low cover. The usefulness of these bare areas for foraging is dependent upon there being

seed production in their immediate vicinity, so extensive bare areas are not valuable to BTF (2016). ed at External

6.4.3 Pests

Weed management is addressed in a project specific Pest Management Plan (Adani 2015), which covers weeds and feral animals (pests). The Pest Management Plan has an overarching strategy, as follows:

- Identification of current and potential pest animals and plants for the area, and current locations of populations of pest animals and plants
- Avoidance of travel through or establishing infrastructure in areas of known pest plant infestation
- Prevention of the introduction of new weed and pest animal species to the area
- Minimisation of the increase in distribution and abundance of currently present pest plants or animals
- Control of identified weeds and pest animals to contain, reduce or eradicate pest populations.

Actions associated with weed management align with this strategy. Weed management issues specific to BTF are the control of introduced grasses and other herbs that have a tendency to dominate the herbaceous vegetation and affect the seeding of grass species on which BTF rely. Incursions of weeds into new areas will be prevented. Existing weeds, including non-native grasses, will be managed, with the intent of reducing further incursion (Adani 2015).

Non-native plant species that are considered potentially detrimental to BTF habitat include Buffel Grass, Indian Couch, *Stylosanthes scabra*, *Parthenium hysterophorus* (Parthenium) and other high biomass non-native grasses. Native understorey shrubs such as *Carissa ovata* and *C. lanceolata* can also be detrimental as they may increase in association with heavy grazing and little burning. Some of the short-lived *Acacia* spp. would be detrimental to BTF if they form extensive thickets.

Non-native invasive shrubs such as *Vachellia nilotica* (Prickly Acacia), *Ziziphus mauritiana* (Chinese Apple), *Jatropha gossypifolia* (Bellyache Bush), *Stylosanthes humilis* and *Lantana camara* (Lantana), while not currently prevalent in the Project Area, will be prevented from establishing.

The risk of further incursions by high biomass grasses will be minimised by effective hygiene measures that include minimising traffic into BTF habitat, use of wash down facilities for vehicles, control of new infestations, avoiding movement of soil potentially bearing weed seeds or other propagules and minimising soil disturbance. The species of greatest concern is Buffel Grass. However *Themeda quadrivalvis*, *Hypharrhenia* spp. and Indian Couch are also a concern, though they are not currently common in the Project Area. Indian Couch is present but the health of the native perennials is probably sufficient to prevent it taking over.

The landscaping plan and rehabilitation plans for the Project will use native species where possible. No invasive species will be used in landscaping.

Habitat management measures for feral cats and feral pigs are provided in **Sections 6.4.5 and 6.4.6** respectively.

6.4.4 Water supply

Water bodies known or considered likely to be used by BTF, in as yet unmined and underground mining areas, must be identified to alert to their environmental significance. Controls to prevent contaminated

run-off or fuel / chemical spills will be implemented to protect water quality for these sources. Controls to manage the protection of BTF water sources include the following:

- Storage of fuels and chemicals must be bunded to 110% the capacity of the storage facility. Storage areas must be at least 300 m from known watering points, waterbodies and waterways.
- Effective erosion and sediment controls must be installed around all topsoil and spoil piles, unless a native cover has been established which prevents run-off of materials.

Current water sources outside of the clearing footprint are to be maintained. Where it is necessary to remove a particular water source within or nearby to BTF habitat, a new water source will be created. These can be relatively small, have intact woodland in their immediate vicinity and have a few trees and / or shrubs close to their margins for BTF to perch on. It is also important to have canopied trees (especially Eucalypts) in which the birds can rest while travelling to and from the water source. Construction of BTF water sources to provide alternative watering points will be undertaken in conjunction with construction of water storage dams early in the mine implementation program.

In order to ensure that the watering points in the Moray Downs West offset area do not interfere with research but also provide water for finches, the following actions will be delivered:

- maintenance of the existing seven water points in the Moray Downs West offset area, as per the Moray Downs West Offset Area Management Plan
- new artificial water sources will be installed in locations within the Moray Downs West offset area in accordance with this research program
- assessment of BTF responses to new water sources and their effectiveness
- results used to inform specific requirements and location of permanent artificial watering points
- permanent artificial watering points will be installed and adequately maintained within the Moray Downs West offset management area within the sooner of one year after the completion of the three-year Research Program, or five years after the commencement of mining operations.

6.4.5 Feral cats

Feral cats are considered one of the threats to local populations of BTF. Ongoing feral cat control will be carried out as it would benefit many other native species in addition to BTF, including the threatened Squatter Pigeon. Feral cat control will be carried out in accordance with the Pest Management Plan for the Project. The key areas to be targeted for feral cat control to protect the BTF are those where birds are likely to be exposed and vulnerable to predation including on the interface of the clearing front and remnant vegetation and at water sources where BTF are vulnerable to attack whilst drinking.

6.4.6 Feral pigs

Feral pigs have the potential to damage BTF habitat and are therefore a threat to the species. Damage to BTF habitat is caused by disturbance of the soil while feeding, trampling of habitat, tusking or rubbing trees and the consumption of plants and soil organisms. Feral pig control will be carried out in accordance with the Pest Management Plan for the Project. Targeted site monitoring for pigs will focus on water courses and BTF feeding areas, where greatest impacts to BTF habitat are likely to occur. Humane pest control measures will be implemented to reduce pig numbers.

6.4.7 Management of Ten Mile Bore

Condition I9b of the EA states that the BTF Research Program must establish management actions to maintain the current BTF population of Ten Mile Bore and surrounds. Management of BTF habitat in the vicinity of Ten Mile Bore will therefore be informed by the findings of the BTF Research Program (**Appendix C**). Until such time as findings of the Research Program are available (3 to 5 years from

approval of the plan), existing management activities at Ten Mile Bore will continue to be implemented, to maintain the BTF population of the area. These interim management measures include:

- Avoiding mining-related disturbance of the area until as late as possible (see **Section 6.3.1**)
- Maintaining water for BTF, to be monitored through weekly water infrastructure inspections
- Managing grazing activities in the vicinity of Ten Mile Bore to enhance and maintain BTF habitat values

6.4.8 Summary of mitigation and management measures

The mitigation and management measures to be implemented for the Project to minimise impacts to BTF for activities other than clearing are summarised in **Table 9** and **Table 10**. These are relevant across all project stages and will be implemented prior to commencement of Project Stage 2 activities as defined by the Carmichael Coal Mine Environmental Authority. Regular monitoring across the site will identify any deterioration in BTF habitat values and trigger a site-specific corrective action. Such a response may involve the control of weeds, implementation of fire management actions or changes to grazing practices, to improve and restore BTF habitat values.

Mitigation of impacts on BTF and its habitat will in part be achieved through implementation of other plans including the CEMP and OEMP. These plans are regularly updated based on site conditions, the results of on-site monitoring and progression of project tasks. A summary of key elements of environmental management, as outlined in the project EIS, is provided in **Appendix A**.

6.5 Offsets

Conditions of approval for the Carmichael Coal Mine and Rail Project under the EPBC Act and within the Coordinator-General report require Adani to address offset requirements for significant residual impacts on MNES and Matters of State Environmental Significance. The approach to be taken by Adani to achieve the required offsets is outlined in the approved BOS (C02 2016) under Condition 8 of EPBC Act approval 2010/5736. Offsets will be delivered in stages, with Stage 1 offsets to be delivered through implementation of an offset area management plan.

A key mechanism for achieving offsets for BTF is management of the Moray Downs West offset area, which includes extensive areas of BTF habitat. The Moray Downs West offset area will be managed under the approved *Offset Area Management Plan: Moray Downs West*, (CO2 2017) including regular assessment to identify any future management and monitoring requirements until offset management objectives are achieved. The area provides an offset for the expected loss of BTF habitat from Stage 1 of the Project including potential impacts from subsidence caused by underground mining.

In the event that additional impacts are proposed, or occur unexpectedly, additional offsets will be provided, subject to approval from Commonwealth and State governments. This would include circumstances where the corrective management measures have not achieved the goals within specified timeframes, and resulted in impacts beyond those that were originally approved. Likewise, if Adani is able to minimise its disturbance of BTF habitat to a smaller area than approved, a corresponding reduction in offsets will apply.

7 Monitoring and Research Programs

The management of the BTF population will be supported by targeted monitoring and research that will be undertaken for the Project. The results of monitoring and research will feed back into the management measures to guide adaptive management. The ongoing monitoring will be focussed on describing spatial and temporal patterns of occurrence while the research will focus on explaining spatial and temporal patterns and ecological relationships.

A BTF Research Program has been developed concurrently and provides a program for addressing specific scientific questions about BTF and its habitat (**Appendix C**). The Research Program details the objectives and methodologies to explain and predict patterns and processes relating to the distribution and abundance of BTF in the Project Area. This research will inform future management and monitoring of the BTF population within the Project Area.

7.1 Monitoring program

As required by Condition 6(b) of the EPBC Act approval, a monitoring program will be implemented upon approval of the management plan to inform assessments of the effectiveness of mitigation measures. The level of disturbance of Project activities on BTF habitat will also be measured and the success of rehabilitation activities evaluated. As committed during the EIS process, Adani will collaborate with research institutions for aspects of the monitoring program, where such an approach would add value (e.g. identification of remnant vegetation changes resulting from subsidence).

The proposed monitoring regime will be used to provide feedback on the effectiveness of mitigation measures and to evaluate the success of rehabilitation activities. Monitoring of the BTF has already commenced as part of the baseline research program for the Project and ongoing monitoring programs locally. Initial monitoring will continue for a period of 10 years as required in the conditions of the Environmental Authority. A major review of the monitoring results will be completed at this time (after 10 years). This will result in the development of a long-term monitoring method that will be implemented for the life of the project. This will ensure compliance with EPBC Act approval conditions, which require monitoring for the life of the Project.

As with mitigation measures, some monitoring activities will be generic and broadly applicable across multiple ecological values, including BTF. Other monitoring activities will be species-specific and tailored to measure the effectiveness of mitigation measures at reducing the impacts of the Project on BTF. The design of specific monitoring tasks will be tailored to the variables being measured, and have sufficient replication to provide statistical power to detect significant change. Indicative monitoring sites have been chosen and the location of these will be confirmed through on site investigations during pre-clearance surveys.

Monitoring measures to be implemented across the Project Area are detailed in **Tables 8 to 10**. **Table 11** provides an overview of monitoring measures.

Table 11 Summary of monitoring measures to be implemented across the Project Area

Monitoring	Description
Pre-clearance surveys	Confirm and identify the spatial extent and condition of BTF habitat to be disturbed prior to any clearing or disturbance commencing, through pre-clearance surveys. BTF surveys will focus on confirming species presence throughout the Project Area, identifying species presence in proximity, but outside (adjacent to) Project Area and

Monitoring	Description
	identifying areas of potential rehabilitation for BTF habitat values inside the Project Area, but outside the disturbance footprint.
Clearing	Monitoring surveys to be conducted biannually for a 10 year period by suitably qualified ecologists in accordance with standard methodology to identify changes in BTF population size and movements over time. Banding and re-sighting techniques will provide a basis for assessing movement patterns and assessment of population dynamics.
Condition	<p>Monitor the condition of BTF habitat adjacent to the development and the Offsets Area. This will be undertaken using standard BioCondition monitoring surveys (see Eyre <i>et al.</i> 2011 for details) and species habitat index.</p> <p>The quality of known BTF water sources will be monitored.</p> <p>Additionally, annual BTF habitat vegetation assessments will occur during May within 2 ha plots at the following locations: CHAB02, CHAB03, CHAB22, CHAB23, CHAB24, CHAB25, CHAB37, CHAB45, CHAB47, CHAB48, CHAB52 (Open cut disturbance areas) and CHAB01, CHAB04, CHAB05, CHAB09, CHAB10, CHAB44 and CHAB46 (Underground disturbance areas).</p> <p>Vegetation assessments will use methodologies described within baseline 'Report for Black Throated Finch On-site Monitoring Survey' dated 12 July 2013 to assess ground cover and ground composition based on Queensland BioCondition Framework (Eyre <i>et al.</i> 2011) and the Queensland Herbarium flora survey methods (Neldner <i>et al.</i> 2005).</p> <p>Moray Downs West Offset Area</p> <p>The monitoring methods included in the <i>Moray Downs West Offset Area Management Plan</i> for the offset area are as follows:</p> <ul style="list-style-type: none"> • method for determining monitoring locations is to apply the Guide to Determining Terrestrial Habitat Quality to calculate habitat quality scores • For the species stocking rate component, the monitoring method for BTF as outlined in this plan • For sites being monitored under the BTFMP within the offset area, use survey results to inform the habitat quality scoring under the OAMP (rather than duplicating survey effort at these sites) <p>Further monitoring methods for BTF in the offset area are consistent with this plan, such as:</p> <ul style="list-style-type: none"> • water source watches • active searches • incidental observations • remote cameras • vegetation condition assessments • foraging plot assessments.
Weeds	Monitor the presence of declared weeds, and abundance of environmental weeds.
Pests	Monitor the presence and population abundance of invasive fauna.
Vegetation rehabilitation areas	Monitor the effectiveness of rehabilitation activities through BioCondition or similar assessment methods.
Water quality	Measure the effectiveness of rehabilitation activities, by monitoring water quality in accordance with the EMP.
Offset areas	Measure the effectiveness of offset management, by monitoring the quality of offset areas in accordance with the OAMP.
Fauna mortality and injuries	Record BTF fatality, including suspected nests / eggs of BTF.
Dust	Monitor dust within and adjacent to construction activities in accordance with the EMP.
Fire	Monitor incidence and extent of Project related fire, and determine impacts through BioCondition assessments.

7.1.1 Survey timing and frequency

Seasonal surveys will be undertaken biannually for a period of at least 10 years in order to satisfy relevant approval requirements and provide useful feedback into the management plan. Surveys will be undertaken to coincide with the end of the dry season (approximately late October) and the latter part of the breeding season (March to April). A major review of the monitoring results will be completed after 10 years. This will result in the development of a long-term monitoring method that will be implemented for the life of the project.

Surveys will occur across all areas of known BTF habitat in the Project Area and adjacent to the Project Area, as well as all areas established for rehabilitation and offsets for BTF. The purpose of the surveys will be to document changes in distribution and abundance of BTF in the Project Area, relate that to habitat condition, quantify use of offset areas and provide feedback for adaptive management.

7.1.2 Survey methodology

The survey methodology for ongoing monitoring is based on the results and recommendations arising from baseline monitoring surveys undertaken to date and the specifications of Commonwealth and State approval conditions (e.g. Condition I6 of the EA). The monitoring methodology is to transition from a methodology aimed at gathering presence / absence data alone, to one gathering data that will better explain BTF movements across the landscape as well as identify any trends in populations and monitor the effectiveness of management actions.

The methodology for BTF monitoring will include the following:

- Water source watches
- Call play-back
- Identification of all birds present when BTF are encountered
- Active searches
- Opportunistic incidental observations gathered whilst traversing the Project Area
- Surveillance cameras
- Monitoring of subsidence areas
- Monitoring of pasture biomass
- Vegetation transects and plots.
- Annual monitoring of 2 ha groundcover plots

Indicative monitoring sites are shown in **Appendix B**. These sites will be reviewed following approval of the management plan, with additional vegetation sites included in the offset areas and subsidence areas. These additional sites will provide representation of critical BTF habitat, core BTF habitat and marginal BTF habitat. Input from the research team appointed to implement the BTF Research Program will be sought on the location of additional monitoring sites. The sites include areas outside of the disturbance footprint (control sites) and areas that will be subject to disturbance in the future (impact sites).

In the case of some monitoring methods, such as fixed point waterhole surveys, the exact location of these are known. However for some survey types, the placement of the permanent monitoring sites will be finalised during the implementation of the monitoring program. The BTF Management Plan will be subsequently updated to include the final locations of monitoring sites.

7.1.2.1 Water source watches

Water source watches are one of the primary survey methods recommended in the Significant Impact Guidelines for the Endangered Black-throated Finch (southern; *Poephila cincta cincta*; DEWHA, 2009a;

the Guidelines). They have also been the most successful survey technique in recording BTF across the Project Area in most surveys undertaken to date.

Fixed point water source watches will be conducted for six continuous hours commencing from dawn at up to 16 water sources where BTF have been previously recorded (**Table 12** and **Appendix B**). Note that some of the sites have been found to be unsuitable for monitoring at times in the past, due to an absence of water. As water sources are removed as a result of mining activities, monitoring at these locations will cease. New water sources will be substituted for monitoring, particularly in the offset areas.

Where BTF are observed during waterhole watches, the following information will be collected:

- Time of observation
- Number of individuals
- Other species present in mixed flocks
- Behaviour (e.g. foraging, drinking, perching, flying, etc).

Table 12 Water source monitoring sites (those sites marked # have been found to have little to no water during monitoring over the past three years)

Site ID	Site Common Name
CWAT01a	Ten mile bore dam (lower)
CWAT01b	Ten mile bore turkey nest
CWAT01c	Ten mile bore dam
CWAT02	16 mile tank dam
CWAT03	Ten mile tank dam
CWAT07	Number 1 dam
CWAT99	Four mile bore
CWAT101 #	Beenboona hole
CWAT104 #	Unnamed waterhole
CWAT105 #	Rocky Dam
CWAT110	Lignum yards dam / trough
CWAT111	Lignum large dam
CWAT116 #	New Laguna dam
CWAT117	Number 2 dam
CWAT118	Carmichael bore tank and troughs
CWAT120	Dingo dam

Characteristics of the water sources that BTF are observed utilising will also be noted in order to build on the existing understanding of use and utilisation of water sources. Any seasonal or longer term changes that may influence suitability for BTF will also be determined. The following information will be documented:

- Approximate size of water source
- Slope of bank
- Surrounding vegetation

- Water retention dynamics (permanent vs seasonal).

7.1.2.2 Active searches

Active searches are to be conducted within suitable habitat to collect BTF population data and search for nests (**Appendix B**). In particular these surveys will focus on areas that are known to be good quality habitat for BTF as well as areas of habitat within the offset area.

Active searches will include random meanders within 1 km of each water point monitoring site for at least three hours with specific effort devoted to areas with grassy open-woodland habitat. 1 km transects will also be undertaken during active searches.

Information collected during active searches will include:

- Location and quantity of BTF
- Behaviour (e.g. foraging, drinking, perching, flying, etc)
- Regional Ecosystem (RE) type and condition
- Presence / absence of mixed-flocks and associated species
- BTF nests (including photographic evidence and GPS location)
- Characteristics of BTF nest including host tree or shrub species, height of nest, active or inactive
- Groundcover measurements of perennial grass cover, non-native grass cover, litter, bare ground and ground cover composition.

Wherever possible, the active search information collection methods will be similar to previous annual BTF vegetation assessments, in order to increase the data comparison value.

7.1.2.3 Slow-drive transects

Slow-drive transects have been undertaken throughout BTF habitat during some previous monitoring surveys. The technique involves using a vehicle driving at a maximum speed of 20 km/hr along a 3 km predefined transect (**Appendix B**). Where BTF were observed, the following information was collected:

- Location and quantity of BTF
- Behaviour (e.g. foraging, drinking, perching, flying, etc)
- Regional Ecosystem (RE) type and condition
- Presence / absence of mixed-flocks and associated species.

However, slow-drive transects have been found to be of limited value in previous surveys in the Project Area, and will not be continued as part of the ongoing monitoring program.

7.1.2.4 Incidental observations

Opportunistic incidental sightings of BTF are to be undertaken whilst travelling between survey sites. Where BTF are observed, the following information will be collected.

- Location and quantity of BTF
- Behaviour (e.g. foraging, drinking, perching, flying, etc)
- Regional Ecosystem (RE) type and condition
- Presence / absence of mixed-flocks and associated species
- Assessment of groundcover characteristics and species composition
- BTF nests (including photographic evidence and GPS location)

- Characteristics of BTF nest including host tree or shrub species, height of nest, active or inactive.

7.1.2.5 Remote cameras

Fixed remote cameras will be set-up at water sources where water source monitoring is not undertaken. In particular these will be used to monitor cattle troughs as well as any new watering points installed throughout the Project Area and including the Moray Downs West offset area. Cameras will be installed for the duration of the monitoring surveys. Photos and recordings of BTF are to be included in the survey results.

7.1.2.6 Vegetation assessments

Vegetation transects will be established throughout the Project Area to monitor the condition of BTF habitats (**Appendix B**). Foraging plots will also be conducted during BTF monitoring in locations where BTF were identified foraging in order to identify the floristic characteristics of habitat and flora species foraged.

Vegetation transects

Vegetation transects will consist of a modified BioCondition survey with indicators that are not important to BTF excluded (such as fallen woody debris). Fixed 100 m x 50 m vegetation transects will be established and monitored throughout the Project Area with the following information recorded in regards to vegetation structure:

- RE
- Canopy species and relative abundance
- Canopy minimum, maximum and average height
- Crown cover
- Shrub species and relative abundance
- Shrub average height
- Shrub canopy cover
- Weed cover
- Ground cover
- Ground layer species and individual percentage cover
- Percentage cover of bare ground and organic material.

Foraging plots

2 m x 2 m foraging plots will be undertaken at locations where BTF are observed foraging. These plots will aim to determine important grass species for BTF in the Project Area as well as seasonal dietary variation. Flora plot information to be collection at each plot will include:

- RE
- Ground cover species including abundance (number of the whole), of each ground cover plant species including exotic and weed species, whether seeding, or not and whether dead or alive
- Cover of each ground cover species
- Total cover of ground cover species
- Bare ground cover
- Forb cover
- Litter cover.

7.1.2.7 Groundcover, species composition and biomass monitoring

Monitoring of groundcover and species composition will be undertaken to assist with the management of grazing to maintain and enhance BTF habitat values. Baseline groundcover and composition have been established, as described in **Appendix F**. If annual vegetation assessments demonstrate a loss of native perennial species number and cover, an investigative review will be completed and relevant corrective management actions will be determined to ensure the maintenance of these species. An increase in invasive species such as Buffel Grass will also be a trigger for investigation. Corrective actions may include additional fencing or spelling of paddocks to control grazing, controlled grazing to reduce biomass levels, pest control (e.g. rabbits, weed eradication) and fire management.

Groundcover biomass monitoring will be conducted in May each year within 2 ha sites at the following monitoring locations:

- CHAB02, CHAB03, CHAB22, CHAB23, CHAB24, CHAB25, CHAB37, CHAB45, CHAB47, CHAB48, CHAB52 (Open cut disturbance areas) and
- CHAB01, CHAB04, CHAB05, CHAB09, CHAB10, CHAB44 and CHAB46 (Underground disturbance areas).

These sites were originally monitored during the Project EIS.

Vegetation assessments will use methodologies described within 'Report for Black Throated Finch On-site Monitoring Survey' dated 12 July 2013 to assess groundcover and ground composition based on Queensland BioCondition Framework (at Externat *et al.* 2011) and the Queensland Herbarium flora survey methods (at Externat *et al.* 2005). Annual vegetation assessments will be reviewed and modified in line with approved Mine Plan changes and improved assessment methodologies. Monitoring will also focus on identifying potential increases in exotic grass composition, such as Buffel Grass.

Groundcover biomass monitoring will also be conducted at representative sites across the offset area. Monitoring will be conducted to determine the biomass and composition of groundcover and appropriate management requirements to optimise BTF habitat values, including specific cattle grazing practices to manage pasture biomass.

In December 2013, ecological equivalence assessments were conducted of the mine area in order to determine baseline condition of impact areas and inform the suitability of offsets (ELA 2014). That report described habitat quality as defined within the Offset Assessment Guidelines under the EPBC Act Environmental Offset Policy. Potential habitat and quality of that habitat were mapped for BTF and guided the establishment of future management objectives for offsets.

In the Moray Downs West Offset Area, the use of strategic grazing within offset management areas will be guided by biomass monitoring. In the Moray Downs West Offset Area, biomass monitoring will be undertaken twice a year, at the end of the wet season (approximately April) and at the end of the dry season (approximately October) using the Department of Natural Resources, Mines and Energy Queensland GRASS Check – Grazier Rangeland Assessment for Self-Sustainability DNRQ97002, Second edition-revised methodology. Monitoring will be undertaken at monitoring sites established as part of the baseline surveying in year 1. Monitoring events will assess pasture composition, pasture biomass and pasture ground cover. These assessments will be used to set stocking rates for the dry season for any strategic grazing to reduce fuel loads or for weed control. Strategic grazing implemented within Moray Downs West Offset Area will aim to retain a biomass of 1,500 kg/ha at the end of the dry season.

7.1.2.8 Bioacoustic monitoring

Bioacoustic Audio Recorders (BARs) have been successfully implemented during BTF surveys of the Project Area in 2017 and 2018 (E2M 2017, 2018). A pilot study was undertaken in 2017 with the objective of developing a recogniser to facilitate automated recognition of BTF calls using Sound ID software.

Two different BTF calls were identified, of which one call was found to be suitable for automated recognition. The pilot study found that automated recognition of BTF calls was a viable method to detect BTF presence, particularly for sites that are impractical to monitor by an ecologist due to the scarcity of BTF use or their remote location. The method had a 69% detection rate of the most characteristic BTF call. However, in approximately 50% of BTF occurrences, BTF did not produce their characteristic call and were therefore not present in acoustic recordings. The method detected 33% of all BTF occurrences recorded by ecologists (including occurrences where BTF did not call).

Following the pilot study for the automated recognition of BTF calls, BAR devices were again deployed during a 2018 survey. BAR devices were used to detect BTF presence/absence at water sources that would otherwise have not been monitored and where remote cameras were not an adequate means of detection. Acoustic data was screened for BTF calls using a combination of automated recognition with manual verification.

BARs will continue to be used as a survey method, with a focus on remote survey sites or locations where other survey techniques are not likely to be an adequate means of detection.

7.1.3 Impact monitoring actions and outcomes

The monitoring will also aim to determine the effectiveness of mitigation measures implemented for management of BTF in the Project Area. The potential impacts of the proposed activities on BTF will be monitored in accordance with the monitoring program outlined in **Tables 8 to 10**, which has monitoring tasks specifically linked to corrective actions.

7.2 Research program

The objectives, indicators and actions for BTF research across the Project Area and the broader area will be undertaken in accordance with the Carmichael Coal Mine BTF Research Program (ELA 2017b; see **Appendix C**) which is summarised in the following sections.

The objective of the Research Program is to determine critical ecological requirements for the BTF in accordance with the conditions of approval for the mine development. In particular the research will aim to identify the movement patterns, habitat requirements and population dynamics, dietary requirements, home range and nesting requirements for the BTF as well as the relationship between water sources, woody habitat and food sources.

The research will also aim to determine the species response to grazing management, fire management and water body locations within the mining lease area and approved offset areas to facilitate appropriate management of these areas. Specific grazing trials will be proposed via the Research Program. The location and timeframe of the trials will be determined at the scoping phase of the research. Further detail is outlined in **Appendix C: BTF Research Program**. Population estimates will also be improved, particularly for key sites such as Ten Mile Bore.

The results of the research will inform and improve management and mitigation measures adopted for the Project to minimise impacts to the local population of BTF as well as enhance habitat within the Moray Downs West offset area in such a way to increase the carrying capacity for BTF in these areas.

7.2.1 Grazing management

BTF can persist in pastoral landscapes even though Maute (2011) demonstrated that birds on pastoral lands had higher stress levels than birds on conservation lands. The abundance of BTF and the viability of their populations, however, are likely to be influenced by the actual grazing regime including stocking rates, land management practices and paddock rotation. The key impacts of grazing are on the composition and structure of the ground layer.

By determining the composition and structure of the ground layer where BTF are known to breed and forage within the Project Area, grazing trials can be implemented within other areas of *Eucalyptus melanophloia* open-woodland that the species appears to utilise less frequently to use grazing as a tool to establish similar composition and structure characteristics which may encourage BTF breeding and foraging. Controlled grazing may also be a suitable means for improving habitat by thinning areas of very dense grass cover as well as assisting in managing bushfire risks. These trials will aim to identify appropriate grazing strategies for managing BTF habitat, especially within the Moray Downs West offset area.

Grazing trials will consist of various cattle stocking densities and wet season resting. These trials will be assessed in terms of the ground layer composition and structure with reference to areas of known high value BTF habitat in the Project Area. The trials will aim to identify the optimal grazing strategy for maintaining good condition BTF habitat that incorporates important food resources including diversity and cover of preferred grass species as well as adequate seed output.

Proposed research methods for this aim are provided in **Appendix C**.

7.2.2 Fire management

Fire is inevitable in the grassy woodlands of central Queensland and a natural component of these ecosystems. European settlement has caused a shift towards frequent, extensive and high intensity fires in the dry season resulting in large uniform areas (Rechetelo 2016). Fire will generally not reduce densities of canopy tree densities, though it can change canopy structure. The most notable impact of fire on BTF habitat is through modification of the ground layer.

While it is apparent that BTF will forage on recently burnt country, it is not known how the fire regime affects the resources available to the birds. Inappropriate fire regimes can impact on the quality of BTF habitat by affecting the production of seeds, reducing the cover and diversity of grass species and causing a decline in food availability. Fire exclusion can lead to thickening of woody shrubs, decreasing the quality of BTF habitat. Therefore high frequency, low intensity, patchy fire regimes may be beneficial to BTF by reducing the thickness of the shrub layer (Riet al. 2001).

This research will include a detailed analysis of fire history across the Project Area to ascertain the frequency and intensity of fires within BTF habitat across the Project Area. Trials will then be considered for implementation and include various regimes of fire frequency and inter-fire interval, fire intensity, the season in which fires occur and the extent (area) of individual fires. However, any fire management trials will need to consider other management strategies and BTF research methods as well as safety and asset protection.

Proposed research methods for this aim are provided in **Appendix C**.

7.2.3 Water sources

BTF need to drink water on at least a daily basis and drink more frequently during the drier times of the year. The importance of water to BTF is highlighted by the fact that they typically nest and breed near water. Within the Project Area this is demonstrated with 68% of BTF records in grassy woodlands within 3 km of known water sources. Therefore the absence of water may preclude BTF from areas that otherwise provide suitable habitat. The addition of water may increase the area of suitable habitat that is available.

BTF surveys and monitoring within the Project Area have also identified the species' ability to utilise natural and artificial water sources. During these surveys they have been regularly observed to drink from cattle troughs, dams and 'turkey nests'.

A key management strategy for the Moray Downs West offset area is to provide additional water sources within areas of suitable woodland habitat for BTF. They will be installed throughout the offset area at locations greater than 3 km from existing water sources.

Artificial water sources will initially be installed in several locations of the Moray Downs West offset area. Research will assess the response of BTF to new water sources and the effectiveness of this strategy by identifying the following:

- Ability to attract BTF
- Frequency of use by BTF
- Change in usage of nearest water sources
- Proximity to existing vegetation especially trees / shrubs

Proposed research methods for this aim are provided in **Appendix C**.

8 Discussion

8.1 Summary of key management issues

The following management approaches will be implemented to minimise impacts of the Project on BTF:

- Pre-clearance surveys to confirm the area of habitat to be disturbed, identify BTF locations not previously recorded in the Project Area and monitor compliance with disturbance limits.
- Vegetation clearing protocols to include staged and sequential clearing of BTF.
- Minimise impacts to BTF breeding by avoiding and buffering known nests where possible and also avoiding vegetation clearing, where possible, during the breeding period (October to April).
- Fire management to prevent accumulation of fuel loads leading to uncontrolled wildfires. Controlled cool burns will be undertaken in accordance with the Fire Management Plan (Adani 2015) to provide a mosaic of fire history and to prevent thickening of the shrub layer in BTF habitat.
- Weed management to prevent the introduction and / or spread of weeds that have the potential to degrade BTF habitat.
- Control and monitoring of pest species, especially predatory species, such as cats, that may impact on BTF.
- Prevent contamination of watering points by bunding fuels and chemical storage areas and buffering these areas from known watering points, waterbodies and waterways. Erosion and sediment controls will be implemented to prevent run-off of materials.
- Use of spotter-catchers before and during clearing activities to mitigate the direct impacts of construction activities on wildlife and record and report fauna mortality and injuries.
- Limit disturbance to pre-defined areas and implement controls to minimise noise, lighting, vibrations and dust.
- Rehabilitate areas that are to be disturbed, to restore habitat values where practicable. Monitor the effectiveness of rehabilitation activities.
- Seasonal monitoring of BTF within the Project Area to identify population trends and important breeding and foraging habitat.
- Monitor the direct and indirect impacts of construction and operations on threatened communities and species (and their habitats), both within and adjacent to the Project Area.
- Evaluate the effectiveness of mitigation measures, and revise them if necessary to improve environmental outcomes.

The BTF Management Plan will be implemented in conjunction with several other management plans specific to threatened species, habitats (groundwater dependent ecosystems) or threats (pest management plan). Collectively, the management plans will achieve a high standard of environmental management.

8.2 Implementation

Responsibility for implementing the BTF Management Plan will lie with Adani's Head of Environment and Sustainability. Mitigation and management measures will be incorporated into site management procedures and the scope of relevant construction activities. Some management tasks described in the management plan will be completed directly by Adani staff, while other tasks may be contracted out to consultants or contractors. Where the support of contractors is required, services will be procured through

Adani's purchasing procedures. Monitoring and research programs will be implemented by suitably qualified environmental suppliers, as described in **Section 9.3**.

Adani recognises the importance of taking a whole-of-ecosystem approach to the implementation of this plan and the minimisation of environmental impacts, including BTF, arising from the Project. During implementation of this plan, and in particular at the construction planning stage, Adani will take the following approach to increasing the effectiveness of the management plan:

- Identify locations where multiple BTF habitat values require management and / or monitoring, and ensure such measures are effectively implemented in parallel.
- Give consideration to the management of environmental impacts for all threatened species (at an ecosystem scale), rather than particular species in isolation.
- Maintain awareness of the changes in the vulnerability of threatened species during different seasons. In particular for the BTF, the breeding season is a critical period to maintain a sustainable local population in the Project Area.

9 Reporting and Compliance

9.1 Updating this plan

Implementation of this BTF Management Plan will commence immediately from the date of its approval by DoE and DES. The plan will be reviewed annually from commencement.

The annual review of the BTF Management Plan will include consideration of:

- delivery and outcomes of any Bioregional BTF Management Plan, including that led by the Queensland Government under the Coordinator-General's Report about the project;
- relevant requirements under the EPBC Act 1999, including the BTF Recovery Plan, conservation advices and threat abatement plans; and
- any amendments to the above or as required in response to outcomes of research, monitoring and management actions.

Further details of the annual review process are provided in **Section 9.2**.

An adaptive management approach will be taken, considering documented impacts of management activities and the results of the approved research and monitoring program. Feedback from the monitoring program that indicates mitigation and management measures are not meeting targets will trigger a review of the relevant goals, performance criteria and triggers to ensure that they are adjusted in response to suit the results of the monitoring program. Updates to the management plan will be made in consultation with DoE and DES. Revisions of the survey and monitoring program will be carried out in consultation with the BTF Recovery Team, in accordance with Condition I7 of the EA.

If pre-clearance surveys identify habitat for BTF not previously identified and reported to DoE and DES, Adani will notify the Departments in accordance with requirements in project conditions.

Work that has the potential to generate new and/or unapproved impacts to BTF must cease until the updated management plan has been considered by DoE. The updated management plan will detail how impacts to the newly identified communities will be avoided, mitigated and/or offset. Once approved, the revised management plan will be implemented.

9.2 Reporting

Adani will prepare an annual report on 1 July each year and will be made available to the administering authority for the *Environmental Protection Act 1994* on request. The annual report will summarise the activities implemented under the plan, and discuss the effectiveness of mitigation measures, based on the results of monitoring activities. The results of research and monitoring activities will be used to inform an annual reassessment of project risks on BTF, as part of the annual reporting process. This assessment will consider the following:

- Has new information become available about vulnerabilities of BTF to project impacts?
- Are mitigation measures still considered to be appropriate, given new knowledge gained through research and monitoring?
- What adaptive changes to mitigation and monitoring measures are recommended on the basis of new information collected during the past 12 months?

In accordance with Condition 17 of the EA, the BTF Management Plan will be reviewed annually by an appropriately qualified person, with findings included in the annual report. The independent review will:

- Assess the plan against the following requirements of Condition 16 of the EA:
 - o A baseline research program on the specific nesting and feeding requirements of the species that will be undertaken prior to and during project stage 1
 - o A baseline research program to establish whether the BTF at the project site are sedentary, locally migratory or regionally migratory
 - o A description of how the results of baseline research are to be used to determine any changes of classification of and/or impact on BTF habitat
 - o Details of proposed impacts to BTF habitat from each project stage including impacts from clearing, subsidence, ecological function changes, hydrological changes and weed and pest infestation changes
 - o Mitigation measures to be undertaken to avoid, mitigate and manage impact resulting from each stage of the project, including rehabilitation of habitat
 - o Monitoring of watering points that must be conducted for a minimum six (6) hour period commencing from dawn, to accurately capture BTF utilisation of water points
 - o Detailed botanical assessment that must occur at all BTF sighting locations in the Project Area to record habitat values at those locations
 - o Detailed survey that must occur across the mining lease area and approved offset areas and must include information on BTF movements. The survey method and effort must be sufficient to accurately describe the BTF home range and detail BTF resource usage patterns between seasons and years (for up to 10 years) and allow robust management actions to be developed for the maintenance of a viable local BTF population
 - o Survey work that should incorporate the usage of call playback and identify all birds present when BTF are encountered
 - o Specific surveys that must be undertaken during the BTF breeding season and include nest location and assessment of the habitat attributes associated with the breeding locations. The survey method and effort must be sufficient to accurately describe the BTF breeding requirements with consideration to spatial and temporal variation of resources of up to 10 years
 - o Survey and monitoring that must be undertaken by experienced ecologists.
- Include recommended actions to ensure actual and potential environmental impacts are effectively managed for the coming year
- Identify any amendments made to the BTF SMP following the review.

All revisions of the survey and monitoring program must be carried out in consultation with the BTF recovery team. Any revisions must be independently peer reviewed.

In addition, Adani will publish a report on its website addressing compliance with each of the conditions of EPBC 2010/5736, including implementation of the BTF Management Plan. The report will be published within three months of every 12 month anniversary of the commencement of the project, in accordance with the requirements of Condition 31 of EPBC 2010/5736. Details of the date of publication and any non-compliance with approval conditions will also be provided to DoE.

Adani will conduct periodic audits to monitor compliance with management plan commitments, in accordance with the Adani quality system. Adani will integrate the management plan commitments with other aspects of the mine construction and operations, to avoid actions being overlooked. It should be noted that reporting timeframes outlined in this plan apply only BTF.

This plan will be available to all employees, contractors and subcontractors. Adani will amend the management measures as necessary in response to regular reviews, monitoring results and changes in legislation, in consultation with regulatory authorities.

9.3 Qualifications

Persons implementing key tasks described in this management plan will have appropriate training, skills and professional qualifications relevant to their role and responsibility. BTF ecologists must be able to provide authoritative assessment, advice and analysis on performance relating to the BTF using the relevant protocols, standards, methods or literature. It is expected that suitably qualified personnel involved in the implementation, review and amendments to this plan will include an ecologist / ornithologist with recent field experience with the species and a knowledge of the habitat and ecological requirements of the BTF.

Fauna spotter-catchers must have demonstrable identification and handling skills, and behaviour knowledge (including nesting requirements) relevant to the BTF, and all threatened fauna species that may, are likely, or are known to occur in the Project Area. Fauna spotter-catchers must be suitably qualified and working under a valid permit from DES.

10 Commitments and actions included in this plan to be delivered by Adani

Table 13 provides a register of key reporting, mitigation and monitoring commitments arising from this plan. This will assist Adani and its contractors to monitor progress with implementation of the plan. Aspects of the monitoring design that should be considered for BTF are described in **Section 7**. These will be taken into consideration by ecologists implementing the management plan.

Table 13 Commitments and actions included in this management plan to be delivered by Adani

Issue	Number	Commitment
Reporting and Notifications	1	Prepare an annual report on 1 July each year and make available to the Administering Authority upon request. .
	2	Conduct periodic audits on compliance with this plan.
	3	Non-compliances with the BTF Management Plan will be identified and recorded through an auditing process.
	4	Work that has the potential to generate new and/or unapproved negative impacts to BTF must cease until the updated management plan has been considered by DoE. The updated management plan will detail how impacts to the newly identified communities will be avoided, mitigated and/or offset. Once approved, the revised management plan will be implemented.
Mitigation	5	Use discretion where possible in the placement of some infrastructure to avoid disturbance to BTF habitats and populations.
	6	Prior to the commencement of site works, any conditions listed in the “Permit to Disturb” will be implemented - e.g. clearing extents clearly marked, trees/areas requiring protection clearly marked, or barricaded. All BTF habitat clearing operations are to be monitored for compliance by a suitably qualified person.
	7	Undertake pre-clearance surveys prior to the commencement of clearing activities, to confirm and identify known areas of occurrence.
	8	Surveys of the area to be disturbed prior to and during construction are to be conducted by a fauna spotter-catcher in BTF habitat areas and remnant vegetation areas. Fauna to be recorded and translocated to suitable habitat adjacent to the disturbance area, where practical. Fauna deaths and injuries to be recorded and managed in accordance with relevant Permit Conditions (e.g. Rehabilitation (Spotter-catcher) Permit) and guidelines. BTF nesting areas observed in areas not to be disturbed will be marked and mapped and monitored during construction and operations works.
	9	Rehabilitate disturbed areas following construction activities where such activity does not compromise the ongoing operation of the project. Progressive rehabilitation of disturbed areas will be undertaken in accordance with the Rehabilitation Management Plan.
	10	Progressive rehabilitation of disturbed areas will be commenced as soon as practical after it has been confirmed that no further activities will occur in each area. Rehabilitation will generally commence within 6 months, unless it is considered more effective to align with the next wet season.
	11	Implement environmental offsets to enhance habitat values used by BTF.

Issue	Number	Commitment
	12	Implement an induction program for staff and contractors about BTF and other threatened species, their habitats and identification. Use posters in prominent work locations to maintain awareness. Implement sound land management practices.
	13	Use directional lighting and strategic timing and placement of lights to minimise light spill into adjacent habitat.
	14	Ensure all plant and equipment is serviced and maintained to minimise machinery noise and vibration.
	15	Management of erosion and sedimentation will be undertaken in accordance with a Project Erosion and Sediment Management Plan.
	16	Mine-related wire and mesh material near water sources will be removed and/or covered to prevent entrapment, if practical
	17	Domestic animals will not be permitted into the Project Area apart from cattle (including horses and dogs during mustering activities).
	18	Monitor BTF populations and their habitats in areas where subsidence occurs.
	19	Weed and pest animal control will be implemented during construction and operations.
	20	Permanent water sources in retained habitat areas will not be drained during construction and operations, unless suitable alternative water supplies are available.
	21	Monitoring BTF populations and their habitats in areas where subsidence occurs.
Monitoring	22	Monitor the presence and population abundance of invasive fauna.
	23	Measure the effectiveness of offset investments by monitoring the quality of offset areas.
	24	Any injured wildlife will be either taken to the nearest qualified veterinary practitioner or wildlife carer, or humanely euthanised on site by a suitably qualified person.
	25	Monitor dust level impacts on BTF habitat, and in water bodies within and adjacent to construction activities.
	26	Monitor water quality in BTF habitat, in accordance with the Surface Water Monitoring Plan.
	27	Annual monitoring (including photo monitoring) of water source availability, in the driest season, in known BTF habitat.
	28	Monitor the incidence of Project-related fire.
	29	Pre-clearance and annual BioCondition assessments and photo monitoring will be completed to determine the condition of retained BTF habitat in impact and control sites. Monitoring will be in conjunction with a research program to monitor remnant vegetation changes over subsidence areas.
	30	Measure the effectiveness of rehabilitation activities through BioCondition monitoring.

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Appendix A Overview of Project Management Plans

This section provides a summary of the EMP prepared to support an EIS process for the Carmichael Coal Project under the EPBC Act and SDPWO Act. The summary is intended to assist readers of the Species Management Plan understand the other management plans in place and how they relate to the management of threatened species and communities. The summary reflects the findings and recommendations of studies undertaken for the EIS. Further details of the management plans can be found at this link <http://www.adanimining.com/aeis-documents>

Each management plan covers design and construction requirements, operational activities and decommissioning. The management plans consider open cut mining, underground mining, mine infrastructure areas, out of pit waste rock dumps, mine water management dams, office, workshop and other facilities and power, water distribution and offsite infrastructure (e.g. worker's accommodation, airport, water supply infrastructure and road upgrades).

The overall project EMP provides details and implementation details for the following aspects: air quality, greenhouse gas emissions, noise and vibration, surface water, groundwater, mine waste management, general and hazardous waste management, terrestrial ecology, aquatic ecology, biosecurity management, scenic amenity, erosion and sediment control, contaminated land, soil resources, aboriginal cultural heritage, non-indigenous cultural heritage, subsidence management, emergency management and response and community. A summary of those plans most relevant to the protection of MNES is summarised below.

The project EMP is a working document and will be updated as required to reflect changes in impacts or mining activities, changes in legal and other obligations and changes from learning and corrective actions through monitoring activities.

Air quality

The management objectives for air quality include protection of biodiversity through avoiding nuisance from dust deposition and meeting EPP (Air) objectives for dust emissions at sensitive receptors. Particulate matter could affect fauna and plants through coating of plant leaves, making them less palatable for fauna and affecting photosynthesis.

Key measures include prevention of dust through planning and sequencing of exposed soils; stockpile design and stabilisation; suppression activities for coal stockpiles and haul roads, access tracks and work areas; and progressive rehabilitation of disturbed areas.

Dust generation will be monitored visually and through and corrective action applied where train loading is generating dust or dust lift off is travelling beyond the lease boundary.

Noise and vibration

The Noise and Vibration Plan aims to protect the qualities of the acoustic environment that are conducive to protecting biodiversity. Potential impacts are possible due to civil works during construction, increased traffic, pile driving, rock breaking, blasting and other mining related activities. In general most of these activities are not expected to affect sensitive receptors.

Airblast overpressure monitoring will be undertaken at sensitive receptors during initial blasting activities as well as other mitigations and monitoring controls that are largely aimed at protection of acoustic quality for surrounding homesteads.

Surface water

The Surface Water Management Plan aims to ensure that Environmental values relating to aquatic ecosystems, stock and domestic use and cultural values are maintained and that discharge and overflow events are undertaken in accordance with the relevant conditions under an environmental authority issued by DES.

Contamination of surface water resources could result from release of mine affected water, wastewater generation and treatment, hydrocarbon leaks or spills, spoil disposal, release of sediments through clearing and earthworks, or draining of low quality water from existing farm dams.

A mine water management system will be implemented based on segregation of water streams into clean, dirty and mine affected streams. Clean water will be managed by diverting around disturbed areas or through the proposed mine in watercourse diversions. Dirty water will be directed to sediment dams to allow sediment to settle out. This water can then be used for dust suppression.

The key management actions to be employed in the prevention of surface water loss and contamination include:

- Prepare and implement a Water Management Plan in accordance with the guideline Preparation of Water Management Plans for Mining Activities
- Preparation and implementation of a Receiving Environment Management Plan including water quality objectives, trigger levels, monitoring and contingency procedures
- Design all watercourse crossings to maintain flow and minimise afflux where this may affect sensitive receptors;
- Design of infrastructure to appropriate standards based on relevant guidelines and all available data to minimise impacts to surface water
- Prohibition of construction water sourced from the Carmichael River
- Controls on design and construction of dams
- Controls for draining of farm dams
- Preparation and implementation of a Plan of Operations for Mine Affected Water and sediment dams, including monitoring and requirements and procedures for discharge

Monitoring will include surface water levels and quality across a network of monitoring sites with at least twelve months of baseline data.

Groundwater

This Plan aims to ensure that impacts on groundwater dependent ecosystems do not cause unacceptable or unapproved losses of biodiversity values including impacts to fauna habitat. Potential threats to groundwater include drawdown from dewatering activities and contamination from spills or leaks.

Key management actions to be employed in the prevention of impacts to groundwater include:

- Groundwater quality trigger levels
- Identify potential impacts before excavation to inform measures required in work permits prevent contaminated runoff through development and implementation of a Surface Water Management Plan
- Laydown and storage areas to be located away from creeks and rivers or sensitive receptors

- On-going monitoring of groundwater levels and updates to models

Monitoring will include groundwater flows to the Carmichael River, groundwater levels and quality across a network of bores.

Pests and Weeds (Biosecurity Management)

Management objectives are to achieve no increase or spread of weeds beyond pre-development conditions as a result of project activities and no unapproved biosecurity management activities. The scope of activities under the plan includes 22 introduced plant species recorded during surveys of the Project Area, of which Parthenium and Prickley Pear are most significant. Eight introduced fauna species are also addressed, including the feral cat, pig, cane toad, dingo, house mouse and rabbit. The plan will manage potential environmental impacts from pests and weeds through vehicle movements, construction activities and ongoing operations. Proposed controls include the following activities:

- Mapping of weeds prior to commencement of construction activities
- Containment of food scraps in sealed containers
- Limitations on the movement of vegetation and soil waste
- Use of weed wash down areas for vehicles and equipment
- No domestic animals in the Project Area
- Feral animal control programs, if necessary.

There will be ongoing monitoring of pests and weeds throughout the Project Area, using baseline and reference sites.

Erosion and Sediment Control

A total of 19 soil types were identified within the Project Area based on geology, landform, native vegetation and soil profile features. It is important to reduce soil loss from the site for the management environmental values relating to both soil and water. Vegetation clearing, topsoil stripping, earthworks, and stockpiling will result in disturbance and exposure of soils to erosive forces from either overland flows of water or wind action. Soil loss reduces soil productivity and removes nutrients and organic matter. Sediment mobilised by overland flow can affect adjacent watercourses through increased turbidity, deposition of sediment on aquatic ecosystems, geomorphological changes and reduced water quality for other water users. Plan objectives are to avoid degradation of aquatic ecosystems and water supply values downstream as a result of sediment releases, and that topsoil resources will not be lost through erosion. Proposed controls include the following activities:

- Preparation of detailed erosion and sediment control plans for each aspect of the project
- Design stormwater systems to include sediment retention basins
- Locate infrastructure away from drainage lines and steep slopes, where ever practicable
- Where practical, schedule works to avoid wet conditions, or if in streams, outside times of flow
- Minimise the areas to be disturbed
- All disturbed areas will be revegetated or protected from erosion using suitable control measures

Monitoring activities will include the inspection of sediment control devices and stormwater systems, including diversion drains and outlets.

Subsidence Management

The management plan objective is that a stable and sustainable landform is created over subsided areas which maximises opportunities for the subsided areas to support native vegetation and fauna. Waterways are important considerations when addressing the potential environmental impacts from subsidence. The Carmichael River is the regional drainage line in the area, and a 500 m buffer from subsided areas will be maintained on either side of the river. Potential impacts from subsidence include altered topography and drainage patterns, tension cracks in the ground surface and disturbance to the root zones of vegetation. Proposed controls include the following activities:

- Develop a detailed management plan in accordance with the mine Environmental Authority
- Design creek diversions around the open cut areas to remain functional after subsidence
- Establish monitoring locations including transects of topographical features and habitat values
- Exclude cattle from subsidence areas.

Monitoring activities will include regular inspections of subsided areas, vegetation health assessments, inspections of ponding in subsidence troughs and groundwater assessments.

Bushfire Management

The Bushfire Management Plan provides a framework and guidance for:

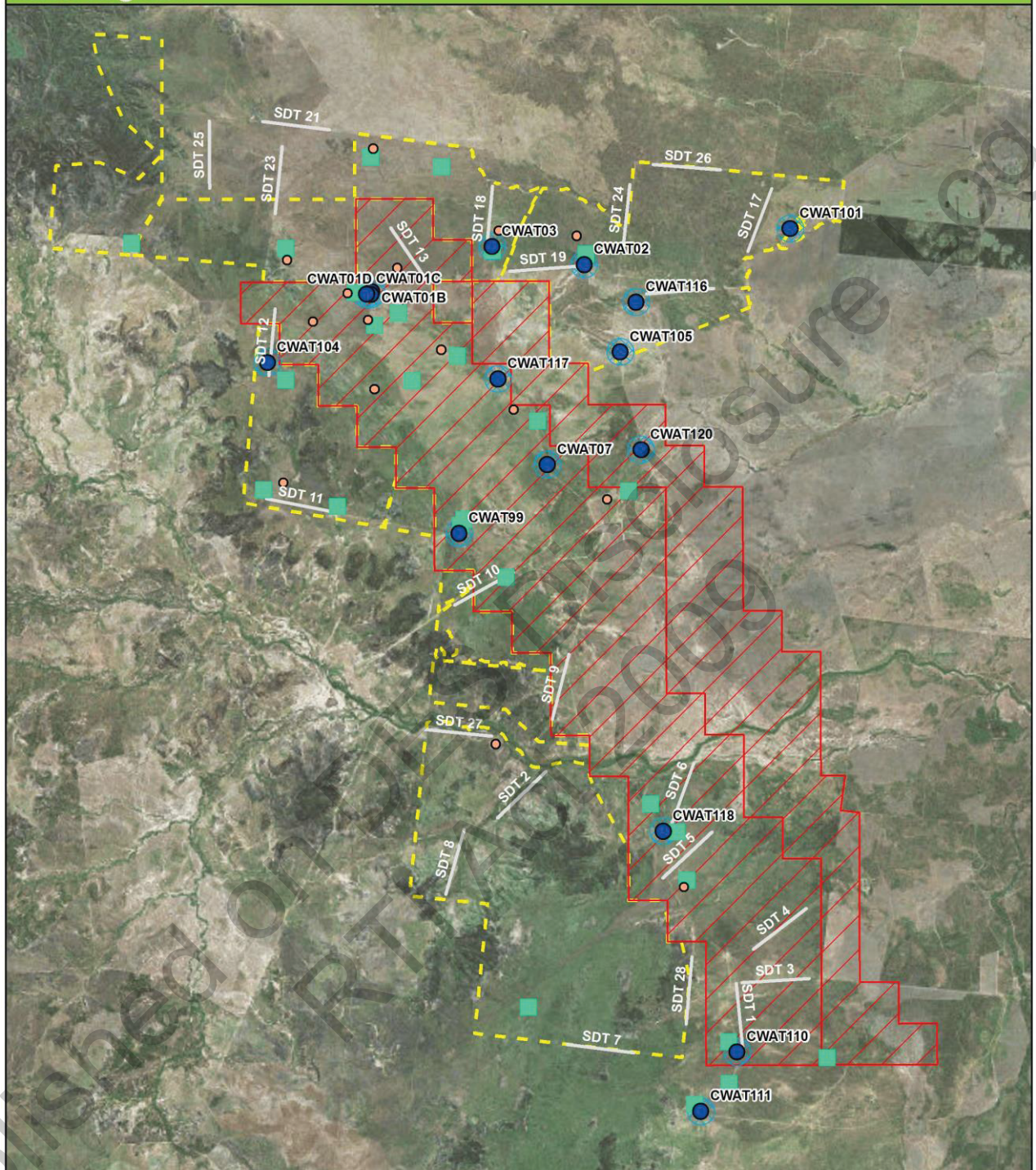
- Identifying, monitoring and prioritising the management of fire risk in the Operational Area
- Preventing bushfires and managing fires throughout the Operational Area
- Developing site-specific and/or activity specific fire management procedures across the life of the project.

The plan is focussed on an overarching strategy to identify, avoid, prevent, minimise and control bushfires. Specific measures are provided on how this will be achieved, and include mapping of relevant environmental features, maintain fire infrastructure (e.g. fire breaks) and levels of fire preparedness. The use of fire in environmentally or culturally sensitive areas is also discussed.

Appendix B Location of Monitoring Sites

The location of monitoring sites are shown on maps on the following pages. The first map shows the location of waterhole surveys sites, 1 km transects, vegetation (BioCondition) transect sites, slow drive transects (historic) and active search areas. The second map shows the location of 2 ha groundcover biomass monitoring sites, which will be monitored in May of each year.

Monitoring Sites



Legend

The Project

■ Carmichael Mine

--- Offset Area Boundary

● Waterhole Survey Sites

● 1km Transects

■ Vegetation Transect Sites

— Slow-drive Transects

■ Active Search Areas

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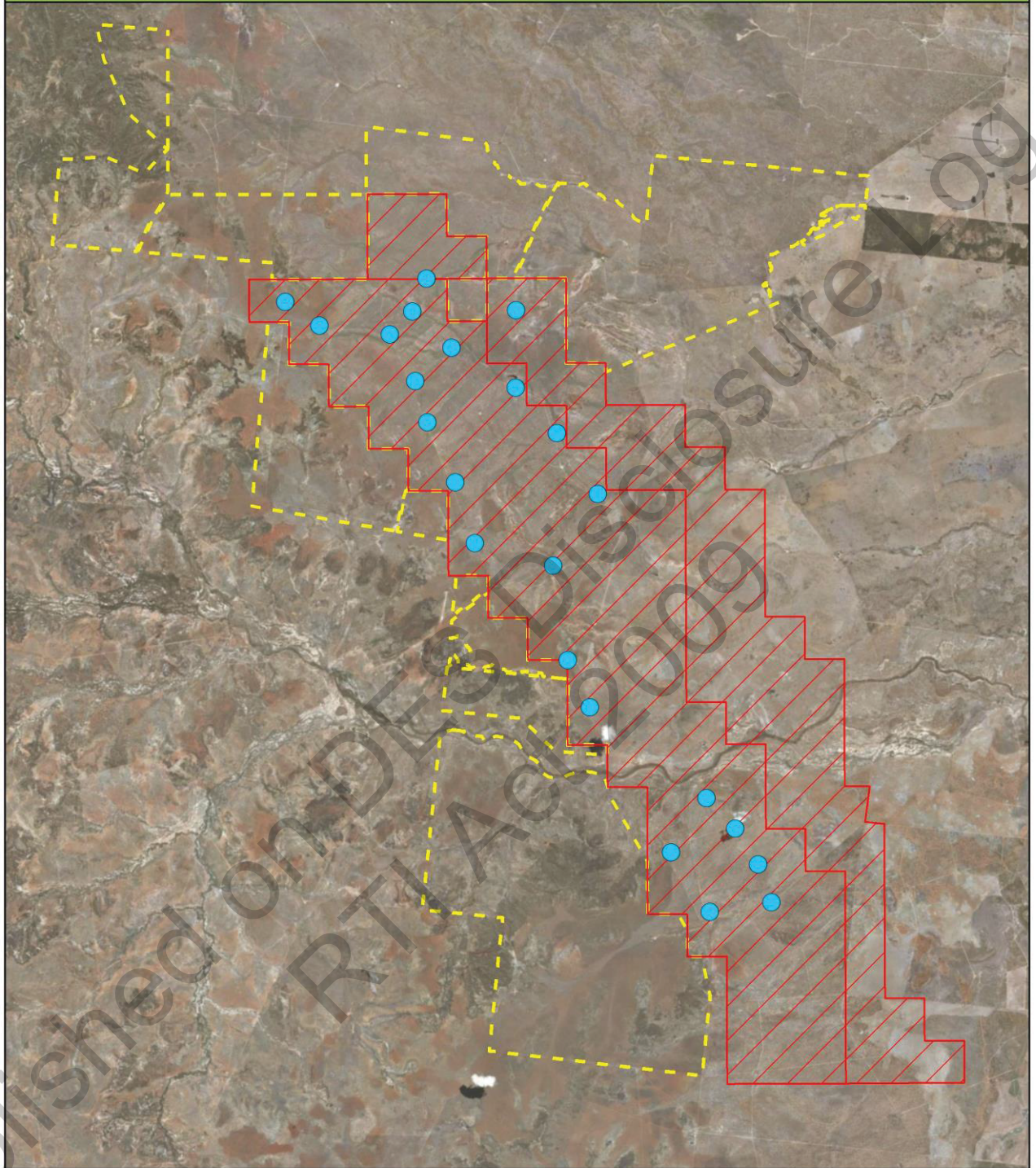


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2ha Groundcover and Composition Monitoring Sites

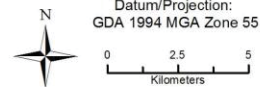


Legend

- Carmichael Mine
- Offset Area Boundary
- 2ha Groundcover and Composition Monitoring Sites

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Appendix C Black-throated Finch Research Program

Published on DES Disclosure Log
RTI Act 2009

Black-throated Finch Research Program

Carmichael Coal Mine

Prepared for
Adani Mining Pty Ltd

October 2018



DOCUMENT TRACKING

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Template 08/05/2014

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Abbreviations

Abbreviation	Description
Adani	Adani Mining Pty Ltd
BioCondition	A vegetation condition assessment tool which provides a measure of how well a terrestrial ecosystem is functioning for the maintenance of biodiversity values at a local or property scale.
BOS	Biodiversity Offsets Strategy
BTF	Black-throated Finch
DAF	Queensland Department of Agriculture and Fisheries
DEHP	Queensland Department of Environment and Heritage Protection (now known as the Department of Environment and Science; DES)
DoE	Commonwealth Department of the Environment
EA	Environmental Authority issued under the <i>Environmental Protection Act 1994</i>
EIS	Environmental Impact Statement
ELA	Eco Logical Australia Pty Ltd
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
EPBC Approval	Approval granted by the Commonwealth under the EPBC Act
ER	Environmental Representative
MNES	Matters of National Environmental Significance, as defined under the EPBC Act
NC Act	Queensland <i>Nature Conservation Act 1992</i>
NGBR	North Galilee Basin Rail Project; a 311 km section of the Carmichael Rail Network located between Mistake Creek and the Port of Abbot Point
RE	Regional Ecosystem
SDPWO Act	<i>State Development and Public Works Organisation Act 1971</i> (Queensland).
SEIS	Supplementary Environmental Impact Statement, prepared in response to comments on the draft EIS.
SP1	Separable Portion 1; a 77 km section of the Carmichael Rail Network located between the Carmichael Mine and Mistake Creek
TEC	Threatened Ecological Community as defined under the EPBC Act
ToR	Terms of Reference

1 Introduction

1.1 Background

Adani Mining Pty Ltd (Adani) is required to develop a Black-throated Finch (BTF) Research Program associated with the Carmichael Coal Mine project (the Project) in the Galilee Basin of central Queensland, as part of the Project approval conditions.

The Carmichael Coal Mine and Rail Project was assessed by the Commonwealth and Queensland governments through an Environmental Impact Statement (EIS) process. Conditional approval of the Carmichael Coal Mine and Rail Project was granted by the Queensland Coordinator-General on 8 May 2014 and the Commonwealth Minister for the Environment on 14 October 2015 (EPBC 2010/5736).

The development of a BTF Research Program is a requirement of the Commonwealth and Queensland approval conditions (refer to **Section 1.5** of this document), to increase the knowledge of the ecological requirements of BTF populations likely to be directly and indirectly impacted by the Project. While the BTF Research Program forms part of the BTF Management Plan (as an appendix), it is intended by be read and implemented as a standalone document.

1.2 Project overview

The Project involves construction of a greenfield coal mine in the Galilee Basin over Mining Leases 70441, 70505 and 70506. The mine site is located approximately 160 km north-west of Clermont, with mining to be conducted using both open cut and underground mining methods. Offsite infrastructure to support the mine will include a workers accommodation village, a permanent airport site and water supply infrastructure. The total disturbance area will be approximately 28,000 ha for the mine and 1,300 ha for the offsite infrastructure. Coal will be transported by rail to the Port of Abbot Point for export (**Figure 1**). The operational mine life will be approximately 60 years, with a production rate peaking at 60 million tonnes per annum (Mtpa).

1.3 Purpose of the research program

The purpose of the BTF Research Program is to meet the conditions of approval granted by the Queensland and Commonwealth governments, and commitments made by Adani in securing approvals. This will include undertaking studies that will increase the knowledge of the ecological requirements of BTF populations within and adjacent to the Carmichael Coal Mine and by doing so, inform and improve management of the local BTF populations. The Research Program will also improve understanding of the biology and ecology of BTF across its current range.

The Research Program is relevant to the population/s of BTF occurring on the Project area (i.e. the mining lease and Moray Downs West offset area) and possibly the immediate adjacent properties (**Figure 1**).

1.4 Relationship with other management plans

Various other management plans will be developed and implemented to address the requirements of approval conditions under Commonwealth and Queensland legislation. There will be some interaction among the plans during construction and operations. The BTF Research Program will also have an interaction with some of these management plans including:

- BTF Management Plan for the Carmichael Coal Mine
- Moray Downs West Offset Area Management Plan.

Data collected during BTF monitoring will be used to inform the implementation of the Research Program. The results of the Research Program, especially with regards to habitat management, BTF behaviour and breeding, will be used to inform and enhance management of BTF across the Project area.

The BTF Research Program will be implemented in parallel with other studies on listed threatened species and communities. Monitoring of BTF will be coordinated with monitoring of other threatened species, which is carried out in accordance with approved Species Management Plans. This coordination will provide for management of threatened species and communities at a landscape scale, in addition to monitoring and implementation of actions for species or communities individually. Such an approach will assist in identifying any synergies in management actions (where one action benefits multiple species) or any areas of conflict (where an action may assist one threatened species but hinder another).

The BTF Research Program will be funded by Adani as part of its operating budget for the mine. In determining priorities for funding, Adani will take advice from technical specialists on the BTF research team, the independent reviewer, the BTF Recovery Team and the Department of Environment and Science (DES).

1.5 Compliance with approval conditions

Appendix D of the BTF Management Plan provides a summary of how compliance with all relevant BTF approval conditions and project commitments has been achieved. This includes a section showing how compliance has been achieved in the development of the BTF Research Program.

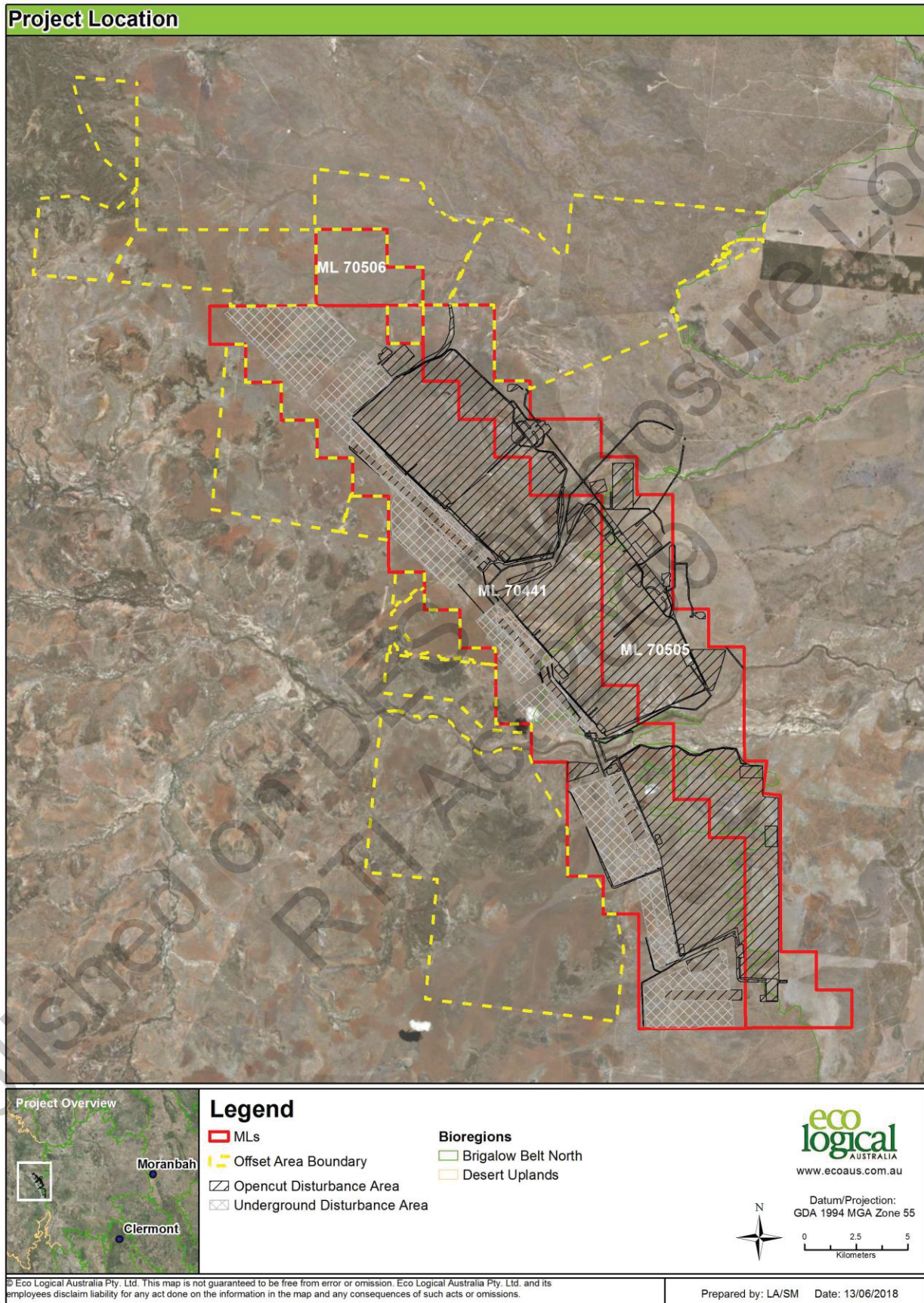


Figure 1 Map showing the location of the Carmichael Mining Lease and Offset Area

2 Black-throated Finch (southern)

2.1 Status

The BTF (southern subspecies) is listed as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Nature Conservation Act 1992* (NC Act). The primary reason for the listing is the decline in size and extent of the population of the southern subspecies, estimated to have declined by approximately 80% since the early 1980s (DoE 2016). Reasons for the decline include loss of habitat from vegetation clearing, degradation of remaining habitat and invasion of exotic weed species.

Large flocks of the southern subspecies of BTF were once seen in discontinuous areas from about the Atherton Tablelands in the north, to northern New South Wales in the south, and up to 700 km inland from the coast. The northern subspecies is found from the Atherton Tablelands, north to Cape York Peninsula, and west to the Gulf of Carpentaria (Removed at External Review 1999, in National Recovery Plan 2007).

It appears that the southern subspecies is now confined to the northern part of its former range and analysis of historical records suggests that a contraction of range has been occurring for several decades. BTF began disappearing from southern areas early in the 20th century and by the 1940s they had mostly disappeared from the south-east of their former range. Declines in their southern extent continued in the following decades, with major declines around Rockhampton reported in the mid-1970s. The subspecies is now patchily distributed within an area extending 500 km inland from the coast between Mareeba in the north and Rockhampton in the south.

2.2 Regional populations

The southern subspecies of the BTF lives in the Brigalow Belt North and Desert Uplands bioregions of Queensland, which cover 135,500 km² and include the towns of Townsville, Bowen, Emerald, Clermont and Collinsville (at External 2011). Based on mapping of all records of BTF up to 2010 and a comparison with post-2000 records, the distribution of BTF is estimated to have contracted by 50-80% of its historical range and the species is now rarely recorded south of Clermont (160 km south of the Project area at External 2011). BTF have also disappeared from several sites around Townsville (at External et al. 2011).

Assessments undertaken as part of the process for listing of the southern subspecies of BTF identified a severe reduction in numbers, with an observed decline in extent of occurrence of up to 59% in the 10 years prior to the release of the listing advice in 2005 (Threatened Species Scientific Committee 2005). Other studies estimated a decline of up to 80% in the 30 years prior to 2007 (at External et al. 2006; BTF Recovery Team 2007).

The Action Plan for Australian Birds (at External et al. 2011) lists the subspecies as Vulnerable C2a(i) and cites the reason for the listing as 'population <10,000 mature individuals and continuing to decline, <1,000 in largest known subpopulation.' Between the 1990 and 2000 listings, the status of the subspecies declined from Near Threatened to Vulnerable on the basis of an increased rate of decline in the extent of occurrence as distant subpopulations disappeared.

2.3 Previous research

The majority of research undertaken on BTF has been carried out since the mid-1990s and has been focused on the population on the Townsville Coastal Plain. It is likely that there are differences in the ecology of BTF between the higher rainfall coastal region and the more arid, Desert Uplands Bioregion due to distinct differences in the vegetation and habitat that the BTF occupy in these areas. The vegetation of the Townsville Coastal Plain is generally more highly modified than that of the Project area, with a higher proportion (in terms of species and biomass) of introduced plants. The Carmichael Project area appears to support a much larger population of BTF in a more intact landscape compared with the Townsville Coastal Plain.

A synopsis of previous research on BTF is provided in the following sections.

2.3.1 [redacted] (1976)

[redacted] (1976) provided results of about 70 hours of observations made in October 1967, May 1970 and June 1970 on the two subspecies *P. c. cincta* and *P. c. atropygialis* at various sites on Cape York Peninsula and further south in far north Queensland. He described the species' habitat as ranging from dry open woodland with a few tall eucalypts to closed woodland.

He stated that "seeding grasses and locally accessible water were common features of all habitats". He identified that small flocks of birds feed in the early morning and late afternoon, taking seeds that had fallen to the ground and occasionally feeding on half-ripe seeds that were taken from the seed-head. [redacted] identified some of the grass species whose seeds were being eaten; *Setaria surgens*, *Digitaria ciliaris*, *Stylosanthes humilis* and *Dactyloctenium radulans*.

Flocks were typically of 12-30 individuals but "nomadic flocks of several hundred may aggregate around water-holes during droughts". The presence of many newly fledged birds on Cape York Peninsula in the October observation period indicated recent breeding, whereas further south there was a large proportion of juvenile birds in June. Birds were reported to nest in colonies, with examples of 30 and 37 nests being observed. Nests were placed in *Melaleuca* spp. and *Eucalyptus* spp. Captured aviary birds had clutch sizes of around five eggs.

2.3.2 [redacted] (1996)

Twenty years later [redacted] (1996) completed a one-year study of BTF near Townsville. He compared the foraging ecology between wet and dry seasons. During his study, a greater diversity of habitats was used after August. He noted that food availability declined following rainfall and seeds of two introduced grass species, *Urochloa mosambicensis* and *Digitaria ciliaris*, were important food sources, the latter also being noted by [redacted] (1976).

2.3.3 [redacted] (unpublished)

During the 1990s, [redacted] undertook studies of BTF around Townsville in connection with environmental impact assessments. He made observations on BTF distribution, abundance and breeding behaviour. He also attempted to estimate the size of the population of BTF in the Townsville Local Government Area, though there was limited information available to provide the basis of such an estimate. Importantly, he modelled BTF breeding habitat on the Townsville Coastal Plain based on the proximity of water and preferred Regional Ecosystems. [redacted] (2013) also modelled the present and future distributions of BTF at the range scale, exploring the potential for impact from climate change.

2.3.4 [redacted] (2007)

In 2007 [redacted] submitted an Honours Thesis based on field work on the BTF on the Townsville Coastal Plain. She studied foraging behaviour of two breeding colonies, during a period when birds are

constrained by their need to remain close to their nests. One of the colonies consisted of three breeding pairs. The nests and associated foraging areas were within 300 m of permanent water. The composition of the herbaceous vegetation where birds were observed foraging was described. In this study, the birds preferred patches dominated by *Alloternopsis cymicina*, *Chloris* spp. and, the introduced *Urochloa mosambicensis*. BTF tended to avoid patches dominated by *Heteropogon contortus*, *Themeda triandra* and *Aristida* spp.

2.3.5 [redacted] (2010)

A second honours thesis [redacted] (2010) compared the abundance of granivorous birds, including BTF, in peri-urban versus rural areas around Townsville. It demonstrated that all the finch species studied were less abundant in the more highly modified peri-urban areas than they were in the rural areas that were generally used for pastoralism. BTF were severely affected by the changes that occurred with peri-urban development, as indicated by comparison of their abundance in the two zones.

2.3.6 [redacted] (2011)

[redacted] (2011) conducted a study of the health of grass finches, including BTF, in northern Australia in relation to season, land tenure (land-use) and conservation status, quantifying health in terms of stress levels and blood chemistry. Stress levels were greater, on average, in birds on pastoral versus conservation lands.

2.3.7 [redacted] (2016)

The most comprehensive field study of BTF was that conducted by [redacted] (2016), based on the Townsville Coastal Plain. It examined daily and seasonal movement patterns, habitat requirements and foraging ecology.

A large number ($n = 102$) of birds in several sub-populations were colour banded and, for the first time, a small number of birds ($n = 18$) were radio-tracked for periods up to 2 weeks. Individual birds appeared to return to areas of just a few hectares over periods of 600 days or more with home ranges of 10-50 ha in the short-medium term. A small number of individuals were recorded at distances of 5-6 km from the location at which they were banded. Three individuals moved more than 15 km from the banding location but there were insufficient data to say much about the frequency of these longer distance movements.

This study suggested that the preferred habitats of BTF on the Townsville Coastal Plain are those with a high percentage of native grasses, low shrub cover, low shrub and tree diversity, some standing trees present and an abundance of *Chrysopogon fallax*, *Eragrostis* spp. and *Setaria surgens*.

2.3.8 [redacted] (2017)

Another study has investigated the genetics of BTF, comparing wild and captive birds [redacted] (2017). Samples were taken from several sub-populations on the Townsville Coastal Plain, the Mareeba district and within the Carmichael Mine Project area. The study also incorporated samples collected by [redacted] on Cape York Peninsula and the Townsville Coastal Plain. The captive birds were obtained from the collections of private aviculturists.

2.3.9 Black-throated Finch Recovery Team

Since 2004, the BTF Recovery Team has organised annual “waterhole counts” during which water sources that are prospective drinking locations for BTF are surveyed on two consecutive days in the late dry season each year. All sites are on the Townsville Coastal Plain. This is more of a monitoring exercise than research. The results indicate that numbers coming to water are affected by conditions at the time of the survey and this variability may exceed that from inter-annual variation and other population trends.

2.4 Habitat requirements

BTF habitat typically consists of grassy eucalypt woodlands adjacent to water or riparian corridors at External

Removed at External Review

Preferred habitat consists of patches with suitable grasses, low vegetation density or bare ground to allow access to the seed bank and an open tree layer that does not have a continuously dense shrubby understorey moved at External Review. moved at External Review noted that the southern subspecies requires a mosaic of different habitats during the wet season in which to find seed. This subspecies has also been recorded in degraded habitats, including cultivated areas in the vicinity of woodlands and a heavily grazed paddock (DoE 2015), most likely to access fallen or available seed.

BTF can be found in a range of woody plant communities with records known from at least 21 Regional Ecosystems ved at External Review *et al.* 2016). Woodland vegetation typically consists of ironbark (e.g. *Eucalyptus melanophloia*, *E. crebra* and *E. drepanophylla*), bloodwood (*Corymbia dallachiana*, *C. erythrophloia* and *C. clarksoniana*) and gums (*E. platyphylla* and *E. brownii*). Records from other vegetation communities include wetlands, riparian paperbark woodlands and native grasslands ved at External Review *et al.* 2016). Approximately 78% of records within the Galilee Basin region are associated with Broad Vegetation Group (BVG) 17b, which is described as 'woodlands to open woodlands dominated by *Eucalyptus melanophloia* (Silver-leaved ironbark; or *E. shirleyi*; Shirley's silver-leaved ironbark) on sand plains and foot slopes of hills and ranges' (Dreis unpublished).

In the Project Area, grassy open-woodland communities dominated by *Eucalyptus melanophloia* (RE 10.5.5a) are preferred, though the species is not restricted to this community (ELA 2017a; ELA 2017b; Niche 2015a, Niche 2015b, Niche 2016a, Niche 2016b). Other habitats where BTF have been recorded on multiple occasions include *Eucalyptus brownii* open-woodland (RE 10.3.6ax1) and *Eucalyptus similis* and *Corymbia brachycarpa* open-woodland (RE 10.5.1a).

BTF habitat within the Project Area generally consists of an open-woodland (approximately 17 % canopy cover) with moderately low canopy (approximately 12 m) and low canopy species richness. The shrub layer is typically low (2 to 2.5 m) and sparse (less than 10 % cover) but a moderately high species diversity. The ground cover is dominated by native grasses (approximately 35% cover and 8 species) with moderate bare ground (34% cover). Exotic grass and herb / forb cover are typically low (less than 5%).

Foraging habitat must provide suitable seeds, principally of grasses. There must be an appropriate density and diversity of grasses, with seeds available and accessible on the surface as the birds predominantly feed on fallen seeds. A mix of grass species that seed at different times is important to provide year-round food supply as BTF can experience food shortages particularly in the lead up to the wet season at External Review (2011). The ground layer of the vegetation is ideally dominated by a diversity of annual and perennial grasses, with sufficient inter-tussock spacing to allow the birds to forage efficiently for grass seeds present on the soil surface.

Access to water is critical for the BTF. During the wet season, they utilise ephemeral water and move into new feeding areas. During the dry season, permanent water provides refuge, because BTF need to drink every day. Permanent water may be in the form of natural springs, perennial streams, waterholes in ephemeral creeks or man-made water sources such as farm dams and troughs. Therefore, water must be within an accessible distance from BTF foraging and nesting habitat and nests are typically constructed in trees within 400 m of water sources at External Review (2011, NRA 2007). However BTF monitoring results from the Project Area have identified a mean distance of approximately 2.5 km between nests and known permanent water sources with the closest nest 280 m from water and the furthest almost 7 km.

2.5 Breeding ecology

BTF breeding season is from October to April, with seasonal and geographic variations (at Extern 2011). The timing and duration of the breeding season appears to be contingent on food resources and is therefore likely to vary annually and geographically according to rainfall patterns, temperature and land condition. Commencement of the wet season is the likely trigger for breeding.

Around Townsville, breeding tends to occur from December to May, which generally encompasses the wet season and the period of most prolific seeding of grasses (at Extern pers. comm.). However, there is considerable variation in this timing throughout the bird's range. Breeding will continue throughout the period of grass seeding generated by the wet season.

NRA (2005a) recorded BTFs breeding in Townsville from January to July; analysis of data contained in (at Extern 1996) recorded breeding in Townsville from March to May; and (at Extern 1970) recorded breeding on the Atherton Tableland from September to January. Although under optimal conditions the species can probably breed continuously throughout the year, the core breeding season around Townsville is believed to begin sometime after the onset of the wet season and continue until ground-stored food resources (fallen grass seed) fall below an undetermined threshold (February to June). Usually five or six eggs are laid at one time (at Extern 2011).

There is little published information regarding the timing of the breeding cycle of this species. In a study of relatively few captive individuals (at Extern 1976) observed the timing of the breeding cycle to be 15 days for incubation, 22 days from hatching to fledging and 18 days from fledging to independence. This indicates BTF are 40 days old at independence. With respect to independence (at Extern 2011) noted that BTF juveniles may remain with their parents for a number of months after fledging.

BTF have been recorded returning to the same nesting location each breeding season (within hundreds of metres). However, nesting location (dozens of metres) tends to change from year to year (at Extern 2015). BTF tend to form loose colonies and multiple nests may be found in a single tree (at Extern et al. 2006; NRA 2006; NRA 2007b). Nests are used for breeding and roosting, with individuals returning each night to roost. During the non-breeding season, some nests may be used as dormitory nests housing multiple adult pairs and young.

Nests are mostly built high in the outer branches of trees and tall shrubs, in tree-hollows, in mistletoes, and in the base of raptor nests (at Extern et al. 2006; BTFRT 2007; DoE 2015). However, nests have also been recorded in large shrubs within 1 m of the ground. Occasionally nests are constructed beneath active raptor nests, of species such as Wedge-tailed Eagle (*Aquila audax*), Whistling Kite (*Haliastur sphenurus*), Swamp Harrier (*Circus approximans*) and Collared Sparrowhawk (*Accipiter cirrocephalus*) (at Extern et al. 2006). Nests may also be built in neighbouring trees within the colony, usually less than 50 m from other nest trees (at Extern et al. 2006; NRA 2006). On occasion, an outlier may be up to 250 m from the main colony (at Extern 2007; NRA 2007b).

The minimum area of nesting habitat required to sustain a viable breeding colony is unknown (NRA 2007). Most known nesting colonies are connected to larger areas of remnant vegetation. Following observations of a single colony on the Townsville Coastal Plains, it has been suggested that a minimum remnant habitat patch of 40–50 ha within 500 m of a nesting colony may be required for that colony to remain viable, at least in the short-term (NRA 2006; NRA 2007). Nests are typically constructed from grass stems with a feather or plant down lining (at Extern et al. 2006; NRA 2006).

The breeding season is an opportunity for BTF populations to recover from losses that may have been sustained during the dry season / early wet season (when resource bottlenecks occur as grass seed supply is low). During the breeding season, parents first need to gain sufficient body condition to breed

and, then, once the young have hatched, be in a condition in which they can forage for both themselves and their young. Activities or events that reduce resource availability during this time may reduce reproductive success. If breeding success is unable to off-set mortality over consecutive years then population declines and, ultimately, local extinctions will occur (at Extern 2011).

2.6 Summary of project surveys

There have been numerous surveys undertaken between 2010 and 2018 to assess the distribution and abundance of BTF within the project area (**Table 1**). This work, conducted as part of the EIS studies and as baseline surveys required by conditions of approval for the Project, is the most comprehensive effort to quantify distribution and abundance of the species across a defined area. Previous surveys conducted across the Project area incorporating or focussed on the BTF are summarised in **Table 1**. Collectively, these surveys provide baseline data to assist with reporting on life history, movement patterns, habitat requirements and population dynamics (see Condition 18a of EPBC 2010/5736).

In order to standardise reference to the wet season and dry season for BTF monitoring in the project area, the following definitions have been developed in consultation with regulatory agencies:

- Wet season: December to March inclusive
- Dry season: April to November inclusive

This allows the standardisation of previous monitoring to an allocated season, to assist with data analysis.

Table 1 Summary of BTF surveys undertaken for Carmichael Mine

Survey period	Assessment process	Consultant	Methodology
Dry season 2012 (May 2012)	BTF survey for EIS	GHD	Water source watches: nine separate sites for almost 28 person hours over a 3-day period. Three of the sites were surveyed twice over two days and the remainder of the sites were surveyed once. Survey effort at each site varied from 90 minutes to 288 minutes. Remote camera traps: nine camera traps deployed at water sources to monitor use by BTF. 2 hectare plots: thirty one 20-minute searches conducted within the study area with a total of 21 person hours.
Dry season 2013 (May 2013)	BTF monitoring survey for SEIS	GHD	Water source watches: a total of eight sites by at least two people and up to four. Included at least one person watching for the full duration of the watch and one person surveying the surrounding habitat (600 m radius of water source). Remote camera traps: twenty remote camera traps deployed at water sources to monitor use by BTF. 2 hectare plots: two 20-minute searches of 2 hectare plots were conducted at fifty-two sites located throughout the study area.
Dry season 2013 (October 2013)	BTF monitoring survey as additional information to EIS	GHD	Water source watches: a total of 16 sites by at least two people and up to four, and included at least one person watching for the full duration of the watch and one person surveying the surrounding habitat (600 m radius of water source). Remote camera traps: seventeen remote camera traps deployed at water sources to monitor use by BTF. 2 hectare plots: two 20-minute searches of 2 hectare plots were conducted at sixty-seven sites located throughout the study area.

Survey period	Assessment process	Consultant	Methodology
Wet season 2014 (December 2014)	Baseline BTF monitoring survey to meet approval conditions	Niche	<p>Water source watches: a total of ten sites where 1 x three hr early morning (i.e. starting from sunrise) and 1 x one hr late afternoon (i.e. between 1500 hrs and 1830 hrs) water source watches were undertaken. Each water source watch was accompanied by a simultaneous habitat search in a 600 m radius of the water source.</p> <p>Remote camera traps: eleven remote camera traps were deployed at water sources to monitor use by BTF.</p> <p>2 hectare plots: Fifty-two 20-minute searches of 2 hectare plots were surveyed using the same BA (2012) methodology as the October survey and an additional 42 supplementary 20-minute searches of 2 hectare plots were established.</p>
Wet Season 2015 (March 2015)	Baseline BTF monitoring survey to meet approval conditions	Niche	<p>Water source watches: a total of 21 sites where 1 x three hr water source watches were undertaken during the three hours immediately after first light. Searches of areas within a 600 m radius of water sources were conducted at nine sites.</p> <p>Remote camera traps: Four remote camera traps were deployed at water sources to monitor use by BTF.</p> <p>Slow drive transects with call playback stations: incorporated into the methodology in this survey to replace the 20-minute searches of 2 hectare plots used in previous surveys to systematically sample a larger area for monitoring movement and habitat use. Slow drive transects were undertaken at 29 sites with 111 call playback stations totalling 20.4 hours of call playback.</p>
Dry Season 2015 (August 2015)	Baseline BTF monitoring survey to meet approval conditions	Niche	<p>Water source watches: a total of 23 sites where 1 x three hr water source watches were undertaken during the three hours immediately after first light. Searches of areas within a 600 m radius of water sources were conducted at 13 sites.</p> <p>Remote camera traps: Three remote camera traps were deployed at water sources to monitor use by BTF.</p> <p>Slow drive transects with call playback stations: Slow drive transects were undertaken at 26 sites with 108 call playback stations totalling 18 hours of call playback.</p>
Dry Season 2016 (April 2016)	Baseline BTF monitoring survey to meet approval conditions	Niche	<p>Water source watches: a total of 25 sites where 3 hr water source watches were conducted at each site immediately after first light. Searches of areas within a 600 m radius of water sources were conducted at seven sites.</p> <p>Remote camera traps: Four remote camera traps were deployed at water sources to monitor use by BTF.</p> <p>Slow drive transects with call playback stations: Slow drive transects were undertaken at 28 sites with 128 call playback stations totalling 21.3 hours of call playback.</p>
Dry Season 2016 (October 2016)	Baseline BTF monitoring survey to meet approval conditions	ELA	<p>Water source watches: a total of 16 sites were surveyed for 6 hr immediately after first light. Searches of areas within a 600 m radius of water sources were conducted at all 16 sites.</p> <p>1 km transects: Five 1 km transects were also undertaken during active searches.</p> <p>Remote camera traps: Five remote camera traps were deployed at water sources to monitor use by BTF.</p> <p>Slow drive transects with call playback stations: Slow drive transects were undertaken at 19 sites with 57 call playback stations totalling approximately 9.5 hours of call playback.</p>
Dry Season 2017 (November 2017)	Baseline BTF monitoring survey to meet	E2M	<p>Water source watches: a total of 14 sites were surveyed for 6 hr immediately after first light. Searches of areas within a 1 km radius of water sources were also conducted.</p>

Survey period	Assessment process	Consultant	Methodology
	approval conditions		<p>Remote camera traps: Five remote camera traps were deployed at water sources to monitor use by BTF.</p> <p>Slow drive transects with call playback stations: A total of 37 slow drive transects were conducted, with 60 call playback stations.</p> <p>Two bioacoustics recorders were deployed for the purpose of developing acoustic recognition tools for BTF.</p>
Dry Season 2018 (April 2018)	Baseline BTF monitoring survey to meet approval conditions	E2M	<p>Water source watches: a total of 11 sites were surveyed for 3 hr immediately after first light. A total of 67 active searches were conducted for a period of 30 to 60 mins.</p> <p>Remote camera traps: Five remote camera traps were deployed at water sources to monitor use by BTF.</p> <p>Slow drive transects with call playback stations: A total of 12 slow drive transects were conducted, with 36 call playback stations.</p> <p>Two bioacoustics recorders were deployed at water sources within the study area.</p>

Surveys undertaken for the Project have adopted a variety of methods including timed fixed point water source watches, habitat searches in the immediate vicinity of the water sources (600 m radius), 2 ha area searches, slow drive line transects with defined call playback stations and opportunistic observations gathered whilst traversing the Project area. Slow drive transects have generally been found to be an ineffective method of conducting surveys for the species, when compared with other methods.

The results from 10 targeted BTF surveys have consistently recorded moderate to large numbers of BTF (**Table 2**). The largest aggregate total of BTF records during these surveys was 1,145 during the August 2015 survey. Variation in observations between the nine surveys is likely to be due to varying survey effort, locations and methodology rather than a trend population size. Collectively these survey results indicate that the Project area provides high quality habitat for the species and that BTF are consistently present.

Table 2 Summary of BTF survey results

Survey	Aggregate total	Number of sightings	Minimum flock size	Maximum flock size	Mean flock size	Number of nests
Dry season 2012 (May 2012)	97	10	1	30	9.7	0
Dry season 2013 (May 2013)	276	26	1	41	10.6	3
Dry season 2013 (October 2013)	84	12	1	31	7	0
Wet season 2014	320	40	1	40	8	6

Survey	Aggregate total	Number of sightings	Minimum flock size	Maximum flock size	Mean flock size	Number of nests
(December 2014)						
Wet Season 2015 (March 2015)	600	108	1	50	5.6	5
Dry Season 2015 (August 2015)	1,145	120	1	36	10.5	5
Dry Season 2016 (April 2016)	431	124	1	32	3.5	5
Dry Season 2016 (October 2016)	610	82	1	30	7.4	8
Dry Season 2017 (November 2017)	390	70	1	100	not reported	13
Dry Season 2018 (April 2018)	846	138	1	40	4 (median)	15

Monitoring results indicate that the Project area, particularly the northern portion of Moray Downs, has consistently supported a large and relatively abundant population of BTF. This part of the Project area, referred to as Ten Mile Bore (in the north-west of the mining lease), appears especially favourable for the BTF due to the combination of large areas of grassy *Eucalyptus melanophloia* open-woodland and reliable water sources.

Areas north of the Carmichael Road in the far west of the Project Area (Four Mile Bore and surrounds) are also favourable, though the numbers of birds are generally lower than around Ten Mile Bore. In addition, large numbers of BTF have been recorded during surveys to the south of the Project Area at a large dam on Lignum Station. The floristic composition and structure representative of the area surrounding this large dam is also consistent with the vegetation assemblages shown to support BTF foraging and nesting habitat to the north.

The key findings from the monitoring surveys include:

- Aggregate BTF totals have ranged from 84 to 1,145 with an average of 480. Dry season surveys have generally yielded the largest aggregate totals (1,145, 846 and 610 in 2015, 2018 and 2016 respectively), with a wet season survey in 2015 yielding 600.

- Surveys to date have focused on the mining lease where the greatest aggregates have been recorded, in particular in the northern area of the mining lease and around Four Mile and Ten Mile bores.
- The 2016 dry season survey included the greatest survey effort within the Moray Downs West offset area to date where an aggregate total of 151 BTF were recorded from 14 locations.
- Monitoring surveys have identified a strong association between BTF records and vegetation communities dominated by remnant RE 10.5.5a *Eucalyptus melanophloia* open woodland on sand plains (Niche 2016a; ELA 2017a). BTF have also been recorded in four other RES (10.3.6ax1, 10.3.13a, 10.5.1a and 10.5.1d).
- The majority of BTF records have been identified during waterhole surveys with this survey method accounting for 37% of the aggregate total in the October 2016 dry season survey (ELA 2017a).
- Foraging BTF have been predominantly observed in woodland or open woodland dominated by *E. melanophloia* with a mean canopy height of 12 m. Areas used for foraging were characterised by sparse to mid-dense ground cover with a mean ground cover recorded of 40%. Grass species diversity at foraging sites was high with a mean grass species richness of 8. Exotic grass cover is typically less than 5 %The species recorded are typical of grassy woodlands of the bioregion, of which the Project area supports some high quality examples (Niche 2015a).
- Based on the data available for dry season, it appears that in dry conditions, records are concentrated in the central-north and central-south areas of the Project area where large stretches of suitable habitat are present and water sources were available at the time of survey (Niche 2016a; ELA 2017a). In particular, large numbers were recorded during the August 2015 BTF monitoring survey in the vicinity of the large dam on the Lignum property (CWAT111), the dam at CWAT03, Four Mile Bore (CWAT99), #2 Dam (CWAT117), the Turkey Nest dam at Ten Mile Bore (CWAT01B) and troughs at Lignum (CWAT110B) and Carmichael Bore (CWAT118) (Niche 2016a).
- A total of 60 BTF nests have been identified during monitoring surveys to date. This includes 15 nests that were found during the 2018 dry season survey which is the largest number to date (E2M 2018).
- A pair of BTF were observed during the 2016 dry season surveys preparing a nest within the outer-branches of a Silver-leaved Ironbark. This tree was approximately 14 m in height and within remnant RE 11.5.5.a.
- Surveys have identified preferred foraging habitat to consist of a grassy understorey with a mosaic of patches of dense grass with open bare patches containing a diversity of native grasses.
- BTF have been observed foraging on seeds of at least nine grass species as well as the woody shrub *Stylosanthes scabra* within the Project area (GHD 2012; Niche 2016; ELA 2017a). Another two grasses have been identified as potential foraging species (GHD 2012).

2.7 Other Relevant Documents

Several other documents provide relevant information regarding the ecology of the BTF as well as recommended survey and assessment techniques and management measures.

These include:

- National recovery plan for the BTF southern subspecies *Poephila cincta cincta*. Report to the Department of the Environment and Water Resources, Canberra (BTF Recovery Team, 2007);

- Significant impact guidelines for the Endangered BTF (southern) (*Poephila cincta cincta*) - EPBC Act policy statement 3.13 (Department of the Environment, Water, Heritage and the Arts (DEWHA), 2009);
- Threat abatement plan for competition and land degradation by rabbits (DEWHA, 2008); and
- Commonwealth Listing Advice on Southern BTF (*Poephila cincta cincta*) (Department of the Environment, 2005).

3 Research scope and objectives

3.1 Scope

The scope of the Research Program is limited to the population/s of BTF occurring primarily on the Project area (i.e. the mining lease and Moray Downs West offset area) and immediately adjacent properties (subject to landowner consent). The research will focus on answering key questions that are relevant for the management and conservation of the BTF population/s occurring in this vicinity, in the context of the Project. The aim of the Research Program is to support management actions that will prevent any declines in the BTF population or habitat quality on the Project area, caused by the mine, land clearing and general degradation to the regional landscape due to this change in land use.

It is envisaged that the outcomes of this research will also be applicable for the management and conservation of BTF (southern) throughout its range and in particular, to the conservation and recovery of populations occurring within the Galilee Basin including the Desert Uplands Bioregion and the southern portion of the Northern Brigalow Belt Bioregion.

Much of the contemporary knowledge of BTF and recommended management measures are based on studies undertaken on the Townsville Coastal Plains population. Given the difference in habitats between the Project area and the Townsville Coastal Plains, it is likely that there will be some differences in the ecology and biology (e.g. key grass species in diet), due to the contrasting nature of the two locations. Overall, core facets of the ecology of the two populations will overlap. However, the degree and nature of the threats to each population will be different, as might be their response. As a result, there may be synergies and differences in management measures for these different populations.

3.2 Objectives

The objective of the Research Program is linked to conditions of approvals and involves determining the critical ecological requirements for the BTF. The research is focussed on the spatial and temporal movement patterns, habitat requirements and population dynamics, dietary requirements, home range and nesting requirements for the BTF as well as the relationship between water sources, woody habitat and food sources. The research will also aim to determine the species response to grazing management, fire management and water body locations within the mining lease area and approved offset areas, to facilitate appropriate management of these areas.

The results of the research will inform and improve management and mitigation measures adopted for the Project to minimise impacts to the local population of BTF as well as enhance habitat within the Moray Downs West offset area in such a way to increase the carrying capacity for BTF in these areas. The Research Program will establish whether Ten Mile Bore and surrounding areas are high value habitat for BTF and establish management actions to maintain the current BTF population in this area.

3.3 Application of research for BTF management

The research aims have been developed to further the understanding of the ecology of the BTF, and more specifically, the relationship with land management activities that can be applied on the Project area. Management actions, and the research and monitoring that provide information for the management, will be based largely on three main themes – grazing management, fire management and water management. These will be reviewed and, if required, expanded depending on the outcomes of the research and monitoring, incorporating new knowledge regarding the ecology of BTF within the Project area. The data collected will avoid where possible, minimise and mitigate any impacts on BTF throughout

the development, operation and decommissioning of the mine, as well as preserve the BTF populations on the offset areas.

3.3.1 Grazing management

BTF can persist in pastoral landscapes even though [redacted] (2011) demonstrated that birds on pastoral lands had higher stress levels than birds on conservation lands. The abundance of BTF and the viability of their populations, however, are likely to be influenced by the intensity of the grazing, which can range from heavy to absent within the Project area. The key effects of grazing can be direct – the reduction or homogenisation of the composition and structure of the ground layer and woody layer, or indirect – clearing, changes to the fire pattern through reduction in fuel loads or promotion of woody thickening.

Small scale experimental trials will be implemented with the aim of identifying appropriate grazing strategies for managing BTF habitat, especially within the Moray Downs West offset area. Research will assist in understanding how absent, low and high cattle stocking densities and different grazing strategies (e.g. wet season resting) effect ground cover and grass composition (positively or negatively).

The trials will aim to identify the optimal grazing strategy for maintaining good condition BTF habitat that incorporates important food resources, including diversity and cover of preferred grass species as well as adequate seed output.

3.3.2 Fire management

Fire is a natural component of tropical savanna woodlands where the BTF occurs. European settlement and the removal of traditional fire practice, has caused a shift in some areas to frequent, extensive and high intensity fires in the dry season. In other rangelands in Queensland, fire is actively excluded and grazing of stock prevents wildfire from occurring. Both these circumstances result in shifts in the ground cover and woody composition and structure, which can in turn degrade BTF habitat.

However, judicious use of fire, and natural patterns of fire are important for recovery and germination of many grasses, especially if associated with rainfall. Alternatively, heavy grazing, that alters the ground cover composition, that is also burnt regularly, can shift the dominance from perennial tussock grasses and spinifex, to annuals and species that benefit from modification to habitat [redacted] 2007, [redacted] 2012).

Many finches, including the BTF will forage on recently burnt country, due to the availability of fallen seed. However, the relationship between local and landscape fire regimes, BTF foraging patterns and the long-term impact on food resources available to birds is not well understood. Inappropriate fire regimes (i.e., frequent, large) may impact on the quality of BTF habitat by affecting the production of seeds, reducing the cover and diversity of grass species and causing a decline in food availability. Conversely, fire exclusion can lead to thickening of woody shrubs, decreasing the quality of BTF habitat. Therefore, as is the case elsewhere in tropical savanna, regular, low intensity (late wet season), small patchy fires may be beneficial to BTF [redacted] *et al.* 2001).

At the Project area, there are several potential impacts from fire that need to be considered in the Research Program, namely;

- Large scale wildfire that can reduce, homogenise and change the ground cover from preferred food species, especially at key periods in the dry season and just after the wet season (when grass curing is sufficient) can destroy significant seed sources on the ground;
- The combination of drought (long periods of rainfall deficit) in concert with poor fire management can reduce habitat and food resources.

Research will include a detailed analysis of fire history across the Project area to ascertain the frequency and intensity of fires within BTF habitat across the Project area and the relationship with recorded distribution and abundance. Fire management and manipulation trials will then be considered for implementation and include careful small scale testing of fuel reduction burns and different spatial and temporal approaches to fire management. However, fire management trials will need to consider other management strategies and BTF research methods as well as safety and asset protection.

3.3.3 Water sources

BTF need to drink water on at least a daily basis and drink more frequently during the dry season (at External 2009). The importance of water to BTF is highlighted by the fact that they typically nest and breed near water. When breeding, regular water is essential, whereas when the BTF are not with young, they can be more mobile across the landscape. Within the Project area this is demonstrated with 68% of BTF records in grassy woodlands within 3 km of known water sources. However, the absence of water may preclude BTF from areas that otherwise provide suitable habitat and conversely, the addition of water may increase the area of suitable habitat that is available.

Though the data are limited, the “3 km waterhole limit” proposed as a factor in determining BTF habitat, is likely to be very conservative, as BTF are known to disperse up to 15 km, and in the wet season, they utilise small water sources. Granivorous birds in general can travel large distance between water points and foraging sites.

BTF surveys and monitoring within the Project Area have identified the species ability to utilise natural and artificial water sources. During these surveys they have been regularly observed to drink from cattle troughs, dams and ‘turkey nests’. Conversely, other surveys (GHD 2012) have indicated that when it has rained or it is the wet season, BTF disperse and utilise ephemeral water sources (e.g. drainage lines, puddles) to access and utilise other feeding areas.

A key management strategy for the Moray Downs West offset area is to provide additional water sources within areas of suitable woodland habitat for BTF. They will be installed throughout the offset area at locations greater than 3 km from existing water sources.

Artificial water sources will initially be installed in several locations of the Moray Downs West offset area. Research will assess the response of BTF to new water sources and the effectiveness of this strategy by identifying the following:

- Ability to attract BTF
- Frequency of use by BTF
- Change in usage of nearest water sources
- Proximity to existing vegetation especially trees / shrubs

4 Proposed research methods

4.1 General requirements

The BTF Research Plan presented here provides a framework for the proposed work. The successful implementation will be enhanced by engagement with and involvement of BTF specialists in the detailed design, planning and implementation of research activities. Adani will consult with suitably qualified and experienced professionals to finalise the design of scientific studies through detailed project plans, implement research programs and complete associated reporting. These professionals will comprise experts in bird research and ecology, and may be sourced from research institutions, government agencies, consulting firms and the wider community.

On commencement of Project Stage 2, Adani will commence appointing a research team and will finalise appointments within 3 months of commencing Project Stage 2 activities. The first step of implementation by the research team will involve development of a detailed project plan for each aim (Section 4) of the Research Program. The project plans will be consistent with the objectives, method, environmental variables, resources and timing of research actions described in Section 4.3 to 4.6. Expert advice will inform the project plans for each aim, with a focus on the statistical design of surveys, refinement of monitoring site locations and timing and duration of field activities. Project plans for each research aim will be completed within 6 months of commencing Project Stage 2 activities and will be provided to DES for comment and approval, prior to implementation.

The Research Program and Management Plan will be reviewed regularly, with the input of specialists in accordance with Condition 17 of the EA. Specifically, the documents will be reviewed annually by an appropriately qualified person and revisions of the survey and monitoring program must be carried out in consultation with the BTF Recovery Team. Any revisions must be independently peer reviewed. An annual report of research findings and the results of the independent peer review will be provided to DES.

Engagement of personnel to implement the Research Program will be in accordance with Adani's purchasing procedures, and involve a financial commitment of five years (see Section 5.1). A timetable for implementation is included in **Figure 2**. Findings of the Research Program will be reported through the annual reporting process and will inform improvements in BTF survey methods and management of BTF and their habitat. An independent review will be completed annually, to provide further scientific rigour and inform the adoption of research findings into management actions.

Adani is working with other stakeholders of the Galilee Basin to develop a Bioregional BTF Management Plan. Information derived from the Adani BTF Research Plan will inform the development and implementation of the broader Bioregional BTF Management Plan. This approach will facilitate future management of BTF at the regional scale, informed by the findings of Research Program activities.

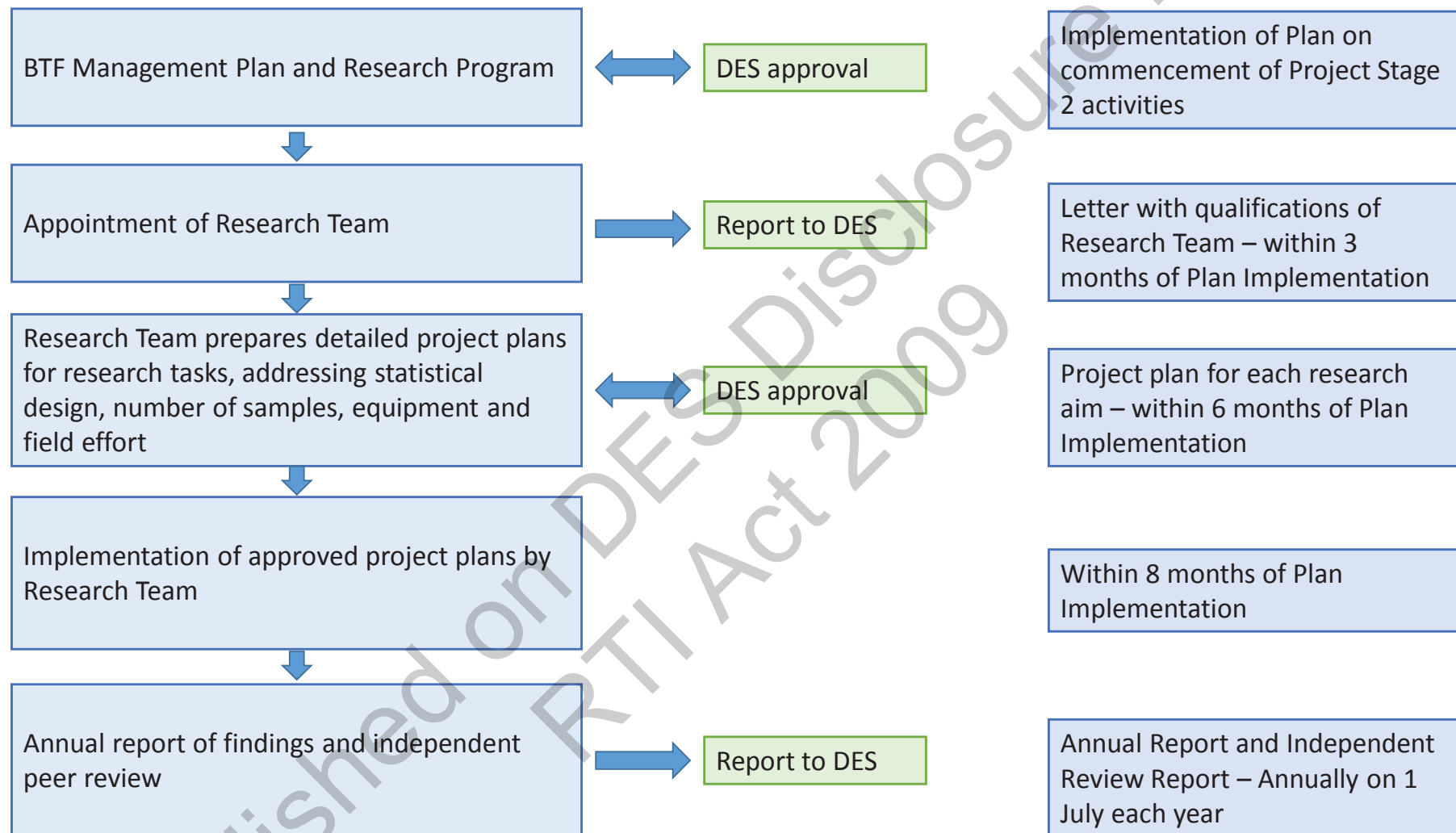


Figure 2 Timetable for implementation of the BTF Research Program

4.2 Approach

The research will build upon existing work that has occurred, such as that undertaken in the Townsville Coastal Plain population (e.g. [Rechetelo 2016](#)). However, some of the approaches will differ at the Project area, due to the different environment and threats that are present in this location (e.g. mine development, fire and grazing). The Research Program will follow two broad approaches:

- Local monitoring, observational and experimental work, that in part links to the existing monitoring that has been on-going since 2012. The aim of this component of the monitoring is to undertake repeated and systematic surveys of BTF distribution and habitat at the Project area, which investigate responses to management, and provide data on distribution, habitat and diet. This research will link to the BTF Management Plan and investigate:
 - o Habitat preferences, local habitat use (i.e. hot spots), preferred habitat structure and vegetation composition, diet, nesting sites and reliance on mixed species flocks
 - o Temporal variation in habitat use
 - o Coarse population estimates and any spatial and temporal variation in numbers
 - o Response to land management effects (i.e. grazing, fire, weeds, water array)
- Detailed, more intrusive research of BTF via the capture, banding, radio-tracking or GPS collaring of birds. This research will complement the observational and experimental work (and overlap via monitoring of banded birds) and will investigate:
 - o habitat use, home range sizes, fine scale distribution changes over seasons,
 - o the genetic status of the local population and physiological health of the BTF populations over time and especially in times of resource bottlenecks
 - o diet via crop analysis.

The two components of the Research Program will utilise data collected through the BTF monitoring program and link these to the BTF Management Plan.

The relationship between water sources, woody habitat and the BTF food sources within the mining lease area and approved offset areas, and the inter-relationships among these factors, will be determined through a synthesis of Aims 2 and 3 (Sections 4.4 and 4.5). This work will achieve compliance with Condition 18 of the EA.

4.3 Aim 1: Estimate the home range and movements of BTF in the Project Area

To manage the population of BTF occurring in the Project Area and surrounding landscape, it is important to understand their movements (spatially and temporally) and local population dynamics. BTF is thought to be a sedentary species with home ranges in the Townsville Coastal Plain identified to be small (ranging from 25.15 ha to 120.88 ha; [Rechetelo 2016](#)). However, it should be noted that this environment is more fragmented, and diverse than the Project area, with more available water supplies. Despite the small home ranges, some individuals were recorded to move relatively large distances (>15 km; Rechetelo, 2016), suggesting that their home range over the course of a year may be much larger.

To estimate the home range and movements of BTF in the Project Area, a number of methods will be employed and are described below. Radio-tracking and banding will require the capture of birds by mist-netting to allow for radio transmitters and bands to be attached to birds (**Table 3**). GPS collaring technology should also be considered, as this allows real time tracking of movement patterns of birds.

Table 3 Details of monitoring task – home range and movements

Objectives	Determine spatial and temporal variation in the movement patterns and home range of BTF in the Project Area.
Methods	Attach bands and radio transmitters to BTF captured by mist netting at multiple water sources across different seasons. Track the location of birds with radio transmitters, and conduct monitoring of individual birds with bands (re-sightings).
Environmental variables to be monitored	<p>Fine-scale spatial and temporal habitat use (i.e. daily and weekly patterns) and across the Project area.</p> <p>Fine-scale spatial and temporal diet shifts (Link to Aims 2 and 3).</p> <p>Home range and distances travelled between nesting, feeding locations, and watering sites over time and season (Link to Aim 2).</p> <p>Improved population estimates, including key locations such as Ten Mile Bore.</p>
Resources	During periods of mist netting and radio tracking, several personnel will be required to implement the research methods. Radio tracking tags of a suitable design, and associated equipment, will also be required. This project may be suitable for a PhD student or similar study.
Timing	Ongoing for three years following approval of the project plan. Field research activities to occur during different seasons to identify associated variability.

4.3.1 Radio-tracking

Radio-tracking of individual birds is the most effective way to gather detailed information on movement patterns. Information available from the Townsville Coastal Plain indicates that BTF may remain within a fairly confined area for extended periods of time.

Radio-tracking will be undertaken over multiple periods to account for seasonal variations (inter-year) and different years. The work will also be conducted at multiple locations across the Project Area (including Ten Mile Bore, Four Mile Bore and Lignum areas) to allow examination of local differences as well as relationships between sub-populations.

There are some constraints to the use of radio-transmitters. First, given the small size of devices (<5 g) suitable for small birds, the equipment has a short field life (ca. 2 weeks or less) before batteries expire. If most movements of BTF in the Galilee Basin region are relatively short-distance (an hypothesis that is yet to be tested), radio-tracking of individuals is mainly likely to deliver information on movements within a "home range" and less likely to provide information on long-distance movements. As birds move further from the point at which they were first captured, there will be a lower probability that they can be relocated and increased effort would be required to relocate them. The application of GPS collar technology will be investigated as a means of overcoming these difficulties.

4.3.2 Banding

Some important questions can only be addressed if individual birds can be distinguished. These relate specifically to movement patterns at various scales. This is best done by leg banding in accordance with the Australian Bird and Bat Banding Scheme (ABBBS) guidelines. Banding of BTF has been successfully incorporated as a method in two previous studies, those of Removed at External Review (see Section 3). Only the study by Rechetelo, where banding was followed by an extended period of field

observation, provided data from resighting of banded birds. Birds will be trapped using mist nets and banded by qualified operators in line with the ABBBS and Queensland guidelines.

Banding will provide a capacity to identify individual birds. It will be necessary to spend sufficient time in the field to provide re-sightings of these known individuals. It should be noted that it is often difficult to read the leg bands of BTF but the work of [removed at External Review](#) near Townsville indicates that very useful information can be gathered by this means. Records of re-sightings will provide information on movement patterns and some indication of longevity.

Banding should be undertaken at multiple sites (e.g. $n = 10$) with large numbers (e.g. a total of 50 birds) banded at each location if possible. Given the mean flock size of <11 birds (**Table 2**), this will require the capture of several flocks at each site. This will provide a reasonable chance that individuals may be resighted and the prospect of information on the regional connectedness of different sub-populations. Banding has the advantage that large numbers of individuals can be marked simultaneously, something that is probably not possible with radio-tracking unless there is an enormous investment in labour to allow frequent relocation of individuals.

4.4 Aim 2: Determine the foraging and breeding habitat requirements and the relationship with vegetation structure and composition and water

Guidelines and information for the identification, description and management of BTF are currently largely based on studies undertaken in the Townsville Coastal Plain population. BTF records occur across at least 21 Regional Ecosystems [removed at External Review](#) *et al.* 2016). Within the Project Area there is a strong association with *Eucalyptus melanophloia* open woodlands (RE 10.5.5a), and the adjacent *E. brownii* (10.3.6) and *E. simillis* (10.5.1) woodlands. However, BTF records are not uniformly distributed throughout this habitat, with large areas of 10.5.5 habitat in the east seemingly unoccupied. This is related to grazing history, clearing and habitat quality.

In order to manage and minimise the impacts on BTF within the Project Area, it is important to have a strong understanding of the specific requirements for breeding and foraging habitat within the large areas of *Eucalyptus melanophloia* open woodland habitat. This will require continued analysis of the structure and composition of vegetation where BTF consistently occur, feed and breed, as well as the proximity to water, foraging and nest locations (**Table 4**).

Table 4 Details of monitoring task – foraging and breeding habitat

Objectives	Identify and describe the breeding locations of BTF in the Project area. Describe the characteristics of foraging habitat utilised by BTF within the Project area, spatially and temporally. Characterise the differences between identified BTF habitat and similar locations which are not used by BTF. Conduct a detailed botanical assessment at all BTF sighting locations, to determine the characteristics that make the habitat suitable. Establish whether Ten Mile Bore and surrounds are high value habitat for BTF. Determine the characteristics of Ten Mile Bore and surrounds that contribute to its frequency of use and compare this with other waterholes and woodlands, through equivalent frequency monitoring.
Environmental variables to be monitored	Landscape, habitat, floristic composition, cover and structure of breeding and foraging habitat (Link to Aims 1 and 3). Spatial and temporal distribution of landscape, habitat, floristic composition, cover and structure of breeding and foraging habitat. Spatial and temporal variation of BTF habitat in the Project area (Link to Aim 1).

Methods	Structured and well stratified search, surveys, census and count methods across the Project area (not biased to only known locations or waterholes), that build on the existing bird, habitat and vegetation methods (i.e., transects off road and random, repeated area searches, targeted transects and searches, standard quadrat methods, camera traps).
Resources	The primary resource for this task will be a suitably qualified individual or small monitoring team, or a well-defined student project.
Timing	Ongoing for three years following approval of the project plan. Results of monitoring will build as the task progresses and seek to achieve objectives by Year 4.

4.4.1 Breeding biology

Systematic searches of areas occupied during the breeding season will aim to locate nests and breeding colonies. As well as identifying nest locations, these surveys will aim to identify evidence of breeding activities including nest preparation, courtship, presence of juveniles and feeding. This will aim to determine the timing and conditions of breeding and, in conjunction with habitat descriptions and floristic surveys described below, the factors governing nest site selection and breeding success for the local BTF population. These surveys will also aim to distinguish between nests that are being used for breeding and those that are being used for roosting.

4.4.2 Habitat description

The systematic monitoring program that is being conducted within the Project area aims to provide information on distribution and abundance of birds. It also aims to provide some capacity to relate distribution and abundance to environmental variables by being linked to habitat descriptions. This will operate at both coarse and fine scales. At the coarse scale it will help identify which broad vegetation types (i.e. Regional Ecosystems) are being utilised by BTF. At the finer scale, it can help determine what constitutes favourable foraging habitat. The vegetation of feeding locations identified during the monitoring program will be described in terms of herbaceous species composition, herbaceous biomass and plant community structure. It will be important to document vegetation characteristics at the time foraging is observed and provide a basis for maintaining quality foraging habitat.

Surveys undertaken as part of the Research Program will collect similar information where BTF are recorded. Regional Ecosystem and vegetation data collected during the management plan monitoring and Research Program will be analysed to determine key habitat factors for breeding and foraging. Potential correlations between water source, woody habitat and Poaceae food resources across the Project area will be examined, to determine the interrelationships between these factors.

4.4.3 Floristic surveys

Floristics of sites provide understanding of habitat requirements. The floristics of the tree, shrub and ground strata will be described at sites that are regularly used by BTF, as well as at random sites where no BTF have been recorded. Vegetation survey sites will cover the Project area including Moray Downs West offsets areas and where possible, neighbouring properties. A detailed botanical assessment will occur at all BTF sighting locations in the Project area.

These surveys will aim to provide a greater understanding of the vegetation characteristics of foraging and breeding sites with regard to species composition and structure of all vegetation strata. By quantifying

abundance of different grass species, this task aims to help determine some of the resources exploited by the birds and how those resources vary seasonally and spatially. Floristic data in the vicinity of nest sites will help relate breeding success to essential foraging resources. Floristic data could also be used to assess the effectiveness of management carried out to improve habitat quality.

This data will be collected by transects and plots to determine the following characteristic of BTF foraging and breeding habitat:

- Canopy species and relative abundance
- Canopy height
- Canopy crown cover
- Shrub species, height and cover
- Ground layer and grass cover
- Ground layer and grass species and individual percentage cover
- Percentage cover of bare ground and organic material
- Weed cover.

An example of the data sheet proforma relating to floristics surveys is provided in Appendix A.

4.4.4 General field observations

General observations of BTF ecology and behaviour will be made during the collective research and monitoring programs. These observations include locations of BTF, flock sizes, nest locations, and phase of breeding cycle. They also provide a basis for relating distribution and abundance to landscape and regional scale patterns of vegetation and other environmental variables. Call playback will be utilised during monitoring programs, and all birds present will be identified when BTF are encountered.

4.5 Aim 3: Determine the dietary requirements for BTF in the Project Area

Knowledge of BTF diet is mostly based on studies undertaken in the Townsville Coastal Plain population. Observations during BTF monitoring in the Project area has provided some evidence of diet within this population. However, observations have also identified some apparent preferences in composition of the ground layer which differ from the Townsville region. For example, studies in the Townsville Coastal Plain revealed that BTF were generally not recorded in patches dominated by *Heteropogon contortus*, *Themeda triandra* and *Aristida* spp. (t Exter 2007), which are all common species at BTF foraging sites within the Project area.

Seasonal variation in grass availability is an important factor in identifying important BTF habitat and for the management of these areas to improve habitat value of offset areas. Surveys within the Project area have recorded BTF foraging on at least eight grass species (ELA 2017a) including:

- *Enteropogon ramosus* (GHD 2012)
- *Paspalidium rarum* (GHD 2012 and Niche 2016)
- *Schizachyrium fragile* (GHD 2012)
- *Digitaria ciliaris* (Niche 2016)
- *Setaria surgens* (ELA 2017b)
- *Cymbopogon bombycinus* (ELA 2017b)
- *Triodia pungens* (ELA 2017b)
- *Eriachne mucronata* (ELA 2017b).

There are several methods to determine important food resources of BTF within the Project area as described in **Table 5**.

Table 5 Details of monitoring task - diet

Objectives	Collect further data on the dietary requirements and foraging preferences of BTF within the Project area.
Environmental variables to be monitored	Species of grasses on which BTF are observed to be feeding (Link to Aims 1 and 2). Spatial and temporal variation in the locations where BTF are feeding (Link to Aims 1 and 2). Variation in food resources used seasonally (Link to Aim 1).
Methods	Direct observation of feeding behaviour. Sampling of seeds from the crop of birds (during mist netting). Well stratified collection and analysis of seeds from the ground where BTF are observed, or randomly near nests or areas identified where BTF are regularly sighted (Link to Aim 2).
Resources	Personnel experienced in the collection of seeds from the crop of birds.
Timing	Ongoing for three years following approval of the project plan.

4.5.1 Direct observation

Direct observations may allow a definitive determination of diet where birds are observed foraging by removing seeds from the inflorescences of grasses which can then be identified, or where birds are observed feeding on distinctive seeds on the ground.

Observations of birds feeding from seeds on the ground may also indicate food resources by identifying grass species in these locations. However, this assumes a close correlation between the composition of the grasses and BTF diets, but may not accurately represent the seed species the birds are feeding on.

4.5.2 Crop sampling

Extraction of samples from the crops of birds that have recently been feeding and identification of the seeds to species level is another definitive method to determine BTF diet. This would need to be done in such a way that there was minimum risk to the individual birds and in line with the requirements of animal ethics approvals. Laboratory analysis of seed material would be required to determine the species of each seed type.

4.5.3 Seed collection and analysis

Observations will be taken of precisely where birds are feeding on the soil surface, followed by gathering of surface soil samples from which seeds can subsequently be extracted and then identified to species level. This approach assumes a close correlation between the composition of surface soil samples and finch diets, but may not accurately represent the seed species the birds are feeding on. Laboratory analysis of seed material would be required to determine the species of each seed type.

This method is not as definitive as crop sampling but it less intrusive on birds.

4.6 Aim 4: Identify management strategies for BTF habitat in the Project Area regarding fire, grazing and water

This research aim requires careful identification of a research approach through expert consultation, prior to the commencement of any work, to avoid potential impacts on BTF. Broad-scale habitat manipulations should be implemented with a careful review of the existing landscape and management patterns on the sites, with respect to BTF distribution and abundance, and with reference to other research activities.

The link between fire, grazing, water distribution and habitat quality should be understood before any change in management is adopted to improve outcomes for BTF. There are several aspects of habitat that could be manipulated which vary in spatial and temporal scales, and which are interactive (**Table 6**). Weather patterns and extreme conditions (wet or dry) can severely affect the relative impact or effect of fire and grazing influences on habitat.

Table 6 Details of monitoring task – management strategies

Objectives	<p>Understand the relative effects of grazing, fire, water distribution and their interactions on BTF habitat, and the current spatial and temporal variation and impacts of these factors on BTF.</p> <p>Determine the effect of cattle grazing on BTF habitat by undertaking small scale experimental trials to understand how absent, low and high cattle stocking densities and different strategies effect ground cover and grass composition (positively or negatively).</p> <p>Determine the effects of various fire regimes on the quality of BTF habitat, and the best fire regimes to enhance or protect existing high quality habitat, under different weather scenarios.</p> <p>Determine the influence of establishing new artificial water sources on the utilisation of adjacent habitat by BTF, via cautious small-scale experimental trials.</p> <p>Use the information gained in these experimental trials to guide management actions that will maintain or enhance BTF habitat across the Project area, and in key, high priority BTF populations and locations (e.g. Ten Mile Bore and surrounds).</p>
Environmental variables to be monitored	<p>Plant species composition, biomass and seed output (for important BTF food sources).</p> <p>BTF abundance, distribution and use of habitat under existing grazing regimes, and small scale experimental trials or manipulations.</p> <p>Changes in BTF habitat in relation to fire frequency and inter-fire interval, fire intensity, the season in which fires occur and the extent (area) of individual fires, using existing data and small-scale manipulations.</p> <p>Presence and absence of BTF before and after the establishment of artificial water sources, and also in control sites.</p>
Methods	<p>Landscape scale review of existing information and spatial and temporal patterns with respect to fire, grazing and water distribution.</p>

	Design small scale experiments, with careful replication and BACI (before-after, control-impact) type design to test the effects of management manipulation on BTF habitat, abundance and distribution (Link to Aims 1 and 2). Monitor BTF habitat utilisation using remote cameras, census, observations and water source surveys (Link to Aims 1 and 2).
Resources	Infrastructure and planning associated with establishing new water sources. Operational resources and planning associated with varying fire regimes and grazing management approaches.
Timing	Ongoing for at least three years following approval of the project plan. Some aspects of the task will be seasonal (e.g. timing of planned burns).

4.6.1 Grazing regimes

BTF largely occur in pastoral landscapes even though [at Extern \(2011\)](#) demonstrated that birds on pastoral lands had higher stress levels than birds on conservation lands. The abundance of BTF and the viability of their populations in the Project area, however, are likely to be influenced by the historical and current grazing regimes.

There are three strategies to examining the effects of grazing on BTF:

- a thorough review of the patterns of BTF across the Project area, with respect to current and historical grazing patterns and pressures
- clear descriptions of the habitat and floristic patterns of paired sites that represent the same RE, but are lightly or not grazed, and more heavily grazed, and
- small scale experiments to test whether removal of cattle, wet season spelling or different grazing strategies can enhance features of the ground cover and composition important for BTF habitat, or whether cattle removal and the use of fire to promote grass growth is more effective.

Stocking densities for grazing trials could be determined in relation to documented stocking rates in the recent past (last ten years) on Moray Downs and the typical stocking densities for the district. These will be compared to the Queensland Department of Agriculture and Fisheries (DAF) recommended rates for commercial grazing in the area to determine stocking rates to be used in the trial. The use of cattle grazing to reduce grass biomass as a means of managing fire and / or opening the ground layer to facilitate feeding by BTF will also be tested. This may involve increasing stocking rates in areas of *Eucalyptus melanophloia* open woodlands where BTF are yet to be recorded and where the grass layer is dense.

Wet season spelling strategies to be tested include a six-week rest period over the wet season and incorporating the main seeding period of the native perennial grasses that BTF are known or thought to forage.

In conjunction with tests of specific grazing systems, detailed records will be kept of actual grazing regimes at the paddock scale to allow analysis of BTF utilisation.

A baseline research program will be established to determine whether Ten Mile bore and surrounds are high value BTF habitat. Ten Mile bore and surrounds is the area within a 3 km radius of Ten Mile bore.

During the baseline research program, the management of grazing will be based on existing pastoral management practices in accordance with land agistment agreements, pastoral holding lease conditions and associated legislation pertaining to pastoral management activities.

Adani will also complete annual BTF habitat vegetation assessments at approved monitoring locations in the vicinity of Ten Mile Bore during May to maintain and where possible enhance BTF habitat within the Ten Mile Bore area. Vegetation assessments will use methodologies described within 'Carmichael Coal Mine and Rail SEIS Report for Black-throated finch On-site Monitoring Survey 2' dated February 2014 to assess ground cover and ground composition based on Queensland BioCondition Framework (at Extern et al., 2011) and the Queensland Herbarium flora survey methods (at Extern et al. 2005).

Groundcover and species composition will be assessed annually against the baseline data (established in 2012/13) from when this Management Plan commences (each May). If the annual vegetation assessment demonstrates a loss of native perennial species and cover from baseline conditions, an investigative review will be completed and relevant corrective management actions will be taken to ensure the maintenance or enhance of these perennial pasture species. Corrective actions may include additional fencing or spelling of paddocks to control grazing, controlled grazing to reduce biomass levels, pest control (e.g. rabbits, weed eradication) and fire management. Monitoring and management actions for the Ten Mile Bore area will be reviewed and modified in line with baseline research program outcomes.

4.6.2 Fire regimes

Fire and cattle grazing are both consumers of fuels, and they interact in complex ways. For example, heavy grazing will reduce fuel loads and therefore reduce the likelihood and intensity of fire – thus causing impacts such as woody vegetation thickening, and the loss of key plant species reliant on fire for reproduction and vigour. Conversely, reduced grazing and increased biomass will increase the risk of large wildfire, removing ground cover, seeds and some species over time. The relationships are complex and variable depending on land use history, land type and long-term weather patterns. While it is apparent that BTF will forage on recently burnt country similarly to other threatened finches, it is not known how the fire regime affects the resources available to the birds.

Fire variables to be tested in experimental work include fire frequency and inter-fire interval, fire intensity, the season in which fires occur and the extent (area) of individual fires. This will initially require analysis of the historical fire for the Project area using available satellite imagery to determine any correlation between BTF utilisation and current fire history.

Trials of various fire regimes (generally small and low intensity fires) will then be undertaken in areas with dense shrub and ground layers, particularly within the Moray Downs West offsets area. Trials will aim to reduce the density of the understorey vegetation in selected areas to open up the ground layer and improve the quality of foraging habitat for BTF. Burning undertaken for the purposes of BTF habitat improvement will be implemented with caution with the input of experts, and involve intensive monitoring.

4.6.3 Water sources

Absence of water may impede BTF from utilising areas that otherwise provide suitable habitat, most notably in the dry season. In the wet season, BTF utilise small ephemeral water sources to access wider areas of the landscape, when many grass species that are preferred food sources are flowering and seeding. There is a hypothesis that the addition of water can therefore increase the area of habitat that is available to the BTF for longer periods. The effectiveness of this manipulation can be tested in terms of the characteristics of the water source provided and the capacity of added water sources to provide access to habitat.

BTF can use many different types of water sources. These include natural streams and springs, ephemeral surface water present immediately after rain, various in-ground structures (earth “tanks”, “turkey nest” dams) and cattle troughs. The addition of small but permanent water sources will be tested for their capacity to attract and support BTF and other granivores. They will be placed in areas that support suitable vegetation, that currently do not have permanent water sources (at least 3 km from water) but which are within 10 km of areas known to support the species.

Areas in the Moray Downs West offsets area are suitable for testing the effects of adding water to the landscape on BTF use. These artificial water sources will be designed to reduce the likelihood of attracting pigs or feral cats that might then prey on the BTF. Troughs should have water close to the lip and internal structures on which birds might perch whilst drinking. Any artificial water source should have trees and shrubs nearby (e.g. within 10 m) on which birds can shelter as they travel to water and use as an intermediate perch while accessing water. Where additional water sources are introduced in potential BTF habitat, utilisation will be assessed by appropriate monitoring methods including remote camera’s and waterhole surveys.

In order to ensure that the watering points in the Moray Downs West offset area do not interfere with research but also provide water for finches, the following actions will be delivered:

- maintenance of the existing seven water points in the Moray Downs West offset area, as per the Moray Downs West Offset Area Management Plan
- new artificial water sources will be installed in locations within the Moray Downs West offset area in accordance with this research program
- assessment of BTF responses to new water sources and their effectiveness
- results used to inform specific requirements and location of permanent artificial watering points
- permanent artificial watering points will be installed and adequately maintained within the Moray Downs West offset management area within the sooner of one year after the completion of the three-year research program, or five years after the commencement of mining operations.

5 Implementation

5.1 Time-line

An indicative time-line of research activities is provided in **Table 7**. It indicates major activities only and will need to be responsive to environmental, logistical, and regulatory factors. The Research Program will be implemented over 3 to 4 years, commencing after DES approval of project plans (**Table 7**).

Table 7 Timeline for research program

	Years after DES approval of project plans				
Monitoring Task	1	2	3	4	5
Home range studies					
Foraging and breeding requirements					
Dietary requirements					
Management strategies for BTF habitat					
Consolidation of research program results					

The research will be conducted in conjunction with implementation of monitoring and management plans for the Project.

5.2 Qualifications

The research proposed in this plan will be conducted by suitably skilled and qualified persons. This is defined as a person who has professional qualifications (such as environmental science, biology or ecology), training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis on performance relating to the subject matter using the relevant protocols, standards, methods or literature.

Adani will explore opportunities to work collaboratively with a university or similar institutions in implementing the Research Plan. This will assist in providing detailed and thorough work, under the technical supervision of a skilled senior researcher. Opportunities to leverage industry funding provided by Adani through research grant schemes will also be explored.

6 Reporting

6.1 Adaptive management

Adaptive management is a process of decision-making that deals with uncertainty and incomplete knowledge that evolves over time using systematic monitoring data to reduce uncertainty and improve future management objectives. Such a process incorporates learning from new data and improved management outcomes, and involves the development of strategic ecological and political consensus for contested management objectives (at External 1973). Adaptive management emphasises the iterative feedback between the implementation of management actions and the assessment of their effectiveness via continuous improvement of knowledge via monitoring and evaluation of the monitoring data (at External, et al. 2012).

The concept of adaptive management aims to resolve many of the problems that have undermined previous attempts to establish long-term research and monitoring by recommending a sensible framework for monitoring. There are four key elements: (i) the requirement to pose tractable (flexible and evolving) questions; (ii) the need to employ a statistical design at the outset; (iii) the use of a conceptual model of the ecosystem or entity being examined; and (iv) acknowledgment that land managers need to know about ecosystem change.

The Research Program will follow this framework as it will:

- Address key questions regarding BTF ecology and distribution, for which data are systematically reviewed and used to refine the monitoring and management at the Project area, the potential impact on BTF during the Project construction, operation and decommissioning, and any offset sites;
- Employ appropriate regular review and analysis of the monitoring data, to refine the monitoring program and refine the Species Management Plan and associated management actions;
- Use a conceptual model for BTF life history and ecology, to underpin monitoring questions and implementation of the Species Management Plan; and
- Address the need by Adani, the Australian and Queensland Governments, and the wider community, to understand effects of the Project on BTF and how best to manage and mitigate these during the long-term operation of the Project.

The results of the research will be applied under this adaptive management framework and the BTF Management Plan will be updated in consultation between Adani, Commonwealth and Queensland Governments and researchers.

6.2 Reporting and scientific permits

Annual reports summarising the monitoring and Research Program's plans will be prepared and submitted by Adani on 1 July each year and will be made available to the Commonwealth and Queensland Governments. Where results of monitoring are likely to be of interest to the scientific community and/or the public, Adani will make relevant information available through appropriate means, such as the submission of scientific papers to peer-reviewed journals (e.g. scientific community) or the provision of research findings on the Adani website or within community newsletters.

All research will be conducted under the requirements of;

- a DAF Animal Ethics Approval to Use Animals for a Scientific Purpose which ensure that conduct of the Project is in accordance with AEC approval, the *Animal Care and Protection Act 2001*, the *Australian code for the care and use of animals for scientific purposes* (the Code) and all other relevant Commonwealth and State legislation. This approval requires the submission of all necessary reports, notices and advices as required by the AEC, and thus the Queensland Government.
- Scientific purposes permit under the *Nature Conservation Act 1992* which requires an annual report and return of all data collected under this permit to the Queensland Government, for lodgement on Wildnet.

Adani will share the findings of the research with the BTF Recovery Team for use and updating of the revised BTF Recovery Plan, of which a revised version is currently being prepared.

Where there are close links in objectives, monitoring activities implemented under the BTF Research Program will be integrated with those completed under the BTF Management Plan. This will provide for the integration of data for a variety of purposes, ranging from building baseline scientific information to informing Adani about the effectiveness of mitigation measures.

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Appendix A Floristics data sheet proforma

Site flora data collection

Date	Site ID	Time	RE	Canopy Species	Canopy relative ab.	Canopy min	Canopy max	Canopy av.	FPC%	Shrub species	Shrub relative ab.	Shrub av.	FPC%	Comments
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Quadrat ground cover data collection

Date	Site ID	Time	RE	Species1	Sp.1 Cover %	Tussock%	Hummock%	Bare Ground%	Litter%	Rock%	Comments
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Quadrat ground cover estimations data collection

Site Name	Structural Formation	Median Height (m)	Min Height (m)	Max Height (m)	Ecologically Dom. Layer	Basal Area (m ² /ha)	Native grass herb and forbs (%)	Woody shrubs and sub-shrubs (%)	Litter (leaf, twigs, grass etc) (%)	Litter (logs >10cm dia) (%)	Bare Ground (%)	Rock (%)	Check
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Structural Formations:

OW - Open woodland

W - Woodland

R - Regrowth (scattered shrubs/small trees)

OF - Open Forest

Rd – Road drain and immediate woodland grass edge

Gm - Grassland modified -cleared/heavily grazed

Gm - Grassland (natural)

Check percentages add together to equal 100



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Appendix D Compliance with Approval Conditions

A table demonstrating compliance with relevant approval conditions is provided on the following pages.

Published on DES Disclosure Log
RTI Act 2009

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
EPBC Act Approval, condition 5	At least three months prior to commencement of mining operations, the approval holder must submit to the Minister for approval Matters of National Environmental Significance plan/s for the management of direct and indirect impacts of mining operations on (MNESMP). Note: If the MNESMP does not address any specific future activities (e.g. possible additional seismic surveys or specific mining stages) it should be updated in accordance with Condition 33.	The BTF Management Plan was lodged on 11 May 2017. This plan addresses the management of direct impacts of mining construction and operations on the BTF. Specifically, management actions of direct impacts are located in Table 8. This plan addresses the management of indirect impacts of mining construction and operations on the BTF. Specifically management actions of indirect impacts are located in Table 9 and Table 10. If this management plan does not address any specific future activities (e.g. possible additional seismic surveys or specific mining stages) it will be updated in accordance with condition 33 of the EPBC Act approval.	Section 6.3.3 (Table 8) Section 6.3.3 (Tables 9 and 10)	
EPBC Act Approval, condition 6	The MNESMP must be consistent with relevant recovery plans, threat abatement plans and approved conservation advices and must include:	This plan is consistent with the BTF Recovery Plan. Threats identified in the BTF Recovery Plan are addressed specifically in Section 4.6 and Table 4. These threats include clearing and fragmentation of vegetation, degradation of habitat by stock and pest species, alteration of habitat by fire regime, invasion by exotic weeds including grasses and predation by introduced predators. Potential project impacts are discussed in Section 4.6. Monitoring and research activities of the BTF Management Plan closely align with recovery objectives described in Section 5 of the BTF Recovery Plan (e.g. investigate breeding requirements, quantify distribution and abundance, investigate feeding and other habitat requirements). Further details of these measures are provided in Section 7 of the BTF Management Plan. There are no current threat abatement plan or conservation advices in force for the BTF.	Section 4.6 and Table 4 Section 7	
	a) A description of environmental values for each of the Matters of National Environmental Significance addressed in the plan	A description of environmental values for the BTF is provided in Section 4 of the BTF Management Plan. The description includes the status under Commonwealth and State legislation, regional populations, habitat requirements, breeding ecology, occurrence in the vicinity of the project area.	Section 4	
	b) Details of baseline and impact monitoring measures to be implemented for each of the Matters of National Environmental Significance including control and impact sites to be monitored throughout the life of the project. The monitoring must provide sufficient data to quantify likely impacts resulting from mining operations, including subsidence and changes in groundwater levels, to set habitat management goals (conditions 6e) and 6f)	A description of baseline and impact monitoring measures for the BTF is provided in Section 7 of the BTF Management Plan. The section describes the need for monitoring to occur prior to project commencement, as well as during construction and operations. The location of monitoring sites is provided in Appendix B, with control and impact sites to be established (Section 7.1.2). The monitoring will quantify impacts resulting from mining activities and provide feedback on the effectiveness of mitigation measures. The monitoring will include consideration of the impacts from subsidence, and groundwater draw down on BTF habitat values and water availability (see Section 7.1.2). Habitat management goals are set in Section 6.	Section 7, Appendix B Section 7.1.2, Section 6.	
	c) Details of potential impacts, including area of impact on each of the Matters of National Environmental Significance from mining operations, including impacts from:	Details of potential impacts of the project on the BTF are addressed in Section 4.6 of the BTF Management Plan. An area of impact is provided in relevant subsections of Section 4.6 for potential impacts for which a quantitative estimate can be provided (e.g. vegetation clearing and subsidence). Potential impacts are also discussed in Section 6 in the context of mitigation measures to minimise impacts.	Section 4.6, Section 6.	
	(i) Vegetation clearing		Section 4.6.1	
	(ii) Subsidence from underground mining, including subsidence induced fracturing and any changes to groundwater or surface water flow		Section 4.6.2	
	(iii) Mine dewatering		Section 4.6.8	
	(iv) Earthworks		Section 4.6.9	
	(v) Noise and vibration		Section 4.6.10	
	(vi) Emissions (including dust)		Section 4.6.11	
	(vii) Light spill and other visual impacts		Section 4.6.12	
	(viii) Stream diversion and flood levees		Section 4.6.13	
	(ix) Weeds and pests		Section 4.6.3 and 4.6.6	

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
	d) Measures that will be undertaken to mitigate and manage impacts on Matters of National Environmental Significance resulting from mining operations. These measures must include but not be limited to:	A description of measures that will be undertaken to mitigate and manage impacts on the BTF resulting from mining operations is provided in Section 6.	Section 6	
	(i) The use of fauna spotters prior to and during all vegetation clearing activities to ensure impacts on Matters of National Environmental Significance are minimised	All BTF habitat clearing operations will be monitored for compliance by a suitably qualified fauna spotter-catcher during clearing activities, to ensure impacts on BTF are minimised. The approach is outlined in Tables 7 and 8 of the BTF Management Plan and Section 6.3.2.	Table 7, Table 8, Section 6.3.2	
	(ii) Measures to avoid impacts on Matters of National Environmental Significance and their habitat located in the Project Area, but outside areas to be cleared, constructed upon and / or undermined, including adjacent to cleared areas	Measures to avoid impacts on BTF and their habitat outside areas to be cleared around described in Section 6.4 and Table 9 of the BTF Management Plan. They include matters such as the management of grazing, fire, water and pests.	Section 6.4, Table 9	
	(iii) Measures to rehabilitate all areas of Matters of National Environmental Significance habitat	Details of rehabilitation of disturbed areas are provided in Section 6.1 and Table 8 of the BTF Management Plan. Monitoring initiatives to determine the success of rehabilitation activities are described in Section 7.	Section 6.1, Table 8, Section 7.	
	(iv) Habitat management measures including but not limited to management of subsidence and groundwater impacts of the project	Mitigation measures for subsidence are provided in Table 8 and address subsidence. Table 10 provides details for mine dewatering.	Table 8 and Table 10.	
	e) Goals for habitat management for each relevant Matters of National Environmental Significance	Goals for habitat management of the BTF are provided in Section 6.4 of the BTF Management Plan. These include maintaining the three main habitat elements: woody layer of vegetation, herbaceous layer of vegetation and water sources. Factors affecting these values are also discussed (e.g. grazing and fire). Table 9 provides further details on how goals will be achieved.	Section 6.4 and Table 9	
	f) A table of specific criteria for assessing the success of management measures against goals, and triggers for implementing corrective measures if criteria are not met within specified timeframes. This table must include but not be limited to measures relating to subsidence and groundwater impacts, including early warning triggers for impacts on groundwater at the Doongmabulla Springs Complex and the Carmichael River. Goals and triggers must be based on the baseline condition of the relevant Matters of National Environmental Significance as determined through baseline monitoring (see Conditions 3b) and 6b)). Corrective measure must include provision of offsets where it is determined that corrective management measures have not achieved goals within specified timeframes (see Conditions 11m) and 11o))	Table 8, Table 9 and Table 10 of the BTF Management Plan provides goals, performance criteria, mitigation measures, triggers and correction actions. The effects of subsidence and groundwater impacts on BTF habitat (i.e., habitat modification) are included in Table 8, Table 9 and Table 10. Goals and triggers are based on the baseline condition of BTF habitat as determined from several years of baseline monitoring surveys. These focus on a range of vegetation and floristics data collected since the EIS. See Table 8, Table 9, Table 10 and Appendix E and F (summary of baseline nesting and analysis). Section 6.5 of the BTF Management Plan describes the approach to achieving offsets and states that if additional impacts are proposed, or occur unexpectedly, then additional offsets will be provided, subject to approval from government agencies. This is stated to include circumstances where the corrective management measures have not achieved the goals within specified timeframes, and resulted in impacts beyond those that were originally approved. Table 8 also states a corrective action that may include the provision of offsets.	Section 6.4, Table 8, Table 9 and Table 10. Table 8, Table 9 and Table 10. Table 8, Table 9, Table 10 and Appendix E and F Section 6.5 and Table 8.	
	g) An ongoing monitoring program to determine the success of mitigation and management measures against the stated criteria in Condition 6f), including monitoring locations, parameters and timing. Monitoring for water resources Matters of National Environmental Significance must include hydrogeological, hydrological and ecological parameters	Details of the ongoing monitoring program are provided in Section 7 of the BTF Management Plan, and specifically Tables 8 to 10 address evaluating the success of mitigation measures. There are objectives to assess the success of mitigation and management measures.	Section 7 and Tables 8 to 10	
	h) Details of how compliance will be reported	Reporting and compliance procedures are described in Section 9 of the BTF Management Plan. Section 9.2 provides details of periodic reporting and audits to monitor compliance with management plan requirements.	Section 9	
	i) Details of how the MNESMP will be updated to incorporate and address outcomes from research undertaken for Matters of National Environmental Significance under this and any state approvals, including updating of goals, criteria and triggers (as required under Conditions 3c), 3d) 6e) and 6f))	Section 9.1 of the BTF Management Plan provides details of how the plan will be updated in response to outcomes of research, monitoring and management actions. An adaptive management approach will be taken and revisions to the survey and monitoring program will be carried out in consultation with the BTF recovery team, in accordance with Condition 17 of the EA. Section 6.1 of the BTF Research Program provides details of how the adaptive management process will be applied to BTF research.	Section 9.1	Section 6.1

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
	j) Provisions to ensure that suitably qualified and experienced persons are responsible for undertaking monitoring, review and implementation of the MNESMP	Section 9.3 of the BTF Management Plan outlines the qualifications of persons responsible for monitoring, reviewing and implementing the plan. This relates primarily to the qualifications of ecologists conducting field surveys and of spotter-catchers that may be involved in handling or managing the impacts of clearing on the species.	Section 9.3	
	k) In the event that future baseline research required by the Queensland Coordinator-General (Appendix 1, Section 3, Condition 1 of the Coordinator-General's Assessment Report) identifies that the Mellaluka Springs Complex provides high value habitat for the Black-throated finch, the approval holder must include management measures to address impacts resulting from drawdown at the Mellaluka Springs Complex in the MNESMP	Studies have determined that the Mellaluka Springs Complex does not provide BTF habitat. A letter from the Office of the Coordinator-General, dated 22 July 2016, has been received confirming the Commonwealth and Queensland government's acceptance of this finding.	Not applicable	
	l) Details of how, where habitat for an EPBC Act listed threatened species or community not previously identified and reported to the Department is found in the Project Area, the approval holder will notify the Department in writing within five business days of finding this habitat, and within 20 business days of finding this habitat will outline in writing how the conditions of this approval will still be met (refer Condition 11j)).	This condition is addressed in the approved threatened species management plan for the Carmichael Mine. Section 5.1 of that plan says "In the event that new species or Threatened Ecological Communities are found, then DoE and/or DES will be notified within five business days and Adani will outline how the conditions of this approval will still be met within 20 business days". The BTF Management Plan deals only with the BTF.	Not applicable	
EPBC Act Approval, condition 7	Mining operations must not commence until the required MNESMP have been approved by the Minister in writing. The approved plan must be implemented. Note – Management plans such as the Black-throated Finch Management Plan and the Groundwater Dependent Ecosystems Management Plan may also be required under state approvals. Wherever possible a combined document should be prepared to address both state government and EPBC Act approval conditions. Note – Impacts of the action other than mining operations will be offset as required in accordance with Conditions 8 to 11, but will be otherwise managed in accordance with state approvals – this is of particular relevance when impacts may occur prior to approval of the MNESMP.	Mining operations will not commence until this plan has been approved. This plan addresses the combined requirements of the Commonwealth and Queensland governments in one document, as encouraged by the condition.	Not applicable.	
Carmichael Coal Mine and Rail Infrastructure Project Coordinator-General's Report, Imposed Condition 1.	Black-throated Finch (southern) baseline research for the Carmichael project a) To increase the knowledge of the ecological requirements of BTF populations likely to be directly and indirectly impacted by the project, the proponent must undertake further baseline research prior to the commencement of Project Stage 2.	Adani has undertaken extensive baseline research and monitoring since the EIS, and prior to the commencement of Project Stage 2. This work is ongoing and is summarised in Section 2.6 of the BTF Research Program.		Section 2.6
	(b) Prior to continuing the baseline research, a suitably qualified person must finalise a baseline research plan to the satisfaction of the authority responsible for administering threatened species provisions of the <i>Nature Conservation Act 1992</i> that includes a description of chosen methodologies.	A Research Program is established in Appendix C of the BTF Management Plan. This provides details of the chosen methodologies and research objectives. Adani has maintained ongoing consultation with DES on the progress of baseline monitoring surveys (Section 2.6 of BTF Research Program) and incorporated feedback into the development of the Research Program.		Entire document
	(c) The baseline research must include: (i) a minimum of two wet season surveys of the project area (ii) a minimum of two dry season surveys of the Mellaluka Springs Complex (iii) the collection of floristic data to enable the identification and mapping of key seasonal (wet and dry season) food sources.	To date, baseline research work conducted by Adani includes 10 surveys across both wet and dry seasons between 2012 and 2018, as summarised in Section 2.6 of the BTF Research Program. Surveys of the Mellaluka Springs Complex have been completed to the satisfaction of DES and DoE, as outlined in letter from the Office of the Coordinator-General, dated 22 July 2016. Monitoring has included floristic data to enable the identification and mapping of key seasonal food sources. This baseline research is ongoing, as outlined in Section 7 of the BTF Management Plan and Section 4 of the BTF Research Program.		Section 2.6, Section 4
	(d) The baseline research must determine: (i) whether the Mellaluka Springs Complex provides BTF habitat, particularly as a refuge during the dry season (ii) movement patterns, habitat requirements and population dynamics, including dietary requirements, home range, nesting requirements (iii) responses to grazing management, fire management and water body locations.	In July 2016, the Office of the Coordinator-General confirmed the baseline research work undertaken by Adani has satisfied the requirements of Imposed Condition 1: part (d)(i). To date, baseline research work conducted by Adani includes 13 surveys across both wet and dry seasons between 2010 and 2018, as summarised in Section 2.6 of the BTF Research Program. Findings of this work in relation to nesting, feeding habitat and dietary requirements are summarised in Appendix E and F. This work is ongoing, as outlined in the BTF Research Program. Responses of the BTF to grazing management, fire management and water body locations are key research objectives as outlined in Section 4 of the BTF Research Program.	Appendix E and F	Section 4

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
Carmichael Coal Mine and Rail Infrastructure Project Coordinator-General's Report, Imposed Condition 4 and Condition 5 (apportionment of costs).	Proponent contribution to BTF Bioregional Management Plan	The BTF Management Plan includes an ongoing monitoring program (Section 7) and Research Program (Appendix C) for BTF. There is not yet any bioregional management plan established by government to address regional impacts to the BTF arising from multiple mines proposed for the Galilee Basin. Adani is committed to participating in the BTF Bioregional Management Plan should this be established in the future.	Section 7	Entire document
	a) To address project impacts and maximise the ongoing protection and long-term conservation of the Black-throated finch (BTF) southern subspecies (<i>Poephila cincta cincta</i>), and its habitat in the Galilee Basin and Desert Uplands bioregion, the proponent must, when required by the administering authority responsible for the threatened species provisions of the <i>Nature Conservation Act 1992</i> :			
	(i) Prepare, to the satisfaction of the administering authority, an ongoing BTF monitoring program that takes into account the relevant requirements of any BTF Bioregional Management Plan specified in Appendix 1, Section 2, Part B and the outputs of baseline research required in Appendix 1, Section 3, Condition 1			
	(ii) Provide baseline and survey results in the format and at intervals specified for the coordination of bioregional survey data to the administering authority for any BTF Bioregional Management Plan			
	(iii) Contribute to the operation of any BTF Bioregional Management Plan including pro-rata funding.			
	Detailed condition about apportionment of costs for bioregional management plan.			
Environmental Authority, condition 16	Black-throated finch (BTF) Species Management Plan (SMP) at Carmichael project The holder of this environmental authority must submit a BTF SMP prepared and certified by a suitably qualified person to the administering authority prior to commencement of Project Stage 2 for approval. The holder must publish the BTF SMP on its website within 10 business days of receiving the administering authority's approval in writing. The approved BTF SMP must be implemented.	The BTF Management Plan has been prepared and certified by Eco Logical Australia, a national environmental consulting company with ~200 staff. Correspondence has been provided to DES outlining the qualifications and experience of the management plan authors (demonstrating that they are suitably qualified), and providing certification. Project Stage 2 will not commence until the BTF Management Plan is approved by the administering authority. The BTF Management Plan will be published online within 10 days of approval by the administering authority and will be implemented.	Entire document	Entire document
	The holder must align the SMP with any Bioregional BTF Management Plan and relevant documentation requirements under the <i>Environmental Protection and Biodiversity Conservation Act 1999</i> including BTF Recovery Plan, conservation advice and the threat abatement plan.	This plan is consistent with the BTF Recovery Plan. Threats identified in the BTF Recovery Plan are addressed specifically in Section 4.6 and Table 4. These threats include clearing and fragmentation of vegetation, degradation of habitat by stock and pest species, alteration of habitat by fire regime, invasion by exotic weeds including grasses and predation by introduced predators. Potential project impacts are discussed in Section 4.6. Monitoring and research activities of the BTF Management Plan closely align with recovery objectives described in Section 5 of the BTF Recovery Plan (e.g. investigate breeding requirements, quantify distribution and abundance, investigate feeding and other habitat requirements). Further details of these measures are provided in Section 7 of the BTF Management Plan. There are no current threat abatement plan or conservation advices in force for the BTF. There is currently no Bioregional BTF Management Plan.	Section 4.6 and Table 4	
	The submitted BTF SMP plan must include:	Adani has undertaken extensive and ongoing baseline monitoring of BTF, including the specific nesting and feeding requirements of the species. This work has been undertaken prior to and during project stage 1, since the wet season of 2012. Details of the monitoring program are provided in Section 2.6 of the BTF Research Program. Appendix E also summarises the findings of this monitoring.	Appendix E	Section 2.6
	a) A baseline research program on the specific nesting and feeding requirements of the species that will be undertaken prior to and during project stage 1.			
	The submitted BTF SMP plan must include:	Adani has undertaken extensive and ongoing baseline monitoring of BTF. Determining the home range and movement patterns of BTF in the project area is a major objective of the BTF Research Program (see Section 4.3)		Section 2.6, Section 3 and Section 4 of the Research Program
	... b) A baseline research program to establish whether the BTF at the project site are sedentary, locally migratory or regionally migratory.			
	The submitted BTF SMP plan must include:	Section 5 of the BTF Management Plan describes the adaptive management framework that will be applied to deal with uncertainty and incomplete knowledge using systematic monitoring to reduce uncertainty and improve management actions over time. Section 6 provides details of how the learnings from this research will be applied to minimise project impacts on BTF, and Section 9.1 provides details of how this will be reported to the Department. Further details on the adaptive management approach to applying research findings are also provided in Section 6.1 of the BTF Research Program.	Sections 5, 6 and 9.1	Section 6.1
	... c) A description of how the results of baseline research are to be used to determine any changes of classification of and/or impact on BTF habitat.			

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
	The submitted BTF SMP plan must include: ... d) Details of proposed impacts to BTF habitat from each project stage including impacts from clearing, subsidence, ecological function changes, hydrological changes and weed and pest infestation changes.	Details of potential project impacts are provided in Section 4.6 of the BTF Management Plan, including Table 4. Direct impacts from vegetation clearing and subsidence are provided for each stage of the project, consistent with the project Biodiversity Offset Strategy. The scale of indirect impacts are discussed, where this is possible to describe in a qualitative manner.	Section 4.6	
	The submitted BTF SMP plan must include: ... e) Mitigation measures to be undertaken to avoid, mitigate and manage impact resulting from each stage of the project, including rehabilitation of habitat.	Detailed mitigation measures are provided in Section 6 of the BTF Management Plan. These cover issues such as clearing and fragmentation of habitat, injury to BTF during works, habitat degradation, loss of water resources and contamination of water sources. Rehabilitation of disturbed areas is addressed in Table 7 and Table 8.	Section 6 and Table 7 and Table 8	
	The submitted BTF SMP plan must include: f) Monitoring of watering points that must be conducted for a minimum six (6) hour period commencing from dawn, to accurately capture BTF utilisation of water points.	Section 7.1.2.1 describes the approach to water source watches, which involve six continuous hours of survey commencing from dawn at 16 water sources where BTF have previously been recorded.	Section 7.1.2.1	
	The submitted BTF SMP plan must include: ... g) Detailed botanical assessment that must occur at all BTF sighting locations in the Project Area to record habitat values at those locations.	Vegetation assessments are described in Sections 7.1.2.6 and 7.1.2.7 of the BTF Management Plan. They include vegetation transects, foraging plots and groundcover monitoring. Detailed research activities on BTF habitat are also outlined in Section 4.4 of the Research Program.	Section 7.1.2.6 and Section 7.1.2.7.	Section 4.4
	The submitted BTF SMP plan must include: ... h) Detailed survey that must occur across the mining lease area and approved offset areas and must include information on BTF movements. The survey method and effort must be sufficient to accurately describe the BTF home range and detail BTF resource usage patterns between seasons and years (for up to 10 years) and allow robust management actions to be developed for the maintenance of a viable local BTF population.	Estimating the home range and movements of BTF is a key aim of the Research Program. Objectives, methods, variables to be monitored, resources and timing are outlined in Section 4.3 of the Research Program. Section 7.2 of the BTF Management also discusses this program of surveys.	Section 7.2	Section 4.3
	The submitted BTF SMP plan must include: ... i) Survey work that should incorporate the usage of call playback and identify all birds present when BTF are encountered.	Call playback has been utilised in previous surveys as described in Section 4.5 of the BTF Management Plan and Section 2.6 of the Research Program. Section 7.1.2 of the BTF Management Plan describes monitoring methods and specifies that all birds are to be identified when BTF are encountered. This is also specified in Section 4.4.4 of the Research Program.	Section 4.5 and Section 7.1.2.	Section 2.6 and Section 4.4.4
	The submitted BTF SMP plan must include: ... j) Specific surveys that must be undertaken during the BTF breeding season and include nest location and assessment of the habitat attributes associated with the breeding locations. The survey method and effort must be sufficient to accurately describe the BTF breeding requirements with consideration to spatial and temporal variation of resources of up to 10 years.	Determining the breeding habitat requirements of the BTF and the relationship with vegetation structure and composition and water is part of a key aim of the Research Program. Details of the objectives, variables to be monitored, methods, resources and timing are outlined in Section 4.4 of the Research Program. Section 7.2 of the BTF Management also discusses this program of surveys. Baseline monitoring activities described in Section 2.6 of the Research Program have also collecting information on nests, if present.	Section 7.2	Section 4.4
	The submitted BTF SMP plan must include: ... k) Survey and monitoring that must be undertaken by experienced ecologists.	The qualifications and experience required by ecologists implementing the BTF Management Plan are outlined in Section 9.3. The involvement of suitably qualified and experienced professionals in the implementation of the Research Program is also discussed in Section 4.1 of the Research Program.	Section 9.3	Section 4.1
Environmental Authority, condition 17	The BTF SMP under condition 16 must be reviewed by an appropriately qualified person annually and a report prepared on 1 July each year. The report must: a) Assess the plan against the requirements under condition 16. ... b) Include recommended actions to ensure actual and potential environmental impacts are effectively managed for the coming year.	As outlined in Section 4.1 of the Research Program, The BTF Management Plan and Research Program will be reviewed annually by an appropriately qualified person, and revisions of the survey and monitoring program will be carried out in consultation with the BTF Recovery Team. Any revisions must be independently peer reviewed. An annual report of research findings and the results of the independent peer review will be provided to DES.		Section 4.1

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
	...c) Identify any amendments made to the BTF SMP following the review.			
	... d) All revisions of the survey and monitoring program must be carried out in consultation with the BTF recovery team.			
	e) Any revisions must be independently peer reviewed.			
Environmental Authority, condition I8	The baseline research program must fund a research project to determine the relationship between water sources, woody habitat and the BTF food sources within the mining lease area and approved offset areas to determine the inter-relationships among these factors.	The Research Program will determine the relationship between water sources, woody habitat and the BTF food sources within the mining lease area and approved offset areas, and the inter-relationships among these factors. This is explained in Section 4.2 of the Research Program, with further details provided in Sections 4.4 and 4.5 of the Research Program.		Sections 4.2, 4.4 and 4.5
Environmental Authority, condition I9	The baseline research program under Condition I6 must:	Surveys completed by Adani to date have identified that BTF are particularly abundant in the area around Ten Mile bore (Section 4.5 of BTF Management Plan). Section 4.4 of the Research Program outlines the objective of determining whether Ten Mile Bore and surrounds are high value habitat for BTF. The research will also determine the characteristics of Ten Mile Bore and surrounds that contribute to its frequency of use and compare this with other waterholes and woodlands, through equivalent frequency monitoring.	Section 4.5	Section 4.4
	a) Establish whether Ten Mile Bore and surrounds are high value habitat for the species, and	Currently Ten Mile Bore and surrounds are managed under the certified environmental management system. Routine checks of the water sources at Ten Mile Bore are carried out. The agistee for the Moray Downs pastoral lease also carry out checks of water sources as a part of their monitoring program. Interim management of the Ten Mile Bore area is discussed in Section 6.4.7. Monitoring and management actions for the Ten Mile Bore area will be reviewed and modified in line with BTF Research Program outcomes, as described in Section 4.6.1 of the Research Program.	Section 6.4.7	Section 4.6.1
Environmental Authority, condition I10	The holder of this environmental authority must maintain water troughs for BTF within undisturbed areas and surface areas of underground mining footprint, and repair where necessary troughs, pipes and tanks to a standard that maintains a constant source of water.	Troughs are identified as an important water source for BTF in the study area (e.g. Section 4.6.3 of BTF Research Program). Table 10 (Section 6.1) of the BTF Management Plan states that known water sources will be avoided, or alternative water sources established outside of disturbance footprint, if avoidance is not possible. Section 6.4.4 of the BTF Management Plan also states that current water sources outside of the clearing footprint are to be maintained. Where it is necessary to remove a particular water source within or nearby to BTF habitat, a new water source will be created.	Section 6.3.3, Section 6.4.4 and Table 10	Section 4.6.3
		Section 6.1 of the BTF Management Plan states "Monitor BTF habitat values through annual groundcover assessments during May to maintain and where possible enhance BTF habitat within the Mining Lease". Table 8 also states as a mitigation measure – Manage non-mined and offset areas to maintain and improve BTF habitat values. This work will be guided by results from annual vegetation assessments, annual BTF surveys and the BTF Research Program.	Section 6.1, Table 8	
Adani Commitment, M4.29	Management actions will seek to maintain and where possible enhance Black-throated finch habitats and populations (e.g. pest control, water source, grazing and fire management) in unmined parts of the Mine Area, as well as in offset areas.	BTF surveys have continued as outlined in this commitment. This work is summarised in Section 2.6 of the Research Program. This work will continue as described in Section 7 of the BTF Management Plan and the Research Program.	Section 7	Section 2.6, entire document
Adani Commitment, M4.30	Black-throated finch surveys will continue so as to provide data on temporal and spatial variation of habitat use in the Mine Area and will contribute significant local data for incorporation into the Black-throated Finch Species Management Plan for the Mine Area, which will assist in refinement of species recovery actions and mitigation of impacts on the Mine Area.	Monitoring of BTF has been ongoing since the project EIS, as outlined in Section 2.6 of the BTF Research Program. A long-term program of research and monitoring has been established.	Section 7.1	Section 2.6
Adani Commitment, P6.30	Monitoring events will commence at least one year before mining operations (in order to continue a baseline understanding of existing conditions), and continue for at least two years after mining operations are completed.	Section 6.3.1 of the BTF Management Plan describes the staged approach to clearing of vegetation in accordance with this commitment.	Section 6.3.1	
Adani Commitment, P6.51	The loss of habitat for the Black-throated finch (southern) will occur in stages, in accordance with the staged development of the operational components of the Mine Area. Management actions to encourage dispersal away from areas that will be cleared for staged Mine operations will also be developed.	Section 6.1 of the BTF Management Plan states "Monitor BTF habitat values through annual groundcover assessments during May to maintain and where possible enhance BTF habitat within the Mining Lease". Table 8 also states as a mitigation measure – Manage non-mined and offset areas to maintain and improve BTF habitat values. This work will be guided by results from annual vegetation assessments, annual BTF surveys and the BTF Research Program.	Section 6.1, Table 8	
Adani Commitment, P6.52	Management actions for Black-throated finch will seek to maintain and where possible enhance habitats and populations (e.g. through pest control, provision of water sources, appropriate grazing and fire management) in unmined parts of the Mine Area, as well as in offset areas.			

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
Adani Commitment, P6.53	Important population, movement and habitat information for Black-throated finch will be collected, particularly with respect to seasonal use, key areas, nest sites, important feeding areas and management of threatening processes.	Section 7 of the BTF Management Plan and Section 4 of the Research Program outline research and monitoring tasks that are consistent with this commitment.	Section 7	Section 4
Adani Commitment, P6.54	Adani will provide a Draft Black-throated Finch Management Plan for approval prior to the commencement of mine construction. The Plan will include the following: <ol style="list-style-type: none"> 1. A management framework that aligns with the other project management plans 2. Clear statements regarding the intent, approval requirements, objectives and actions 3. Details of how the management plan will be applied across the project phases – pre construction / construction / operation / post operations, 4. Offset areas 5. Details of the current and proposed adaptive monitoring program to support the plan objectives. 6. Details of how experts will be used in a review capacity to inform ongoing monitoring and management 7. Incorporates all proposed management and mitigation measures, including reference to how these will align with the Significant Impact Guidelines and the National Recovery Plan. 8. Specific performance targets and how these will be measured and reported. 	This BTF Management Plan and Research Program address these requirements.	Details are addressed in the following sections: 1) Section 1.3 2) Section 1 3) Section 6 4) Section 6.5 5) Section 5 6) Section 9 7) Section 6 8) Section 6 and Section 9	5) Section 6.1 6) Sections 4.1 and 6
Adani Commitment, P6.55	Black-throated finch surveys will continue over time to provide data on temporal and spatial variation of habitat use in the Mine Area and will contribute significant local data for incorporation into the Black-throated Finch Species Management Plan for the Mine Area, which will assist in refinement of species recovery actions and mitigation of impacts on the Mine Area. In the case of subsidence, which will occur gradually and in a complex and partly unpredictable manner, the data being collected by this monitoring will provide information regarding the best strategies over time to mitigate negative effects and manage key resources for Black-throated finch on the Mine Area.	BTF surveys have continued in accordance with this commitment. A program for future monitoring and research is outlined in this plan.	Section 7	Entire document
Adani Commitment, P6.56	The onsite and offsite (offset areas) habitat management and complementary monitoring program, as described above, will be developed and implemented in consultation with relevant stakeholders (i.e. Black-throated Finch Recovery Team, Commonwealth and State governments).	This plan has been developed in consultation with relevant stakeholders. Implementation of the plan will be conducted as described in Section 9.2 of this plan and Section 6.2 of the Research Program. This involves sharing the findings of the research with the BTF Recovery Team for use and updating of the recovery plan and ongoing engagement with Commonwealth and state governments.	Section 9.2	Section 6.2
Adani Commitment, P6.57	Adani's overarching commitments in regards to the Black-throated Finch are: <ol style="list-style-type: none"> 1. Implementing management measures across the Project Mining Lease where there are indirect impacts including land management activities, water management, habitat maintenance, pest control, fire management, survey and recording. This commitment would continue through the duration of mining operations. 2. Implementing management measures across a proposed like for like mitigation area within those property areas mapped in Figure 1 below, including land management activities, water management, habitat maintenance, pest control, fire management, survey and recording. This commitment would continue for a period of 20 years. 3. Securing and maintaining appropriate offsets including land management activities, water management, habitat maintenance, pest control, fire management, survey and recording. This commitment would continue for the duration of the offset agreement, nominated as 20 years. 4. Ongoing monitoring programs locally, and contributing to regional monitoring programs including utilising and assisting where possible monitoring effort from the BTFRT. This commitment would continue for a period of 10 years, commencing from 2014. 5. Contributing time and resources to a government-led regional management program. In the order of an in-kind contribution of \$100,000 per year, over a period of 10 years, commencing from Mining Operations. 	Adani has met these commitments to the BTF, as summarised in the BTF Management Plan and associated Research Program. Indirect impacts are addressed in Section 6 of the BTF Management Plan, and include a range of land and water management activities and offsets. A long term program of research and monitoring has been established.	1-3) Section 6 4) Section 7 5) Government-led regional management program not yet established.	4) Entire document

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
Adani Commitment, P6.60	<p>Project Species Specific Management Plan(s)</p> <p><u>Key actions</u></p> <ul style="list-style-type: none"> Develop and implement programs to provide a greater level of detail on the ecology of threatened species at the Study Area – to be undertaken in collaboration with applicable research organisations, conservation groups and government agencies. <p><u>Timeframes</u></p> <ul style="list-style-type: none"> Implement targeted ecology and threatened species programs prior to and during Mine operations. Five yearly revisions and updating of this plan based on currency of information available. 	The BTF Research Program outlines a comprehensive program to provide greater level of detail on the ecology of the BTF in the study area, in collaboration with relevant stakeholders.	Section 7	Entire document

Appendix E Summary of baseline research on BTF nesting and foraging habitat in the project area (E2M Consulting)

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Black-throated Finch Habitat Assessment

Adani
Carmichael Coal Mine

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RTI 18-378

File A

Issue Date: 12 October 2018
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1 Introduction

1.1 Background

Adani Mining Pty Ltd (Adani) is planning and preparing for development of the Carmichael Coal Mine (CCM), herein referred to as 'the Project', which was granted conditional approval by the Queensland Coordinator-General on 8 May 2014 and the Commonwealth Minister for the Environment on 14 October 2015 (EPBC 2010/5736). The Department of Environment and Heritage Protection (DEHP), now the Department of Environment and Science (DES), issued the Environmental Authority (EA) EPML01470513 (herein referred to as 'the EA') for the Mining Leases (ML) 70441, 70505 and 70506 on 5 June 2017.

The EA contains numerous requirements relating to management, monitoring and research of the black-throated finch (southern) (BTF) (*Poephila cincta cincta*) that occur within the Project area. In particular, Condition I6 (a) of the Environmental Authority (EA) states that:

A baseline research program on the specific nesting and feeding requirements of the species that will be undertaken prior to and during project stage 1.

Current literature and research regarding the habitat and dietary preferences of BTF are largely based on populations in the Townsville Coastal Plains region. The habitat that the species occupies in the Desert Uplands region is notably different. The data collected during surveys undertaken for the Project provides important information for the specific habitat requirements for BTF in the Desert Uplands.

1.2 Scope and objectives

E2M Pty Ltd (E2M) has been engaged by Adani to undertake an analysis of BTF habitat based on the data collected during surveys and monitoring undertaken during the Project in order to satisfy Condition I6(a) of the EA. The objective of the assessment is to analyse this vegetation and habitat data to determine the specific nesting and feeding habitat requirements for BTF residing in the Project area.

The scope of this assessment was to:

- collate habitat assessment and vegetation survey data collected during BTF surveys for the Project
- analyse data to identify characteristics of BTF breeding and feeding habitat within the Project area
- identify key attributes and limiting factors of BTF habitat utilisation within the Project area; and
- provide recommendations for ongoing BTF habitat assessment during Stage 1 of the Project.



2 Survey history

2.1 Review of BTF surveys

Since 2010 Adani has undertaken 13 surveys within the mining lease and the Moray Downs West offset area, including associated reports assessing the presence, habitat preferences, ecology, population and spatial patterns of BTF with the Project area. Two of these surveys did not include vegetation surveys of BTF habitat. Table 1 outlines the previous studies and vegetation survey methodologies undertaken.

Table 1 Habitat assessment and vegetation survey methods for BTF surveys on CCM

Survey period	Consultant	Habitat and Vegetation Survey Methodology
Wet season 2011 (April 2011)	GHD	No vegetation surveys undertaken.
Dry season 2011 (May 2011)	GHD	No vegetation surveys undertaken.
Dry season 2012 ¹ (May 2012)	GHD	Quaternary level vegetation assessments were undertaken at each water source and 2 ha BTF survey site. Vegetation data collected included vegetation structure, cover of dominant plant species, relative dominance and strata, ground cover estimates (native and non-native grass and forb cover, litter, rock and bare ground cover).
Dry season 2012 ¹ (June 2012)	Environment & Heritage Partners	No vegetation surveys undertaken.
Dry season 2013 ¹ (May 2013)	GHD	Quaternary level vegetation assessments were undertaken at 52 x 2 ha BTF survey sites. Vegetation data collected included vegetation structure, cover of dominant plant species, relative dominance and strata, ground cover estimates (native and non-native grass and forb cover, litter, rock and bare ground cover).
Dry season 2013 ¹ (October 2013)	GHD	Quaternary level vegetation assessments were undertaken at 15 x 2 ha BTF survey sites. Vegetation data collected included vegetation structure, cover of dominant plant species, relative dominance and strata, ground cover estimates (native and non-native grass and forb cover, litter, rock and bare ground cover).
Wet season 2014 ¹ (December 2014)	Niche	Quaternary level vegetation assessments were undertaken at 52 sites. Vegetation structure and floristic assemblage were recorded, with specific focus placed on the presence / absence of food source and characteristics for BTF.

¹ Naming of previous surveys has been amended to reflect the season they were conducted within. Surveys conducted from April to October are considered dry season, while surveys conducted from November to March are considered wet season.



Survey period	Consultant	Habitat and Vegetation Survey Methodology
Wet Season 2015 ² (March 2015)	Niche	Twenty-nine flora survey sites were assessed during the March 2015 survey, 27 of which were determined based on BTF observations. Vegetation structure and floristic assemblage were recorded, with specific focus placed on the presence / absence of food source and characteristics for BTF.
Dry Season 2015 ² (August 2015)	Niche	Eighteen flora survey sites were assessed consisting of Quaternary level vegetation surveys to record vegetation structure and the flora, and their relative dominance according to strata.
Dry Season 2016 ² (April 2016)	Niche	Nineteen flora survey sites were assessed consisting of Quaternary level vegetation surveys to record vegetation structure and the flora, and their relative dominance according to strata.
Wet Season 2016 ² (December 2016)	Eco Logical Australia	Eight 100 m x 50 m vegetation transects were conducted throughout the Study Area. The vegetation transects consisted on two components, vegetation structure and ground cover. Fourteen 2 m x 2 m foraging plots were undertaken throughout the Study Area at direct locations where BTF were observed foraging.
Wet Season 2017 (November 2017)	E2M	Eight vegetation assessments were undertaken during the field assessment. The objective of vegetation assessment was to record data on floristic characteristics of BTF habitat. Vegetation assessments used a 100 m x 50 m transect
Dry Season 2018 (April 2018)	E2M	Fifteen vegetation assessments were undertaken during the field assessment. The objective of vegetation assessment was to record data on floristic characteristics of BTF habitat. Vegetation assessments used a 100 m x 50 m transect

2.2 Survey timing and conditions

Surveys have been undertaken at different times throughout the year to account for seasonal variation in BTF activities and availability of food sources (i.e. seed of different preferred dietary grass species). Survey timing may also affect the results of vegetation surveys due to the presence (or otherwise) of annual species and / or lack of fertile material for the identification of grass species.

Of the 11 BTF surveys to have featured vegetation assessments, seven were undertaken during the dry season (April to October) and four during the wet season (November to March). Vegetation data has been collected from eight months of the year with April, May and December having two surveys in each.

² Naming of previous surveys has been amended to reflect the season they were conducted within. Surveys conducted from April to October are considered dry season, while surveys conducted from November to March are considered wet season.



3 Methods

3.1 Data collation

Data was collated from the following studies and sources undertaken during the Project:

- EIS surveys (GHD)
 - Dry season 2012³ (May 2012)
 - Dry season 2013³ (May 2013)
 - Dry season 2013³ (October 2013)
- BTF monitoring program (Niche)
 - Wet season 2014³ (December 2014)
 - Wet season 2015³ (March 2015)
 - Dry season 2015³ (August 2015)
 - Dry season 2016³ (April 2016)
- Wet Season survey 2016³ (December 2016) (Eco Logical Australia)
- Wet Season survey 2017 (November 2017) (E2M)
- Dry Season survey 2018 (April 2018) (E2M)

BTF and vegetation survey data (Table 2) from surveys undertaken during the Project was collated, cleaned and formatted into a single Microsoft Excel database. BTF records from water sources were filtered out as these records do not correspond with nesting or foraging habitat. Information that was not relevant to the analysis (e.g. observer and survey type) was removed at this time as well.

Table 2 BTF survey datasets utilised

Dataset name	Consultant	Content
CCP BTF 2013	GHD	Location of BTF and BTF nests recorded during EIS surveys between 2011 and 2013
2313 BTF DATA DEC 2014 – APR 2016	Niche	Location of BTF and BTF nests recorded during 2014 and 2016 surveys
2313 Floristic Data Dec 2014 – Aug 2015	Niche	Vegetation survey data collected during 2014 and 2015 surveys
2313 Floristic Data Apr 2016	Niche	Vegetation survey data collected during 2016 dry season survey
Black-throated Finch Data Collection_v2	ELA	Location of BTF nests recorded during 2016 wet season survey

³ Naming of previous surveys has been amended to reflect the season they were conducted within. Surveys conducted from April to October are considered dry season, while surveys conducted from November to March are considered wet season.



Dataset name	Consultant	Content
Black-throated Finch Floristics	ELA	Vegetation survey data collected during 2016 wet season survey
BTF_SIGHTING	E2M	Location of BTF recorded during 2017 and 2018 surveys
BTF_NEST	E2M	Location of BTF nests recorded during 2017 and 2018 surveys
BTF_VegPlot	E2M	Vegetation survey data collected during 2017 and 2018 surveys

3.2 Data analysis

3.2.1 BTF records

BTF surveys undertaken to date have yielded a total of 651 separate BTF observations and 69 nest records. The location of these has been depicted in Figure 1. BTF drinking records (169) were deleted from the analysis as the birds will use water sources that are not necessarily located within suitable breeding or foraging habitat. Furthermore the concentration of survey effort and BTF records at water sources would bias the results of the analysis.

The remaining 354 BTF records were used in the analysis. Where the data for BTF records did not identify the activity, they were assumed to be foraging records. Activities such as preening, perching and flying were also assumed to be associated with foraging habitat.

3.2.2 BTF habitat characteristics

Vegetation data was reviewed to determine which characteristics had suitable and sufficient data to analyse. The following thirteen vegetation characteristics were identified as suitable for the analysis:

- Canopy height
- Canopy cover
- Canopy species richness
- T2 layer cover
- Shrub height
- Shrub cover
- Shrub species richness
- Native grass cover
- Native grass richness
- Herb and forb cover
- Exotic grass cover
- Leaf litter cover; and
- Bare ground cover.

Other habitat factors that were identified as being appropriate for the habitat analysis were:

- Regional Ecosystem (RE); and
- Proximity to permanent water sources.



3.2.3 Vegetation survey sites

Vegetation surveys have been undertaken at 162 unique sites of which 52 have been surveyed twice. The location of these survey sites has been depicted in Figure 2. Therefore a total of 214 vegetation surveys have been completed for the data analysis to be based upon. The majority (152) of these have been undertaken during the dry season.

A spatial analysis was undertaken on BTF records and vegetation survey sites to identify the spatial relationships between key habitat areas (such as nests and areas with multiple foraging records) and factors such as Regional Ecosystems (REs) and proximity to permanent water. This process was also used to assign each vegetation survey site as representing foraging or nest (or both) habitat based on the following criteria:

- Sites within 100 m of a nest record were assigned as breeding habitat
- Sites within 400 m of a BTF foraging record were assigned as foraging habitat; and
- Sites within 100 m of a nest record and 400 m of a BTF foraging record were assigned as breeding and foraging habitat.

Twenty-four vegetation sites were attributed to breeding habitat and 115 to foraging habitat.

The 400 m buffer from foraging records was based on a 50 ha home range for BTF in the Townsville Coastal Plains population (Rechetelo 2015). The number of BTF records within a 400 m buffer of each foraging and breeding vegetation survey site was calculated (see Figure 3 for example).

3.2.4 Foraging and breeding habitat analysis

The typical habitat characteristics for BTF foraging and breeding habitat was determined by calculating the minimum, maximum and mean values for each of the 13 habitat characteristics listed in Section 3.2.2. The proximity to a known permanent water source was calculated in GIS. The minimum, maximum and mean distances were then determined.

The analysis also aimed to identify the statistical relationship of each characteristic with foraging and breeding habitat by undertaking a linear regression for each characteristic. The regression used each of the 13 characteristics as the predictor variables and a response variable of BTF observations within 400 m of the corresponding vegetation survey site. The following results of the regression analysis were used to determine the strength and nature of the relationships with these variables:

- Multiple R – indicates how strong the linear relationship is (a value of 1 means a perfect positive relationship and a value of zero means no relationship at all)
- Coefficient – a positive number indicates a positive relationship (i.e. as the variable increases so does the response) and vice versa; and
- P-value – indicates whether the relationships are statistically significant (P-value <0.05 indicates a significant difference).

3.2.5 Native grass analysis

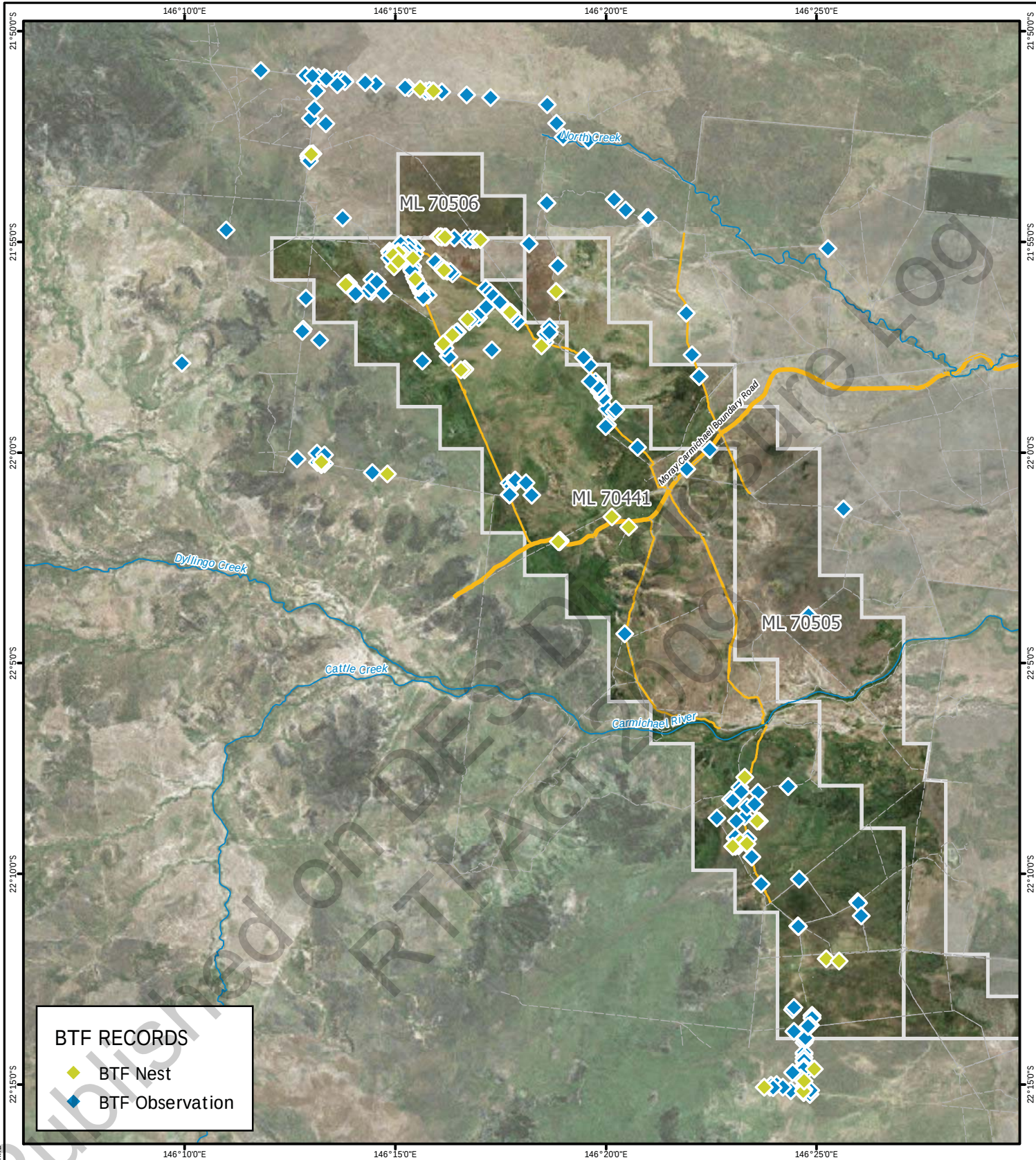
Vegetation data was reviewed to determine the most commonly recorded native grasses within BTF foraging and breeding habitat. Twelve species were identified as recorded at more than 10% of breeding and foraging vegetation sites. For these species the frequency (percentage of sites recorded), minimum, maximum and mean covers were calculated.



A linear regression was also undertaken for each species for foraging habitat to determine whether a statistical relationship could be identified for each species. Insufficient quantitative grass species cover was available to do this for breeding sites.

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Legend

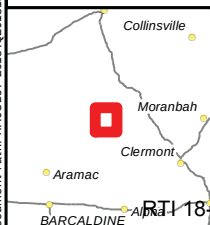
- Major Road
- Minor Road
- Track
- Watercourse
- Mining Lease



Scale 1:230,000 (A4)

0 2 4 6 8 10 Kilometers

Coordinate System: GCS GDA 1994



Notes:

- Aerial Imagery: © ESRI 2018
- Watercourse: © Geoscience Australia 2016
- Road: © Adani 2017
- Mining Lease: © DNRME 2018

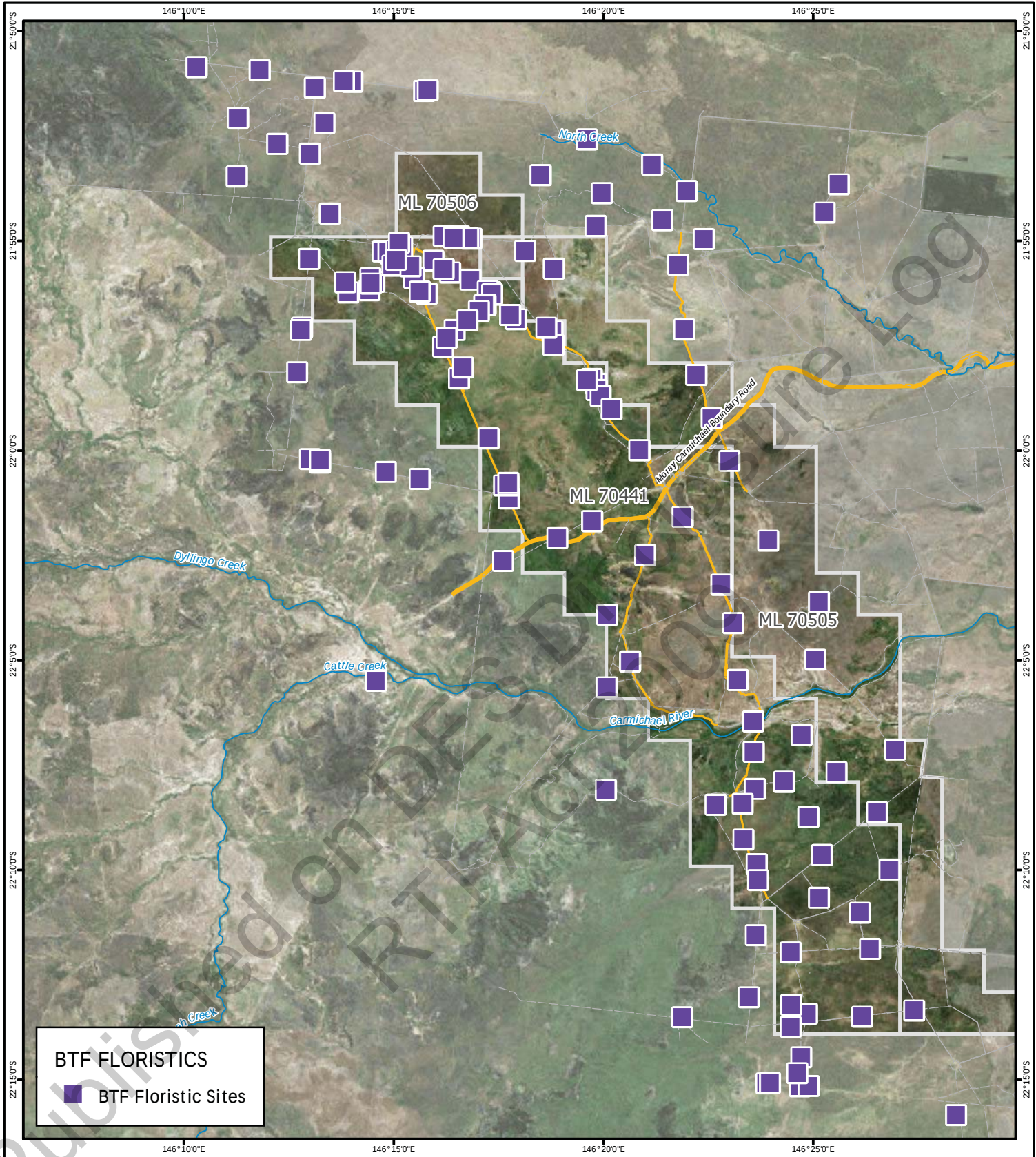
Rev	Description	Drawn	Approved	Date
A	Issued for Review	CD	CO	21/09/2018



FIGURE 1: BTF OBSERVATION RECORDS AND NEST SITES

2018 BTF Dry Season Survey
Adani Mining Pty Ltd

Map Number	Job Number	Rev
1 of 1	QE118120	A



Legend

- Major Road
- Minor Road
- Track
- Watercourse
- Mining Lease

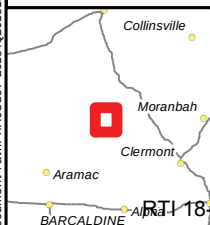


Scale 1:230,000 (A4)

0 2 4 6 8 10

Kilometers

Coordinate System: GCS GDA 1994



Notes:
 Aerial Imagery: © ESRI 2018
 Watercourse: © Geoscience Australia 2016
 Road: © Adani 2017
 Mining Lease: © DNRME 2018

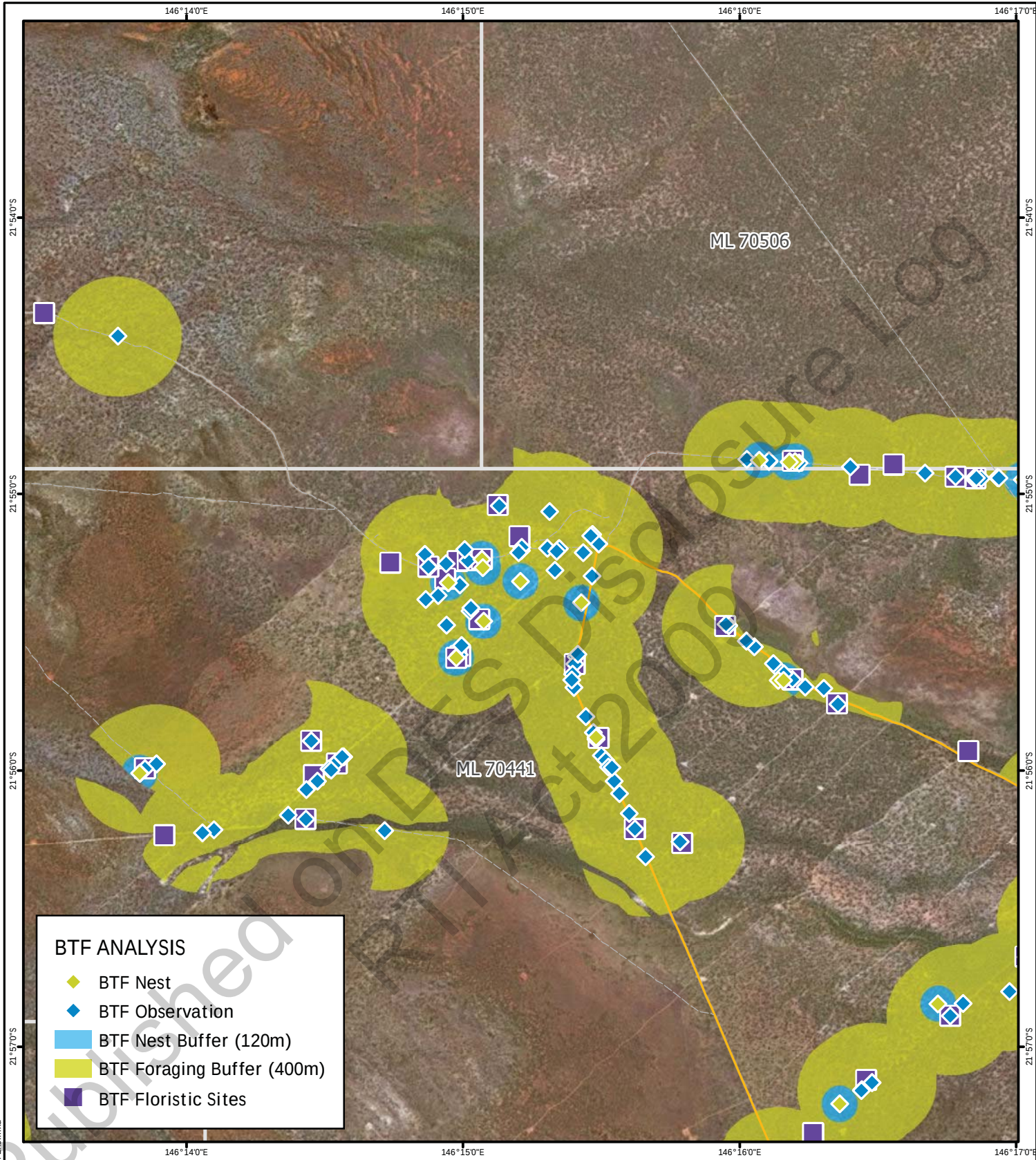
Rev	Description	Drawn	Approved	Date
A	Issued for Review	CD	CO	21/09/2018



FIGURE 2: BTF FLORISTIC SURVEY SITES

2018 BTF Dry Season Survey
 Adani Mining Pty Ltd

Map Number	Job Number	Rev
1 of 1	QE118120	A



BTF ANALYSIS

- ◆ BTF Nest
- ◆ BTF Observation
- BTF Nest Buffer (120m)
- BTF Foraging Buffer (400m)
- BTF Floristic Sites

Legend

- Major Road
- Minor Road
- Track
- Watercourse
- Mining Lease

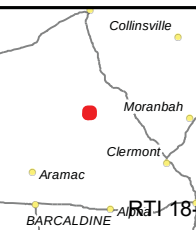


Scale 1:35,000 (A4)

0 0.5 1 1.5

Kilometers

Coordinate System: GCS GDA 1994



Notes:
 Aerial Imagery: © ESRI 2018
 Watercourse: © Geoscience Australia 2016
 Road: © Adani 2017
 Mining Lease: © DNRME 2018

Rev	Description	Drawn	Approved	Date
A	Issued for Review	CD	CO	21/09/2018



FIGURE 3: INDICATIVE BTF BUFFERS AND FLORISTIC SITES

2018 BTF Dry Season Survey
 Adani Mining Pty Ltd

Map Number	Job Number	Rev
1 of 1	QE-118120	A

4 Results

4.1 BTF habitat characteristics

Preferred habitat for BTF typically consists of grassy eucalypt woodlands in proximity to water or riparian corridors Removed at External Review High value habitats comprise areas of grassy woodland containing key seeding grass species and low vegetation density or bare ground to allow access to the seed bank and an open tree layer that does not have a continuously dense shrubby understorey (Black-throated Finch Recovery Team Department of Environment and Climate Change (NSW) and Queensland Parks and Wildlife Service, 2007; Rechetelo, 2015).

In the Project area, BTF demonstrate a strong association with vegetation communities dominated by RE 10.5.5a (*Eucalyptus melanophloia* open woodland on sandplains, with a sparse shrub layer) and a mosaic of ground cover, which included a diversity in grass species present and bare inter-tussock patches (E2M 2018). The data analysis identified that 58% of BTF records occur with REs dominated by 10.5.5a. However when only foraging and breeding records are considered, this increases to 80%.

Other habitats where BTF have been recorded include *Eucalyptus brownii* open-woodland (RE 10.3.6ax1) (9%), *Eucalyptus similis*, *Corymbia brachycarpa* and *Corymbia setosa* open-woodland (RE 10.5.1) (7%) and non-remnant vegetation (12%).

4.2 Foraging habitat

BTF foraging habitat characteristics were analysed based on data collected from 115 vegetation survey sites between 2013 and 2018. For the majority of these sites all 13 habitat features listed in Section 3.2.2 were assessed, however for some surveys canopy height, T2 and shrub cover were not recorded and therefore these were omitted from the linear regression analysis.

The results of the analysis of BTF foraging habitat are shown in Table 3. The results demonstrate that BTF have a preference to forage in areas dominated by RE 10.5.5a (81% of foraging records), however they will utilise a wide range of habitat conditions in these areas, including three sites where native grass cover was recorded as 0%. Similarly the results indicate that BTF will forage in areas with no tree cover or no shrub cover.

The results indicate that BTF foraging habitat generally consists of an open-woodland (17.3 % canopy cover) with moderately low canopy (approximately 12 m) and low canopy species richness (2). The shrub layer is typically low (2.4m) and sparse (6.2% cover) but a moderately high species diversity (6). The ground cover is dominated by native grasses (36.6% cover and 8 species) with moderate bare ground (33.6% cover). Exotic grass and herb / forb cover are typically low (4.2% and 4% respectively). BTF have not been recorded foraging in areas with more than 50% exotic grass cover.

The results of the linear regression identified that two habitat characteristics had a significant relationship with BTF foraging. Both canopy species richness (0.0002) and shrub cover (0.0275) have a P-value of less than 0.05. Native grass richness (0.0892) and exotic grass cover (0.1083) were the only other variables that were close to having a significant relationship with BTF foraging records.



Canopy species richness has a moderately strong negative relationship indicated by a Multiple R of 0.3378 and a Coefficient of -1.6511. Shrub cover also has a moderately strong negative relationship indicated by a Multiple R of 0.2132 and a Coefficient of -0.1618. Native grass richness has a moderately strong positive relationship indicated by a Multiple R of 0.1592 and a Coefficient of 0.2166. Exotic grass cover has a moderately strong negative relationship indicated by a Multiple R of 0.1506 and a Coefficient of -0.0867.

Table 3 BTF Foraging Habitat Characteristics and Linear Regression Results

Habitat Feature	Values			Regression Results		
	Mean	Minimum	Maximum	Multiple R	Coefficient	P-value
Canopy Height (m)	12.1	0	18	-	-	-
Canopy cover	17.3	0	48	0.0221	-0.0124	0.8144
Canopy species richness	2	0	5	0.3378	-1.6511	0.0002
T2 cover	10.4	0	30	-	-	-
Shrub height (m)	2.4	1	6	-	-	-
Shrub cover	6.2	0	34.8	0.2132	-0.1618	0.0275
Shrub species richness	6	0	12	0.0444	-0.0898	0.6373
Native grass cover	36.6	0	85	0.0605	-0.0170	0.5208
Herb and forb cover	4.0	0	39	0.0122	-0.0088	0.8975
Exotic grass cover	4.2	0	50	0.1506	-0.0867	0.1083
Native grass richness	8	0	18	0.1592	0.2166	0.0892
Leaf litter cover	16.6	0	57	0.0982	-0.0378	0.2964
Bare ground cover	33.6	0	90	0.0983	0.0277	0.2958
10.5.5.a dominated RE's		81%			-	

Twelve grass species were identified as being recorded at more than 10% of the vegetation survey sites. *Aristida spp.* were the most commonly recorded grass in foraging habitat, occurring at 60% of sites. Other species recorded at more than 20% of foraging habitat survey sites were *Heteropogon contortus* (34%), *Themeda triandra* (33%), *Eriachne mucronata* (26%), *Panicum effusum* (25%) and *Triodia pungens* (24%) (Table 4). However *Bothriochloa ewartiana* (16%), *Triodia pungens* (13.2%) and *Heteropogon contortus* (9.3%) have the highest mean covers at sites where they have been recorded. The linear regression did not identify a statistically significant or strong relationship with any individual grass species. The P-value for all grasses was well above 0.05 (Table 4).

BTF have also been observed foraging on numerous grass species during the surveys including:

- *Bothriochloa ewartiana*
- *Enneapogon polyphyllus*
- *Themeda triandra*
- *Panicum effusum*
- *Digitaria brownii*
- *Schizachyrium fragile*



- *Sehima nervosum*
- *Chrysopogon fallax*
- *Enteropogon ramosus*
- *Paspalidium rarum*
- *Schizachyrium fragile*
- *Cymbopogon bombycinus*
- *Triodia pungens*
- *Eriachne mucronata*
- *Setaria surgens**
- *Digitaria ciliaris**
- *Aristida* spp.; and
- *Stylosanthes humilis* * (GHD 2012, Niche 2016, ELA 207, E2M 2017 and E2M 2018).

Table 4 BTF Foraging Habitat Native Grass and Linear Regression Results

Species	Values			Regression Results		
	Frequency (%)	Mean cover (%)	Maximum cover (%)	Multiple R	Coefficient	P-value
<i>Aristida</i> spp.	60	6.7	50	0.0802049	0.02657714	0.646949
<i>Bothriochloa ewartiana</i>	15	16.0	20	0.0148753	0.01051751	0.932411
<i>Chrysopogon fallax</i>	19	4.6	10	0.0824834	-0.0882015	0.637598
<i>Cymbopogon bombycinus</i>	16	2.6	10	0.1373041	-0.1644413	0.431553
<i>Enneapogon polyphyllus</i>	19	4.1	10	0.2361793	-0.246901	0.171962
<i>Eriachne mucronata</i>	26	5.4	20	0.0606496	0.04742036	0.729271
<i>Eulalia aurea</i>	12	0.5	10	0.1733716	-0.4508659	0.319251
<i>Heteropogon contortus</i>	34	9.3	20	0.1317142	0.08140311	0.450713
<i>Panicum effusum</i>	25	4.1	10	0.0713383	0.07077159	0.683835
<i>Sehima nervosum</i>	19	3.1	10	0.2021374	0.20742707	0.244222
<i>Themeda triandra</i>	33	6.7	10	0.1511338	0.1238827	0.386139
<i>Triodia pungens</i>	24	13.2	30	0.0125656	-0.006378	0.942887

4.3 Breeding habitat

BTF breeding habitat characteristics were analysed based on data collected from 24 vegetation survey sites between 2013 and 2018. For the majority of these sites all 13 habitat features listed in Section 3.2.2 were assessed, however for some surveys canopy height, T2 and shrub cover were not recorded and therefore these were omitted from the linear regression analysis.

The results of the analysis of BTF breeding habitat are shown in Table 5. The results again demonstrate that BTF have a preference to breed in areas dominated by RE 10.5.5a (79% of nest records). However unlike the foraging areas, BTF demonstrate a narrower range of habitat conditions for breeding habitat. In particular the range of values for canopy height and shrub cover were much lower than foraging areas.

An additional variable, proximity to known permanent water, was also analysed for breeding habitat. These results identified a mean distance of approximately 2.5 km between nests and permanent water sources. The closest nest to a water source was 280m and the furthest was almost 7 km.



The results indicate that BTF breeding habitat generally consists of an open-woodland (17 % canopy cover) with moderately low canopy (approximately 11.6 m) and low canopy species richness (2). The shrub layer is typically low (2.5 m) and sparse (5.2% cover) but a moderately high species diversity (6). The ground cover is dominated by native grasses (37.7% cover and 8 species) with moderate bare ground (33.9% cover). Exotic grass and herb / forb cover are typically low (3.5% and 4.3% respectively). BTF nests have not been recorded in areas with more than 15% exotic grass cover.

The results of the linear regression identified that only one habitat characteristic had a significant relationship with BTF nest sites with native grass richness (0.0256) having a P-value of less than 0.05. Shrub cover (0.1319) was the only other variable that was close to having a significant relationship with BTF nests based on the existing data.

Native grass richness has a moderately strong positive relationship indicated by a Multiple R of 0.4546 and a Coefficient of 0.7591. Shrub cover has a moderately strong negative relationship indicated by a Multiple R of 0.3164 and a Coefficient of -0.4255.

Table 5 BTF Nesting Habitat Characteristics and Linear Regression Results

Habitat Feature	Values			Regression Results		
	Mean	Minimum	Maximum	Multiple R	Coefficient	P-value
Distance to water (m)	2,495	280	6,965	-	-	-
Canopy height (m)	11.6	9	15	-	-	-
Canopy cover	17.0	7	35	0.1883	-0.1423	0.3781
Canopy species richness	2	1	5	0.1398	-0.8473	0.5148
T2 cover	9.8	0	20	-	-	-
Shrub height (m)	2.5	2	4		-	-
Shrub cover	5.2	0	19	0.3164	-0.4255	0.1319
Shrub species richness	6.0	2	11	0.1647	0.4208	0.4417
Native grass cover	37.7	9.6	85	0.1441	-0.0476	0.5017
Herb and forb cover	4.3	0	25	0.0457	-0.0350	0.8321
Exotic grass cover	3.5	0	15	0.1296	-0.1639	0.5462
Native grass richness	8	3	17	0.4546	0.7591	0.0256
Leaf litter cover	18.8	0	50	0.0959	-0.0446	0.6558
Bare ground cover	33.9	7	80.4	0.0781	-0.0250	0.7168
10.5.5.a dominated RE's		79%			-	

BTF nests recorded during the 2018 dry season survey indicated a preference to construct nests in the tall shrub layer dominated by *Acacia sericophylla*, typically at 2 to 4 m in height. Other nests were observed



low in the canopy layer at 7 m in height. BTF nests were most commonly found in *Acacia sericophylla* (12 records), followed by *Grevillea parallela* (2 records) and *Eucalyptus melanophloia* (1 record) (E2M 2018).

Aristida spp. were the most commonly recorded grass in foraging habitat, occurring at all nesting vegetation sites. Other species recorded at more than 20% of breeding habitat survey sites were *Themeda triandra* (38%), *Triodia pungens* (33%), *Heteropogon contortus* (29%), *Cymbopogon bombycinus* (24%), *Panicum effusum* (24%) and (Table 6). No individual cover data was available for two species (*Cymbopogon bombycinus* and *Eulalia aurea*) to identify the mean and maximum covers in breeding habitat. Of the other ten species, the mean covers were all generally similar with a mean between 10 and 17%.

Table 6 BTF Nesting Habitat Native Grass Results

Species	Frequency (%)	Mean cover (%)	Maximum cover (%)
<i>Aristida spp.</i>	100	15	30
<i>Bothriochloa ewartiana</i>	10	10	10
<i>Chrysopogon fallax</i>	19	10	10
<i>Cymbopogon bombycinus*</i>	24	n/a	n/a
<i>Enneapogon polyphyllus</i>	19	10	10
<i>Eriachne mucronata</i>	14	17	20
<i>Eulalia aurea*</i>	10	n/a	n/a
<i>Heteropogon contortus</i>	29	10	10
<i>Panicum effusum</i>	24	10	10
<i>Sehima nervosum</i>	19	10	10
<i>Themeda triandra</i>	38	10	10
<i>Triodia pungens</i>	33	13	20

* No quantitative cover data was recorded for these species at breeding vegetation sites

5 Discussion

The results of the BTF habitat analysis indicate that the typical habitat characteristics for foraging and breeding habitat are generally similar (Table 7). The mean values for the majority of the 13 variables that were assessed during this analysis were very similar for both habitat types. This is likely to be partially due to some vegetation surveys being located in areas that were defined as breeding and foraging habitat. However the minimum and maximum values for each variable indicate there is a greater tolerance for variation in the habitat conditions for foraging habitat.

The results confirm that BTF in the Project area have a strong association with RE 10.5.5a, especially in areas where the canopy is approximately 12 m tall and 17% cover. A low and sparse shrub layer is preferred with a diversity of species, especially *Acacia sericophylla* and *Grevillea parallela* in which they have been recorded nesting in on multiple occasions. A ground layer containing a mosaic of approximately 37% native grass cover and 34% bare ground as well as at least 8 native grass species and less than 5% exotic grass cover is preferred. Table 7 provides a summary of the key characteristics of BTF foraging and breeding habitats.

The analysis failed to identify a strong relationship with any individual grass species. This is likely due to the importance of native grass richness, which indicates that BTF require a variety of native grasses for foraging and nest site selection. The results also suggest that BTF prefer to forage and breed in areas that are not dominated by a single grass species and prefer habitat where a more even cover of native grasses occurs.

Twelve grass species were identified as being recorded at more than 10% of the vegetation survey sites. Further native grass cover data is required to undertake a linear regression for individual grass species in BTF breeding habitat, however it is unlikely that any single species is likely to be identified as statistically significant given the similarity in results for foraging and breeding habitat.



Table 7 BTF foraging habitat vegetation attributes

Attribute	Foraging Habitat	Breeding Habitat
Canopy		
Average height (m)	12.1	11.6
Foliage projected cover (%)	17.3	17
Key species	<i>Eucalyptus melanophloia</i> <i>Corymbia dallachiana</i> <i>Corymbia clarksoniana</i> <i>Eucalyptus brownii</i> <i>Eucalyptus whitei</i>	<i>Eucalyptus melanophloia</i> <i>Corymbia dallachiana</i> <i>Corymbia clarksoniana</i> <i>Eucalyptus brownii</i> <i>Eucalyptus whitei</i>
Shrub layer		
Average height (m)	2.4	2.5
Foliage projected cover (%)	6.2	5.2
Key species	<i>Acacia sericophylla</i> <i>Acacia bidwillii</i> <i>Acacia elachantha</i> <i>Acacia excelsa</i> <i>Acacia laccata</i> <i>Acacia tenuissima</i> <i>Capparis lasiantha</i> <i>Carissa lanceolata</i> <i>Grevillea parallela</i> <i>Grewia latifolia</i> <i>Hakea lorea</i> <i>Maytenus cunninghamii</i>	<i>Acacia sericophylla</i> <i>Acacia bidwillii</i> <i>Acacia elachantha</i> <i>Acacia excelsa</i> <i>Acacia laccata</i> <i>Carissa lanceolata</i> <i>Grevillea parallela</i> <i>Grewia latifolia</i> <i>Hakea lorea</i> <i>Maytenus cunninghamii</i>

Attribute	Foraging Habitat	Breeding Habitat
Ground layer		
Native grass cover (%)	36.6	37.7
Bare ground cover (%)	33.6	33.9
Exotic grass cover (%)	4.2	3.5
Key species	<i>Aristida</i> spp., <i>Bothriochloa ewartiana</i> , <i>Chrysopogon fallax</i> , <i>Cymbopogon bombycinus</i> , <i>Enneapogon polyphyllus</i> , <i>Eriachne mucronata</i> , <i>Eulalia aurea</i> , <i>Heteropogon contortus</i> , <i>Panicum effusum</i> , <i>Sehima nervosum</i> , <i>Themeda triandra</i> , <i>Triodia pungens</i>	<i>Aristida</i> spp., <i>Bothriochloa ewartiana</i> , <i>Chrysopogon fallax</i> , <i>Cymbopogon bombycinus</i> , <i>Enneapogon polyphyllus</i> , <i>Eriachne mucronata</i> , <i>Eulalia aurea</i> , <i>Heteropogon contortus</i> , <i>Panicum effusum</i> , <i>Sehima nervosum</i> , <i>Themeda triandra</i> , <i>Triodia pungens</i>

The results only identified a significant statistical relationship with a few habitat variables, however it is considered likely that additional data collected during ongoing surveys will identify more, particularly for breeding habitat where there is still relatively less habitat data. The analysis indicates that native grass richness is a critical factor in the selection of BTF foraging and breeding habitat. Other variables that had a strong relationship with BTF occurrence were canopy species richness, shrub cover and exotic grass cover. However further analysis that also considers the relationships between each variable may also identify significant relationships for BTF foraging and breeding habitat.

BTF nests in the study area demonstrate a much greater distance from water than the current literature and government guidelines indicate. This may be due to the relative scarcity of water in the Desert Uplands region compared to the Townsville Coastal Plains region where current literature and guidelines have been based upon. This has implications for the monitoring and management of BTF in the Project area as there is a need to survey and manage areas of important habitat for a greater area.



6 Conclusion and recommendations

Condition I6 (a) of the EA requires that Adani undertake 'a baseline research program on the specific nesting and feeding requirements of the species that will be undertaken prior to and during project stage 1'. E2M was engaged by Adani to undertake an analysis of BTF habitat based on the data collected during surveys and monitoring undertaken during the Project. The objective of the assessment is to analyse this vegetation and habitat data to determine the specific nesting and feeding habitat requirements for BTF residing in the Project area.

Since 2010 Adani has undertaken a comprehensive assessment of BTF within the Project area consisting of 13 surveys within the mining lease and the Moray Downs West offset area. These surveys have assessed the presence, habitat preferences, ecology, population and spatial patterns of BTF with the Project area. Eleven of the surveys have included vegetation surveys to capture data relating to BTF habitat in the Project area. These surveys have been undertaken at different times throughout the year to account for seasonal variation in BTF activities and availability of food sources.

The BTF surveys have recorded a total of 651 separate BTF observations and 69 nests. Vegetation surveys have been undertaken at 162 unique sites of which 52 have been surveyed twice to give a total of 214 vegetation surveys for the data analysis to be based upon.

The analysis was based on 13 vegetation variables, 12 native grass species and a response variable of BTF records within 400 m of the vegetation survey site to determine the key habitat characteristics for BTF foraging and breeding habitat. The minimum, maximum and mean values for each variable was calculated and a linear regression completed to identify the statistical relationship of each characteristic with foraging and breeding habitat. The proximity to a known permanent water source was also calculated as well as the percentage of records within each RE in the Project area.

The results of the BTF habitat analysis indicate that the typical habitat characteristics for foraging and breeding habitat are generally similar with the mean values for most of the 13 variables very similar. However the minimum and maximum values for each variable indicate BTF have a greater tolerance for variation in the habitat conditions for foraging habitat.

Approximately 80% of BTF foraging and breeding records were located in RE 10.5.5a where they typically prefer areas where the canopy is approximately 12 m tall and 17% cover. A low and sparse shrub layer is preferred with a diversity of species, especially *Acacia sericophylla* and *Grevillea parallela* in which they have been recorded nesting in on multiple occasions. A ground layer containing a mosaic of approximately 37% native grass cover and 34% bare ground as well as at least 8 native grass species and less than 5% exotic grass cover is preferred.

The mean distance of BTF nests to known permanent water was approximately 2.5 km. The closest nest to a water source was 280 m and the furthest was almost 7 km.

Twelve grass species were identified as being recorded at more than 10% of the vegetation survey sites. *Aristida spp.* were the most commonly recorded grass in foraging and breeding habitat. Other species that were recorded often were *Heteropogon contortus*, *Themeda triandra*, *Eriachne mucronata*, *Panicum effusum* and *Triodia pungens*. The linear regression did not identify a statistically significant or strong relationship with any individual grass species, rather they indicated a requirement for a variety of native grasses for foraging and breeding habitat. The results also suggest that BTF prefer to forage and breed in areas that are not dominated by a single grass species and prefer habitat where a more even cover of native grasses occurs.

The results only identified a significant statistical relationship with a few habitat variables. The analysis indicates that native grass richness is a critical factor in the selection of BTF foraging and breeding habitat. Other variables that had a strong relationship with BTF occurrence were canopy species richness,



shrub cover and exotic grass cover. However further analysis that also considers the relationships between each variable may also identify significant relationships for BTF foraging and breeding habitat.

The following recommendations are made for future BTF monitoring and habitat analysis for the Project:

- Increase the number of vegetation surveys undertaken during the wet season as the current dataset has a bias towards dry season survey data
- Undertake further vegetation surveys in areas of RE 10.5.5a where BTF are absent in order to undertake a statistical comparison of the differences between occupied and unoccupied 10.5.5a habitat. This may also assist in the management of offset areas by identifying limiting factors for BTF habitat
- Undertake further vegetation assessments of recorded BTF breeding sites, particularly during the wet season when ground cover species identification is improved
- Undertake further analysis during future BTF monitoring and research to explore the relationship between individual grass species and combinations of grass species; and
- Undertake further analysis (such as a Principal Component Analysis) during future BTF monitoring and research that also considers the relationships between each habitat variable.



Appendix F Summary of baseline groundcover characteristics to assist with future management of grazing

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Background

The Carmichael Coal Mine and Rail Infrastructure Project comprises the Carmichael Coal Mine (open-cut and underground coal mine) and 189 km of rail line and associated infrastructure in the Galilee Basin of central Queensland. As a requirement of Commonwealth and State approval conditions, a Black-throated Finch (BTF) Management Plan (ELA 2018) has been developed for the project. The BTF Management Plan is specific to the coal mine component of the project and details management actions and monitoring requirements to mitigate potential impacts on BTF.

Management actions described in the plan include measures related to the management of grazing within the project area. Risks to BTF habitat associated with heavy grazing include decreased grass species richness and increased prevalence of annual grasses and unpalatable weeds. However, appropriately managed grazing may be beneficial for maintenance of BTF habitat within the project area, as it can prevent thickening of a woody shrub layer, open up the grass layer and increase the amount of bare ground which BTF use to forage. BTF foraging habitat must provide suitable seeds, which are principally of grasses, with fallen seeds accessible on the ground.

This memorandum outlines the results from a review of baseline (prior to mining) BTF habitat data collected at the project area. The data will be useful to monitor the influence of grazing on BTF habitat values, as described in the BTF Management Plan. Adani provided Eco Logical Australia (ELA) vegetation survey data collected across the project area by four consultants since 2012. Data was collated and assessed for its suitability to establish a baseline of groundcover conditions, with which future monitoring results can be compared.

Purpose

The purpose of this memorandum is to determine a baseline from the period of the project's Environmental Impact Statement (2011-2013), for the following key BTF habitat variables:

1. Groundcover, with specific reference to the percent cover of native grasses, litter and bare ground
2. Groundcover species composition; that is the number of native grass species
3. The fixed locations at which ongoing monitoring for comparison with the baseline will be conducted

Analysis of vegetation data (2012-2018)

A monitoring program is included in the BTF Management Plan with targeted BTF population surveys as well as a habitat assessment component. Habitat assessments include key ground layer characteristics relevant to BTF, including groundcover type (native perennial cover, litter and bare ground), proportion and composition (native grass species richness). The monitoring program includes seasonal surveys undertaken on a biannual basis, with ten surveys completed since 2013. Prior to this, in 2011 and 2012, some initial surveys were completed. However, the quantity and type of groundcover data collected was limited. In this regard, for the purposes of establishing a baseline for future comparisons, this analysis has focussed on data collected from May 2013 onwards.

A structured approach was used to determine the location of baseline monitoring sites established during the first two biannual surveys, completed in May and August 2013 by consultants GHD. Prior to the selection of sites by GHD, the project area was stratified by factors known to influence BTF presence or absence, including vegetation type, level of vegetation disturbance, elevation and distance to water. Monitoring sites were then located across the range of habitat types present within the project area, including habitat that is suitable and unsuitable for BTF. As explained in GHD (2013), the intent of targeting a range of habitat values was to gain an understanding of spatial variation in habitat use over time and to determine whether certain habitat areas are utilised by BTF more consistently than others.

A total of 67 monitoring sites were established during surveys undertaken in May and August 2013 (GHD 2014; **Table 1**). Repeat monitoring of all 67 sites was undertaken in October 2013 and a subset of these sites was monitored in December 2014 by consultants Niche. These fixed sites provide a suitable baseline of groundcover conditions across the project area. As seasonal variation can be expected in the results for various groundcover variables, data from surveys were allocated to a category of wet season (November to March) or dry season (April to October).

Table 1: Number of BTF habitat assessment sites monitored

Consultant	Date	Survey season	Number of habitat assessment sites
GHD (2014)	May 2013	Dry season	52
	August 2013	Dry season	15
	October 2013	Dry season	67
Niche (2015a, b; 2016a, b)	December 2014	Wet season	52

Surveys March 2015 to April 2018

The survey methodology was modified for surveys completed after December 2014, with the location of habitat assessments selected based on BTF presence. In this regard, monitoring sites departed from being fixed to a particular location, but rather established at sites where BTF were observed. The majority of habitat assessments were located in areas where BTF were observed to be foraging or where BTF nests were identified. In instances when the number of BTF records was low, additional habitat assessments were generally undertaken in areas of suitable habitat where a habitat assessment had not been completed previously, for the purpose of improving the spatial stratification of habitat assessment data.

A total of 95 unique habitat assessment sites were monitored during surveys between March 2015 and April 2018 (**Table 2**). A list of all monitoring site names from 2013 to 2018 are provided in **Appendix A**. A map showing the location of all monitoring sites from 2013 to 2018 are provided in **Appendix B**.

The objective of the revised approach from March 2015 was to collect data on the floristic characteristics of known BTF habitat (being utilised at the time of the survey). Information on known BTF habitat is important as it increases understanding of the habitat requirements, diet, nesting requirements and relationship between water sources and food sources specific to BTF within the project area. Data from these monitoring sites provides information on the groundcover conditions of areas that were observed to be actively used by BTF for foraging and/or nesting. However, data from these sites are not suitable to be used as a baseline for fixed sites to monitor groundcover over time. This is because establishment of the sites was stratified to areas of BTF habitat utilisation at the time of data collection, which presents a strong bias in the results. Future comparisons of these data should therefore be made with areas that are also observed to be used by BTF for foraging and/or nesting at the time of survey.

Table 2: Summary of BTF presence monitoring sites and number of monitoring sites assessed

Consultant	Date	Survey type	Number of habitat assessment sites
Niche (2015a, b; 2016a, b)	March 2015	Wet season	29
	August 2015	Dry season	18
	April 2016	Dry season	19
ELA (2017)	October 2016	Dry season	8
E2M (2017, 2018)	November 2017	Wet season	6
	April 2018	Dry season	15

Groundcover and ground composition baseline values

1. *Groundcover*

The groundcover component of the habitat assessment included an assessment of groundcover type and percentage cover within five 1 m² quadrats at each site. The results were then averaged to give a mean groundcover score for the site.

Groundcover data collected at each of the proposed baseline monitoring sites in 2013 and 2014 was analysed to determine the average score for each of the key BTF habitat characteristics. These include native perennial grass cover, non-native grass cover, litter and bare ground. These habitat characteristics have been selected as baseline values based on known BTF habitat requirements. These include areas with an appropriate density and diversity of grasses and patches of bare ground which provide access to fallen grass seeds which the species feeds on (at Extern 2011 & ELA, 2018).

A summary of all baseline data is provided in **Appendix C**. Average native perennial grass cover ranged between 12.8% and 50% during monitoring in 2013 (**Figure 1**). Native perennial grass cover was higher during monitoring in 2014, ranging between 24% and 85%. Such seasonal variations are consistent with those expected, with a higher percent cover of native grasses in the wet season than the dry season. Grazing management practices in 2013 and 2014 may also have influenced the result.

Non-native grass cover was highly variable during both the 2013 and 2014 survey periods. Non-native grass cover ranged between 0% and 22% during monitoring in 2013 and between 0% and 30% in 2014 (**Figure 2**). The number of sites where no non-native grass cover was recorded was a total of 12 sites in 2013 and 14 sites in 2014.

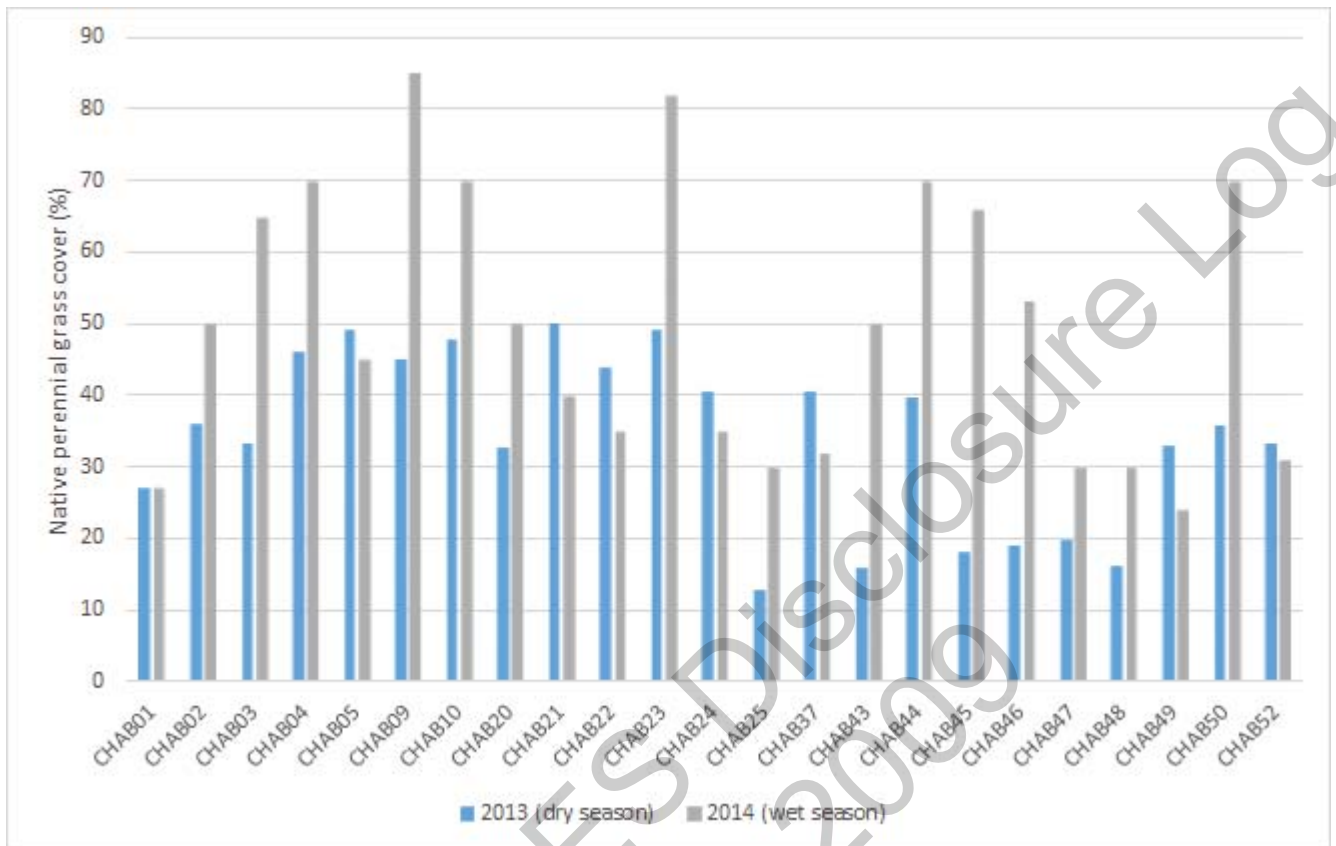


Figure 1: Native perennial grass cover at baseline monitoring sites in 2013 and 2014

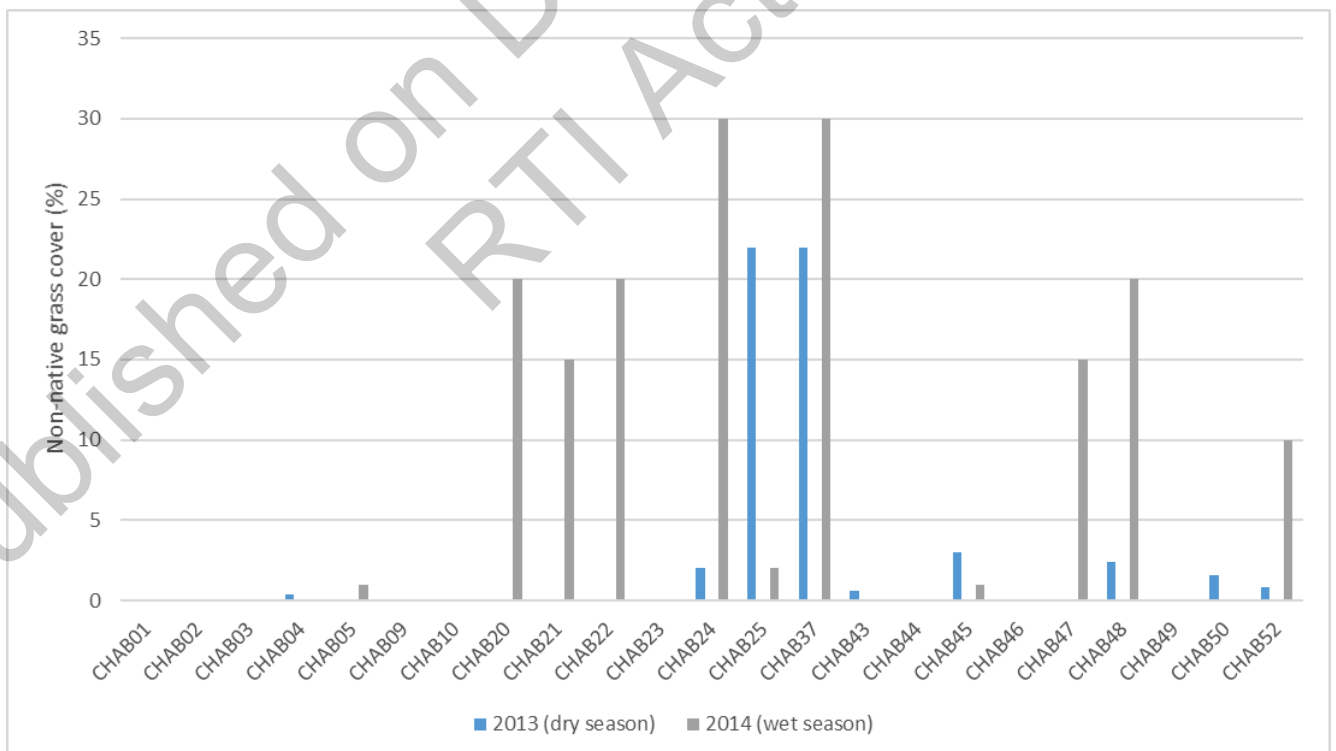


Figure 2: Non-native grass cover at baseline monitoring sites in 2013 and 2014

Litter cover was highly variable among sites during both survey periods (**Figure 3**). Litter cover ranged from 0% to 36.4% in 2013 and from 3% to 31% in 2014. Such results are as expected due to seasonal variation, with litter increasing during the dry season as grasses die back and trees lose their leaves.

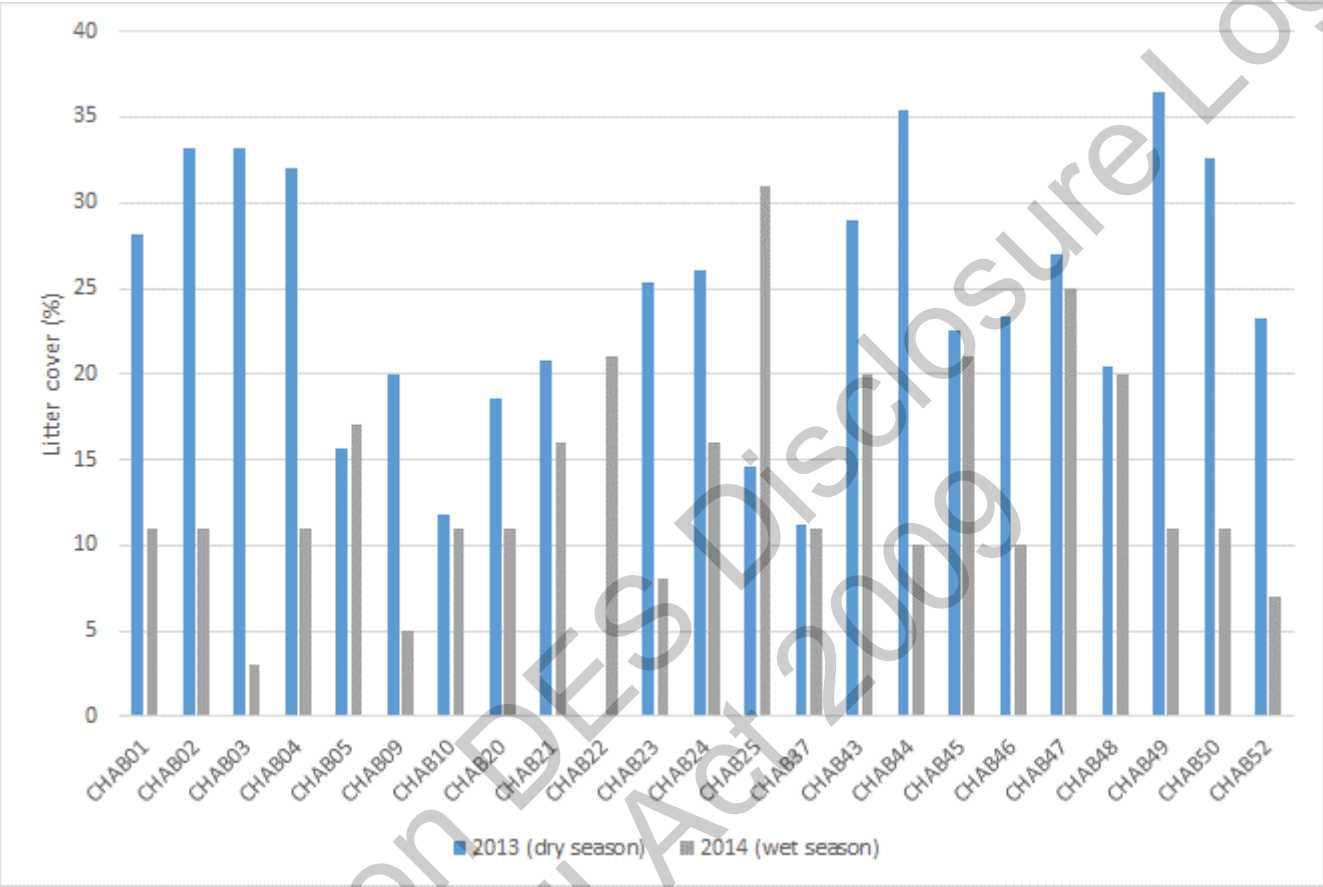


Figure 3: Litter cover at baseline monitoring sites in 2013 and 2014

The proportion of bare ground ranged between 17.6% and 57.2% in 2013 (**Figure 4**). The proportion of bare ground, ranged between 10% and 65% in 2014.

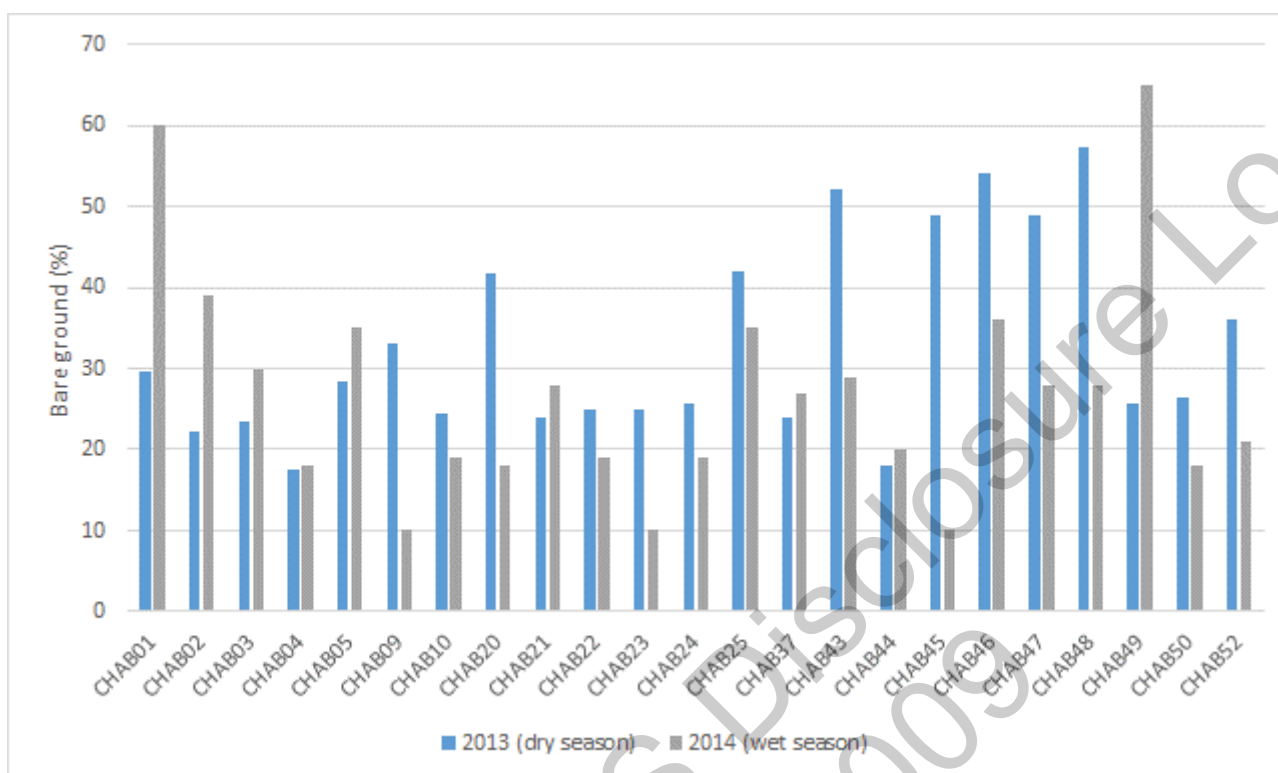


Figure 4: Proportion of bare ground at baseline monitoring sites in 2013 and 2014

The native perennial grass cover, non-native grass cover, litter and bare ground data for each proposed baseline monitoring site was averaged separately for the 2013 and 2014 survey periods to control for variation in the data due to seasonality (**Table 3**). As noted above, native perennial grass cover can be expected to increase during the wet season and decrease during the dry season. Litter can also be expected to be higher in the dry season than the wet season. Baseline results are consistent with these trends, and may also have been influenced by grazing management practices during 2013 and 2014.

Table 3: Average seasonal groundcover values at baseline monitoring sites in 2013 & 2014

Groundcover type	2013 Dry season survey average cover (%)	2014 Wet season survey average cover (%)
Native perennial grass cover	34.16 (Standard Deviation 12.1)	49.57
Non-native grass cover	2.38 (Standard Deviation 6.3)	7.13
Litter	23.50	13.83
Bare ground	32.77	27.04

2. Ground composition

The composition of the ground layer was assessed within the same five 1 m² quadrats at each site. Groundcover composition was assessed by recording the number of species in the ground layer within the plot. The results for each plot were then averaged to give a mean ground composition score for the site.

Native grass species richness ranged from 5 species to 14 species per monitoring site in 2013 (**Figure 5**). Native grass species richness ranged from 2 species to 5 species per monitoring site in 2014.

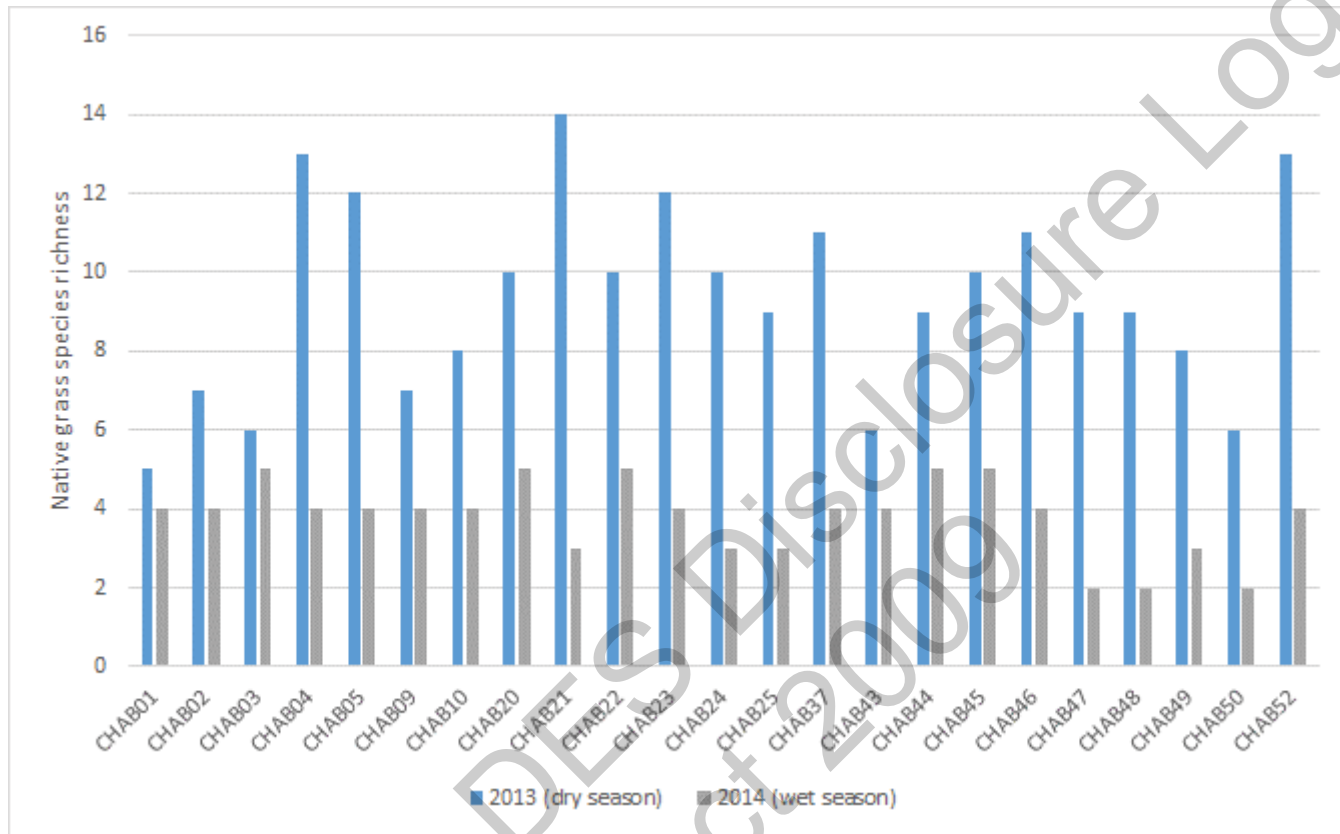


Figure 5: Number of species recorded at baseline monitoring sites in 2013 and 2014

The average number of species recorded at each monitoring site during the 2013 survey period (dry season) was much higher than the average number of species recorded during the 2014 survey period (wet season; **Table 4**). This may be due to varying seasonality of the survey periods, with monitoring conducted after the wet season in 2013 and in the early phase of the wet season in 2014. There was 197 mm of rainfall in the three months prior to the May 2013 survey. Rainfall records prior to the December 2014 survey are incomplete. The ability to identify many plants, particularly grasses, can vary greatly with seasonality as many grass species can only be identified to species level if reproductive material is present. It is likely that seasonal timing of the survey has affected the observed species diversity, particularly during the 2014 survey period.

Table 4: Average species diversity during the 2013 and 2014 survey periods

Monitoring variable	2013 Dry season survey average species richness	2014 Wet season survey average species richness
All groundcover species	15	6
Native grass species	9	4

Native and non-native grass species recorded at baseline monitoring sites during surveys in 2013 and 2014 are shown in **Table 5**. Percent cover data for grass species were recorded in 2013 only.

Buffel Grass

The non-native grass species *Cenchrus ciliaris* (Buffel Grass) was recorded at a total of nine sites in 2013 (average 5.87% cover) and at 13 sites in 2014 (out of a total of 23 sites). Buffel Grass is a potential threat to BTF habitat values as it can form a monoculture, reducing the diversity of native grasses utilised as foraging resources and colonising bare ground. Grazing can be an effective tool in managing Buffel Grass.

Table 5: Native and non-native grass species recorded at baseline monitoring sites during surveys in 2013 and 2014

Scientific name	Survey period	
	2013 Dry Season – average cover when present (%) and number of sites present	2014 Wet Season Present / Absent (% cover not recorded)
<i>Alloteropsis semialata</i>	0.2 (1 site)	
<i>Aristida calycina</i>	1.99 (16 sites)	
<i>Aristida contorta</i>	4.18 (8 sites)	✓
<i>Aristida holathera</i>	0.68 (5 sites)	
<i>Aristida hygrometrica</i>	1.00 (1 site)	
<i>Aristida ingrata</i>	2.80 (17 sites)	✓
<i>Aristida jerichoensis</i>	1.76 (5 sites)	✓
<i>Aristida latifolia</i>	1.07 (3 sites)	✓
<i>Aristida queenslandica</i>	1.20 (1 site)	
<i>Aristida</i> sp.	X	✓
<i>Bothriochloa ewartiana</i>	5.23 (12 sites)	
<i>Bothriochloa pertusa</i> *	0.80 (1 site)	
<i>Cenchrus ciliaris</i> *	5.87 (9 sites)	✓
<i>Chrysopogon fallax</i>	5.30 (16 sites)	✓
<i>Cleistochloa subjuncea</i>	1.80 (1 site)	
<i>Cymbopogon obtectus</i>	3.56 (8 sites)	
<i>Dichanthium sericeum</i>	0.80 (1 site)	
<i>Digitaria brownii</i>	1.78 (12 sites)	
<i>Digitaria divaricatissima</i>	0.53 (8 sites)	
<i>Digitaria</i> sp.	X	✓
<i>Enneapogon polyphyllus</i>	1.75 (11 sites)	
<i>Enneapogon robustissimus</i>	0.80 (1 site)	
<i>Enteropogon ramosus</i>	0.20 (1 site)	

Scientific name	Survey period	
	2013 Dry Season – average cover when present (%) and number of sites present	2014 Wet Season Present / Absent (% cover not recorded)
<i>Eragrostis lacunaria</i>	0.75 (4 sites)	
<i>Eragrostis</i> sp.	X	✓
<i>Eragrostis speciosa</i>	0.8 (1 site)	
<i>Eriachne mucronata</i>	3.03 (7 sites)	✓
<i>Eriachne</i> sp.	X	✓
<i>Heteropogon contortus</i>	8.86 (19 sites)	✓
<i>Imperata cylindrica</i>	X	✓
<i>Ischaemum australe</i>	X	✓
<i>Melinis repens</i> *	1.80 (1 site)	
<i>Panicum decompositum</i>	0.60 (1 site)	
<i>Panicum effusum</i>	0.90 (4 sites)	
<i>Sarga plumosum</i>	1.12 (5 sites)	✓
<i>Setaria plumosum</i>	X	✓
<i>Schizachyrium fragile</i>	1.20 (1 site)	
<i>Sehima nervosum</i>	4.31 (9 sites)	
<i>Sporobolus australasicus</i>	X	✓
<i>Themeda avenacea</i>	0.60 (2 sites)	
<i>Themeda triandra</i>	6.22 (11 sites)	✓
<i>Triodia pungens</i>	11.03 (13 sites)	✓
<i>Tripogon loliiformis</i>	1.07 (6 sites)	

*non-native species

3. Proposed baseline monitoring sites

A total of 23 fixed monitoring sites have been selected as baseline habitat monitoring sites, to assist in the management of BTF habitat in areas subject to grazing. The 23 sites have been selected as a subset of the 52 sites established in May 2013, for consistency. The sites represent an even spread across the mining leases, both north and south of the Carmichael River. They include areas that are not proposed to be impacted by mining activities, as well as areas that will be impacted by mining activities.

The proposed baseline sites are spatially distributed across the project area (see **Appendix B**) and are listed as follows:

- Unmined areas - CHAB20, CHAB21, CHAB43, CHAB49 and CHAB50.
- Mine areas - CHAB02, CHAB03, CHAB22, CHAB23, CHAB24, CHAB25, CHAB37, CHAB45, CHAB47, CHAB48, CHAB52 (Open cut disturbance areas) and CHAB01, CHAB04, CHAB05, CHAB09, CHAB10, CHAB44 and CHAB46 (Underground disturbance areas).

These 23 sites are appropriate to use for long-term monitoring to demonstrate that BTF habitat is being maintained within the project area. These sites have been selected to provide data on a range of habitat types and quality throughout the project area.

Monitoring has been undertaken at these baseline monitoring sites on three occasions, in May and October 2013 and in December 2014. Data for the October 2013 survey period is not available, so only data from the May 2013 (Wet Season) and December 2014 (Dry Season) survey periods has been included in this analysis.

Data from 2012 and from the period 2015 to 2018 is not suitable for the establishment of long-term monitoring sites at fixed locations. However, these data will be useful for other purposes, including determining the characteristics of habitat being actively utilised by BTF at the time of future surveys for foraging and nesting.

Summary and Conclusions

Ten biannual seasonal monitoring surveys have been undertaken across the Carmichael Coal Mine project area since 2013, utilising a range of monitoring methods. A total of 52 baseline monitoring sites were established in May 2013 to assess BTF habitat quality across the project area. Repeated monitoring was undertaken at these sites in October 2013 and December 2014. A subset of these sites has been selected for ongoing monitoring and establishing a baseline, for the purpose of demonstrating the maintenance of BTF habitat values within the project mining leases.

After December 2014, the habitat assessment methodology was modified to focus on areas where BTF were observed to be feeding and nesting at the time of the survey. These sites were not fixed, but established to capture data on BTF habitat being actively used on the day of the survey. Data from these subsequent sites are considered unsuitable for use as fixed baseline monitoring sites as they are biased to areas of active feeding or nesting of BTF at the time of the survey. Comparisons of these data with those collected in a similar manner at other locations in the future are likely to be useful to understand the salient features of BTF habitat within the project area. Data collected in 2012 also had limited application to the objective of establishing a baseline for long-term monitoring of groundcover conditions.

An analysis of groundcover and ground composition data collected at the proposed baseline monitoring sites during the May 2013 and December 2014 indicates that the following baseline targets would be appropriate (averaged across all sites):

- 34% cover native perennial grass cover (minimum). Baseline standard deviation is 12.1%
- 27% bare ground
- four native grass species per site (minimum)
- 2.4% native perennial forb cover
- 1.8% native annual grass and forbs

Some seasonal variability in the results are to be expected, with higher native perennial grass cover and native grass species richness following periods of rainfall during warm seasonal conditions.

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Appendix A: Monitoring Sites

Habitat condition monitoring sites assessed during Black-throated Finch monitoring surveys 2013 - 2018

Sites Monitored	GHD			Niche				ELA	E2M	
	May 2013	August 2013	October 2013	December 2014	March 2015	August 2015	April 2016	October 2016	November 2017	April 2018
CHAB01	✓		✓	✓						
CHAB02	✓		✓	✓						
CHAB03	✓		✓	✓						
CHAB04	✓		✓	✓						
CHAB05	✓		✓	✓						
CHAB06	✓		✓	✓						
CHAB07	✓		✓	✓						
CHAB08	✓		✓	✓						
CHAB09	✓		✓	✓						
CHAB10	✓		✓	✓						
CHAB11	✓		✓	✓						
CHAB12	✓		✓	✓						
CHAB13	✓		✓	✓						
CHAB14	✓		✓	✓						
CHAB15	✓		✓	✓						
CHAB16	✓		✓	✓						
CHAB17	✓		✓	✓						
CHAB18	✓		✓	✓						
CHAB19	✓		✓	✓						
CHAB20	✓		✓	✓						

Sites Monitored	GHD			Niche				ELA	E2M	
	May 2013	August 2013	October 2013	December 2014	March 2015	August 2015	April 2016	October 2016	November 2017	April 2018
CHAB21	✓		✓	✓						
CHAB22	✓		✓	✓						
CHAB23	✓		✓	✓						
CHAB24	✓		✓	✓						
CHAB25	✓		✓	✓						
CHAB26	✓		✓	✓						
CHAB27	✓		✓	✓						
CHAB28	✓		✓	✓						
CHAB29	✓		✓	✓						
CHAB30	✓		✓	✓						
CHAB31	✓		✓	✓						
CHAB32	✓		✓	✓						
CHAB33	✓		✓	✓						
CHAB34	✓		✓	✓						
CHAB35	✓		✓	✓						
CHAB36	✓		✓	✓						
CHAB37	✓		✓	✓						
CHAB38	✓		✓	✓						
CHAB39	✓		✓	✓						
CHAB40	✓		✓	✓						
CHAB41	✓		✓	✓						
CHAB42	✓		✓	✓						
CHAB43	✓		✓	✓						

Sites Monitored	GHD			Niche				ELA	E2M	
	May 2013	August 2013	October 2013	December 2014	March 2015	August 2015	April 2016	October 2016	November 2017	April 2018
CHAB44	✓		✓	✓						
CHAB45	✓		✓	✓						
CHAB46	✓		✓	✓						
CHAB47	✓		✓	✓						
CHAB48	✓		✓	✓						
CHAB49	✓		✓	✓						
CHAB50	✓		✓	✓						
CHAB51	✓		✓	✓						
CHAB52	✓		✓	✓						
CHAB53		✓	✓							
CHAB54		✓	✓							
CHAB55		✓	✓							
CHAB56		✓	✓							
CHAB57		✓	✓							
CHAB58		✓	✓							
CHAB59		✓	✓							
CHAB60		✓	✓							
CHAB61		✓	✓							
CHAB62		✓	✓							
CHAB63		✓	✓							
CHAB64		✓	✓							
CHAB65		✓	✓							
CHAB66		✓	✓							

Sites Monitored	GHD			Niche				ELA	E2M	
	May 2013	August 2013	October 2013	December 2014	March 2015	August 2015	April 2016	October 2016	November 2017	April 2018
CHAB67		✓	✓							
CFS1					✓					
CFS2					✓					
CFS3					✓					
CFS4					✓					
CFS5					✓					
CFS6					✓					
CFS7					✓					
CFS8					✓					
CFS9					✓					
CFS10					✓					
CFS11					✓					
CFS12					✓					
CFS13					✓					
CFS14					✓					
CFS15					✓					
CFS16					✓					
CFS17					✓					
CFS18					✓					
CFS19					✓					
CFS20					✓					
CFS21					✓					
CFS22					✓					

Sites Monitored	GHD			Niche				ELA	E2M	
	May 2013	August 2013	October 2013	December 2014	March 2015	August 2015	April 2016	October 2016	November 2017	April 2018
CFS23					✓					
CFS24					✓					
CFS25					✓					
CFS26					✓					
CFS27					✓					
CFS28					✓					
CFS29					✓					
CFS30						✓				
CFS31						✓				
CFS32						✓				
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CFS36						✓				
CFS37						✓				
CFS38						✓				
CFS39						✓				
CFS40						✓				
CFS41						✓				
CFS42						✓				
CFS43						✓				
CFS44						✓				
CFS45					File A	✓				

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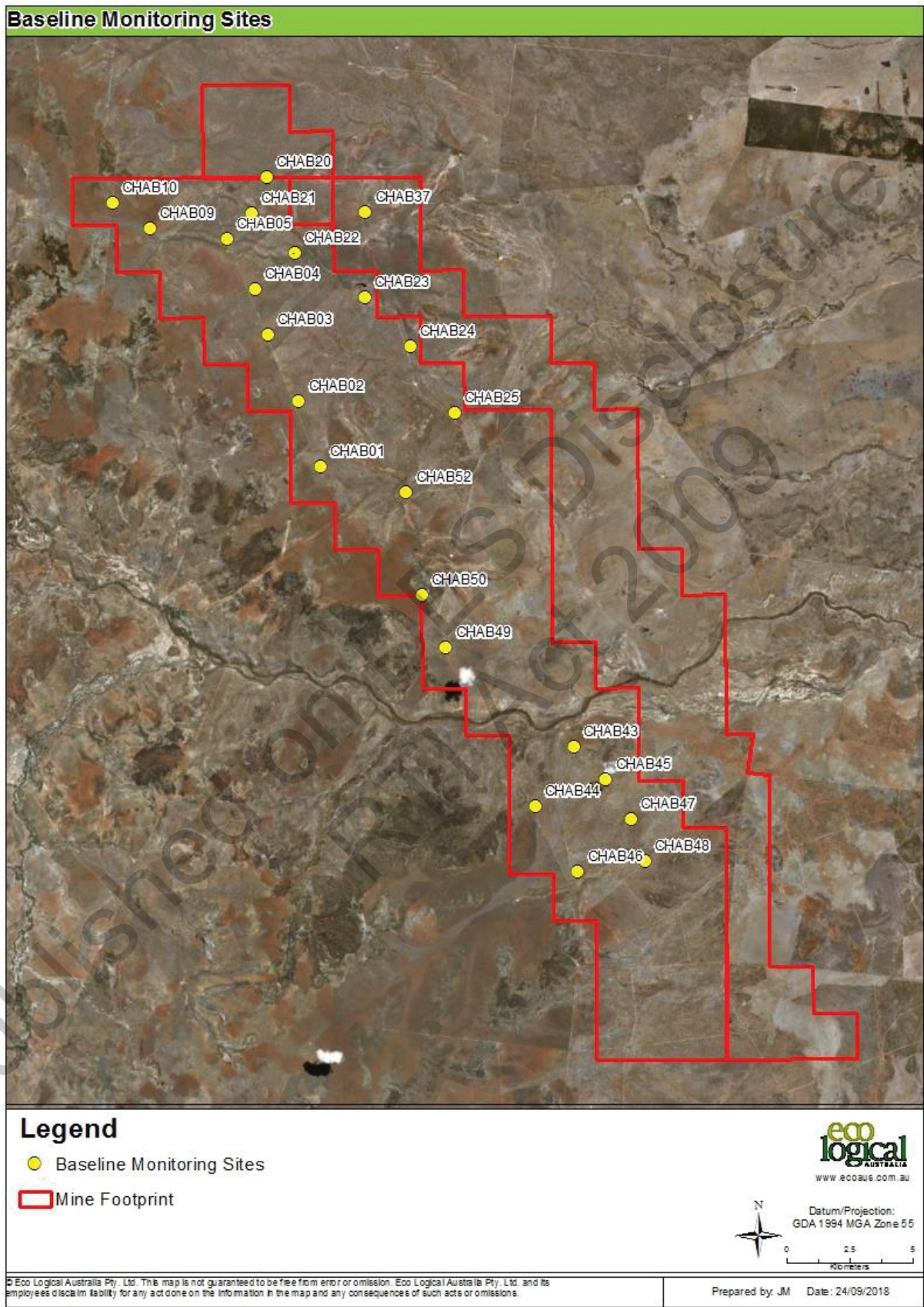
Page 1

Sites Monitored	GHD			Niche				ELA	E2M	
	May 2013	August 2013	October 2013	December 2014	March 2015	August 2015	April 2016	October 2016	November 2017	April 2018
CFS46						✓				
CFS47						✓				
CFS48							✓			
CFS49							✓			
CFS50							✓			
CFS51							✓			
CFS52							✓			
CFS53							✓			
CFS54							✓			
CFS55							✓			
CFS56							✓			
CFS57							✓			
CFS58							✓			
CFS59							✓			
CFS60							✓			
CFS61							✓			
CFS62							✓			
CFS63							✓			
CFS64							✓			
CFS65							✓			
CFS66							✓			
CVN1								✓		
CVN2								✓		

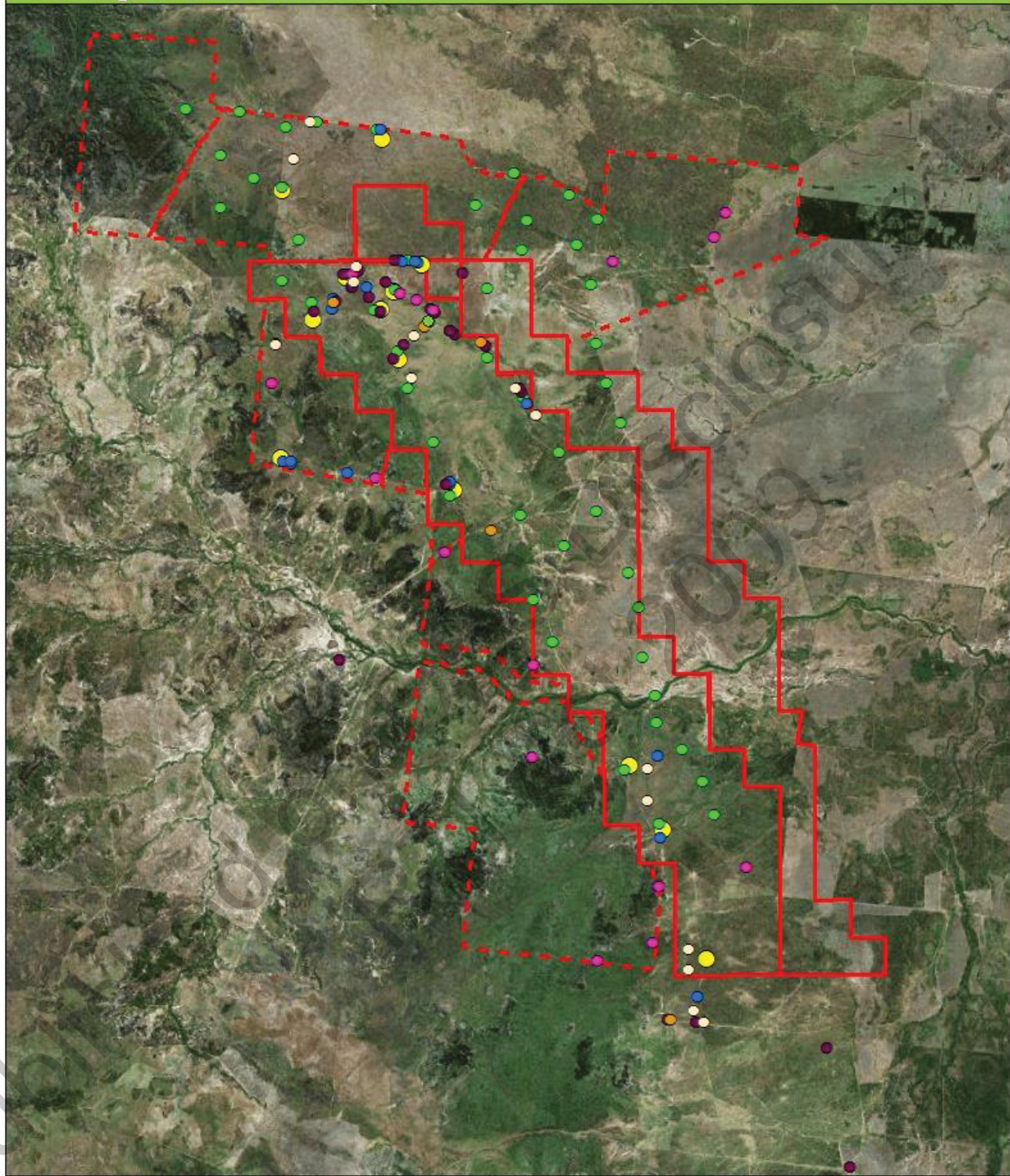
Sites Monitored	GHD			Niche				ELA	E2M	
	May 2013	August 2013	October 2013	December 2014	March 2015	August 2015	April 2016	October 2016	November 2017	April 2018
CVN3								✓		
CVN4								✓		
CVN5								✓		
CVN6								✓		
CVN7								✓		
CVN8								✓		
VP01									✓	
VP02									✓	
VP03									✓	
VP04									✓	
VP05									✓	
VP06									✓	
1										✓
2										✓
3										✓
4										✓
5										✓
6										✓
7										✓
8										✓
9										✓
10										✓
11 RTI 18-378					File A					✓ Page 198 of 631

Sites Monitored	GHD			Niche				ELA	E2M	
	May 2013	August 2013	October 2013	December 2014	March 2015	August 2015	April 2016	October 2016	November 2017	April 2018
12										✓
13										✓
14										✓
15										✓
Total sites monitored:	52	15	67	52	29	18	19	8	6	15

Appendix B: Maps – 23 fixed monitoring sites (this page) and other sites (next page)



Monitoring sites 2013 - 2018



Legend

- GHD - May + October 2013 & Niche - December 2014
- Niche - March 2015
- Niche - August 2015
- Niche - April 2016
- ELA - October 2016
- E2M - November 2017
- E2M - April 2018
- ▭ Mine Footprint
- ▭ IMDW Boundary Final

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Prepared by: JM Date: 20/09/2018

Appendix C – Baseline data summary (only available for May 2013 and December 2014 surveys)

Baseline monitoring sites groundcover data analysis – May 2013

Groundcover type (%)	Monitoring site																								
	CHAB01	CHAB02	CHAB03	CHAB04	CHAB05	CHAB09	CHAB10	CHAB20	CHAB21	CHAB22	CHAB23	CHAB24	CHAB25	CHAB37	CHAB43	CHAB44	CHAB45	CHAB46	CHAB47	CHAB48	CHAB49	CHAB50	CHAB52	Average	SD
Native perennial grass cover – tussock	10.8	25.0	27.4	20.6	36.8	21.8	40.6	15.8	50.0	43.2	49.2	40.6	12.8	37.6	15.8	27.8	18.2	16.2	19.8	16.2	33.0	32.8	33.4	28.1	11.9
Native perennial grass cover – hummock	16.4	11.0	6.0	25.4	12.4	23.2	7.2	17.0	0.0	0.8	0.0	0.0	0.0	3.0	0.0	12.0	0.0	2.8	0.0	0.0	0.0	3.0	0.0	6.1	8.0
Native perennial forb cover	5.4	2.2	1.4	1.4	4.8	0.4	5.8	2.0	2.4	1.4	0.8	3.4	1.0	1.6	2.4	1.8	4.4	2.2	1.0	2.6	3.6	1.2	2.2	2.4	1.5
Native annual grass and forbs	5.6	5.8	6.6	1.6	0.4	0.6	3.0	4.4	0.8	0.0	1.2	1.6	0.6	0.0	0.0	0.4	1.6	1.4	1.2	3.2	0.8	0.0	0.0	1.8	2.0
Non-native grass	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	22.0	22.0	0.6	0.0	3.0	0.0	0.0	2.4	0.0	1.6	0.8	2.4	6.3
Litter (<10cm diameter)	28.2	33.2	33.2	32.0	15.6	20.0	11.8	18.6	20.8	0.0	25.4	0.0	14.0	11.2	27.0	35.4	20.6	23.4	27.0	20.4	36.4	32.6	23.2	22.2	10.2
Litter (> 10cm diameter)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.0	0.6	0.0	2.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	5.4
Rock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	6.1
Bare ground	29.6	22.2	23.4	17.6	28.4	33.0	24.4	41.8	24.0	25.0	25.0	25.8	42.0	24.0	52.2	18.0	49.0	54.0	49.0	57.2	25.8	26.4	36.0	32.8	12.2

Baseline monitoring sites groundcover data analysis – December 2014

Groundcover type (%)	Monitoring site																								
	CHAB01	CHAB02	CHAB03	CHAB04	CHAB05	CHAB09	CHAB10	CHAB20	CHAB21	CHAB22	CHAB23	CHAB24	CHAB25	CHAB37	CHAB43	CHAB44	CHAB45	CHAB46	CHAB47	CHAB48	CHAB49	CHAB50	CHAB52	Average	SD
Native perennial grass cover – tussock	10	20	25	15	40	35	30	40	40	30	80	34	30	30	50	35	66	28	30	30	24	40	30	34.4	15.1
Native perennial grass cover – hummock	17	30	40	55	5	50	40	10	0	5	2	1	0	2	0	35	0	25	0	0	0	30	1	15.1	18.5
Native perennial forb cover	2	0	2	0	2	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	0	0	30	1.7	6.2
Native annual grass and forbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Non-native grass	0	0	0	0	1	0	0	20	15	20	0	30	2	30	0	0	1	0	15	20	0	0	10	7.1	10.4
Litter (<10cm diameter)	10	10	2	10	16	5	10	10	15	20	7	15	30	10	15	10	20	8	20	15	10	10	5	12.3	6.2
Litter (> 10cm diameter)	1	1	1	1	1	0	1	1	1	1	1	1	1	1	5	0	1	2	5	5	1	1	2	1.5	1.4
Rock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Bare ground	60	39	30	18	35	10	19	18	28	19	10	19	35	27	29	20	10	36	28	28	65	18	21	27.0	14.0



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Black-throated Finch Management Plan

Carmichael Coal Mine and Offsite Infrastructure

Prepared for
Adani Mining Pty Ltd

October 2018



DOCUMENT TRACKING

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Abbreviations

Abbreviation	Description
Adani	Adani Mining Pty Ltd
BioCondition	A vegetation condition assessment tool which provides a measure of how well a terrestrial ecosystem is functioning for the maintenance of biodiversity values at a local or property scale.
BOS	Biodiversity Offset Strategy
BTF	Black-throated Finch
CEMP	Construction Environmental Management Plan
CG	Coordinator-General
DES	Queensland Department of Environment and Science (formerly known as the Department of Environment and Heritage Protection (DEHP))
DoE	Commonwealth Department of the Environment
EA	Environmental Authority issued under the <i>Environmental Protection Act 1994</i>
EIS	Environmental Impact Statement
ELA	Eco Logical Australia Pty Ltd
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
EPBC Approval	Approval granted by the Commonwealth under the EPBC Act
ER	Environmental Representative
MNES	Matters of National Environmental Significance, as defined under the EPBC Act
MNESMP	Matters of National Environmental Significance plan/s for the management of direct and indirect impacts of mining operations
NC Act	<i>Queensland Nature Conservation Act 1992</i>
NGBR	North Galilee Basin Rail Project; a 311 km section of the Carmichael Rail Network located between Mistake Creek and the Port of Abbot Point
OEMP	Operations Environmental Management Plan
RE	Regional Ecosystem
SDPWO Act	<i>State Development and Public Works Organisation Act 1971</i> (Queensland).
SEIS	Supplementary Environmental Impact Statement, prepared in response to comments on the draft EIS.
SMP	Species Management Plan
SP1	Separable Portion 1; a 77 km section of the Carmichael Rail Network located between the Carmichael Mine and Mistake Creek
TEC	Threatened Ecological Community as defined under the EPBC Act
VMP	Vegetation Management Plan

1 Introduction

1.1 Background

Eco Logical Australia (ELA) has been engaged by Adani Mining Pty Ltd (Adani) to develop a Black-throated Finch (BTF) Management Plan for the construction and operation of the Carmichael Coal Mine and Rail Infrastructure Project in the Galilee Basin of central Queensland. The Carmichael Coal Mine and Rail Infrastructure Project is one of two components of the overall project proposed by Adani, which includes:

1. Carmichael Coal Mine and Rail Infrastructure Project, comprising the Carmichael Coal Mine (open cut and underground coal mine) and 189 km of rail link and associated infrastructure; and
2. North Galilee Basin Rail (NGBR) Project, comprising 310 km of rail from approximately 70 km east of the Carmichael Mine, to the Port of Abbot Point.

The Carmichael Coal Mine and Rail Project and the NGBR Project have been assessed by the Commonwealth and Queensland governments through separate Environmental Impact Statement (EIS) processes. Conditional approval of the Carmichael Coal Mine and Rail Project was granted by the Queensland Coordinator-General on 8 May 2014 and the Commonwealth Minister for the Environment on 14 October 2015 (EPBC 2010/5736). Conditional approval of the NGBR Project was granted by the Queensland Coordinator-General on 12 August 2014 and the Commonwealth Minister for the Environment on 14 October 2015 (EPBC 2013/6885).

The development of a BTF Management Plan is a requirement of the Commonwealth and Queensland approval conditions (refer to **Section 1.5** of this document), to protect BTF and its habitat from avoidable impacts associated with the mine and rail projects.

1.2 Scope and purpose of management plan

This BTF Management Plan is specific to the Carmichael Coal Mine and associated infrastructure component of Adani's overall mine and rail project. This document is a BTF Management Plan for the Carmichael Coal Mine (which includes open cut and underground mining) and required associated infrastructure which includes workers' accommodation, an airport, and water supply infrastructure. These combined components of the development are hereafter referred to as the Project (**Figure 1**). The management plan describes the proposed management of direct and indirect impacts of mining operations on BTF which will be implemented throughout the Project.

The management of the BTF for the rail link component of the Carmichael Coal Mine and Rail Project and the NGBR are addressed in separate documents. Additionally, Species Management Plans for other threatened species and ecological communities, groundwater dependent ecosystems are also addressed in separate documents.

The purpose of the BTF Management Plan is to meet the conditions of approval granted by the Queensland and Commonwealth governments, and commitments made by Adani in securing these approvals. The BTF Management Plan is consistent with relevant guidelines and policies on the protection of Matters of National Environmental Significance (MNES) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and the management of threatened species listed under the Queensland *Nature Conservation Act 1992* (NC Act).

The BTF Management Plan details the management actions and monitoring requirements for the Carmichael Mine to minimise and mitigate impacts prior to and during construction. Management and monitoring actions apply to mining-related activities across the Project area, including those conducted on ML70505, ML70506 and ML70441. Conceptually, the adaptive management approach to be implemented applies to areas that will be disturbed by mining activities, areas of mining leases where no mining impacts are proposed, and offset areas where BTF habitat will be improved ([Figure 1](#)).

However, in relation to the management of offset areas, it should be noted that a detailed Offset Area Management Plan: Moray Downs West (OAMP; C02 2017), has been developed with specific management actions to achieve offsets for a range of environmental values, including BTF. While the BTF management plan includes some reference to management of the offset area, reference should be made to the OAMP for details of specific management actions.

Objectives of the BTF Management Plan are as follows:

- Describe management objectives, performance criteria and practical measures (management actions) to mitigate impacts of the Project on BTF
- Describe monitoring measures that will be implemented to assess the effectiveness of mitigation measures, and inform adaptive management actions
- Describe triggers for the implementation of adaptive management and corrective actions
- Provide a consistent framework across the Project for the mitigation of risks to BTF
- Collate relevant Project commitments relating to mitigation and monitoring of BTF ecological values, to assist in streamlining their implementation, the monitoring of compliance and reporting
- Achieve consistency with other management plans for the Project, related to biodiversity offsets, groundwater dependent ecosystems, construction activities and operations
- Achieve compliance with relevant Commonwealth and Queensland approval conditions ([Appendix D](#)).

As required under Condition 16a) to c) and 18 of the EA the BTF Management Plan includes a BTF Research Program ([Appendix C](#)). The purpose of the BTF Research Program is to increase the knowledge of the ecological requirements of BTF populations within and adjacent to the Carmichael Coal Mine and by doing so, inform and improve management of the local populations. The Research Program outlines the studies to be undertaken to identify:

- Specific nesting and feeding requirements of the species
- Whether BTF in the Project Area are sedentary, local migratory or regionally migratory
- Any changes in of classification and / or impact on BTF habitat
- The relationship between water sources, woody habitat and food sources
- Population dynamics, including dietary requirements, home range, nesting requirements
- Responses of the BTF and its habitat to grazing management practices, fire management practices and water body locations

The Research Program will primarily focus on studies that will provide results and information that facilitate improving suitable BTF habitat within the Moray Downs West offset area as well as habitat within ML70506 where no impacts from mining are proposed.

1.3 Relationship with other management plans

Other plans and strategies have been developed and there will be some interaction among the outputs during construction and operation, as illustrated in [Figure 2](#).

This BTF Management Plan has been prepared to be consistent, where appropriate, with the following management plans:

- Biodiversity Offset Strategy for the Carmichael Coal Mine and Rail Project
- Moray Downs West Offset Area Management Plan
- Species Management Plan for the Carmichael Coal Mine
- Environment Management Plan for the Carmichael Coal Mine (Mine; for both construction and operations)
- Groundwater Dependent Ecosystems Management Plan for the Carmichael Coal Mine.

Other management plans will also be developed and implemented where required as part of the mine and offsite infrastructure construction and operation, and align with this plan.

This BTF Management Plan should not be confused with a Species Management Program required under the *Nature Conservation Act 1992*, for tampering with a protected animal breeding place in Queensland. A Species Management Program authorises activities that will impact on breeding places of animals protected under the *Nature Conservation Act 1992*. Adani will undertake a survey of animal breeding places prior to clearing activities and develop a Species Management Program for approval, consistent with guidelines provided by the Queensland Department of Environment and Science (DES).

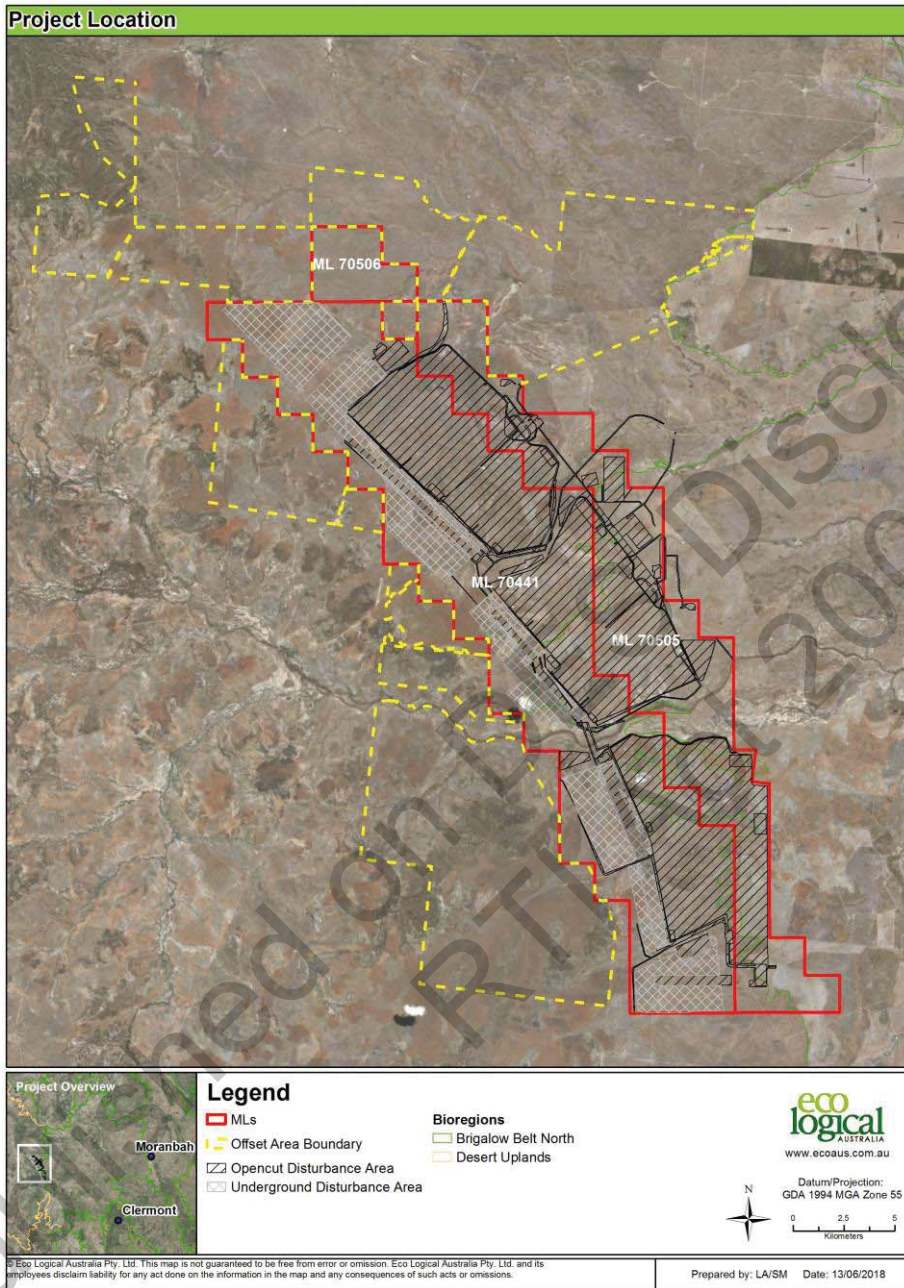


Figure 1 Project Location

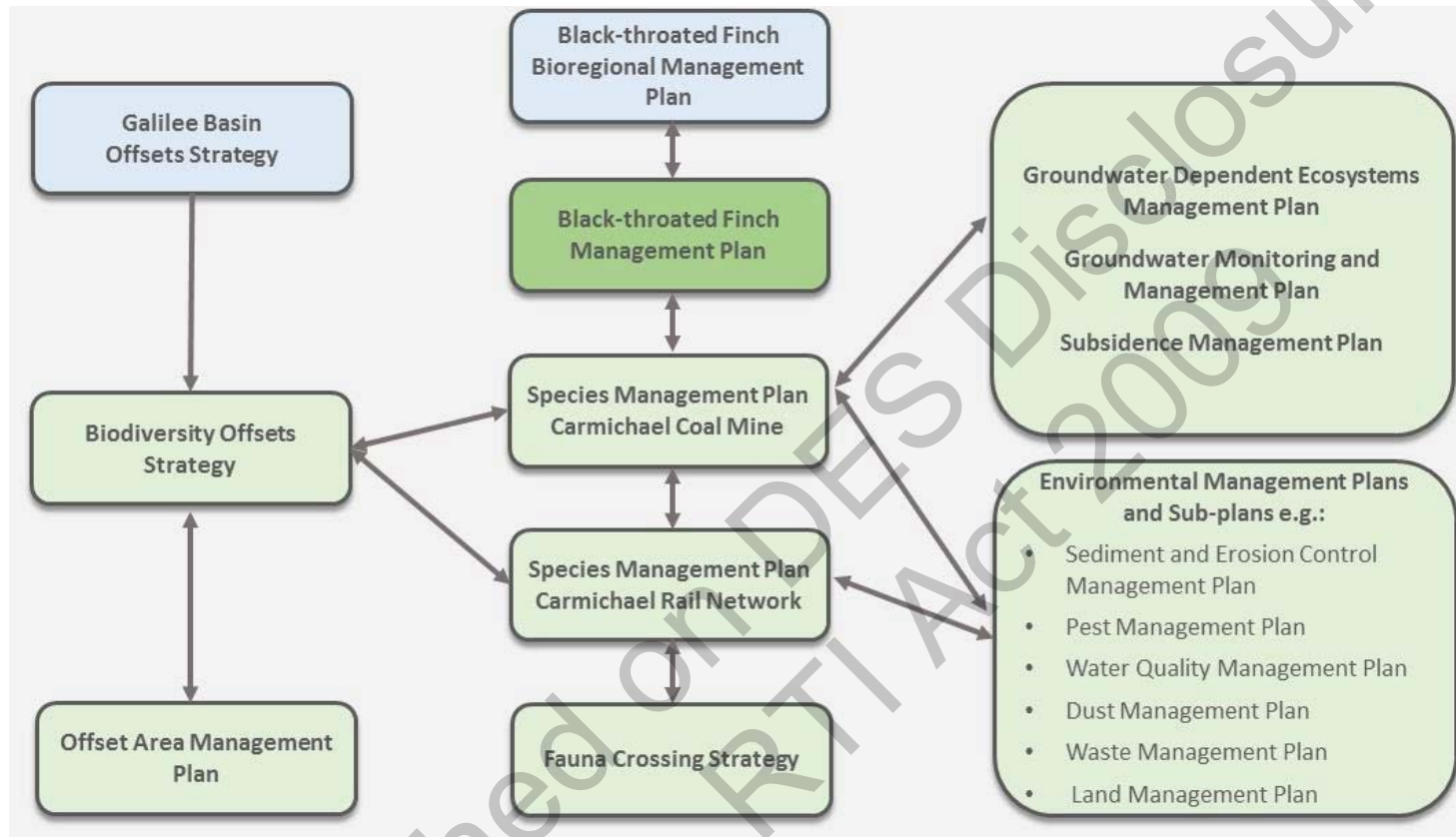


Figure 2 Flow chart showing the interactions among examples of key management plans and sub-plans for the Carmichael Coal Mine. The BTF Management Plan is shaded green, with regional plans and strategies covering multiple projects shaded blue.

1.4 Structure of this report

This report has been structured to address the requirements of relevant approval conditions and to facilitate practical implementation of management measures 'on the ground'. A summary of key sections is provided below:

- A contextual description of the Project (**Section 2**)
- Overview of the legislative framework and approval conditions to be addressed within the BTF Management Plan (**Section 3**)
- General description of BTF ecology and known threats to the sub-species (**Section 4**)
- Adaptive management framework (**Section 5**)
- Mitigation and management measures for BTF (**Section 6**)
- Monitoring Program for BTF (**Section 7**)
- A discussion of the key outcomes of the management planning process (**Section 8**)
- Arrangements for reporting and monitoring compliance with Species Management Plan actions (**Section 9**)
- A register of key mitigation and monitoring commitments within the Species Management Plan (**Section 10**)

Appendix A provides an overview of project management plans, **Appendix B** shows the location of sites where monitoring will be conducted during BTF surveys and the BTF Research Program is provided in **Appendix C**. **Appendix E** provides a summary of the results of baseline research on BTF nesting and foraging habitat. **Appendix F** provides a summary of baseline groundcover characteristics to assist with future management of grazing.

1.5 Compliance with approval conditions

Compliance matrices indicating where approval conditions and commitments relevant to the BTF Management Plan have been addressed within this report are outlined in **Appendix D**.

1.6 Environmental setting

The Carmichael Coal Mine is located in central Queensland within the Burdekin catchment. It covers the boundary of the Brigalow Belt and Desert Uplands bioregions of Queensland. The Brigalow Belt North and Desert Uplands bioregions are semi-arid, and located in the tropics where summer rainfall dominates, with distinct wet and dry seasons.

The Brigalow Belt North Bioregion is a large and complex area characterised by clay soils with forests and woodlands dominated by Brigalow (*Acacia harpophylla*), eucalypts and grasslands. The general land types include undulating rugged ranges to alluvial plains. **Removed at External Review** The Desert Uplands Bioregion is characterised by sandstone ranges and sand plains, with thick eucalypt and acacia woodlands, often with a spinifex understory **at External Review** (2008). Each of these bioregions is further divided into subregions based on land forms.

The Project Area is located in the Belyando Downs subregion of the Brigalow Belt North Bioregion, and the Alice Tableland subregion of the Desert Uplands. The dominant vegetation communities in these subregions are Silver-leaved Ironbark (*Eucalyptus melanophloia*) and Poplar Box (*E. populnea*) woodlands on alluvial deposits, and Lancewood (*Acacia shirleyi*) and Bendee (*A. catenulata*) woodlands on rocky hills and sandstone ranges **Removed at External Review** (1999). The Brigalow Belt North Bioregion is also dominated by Brigalow and Gidgee (*A. cambagei*) woodlands on fine soils, and Queensland Bluegrass (*Dichanthium sericeum*) grasslands on alluvial deposits; whilst the northern reaches of the

Alice Tablelands are dominated by White's Ironbark (*E. whitei*) and Reid River Box (*E. brownie*; Sattler and Williams 1999).

The predominant land use of the region is beef cattle grazing, which covers over 90% of the total area (2008). Other land uses include conservation and minimal use, forestry, dryland agriculture, horticulture, mining, and urban centres (2009). There are few major urban centres in the region, with the largest being Bowen, Barcaldine, Collinsville, Alpha, Clermont, and Pentland (2008).

The mine is located within the Carmichael River sub-catchment of the Belyando Basin in the Burdekin Catchment. The Belyando Basin is characterised by generally low relief floodplains drained by braided channels and surrounded by wide alluvial plains (2009).

1.7 Method

Utilising outcomes of previous monitoring surveys conducted during and post the EIS, a team of experienced ecologists was established with local knowledge of the Project Area to develop an effective approach to BTF management (this document). The BTF Management Plan was developed with guidance from relevant Commonwealth and State approval conditions, other legislative requirements for native flora and fauna, relevant species recovery plans occurring within the Project Area, and best-practice approaches to species management. The following key steps were taken to develop the management plan for BTF:

- A review of the ecological requirements relating to BTF was conducted, drawing upon the EIS studies, surveys completed after the EIS, published literature and relevant database searches
- The impacts from a range of activities associated with construction and operation of the Project were considered, including vegetation clearing, subsidence, mine dewatering, earthworks, the generation of noise and vibration, emissions such as dust, light spill and other visual impacts, stream diversion and flood levees and the spread of weed and pest species.
- Measures to mitigate the impacts of the Project on BTF were described, including at locations adjacent to areas of direct disturbance. Mitigation measures were informed by commitments within the EIS and associated Project approvals, and the technical knowledge and experience of ecologists developing this management plan.
- An approach to monitoring BTF was developed for a variety of project stages. These included before the commencement of work (baseline monitoring and pre-clearance surveys), monitoring of impacts during construction, assessing recovery post-construction and monitoring the impacts of ongoing operations.
- Goals, triggers and corrective actions were developed for mitigation measures, to establish a framework of adaptive management for BTF with the potential to be affected by the Project.
- An ongoing system of monitoring was described to determine the effectiveness of the mitigation measures.

Consideration was also given to the potential for impacts at a landscape level and groups of similar species, as Project impacts may not necessary be manifested on individual BTF or species in isolation.

2 Project Description

2.1 Project overview

The Project involves construction of a greenfield coal mine in the Galilee Basin over Mining Leases 70441, 70505 and 70506. The mine site is located approximately 160 km north-west of Clermont, with mining to be conducted using both open cut and underground mining methods. Offsite infrastructure to support the mine will include a workers accommodation village, a permanent airport site and water supply infrastructure (associated infrastructure). The total disturbance area will be approximately 28,000 ha for the mine and 1,300 ha for the offsite infrastructure. Coal will be transported by rail to the Port of Abbot Point for export. The operational mine life will be approximately 60 years, with a production rate peaking at 60 Mtpa.

The open cut mine will have a capacity of 40 Mtpa and will be located along the eastern section of Mining Lease 70441. The open cut mine will be operated primarily using truck shovel/excavator methods. A series of open cut pits will be progressively mined. During the early stages of developing each mine pit, overburden will be transported to pit dumps, where it will be profiled and rehabilitated. A proportion of this material will be used to re-profile the high-wall of the final voids (Adani 2012).

The underground mine will operate concurrently with the open cut pits, to provide for coal blending and ensure continuity of production. The underground mine will comprise independent underground longwall mines, producing approximately 20 Mtpa of product. Each underground mine will be serviced by above ground infrastructure.

All run of mine coal will be transported by truck and/or overland conveyor to a centralised coal handling facility, where the high-ash portion will be washed for blending with the bypass coal (un-washed coal). Coal will be stockpiled prior to loading on trains for transportation by rail. The channel and riparian zone of the Carmichael River will be preserved and the adjacent pits protected from flooding events by a levee (Adani 2012).

All offsite infrastructure to support the operation of the mine will be located on the Moray Downs Pastoral Lease (Lot 662 on SP282172) to the east of the mine. The workers accommodation village will be located approximately 12 km east of the Mine and accessed via the upgraded Moray-Carmichael Road. The village will accommodate construction and operational workforces for the Mine. All recreational, health and safety requirements to support workers will be provided at the village.

The permanent airport will be located approximately 5 km west of the workers accommodation village and will provide access for fly-in-fly-out workers. Offsite water supply infrastructure will enable the extraction, storage and delivery of water during the construction and operation phases of the mine.

2.2 Mine staging

The Project will be implemented in several stages. An understanding of the project stages and their relative timing is important for developing appropriate management and mitigation measures to address potential impacts of the Project on BTF and their habitat. The total Project Area (Mining Lease Area) is about 45,000 Ha out of which 28,016 Ha (62%) will be disturbed in several stages for open cut mining, underground mining and mine infrastructure (including, water storage, tailings drying cells, diversion drains and levees). The initial areas of disturbance will be required for opening up of box cut areas for open cut and underground mining and areas required for mine infrastructure. The details of the staged disturbance are provided in [Table 1Table 1](#). It is evident from [Table 1Table 1](#) that areas will be

manner and will only be cleared commensurate with development of the project within each stage. Some areas of the mining lease will not be impacted by mining activities as evident from [Figure](#) Where BTF habitat occurs in these areas, management will be to maintain and/or aim to improve the habitat condition.

Key elements of the Project and their relative timing are summarised in the following sections.

Table 1 Details of staged disturbance areas (note: relates to all areas – not only BTF habitat)

Disturbance domain	Area (Ha)	Disturbance Areas (Ha)		
		Year 1-10	Year 11-20	Year 21-30
Open cut Mining (Including pits, slopes voids and out of pit spoil dumps)	16,640.24	10332.66	3682.75	2624.83
Underground Mining(subsidence areas)	7786.76	1931.95	3030.16	2824.65
Infrastructure Area (including, water storage, tailings drying cells, diversion drains and levees)	3589.93	3403.89	174.82	11.22
Total	28,016.93	15,668.50	6,887.73	5,460.70
% disturbance		56%	25%	19%

2.2.1 Open cut Mining Operations

Open cut Mining operations include extraction of coal from the ground as well as any immediately associated activities, including initial clearing of vegetation, removal and storage of overburden, storage of coal and dewatering, but not including exploratory surveys or the construction or operation of transport, accommodation or power generation infrastructure.

- The Open cut mines consist of six pits from North to south of the Mining Lease area
- Pits B, C, D and E are located to the north of the Carmichael River.
- Pits F and G are located to the south of the Carmichael River.

Open cut mining activities will be carried out in three stages of the project across 60 years of life of the project. Stage 1 of Open cut mining is defined as year 1-10 and includes all associated activities such as box cut excavation, formation of haul roads, forming of out of pit spoil dumps and building mine related infrastructure like CHPP, ROM, Product coal storage areas, water infrastructure and waste storage facilities.

Activities associated with mining operations north of the Carmichael River are anticipated to commence in Year 1 (early stages of the Project). In this area open cut Pits D and E will be opened up initially during the first year of the start of mining. During later years, additional Pits B and C will be opened up to the north of the Mining Lease area. As shown in [Figure 3](#), there is minimal BTF habitat in areas immediately north of Carmichael River (Pits D and E), which will be the focus of early stages of the Project. This delay in the disturbance of BTF habitat will coincide with improvements to BTF habitat in the offset area, minimising Project impacts on BTF habitat values overall.

Mining operations south of the Carmichael River are anticipated to commence in Year 8 (i.e., 7 years after the commencement of mining operations north of the Carmichael River). In this area open cut Pits F and G will be opened up and will continue till the end of project life.

2.2.2 Underground Mining

Underground mining will be completed in three stages across the 60 year life of the Project. Stage 1 of underground mining is defined as Years 1-10 and includes all associated activities including box cut excavation, portal construction, long wall construction and longwall panel mining. Multi seam mining within the first underground mine will occur during this time. Stage 2 of underground mining will occur from approximately Year 11-23 and Stage 3 will occur from approximately Year 24 and beyond.

2.3 Moray Downs West

The Moray Downs West offset area has been identified in the approved BOS as a priority offset to acquit most of the Project's offset requirements, including those required for BTF (CO2 2016). The offset area for offset delivery stage 1 is located on the western portion of the Moray Downs property (Lot 662 on SP282172; [Figure 1](#)).

Parts of Moray Downs West are mapped as priority 1 areas in the Queensland Government's Galilee Basin Offset Strategy (DEHP 2013). Priority 1 areas contain high levels of conservation value and are likely to have the lowest risk of future development through mining. Moray Downs West also borders priority 1, 2 and 3 Galilee Basin Offset Strategy areas.

The offset area includes 20,274 ha of BTF habitat. It is anticipated that the management objectives will be achieved within the 20 year management period through the implementation of adaptive management. However, if required additional management will be considered at the end of the management period should any of the objectives not be met (CO2 2016). Monitoring is likely to be required beyond 20 years to clearly demonstrate the effectiveness of the offset, and to achieve compliance with EPBC Act approval conditions, which require monitoring for the life of the project.

3 Legislative and Regulatory Framework

3.1 Project approval conditions

The Project Area provides habitat for a variety of threatened species, listed under the EPBC Act or the NC Act. State and Commonwealth approval conditions require the development of management plans for those species and ecological communities that were considered most likely to be affected by the Project.

For the Commonwealth approval, these species and communities are as follows:

- Black-throated Finch (southern; *Poephila cincta cincta*) - Endangered
- Squatter Pigeon (southern; *Geophaps scripta scripta*) - Vulnerable
- Ornamental Snake (*Denisonia maculata*) - Vulnerable
- Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC - Endangered
- Yakka Skink (*Egernia rugosa*) - Vulnerable
- Waxy Cabbage Palm (*Livistona lanuginosa*) - Vulnerable
- Doongmabulla Springs Complex – Nationally Important Wetland and a community of native species dependent on natural discharge of groundwater from the Great Artesian Basin TEC - Endangered

For the State approval, the Coordinator-General recommended in Section 2 of Appendix 2 of its report that a Species Management Plan be prepared for all threatened species known, or likely to, occur within the Project Area. Within the mining lease, Adani has committed to a range of environmental management measures to reduce impacts on threatened species.

3.2 Approval conditions relevant to BTF management plan

There are multiple Commonwealth and Queensland approval conditions that require Adani to prepare a BTF Management Plan, describing how potential impacts of the Project on ecological values will be mitigated and monitored. This report addresses the requirements of these conditions for both Commonwealth and Queensland legislation. This document is specific to the Carmichael Coal Mine and associated infrastructure and addresses the approval conditions relating to BTF for this component of Adani's overall mine and rail project. Conditions relevant to the rail components of the Carmichael Coal Mine and Rail Project have been addressed separately (ELA 2015c; ELA 2015d).

An inventory of all relevant Commonwealth and State approval conditions is provided in **Appendix D**, with a description of the location within this report where each condition has been addressed.

3.3 Key legislation

Assessment of the Project by the Commonwealth Government occurred through the EIS process under the Commonwealth EPBC Act. This assessment considered potential impacts of the Project on MNES, such as federally-listed threatened species, migratory species, and threatened ecological communities.

Assessment of the Project by the Queensland Government occurred through the EIS process under the *State Development and Public Works Organisation Act 1971* (SDPWO Act). This act provides for the assessment of 'coordinated projects' by the Coordinator-General, while considering other Queensland legislation relevant to the proposed activity, including the:

- *Environmental Protection Act 1994*

- *Nature Conservation Act 1992*
- *Vegetation Management Act 1999*

Adani began formal environmental assessment of the Carmichael Coal Mine and Rail Project in 2010, through preparation of an EIS, to address the Commonwealth and Queensland government approval requirements. The Project was declared a 'significant project' under the SDPWO Act requiring an EIS and was assessed to be a 'controlled action' requiring assessment and approval under the EPBC Act.

An EIS was prepared in accordance with the bilateral agreement between the Commonwealth of Australia and the State of Queensland, with the objective of avoiding or mitigating potentially adverse impacts on environmental, social and economic values and enhancing positive impacts. Where there were unavoidable residual impacts, offsets were proposed in accordance with State and Federal government policies.

Adani prepared an SEIS in accordance with Section 35 (2) of the SDPWO Act and the bilateral agreement between the Commonwealth of Australia and the State of Queensland. The SEIS provided revised and additional environmental studies undertaken to reflect the amendments made to the Project since the EIS publication and to address matters raised in submissions. It included revised technical studies, impact assessment and management plans for a range of project issues.

The Carmichael Coal Mine and Rail Project was subsequently approved by the Queensland Coordinator-General on 8 May 2014, subject to conditions. The project was approved by DoE on 14 October 2015, subject to conditions (EPBC 2010/5736).

Adani was granted an Environmental Authority (EA) EPML01470513 for the Carmichael Coal Mine on 2 February 2016 in which conditions relating to the Black-throated Finch were also imposed. These conditions require a management plan and research program.

In addition to State and Federal approval conditions, Adani made commitments in regards to the management of BTF within the Coordinator-General report. **Appendix D** describes the relevant approval conditions and / or commitment relating to the monitoring and management of BTF and where the condition is addressed within this management plan.

3.4 Other guiding documents

In accordance with the Environmental Authority (EA) Condition I6 and Adani company commitment P6.54 the BTF Management Plan has been developed to align with the following references:

- National recovery plan for the Black-throated Finch southern subspecies *Poephila cincta cincta*. Report to the Department of the Environment and Water Resources, Canberra (Black-throated Finch Recovery Team, 2007)
- Significant impact guidelines for the Endangered Black-throated Finch (southern; *Poephila cincta cincta*) - EPBC Act policy statement 3.13 (Department of the Environment, Water, Heritage and the Arts (DEWHA), 2009)
- Threat abatement plan for competition and land degradation by rabbits (DEWHA, 2008),
- Commonwealth Listing Advice on Southern Black-throated Finch (*Poephila cincta cincta*; Department of the Environment, 2005), and
- Queensland Government Bio-regional BTF Management Plan as required under the Coordinator-General's report about the Project, currently under development by DES.

4 Black-throated Finch (southern) Ecology

EPBC Condition 6a) requires that all MNES management plans include a description of the environmental values for each particular MNES.

4.1 Status

The Black-throated Finch (southern; BTF) is listed as endangered under the EPBC Act and the NC Act. The primary reason for the listing is the decline in size and extent of the population of the southern subspecies.

4.2 Regional populations

The southern subspecies of the BTF lives in the Brigalow Belt North and Desert Uplands bioregions of Queensland, which cover 135,500 km² and include the towns of Townsville, Bowen, Emerald, Clermont and Collinsville (Exter 2011).

Based on mapping of all records of BTF up to 2010 and a comparison with post-2000 records, the distribution of BTF is estimated to have contracted by 50-80% of its historical range and is now rarely recorded south of Clermont (160 km south of the Project Area) (Exter 2011). BTF have also disappeared from several sites around Townsville (Exter et al. 2011).

4.3 Habitat requirements

A summary of baseline research on the characteristics of BTF nesting and foraging habitat within the project area is provided in **Appendix D**. Black-throated Finch habitat typically consists of grassy eucalypt woodlands adjacent to water or riparian corridor.

Removed at External Review Preferred habitat consists of patches with suitable grasses, low vegetation density or bare ground to allow access to the seed bank and an open tree layer that does not have a continuously dense shrubby understorey. Removed at External Review noted that the southern subspecies requires a mosaic of different habitats during the wet season in which to find seed. This subspecies has also been recorded in degraded habitats, including cultivated areas near woodlands and heavily grazed paddocks (DoE 2016).

The species can be found in a range of woody plant communities with records known from at least 21 Regional Ecosystems (Exter et al. 2016). Woodland vegetation typically consists of ironbark (e.g. *Eucalyptus melanophloia*, *E. crebra* and *E. drepanophylla*), bloodwood (*Corymbia dallachiana*, *C. erythrophloia* and *C. clarksoniana*) and gums (*E. platyphylla* and *E. brownii*). Records from other vegetation communities includes wetlands, riparian paperbark woodlands and native grasslands (Exter et al. 2016). Approximately 78% of records within the Galilee Basin region are associated with Broad Vegetation Group (BVG) 17b which is described as 'woodlands to open woodlands dominated by *Eucalyptus melanophloia* (Silver-leaved ironbark; or *E. shirleyi*; Shirley's silver-leaved ironbark) on sand plains and footslopes of hills and ranges (Exter unpublished).

In the Project Area, grassy open-woodland communities dominated by *Eucalyptus melanophloia* (RE 10.5.5a) are preferred, though the species is not restricted to this community (ELA 2017a, Niche 2015a, Niche 2015b, Niche 2016a, Niche 2016b). Other habitats where BTF have been recorded on multiple occasions include *Eucalyptus brownii* open-woodland (RE 10.3.6ax1), and less commonly in *Eucalyptus similis* and *Corymbia brachycarpa* open-woodland (RE 10.5.1a) and *Corymbia setosa* open-woodland

(RE 10.5.1d; ELA 2017a). **Table 2** lists all REs identified in the Project Area that are considered potential habitat.

BTF habitat within the Project Area generally consists of an open-woodland (approximately 17 % canopy cover) with moderately low canopy (approximately 12 m) and low canopy species richness. The shrub layer is typically low (2 to 2.5 m) and sparse (less than 10 % cover) but a moderately high species diversity. The ground cover is dominated by native grasses (approximately 35% cover and 8 species) with moderate bare ground (34% cover). Exotic grass and herb / forb cover are typically low (less than 5%; **Appendix E**).

Table 2 Regional Ecosystem associations for the BTF within the Project Area

RE	Description	Habitat Code
10.5.5a	<i>Eucalyptus melanophloia</i> dominates the very sparse canopy. <i>Corymbia plena</i> and <i>C. dallachiana</i> are occasionally co-dominants in the canopy. <i>Petalostigma pubescens</i> and <i>Acacia spp.</i> occasionally occur as dominants or as scattered trees in the very sparse to mid-dense low tree layer. <i>Carissa lanceolata</i> , <i>Psyrax oleifolia</i> and <i>Denhamia cunninghamii</i> frequently occur in the very sparse to sparse shrub layer. <i>Triodia pungens</i> is often dominant in the very sparse to mid-dense ground layer. <i>Aristida spp.</i> , <i>Bothriochloa ewartiana</i> , <i>Eriachne mucronata</i> , <i>Eragrostis lacunaria</i> and <i>Heteropogon contortus</i> occasionally occur as dominant or codominant graminoids. Occurs on sandplain.	<i>Eucalyptus melanophloia</i> dominant
10.3.6ax1	<i>Eucalyptus brownii</i> dominates the very sparse tree layer with scattered shrubs and very sparse ground layer frequently dominated by <i>Aristida contorta</i> . Occurs on flat to gently undulating sandplain.	<i>Eucalyptus brownii</i> dominant
10.3.13a	Riverine wetland or fringing riverine wetland. <i>Eucalyptus camaldulensis</i> dominates the very sparse to sparse canopy. <i>E. coolabah</i> , <i>Casuarina cunninghamiana</i> and <i>Melaleuca leucadendra</i> are frequently present in the canopy. <i>Corymbia tessellaris</i> is occasionally present. <i>Melaleuca spp.</i> are frequently present in the mostly very sparse low tree layer. Graminoid <i>Lomandra longifolia</i> is commonly present in the very sparse to sparse ground layer. Occurs along watercourses.	Riverine
10.5.1a	<i>Eucalyptus similis</i> dominates the usually very sparse canopy. <i>Corymbia brachycarpa</i> is frequently present in the canopy. <i>Eucalyptus drepanophylla</i> can occasionally occur as a codominant. The low tree layer is very sparse or composed of scattered small trees including <i>Bursaria incana</i> , <i>Acacia sericophylla</i> , <i>Alphitonia excelsa</i> and <i>Grevillea glauca</i> . A very sparse to mid-dense tall shrub layer is often present and dominated by <i>Acacia spp.</i> <i>Petalostigma pubescens</i> and <i>Persoonia falcata</i> are commonly present. A low shrub layer is usually present and dominated by <i>Carissa lanceolata</i> . <i>Triodia pungens</i> usually dominates the very sparse to mid-dense ground layer. Occurs on sandplains.	<i>Eucalyptus</i> or <i>Corymbia</i> spp. dominant with shrub layer
10.5.1d	<i>Corymbia setosa</i> dominates the very sparse canopy. <i>Melaleuca nervosa</i> , <i>Acacia sericophylla</i> , <i>A. elachantha</i> , <i>Bursaria incana</i> , <i>Grevillea glauca</i> and <i>Petalostigma pubescens</i> are frequently present in the very sparse low trees layer or occur as scattered small trees. <i>Acacia spp.</i> and <i>Carissa lanceolata</i> dominate the very sparse shrub layer. The ground layer is usually dominated by <i>Triodia pungens</i> . Occurs on sandplains.	

Grazing and fire are important drivers of the composition and structure of both the woody and ground layers of the vegetation (Exter 2011, NRA 2007). Details on how grazing and fire impact the structure and composition of vegetation relevant to the BTF are provided in **Sections 4.6.4** and **4.6.5** respectively. Managing these factors is therefore important for the maintenance and management of BTF habitat. The optimal grazing and fire regimes required to maintain or improve habitat quality for the BTF are yet to be determined. Trials to determine the appropriate management of habitat with grazing and fire are proposed

as part of the Carmichael Coal Mine BTF Research Program (**Appendix C**), the results of which will feed back into the BTF Management Plan.

Permanent water is critical for the BTF as it provides refuge during dry periods and because they need to drink every day (Exter 2011, NRA 2007). This water may be in the form of natural springs, perennial streams, waterholes in ephemeral creeks or man-made water sources such as farm dams and troughs. Therefore water must be within an accessible distance from their foraging and nesting habitat, and nests within the Townsville Coastal Plains populations are typically constructed in trees within 400 m of water sources (Exter 2011, NRA 2007). However BTF monitoring results from the Project Area have identified a mean distance of approximately 2.5 km between nests and known permanent water sources, with the closest nest 280 m from water and the furthest almost 7 km from water (**Appendix E**).

Foraging habitat must provide suitable seeds, principally of grasses (Exter 2011, NRA 2007). There must be an appropriate density and diversity of grasses, with seeds available and accessible on the surface as the birds predominantly feed on fallen seeds. A mix of grass species that seed at different times is important to provide year round food supply as BTF can experience food shortages particularly in the lead up to the wet season (Exter 2011). The ground layer of the vegetation is ideally dominated by a diversity of annual and perennial grasses with sufficient inter-tussock spacing to allow the birds to forage efficiently for grass seeds present on the soil surface. Studies in the Project Area have identified a ground layer containing a mosaic of approximately 37% native grass cover and 34% bare ground as well as at least 8 native grass species and less than 5% exotic grass cover is preferred. BTF have not been recorded foraging in areas with more than 50% exotic grass cover (**Appendix E**).

Grass seed abundance usually peaks around the early dry season (May to June) and gradually declines through until the next wet season. Consequently, BTF can experience food shortages at particular times of year. The onset of wet season rains causes any remaining seed to germinate or rot, resulting in a significant food shortage (Exter 2011) that can cause BTF to forage for longer in order to meet their needs. **Table 3** lists preferred grass species for the BTF based on research and studies in the Coastal Plains, Cape York Peninsula and Mareeba. Most are derived from observations of where BTF individuals were seen foraging. A summary of baseline groundcover and grass species at selected monitoring sites across the Project Area is provided in **Appendix F**.

Table 3: Grass species preferred by Black-throated Finches

Grass species	Location	Method	Reference
Favoured			
<i>Setaria surgens</i> *	Cape York Peninsula Mareeba West of Townsville	Direct observation of feeding by <i>P. c. atropygialis</i> and <i>P. c. cincta</i>	Zann (1976)
<i>Digitaria ciliaris</i> *			
<i>Stylosanthes humilis</i> *			
<i>Dactyloctenium radulans</i> *			
<i>Setaria surgens</i> *	Cape York Peninsula Mareeba West of Townsville	Observed to be dominant at sites used by Black-throated finches	Zann (1976)
<i>Melinis repens</i>			
<i>Schizachyrium fragile</i>			
<i>Panicum seminudum</i>			
<i>Aristida superpendens</i>			
<i>Aristida ingrata</i>			
<i>Aristida calycina</i>			

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<i>Urochloa mosambicensis</i>	Townsville Coastal Plain	Direct observation of feeding birds	Mitchell (1996)
<i>Digitaria ciliaris</i>*			
<i>Alloteropsis cimicina</i>	Townsville Coastal Plain	Abundant on plots where Black-throated finches were foraging	Isles (2007)
<i>Alloteropsis semialata</i>			
<i>Chloris</i> spp.			
<i>Setaria apiculata</i>			
<i>Urochloa mosambicensis</i>	Townsville Coastal Plain	Abundant on plots where BTF were foraging	Rechetelo (2015)
<i>Chrysopogon fallax</i>			
<i>Eragrostis</i> spp.			
<i>Setaria surgens</i>*			

Bold species indicate those that have been recorded in the Project Area

* Indicates species which BTF have been observed foraging on in the Project Area

Within the Project Area BTF have been observed foraging on similar species as indicated in [Table 3](#), as well as additional grasses including:

- *Enteropogon ramosus* (GHD 2012)
- *Paspalidium rarum* (GHD 2012 and Niche 2016)
- *Schizachyrium fragile* (GHD 2012)
- *Cymbopogon bombycinus* (ELA 2017)
- *Triodia pungens* (ELA 2017)
- *Eriachne mucronata* (ELA 2017 and E2M 2018)
- *Bothriochloa ewartiana* (E2M 2018)
- *Panicum effusum* (E2M 2018)
- *Enneapogon polyphyllus* (E2M 2018)
- *Sehima nervosum* (E2M 2018)
- *Digitaria brownii* (E2M 2018).

During the 2016 dry season survey BTF were observed foraging on the seeds of the introduced woody herb *Stylosanthes scabra* (ELA 2017a).

The BTF monitoring surveys for the Project Area have indicated some differences with grass species that have been previously identified as being avoided in research undertaken on the Townsville Coastal Plains. In particular, the “avoided” species *Heteropogon contortus* and *Aristida* spp. have been commonly found at foraging sites in the Project Area, at varying percentage cover. At this stage the nature and scale of these differences are unknown, with monitoring programs currently underway to provide further clarity. In this regard, there remains ecological behaviours that are not fully understood for the local BTF population and their foraging requirements. Further surveys dedicated to analysing foraging behaviours of BTF within the Project Area, and comparison of the data, are required to identify the key factors that define preferred foraging habitat for the local BTF population and form part of the Research Program (ELA, 2017b). Initial findings from baseline monitoring are provided in **Appendix E** and **Appendix F**.

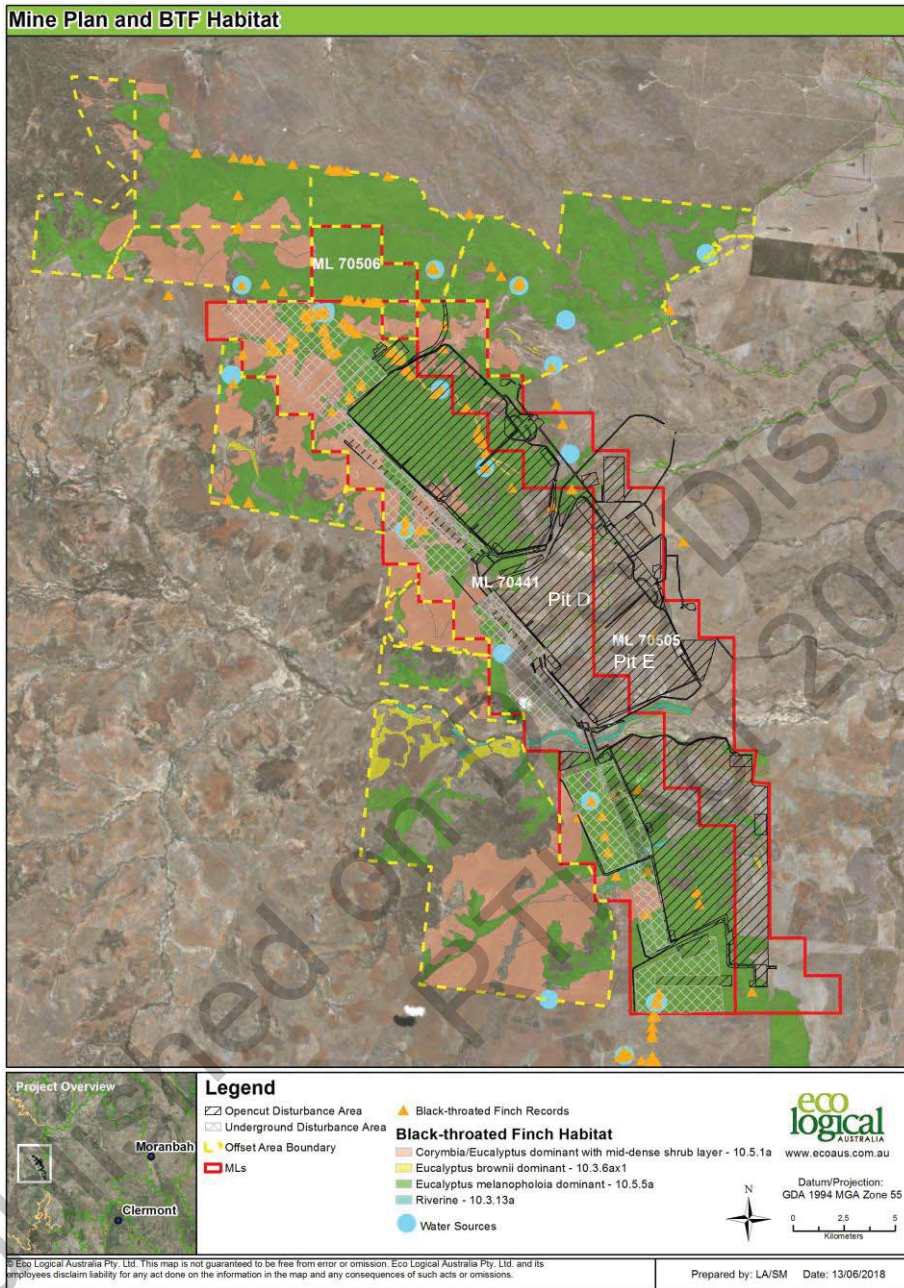


Figure 3 Black-throated Finch Habitat within the Project Area and adjacent areas (note this plan does not cover the Moray Downs West Offset Area, which is regulated by the OAMP)

4.4 Breeding ecology

BTF breeding season is from October to April, with seasonal and geographic variation (at Extern 2011). The timing and duration of the breeding season appears to be contingent on food resources and is therefore likely to vary annually and geographically according to rainfall patterns, temperature and land condition. Commencement of the wet season is the likely trigger for breeding.

Around Townsville, breeding tends to occur from December to May, which generally encompasses the wet season and the period of most prolific seeding of grasses (at Extern pers. comm.), but there is considerable variation in this timing throughout the bird's range. Breeding will continue throughout grass seeding generated by the wet season.

NRA (2005a) recorded BTFs breeding in Townsville from January to July; analysis of data contained in (at Extern 1996) recorded breeding in Townsville from March to May; and (at Extern 1970) recorded breeding on the Atherton Tableland from September to January. Although under optimal conditions the species can probably breed continuously throughout the year, the core breeding season around Townsville is believed to begin sometime after the onset of the wet season and continue until ground-stored food resources (fallen grass seed) fall below an undetermined threshold (c. February to June). Usually five or six eggs are laid at one time (at Extern 2011).

There is little published information regarding the timing of the breeding cycle of this species. In a study of relatively few captive individuals, (at Extern 1976) observed the timing of the breeding cycle of this species to be 15 days for incubation, 22 days from hatching to fledging and 18 days from fledging to independence. This indicates they are 40 days old at independence. With respect to independence, (at Extern 2011) notes that BTF juveniles may remain with their parents for a number of months after fledging.

Nests are mostly built high in the outer branches of trees and tall shrubs, in tree-hollows, in mistletoes, and in the base of raptor nests (BTFRT 2007). However, nests have also been recorded in large shrubs within 1 m of the ground. Occasionally nests are constructed beneath active raptor nests, of species such as Wedge-tailed Eagle (*Aquila audax*), Whistling Kite (*Haliastur sphenurus*), Swamp Harrier (*Circus approximans*) and Collared Sparrowhawk (*Accipiter cirrocephalus*; (at Extern et al. 2006). Nests may also be built in neighbouring trees within the colony, usually less than 50 m from other nest trees (at Extern et al. 2006; NRA 2006) and on occasion an outlier may be up to 250 m from the main colony (at Extern 2007; NRA 2007).

Within the Project Area, BTF nests have been recorded in various vegetation strata and species, with an apparent preference for the tall shrub layer dominated by *Acacia sericophylla*, typically at 2 to 4 m in height. Other nests have been recorded in the canopy layer at 7 m in height. BTF nests were most commonly found in *Acacia sericophylla* (12 records), followed by *Grevillea parallela* (2 records) and *Eucalyptus melanophloia* (1 record; E2M 2018; **Appendix E**).

The minimum area of nesting habitat required to sustain a viable breeding colony is unknown (NRA 2007). Most known nesting colonies are connected to larger areas of remnant vegetation. Following observations of a single colony, it has been suggested that a minimum remnant habitat patch of 40 to 50 ha within 500 m of a nesting colony may be required for that colony to remain viable, at least in the short-term (NRA 2006; NRA 2007). Nests are typically constructed from grass stems with feathers or plant down lining (at Extern et al. 2006; NRA 2006), and are used for breeding and roosting (NRA 2007).

The breeding season is an opportunity for BTF populations to recover from losses sustained during the dry season / early wet season (when resource bottlenecks occur as grass seed supply is low). During the breeding season, parents first need to gain sufficient body condition to breed and, then, once the young have hatched, be in a condition in which they can forage for both themselves and their young. Activities

or events that reduce resource availability during this time may reduce reproductive success. If breeding success is unable to off-set mortality over consecutive years then population declines and, ultimately, local extinctions will occur (Exter 2011).

4.5 Carmichael population

Over a period of nine years (2010 to 2018), Adani has commissioned 13 surveys and associated reports assessing the habitat preferences, ecology and population presence of BTF with the Project Area. The most recent BTF surveys undertaken within the Project Area were in March 2015 (Niche 2015a), August 2015 (Niche 2016a), April 2016 (Niche 2016a), October 2016 (ELA 2017a), November 2017 (E2M 2017) and April 2018 (E2M 2018), and have included surveys within the Moray Downs West offset area. Prior to that, surveys had focussed on the mining lease.

The methodology adopted in the most recent monitoring surveys consisted of timed fixed point water source watches; habitat searches in the immediate vicinity of the water sources (600 m radius); slow drive line transects with defined call playback stations; and opportunistic observations gathered whilst traversing the Project Area. The key findings from the monitoring surveys include:

- Aggregate BTF totals have ranged from 84 to 1,145 with an average of 480. Dry season surveys have generally yielded the largest aggregate totals (1,145, 846 and 610 in 2015, 2018 and 2016 respectively), although a wet season survey in 2015 yielded records of 600 BTF.
- Surveys to date have focused on the mining lease where the greatest aggregates have been recorded, in particular in the northern area of the mining lease and around Four Mile and Ten Mile Bores.
- The 2016 dry season survey included the greatest survey effort within the Moray Downs West offset area to date where an aggregate total of 151 BTF were recorded from 14 locations.
- Monitoring surveys have identified a strong association between BTF records and vegetation communities dominated by remnant RE 10.5.5a *Eucalyptus melanophloia* open woodland on sand plains (Niche 2016a; ELA 2017a). BTF have also been recorded in four other REs (Table 2 Table 2).
- A majority of BTF records have been identified during waterhole surveys with this survey method accounting for 37% of the aggregate total in the October 2016 dry season survey (ELA 2017a).
- Foraging BTF have been predominantly observed in woodland or open woodland dominated by *E. melanophloia* with a mean canopy height of 12 m. Areas used for foraging were characterised by sparse to mid-dense ground cover with a mean ground cover recorded of 40%. Grass species diversity at foraging sites was high with a mean grass species richness of 8. Exotic grass cover is typically less than 5 % (Appendix E). The species recorded are typical of grassy woodlands of the bioregion, of which the Project Area supports some high quality examples (Niche 2015a).
- Based on the data available for dry season surveys, it appears that in dry conditions records are concentrated in the central-north and central-south areas of the Project Area where large stretches of suitable habitat area are present and water sources were available at the time of survey (Niche 2016a; ELA 2017a). In particular, large numbers were recorded during the August 2015 BTF monitoring survey in the vicinity of the large dam on the Lignum property (CWAT111), the dam at CWAT03, Four Mile Bore (CWAT99), #2 Dam (CWAT117), the Turkey Nest dam at Ten Mile Bore (CWAT01B) and troughs at Lignum (CWAT110B) and Carmichael Bore (CWAT118; Niche 2016a).
- A total of 60 BTF nests have been identified during monitoring surveys to date. This includes 15 nests that were identified during the 2018 dry season survey which is the largest number to date (E2M 2018).

- A pair of BTF were observed during the 2016 dry season surveys preparing a nest within the outer-branches of a Silver-leaved Ironbark. This tree was approximately 14m in height and within remnant RE 11.5.5.a.
- Surveys have identified preferred foraging habitat to consist of a grassy understorey with a mosaic of patches of dense grass with open bare patches containing a diversity of native grasses.
- BTF have directly observed foraging on seeds of at least nine grass species as well as the woody shrub *Stylosanthes scabra* within the Project Area (GHD 2012; Niche 2016; ELA 2017a). Another two grasses have been identified as potential foraging species (GHD 2012).

BTF are most regular and most abundant in the northern third and the southern quarter of the Project Area (Figure 4). The area around Ten Mile Bore (CWAT01B; in the north-west of the mining area) appears especially favourable, possibly due to the combination of open grassy *Eucalyptus melanophloia* woodland and the water that it provides. In general, this area has a low shrub cover in the understorey. Areas north of the Carmichael Road in the far west of the Project Area (Four Mile Bore and surrounds) are also favourable, though the numbers of birds are generally lower than around Ten Mile Bore. The Four Mile Bore (CWAT99) area tends to have reasonably extensive patches of understorey shrubs, particularly just north of the Carmichael Road. In addition, large numbers of BTF have been recorded between 2015 and 2018 at a large dam and surrounding habitats on Lignum Station. The floristic composition and structure representative of the area surrounding this large dam is also consistent with the vegetation assemblages shown to support BTF foraging and nesting habitat.

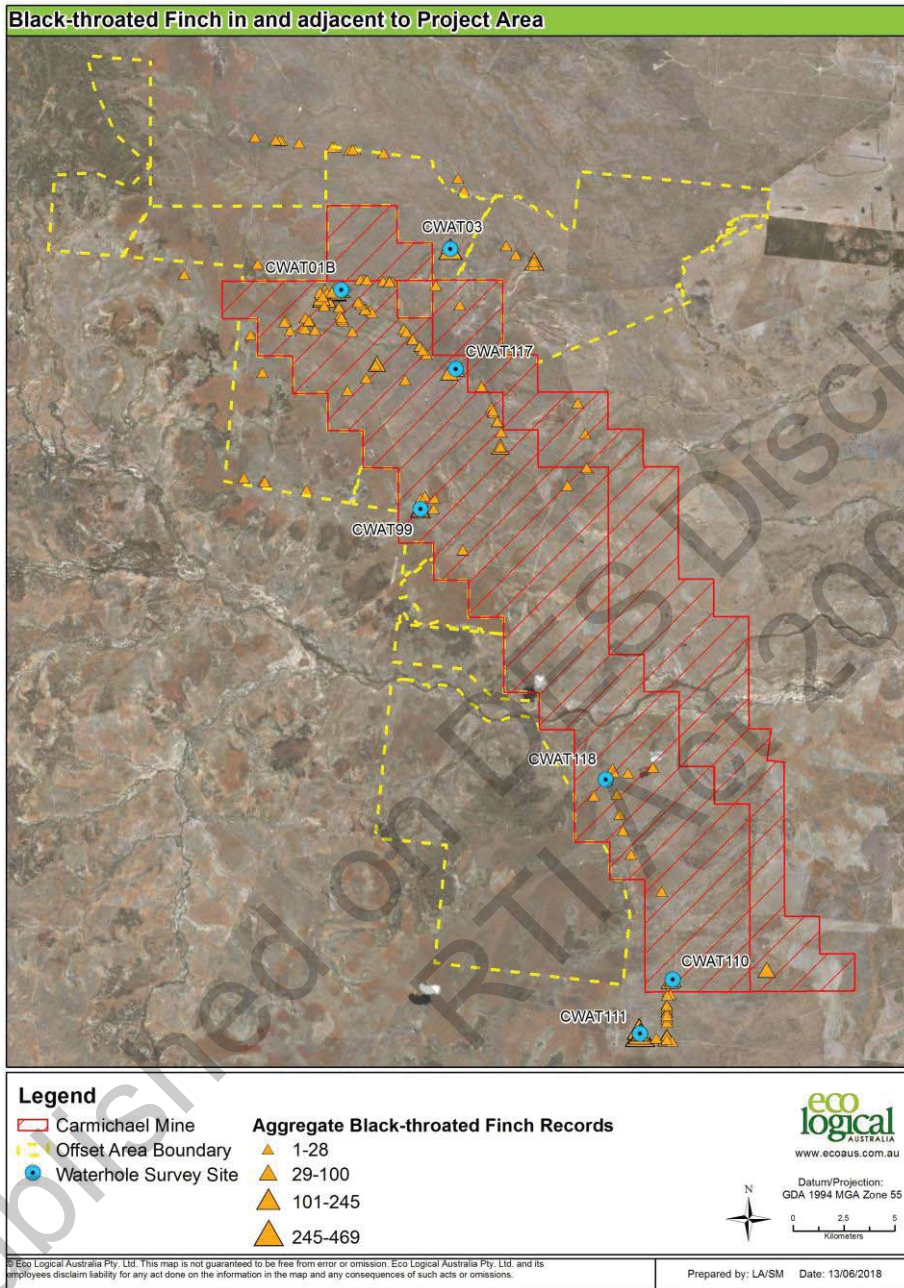


Figure 4 BTF Records – 2012 to 2016 (GHD 2012, GHD 2013a, GHD 2013b, Niche 2015a, Niche 2015b, Niche 2016a, Niche 2016b and ELA 2016)

4.6 Threats, potential direct / indirect project impacts

Threats and potential direct / indirect project impacts that are required to be addressed as they apply to the BTF on the Project Area are:

- threats to the BTF as identified in [Table 4](#) and the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007; BTF Recovery Plan)
- direct and indirect project impacts outlined in the EIS (GHD 2012a; Adani 2012)
- matters outlined in Condition 6 of the EPBC Approval (2010/5736).

EPBC Condition 6c) and EA Condition I6d) require details for all impacts and threats MNES to be included in this plan. Known threats to BTF from the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007) are listed in [Table 4](#).

The potential sedentary lifestyle of the BTF may make it vulnerable to any loss, disturbance or modification to any of the three key resources of water sources, grass seeds and trees providing suitable nesting habitat (DEWHA 2009). Particularly, the synergistic effects of pastoralism, drought and fire are thought to have the greatest impact on the species by increasing the period of resource shortage and decreasing the quality and availability of breeding habitat (at External al. 2011). However, some aspects of pastoralism may also benefit the species (e.g. stocking rates, fire fuel management and artificial water sources).

Other potential threats to the BTF (southern) are illegal trapping, hybridisation with escapees of the northern subspecies, resource bottlenecks associated with drought and changes in land management practices and impacts on seasonal breeding success from cyclonic activity (i.e. destruction of nests; BTF Recovery Team, DECC & NPWS 2007; DoE 2015).

Whilst there is information available helping to identify likely threats to BTF, there are still gaps in the knowledge of how these threats operate, and how they may vary in their impact in different geographical areas that the species inhabits, and how the threats interact with each other.

Impacts resulting directly from the removal of coal include initial clearing of vegetation, removal and storage of topsoil, overburden, coal, rejects and dry tailings, dewatering, and clearing and construction of haul roads. Key impacts on BTF from these activities will be the loss of suitable habitat, direct loss of birds, loss of water sources and uncontrolled fires. As required by Condition 6 of the EPBC approval (2010/5736), potential impacts including area of impact to BTF must be addressed in this plan.

Indirect impacts as a result of clearing and construction for mining and associated activities include weed spread (especially of grass species that are unpalatable to BTF and / or tend to form monocultures), change in species diversity and composition of the grass layer, potential for contamination of water sources and habitat degradation through light spill, noise and dust. Threats, potential direct and indirect project impacts to the BTF are described in detail in the following sections.

Table 4 BTF threats, potential direct / indirect project impacts and matters required to be addressed by conditions

#	Potential Threat or Impact	Threat identified in the BTF Recovery Plan	Potential direct project impact identified in SEIS	Potential indirect threat or impact identified in SEIS	EPBC Approval, condition 6	Project Phase/s	Description of threat and potential project impact	Impact addressed
1	Vegetation clearing / habitat loss, including fragmentation of key habitat areas and potential fatalities from clearing	Yes	Yes	-	(c)(i)	Construction	Section 4.6.1	Table 8
2	Habitat alteration through subsidence	-	Yes	-	-	Operations	Section 4.6.2	Table 8
3	Increased exotic pasture and weed invasion of key habitat areas	Yes	-	Yes	(c)(ix)	Construction Operations	Section 4.6.3	Table 9
4	Grazing in key habitat areas that changes the ground cover composition	Yes	-	Yes	-	Construction Operations	Section 4.6.4	Table 9
5	Wildfire or inappropriate fire management to key habitat areas that changes the ground cover composition	Yes	-	Yes	-	Construction Operations	Section 4.6.5	Table 9
6	Feral animal impacts	Yes	-	Yes	-	Construction Operations	Section 4.6.6	Table 9
7	Loss or degradation of water sources	Yes	-	Yes	(c)(ii)	Construction Operations	Section 4.6.7	Table 10
8	Mine dewatering	-	-	-	(c)(if)	Operations	Section 4.6.8	Table 10
9	Earthworks	-	-	-	(c)(iv)	Construction	Section 4.6.9	Table 10
10	Noise and vibration	-	-	-	(c)(v)	Construction	Section 4.6.10	Table 10
11	Emissions (including dust)	-	-	-	(c)(vi)	Construction	Section 4.6.11	Table 10
12	Light spill and other visual impacts	-	-	-	(c)(vii)	Construction	Section 4.6.12	Table 10
13	Stream diversion and flood levees	-	-	-	(c)(vii)	Construction	Section 4.6.13	Table 10

Each of the threats to BTF, potential direct / indirect project impacts and matters required to be addressed by EPBC Approval, Condition 6 are described in detail in the following sections.

4.6.1 #1: Vegetation clearing / habitat loss, including fragmentation of key habitat areas

Clearing of vegetation is the primary threat that would affect the availability of breeding and foraging habitat for the BTF. Habitat loss, fragmentation and degradation are the main threats to the BTF at External 000; Department of the Environment 2005; BTFRT 2007).

The most probable cause of decline from the southern parts of the historic range are overgrazing and habitat clearing at External 1999; Department of the Environment 2005). Declines have been less severe in the northern part of the subspecies range where clearing is not yet as widespread and grazing is predominately by cattle (External 2000; BTFRT 2007).

A total of 9,492 ha of identified BTF habitat are proposed to be impacted by vegetation clearing over the life of the Project (CO2 2016). This represents 0.16 percent of the total potential habitat within the Desert Uplands and Brigalow Belt bioregions within which the Project occurs. Details of habitat disturbance across the project stages are summarised in Table 5, with the sum of critical, core and marginal habitat disturbance totalling 9,492 ha.

Table 5 Summary of disturbance to BTF habitat at the Mine, off lease and Rail West aspects of the project over Stage 1 and 2 (CO2 2016)

BTF Habitat type	Stage 1 (ha)	Stage 2 (ha)	Total (ha)
Very High (Critical)	4,628	3,080	7,708
High (Core)	726	288	1,014
Marginal	739	31	770
Low	344	634	978

The area of direct impact has been minimised as far as possible throughout the design and development of the mine plan. Through relocation of the out of pit stockpiles, the area of direct impact was reduced by approximately 7,000 ha. This change to the mine plan resulted in an approximately 40% reduction in the potential area of direct impact (GHD, 2013).

High quality BTF habitat within the mining lease area is considered to be located generally in the northern third and the southern quarters of the Project Area (Figure 3 and Figure 4). While delivery of the Project will be a staged process, each stage covers large areas of remnant vegetation and will have effects on the behaviour and movements of the local BTF population, reducing areas of suitable habitat.

Fragmentation of woodland and grassland vegetation associated with the Project development may reduce habitat availability due to the sedentary nature of the BTF as well as causing an alteration in grass species composition or seed availability, affecting the ability of the BTF to find food throughout the seasons. Fragmentation within 5 km of water sources may also reduce habitat availability due to loss of critical resources.

Planning and development of the mine will aim to minimise vegetation clearing in areas considered to be higher value habitat and where high concentrations of BTF occur. The approach of underground mining has been adopted in areas of *Eucalyptus melanophloia* dominant vegetation communities (RE 10.5.5a) and *Eucalyptus brownii* dominant vegetation communities (RE 10.3.6ax1), where possible, to minimise impacts to habitat known to be utilised by BTF in the Project Area (Figure 3).

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It is anticipated that approximately 20,230 ha of vegetation will be cleared within the open cut mine footprint which includes open cut mining (including pits, slopes, voids and out of sit spoil dumps) and Infrastructure Area (including water storage, tailings drying cells, diversion drains and levees), of which approximately 9,492 ha is BTF habitat. This clearing is expected to occur over a period of life of open cut pits (approximately 40 years). A mine plan and schedule has been developed for the Project. The mine schedule is broken into 13 time periods, with a mine life of approximately 50 years. Periods 1- 5 are on a yearly basis and periods 6 – 13 are based on 5 years.

As shown in [Table 1](#), the area required for clearing of vegetation in the first 10 years of the project only approximately 56% of the total disturbance area. As the open cut pit workings proceed towards the midlife (approximately 10-15 years), the rehabilitation of spoil dump areas will commence and hence the net disturbance areas will be reduced.

Portions of the Project Area will also be cleared for storage of earthen materials such as topsoil, overburden, coal, and tailings. An area of approximately 9,200 ha will be impacted by the placement of top soil and overburden. This area extends from the north-eastern to south-eastern corner of the mine footprint, along its eastern edge, over an area approximately 32 km long by 3 km wide. This will result in some direct loss of BTF habitat, particularly in the north-eastern section of the Project Area where large groups of BTF were recorded (Niche 2015a and Niche 2015b).

The proposed mine plan in relation to BTF habitat and records is shown in [Figure 3](#).

Management objectives about the threat and impacts include minimising habitat loss and fauna death during vegetation clearing, progressive habitat restoration of disturbed areas and improving awareness of BTF by site personnel. [Table 8](#) describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.2 #2: Habitat alteration through subsidence

Habitat alteration through subsidence as a result of underground mining at Carmichael Mine has the potential to degrade BTF habitat. Subsidence can cause surface movement, cracking and hydrological changes and lead to tree slumping, root damage, vegetation stress and dieback and ultimately alter grass species diversity and composition to those that may be unpalatable to BTF (Adani 2013).

A subsidence assessment was undertaken in 2013 and describes impacts to vegetation and fauna (Adani 2013). The assessment determined:

- Surface movement due to subsidence may lead to areas of destabilisation causing vegetation slumping, tree falls, erosion and root exposure
- Localised variable impacts for mine sites may occur under native vegetation, but were difficult to predict
- Tension cracks may leave soil vulnerable to erosion, leading to damage to root systems
- Impacts to changes in hydrology include loss or changes to the flow and direction through the subsurface, and depression of the surface may lead to water ponding after rain.

The study determined that ponding duration was predicted to range from less than a day to several months. The assessment was based on a typical wet year. The study detailed the subsidence impact area for each environmental value which intersected with the total cumulative layer of subsidence. The study determined the rankings for impacts for assessment of subsidence in [Table 6](#).

Table 6 Ranking of impacts for subsidence, cracking, ponding and infrastructure

Impacts	Ranking of impacts
Subsidence	High: slope change of more than 2% (>5 m) Low: slope change of less than 2% (<5 m)
Cracking	High: > 100 mm (width) Low: < 100 mm (width)
Ponding	High: duration of ponding greater than 2 days Low: duration of ponding less than 2 days
Infrastructure	High: impacted by infrastructure Low: not impacted by infrastructure

The following quantity of subsidence impacts were predicted for BTF habitat (Adani 2013):

- High impact – 163.32 hectares
- Low impact – 6,145.39 hectares
- No impact – 574 hectares.

A management objective under this plan is to minimise habitat alteration through subsidence. **Table 8** describes how the management objective will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.3 #3: Increased exotic pasture and weed invasion of key habitat areas

The main non-native grass present in the Project Area is Buffel Grass which tends to form a monoculture and is associated with a depleted diversity of grasses. This grass dominates cleared areas in the east of the Project Area but is less prevalent in the intact woodlands favoured by BTF in the Project Area. BTF are not known to eat the seeds of Buffel Grass. A monoculture of any species will not provide quality foraging habitat as it reduces the diversity of species whose seeds can collectively provide continuity of supply through the year and during different seasons. The introduced forage legume *Stylosanthes* spp., especially *S. scabra*, is also likely to be detrimental if it becomes a common component of the ground layer of the vegetation, as it has a negative impact on native plant species richness and diversity (DSITIA 2014).

The introduction and / or spread of weeds is acknowledged as a threat to BTF (BTF Recovery Team, DECC & NPWS 2007). Buffel Grass is the primary existing threat to BTF habitat degradation in the Project Area. However other weeds, such as Parthenium, Prickly Acacia and other exotic grasses that are also known from the Project Area (Adani 2015) also have the potential to degrade BTF habitat if allowed to spread through mining activities. Vehicles and machinery also have the potential to import new weeds into the Project Area, with detrimental effects on BTF habitat.

A management objective under this plan is to reduce weed competition within BTF habitat. **Table 9** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.4 #4: Grazing in key habitat areas that changes the ground cover composition

The most probable cause of BTF decline from the southern parts of the historic range are overgrazing and habitat clearing **at Extern** (1999; Department of the Environment 2005). Pastoralism was typically concentrated in areas containing suitable habitat for the southern BTF subspecies, such as grassy, riparian woodlands on alluvial plains (NRA 2007). Declines have been less severe in the northern part of

the subspecies range, where clearing is not yet as widespread and grazing is predominately by cattle (BTFRT 2007).

BTF are known to persist in pastoral landscapes due to the prevalence of open eucalypt woodlands with suitable water resources and grasses (DEWHA 2009). The abundance of BTF and the viability of their populations in the landscape are influenced by the grazing regime that is in place (DEWHA 2009).

The grazing regime influences the composition and structure of the herbaceous layer of the vegetation. Long-term heavy grazing will selectively remove perennial grass species that are less tolerant of grazing (BTFRT 2011). This is likely to increase the prevalence of species such as *Aristida* spp. (Wire grasses), *Cenchrus ciliaris* (Buffel Grass) and *Bothriochloa pertusa* (Indian Bluegrass), annual grasses in general, and unpalatable weeds. Grass species richness is also likely to decrease under long-term heavy grazing.

Currently, the Project Area is being predominantly used for cattle grazing. The Project activities do not specifically include grazing, however, parts of the mining leases not being used for the construction and operation of the mine will be used for grazing. Long-term heavy grazing is likely to decrease the grass species richness and increase the prevalence of annual grasses and unpalatable weeds, and therefore decrease habitat quality for BTF (BTFRT 2011). Strategically managed grazing can 'open up' the grass layer, increasing the amount of bare ground on which BTF often forage as well as prevent thickening of a woody shrub layer. Particular cattle grazing regimes can also be used to manipulate the grass layer and manage fire by reducing fuel loads and therefore fire intensity. Grazing by cattle can be used strategically to reduce fuel loads in order to reduce the risk of hot extensive fires.

Sustainable grazing practices will be used in the Project Area as a management tool to manage threats to BTF habitat. Grazing will be used to decrease the abundance and presence of weeds, including Buffel Grass and other exotic pasture grasses, and control fuel loads so as to reduce the risk of an uncontrolled fire.

A management objective under this plan is to use strategic and sustainable grazing to manipulate the grass layer and manage fire by reducing fuel loads and therefore fire intensity. However, the objective is to also ensure grazing itself does not become a threat. Table 9 describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.5 #5: Wildfire or inappropriate fire management to key habitat areas that changes the ground cover composition

Fire is inevitable in the grassy woodlands of central Queensland and a natural component of these ecosystems. Historically, ignition sources include lightning-strike, low intensity wet season fires, or under traditional indigenous management (DEWHA 2009). Changes in the fire regimes can alter the habitat and food resource availability for the subspecies (BTFRT 1999); season-dependent diets have been documented in related finch species such as the Gouldian Finch (*Erythrura gouldiae*), Long-tailed Finch (*Poephila acuticauda*) and Masked Finch (*Poephila personata*) (BTFRT 2002).

Fire frequency can have the biggest impact on ecological function. High frequency, low intensity, patchy fire regimes can be beneficial to BTF by reducing the thickness of the shrub layer (BTFRT 2001). However, European settlement has caused a shift towards frequent, extensive and high intensity fires in the dry season resulting in large uniform areas being subject to fire (Rechetelo 2015). Inappropriate fire regimes can impact on the quality of habitat for the BTF by affecting the production of seeds and the diversity of grass species impacting on food availability. Fire will generally not reduce densities of *Eucalyptus* spp., such as Silver-leaved Ironbark, though it can change canopy structure.

Alternatively, fire exclusion can also lead to thickening of woody shrubs, decreasing the quality of BTF habitat.

BTF tend to favour habitat with a sparse cover (less than 5%) of shrubs (**Appendix E**). Short-lived *Acacia* spp. or dense areas of *Carissa ovata* and / or *C. lanceolata* will suppress the grass layer and grazing, and an altered fire regime will also increase woody thickening, diminishing both the forage supply and the quality of foraging habitat (Ludwig 2000; DSITIA 2014).

BTF require open patches between grass tussocks to feed on fallen grass seed. If the understorey is shrubby, the supply of grass seeds is likely to be diminished. Extensive areas of dense shrubs are likely to be detrimental to the species as the shrubs suppress grass growth and the exclusion of fire can facilitate the development of these areas (Removed at External Review *et al.* 2001). Small patches of shrubs and low trees may be used to rest and for shelter.

Fires in woodlands of the type that occur in the Project Area are fuelled principally by grass biomass rather than by woody material. Fire intensity will be greater with high fuel biomass, continuity of the fuel layer, a high degree of curing (drying) of the grassy fuel and ambient conditions, including high temperatures, low humidity and high wind speeds. Lower intensity fires will occur when fuel biomass is low and / or discontinuous, fuel moisture levels are high, ambient temperatures and wind speeds are low and atmospheric humidity is high.

Fire frequency, scale and intensity may also impact on habitat quality for BTF through numerous mechanisms. Large uncontrolled wildfires have the potential to destroy large areas of BTF habitat with consequential long recovery times. Fire frequency can also affect BTF habitat with inappropriate fire regimes impacting on the quality by affecting the production of seeds and the diversity of grass species and food availability (in the case of overly frequent fires) or by causing thickening of woody shrubs where fire is excluded from the landscape.

Management objectives under this plan are to reduce the risk of bushfire ignition, maintain a mosaic of fire history in BTF habitat and reduce the risk of bushfire spread. **Table 9** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.6 #6: Feral animal impacts

Domestic stock and rabbits can degrade habitat through grazing, trampling and altering the fuel loads (Removed at External Review). Woodland bird communities often feed in mixed flocks which is a predator vigilance and avoidance behaviour (Removed at External Review 2012; Adani 2012). Flocks may be reduced in size when the abundance of seeding grasses is low, and as a consequence can increase predation on bird species through loss of predator vigilance when feeding (at External Review *et al.* 2011).

Invasive animals are known to occur in the Brigalow Belt North and Desert Uplands bioregions. Feral cats (*Felis catus*), were recorded in the Project Area in 2010 and 2011 and are likely to prey on BTF (GHD 2012a). There are currently no data on cat presence or predation rates within Moray Downs West or the Project Area. Studies near Townsville found that nests were abandoned or became inactive when they were destroyed by predators (NRA 2005 in DoE 2016). Foraging and watering areas may also be disturbed by wallowing and uprooting of feral pigs.

Management objectives under this plan are to reduce habitat degradation from grazing by introduced herbivores, minimise predation risk by invasive mammals and use adaptive management of weed and

pest controls to minimise threats to BTF and their habitat. **Table 9** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.7 #7: Loss or degradation of water sources

BTF need to drink water on at least a daily basis and drink more frequently during the drier times of the year. The importance of water to BTF is highlighted by the fact that they typically nest and breed near water. The species is thought to undertake local movements in response to rainfall patterns, with some populations utilising seasonally (wet season) available water to access breeding grounds then contracting back to permanent water sources during the dry season (at External pers obs.).

Activities that reduce the availability (location and duration) of water or detrimentally alter water quality in areas of BTF habitat may negatively impact on the species. This impact will be greatest in breeding areas and / or dry season refugia. The availability of vegetation in the immediate vicinity of the water is important, to provide shelter for perching prior to drinking, and trees through which they can travel to and from the water are important. Pressures on the availability of water will be most pronounced during periods of drought. Conversely, the creation of water sources in certain parts of the landscape may create habitat for the BTF.

Numerous occurrences of BTF drinking from water troughs were recorded within the Project Area during surveys completed in the period 2013 to 2018 (GHD 2012; Niche 2015a and 2015b, ELA 2017a, E2M 2018). Vegetation in close proximity to water sources is important as it provides shelter for birds (at External 2011). It is likely that additional anthropogenic water sources in BTF habitat will assist the species in drought conditions by providing a more reliable and permanent source of water.

Within areas to be open cut mined, existing natural and artificial surface water sources will be lost. There are six dams within the Project Area where BTF have been identified (Niche 2015a, Niche 2015b, Niche 2015c and ELA 2017a) that will be lost due to mining activities (Figure 3). BTF have been recorded consistently utilising some of these water sources, in particular #1 Dam and #2 Dam. Removal of these permanent water sources from the Project Area will decrease the overall availability of water for the BTF across the broader landscape.

Availability of drinking water in proximity to good quality habitat is critical for BTF persistence. Contamination of potential BTF water resources surrounding the mine from sources such as hydrocarbon leaks or spills, spoil disposal, release of sediments through clearing and earthworks, or draining of low quality water from existing farm dams, could impact on the species. These impacts are unlikely to occur due to the alignment and location of mining activities and the implementation of adequate control measures. Such changes to water quality may reduce the suitability of aquatic and riparian habitats for terrestrial species.

Management objectives under this plan are to:

- ensure water quality in known BTF water sources outside disturbance footprint remain within acceptable limits
- reduce degradation of suitable water sources
- protect environmental values within waterways of the receiving environment
- minimise siltation of water resources
- maintain access to water, with no net loss of suitable permanent water sources
- reduce the risk of contamination of BTF habitat by chemicals, fuel, heavy metals

Table 10 describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.8 #8: Mine dewatering

Mine dewatering has the potential to negatively impact on groundwater-fed BTF watering sources. Drawdown may reduce the temporal and spatial availability of water by restricting or removing the base flow that persists in the Carmichael River during the dry season or increase the low flow periods as well as impacting spring wetland areas which BTF may use (ELA, 2015b). However, it should be noted that BTF have not been observed to utilise the Carmichael River ([Figure 4](#)).

A management objective under this plan is to manage the impacts of mine dewatering. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.9 #9: Earthworks

Earthworks carried out as a part of mine construction will lead to increased exposure to light, noise, dust, vehicles and people. Animals may also become more vulnerable to predation, because of increased light making it easier for predators to locate prey or noise levels making it harder for prey to detect approaching predators (Adani 2012).

Increased exposure to light, noise, dust, vehicles and people are dealt with in other sections. The other possible impact to BTF as a result of earthworks are the mortality and injury of individuals due to machinery strike.

Vehicles and machinery used to undertake land clearing have the potential to lead to direct mortality of fauna in the event that individuals are struck. Those animals that are unable to disperse away from areas under active clearing are also particularly susceptible to injury or death. This includes amphibians, reptiles, small ground-dwelling mammals, arboreal mammals and nocturnal species that are inactive during daylight hours.

Other potential causes of mortality include animals becoming trapped in excavations, and carrion eaters being struck when feeding on road kill. However, as the BTF are able to disperse away from areas subject to earthworks, fauna mortality and injury to individuals due to machinery strike is not expected to be a common occurrence (Adani 2012).

A management objective under this plan is to minimise the risk of light vehicle and machinery strike during earthworks and operations. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.10#10: Noise and vibration

As the Project Area is currently exposed to some disturbance as a working cattle property, the BTF that occur there exhibit a degree of disturbance tolerance. BTF are known to inhabit areas exposed to anthropogenic disturbance (peri-urban Townsville including habitat directly adjacent to military training areas and numerous towns in central Queensland).

The BTF may exhibit initial fright behaviour in response to the increased intensity of disturbance at the Project Area, and will either adapt to the disturbance levels, or move away from the areas of activity into

similar habitat that is extensively available in the adjacent landscape. Dispersal will be facilitated by active management and where possible enhancement of habitats occurring onsite (outside the mine footprint) and offsite (offset areas; Adani 2012).

The project will use standard construction equipment, general trade equipment and specialised equipment as required. Some blasting will be required to prepare overburden for removal and also coal extraction (Adani 2012).

Noise and vibration disturbance from coal transport may reduce the quality of resources for BTF, both within the Project Area and in adjacent areas. Noise from mining operations may increase BTF stress and flushing responses, change foraging behaviours, reduce reproductive success and communication at External (Adani 2012).

A management objective under this plan is to minimise habitat modification as a result of noise and vibration. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.11#11: Emissions (including dust)

Vegetation clearing has the potential to facilitate erosion (by water and wind). This can have a localised impact on species and habitat suitability by reducing the quality and abundance of refuges, microhabitats and food availability through the smothering of native vegetation with sediment.

Earthworks will result in dust emissions. Excessive dust settling on vegetation could also suppress vegetation growth by limiting the photosynthesis potential of plants in close proximity to the construction area (Adani 2007). Plants with dust on leaves may also be less palatable as a food source for animals. Dust deposition associated with earthwork activities will generally occur relatively close to areas of disturbance and hence, plants within 50 m – 100 m of construction activities may be affected by dust. As construction activities are temporary, effects will be short lived, and rainfall will generally remove dust from plants (Adani 2012).

Dust emissions from coal transport may reduce the quality of resources for BTF, both within the Project Area and in adjacent areas. Dust may also affect plant health and palatability, particularly for native grasses within foraging habitat.

A management objective under this plan is to minimise emissions, particularly dusts. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.12#12: Light spill and other visual impacts

Development of the project will necessitate the installation of lighting for safety and security of operations as the proposed mine will operate 24 hours per day. Impacts from lighting will involve static floodlights associated with mine operations, lighting around the mine infrastructure area, workshops and ancillary buildings, vehicle lights moving around the site. Artificial night lighting levels are expected to be very low indeed, if present at all, and this is considered to be an impact of minor significance on fauna generally, including the BTF (Adani 2012).

A management objective under this plan is to minimise light spill and other visual impacts. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.13 #13: Stream diversion and flood levees

Existing hydrology will be altered as a result of the mine operations through realignment of watercourses as well as removal of some existing farm dams and cattle troughs. Diversion drains around the perimeter of the mine site as well as areas of ponding and drainage management within the subsidence area provide water sources. The provision and security of surface water in those potential habitat areas may provide additional localised access to drinking water for the subspecies.

A management objective under this plan is to reduce the impact of stream diversion and flood levees. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

5 Adaptive Management Framework

This section describes the adaptive management framework that will be applied to the management of BTF, as originally outlined in the BTF Management Plan prepared during the environmental impact assessment process (Adani 2014).

Adaptive management is a process that deals with uncertainty and incomplete knowledge by using systematic monitoring to reduce uncertainty and improve management actions over time. The monitoring program that will provide data to inform and improve the management actions in this plan are outlined in **Section 7** and **Appendix C**. In general, the monitoring framework will:

- Address key questions regarding BTF ecology and distribution. The new knowledge will be systematically reviewed and used to refine the monitoring and management of BTF in the Project Area. Improved knowledge about BTF ecology and distribution will allow understanding of the potential project impacts to be further refined.
- Employ appropriate regular review and analysis of the monitoring data to refine the monitoring program and refine management actions.

Adaptive management emphasises the iterative feedback between the implementation of management actions and the assessment of their effectiveness via continuous improvement of knowledge via monitoring and evaluation of the monitoring data (Exter *et al.* 2012). In particular, the results of the BTF Research Program and monitoring completed under the BTF Management Plan will provide a basis for review of the management actions, and ensure that mitigation measures are appropriately targeted and based on the best available science.

The key management actions are outlined in **Section 6**. Management actions, and the monitoring that provides information for the management, will be based largely on the main themes within **Section 6**, and may be expanded as new knowledge of BTF at the Project Area becomes available. Specific management objectives, performance criteria, management actions, monitoring, triggers for adaptive management, and corrective actions have been established (see **Table 8** to **Table 10**), consistent with the framework for adaptive management outlined in **Figure 5**. The monitoring program will inform the management over time, which in turn will help develop more effective monitoring programs. All of these steps will allow ongoing revision and improvement of the BTF Management Plan.

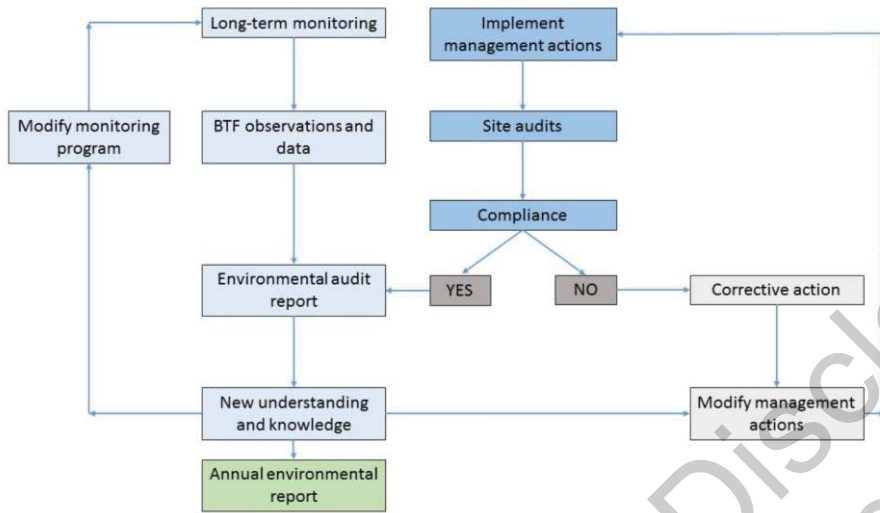


Figure 5 Adaptive management framework

6 Mitigation and Management Measures

The mitigation and management measures are required under EPBC conditions 6d) to f) and EA condition 16e) and have been developed in accordance with relevant guidance documents and best available knowledge regarding BTF ecology and habitat use within the Project Area.

An adaptive management approach will also be implemented where:

1. monitoring identifies that mitigation and management measures are not achieving the performance criteria
2. in response to triggers identified by the monitoring process and from information gathered in the field from the pre-clearance survey and fauna spotter-catchers, and
3. implementation of the BTF Research Program.

Measures intended to mitigate and / or manage the potential impacts to BTF are described in **Section 6.1**. As per EPBC Act approval condition 6j) and EA condition 16k), monitoring will be undertaken by a suitably qualified person (see **Section 9.3** for details), to determine the effectiveness of mitigation measures. This process is referred to as the adaptive management loop. The results of monitoring, and associated assessments of the effectiveness of mitigation measures, will be reported to DoE and DES.

6.1 Mitigation measures

Mitigation measures described are either those specific to BTF or for other ecological values of significance (i.e. TECs and other threatened species) of relevance to the BTF occurring in the Project Area. Generic mitigation measures are included as they provide an important approach to whole of ecosystem protection, which will also enable management of impacts to specific species, such as BTF.

Pre-clearance surveys are a collective mitigation measure proposed across this and other management plans as the surveys will provide information on the composition and area of vegetation and habitat to be disturbed prior to construction works. These surveys provide opportunities for avoidance of further impacts, as well as enabling accurate determination of disturbance areas to ensure these are not greater than approved disturbance limits.

A description of the generic mitigation measures that are applicable to the management of BTF is provided in **Table 7**.

Table 7 Generic mitigation measures to be implemented across the Project Area

Objectives	Actions
Educate <u>staff site personnel</u> and contractors about the presence and identification of threatened species, and maintain awareness during construction and operations.	Education <ul style="list-style-type: none"> • Induction program for <u>site personnel staff</u> and contractors about threatened species, their habitats and identification. • Identification posters in prominent work locations to maintain awareness. • Implement sound land management practices.
Reduce the magnitude of disturbance to threatened communities and threatened species within the Project Area where possible.	<ul style="list-style-type: none"> • There will be some discretion in the precise location of some infrastructure. Where possible, such infrastructure will be located in areas which avoid disturbance to threatened species habitat.

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Objectives	Actions
Determine the environmental condition, immediately prior to construction activities. Monitor compliance with approval conditions as required by Condition 6g) of EPBC2010/5736.	Undertake pre-clearance surveys <ul style="list-style-type: none"> Conduct surveys of vegetation and threatened species habitat extent and condition, prior to the commencement of any clearing or disturbance activities. Define the area (hectares) of threatened ecological communities and threatened species habitat to be cleared.
Minimise impacts of construction on threatened communities and species.	Use licensed fauna spotter-catchers during vegetation clearing <ul style="list-style-type: none"> Fauna to be recorded and translocated to suitable habitat adjacent to the disturbance area, where practical. Fauna spotter-catchers are qualified professionals trained in competencies to handle animals, minimise capture myopathy and shock in birds and reptiles. Under the <i>Nature Conservation Act 1992</i> (Qld), fauna spotter-catchers hold permits for dispersing, removing and relocating wildlife. Fauna deaths and injuries to be recorded, and managed in accordance with relevant guidelines.
Minimise impacts on threatened communities and species, and their habitat. Promote post-construction recovery of the natural ecosystem.	Rehabilitate all temporarily disturbed areas (e.g. lay down areas and turning circles) <ul style="list-style-type: none"> All temporarily disturbed areas will be rehabilitated as soon as possible following completion of use, where such activity does not compromise the ongoing operation of the project (e.g. increase bushfire risk). The timing of rehabilitation actions after disturbance will be outlined in the Plan of Operations, developed in accordance with the EA. The ongoing program of rehabilitation works will be developed on the basis of environmental objectives, local site conditions and logistical requirements.
No net loss of threatened communities and species. Maintain the integrity of ecological habitats within the region.	Implement environmental offsets (for selected species and ecological communities) <ul style="list-style-type: none"> Offset the habitat values of threatened ecological communities and used by threatened species, within the Project Area by securing ecologically equivalent areas elsewhere. Monitor BTF habitat values through annual groundcover assessments during May to maintain and where possible enhance BTF habitat within the Mining Lease. Maintain BTF habitat values in non-mined areas
Reduce the impact of lighting on threatened species during construction and operation.	Manage light pollution <ul style="list-style-type: none"> Use directional lighting and strategic timing and placement of lights to minimise light spill into known threatened species habitat and TECs.

The results of all mitigation actions will be recorded as specified in approval condition 6g) of EPBC2010/5736. Further details of such reporting are provided in **Section 9**. A register of all commitments arising from the management planning process is provided in **Section 10**.

Tables 8 to Table 10 summarises the proposed mitigation and management measures specific to BTF which will be implemented during planning, pre-construction, construction, operation and decommissioning phases of the Project that address potential impacts specific to BTF. They include management actions for Ten Mile Bore, and the management of water sources. Within the approved level of disturbance, if there are management practices that can be taken to avoid, or reduce impacts to BTF and their habitat, such practices will be implemented.

6.2 Impact mitigation and management

In accordance with EPBC conditions 6d) to f) and EA condition 16e), measures will be implemented to mitigate and manage impacts to BTF during the Project.

To address the impacts to important BTF habitat in the northern section of the Project Area, Adani altered the mine plan during the EIS process to access coal reserves in this northern section via underground mining, thereby reducing the clearing requirements in this area. Where possible, associated mining infrastructure and disturbances (such as linear infrastructure, spoil and / or stockpiling) have been located in locations where there is no confirmed BTF habitat. In particular, this applies to the northern section of the Project Area where stockpiling and chemical storage will be within and / or adjoining locations where BTF have been recorded.

Mitigation measures associated with clearing will be implemented strategically in accordance with the staging of Project activities (**Section 2.2**). Prior to any clearing commencing, clearing requirements for mine and other infrastructure will be reviewed in order to identify opportunities to reduce clearing of native vegetation and utilise existing cleared areas wherever possible. Spoil and topsoil stockpiling will be avoided in areas where BTF have been recorded or within known or potential habitat, where possible.

Threatened species and vegetation mapping will be consulted prior to planning spoil pile placement to minimise the potential for impacts to BTF habitat. Rehabilitation of BTF habitat will occur in areas that are subject to temporary disturbance, and in areas that are no longer required for mining operations. Offsets are in place for areas of BTF habitat that can't be rehabilitated (see **Section 6.5**). Management activities for areas subject to offsets are described in the OAMP, and include the provision of water supplies to support BTF. At the completion of the Project, parts of the Project Area are likely to be utilised for pastoral activities, providing similar habitat values for BTF that existed prior to the Project commencing, including the provision of water for cattle grazing.

6.3 Impact minimisation measures

In accordance with EPBC conditions 6d) to f) and EA condition 16e), measures will be implemented to minimise impacts to BTF during the Project.

6.3.1 Vegetation clearing protocols

Planning phase – whole-of-project staging

The development of the Project will be a staged process throughout the life of the Project and is expected to result in impacts of up to 9,492 ha of BTF habitat (CO2 2016). In order to mitigate these impacts, the development and clearing will be staged (see [Table 1](#) for different Project stages causing

Generally, clearing will commence from the middle of the Project Area which largely consists of non-remnant vegetation that does not provide habitat for BTF, before gradually progressing towards the north and south, respectively. Clearing of important habitat located in the northern third (i.e. between Four Mile Bore and Ten Mile Bore) and the southern quarter (south from Carmichael Bore) of the Project Area, will occur as late as possible during the construction and operational phases. The rationale behind this staged approach is:

- The existing breeding population of BTF within the Project Area will be protected for as long as possible, allowing for ongoing recovery and redistribution of the population;
- Clearing disturbed areas first will allow birds to remain in areas of good habitat rather than be directed into the mid-sections of the Project Area, where habitats are less favourable; and

- Staging will allow time for BTF habitat in the surrounding offset areas to improve such that birds may be attracted to these areas prior to clearing impacts occurring and / or have areas of suitable habitat to move into during construction.

Clearing will be minimised as far as practicable during the wet season, which is the known breeding season for BTF. The wet season is nominally December to March each year, and Adani will use its best endeavours to plan and implement clearing activities to occur outside the breeding season. However, the actual timing of the wet season will be determined on an annual basis depending on local weather conditions.

Management measures to achieve the clearing outcome will be through long term planning process according to the stages of mine plan that will allow these timing restrictions to be adhered to. However, if operational constraints (particularly in the early stages of the mine construction) necessitate clearing during the wet season, additional measures will be required and will be implemented during the pre-construction phase (see below).

Pre-construction phase – stage scale planning for vegetation clearing

A range of measures will be implemented prior to vegetation clearing for each stage, in order to further avoid and / or reduce impacts to BTF. Collectively, these measures are aimed at encouraging birds still present in the clearing zone to leave the area without human intervention.

A clearing plan will be developed for each stage. The development of this plan will require up-to-date information on the habitat quality and utilisation of the area by BTF. This information will be gathered during baseline and pre-clearance surveys, to be undertaken by suitably qualified ecologists, with demonstrated experience in the survey and management of BTF. Additional information gathered during the monitoring and research components of the Project must also be utilised.

The clearing plan for each stage will be developed and must consider/include:

- Mapping depicting disturbed areas, vegetated areas that are not potential BTF habitat, potential BTF habitat, areas where there have been sightings of BTF within the last five years, and areas showing breeding records.
- Structuring works in a way that specifies daily clearing extents within BTF habitats to allow BTF to fly to other habitat areas while habitat is cleared. Currently, it is conservatively assumed that BTF are able to travel at least 0.5 km in one day to escape clearing activities (BTF may travel several km in a day to access water). However these clearing limits will need to be tested as part of the on-going monitoring and adaptive management process.
- Structuring clearing so that wherever possible habitat connectivity can be maintained by providing stepping stones of habitat the BTF can travel through when escaping the clearing front.
- Site plans and maps depicting exclusion zones for vegetation clearance and machinery within areas of BTF habitat. Access to these zones must be restricted in order to prevent any unnecessary damage to BTF habitat.

Prior to the commencement of site works, any conditions listed in the "Permit to Disturb" must be implemented (e.g. clearing extents clearly marked and trees / areas requiring protection clearly marked).

Construction phase – clearing

Vegetation clearing will be undertaken in accordance with the clearing plan for each stage. All BTF habitat clearing operations will be monitored for compliance by suitably qualified fauna spotter-catchers during clearing activities (see below).

6.3.2 Fauna spotter-catcher

The use of fauna spotter-catchers prior to and during vegetation clearing activities within BTF habitat will be implemented to ensure impacts on BTF are minimised. This role is not specific to the BTF and will be implemented in accordance with the requirements of the overarching Species Management Plan and relevant approvals to protect fauna during clearing activities. The fauna spotter-catcher will instruct contractors on the most appropriate technique for felling habitat trees to minimise harm to undetected fauna and also inspect felled vegetation for fauna and relocate individuals as required.

If clearing is to occur during the wet season (to be avoided where possible), the role of the fauna spotter-catcher with respect to the BTF is to:

- Identify active nests not picked up by the pre-clearance surveys;
- Assess whether breeding places (i.e. nests) contain eggs or young;
- Establish and implement relocation requirements.

The fauna spotter-catcher will utilise expert advice from a BTF specialist to assist in the development of fauna handling/relocation plans to ensure consideration of life-cycle or ecological constraints. In circumstances where avoidance has been assessed but impacts on an isolated nest are unavoidable during the clearing process, with relevant approval from authorities for tampering with the breeding place of a threatened species, the fauna spotter-catcher would be responsible for removing the nest and placing young / eggs into care in captivity.

6.3.3 Summary of mitigation and management measures

The threats to the BTF relevant to the Project and potential project impacts and actions minimising impacts to the BTF are summarised in **Tables 8 to 10**. The tables address the following:

- management objectives
- performance criteria
- management actions
- monitoring
- triggers for adaptive management and corrective actions
- specific, measurable and time-bound corrective actions.

When adaptive management and corrective actions are triggered, the first step is to investigate the cause of the trigger. The investigation will be carried out as soon as possible, but within 2 days, after the trigger is identified and will focus on the reasons and causes of the triggers, and identify appropriate corrective actions in a timely way. The investigation will be:

- Carried out in accordance with the Environmental Management System (certified ISO 14001)
- Assessing actual or potential, short and long term impacts
- Determining the root and contributing causes
- Recording details on approved templates

- Identifying appropriate corrective actions, as per the last column in **Tables 8 to 10**. Notification of relevant managing agencies and a revision to the BOS will be proposed if an increased impact cannot be avoided.

Table 8 Management objectives, performance criteria, adaptive management triggers and corrective actions – Vegetation clearing / habitat loss, including fragmentation of key habitat areas

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
Minimise habitat loss	Avoid-No unnecessary clearing	<p>No-go zones for vegetation clearance and machinery to-will be developed for areas of BTF habitat outside of the clearing footprint and to-will be depicted on site plans and maps to restrict access and prevent unapproved clearing.</p> <p>Prior to the commencement of site works, any conditions listed in the "Permit to Disturb" must be implemented (e.g. clearing extents clearly marked, trees/areas requiring protection clearly marked).</p> <p>The time between clearing BTF habitat, and the next construction activity will be as short as possible. However, the time between BTF habitat clearing and next activities will be a maximum of 12 months.</p>	<p><u>Regular site inspections in accordance with the Environmental Management Plan and System.</u></p> <p>Close out report for the Permit to Disturb process includes check for compliance with:</p> <ul style="list-style-type: none"> clearing only in the approved footprint no clearing in the no-go zone/s. <p>Regular site inspections in accordance with the Environmental Management Plan and System.</p> <p>Regular site inspections in accordance with the Environmental Management Plan and System.</p>	<p>Clearing in BTF habitat:</p> <ul style="list-style-type: none"> outside approved clearing footprint in no-go zone/s without a "Permit to Disturb" issued <p>Cleared BTF habitat area exposed for 11 months.</p>	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> When clearing outside approved clearing footprint, no go zones or without a "Permit to Disturb Permit" issued, <ul style="list-style-type: none"> Environment Manager ensure that all clearing activities cease immediately Area assessed by a suitably qualified ecologist/person within 15 business days of investigation Reviewing and modifying "Permit to Disturb" process and no-go zone identification and communication protocols <p>The provision of offsets, as an overarching corrective action to achieve the objective of minimising habitat loss.</p> <p>When cleared BTF habitat area exposed for 11 months, rehabilitation of the impacted area.</p>
	Clearing of BTF habitat does not exceed 9,492 ha as approved in EIS and referral documentation	<p>Prior to the commencement of site works, any conditions listed in the "Permit to Disturb" must be implemented (e.g. clearing extents clearly marked, trees/areas requiring protection clearly marked).</p>	<p>Monitoring of vegetation proposed to be cleared by the Environmental Manager, via the Permit to Disturb process.</p> <p>Ongoing monitoring and reporting on the amount of BTF habitat that is cleared annually, and predicted to be cleared.</p>	<p>Reach 75% of the clearing BTF habitat approved area for stage 1</p>	<p>The trigger of reaching 75% of clearing BTF habitat does not require correction as the clearing is approved to be carried out, however the following actions will be triggered:</p> <ul style="list-style-type: none"> Contact with nominated representatives from compliance teams of DoE and DES under the EPBC and Environmental Protection Acts when clearing reaches 75% of approved area for stage 1 Provision of maps and data showing clearing in approved impact areas, and calculations showing quantity of approved clearing Provide advice demonstrating how the clearing will not exceed approved limits. <p><u>If the assessment finds that the actual area of impact differs from the area of impact as detailed in the BOS, within 30 days of this determination the BOS will be revised and submitted to the Department. If an increased offset is required by the revised BOS, this will be delivered within 12 months of the revised BOS being submitted to the Department.</u></p>

Commented [MB1]: Moved further down to the rehabilitation section

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
	Minimise habitat fragmentation	<p>The area of direct impact has been minimised as far as possible throughout the design and development of the mine plan. In 2012, the relocation of the out of pit stockpiles was reduced by approximately 7,000 ha. This change to the mine plan resulted in approximately 40 percent reduction in the potential area of direct impact.</p> <p>Where practical, spoil and / or stockpiling to <u>will</u> be preferentially located in areas of previously disturbed environment or areas of future disturbance, rather than within BTF habitat. The assessment of practicality will consider issues such as the proximity and accessibility of alternative areas, safety of personnel and logistical requirements of transporting spoil.</p> <p>Manage non-mined and offset areas to maintain and improve BTF habitat values. This work will be guided by results from annual vegetation assessments, annual BTF surveys and the BTF Research Program. Ensure the pre-disturbance condition of BTF habitat adjacent to the development is maintained</p>	<p>Monitoring of vegetation proposed to be cleared by the Environmental Manager, via the Permit to Disturb process.</p> <p>Annual vegetation assessments, annual BTF surveys and the BTF Research Program.</p>	Direct impacts occur outside of approved impact areas particularly in non-mined areas.	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Impacts assessed by a suitably qualified ecologist/person within 15 business days of investigation Reviewing and modifying "Permit to Disturb" process and no-go zone identification and communication protocols Review of activities with respect to potential direct and indirect impacts outside of approved areas. Rehabilitation of the impacted area. <p><u>If the assessment finds that the actual area of impact differs from the area of impact as detailed in the BOS, within 30 days of this determination the BOS will be revised and submitted to the Department. If an increased offset is required by the revised BOS, this will be delivered within 12 months of the revised BOS being submitted to the Department.</u></p>
	Minimise <u>the impacts of</u> habitat alteration through subsidence	<p>Ameliorate impacts of ponding and cracking in subsidence areas if required to mitigate any negative impacts on BTF habitat values, in accordance with the Subsidence Management Plan.</p> <p>Establish exclusion zones and remove cattle from underground mining footprint, when subsidence is predicted. Construct fences outside subsidence footprint to keep cattle from the subsided area.</p>	<p>Develop a numerical model based on the geological data to refine predicted cracking and subsidence impacts. Modelling to inform detailed monitoring methodologies.</p> <p><u>Use of b</u>Baseline habitat quality for comparison during monitoring, including establishing control monitoring points.</p> <p>Conduct annual monitoring of the condition of BTF habitat in subsidence areas, using methodologies identified in the Subsidence Management Plan.</p>	<p>Impacts to BTF habitat, including ponding and cracking, found in subsidence areas.</p> <p>Weeds found in subsidence cracking and ponding areas.</p>	<p>The appropriate corrective actions will commence within 2 days of identification of cause and may include:</p> <ul style="list-style-type: none"> Reviewing and redesigning the monitoring program, increasing monitoring events, changing monitoring methodology Rectifying impacts (e.g. pumping out ponds) Re designing and implementing and water diversions Actively manage control weeds to maintain and enhance BTF habitat values <u>in the cracking and ponding areas.</u>

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
Minimise fauna death during vegetation clearing	<p>Ensure BTF living near the clearance zone have time to move out of the areas of disturbance without human intervention</p>	<p>Stages are will to be structured in a way that limits clearing extents to allow BTF to fly to other habitat areas while when habitat is cleared.</p> <p>Clearing limits are untested and to will be developed based on the likely ability of the BTF to travel a conservative minimum of 0.5 km in one day to escape clearing impacts to where suitable habitat is present in adjoining areas to be retained.</p> <p>Where possible, the overall direction of sequential vegetation clearance will be away from threatening processes (i.e. mining operations/roads cleared land) to direct fauna towards areas of retained native vegetation.</p> <p>The general progress of clearance shall will be towards habitat to be retained in the north and/or west of the Project Area for areas north of the Carmichael River and towards habitat to be retained in the south and/or west of the Project Area for areas south of the Carmichael River.</p>	<p>Record the areas of occupancy for all BTF prior to clearing activities that occur within the Project Area, adjacent to Project Area and areas for suitable BTF habitat rehabilitation.</p> <p>Confirm and identify the spatial extent and condition of BTF habitat to be disturbed prior to any clearing or disturbance commencing, through pre-clearance surveys. BTF surveys will focus on confirming species presence throughout the Project Area, identifying species presence in proximity, but outside (adjacent to) Project Area and identifying areas of potential rehabilitation for BTF habitat values inside the Project Area, but outside the disturbance footprint.</p> <p>Record observed BTF fatality, including suspected nests / eggs of BTF.</p>	<ul style="list-style-type: none"> Insufficient adjacent habitat within 500m from clearance areas to allow refuge from impacts. Fauna spotter-catchers and monitoring results indicating that BTF are not able to move away from cleared areas in sufficient time. BTF death or injury during vegetation clearing. 	<p>The appropriate corrective actions will commence within 2 days of identification of cause and may include:</p> <ul style="list-style-type: none"> Redesign of activities associated with observed mortality to avoid causal and contributing factors Re-planning / adjusting clearing progression timeframes and locations with respect to refuge availability Third party review by suitably qualified ecologist/person of management and monitoring actions to provide input on effectiveness Modifying the strategic grazing regime, or fire management measures, to better support enhancement of values Divert clearing to other habitat to provide time for BTF to adjust Re-evaluate the suitability of the relevant management and monitoring actions in this plan The installation and maintenance of additional artificial watering points for the black-throated finch.
No injury or death to BTF individuals, nests or their young during vegetation clearing		<p>Pre-clearance surveys are will to be conducted by a suitably qualified ecologist throughout BTF habitat prior to the commencement of each stage of clearing to identify and map significant areas for the BTF.</p> <p>Where active nests or other sensitive habitat areas are identified during the pre-clearing</p>	<p>Confirm and identify the spatial extent and condition of BTF habitat to be disturbed prior to any clearing or disturbance commencing, through pre-clearance surveys.</p> <p>BTF surveys will focus on confirming species presence throughout the Project Area, identifying species presence in</p>	<ul style="list-style-type: none"> Vegetation clearance undertaken without a pre-clearance survey. Clearance of vegetation does not follow vegetation clearance protocols with no progressive clearing plan developed prior to each stage of clearing. 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Depending on the extent of any injuries, injured BTFs will either immediately be taken to the nearest qualified veterinary practitioner or wildlife carer, or humanely euthanized on site by an authorised and trained person Rectifying impacts of vegetation loss Review and re design to avoid reoccurrence and address actual cause

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
		<p>surveys specific actions are will to be implemented to address these areas.</p> <p>Suitably qualified and experienced fauna spotter-catchers will be present during vegetation clearance works within areas of BTF habitat and remnant vegetation.</p> <p>No tampering with BTF breeding places is to occur without the relevant approvals / permits. A and any removal of nests would <u>will</u> be required to be undertaken in accordance with the requirements of these approvals.</p> <p>BTF deaths and injuries to will be recorded, and managed in accordance with relevant guidelines.</p> <p>Record the areas of occupancy for all BTF prior to clearing activities that occur within the Project Area, adjacent to Project Area and areas for suitable <u>for</u> BTF habitat rehabilitation.</p>	<p>proximity, but outside (adjacent to) Project Area and identifying areas of potential rehabilitation for BTF habitat values inside the Project Area, but outside the disturbance footprint.</p> <p>After BTF habitat clearing, a search for remaining BTF is will be conducted as soon as practicable.</p>	<ul style="list-style-type: none"> BTF death or injury during vegetation clearing Vegetation clearance undertaken without a qualified fauna spotter-catcher present during BTF habitat clearing 	<ul style="list-style-type: none"> Communication with personnel involved and across all site team members (for example, via toolbox meetings) Incidents will be reported to DES and DoE within 24 hours by the Environmental Manager as per Species Management Program conditions.
	No entangled BTFs	No mine-related equipment or infrastructure with the potential to entangle fauna (e.g. bundled mesh fencing) will be left in sensitive areas such as near water bodies or potential BTF foraging areas.	Regular site inspections in accordance with the Environmental Management Plan and System.	Notification of BTF found entangled. BTF death or injury	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Depending on the extent of any injuries, injured BTFs will be either taken to the nearest qualified veterinary practitioner or wildlife carer, or humanely euthanized on site by an authorised and trained person Reviewing procedures and fencing protocols Actions to avoid entanglement re occurrence Incidents will be reported to DES and DoE within 24 hours by the Environmental Manager as per Species Management Program conditions.
	Areas for BTF to relocate to are in <u>place available</u> during clearing	<p>Ensure the pre-disturbance condition of BTF habitat adjacent to the development is maintained and condition of Offset Areas is being improved as per the OAMP.</p> <p>Offset Area condition adjacent to the mining leases is being improved as per the OAMP.</p>	<p>Deliver the Moray Downs West Offset Area Management Plan, as approved.</p> <p>The monitoring methods included in the <i>Moray Downs West Offset Area Management Plan</i> for the offset area are as follows:</p> <ul style="list-style-type: none"> method for determining monitoring locations is to apply the Guide to Determining Terrestrial Habitat Quality to calculate habitat quality scores For the species stocking rate component, the monitoring method for BTF as outlined in this plan For sites being monitored under the BTFMP within the offset area, use survey results to inform the habitat quality scoring under the OAMP (rather than duplicating survey effort at these sites). 	At 12 months after commencement of specified component of the action, no progress in legally securing Moray Downs West as an offset area.	Submission of application for alternative legal security with the Queensland and Commonwealth Governments, within the 12 months of trigger.

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
Progressive habitat restoration of disturbed areas	<u>Rehabilitation of All temporarily disturbed areas rehabilitated within 12 months of activity</u>	<u>The time between clearing BTF habitat, and the next construction activity will be as short as possible. However, the time between BTF habitat clearing and next activities will be a maximum of 12 months.</u> All temporarily disturbed areas will be rehabilitated as soon as possible following completion of use, where such activity does not compromise the ongoing operation of the project (e.g. increase bushfire risk).	<u>Regular site inspections in accordance with the Environmental Management Plan and System.</u> Measure the effectiveness of mitigation measures involving rehabilitation. Compare to relevant control sites or benchmarks for RE. Identify areas where rehabilitation effectiveness needs to be improved to achieve environmental objectives. Targeted searches during monitoring events for rehabilitation areas.	<u>Cleared BTF habitat area exposed for 11 months.</u> Temporary disturbance areas that are no longer required not rehabilitated, leading to excessive dust or other environmental nuisance or disturbance triggers. Targeted searches during monitoring events for rehabilitation areas.	<u>When cleared BTF habitat area exposed for 11 months, rehabilitation of the impacted area.</u> The appropriate corrective actions <u>for disturbance triggers, will be</u> in accordance with the Environmental Management System, <u>will be</u> implemented and may include: <ul style="list-style-type: none"> Review of process for temporary disturbance and monitoring to improve response time Rehabilitation activities to be undertaken in areas of temporary disturbance.
Rehabilitation of disturbed areas that are no longer required for operations		Progressive rehabilitation of disturbed areas will commence as soon as possible and generally within 6 months of the completion of operations activities in each area, in accordance with the Rehabilitation Management Plan. Rehabilitation will only commence later than 6 months if there will be benefits in coinciding commencement with the wet season. Rehabilitated areas must include food and water resources, and open foraging areas.	Monitoring surveys to <u>will</u> be conducted biannually for a 10 year period by suitably qualified ecologists in accordance with standard methodology to identify changes in BTF population size and movements over time. Banding and re-sighting techniques will provide a basis for assessing movement patterns and assessment of population dynamics. Targeted searches for BTFs in each rehabilitated area. Monitoring measures as shown on previous page (same row of table)	Annual rehabilitation monitoring report determines provided to DES <u>and DES state</u> rehabilitated areas do not achieve outcomes as specified and in Environmental Authority conditions. Disturbance areas that are no longer required not rehabilitated, leading to excessive dust or other environmental nuisance or disturbance triggers. <u>(See also Triggers for Performance Criterion for "All temporarily disturbed areas rehabilitated within 12 months of activity")</u>	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Delivering recommendations by a suitably qualified ecologist/expert for the reason for rehabilitation not achieving outcomes Review of weather conditions / seasons and timing of rehabilitation activities Trials of new rehabilitation methods.
Disturbed habitat are is restored or enhanced as soon as practicable <u>(See also Performance Criterion "All temporarily disturbed areas rehabilitated within 12 months of activity")</u>		Management of habitat <u>within the Project and offset areas</u> will occur concurrently. <u>The management will commence in areas adjoining the disturbance areas and in offset areas to</u> increase the carrying capacity of the adjoining habitat and provide refuge to BTF no longer able to utilise cleared areas. Rehabilitated areas must include food and water resources, and open foraging areas. A combination of short-term fast acting habitat modification activities (such as shrub layer reductions and grass layer improvements) to improve habitat qualities for BTF foraging, and longer-term activities such as weed management replanting programs to rehabilitate heavily disturbed areas over time.			The appropriate corrective actions in accordance with the Environmental Management System will be implemented and may include: <ul style="list-style-type: none"> Review of process for temporary disturbance and monitoring to improve response time Rehabilitation activities to be undertaken in areas of temporary disturbance.

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
Improve awareness of site personnel	All staff <u>site personnel</u> aware of management requirements with respect to BTF	<p>Incorporate information regarding BTF (such as map of habitat areas within the Project Area) and BTF management requirements into site inductions, toolboxes and pre-starts, particularly where working in <u>or around</u> BTF habitat.</p> <p>Identification posters for all threatened species with the potential to occur in the Project Area will be displayed in prominent positions.</p>	Records kept as a part of the Environmental Management System of inductions, training and toolbox meetings to ensure <u>site personnel</u> all staff receive the appropriate environmental training.	Environmental harm to BTF or their habitat as a result of <u>site personnel</u> staff activities.	<p>The appropriate corrective actions in accordance with the Environmental Management System will be implemented and may include:</p> <ul style="list-style-type: none"> Depending on the extent of any injuries, injured BTFs will be either taken to the nearest qualified veterinary practitioner or wildlife carer, or humanely euthanized on site by an authorised and trained person Rectifying impacts of vegetation loss Review of induction information and implementation processes to ensure BTF management requirements are addressed and distributed to all site team members Additional educational awareness training for <u>site personnel</u> all staff and contractors Incidents will be reported to DES and DoE within 24 hours by the Environmental Manager as per Species Management Program conditions.

Table 9 Management objectives, performance criteria, adaptive management triggers and corrective actions – Potential indirect project impacts

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
3	Increased exotic pasture and weed invasion of key habitat areas	Reduce weed competition	<p>No introduction of pest plants, invasive understorey species into BTF habitat.</p> <p>Minimise No significant increase in the abundance of weeds the spread of weeds across the Project Area and into / from adjacent habitat.</p>	<p>Weed control, as part of the PMP, will focus on managing declared pest plants and invasive species during construction and operations, <u>in accordance with the project pest management plan</u>.</p> <p>Weed hygiene controls, including the use of weed wash down stations, will be implemented in accordance with the <u>project pest management plan PMP</u> to prevent the introduction and spread of declared pest plants and other invasive weeds.</p> <p>Weed free areas within sensitive BTF habitat will be identified and mapped with strict weed control requirements for entering weed free areas.</p> <p>The establishment of new tracks through BTF habitat outside of the clearing areas will be minimised to prevent transport of weed seeds into BTF management areas.</p> <p>Provide weed wash-down stations at all Project Area entry and exit points, and tracks through known weed-infested areas.</p> <p>Enforce the use of weed wash-down stations at all times.</p> <p>Adaptive management of weed controls to minimise threats to BTF and their habitat.</p>	<p>Monitoring of weeds will be conducted yearly (including photo monitoring) or as per the project pest management plan. Monitoring will be for pest plants in BTF habitat in, and adjacent to, the Project Area (consistent with the OAMP).</p> <p>Monitoring will occur at the optimal time for detecting and identifying pest plant species.</p> <p>Monitoring will include for the presence of declared weeds, and abundance of environmental weeds.</p>	<ul style="list-style-type: none"> • Introduction or establishment of declared pest plants, and invasive species into previously unaffected areas. • Results of weed monitoring indicate a degradation of BTF habitat values, due to a proliferation of weeds. • A significant increase in the abundance of weeds, or pests or identification of new infestations. • Infestation of new weed species. 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> • Eliminate potential sources or reasons that may have attributed to an increase in species richness and/or relative abundance of weeds • Amending weed hygiene restrictions • Providing additional educational awareness training for <u>site personnel</u> all staff and contractors to ensure weed hygiene restrictions are adhered to • Revising weed control methods in accordance with the <i>Biosecurity Act 2014</i> • Take action to protect and restore BTF habitat values through implementation of site-specific measures such as weed control, fire management or grazing • Actively manage weeds to maintain and enhance BTF habitat values • Increasing the frequency and intensity of weed controls • Updating weed control methods in targeted weed control programs and plans.

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
4	Grazing of key habitat areas that changes the ground cover composition	Strategic use of grazing to manipulate the grass layer and manage fire by reducing fuel loads and therefore fire intensity. Do not allow grazing itself to become a threat.	<u>Manage-g</u> Grass loads is <u>managed</u> to reduce fire risk <u>in accordance with controlled grazing methods</u> . Grazing does not become an impact to grass layers and grass composition	The management of grazing within non-mined areas will be based on existing pastoral management practices under land agistment agreements, pastoral holding lease conditions and associated legislation. Management actions will seek to maintain and where possible enhance BTF habitats and populations (e.g. pest control, water source, grazing and fire management) in unmined parts of the Mine Area, as well as in offset areas.	Native perennial ground cover and ground composition assessed annually against the baseline data Monitor the condition of BTF habitat adjacent to the development and the Offsets Area. This will be undertaken using standard BioCondition monitoring surveys (see <u>Ext</u> ^{et al. 2011} for details) and species habitat index. The quality of known BTF water sources will be monitored. Annual BTF habitat vegetation assessments will occur during May within 2 ha plots at the following locations: CHAB02, CHAB03, CHAB22, CHAB23, CHAB24, CHAB25, CHAB37, CHAB45, CHAB47, CHAB48, CHAB52 (Open cut disturbance areas) and CHAB01, CHAB04, CHAB05, CHAB09, CHAB10, HAB44 and CHAB46 (Underground disturbance areas). Vegetation assessments will use methodologies described within baseline 'Report for Black Throated Finch On-site Monitoring Survey' dated 12 July 2013 to assess ground cover and ground composition based on Queensland BioCondition Framework (<u>Ext</u> ^{et al. 2011}) and the Queensland Herbarium flora survey methods (<u>t Exter</u> ^{et al. 2005}).	<ul style="list-style-type: none"> Annual vegetation assessment demonstrates a loss of native perennial species and / or cover from baseline conditions A significant increase in the abundance of non-native species such as Buffel Grass <u>Incidence of uncontrolled bushfire</u> 	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Additional fencing Spelling of paddocks to control grazing Additional controlled grazing to reduce biomass levels Additional pest controls Further fire management.

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
					<p>Moray Downs West Offset Area The monitoring methods included in the <i>Moray Downs West Offset Area Management Plan</i> for the offset area are as follows:</p> <ul style="list-style-type: none"> method for determining monitoring locations is to apply the Guide to Determining Terrestrial Habitat Quality to calculate habitat quality scores For the species stocking rate component, the monitoring method for BTF as outlined in this plan For sites being monitored under the BTFMP within the offset area, use survey results to inform the habitat quality scoring under the OAMP (rather than duplicating survey effort at these sites) <p>Further monitoring methods for BTF in the offset area are consistent with this plan, such as:</p> <ul style="list-style-type: none"> water source watches active searches incidental observations remote cameras vegetation condition assessments foraging plot assessments 		

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
5	Wildfire or inappropriate fire management of key habitat areas that changes ground cover composition	Maintain a mosaic of fire history in BTF habitat. Reduce the risk of bushfire spread	No uncontrolled fires (bushfires) in the Project Area. Fire management is conducted within an appropriate planning regime in accordance with the Bushfire Management Plan	Where possible, planned burns within BTF habitat are will be undertaken outside of the BTF breeding season. This will depend on seasonal conditions from year to year. The fire regime will be managed to utilise a patchwork of areas of different fire frequencies and times but biased toward low intensity fires. This regime would also help to reduce the risk of widespread hot fires by reducing fuel loading at the landscape scale. Higher intensity fires can be used strategically to reduce dense stands of <i>Acacia</i> spp., which may affect BTF foraging habitat. Two fires, approximately 2-3 years apart, could reduce the abundance of these species but it would be important to then allow several years for recovery of the community. The existing network of roads and tracks will be used to manage fire, rather than establishing additional firebreaks. This will help reduce the risk of weed incursion through movement of traffic into intact grasslands. Avoid the planning of scheduled burns in BTF habitat during the wet season where possible. Any planned burns during the breeding season that cannot be avoided will are to be carefully managed with respect to location relative to water sources and preferred breeding areas so as to seek opportunity to exclude these areas.	Monitoring of fuel load levels and native perennial ground cover and ground composition will. To be assessed at least annually against the baseline data. Additional monitoring actions as per the Bushfire Fire Management Plan.	<ul style="list-style-type: none"> Unplanned burn during the breeding season. Dense shrub layers forming in BTF habitat due to fire promoted germination. Incidence of uncontrolled bushfire 	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Review of fire regime based on monitoring results and aim to achieve appropriate balance of groundcover/shrub layer management without degrading foraging habitat Increasing the frequency of biomass monitoring Amending the strategic grazing regime Reviewing effectiveness of firebreaks, and establishment of additional fire breaks Modifying the timing and/or intensity of controlled burns.

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
		Reduce the risk of bushfire ignition	No bushfires sparked by project activities.	<p>Prior to site entry, all relevant site personnel, including contractors, will be made aware of fire safety and risks, including compliance with the Fire Management Plan.</p> <p>Bushfire mitigation measures will be outlined specified in the Bushfire Management Plan and will include but not be limited to:</p> <ul style="list-style-type: none"> Monitoring of weather conditions to identify high fire risk days, with controls to be upgraded on these days Restrictions on vehicles being left idling with the exhaust in contact with dry grass Designation of smoking areas Development of bushfire fuel management practices in the Project Area Minimise the residency time of accumulated coal around coal handling facilities to reduce the risk of spontaneous combustion Ensure all crews are equipped to deal with fires. This includes both fire-fighting equipment and training Monitor pasture biomass at the beginning of the wet season Work sites will be provided with adequate fire-fighting equipment (water cart) and training implement actions to prevent and suppress the spread of fire, should bushfire be ignited. 	<p>Monitoring of fuel load levels and native perennial ground cover and ground composition will to be assessed at least annually against the baseline data.</p> <p>Additional monitoring actions as per the Fire Management Plan.</p>	<ul style="list-style-type: none"> Bushfire sparked by project activities. 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Mitigate the established source, arising from the investigation, as to why and how the bushfire was sparked by project activities Review existing Bushfire Management Plan, ensuring consideration of ecological values and Rural Fire Service recommendations Greater monitoring of adherence to fire management measures Amending the strategic grazing regime Modifying the timing and/or intensity of controlled burns Re-training of site team members Delayed additional BTF habitat clearing Assess the benefits of strategic burning prior to the storm season to address pasture biomass that is unfavourable to BTF.

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#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
6	Feral animal impacts	Reduce habitat degradation from grazing by introduced herbivores Minimise predation risk by invasive mammals Adaptive management of weed and pest controls to minimise threats to BTF and their habitat.	No measured increase in rabbit, goat, fox and <u>/ or</u> cat numbers in the Project Area.	<p>Adaptive management of pest controls to minimise threats to BTF and their habitat.</p> <p>A project pest management plan will be developed and implemented prior to construction and operations, including measures for controlling rabbits, goats, foxes, cats and weeds. The project pest management plan will be developed in conjunction with neighbouring land owners, and will focus on tracks, waterways and habitat edges.</p> <p>Feral cat control outlined in the project pest management plan will focus on areas where BTF will be exposed and vulnerable to predation including on the interface of the clearing front and remnant vegetation and at water sources where BTF are vulnerable to attack while drinking.</p> <p>Domestic animals other than cattle (horses and dogs may also be required e.g. during mustering) will not be permitted into the Project Area.</p> <p>Feral cat control, <u>as specified</u>, outlined in the project pest management plan will focus on areas where BTF will be exposed and vulnerable to predation including on the interface of the clearing front and remnant vegetation and at water sources where BTF are vulnerable to attack while drinking.</p> <p>Domestic animals other than cattle (horses and dogs may also be required e.g. during mustering) will not be permitted into the Project Area. <u>Domestic animals will not be permitted into the Project Area, except for cattle and, when required for mustering, horses and dogs.</u></p>	<p>Monitor the presence and population abundance of invasive fauna to will be yearly as per the project pest management plan.</p>	<ul style="list-style-type: none"> Significant increase in the population of any invasive predator species from baseline scores. Observed (or evidence of) predation of BTF by pest species Observed habitat degradation attributed to threatening pest species <p>>Significant increase in the population of any invasive predator species from baseline scores.</p> <p>Domestic animals not permitted are observed in the Project Area</p>	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Increasing the frequency and intensity of pest animal control. Revising methods of pest animal control in accordance with Queensland Department of Agriculture and Fisheries (DAF) guidelines, and coordinate with neighbouring land owners to ensure a consistent approach Reviewing actions and methods included in the project pest management plan Updating pest animal control methods in targeted pest animal control programs Increase feral herbivore management efforts, in conjunction with neighbouring land owners Increase invasive predator management efforts, in conjunction with neighbouring land owners. <p>The appropriate corrective actions in accordance with the Environmental Management System will be implemented and may include:</p> <ul style="list-style-type: none"> Rectifying impacts <u>Communication with personnel involved and across all site team members (for example, via toolbox meetings)</u> <u>Review the project pest management plan.</u>

Table 10 Management objectives, performance criteria, adaptive management triggers and corrective actions – Matters required to be addressed under EPBC Approval, condition 6

#	Matters under EPBC Approval, condition 6	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
7	Loss or degradation of water sources	Ensure water quality in known BTF water sources outside disturbance footprint remain within acceptable limits.	Emissions (i.e. dust, coal and heavy metals) do not degrade water source quality in BTF habitat. Water sources not secured/disturbed from by other disturbing processes, such as overuse by cattle	Project impacts like, dust and cattle access will be minimised by the implementation of the Environment Management Plan, using standard procedures typical of large infrastructure projects. Maintain the required condition of water sources. Erosion and sediment control measures will be implemented where required, to reduce the potential for contamination of water sources prior to commencement of construction activities.	Annual monitoring, including photo monitoring, of water source availability, in the driest season Water and sediment samples will be collected in areas with the potential to be impacted by mining activities to test for the presence of heavy metals and chemical contaminants (annually during the dry season).	Physical evidence of dust degradation to water sources outside active mining areas. Water and sediment samples of water quality do not meet guideline triggers.	The appropriate corrective actions in accordance with the Environmental Management System will be implemented and may include: <ul style="list-style-type: none"> • More frequent chemistry testing to confirm water quality against relevant standards, in the event that visual inspection of dust impacts fails • Review and re design to avoid reoccurrence and address actual cause • Review adherence to control procedures to ensure compliance • Take remedial action where compliance has not been adhered to • Communication with personnel involved and across all site team members (for example, via toolbox meetings) • Reporting to DES as per statutory and project requirements where incidents trigger reporting thresholds.
		Reduce degradation of suitable water sources Protection of environmental values within waterways of the receiving environment. Minimise siltation of water resources	No contamination of surface waters by effluent outside the active Mining Areas by effluent. No degradation by siltation of permanent water sources by siltation.	Sewage waste for the operation workforce will be treated in a package treatment plant to a Class A standard. All effluent will be recycled onsite for reuse or controlled discharge. Vegetation clearing near, or within ephemeral waterways will be avoided when rain is falling, or imminent. Management of erosion and sedimentation will be undertaken in accordance with a Project Erosion and Sediment Management Plan. This plan will identify all practices to be implemented prior to, during, and post-construction to minimise the potential for erosion to occur, including (but not limited to) timing of clearing activities, sediment and erosion control measures to be implemented, performance criteria and corrective actions. Implement dust control measures. Erosion and sediment control measures will be implemented where required, to reduce the potential for contamination of water sources prior to commencement of construction activities.	Monitor the efficacy of erosion control measures (at least monthly), such that measures can be constantly improved throughout life of Mine. Water and sediment samples will be collected in areas with the potential to be impacted by mining activities to test for the presence of heavy metals and chemical contaminants (annually during the dry season).	Monitoring results record exceedance and contamination of surface water.	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> • Review and re design to avoid reoccurrence and address actual cause • Review adherence to control procedures to ensure compliance • Take remedial action where compliance has not been adhered to • Communication with personnel involved and across all site team members (for example, via toolbox meetings) • Reporting to DES as per statutory and project requirements where incidents trigger reporting thresholds.

#	Matters under EPBC Approval, condition 6	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
		Maintain access to water	No net loss of suitable permanent water sources.	<p>Permanent water sources in retained suitable BTF habitat in the Project Area will not be drained or lost as a result of drought unless suitable alternative water supplies (such as permanent water with gently sloping, bare ground at the edge) are available within suitable habitat within 3 km, or connected habitat outside of the ML. This includes permanent water sources in waterways and dams.</p> <p>Maintain water troughs for BTF within undisturbed areas and surface areas of underground mining footprint and repair where necessary troughs, pipes and tanks to a standard that maintains a constant source of water.</p> <p>Known water sources will be avoided, or alternative water sources established outside the disturbance footprint, if avoidance is not possible.</p>	<p>Weekly inspections of water infrastructure at Ten Mile Bore, to maintain water supply available to BTF.</p> <p>Monitoring of water levels and availability across all water sources (fortnightly inspections at all sites other than Ten Mile Bore).</p>	Draining of suitable permanent water source in retained BTF habitat, without an offset water source provided.	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Review and re design to avoid reoccurrence and address actual cause Review adherence to control procedures to ensure compliance Undertake chemical testing of any water source that fails a visual inspection or increased monitoring events Take remedial action where compliance has not been adhered to; including repairs where necessary troughs, pipes and tanks to a standard that maintains a constant source of water Implement remedial actions to provide supplementary water sources, where possible.
		Reduce the risk of contamination of BTF habitat by chemicals, fuel, heavy metals etc.	No pollution of BTF habitat by contaminants (e.g. chemicals, fuel etc.).	<p>Any sites used for chemical and fuel storage will be located a safe distance away from BTF habitat, with bunding or other raised barrier, resistant to normal flood events, between chemicals and habitat.</p> <p>All vehicles and machinery will be cleaned and maintained to minimise the introduction of contaminants such as oil and fuel.</p>	<p>Design and implement a monitoring program, in accordance with the Water Management Plan. The monitoring program will target key areas with low flow, and water sources of known BTF locations.</p> <p>Water and sediment samples will be collected in areas with the potential to be impacted by mining activities to test for the presence of heavy metals and chemical contaminants (annually during the dry season).</p> <p>Erosion and sediment control measures will be implemented where required, to reduce the potential for contamination of water sources prior to commencement of construction activities.</p>	Pollution of BTF habitat by contaminants.	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Minimising and rectifying impacts Training and / or communication with personnel involved and across all site team members Reporting to DES as per statutory and project requirements where incidents trigger reporting thresholds.

#	Matters under EPBC Approval, condition 6	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
8	Mine dewatering	Manage the impacts of mine dewatering	Permanent water sources in retained suitable BTF habitat in the Project Area will not be -drained or lost as a result of changes in hydrology, unless suitable alternative water supplies (such as permanent water with gently sloping, bare ground at the edge) are available within suitable habitat within 3 km, or connected habitat outside of the MLA. This includes permanent water sources in waterways and dams.	Maintain water troughs for BTF within undisturbed areas and surface areas of underground mining footprint and repair where necessary troughs, pipes and tanks to a standard that maintains a constant source of water. Known water sources will be avoided, or alternative water sources established outside the disturbance footprint, if avoidance is not possible. Erosion and sediment control measures will be implemented where required, to reduce the potential for contamination of water sources prior to commencement of construction activities.	Design and implement a monitoring program, in accordance with the Water Management Plan. The monitoring program will target key areas with low flow, and water sources of known BTF locations. Water and sediment samples will be collected in areas with the potential to be impacted by mining activities to test for the presence of heavy metals and chemical contaminants (annually during the dry season).	Draining of suitable permanent water source in retained BTF habitat, without an offset water source provided.	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Review and re design to avoid reoccurrence and address actual cause Review adherence to control procedures to ensure compliance Undertake chemical testing of any water source that fails a visual inspection or increased monitoring events Take remedial action where compliance has not been adhered to; including repairs where necessary troughs, pipes and tanks to a standard that maintains a constant source of water Implement remedial actions to provide supplementary water sources, where possible.
9	Earthworks	Minimise the risk of light vehicle and machinery strike during earthworks and operations	Vehicles will -only drive on designated access tracks, and the access tracks will be -are defined in relevant overarching management plans (e.g. Environmental Management Plan).	All relevant site personnel, including contractors, will be made aware of the locations of BTF populations and the potential for birds to be foraging adjacent road sides. Vehicles and plant will drive on pre-determined roads only, and adhere to all speed limits, which will be clearly communicated. All relevant site personnel, including contractors, will be made aware of the locations of BTF populations and the potential for birds to be foraging adjacent road sides. Vehicles and plant will drive on pre-determined roads only, and adhere to all speed limits, which will be clearly communicated.	Monitoring surveys to -will be conducted biannually for a 10 year period by suitably qualified ecologists in accordance with standard methodology to identify changes in BTF population size and movements over time. Banding and re-sighting techniques will provide a basis for assessing movement patterns and assessment of population dynamics. Fauna spotter-catcher observations and results during the BTF habitat clearing progress are -will be fed into the monitoring results and adaptive management of clearing progression plans.	<ul style="list-style-type: none"> Vehicles observed driving outside designated areas Light vehicle or machinery strike during other activities 	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Rectifying impacts Review and re design to avoid reoccurrence and address actual cause Communication with personnel involved and across all site team members (for example, via toolbox meetings).
10	Noise and vibration	Minimise habitat modification	No abandonment of BTF nests due to noise, and vibration disturbance	Project impacts like noise, dust and lighting will be minimised by the implementation of the Environment Management Plan, using standard procedures typical of large infrastructure projects.	During the breeding season the Environment Manager will monitor verified BTF nests within 1 km of active operational areas (weekly at a minimum) Any signs of possible abandonment will be verified by a suitably qualified ecologist, who will consider the role of noise and vibration in the abandonment.	Abandonment of a BTF nest without signs of predation, which is likely to have been caused by noise and vibration.	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Assessment to establish (a) abandonment of a BTF nest was without signs of predation; and (b) determine the root and contributing causes as being likely caused by noise and vibration Review and re design to avoid reoccurrence and address actual cause Communication with personnel involved where appropriate and across all site team members (for example, via toolbox meetings).

#	Matters under EPBC Approval, condition 6	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
11	Emissions, including dust	Minimise emissions (dusts)	<u>Limit disturbance from emissions (dust) on the photosynthetic ability of grasses in BTF habitat are not inhibited by dust emissions from the Project Area.</u>	Regular watering of project areas in accordance with procedures under the Environmental Management Plan. Vehicles are will be cleaned regularly and are not to be overloaded. Coal dust to will be managed in accordance with the Environmental Management Plan	Regular site inspections in accordance with the Project Environmental Management Plan and Management System. Emissions and dust monitoring undertaken under the construction and Environmental Management Plan.	Growth of grasses in known BTF habitat in, and adjacent to, the Project Area are inhibited due to dust emissions.	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Where monitoring shows a reduction in habitat condition due to dust, mitigate source of dust Review and re design to avoid reoccurrence and reduce dust emissions impacts on habitat. Communication with personnel involved and across all site team members (for example, via toolbox meetings).
12	Light spill and other visual impacts	Minimise light spill	<u>Minimal light disturbance in known BTF habitat adjacent to works limited to <100 m.</u>	Install light controlling devices to deflect lighting away from adjacent habitats. Avoid using unnecessary lighting.	Regular site inspections in accordance with the Environmental Management System.	Direct light spill >100 m into known BTF breeding habitat.	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Review and re design of light controlling devices, or adjust location of light, to reduce light spill and lighting levels below trigger levels Communication with personnel involved and across all site team members (for example, via toolbox meetings).
13	Stream diversion and flood levees	Reduce the impact of stream diversion and flood levees	<u>Maintain All suitable permanent water sources are maintained.</u>	As per the management actions included in items 9 to 12.	Annual monitoring, including photo monitoring, of water source availability, in the driest season	Draining of suitable permanent water source in retained BTF habitat, without an offset water source provided.	The appropriate corrective actions in accordance with the Environmental Management System will be implemented and may include: <ul style="list-style-type: none"> Review and re design to avoid reoccurrence and address actual cause Review adherence to control procedures to ensure compliance Take remedial action where compliance has not been adhered to; including repairs where necessary troughs, pipes and tanks to a standard that maintains a constant source of water Implement remedial actions to provide supplementary water sources, where possible.

6.4 Habitat management measures

In accordance with EPBC conditions 6d) to f) and EA condition 16e), measures will be implemented to manage BTF habitat to prevent further decline and, in the case of the offsets area, improve the condition. These management actions are also required to address potential Project impacts identified in EPBC condition 6c).

Managing BTF habitat requires management of three broad elements: the woody layer of the vegetation, the herbaceous layer of the vegetation and water sources. Grazing and fire are important drivers of the composition and structure of both woody and ground layers of the vegetation and managing grazing and fire is important for the maintenance and management of habitat quality for the BTF (Exter 2011). While useful tools, these factors cannot be used to shift from one vegetation community to another as the vegetation community that occupies a particular location is largely driven by soil type and rainfall regime. Management measures are described below in relation to the threats outlined in Section 4.

6.4.1 Grazing management

Grazing will be used in the Project Area as a management tool to manage threats to BTF habitat. Grazing will be used to decrease the abundance and presence of weeds, including Buffel Grass and other exotic pasture grasses, and control fuel loads so as to reduce the risk of an uncontrolled fire.

The management of grazing within non-mined areas will be based on existing pastoral management practices under land agistment agreements, pastoral holding lease conditions and associated legislation. Sustainable grazing guides such as the 'Sustainable management of the Burdekin grazing lands' (Exter 2012) will also guide the management of grazing activities. The following actions will be delivered under the legislation, agreements and conditions:

- Adani will complete annual BTF habitat vegetation assessments at approved monitoring locations during May to maintain and where possible enhance BTF habitat
- The baseline groundcover and native perennial species composition at 23 established baseline monitoring sites are included in Appendix F. Baseline characteristics are:
 - o 34% cover native perennial grass cover (minimum). Baseline standard deviation is 12.1%
 - o 27% bare ground
 - o four native grass species per site (minimum)
 - o 2.4% native perennial forb cover
 - o 1.8% native annual grass and forbs
- Vegetation assessments will use methodologies described within the 'Carmichael Coal Mine and Rail SEIS Report for Black-throated finch On-site Monitoring Survey 2' dated February 2014 to assess native perennial groundcover and ground composition based on Queensland BioCondition Framework (Exter *et al.* 2011) and the Queensland Herbarium flora survey methods (Neldner *et al.* 2005)
- Groundcover and species composition will be assessed annually against the baseline data (established in 2012/13) from when this Management Plan commences (each May)
- If the annual vegetation assessment demonstrates a loss of native perennial species and cover from baseline conditions, an investigative review will be completed and relevant corrective management actions will be taken to ensure the maintenance or enhance of these perennial pasture species
- Corrective actions may include additional fencing or spelling of paddocks to control grazing, controlled grazing to maintain biomass levels, pest control (e.g. rabbits, weed eradication) and fire management.

Since BTF have been shown to access a range of artificial water sources, including drinking at troughs visited by cattle, it would not be necessary to restrict cattle from existing troughs or watering points. However, in accordance with EA Condition I8, water troughs for BTF must be maintained within undisturbed areas and surface areas of the underground mining footprint. Also, the condition includes a requirement to repair, where necessary, troughs, pipes and tanks to a standard that maintains a constant source of water. The retention or provision of some trees / shrubs within a suitable distance to water may increase utilisation of water sources, by providing shelter for birds if they are disturbed by the arrival of large groups of cattle, allowing them to return to drink when the cattle depart.

6.4.2 Fire management

Fire and grazing can be considered competitors of one another for the available grass fuel / forage. In considering the use of cattle grazing to manipulate the grass fuel load and distribution it is also important to address other aspects of the herbaceous layer that will be affected by grazing, namely species composition and seed production. Breeding of BTF must be monitored in terms of location and timing so that breeding locations are not burnt when birds are nesting (constructing breeding nests, incubating and feeding nestlings).

Given the uncertainty around and complexity of the relationship between fire and habitat quality, it is important that all parts of a landscape being managed for BTF are not subject to the same fire regime. In general, the overall fire regime of the Project Area will aim to be one of periodic, small scale, low intensity fires being used to target areas that are developing a shrubby understorey. However, the outcomes of the BTF Research Program will also study the relationship between fire and habitat quality. The outcomes of that research will inform fire management in the Project Area and this plan, once finalised.

Low intensity fires will temporarily open up the grass layer but generally are not known to kill tussocks. These types of fires will create foraging patches by improving accessibility to the grass seed that is present. Burning should not be carried out too soon after seed set, though BTF may forage on recently burnt land (at Externat 2016).

Fire will reduce the density of the shrub layer by killing obligate seeders and removing stems from re-sprouting species. Fire may also promote the germination of obligate seeders and other species, particularly *Acacia* spp. Currently there are areas of the Project Area that have dense stands of short-lived *Acacia* spp. as a result of fire-stimulated germination. BTF tend to avoid extensive areas of woodlands with a dense shrubby understorey, though they do use patches of shrubs or smaller trees for resting and shelter (at Externat 2011). Dense shrubby understoreys also tend to have fewer grasses and so are less productive in terms of the seeds upon which BTF forage.

Dense stands of these species can be reduced by fire frequencies shorter than the time between germination and seed production. Some of these species probably produce seeds within 3 to 4 years of germination (e.g. *Acacia holosericea*).

The existing network of roads and tracks will be used to manage fire, rather than establishing additional firebreaks. This will help reduce the risk of weed incursion through movement of traffic into intact understorey. The numerous existing tracks that were created during mine exploration and development, especially in the northern sector of the Project Area, provide firebreaks that can help ensure that prescribed fires are not extensive. The value of maintaining these tracks as firebreaks needs to be weighed up against the value of minimising the risk they present in terms of weed incursion and as useful foraging habitat. It is worth noting that BTF often forage on or in close proximity to tracks and other surfaces with low cover. The usefulness of these bare areas for foraging is dependent upon there being

seed production in their immediate vicinity, so extensive bare areas are not valuable to BTF (Adani 2016).

6.4.3 Pests

Weed management is addressed in a project specific Pest Management Plan (Adani 2015), which covers weeds and feral animals (pests). The Pest Management Plan has an overarching strategy, as follows:

- Identification of current and potential pest animals and plants for the area, and current locations of populations of pest animals and plants
- Avoidance of travel through or establishing infrastructure in areas of known pest plant infestation
- Prevention of the introduction of new weed and pest animal species to the area
- Minimisation of the increase in distribution and abundance of currently present pest plants or animals
- Control of identified weeds and pest animals to contain, reduce or eradicate pest populations.

Actions associated with weed management align with this strategy. Weed management issues specific to BTF are the control of introduced grasses and other herbs that have a tendency to dominate the herbaceous vegetation and affect the seeding of grass species on which BTF rely. Incursions of weeds into new areas will be prevented. Existing weeds, including non-native grasses, will be managed, with the intent of reducing further incursion (Adani 2015).

Non-native plant species that are considered potentially detrimental to BTF habitat include Buffel Grass, Indian Couch, *Stylosanthes scabra*, *Parthenium hysterophorus* (Parthenium) and other high biomass non-native grasses. Native understorey shrubs such as *Carissa ovata* and *C. lanceolata* can also be detrimental as they may increase in association with heavy grazing and little burning. Some of the short-lived *Acacia* spp. would be detrimental to BTF if they form extensive thickets.

Non-native invasive shrubs such as *Vachellia nilotica* (Prickly Acacia), *Ziziphus mauritiana* (Chinese Apple), *Jatropha gossypifolia* (Bellyache Bush), *Stylosanthes humilis* and *Lantana camara* (Lantana), while not currently prevalent in the Project Area, will be prevented from establishing.

The risk of further incursions by high biomass grasses will be minimised by effective hygiene measures that include minimising traffic into BTF habitat, use of wash down facilities for vehicles, control of new infestations, avoiding movement of soil potentially bearing weed seeds or other propagules and minimising soil disturbance. The species of greatest concern is Buffel Grass. However *Themeda quadrivalvis*, *Hypharrhenia* spp. and Indian Couch are also a concern, though they are not currently common in the Project Area. Indian Couch is present but the health of the native perennials is probably sufficient to prevent it taking over.

The landscaping plan and rehabilitation plans for the Project will use native species where possible. No invasive species will be used in landscaping.

Habitat management measures for feral cats and feral pigs are provided in **Sections 6.4.5** and **6.4.6** respectively.

6.4.4 Water supply

Water bodies known or considered likely to be used by BTF, in as yet unmined and underground mining areas, must be identified to alert to their environmental significance. Controls to prevent contaminated

run-off or fuel / chemical spills will be implemented to protect water quality for these sources. Controls to manage the protection of BTF water sources include the following:

- Storage of fuels and chemicals must be banded to 110% the capacity of the storage facility. Storage areas must be at least 300 m from known watering points, waterbodies and waterways.
- Effective erosion and sediment controls must be installed around all topsoil and spoil piles, unless a native cover has been established which prevents run-off of materials.

Current water sources outside of the clearing footprint are to be maintained. Where it is necessary to remove a particular water source within or nearby to BTF habitat, a new water source will be created. These can be relatively small, have intact woodland in their immediate vicinity and have a few trees and / or shrubs close to their margins for BTF to perch on. It is also important to have canopied trees (especially Eucalypts) in which the birds can rest while travelling to and from the water source. Construction of BTF water sources to provide alternative watering points will be undertaken in conjunction with construction of water storage dams early in the mine implementation program.

In order to ensure that the watering points in the Moray Downs West offset area do not interfere with research but also provide water for finches, the following actions will be delivered:

- maintenance of the existing seven water points in the Moray Downs West offset area, as per the Moray Downs West Offset Area Management Plan
- new artificial water sources will be installed in locations within the Moray Downs West offset area in accordance with this research program
- assessment of BTF responses to new water sources and their effectiveness
- results used to inform specific requirements and location of permanent artificial watering points
- permanent artificial watering points will be installed and adequately maintained within the Moray Downs West offset management area within the sooner of one year after the completion of the three-year Research Program, or five years after the commencement of mining operations.

6.4.5 Feral cats

Feral cats are considered one of the threats to local populations of BTF. Ongoing feral cat control will be carried out as it would benefit many other native species in addition to BTF, including the threatened Squatter Pigeon. Feral cat control will be carried out in accordance with the Pest Management Plan for the Project. The key areas to be targeted for feral cat control to protect the BTF are those where birds are likely to be exposed and vulnerable to predation including on the interface of the clearing front and remnant vegetation and at water sources where BTF are vulnerable to attack whilst drinking.

6.4.6 Feral pigs

Feral pigs have the potential to damage BTF habitat and are therefore a threat to the species. Damage to BTF habitat is caused by disturbance of the soil while feeding, trampling of habitat, tusking or rubbing trees and the consumption of plants and soil organisms. Feral pig control will be carried out in accordance with the Pest Management Plan for the Project. Targeted site monitoring for pigs will focus on water courses and BTF feeding areas, where greatest impacts to BTF habitat are likely to occur. Humane pest control measures will be implemented to reduce pig numbers.

6.4.7 Management of Ten Mile Bore

Condition 19b of the EA states that the BTF Research Program must establish management actions to maintain the current BTF population of Ten Mile Bore and surrounds. Management of BTF habitat in the vicinity of Ten Mile Bore will therefore be informed by the findings of the BTF Research Program (Appendix C). Until such time as findings of the Research Program are available (3 to 5 years from

approval of the plan), existing management activities at Ten Mile Bore will continue to be implemented, to maintain the BTF population of the area. These interim management measures include:

- Avoiding mining-related disturbance of the area until as late as possible (see **Section 6.3.1**)
- Maintaining water for BTF, to be monitored through weekly water infrastructure inspections
- Managing grazing activities in the vicinity of Ten Mile Bore to enhance and maintain BTF habitat values

6.4.8 Summary of mitigation and management measures

The mitigation and management measures to be implemented for the Project to minimise impacts to BTF for activities other than clearing are summarised in [Table 9](#) and **Table 10**. These are relevant project stages and will be implemented prior to commencement of Project Stage 2 activities as defined by the Carmichael Coal Mine Environmental Authority. Regular monitoring across the site will identify any deterioration in BTF habitat values and trigger a site-specific corrective action. Such a response may involve the control of weeds, implementation of fire management actions or changes to grazing practices, to improve and restore BTF habitat values.

Mitigation of impacts on BTF and its habitat will in part be achieved through implementation of other plans including the CEMP and OEMP. These plans are regularly updated based on site conditions, the results of on-site monitoring and progression of project tasks. A summary of key elements of environmental management, as outlined in the project EIS, is provided in **Appendix A**.

6.5 Offsets

Conditions of approval for the Carmichael Coal Mine and Rail Project under the EPBC Act and within the Coordinator-General report require Adani to address offset requirements for significant residual impacts on MNES and Matters of State Environmental Significance. The approach to be taken by Adani to achieve the required offsets is outlined in the approved BOS (CO2 2016) under Condition 8 of EPBC Act approval 2010/5736. Offsets will be delivered in stages, with Stage 1 offsets to be delivered through implementation of an offset area management plan.

A key mechanism for achieving offsets for BTF is management of the Moray Downs West offset area, which includes extensive areas of BTF habitat. The Moray Downs West offset area will be managed under the approved *Offset Area Management Plan: Moray Downs West*, (CO2 2017) including regular assessment to identify any future management and monitoring requirements until offset management objectives are achieved. The area provides an offset for the expected loss of BTF habitat from Stage 1 of the Project including potential impacts from subsidence caused by underground mining.

In the event that additional impacts are proposed, or occur unexpectedly, additional offsets will be provided, subject to approval from Commonwealth and State governments. This would include circumstances where the corrective management measures have not achieved the goals within specified timeframes, and resulted in impacts beyond those that were originally approved. Likewise, if Adani is able to minimise its disturbance of BTF habitat to a smaller area than approved, a corresponding reduction in offsets will apply.

7 Monitoring and Research Programs

The management of the BTF population will be supported by targeted monitoring and research that will be undertaken for the Project. The results of monitoring and research will feed back into the management measures to guide adaptive management. The ongoing monitoring will be focussed on describing spatial and temporal patterns of occurrence while the research will focus on explaining spatial and temporal patterns and ecological relationships.

A BTF Research Program has been developed concurrently and provides a program for addressing specific scientific questions about BTF and its habitat (**Appendix C**). The Research Program details the objectives and methodologies to explain and predict patterns and processes relating to the distribution and abundance of BTF in the Project Area. This research will inform future management and monitoring of the BTF population within the Project Area.

7.1 Monitoring program

As required by Condition 6(b) of the EPBC Act approval, a monitoring program will be implemented upon approval of the management plan to inform assessments of the effectiveness of mitigation measures. The level of disturbance of Project activities on BTF habitat will also be measured and the success of rehabilitation activities evaluated. As committed during the EIS process, Adani will collaborate with research institutions for aspects of the monitoring program, where such an approach would add value (e.g. identification of remnant vegetation changes resulting from subsidence).

The proposed monitoring regime will be used to provide feedback on the effectiveness of mitigation measures and to evaluate the success of rehabilitation activities. Monitoring of the BTF has already commenced as part of the baseline research program for the Project and ongoing monitoring programs locally. Initial monitoring will continue for a period of 10 years as required in the conditions of the Environmental Authority. A major review of the monitoring results will be completed at this time (after 10 years). This will result in the development of a long-term monitoring method that will be implemented for the life of the project. This will ensure compliance with EPBC Act approval conditions, which require monitoring for the life of the Project.

As with mitigation measures, some monitoring activities will be generic and broadly applicable across multiple ecological values, including BTF. Other monitoring activities will be species-specific and tailored to measure the effectiveness of mitigation measures at reducing the impacts of the Project on BTF. The design of specific monitoring tasks will be tailored to the variables being measured, and have sufficient replication to provide statistical power to detect significant change. Indicative monitoring sites have been chosen and the location of these will be confirmed through on site investigations during pre-clearance surveys.

A description of monitoring measures to be implemented across the Project Area are detailed per management objective and performance criteria in **Tables 8 to 10**. **Table 11** provides an overview of monitoring measures.

Table 11 Summary of monitoring measures to be implemented across the Project Area

Monitoring	Description
Pre-clearance surveys	Confirm and identify the spatial extent and condition of BTF habitat to be disturbed prior to any clearing or disturbance commencing, through pre-clearance surveys. BTF surveys will focus on confirming species presence throughout the Project Area, identifying species presence in proximity, but outside (adjacent to) Project Area and

Monitoring	Description
	identifying areas of potential rehabilitation for BTF habitat values inside the Project Area, but outside the disturbance footprint.
Clearing	Monitoring surveys to be conducted biannually for a 10 year period by suitably qualified ecologists in accordance with standard methodology to identify changes in BTF population size and movements over time. Banding and re-sighting techniques will provide a basis for assessing movement patterns and assessment of population dynamics.
Condition	<p>Monitor the condition of BTF habitat adjacent to the development and the Offsets Area. This will be undertaken using standard BioCondition monitoring surveys (see Eyre <i>et al.</i> 2011 for details) and species habitat index.</p> <p>The quality of known BTF water sources will be monitored.</p> <p>Additionally, annual BTF habitat vegetation assessments will occur during May within 2 ha plots at the following locations: CHAB02, CHAB03, CHAB22, CHAB23, CHAB24, CHAB25, CHAB37, CHAB45, CHAB47, CHAB48, CHAB52 (Open cut disturbance areas) and CHAB01, CHAB04, CHAB05, CHAB09, CHAB10, CHAB44 and CHAB46 (Underground disturbance areas).</p> <p>Vegetation assessments will use methodologies described within baseline 'Report for Black Throated Finch On-site Monitoring Survey' dated 12 July 2013 to assess ground cover and ground composition based on Queensland BioCondition Framework (at Extern <i>et al.</i> 2011) and the Queensland Herbarium flora survey methods at Extern <i>et al.</i> 2005).</p> <p>Moray Downs West Offset Area</p> <p>The monitoring methods included in the <i>Moray Downs West Offset Area Management Plan</i> for the offset area are as follows:</p> <ul style="list-style-type: none"> method for determining monitoring locations is to apply the Guide to Determining Terrestrial Habitat Quality to calculate habitat quality scores For the species stocking rate component, the monitoring method for BTF as outlined in this plan For sites being monitored under the BTFMP within the offset area, use survey results to inform the habitat quality scoring under the OAMP (rather than duplicating survey effort at these sites) <p>Further monitoring methods for BTF in the offset area are consistent with this plan, such as:</p> <ul style="list-style-type: none"> water source watches active searches incidental observations remote cameras vegetation condition assessments foraging plot assessments.
Weeds	Monitor the presence of declared weeds, and abundance of environmental weeds.
Pests	Monitor the presence and population abundance of invasive fauna.
Vegetation rehabilitation areas	Monitor the effectiveness of rehabilitation activities through BioCondition or similar assessment methods.
Water quality	Measure the effectiveness of rehabilitation activities, by monitoring water quality in accordance with the EMP.
Offset areas	Measure the effectiveness of offset management, by monitoring the quality of offset areas in accordance with the OAMP.
Fauna mortality and injuries	Record BTF fatality, including suspected nests / eggs of BTF.
Dust	Monitor dust within and adjacent to construction activities in accordance with the EMP.
Fire	Monitor incidence and extent of Project related fire, and determine impacts through BioCondition assessments.

7.1.1 Survey timing and frequency

Seasonal surveys will be undertaken biannually for a period of at least 10 years in order to satisfy relevant approval requirements and provide useful feedback into the management plan. Surveys will be undertaken to coincide with the end of the dry season (approximately late October) and the latter part of the breeding season (March to April). A major review of the monitoring results will be completed after 10 years. This will result in the development of a long-term monitoring method that will be implemented for the life of the project.

Surveys will occur across all areas of known BTF habitat in the Project Area and adjacent to the Project Area, as well as all areas established for rehabilitation and offsets for BTF. The purpose of the surveys will be to document changes in distribution and abundance of BTF in the Project Area, relate that to habitat condition, quantify use of offset areas and provide feedback for adaptive management.

7.1.2 Survey methodology

The survey methodology for ongoing monitoring is based on the results and recommendations arising from baseline monitoring surveys undertaken to date and the specifications of Commonwealth and State approval conditions (e.g. Condition I6 of the EA). The monitoring methodology is to transition from a methodology aimed at gathering presence / absence data alone, to one gathering data that will better explain BTF movements across the landscape as well as identify any trends in populations and monitor the effectiveness of management actions.

The methodology for BTF monitoring will include the following:

- Water source watches
- Call play-back
- Identification of all birds present when BTF are encountered
- Active searches
- Opportunistic incidental observations gathered whilst traversing the Project Area
- Surveillance cameras
- Monitoring of subsidence areas
- Monitoring of pasture biomass
- Vegetation transects and plots.
- Annual monitoring of 2 ha groundcover plots

Indicative monitoring sites are shown in **Appendix B**. These sites will be reviewed following approval of the management plan, with additional vegetation sites included in the offset areas and subsidence areas. These additional sites will provide representation of critical BTF habitat, core BTF habitat and marginal BTF habitat. Input from the research team appointed to implement the BTF Research Program will be sought on the location of additional monitoring sites. The sites include areas outside of the disturbance footprint (control sites) and areas that will be subject to disturbance in the future (impact sites).

In the case of some monitoring methods, such as fixed point waterhole surveys, the exact location of these are known. However for some survey types, the placement of the permanent monitoring sites will be finalised during the implementation of the monitoring program. The BTF Management Plan will be subsequently updated to include the final locations of monitoring sites.

7.1.2.1 Water source watches

Water source watches are one of the primary survey methods recommended in the Significant Impact Guidelines for the Endangered Black-throated Finch (southern; *Poephila cincta cincta*; DEWHA, 2009a;

the Guidelines). They have also been the most successful survey technique in recording BTF across the Project Area in most surveys undertaken to date.

Fixed point water source watches will be conducted for six continuous hours commencing from dawn at up to 16 water sources where BTF have been previously recorded (Table 12 and Appendix B). Some of the sites have been found to be unsuitable for monitoring at times in the past, due to an absence of water. As water sources are removed as a result of mining activities, monitoring at these locations will cease. New water sources will be substituted for monitoring, particularly in the offset areas.

Where BTF are observed during waterhole watches, the following information will be collected:

- Time of observation
- Number of individuals
- Other species present in mixed flocks
- Behaviour (e.g. foraging, drinking, perching, flying, etc).

Table 12 Water source monitoring sites (those sites marked # have been found to have little to no water during monitoring over the past three years)

Site ID	Site Common Name
CWAT01a	Ten mile bore dam (lower)
CWAT01b	Ten mile bore turkey nest
CWAT01c	Ten mile bore dam
CWAT02	16 mile tank dam
CWAT03	Ten mile tank dam
CWAT07	Number 1 dam
CWAT99	Four mile bore
CWAT101 #	Beenboona hole
CWAT104 #	Unnamed waterhole
CWAT105 #	Rocky Dam
CWAT110	Lignum yards dam / trough
CWAT111	Lignum large dam
CWAT116 #	New Laguna dam
CWAT117	Number 2 dam
CWAT118	Carmichael bore tank and troughs
CWAT120	Dingo dam

Characteristics of the water sources that BTF are observed utilising will also be noted in order to build on the existing understanding of use and utilisation of water sources. Any seasonal or longer term changes that may influence suitability for BTF will also be determined. The following information will be documented:

- Approximate size of water source
- Slope of bank
- Surrounding vegetation

- Water retention dynamics (permanent vs seasonal).

7.1.2.2 Active searches

Active searches are to be conducted within suitable habitat to collect BTF population data and search for nests (**Appendix B**). In particular these surveys will focus on areas that are known to be good quality habitat for BTF as well as areas of habitat within the offset area.

Active searches will include random meanders within 1 km of each water point monitoring site for at least three hours with specific effort devoted to areas with grassy open-woodland habitat. 1 km transects will also be undertaken during active searches.

Information collected during active searches will include:

- Location and quantity of BTF
- Behaviour (e.g. foraging, drinking, perching, flying, etc)
- Regional Ecosystem (RE) type and condition
- Presence / absence of mixed-flocks and associated species
- BTF nests (including photographic evidence and GPS location)
- Characteristics of BTF nest including host tree or shrub species, height of nest, active or inactive
- Groundcover measurements of perennial grass cover, non-native grass cover, litter, bare ground and ground cover composition.

Wherever possible, the active search information collection methods will be similar to previous annual BTF vegetation assessments, in order to increase the data comparison value.

7.1.2.3 Slow-drive transects

Slow-drive transects have been undertaken throughout BTF habitat during some previous monitoring surveys. The technique involves using a vehicle driving at a maximum speed of 20 km/hr along a 3 km predefined transect (**Appendix B**). Where BTF were observed, the following information was collected:

- Location and quantity of BTF
- Behaviour (e.g. foraging, drinking, perching, flying, etc)
- Regional Ecosystem (RE) type and condition
- Presence / absence of mixed-flocks and associated species.

However, slow-drive transects have been found to be of limited value in previous surveys in the Project Area, and will not be continued as part of the ongoing monitoring program.

7.1.2.4 Incidental observations

Opportunistic incidental sightings of BTF are to be undertaken whilst travelling between survey sites. Where BTF are observed, the following information will be collected.

- Location and quantity of BTF
- Behaviour (e.g. foraging, drinking, perching, flying, etc)
- Regional Ecosystem (RE) type and condition
- Presence / absence of mixed-flocks and associated species
- Assessment of groundcover characteristics and species composition
- BTF nests (including photographic evidence and GPS location)

- Characteristics of BTF nest including host tree or shrub species, height of nest, active or inactive.

7.1.2.5 Remote cameras

Fixed remote cameras will be set-up at water sources where water source monitoring is not undertaken. In particular these will be used to monitor cattle troughs as well as any new watering points installed throughout the Project Area and including the Moray Downs West offset area. Cameras will be installed for the duration of the monitoring surveys. Photos and recordings of BTF are to be included in the survey results.

7.1.2.6 Vegetation assessments

Vegetation transects will be established throughout the Project Area to monitor the condition of BTF habitats (**Appendix B**). Foraging plots will also be conducted during BTF monitoring in locations where BTF were identified foraging in order to identify the floristic characteristics of habitat and flora species foraged.

Vegetation transects

Vegetation transects will consist of a modified BioCondition survey with indicators that are not important to BTF excluded (such as fallen woody debris). Fixed 100 m x 50 m vegetation transects will be established and monitored throughout the Project Area with the following information recorded in regards to vegetation structure:

- RE
- Canopy species and relative abundance
- Canopy minimum, maximum and average height
- Crown cover
- Shrub species and relative abundance
- Shrub average height
- Shrub canopy cover
- Weed cover
- Ground cover
- Ground layer species and individual percentage cover
- Percentage cover of bare ground and organic material.

Foraging plots

2 m x 2 m foraging plots will be undertaken at locations where BTF are observed foraging. These plots will aim to determine important grass species for BTF in the Project Area as well as seasonal dietary variation. Flora plot information to be collection at each plot will include:

- RE
- Ground cover species including abundance (number of the whole), of each ground cover plant species including exotic and weed species, whether seeding, or not and whether dead or alive
- Cover of each ground cover species
- Total cover of ground cover species
- Bare ground cover
- Forb cover
- Litter cover.

7.1.2.7 Groundcover, species composition and biomass monitoring

Monitoring of groundcover and species composition will be undertaken to assist with the management of grazing to maintain and enhance BTF habitat values. Baseline groundcover and composition have been established, as described in **Appendix F**. If annual vegetation assessments demonstrate a loss of native perennial species number and cover, an investigative review will be completed and relevant corrective management actions will be determined to ensure the maintenance of these species. An increase in invasive species such as Buffel Grass will also be a trigger for investigation. Corrective actions may include additional fencing or spelling of paddocks to control grazing, controlled grazing to reduce biomass levels, pest control (e.g. rabbits, weed eradication) and fire management.

Groundcover biomass monitoring will be conducted in May each year within 2 ha sites at the following monitoring locations:

- CHAB02, CHAB03, CHAB22, CHAB23, CHAB24, CHAB25, CHAB37, CHAB45, CHAB47, CHAB48, CHAB52 (Open cut disturbance areas) and
- CHAB01, CHAB04, CHAB05, CHAB09, CHAB10, CHAB44 and CHAB46 (Underground disturbance areas).

These sites were originally monitored during the Project EIS.

Vegetation assessments will use methodologies described within 'Report for Black Throated Finch On-site Monitoring Survey' dated 12 July 2013 to assess groundcover and ground composition based on Queensland BioCondition Framework (Exter *et al.* 2011) and the Queensland Herbarium flora survey methods (at Exter *et al.* 2005). Annual vegetation assessments will be reviewed and modified in line with approved Mine Plan changes and improved assessment methodologies. Monitoring will also focus on identifying potential increases in exotic grass composition, such as Buffel Grass.

Groundcover biomass monitoring will also be conducted at representative sites across the offset area. Monitoring will be conducted to determine the biomass and composition of groundcover and appropriate management requirements to optimise BTF habitat values, including specific cattle grazing practices to manage pasture biomass.

In December 2013, ecological equivalence assessments were conducted of the mine area in order to determine baseline condition of impact areas and inform the suitability of offsets (ELA 2014). That report described habitat quality as defined within the Offset Assessment Guidelines under the EPBC Act Environmental Offset Policy. Potential habitat and quality of that habitat were mapped for BTF and guided the establishment of future management objectives for offsets.

In the Moray Downs West Offset Area, the use of strategic grazing within offset management areas will be guided by biomass monitoring. In the Moray Downs West Offset Area, biomass monitoring will be undertaken twice a year, at the end of the wet season (approximately April) and at the end of the dry season (approximately October) using the Department of Natural Resources, Mines and Energy Queensland GRASS Check – Grazier Rangeland Assessment for Self-Sustainability DNRQ97002, Second edition-revised methodology. Monitoring will be undertaken at monitoring sites established as part of the baseline surveying in year 1. Monitoring events will assess pasture composition, pasture biomass and pasture ground cover. These assessments will be used to set stocking rates for the dry season for any strategic grazing to reduce fuel loads or for weed control. Strategic grazing implemented within Moray Downs West Offset Area will aim to retain a biomass of 1,500 kg/ha at the end of the dry season.

7.1.2.8 Bioacoustic monitoring

Bioacoustic Audio Recorders (BARs) have been successfully implemented during BTF surveys of the Project Area in 2017 and 2018 (E2M 2017, 2018). A pilot study was undertaken in 2017 with the objective of developing a recogniser to facilitate automated recognition of BTF calls using Sound ID software.

Two different BTF calls were identified, of which one call was found to be suitable for automated recognition. The pilot study found that automated recognition of BTF calls was a viable method to detect BTF presence, particularly for sites that are impractical to monitor by an ecologist due to the scarcity of BTF use or their remote location. The method had a 69% detection rate of the most characteristic BTF call. However, in approximately 50% of BTF occurrences, BTF did not produce their characteristic call and were therefore not present in acoustic recordings. The method detected 33% of all BTF occurrences recorded by ecologists (including occurrences where BTF did not call).

Following the pilot study for the automated recognition of BTF calls, BAR devices were again deployed during a 2018 survey. BAR devices were used to detect BTF presence/absence at water sources that would otherwise have not been monitored and where remote cameras were not an adequate means of detection. Acoustic data was screened for BTF calls using a combination of automated recognition with manual verification.

BARs will continue to be used as a survey method, with a focus on remote survey sites or locations where other survey techniques are not likely to be an adequate means of detection.

7.1.3 Impact monitoring actions and outcomes

The monitoring will also aim to determine the effectiveness of mitigation measures implemented for management of BTF in the Project Area. The potential impacts of the proposed activities on BTF will be monitored in accordance with the monitoring program outlined in **Tables 8 to 10**, which ~~have~~has monitoring tasks specifically linked to corrective actions.

7.2 Research program

The objectives, indicators and actions for BTF research across the Project Area and the broader area will be undertaken in accordance with the Carmichael Coal Mine BTF Research Program (ELA 2017b; see **Appendix C**) which is summarised in the following sections.

The objective of the Research Program is to determine critical ecological requirements for the BTF in accordance with the conditions of approval for the mine development. In particular the research will aim to identify the movement patterns, habitat requirements and population dynamics, dietary requirements, home range and nesting requirements for the BTF as well as the relationship between water sources, woody habitat and food sources.

The research will also aim to determine the species response to grazing management, fire management and water body locations within the mining lease area and approved offset areas to facilitate appropriate management of these areas. Specific grazing trials will be proposed via the Research Program. The location and timeframe of the trials will be determined at the scoping phase of the research. Further detail is outlined in **Appendix C: BTF Research Program**. Population estimates will also be improved, particularly for key sites such as Ten Mile Bore.

The results of the research will inform and improve management and mitigation measures adopted for the Project to minimise impacts to the local population of BTF as well as enhance habitat within the Moray Downs West offset area in such a way to increase the carrying capacity for BTF in these areas.

7.2.1 Grazing management

BTF can persist in pastoral landscapes even though [Exter \(2011\)](#) demonstrated that birds on pastoral lands had higher stress levels than birds on conservation lands. The abundance of BTF and the viability of their populations, however, are likely to be influenced by the actual grazing regime including stocking rates, land management practices and paddock rotation. The key impacts of grazing are on the composition and structure of the ground layer.

By determining the composition and structure of the ground layer where BTF are known to breed and forage within the Project Area, grazing trials can be implemented within other areas of *Eucalyptus melanophloia* open-woodland that the species appears to utilise less frequently to use grazing as a tool to establish similar composition and structure characteristics which may encourage BTF breeding and foraging. Controlled grazing may also be a suitable means for improving habitat by thinning areas of very dense grass cover as well as assisting in managing bushfire risks. These trials will aim to identify appropriate grazing strategies for managing BTF habitat, especially within the Moray Downs West offset area.

Grazing trials will consist of various cattle stocking densities and wet season resting. These trials will be assessed in terms of the ground layer composition and structure with reference to areas of known high value BTF habitat in the Project Area. The trials will aim to identify the optimal grazing strategy for maintaining good condition BTF habitat that incorporates important food resources including diversity and cover of preferred grass species as well as adequate seed output.

Proposed research methods for this aim are provided in **Appendix C**.

7.2.2 Fire management

Fire is inevitable in the grassy woodlands of central Queensland and a natural component of these ecosystems. European settlement has caused a [shift towards](#) frequent, extensive and high intensity fires in the dry season resulting in large uniform areas [at Extern \(2016\)](#). Fire will generally not reduce densities of canopy tree densities, though it can change canopy structure. The most notable impact of fire on BTF habitat is through modification of the ground layer.

While it is apparent that BTF will forage on recently burnt country, it is not known how the fire regime affects the resources available to the birds. Inappropriate fire regimes can impact on the quality of BTF habitat by affecting the production of seeds, reducing the cover and diversity of grass species and causing a decline in food availability. Fire exclusion can lead to thickening of woody shrubs, decreasing the quality of BTF habitat. Therefore high frequency, low intensity, patchy fire regimes may be beneficial to BTF by reducing the thickness of the shrub layer [ed at Extern \(t al. 2001\)](#).

This research will include a detailed analysis of fire history across the Project Area to ascertain the frequency and intensity of fires within BTF habitat across the Project Area. Trials will then be considered for implementation and include various regimes of fire frequency and inter-fire interval, fire intensity, the season in which fires occur and the extent (area) of individual fires. However, any fire management trials will need to consider other management strategies and BTF research methods as well as safety and asset protection.

Proposed research methods for this aim are provided in **Appendix C**.

7.2.3 Water sources

BTF need to drink water on at least a daily basis and drink more frequently during the drier times of the year. The importance of water to BTF is highlighted by the fact that they typically nest and breed near water. Within the Project Area this is demonstrated with 68% of BTF records in grassy woodlands within 3 km of known water sources. Therefore the absence of water may preclude BTF from areas that otherwise provide suitable habitat. The addition of water may increase the area of suitable habitat that is available.

BTF surveys and monitoring within the Project Area have also identified the species' ability to utilise natural and artificial water sources. During these surveys they have been regularly observed to drink from cattle troughs, dams and 'turkey nests'.

A key management strategy for the Moray Downs West offset area is to provide additional water sources within areas of suitable woodland habitat for BTF. They will be installed throughout the offset area at locations greater than 3 km from existing water sources.

Artificial water sources will initially be installed in several locations of the Moray Downs West offset area. Research will assess the response of BTF to new water sources and the effectiveness of this strategy by identifying the following:

- Ability to attract BTF
- Frequency of use by BTF
- Change in usage of nearest water sources
- Proximity to existing vegetation especially trees / shrubs

Proposed research methods for this aim are provided in **Appendix C**.

8 Discussion

8.1 Summary of key management issues

The following management approaches will be implemented to minimise impacts of the Project on BTF:

- Pre-clearance surveys to confirm the area of habitat to be disturbed, identify BTF locations not previously recorded in the Project Area and monitor compliance with disturbance limits.
- Vegetation clearing protocols to include staged and sequential clearing of BTF.
- Minimise impacts to BTF breeding by avoiding and buffering known nests where possible and also avoiding vegetation clearing, where possible, during the breeding period (October to April).
- Fire management to prevent accumulation of fuel loads leading to uncontrolled wildfires. Controlled cool burns will be undertaken in accordance with the Fire Management Plan (Adani 2015) to provide a mosaic of fire history and to prevent thickening of the shrub layer in BTF habitat.
- Weed management to prevent the introduction and / or spread of weeds that have the potential to degrade BTF habitat.
- Control and monitoring of pest species, especially predatory species, such as cats, that may impact on BTF.
- Prevent contamination of watering points by bunding fuels and chemical storage areas and buffering these areas from known watering points, waterbodies and waterways. Erosion and sediment controls will be implemented to prevent run-off of materials.
- Use of spotter-catchers before and during clearing activities to mitigate the direct impacts of construction activities on wildlife and record and report fauna mortality and injuries.
- Limit disturbance to pre-defined areas and implement controls to minimise noise, lighting, vibrations and dust.
- Rehabilitate areas that are to be disturbed, to restore habitat values where practicable. Monitor the effectiveness of rehabilitation activities.
- Seasonal monitoring of BTF within the Project Area to identify population trends and important breeding and foraging habitat.
- Monitor the direct and indirect impacts of construction and operations on threatened communities and species (and their habitats), both within and adjacent to the Project Area.
- Evaluate the effectiveness of mitigation measures, and revise them if necessary to improve environmental outcomes.

The BTF Management Plan will be implemented in conjunction with several other management plans specific to threatened species, habitats (groundwater dependent ecosystems) or threats (pest management plan). Collectively, the management plans will achieve a high standard of environmental management.

8.2 Implementation

Responsibility for implementing the BTF Management Plan will lie with Adani's Head of Environment and Sustainability. Mitigation and management measures will be incorporated into site management procedures and the scope of relevant construction activities. Some management tasks described in the management plan will be completed directly by Adani staff, while other tasks may be contracted out to consultants or contractors. Where the support of contractors is required, services will be procured through

Adani's purchasing procedures. Monitoring and research programs will be implemented by suitably qualified environmental suppliers, as described in **Section 9.3**.

Adani recognises the importance of taking a whole-of-ecosystem approach to the implementation of this plan and the minimisation of environmental impacts, including BTF, arising from the Project. During implementation of this plan, and in particular at the construction planning stage, Adani will take the following approach to increasing the effectiveness of the management plan:

- Identify locations where multiple BTF habitat values require management and / or monitoring, and ensure such measures are effectively implemented in parallel.
- Give consideration to the management of environmental impacts for all threatened species (at an ecosystem scale), rather than particular species in isolation.
- Maintain awareness of the changes in the vulnerability of threatened species during different seasons. In particular for the BTF, the breeding season is a critical period to maintain a sustainable local population in the Project Area.

9 Reporting and Compliance

9.1 Updating this plan

Implementation of this BTF Management Plan will commence immediately from the date of its approval by DoE and DES. The plan will be reviewed annually from commencement.

The annual review of the BTF Management Plan will include consideration of:

- delivery and outcomes of any Bioregional BTF Management Plan, including that led by the Queensland Government under the Coordinator-General's Report about the project;
- relevant requirements under the EPBC Act 1999, including the BTF Recovery Plan, conservation advices and threat abatement plans; and
- any amendments to the above or as required in response to outcomes of research, monitoring and management actions.

Further details of the annual review process are provided in **Section 9.2**.

An adaptive management approach will be taken, considering documented impacts of management activities and the results of the approved research and monitoring program. Feedback from the monitoring program that indicates mitigation and management measures are not meeting targets will trigger a review of the relevant goals, performance criteria and triggers to ensure that they are adjusted in response to suit the results of the monitoring program. Updates to the management plan will be made in consultation with DoE and DES. Revisions of the survey and monitoring program will be carried out in consultation with the BTF Recovery Team, in accordance with Condition I7 of the EA.

If pre-clearance surveys identify habitat for BTF not previously identified and reported to DoE and DES, Adani will notify the Departments in accordance with requirements in project conditions.

Work that has the potential to generate new and/or unapproved impacts to BTF must cease until the updated management plan has been considered by DoE. The updated management plan will detail how impacts to the newly identified communities will be avoided, mitigated and/or offset. Once approved, the revised management plan will be implemented.

9.2 Reporting

Adani will prepare an annual report on 1 July each year and will be made available to the administering authority for the *Environmental Protection Act 1994* on request. The annual report will summarise the activities implemented under the plan, and discuss the effectiveness of mitigation measures, based on the results of monitoring activities. The results of research and monitoring activities will be used to inform an annual reassessment of project risks on BTF, as part of the annual reporting process. This assessment will consider the following:

- Has new information become available about vulnerabilities of BTF to project impacts?
- Are mitigation measures still considered to be appropriate, given new knowledge gained through research and monitoring?
- What adaptive changes to mitigation and monitoring measures are recommended on the basis of new information collected during the past 12 months?

In accordance with Condition 17 of the EA, the BTF Management Plan will be reviewed annually by an appropriately qualified person, with findings included in the annual report. The independent review will:

- Assess the plan against the following requirements of Condition 16 of the EA:
 - o A baseline research program on the specific nesting and feeding requirements of the species that will be undertaken prior to and during project stage 1
 - o A baseline research program to establish whether the BTF at the project site are sedentary, locally migratory or regionally migratory
 - o A description of how the results of baseline research are to be used to determine any changes of classification of and/or impact on BTF habitat
 - o Details of proposed impacts to BTF habitat from each project stage including impacts from clearing, subsidence, ecological function changes, hydrological changes and weed and pest infestation changes
 - o Mitigation measures to be undertaken to avoid, mitigate and manage impact resulting from each stage of the project, including rehabilitation of habitat
 - o Monitoring of watering points that must be conducted for a minimum six (6) hour period commencing from dawn, to accurately capture BTF utilisation of water points
 - o Detailed botanical assessment that must occur at all BTF sighting locations in the Project Area to record habitat values at those locations
 - o Detailed survey that must occur across the mining lease area and approved offset areas and must include information on BTF movements. The survey method and effort must be sufficient to accurately describe the BTF home range and detail BTF resource usage patterns between seasons and years (for up to 10 years) and allow robust management actions to be developed for the maintenance of a viable local BTF population
 - o Survey work that should incorporate the usage of call playback and identify all birds present when BTF are encountered
 - o Specific surveys that must be undertaken during the BTF breeding season and include nest location and assessment of the habitat attributes associated with the breeding locations. The survey method and effort must be sufficient to accurately describe the BTF breeding requirements with consideration to spatial and temporal variation of resources of up to 10 years
 - o Survey and monitoring that must be undertaken by experienced ecologists.
- Include recommended actions to ensure actual and potential environmental impacts are effectively managed for the coming year
- Identify any amendments made to the BTF SMP following the review.

All revisions of the survey and monitoring program must be carried out in consultation with the BTF recovery team. Any revisions must be independently peer reviewed.

In addition, Adani will publish a report on its website addressing compliance with each of the conditions of EPBC 2010/5736, including implementation of the BTF Management Plan. The report will be published within three months of every 12 month anniversary of the commencement of the project, in accordance with the requirements of Condition 31 of EPBC 2010/5736. Details of the date of publication and any non-compliance with approval conditions will also be provided to DoE.

Adani will conduct periodic audits to monitor compliance with management plan commitments, in accordance with the Adani quality system. Adani will integrate the management plan commitments with other aspects of the mine construction and operations, to avoid actions being overlooked. It should be noted that reporting timeframes outlined in this plan apply only BTF.

This plan will be available to all employees, contractors and subcontractors. Adani will amend the management measures as necessary in response to regular reviews, monitoring results and changes in legislation, in consultation with regulatory authorities.

9.3 Qualifications

Persons implementing key tasks described in this management plan will have appropriate training, skills and professional qualifications relevant to their role and responsibility. BTF ecologists must be able to provide authoritative assessment, advice and analysis on performance relating to the BTF using the relevant protocols, standards, methods or literature. It is expected that suitably qualified personnel involved in the implementation, review and amendments to this plan will include an ecologist / ornithologist with recent field experience with the species and a knowledge of the habitat and ecological requirements of the BTF.

Fauna spotter-catchers must have demonstrable identification and handling skills, and behaviour knowledge (including nesting requirements) relevant to the BTF, and all threatened fauna species that may, are likely, or are known to occur in the Project Area. Fauna spotter-catchers must be suitably qualified and working under a valid permit from DES.

10 Commitments and actions included in this plan to be delivered by Adani

Table 13 provides a register of key reporting, mitigation and monitoring commitments arising from this plan. This will assist Adani and its contractors to monitor progress with implementation of the plan. Aspects of the monitoring design that should be considered for BTF are described in **Section 7**. These will be taken into consideration by ecologists implementing the management plan.

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Table 13 Commitments and actions included in this management plan to be delivered by Adani

Issue	Number	Commitment
Reporting and Notifications	1	Prepare an annual report on 1 July each year and make available to the Administering Authority upon request.
	2	Conduct periodic audits on compliance with this plan.
	3	Non-compliances with the BTF Management Plan will be identified and recorded through an auditing process.
	4	Work that has the potential to generate new and/or unapproved negative impacts to BTF must cease until the updated management plan has been considered by DoE. The updated management plan will detail how impacts to the newly identified communities will be avoided, mitigated and/or offset. Once approved, the revised management plan will be implemented.
Mitigation	5	Use discretion where possible in the placement of some infrastructure to avoid disturbance to BTF habitats and populations.
	6	Prior to the commencement of site works, any conditions listed in the "Permit to Disturb" will be implemented - e.g. clearing extents clearly marked, trees/areas requiring protection clearly marked, or barricaded. All BTF habitat clearing operations are to be monitored for compliance by a suitably qualified person.
	7	Undertake pre-clearance surveys prior to the commencement of clearing activities, to confirm and identify known areas of occurrence.
	8	Surveys of the area to be disturbed prior to and during construction are to be conducted by a fauna spotter-catcher in BTF habitat areas and remnant vegetation areas. Fauna to be recorded and translocated to suitable habitat adjacent to the disturbance area, where practical. Fauna deaths and injuries to be recorded and managed in accordance with relevant Permit Conditions (e.g. Rehabilitation (Spotter-catcher) Permit) and guidelines. BTF nesting areas observed in areas not to be disturbed will be marked and mapped and monitored during construction and operations works.
	9	Rehabilitate disturbed areas following construction activities where such activity does not compromise the ongoing operation of the project. Progressive rehabilitation of disturbed areas will be undertaken in accordance with the Rehabilitation Management Plan.
	10	Progressive rehabilitation of disturbed areas will be commenced as soon as practical after it has been confirmed that no further activities will occur in each area. Rehabilitation will generally commence within 6 months, unless it is considered more effective to align with the next wet season.
	11	Implement environmental offsets to enhance habitat values used by BTF.

Issue	Number	Commitment
	12	Implement an induction program for staff and contractors about BTF and other threatened species, their habitats and identification. Use posters in prominent work locations to maintain awareness. Implement sound land management practices.
	13	Use directional lighting and strategic timing and placement of lights to minimise light spill into adjacent habitat.
	14	Ensure all plant and equipment is serviced and maintained to minimise machinery noise and vibration.
	15	Management of erosion and sedimentation will be undertaken in accordance with a Project Erosion and Sediment Management Plan.
	16	Mine-related wire and mesh material near water sources will be removed and/or covered to prevent entrapment, if practical
	17	Domestic animals will not be permitted into the Project Area apart from cattle (including horses and dogs during mustering activities).
	18	Monitor BTF populations and their habitats in areas where subsidence occurs.
	19	Weed and pest animal control will be implemented during construction and operations.
	20	Permanent water sources in retained habitat areas will not be drained during construction and operations, unless suitable alternative water supplies are available.
	21	Monitoring BTF populations and their habitats in areas where subsidence occurs.
Monitoring	22	Monitor the presence and population abundance of invasive fauna.
	23	Measure the effectiveness of offset investments by monitoring the quality of offset areas.
	24	Any injured wildlife will be either taken to the nearest qualified veterinary practitioner or wildlife carer, or humanely euthanised on site by a suitably qualified person.
	25	Monitor dust level impacts on BTF habitat, and in water bodies within and adjacent to construction activities.
	26	Monitor water quality in BTF habitat, in accordance with the Surface Water Monitoring Plan.
	27	Annual monitoring (including photo monitoring) of water source availability, in the driest season, in known BTF habitat.
	28	Monitor the incidence of Project-related fire.
	29	Pre-clearance and annual BioCondition assessments and photo monitoring will be completed to determine the condition of retained BTF habitat in impact and control sites. Monitoring will be in conjunction with a research program to monitor remnant vegetation changes over subsidence areas.
	30	Measure the effectiveness of rehabilitation activities through BioCondition monitoring.

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Appendix A Overview of Project Management Plans

This section provides a summary of the EMP prepared to support an EIS process for the Carmichael Coal Project under the EPBC Act and SDPWO Act. The summary is intended to assist readers of the Species Management Plan understand the other management plans in place and how they relate to the management of threatened species and communities. The summary reflects the findings and recommendations of studies undertaken for the EIS. Further details of the management plans can be found at this link <http://www.adanimining.com/aeis-documents>

Each management plan covers design and construction requirements, operational activities and decommissioning. The management plans consider open cut mining, underground mining, mine infrastructure areas, out of pit waste rock dumps, mine water management dams, office, workshop and other facilities and power, water distribution and offsite infrastructure (e.g. worker's accommodation, airport, water supply infrastructure and road upgrades).

The overall project EMP provides details and implementation details for the following aspects: air quality, greenhouse gas emissions, noise and vibration, surface water, groundwater, mine waste management, general and hazardous waste management, terrestrial ecology, aquatic ecology, biosecurity management, scenic amenity, erosion and sediment control, contaminated land, soil resources, aboriginal cultural heritage, non-indigenous cultural heritage, subsidence management, emergency management and response and community. A summary of those plans most relevant to the protection of MNES is summarised below.

The project EMP is a working document and will be updated as required to reflect changes in impacts or mining activities, changes in legal and other obligations and changes from learning and corrective actions through monitoring activities.

Air quality

The management objectives for air quality include protection of biodiversity through avoiding nuisance from dust deposition and meeting EPP (Air) objectives for dust emissions at sensitive receptors. Particulate matter could affect fauna and plants through coating of plant leaves, making them less palatable for fauna and affecting photosynthesis.

Key measures include prevention of dust through planning and sequencing of exposed soils; stockpile design and stabilisation; suppression activities for coal stockpiles and haul roads, access tracks and work areas; and progressive rehabilitation of disturbed areas.

Dust generation will be monitored visually and through and corrective action applied where train loading is generating dust or dust lift off is travelling beyond the lease boundary.

Noise and vibration

The Noise and Vibration Plan aims to protect the qualities of the acoustic environment that are conducive to protecting biodiversity. Potential impacts are possible due to civil works during construction, increased traffic, pile driving, rock breaking, blasting and other mining related activities. In general most of these activities are not expected to affect sensitive receptors.

Airblast overpressure monitoring will be undertaken at sensitive receptors during initial blasting activities as well as other mitigations and monitoring controls that are largely aimed at protection of acoustic quality for surrounding homesteads.

Surface water

The Surface Water Management Plan aims to ensure that Environmental values relating to aquatic ecosystems, stock and domestic use and cultural values are maintained and that discharge and overflow events are undertaken in accordance with the relevant conditions under an environmental authority issued by DES.

Contamination of surface water resources could result from release of mine affected water, wastewater generation and treatment, hydrocarbon leaks or spills, spoil disposal, release of sediments through clearing and earthworks, or draining of low quality water from existing farm dams.

A mine water management system will be implemented based on segregation of water streams into clean, dirty and mine affected streams. Clean water will be managed by diverting around disturbed areas or through the proposed mine in watercourse diversions. Dirty water will be directed to sediment dams to allow sediment to settle out. This water can then be used for dust suppression.

The key management actions to be employed in the prevention of surface water loss and contamination include:

- Prepare and implement a Water Management Plan in accordance with the guideline Preparation of Water Management Plans for Mining Activities
- Preparation and implementation of a Receiving Environment Management Plan including water quality objectives, trigger levels, monitoring and contingency procedures
- Design all watercourse crossings to maintain flow and minimise afflux where this may affect sensitive receptors;
- Design of infrastructure to appropriate standards based on relevant guidelines and all available data to minimise impacts to surface water
- Prohibition of construction water sourced from the Carmichael River
- Controls on design and construction of dams
- Controls for draining of farm dams
- Preparation and implementation of a Plan of Operations for Mine Affected Water and sediment dams, including monitoring and requirements and procedures for discharge

Monitoring will include surface water levels and quality across a network of monitoring sites with at least twelve months of baseline data.

Groundwater

This Plan aims to ensure that impacts on groundwater dependent ecosystems do not cause unacceptable or unapproved losses of biodiversity values including impacts to fauna habitat. Potential threats to groundwater include drawdown from dewatering activities and contamination from spills or leaks.

Key management actions to be employed in the prevention of impacts to groundwater include:

- Groundwater quality trigger levels
- Identify potential impacts before excavation to inform measures required in work permits prevent contaminated runoff through development and implementation of a Surface Water Management Plan
- Laydown and storage areas to be located away from creeks and rivers or sensitive receptors

- On-going monitoring of groundwater levels and updates to models

Monitoring will include groundwater flows to the Carmichael River, groundwater levels and quality across a network of bores.

Pests and Weeds (Biosecurity Management)

Management objectives are to achieve no increase or spread of weeds beyond pre-development conditions as a result of project activities and no unapproved biosecurity management activities. The scope of activities under the plan includes 22 introduced plant species recorded during surveys of the Project Area, of which Parthenium and Prickly Pear are most significant. Eight introduced fauna species are also addressed, including the feral cat, pig, cane toad, dingo, house mouse and rabbit. The plan will manage potential environmental impacts from pests and weeds through vehicle movements, construction activities and ongoing operations. Proposed controls include the following activities:

- Mapping of weeds prior to commencement of construction activities
- Containment of food scraps in sealed containers
- Limitations on the movement of vegetation and soil waste
- Use of weed wash down areas for vehicles and equipment
- No domestic animals in the Project Area
- Feral animal control programs, if necessary.

There will be ongoing monitoring of pests and weeds throughout the Project Area, using baseline and reference sites.

Erosion and Sediment Control

A total of 19 soil types were identified within the Project Area based on geology, landform, native vegetation and soil profile features. It is important to reduce soil loss from the site for the management environmental values relating to both soil and water. Vegetation clearing, topsoil stripping, earthworks, and stockpiling will result in disturbance and exposure of soils to erosive forces from either overland flows of water or wind action. Soil loss reduces soil productivity and removes nutrients and organic matter. Sediment mobilised by overland flow can affect adjacent watercourses through increased turbidity, deposition of sediment on aquatic ecosystems, geomorphological changes and reduced water quality for other water users. Plan objectives are to avoid degradation of aquatic ecosystems and water supply values downstream as a result of sediment releases, and that topsoil resources will not be lost through erosion. Proposed controls include the following activities:

- Preparation of detailed erosion and sediment control plans for each aspect of the project
- Design stormwater systems to include sediment retention basins
- Locate infrastructure away from drainage lines and steep slopes, where ever practicable
- Where practical, schedule works to avoid wet conditions, or if in streams, outside times of flow
- Minimise the areas to be disturbed
- All disturbed areas will be revegetated or protected from erosion using suitable control measures

Monitoring activities will include the inspection of sediment control devices and stormwater systems, including diversion drains and outlets.

Subsidence Management

The management plan objective is that a stable and sustainable landform is created over subsided areas which maximises opportunities for the subsided areas to support native vegetation and fauna. Waterways are important considerations when addressing the potential environmental impacts from subsidence. The Carmichael River is the regional drainage line in the area, and a 500 m buffer from subsided areas will be maintained on either side of the river. Potential impacts from subsidence include altered topography and drainage patterns, tension cracks in the ground surface and disturbance to the root zones of vegetation. Proposed controls include the following activities:

- Develop a detailed management plan in accordance with the mine Environmental Authority
- Design creek diversions around the open cut areas to remain functional after subsidence
- Establish monitoring locations including transects of topographical features and habitat values
- Exclude cattle from subsidence areas.

Monitoring activities will include regular inspections of subsided areas, vegetation health assessments, inspections of ponding in subsidence troughs and groundwater assessments.

Bushfire Management

The Bushfire Management Plan provides a framework and guidance for:

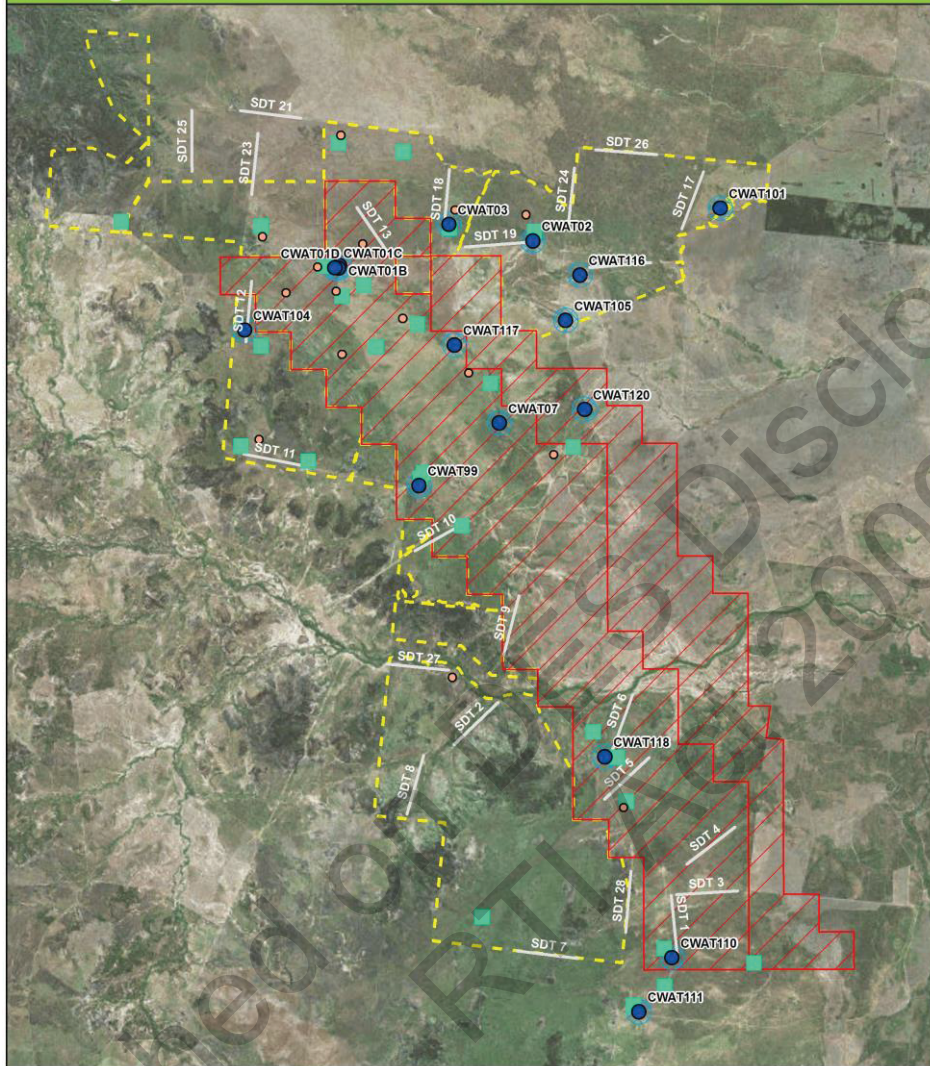
- Identifying, monitoring and prioritising the management of fire risk in the Operational Area
- Preventing bushfires and managing fires throughout the Operational Area
- Developing site-specific and/or activity specific fire management procedures across the life of the project.

The plan is focussed on an overarching strategy to identify, avoid, prevent, minimise and control bushfires. Specific measures are provided on how this will be achieved, and include mapping of relevant environmental features, maintain fire infrastructure (e.g. fire breaks) and levels of fire preparedness. The use of fire in environmentally or culturally sensitive areas is also discussed.

Appendix B Location of Monitoring Sites

The location of monitoring sites are shown on maps on the following pages. The first map shows the location of waterhole surveys sites, 1 km transects, vegetation (BioCondition) transect sites, slow drive transects (historic) and active search areas. The second map shows the location of 2 ha groundcover biomass monitoring sites, which will be monitored in May of each year.

Monitoring Sites



Legend

- The Project**
- Waterhole Survey Sites
 - 1km Transects
 - Vegetation Transect Sites
 - Slow-drive Transects
 - Active Search Areas
- Carmichael Mine
- Offset Area Boundary

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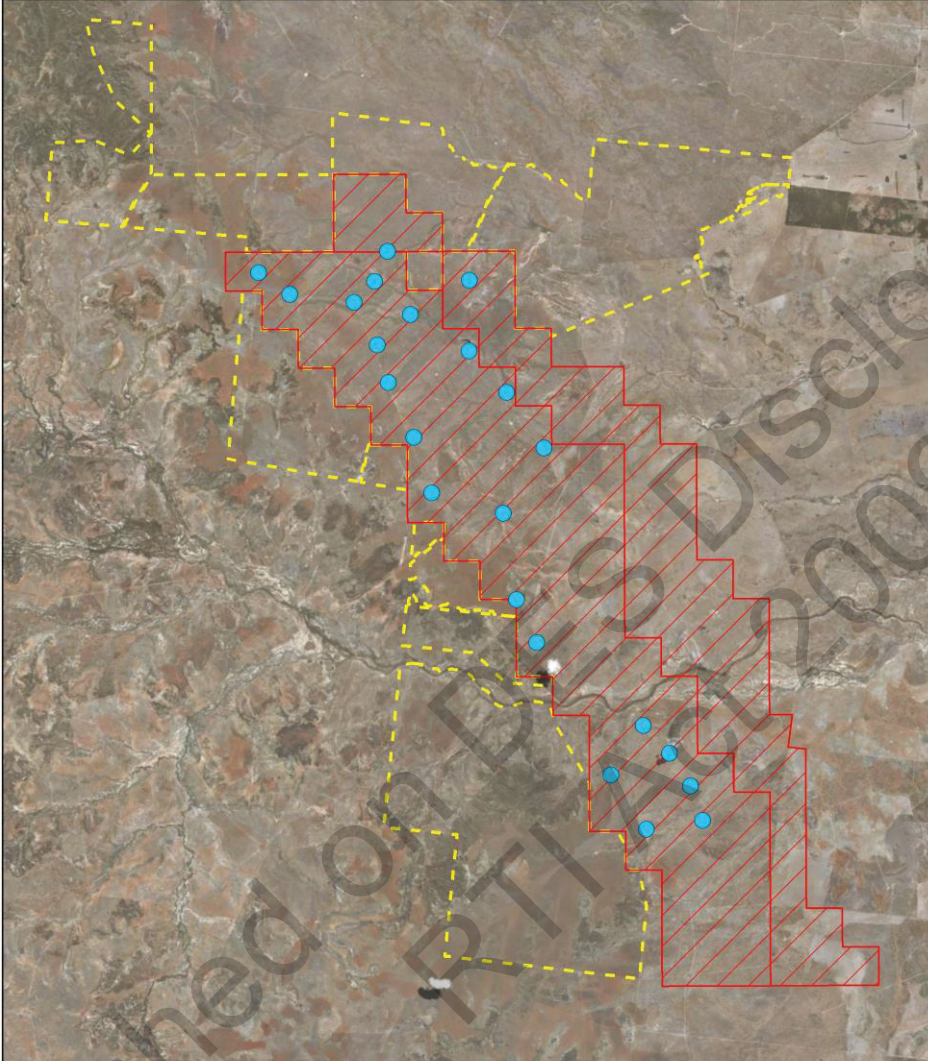
Datum/Projection:
GDA 1994 MGA Zone 55

0 2.5 5
Kilometers

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Prepared by: LA Date: 13/06/2018

2ha Groundcover and Composition Monitoring Sites



Legend

- Carmichael Mine
- Offset Area Boundary
- 2ha Groundcover and Composition Monitoring Sites

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Datum/Projection:
GDA 1994 MGA Zone 55

0 2.5 5
Kilometers

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Prepared by: SM Date: 13/06/2018

Appendix C Black-throated Finch Research Program

Published on DES Disclosure Log
RTI Act 2009

Appendix D Compliance with Approval Conditions

A table demonstrating compliance with relevant approval conditions is provided on the following pages.

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
EPBC Act Approval, condition 5	At least three months prior to commencement of mining operations, the approval holder must submit to the Minister for approval Matters of National Environmental Significance plan/s for the management of direct and indirect impacts of mining operations on (MNESMP). Note: If the MNESMP does not address any specific future activities (e.g. possible additional seismic surveys or specific mining stages) it should be updated in accordance with Condition 33.	The BTF Management Plan was lodged on 11 May 2017. This plan addresses the management of direct impacts of mining construction and operations on the BTF. Specifically, management actions of direct impacts are located in Table 8. This plan addresses the management of indirect impacts of mining construction and operations on the BTF. Specifically management actions of indirect impacts are located in Table 9 and Table 10. If this management plan does not address any specific future activities (e.g. possible additional seismic surveys or specific mining stages) it will be updated in accordance with condition 33 of the EPBC Act approval.	Section 6.3.3 (Table 8) Section 6.3.3 (Tables 9 and 10)	
EPBC Act Approval, condition 6	The MNESMP must be consistent with relevant recovery plans, threat abatement plans and approved conservation advices and must include:	This plan is consistent with the BTF Recovery Plan. Threats identified in the BTF Recovery Plan are addressed specifically in Section 4.6 and Table 4. These threats include clearing and fragmentation of vegetation, degradation of habitat by stock and pest species, alteration of habitat by fire regime, invasion by exotic weeds including grasses and predation by introduced predators. Potential project impacts are discussed in Section 4.6. Monitoring and research activities of the BTF Management Plan closely align with recovery objectives described in Section 5 of the BTF Recovery Plan (e.g. investigate breeding requirements, quantify distribution and abundance, investigate feeding and other habitat requirements). Further details of these measures are provided in Section 7 of the BTF Management Plan. There are no current threat abatement plan or conservation advices in force for the BTF.	Section 4.6 and Table 4 Section 7	
	a) A description of environmental values for each of the Matters of National Environmental Significance addressed in the plan	A description of environmental values for the BTF is provided in Section 4 of the BTF Management Plan. The description includes the status under Commonwealth and State legislation, regional populations, habitat requirements, breeding ecology, occurrence in the vicinity of the project area.	Section 4	
	b) Details of baseline and impact monitoring measures to be implemented for each of the Matters of National Environmental Significance including control and impact sites to be monitored throughout the life of the project. The monitoring must provide sufficient data to quantify likely impacts resulting from mining operations, including subsidence and changes in groundwater levels, to set habitat management goals (conditions 6e and 6f)	A description of baseline and impact monitoring measures for the BTF is provided in Section 7 of the BTF Management Plan. The section describes the need for monitoring to occur prior to project commencement, as well as during construction and operations. The location of monitoring sites is provided in Appendix B, with control and impact sites to be established (Section 7.1.2). The monitoring will quantify impacts resulting from mining activities and provide feedback on the effectiveness of mitigation measures. The monitoring will include consideration of the impacts from subsidence, and groundwater draw down on BTF habitat values and water availability (see Section 7.1.2). Habitat management goals are set in Section 6.	Section 7, Appendix B Section 7.1.2, Section 6.	
	c) Details of potential impacts, including area of impact on each of the Matters of National Environmental Significance from mining operations, including impacts from:	Details of potential impacts of the project on the BTF are addressed in Section 4.6 of the BTF Management Plan. An area of impact is provided in relevant subsections of Section 4.6 for potential impacts for which a quantitative estimate can be provided (e.g. vegetation clearing and subsidence). Potential impacts are also discussed in Section 6 in the context of mitigation measures to minimise impacts.	Section 4.6, Section 6.	
	(i) Vegetation clearing		Section 4.6.1	
	(ii) Subsidence from underground mining, including subsidence induced fracturing and any changes to groundwater or surface water flow		Section 4.6.2	
	(iii) Mine dewatering		Section 4.6.8	
	(iv) Earthworks		Section 4.6.9	
	(v) Noise and vibration		Section 4.6.10	
	(vi) Emissions (including dust)		Section 4.6.11	
	(vii) Light spill and other visual impacts		Section 4.6.12	
	(viii) Stream diversion and flood levees		Section 4.6.13	
	(ix) Weeds and pests		Section 4.6.3 and 4.6.6	

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
	d) Measures that will be undertaken to mitigate and manage impacts on Matters of National Environmental Significance resulting from mining operations. These measures must include but not be limited to:	A description of measures that will be undertaken to mitigate and manage impacts on the BTF resulting from mining operations is provided in Section 6.	Section 6	
	(i) The use of fauna spotters prior to and during all vegetation clearing activities to ensure impacts on Matters of National Environmental Significance are minimised	All BTF habitat clearing operations will be monitored for compliance by a suitably qualified fauna spotter-catcher during clearing activities, to ensure impacts on BTF are minimised. The approach is outlined in Tables 7 and 8 of the BTF Management Plan and Section 6.3.2.	Table 7, Table 8, Section 6.3.2	
	(ii) Measures to avoid impacts on Matters of National Environmental Significance and their habitat located in the Project Area, but outside areas to be cleared, constructed upon and / or undermined, including adjacent to cleared areas	Measures to avoid impacts on BTF and their habitat outside areas to be cleared around described in Section 6.4 and Table 9 of the BTF Management Plan. They include matters such as the management of grazing, fire, water and pests.	Section 6.4, Table 9	
	(iii) Measures to rehabilitate all areas of Matters of National Environmental Significance habitat	Details of rehabilitation of disturbed areas are provided in Section 6.1 and Table 8 of the BTF Management Plan. Monitoring initiatives to determine the success of rehabilitation activities are described in Section 7.	Section 6.1, Table 8, Section 7.	
	(iv) Habitat management measures including but not limited to management of subsidence and groundwater impacts of the project	Mitigation measures for subsidence are provided in Table 8 and address subsidence. Table 10 provides details for mine dewatering.	Table 8 and Table 10.	
	e) Goals for habitat management for each relevant Matters of National Environmental Significance	Goals for habitat management of the BTF are provided in Section 6.4 of the BTF Management Plan. These include maintaining the three main habitat elements: woody layer of vegetation, herbaceous layer of vegetation and water sources. Factors affecting these values are also discussed (e.g. grazing and fire). Table 9 provides further details on how goals will be achieved.	Section 6.4 and Table 9	
	f) A table of specific criteria for assessing the success of management measures against goals, and triggers for implementing corrective measures if criteria are not met within specified timeframes. This table must include but not be limited to measures relating to subsidence and groundwater impacts, including early warning triggers for impacts on groundwater at the Doongmabulla Springs Complex and the Carmichael River. Goals and triggers must be based on the baseline condition of the relevant Matters of National Environmental Significance as determined through baseline monitoring (see Conditions 3b) and 6b)). Corrective measure must include provision of offsets where it is determined that corrective management measures have not achieved goals within specified timeframes (see Conditions 11m) and 11o))	Table 8, Table 9 and Table 10 of the BTF Management Plan provides goals, performance criteria, mitigation measures, triggers and correction actions. The effects of subsidence and groundwater impacts on BTF habitat (i.e., habitat modification) are included in Table 8, Table 9 and Table 10. Goals and triggers are based on the baseline condition of BTF habitat as determined from several years of baseline monitoring surveys. These focus on a range of vegetation and floristics data collected since the EIS. See Table 8, Table 9, Table 10 and Appendix E and F (summary of baseline nesting and analysis). Section 6.5 of the BTF Management Plan describes the approach to achieving offsets and states that if additional impacts are proposed, or occur unexpectedly, then additional offsets will be provided, subject to approval from government agencies. This is stated to include circumstances where the corrective management measures have not achieved the goals within specified timeframes, and resulted in impacts beyond those that were originally approved. Table 8 also states a corrective action that may include the provision of offsets.	Section 6.4, Table 8, Table 9 and Table 10. Table 8, Table 9 and Table 10. Table 8, Table 9, Table 10 and Appendix E and F Section 6.5 and Table 8.	
	g) An ongoing monitoring program to determine the success of mitigation and management measures against the stated criteria in Condition 6f), including monitoring locations, parameters and timing. Monitoring for water resources Matters of National Environmental Significance must include hydrogeological, hydrological and ecological parameters	Details of the ongoing monitoring program are provided in Section 7 of the BTF Management Plan, and specifically Tables 8 to 10 address evaluating the success of mitigation measures. There are objectives to assess the success of mitigation and management measures.	Section 7 and Tables 8 to 10	
	h) Details of how compliance will be reported	Reporting and compliance procedures are described in Section 9 of the BTF Management Plan. Section 9.2 provides details of periodic reporting and audits to monitor compliance with management plan requirements.	Section 9	
	i) Details of how the MNESMP will be updated to incorporate and address outcomes from research undertaken for Matters of National Environmental Significance under this and any state approvals, including updating of goals, criteria and triggers (as required under Conditions 3c), 3d) 6e) and 6f))	Section 9.1 of the BTF Management Plan provides details of how the plan will be updated in response to outcomes of research, monitoring and management actions. An adaptive management approach will be taken and revisions to the survey and monitoring program will be carried out in consultation with the BTF recovery team, in accordance with Condition 17 of the EA. Section 6.1 of the BTF Research Program provides details of how the adaptive management process will be applied to BTF research.	Section 9.1	Section 6.1

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
	j) Provisions to ensure that suitably qualified and experienced persons are responsible for undertaking monitoring, review and implementation of the MNESMP	Section 9.3 of the BTF Management Plan outlines the qualifications of persons responsible for monitoring, reviewing and implementing the plan. This relates primarily to the qualifications of ecologists conducting field surveys and of spotter-catchers that may be involved in handling or managing the impacts of clearing on the species.	Section 9.3	
	k) In the event that future baseline research required by the Queensland Coordinator-General (Appendix 1, Section 3, Condition 1 of the Coordinator-General's Assessment Report) identifies that the Mellaluka Springs Complex provides high value habitat for the Black-throated finch, the approval holder must include management measures to address impacts resulting from drawdown at the Mellaluka Springs Complex in the MNESMP	Studies have determined that the Mellaluka Springs Complex does not provide BTF habitat. A letter from the Office of the Coordinator-General, dated 22 July 2016, has been received confirming the Commonwealth and Queensland government's acceptance of this finding.	Not applicable	
	l) Details of how, where habitat for an EPBC Act listed threatened species or community not previously identified and reported to the Department is found in the Project Area, the approval holder will notify the Department in writing within five business days of finding this habitat, and within 20 business days of finding this habitat will outline in writing how the conditions of this approval will still be met (refer Condition 11)).	This condition is addressed in the approved threatened species management plan for the Carmichael Mine. Section 5.1 of that plan says "In the event that new species or Threatened Ecological Communities are found, then DoE and/or DES will be notified within five business days and Adani will outline how the conditions of this approval will still be met within 20 business days". The BTF Management Plan deals only with the BTF.	Not applicable	
EPBC Act Approval, condition 7	Mining operations must not commence until the required MNESMP have been approved by the Minister in writing. The approved plan must be implemented. Note – Management plans such as the Black-throated Finch Management Plan and the Groundwater Dependent Ecosystems Management Plan may also be required under state approvals. Wherever possible a combined document should be prepared to address both state government and EPBC Act approval conditions. Note – Impacts of the action other than mining operations will be offset as required in accordance with Conditions 8 to 11, but will be otherwise managed in accordance with state approvals – this is of particular relevance when impacts may occur prior to approval of the MNESMP.	Mining operations will not commence until this plan has been approved. This plan addresses the combined requirements of the Commonwealth and Queensland governments in one document, as encouraged by the condition.	Not applicable.	
Carmichael Coal Mine and Rail Infrastructure Project Coordinator-General's Report, Imposed Condition 1.	Black-throated Finch (southern) baseline research for the Carmichael project a) To increase the knowledge of the ecological requirements of BTF populations likely to be directly and indirectly impacted by the project, the proponent must undertake further baseline research prior to the commencement of Project Stage 2.	Adani has undertaken extensive baseline research and monitoring since the EIS, and prior to the commencement of Project Stage 2. This work is ongoing and is summarised in Section 2.6 of the BTF Research Program.		Section 2.6
	(b) Prior to continuing the baseline research, a suitably qualified person must finalise a baseline research plan to the satisfaction of the authority responsible for administering threatened species provisions of the <i>Nature Conservation Act 1992</i> that includes a description of chosen methodologies.	A Research Program is established in Appendix C of the BTF Management Plan. This provides details of the chosen methodologies and research objectives. Adani has maintained ongoing consultation with DES on the progress of baseline monitoring surveys (Section 2.6 of BTF Research Program) and incorporated feedback into the development of the Research Program.		Entire document
	(c) The baseline research must include: (i) a minimum of two wet season surveys of the project area (ii) a minimum of two dry season surveys of the Mellaluka Springs Complex (iii) the collection of floristic data to enable the identification and mapping of key seasonal (wet and dry season) food sources.	To date, baseline research work conducted by Adani includes 10 surveys across both wet and dry seasons between 2012 and 2018, as summarised in Section 2.6 of the BTF Research Program. Surveys of the Mellaluka Springs Complex have been completed to the satisfaction of DES and DoE, as outlined in letter from the Office of the Coordinator-General, dated 22 July 2016. Monitoring has included floristic data to enable the identification and mapping of key seasonal food sources. This baseline research is ongoing, as outlined in Section 7 of the BTF Management Plan and Section 4 of the BTF Research Program.		Section 2.6, Section 4
	(d) The baseline research must determine: (i) whether the Mellaluka Springs Complex provides BTF habitat, particularly as a refuge during the dry season (ii) movement patterns, habitat requirements and population dynamics, including dietary requirements, home range, nesting requirements (iii) responses to grazing management, fire management and water body locations.	In July 2016, the Office of the Coordinator-General confirmed the baseline research work undertaken by Adani has satisfied the requirements of Imposed Condition 1: part (d)(i). To date, baseline research work conducted by Adani includes 13 surveys across both wet and dry seasons between 2010 and 2018, as summarised in Section 2.6 of the BTF Research Program. Findings of this work in relation to nesting, feeding habitat and dietary requirements are summarised in Appendix E and F. This work is ongoing, as outlined in the BTF Research Program. Responses of the BTF to grazing management, fire management and water body locations are key research objectives as outlined in Section 4 of the BTF Research Program.	Appendix E and F	Section 4

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
Carmichael Coal Mine and Rail Infrastructure Project Coordinator-General's Report, Imposed Condition 4 and Condition 5 (apportionment of costs).	Proponent contribution to BTF Bioregional Management Plan	The BTF Management Plan includes an ongoing monitoring program (Section 7) and Research Program (Appendix C) for BTF. There is not yet any bioregional management plan established by government to address regional impacts to the BTF arising from multiple mines proposed for the Galilee Basin. Adani is committed to participating in the BTF Bioregional Management Plan should this be established in the future.	Section 7	Entire document
	a) To address project impacts and maximise the ongoing protection and long-term conservation of the Black-throated finch (BTF) southern subspecies (<i>Poephila cincta cincta</i>), and its habitat in the Galilee Basin and Desert Uplands bioregion, the proponent must, when required by the administering authority responsible for the threatened species provisions of the <i>Nature Conservation Act 1992</i> :			
	(i) Prepare, to the satisfaction of the administering authority, an ongoing BTF monitoring program that takes into account the relevant requirements of any BTF Bioregional Management Plan specified in Appendix 1, Section 2, Part B and the outputs of baseline research required in Appendix 1, Section 3, Condition 1			
	(ii) Provide baseline and survey results in the format and at intervals specified for the coordination of bioregional survey data to the administering authority for any BTF Bioregional Management Plan			
	(iii) Contribute to the operation of any BTF Bioregional Management Plan including pro-rata funding.			
	Detailed condition about apportionment of costs for bioregional management plan.			
Environmental Authority, condition 16	Black-throated finch (BTF) Species Management Plan (SMP) at Carmichael project The holder of this environmental authority must submit a BTF SMP prepared and certified by a suitably qualified person to the administering authority prior to commencement of Project Stage 2 for approval. The holder must publish the BTF SMP on its website within 10 business days of receiving the administering authority's approval in writing. The approved BTF SMP must be implemented.	The BTF Management Plan has been prepared and certified by Eco Logical Australia, a national environmental consulting company with ~200 staff. Correspondence has been provided to DES outlining the qualifications and experience of the management plan authors (demonstrating that they are suitably qualified), and providing certification. Project Stage 2 will not commence until the BTF Management Plan is approved by the administering authority. The BTF Management Plan will be published online within 10 days of approval by the administering authority and will be implemented.	Entire document	Entire document
	The holder must align the SMP with any Bioregional BTF Management Plan and relevant documentation requirements under the <i>Environmental Protection and Biodiversity Conservation Act 1999</i> including BTF Recovery Plan, conservation advice and the threat abatement plan.	This plan is consistent with the BTF Recovery Plan. Threats identified in the BTF Recovery Plan are addressed specifically in Section 4.6 and Table 4. These threats include clearing and fragmentation of vegetation, degradation of habitat by stock and pest species, alteration of habitat by fire regime, invasion by exotic weeds including grasses and predation by introduced predators. Potential project impacts are discussed in Section 4.6. Monitoring and research activities of the BTF Management Plan closely align with recovery objectives described in Section 5 of the BTF Recovery Plan (e.g. investigate breeding requirements, quantify distribution and abundance, investigate feeding and other habitat requirements). Further details of these measures are provided in Section 7 of the BTF Management Plan. There are no current threat abatement plan or conservation advices in force for the BTF. There is currently no Bioregional BTF Management Plan.	Section 4.6 and Table 4	
	The submitted BTF SMP plan must include:	Adani has undertaken extensive and ongoing baseline monitoring of BTF, including the specific nesting and feeding requirements of the species. This work has been undertaken prior to and during project stage 1, since the wet season of 2012. Details of the monitoring program are provided in Section 2.6 of the BTF Research Program. Appendix E also summarises the findings of this monitoring.	Appendix E	Section 2.6
	a) A baseline research program on the specific nesting and feeding requirements of the species that will be undertaken prior to and during project stage 1.			
	The submitted BTF SMP plan must include:	Adani has undertaken extensive and ongoing baseline monitoring of BTF. Determining the home range and movement patterns of BTF in the project area is a major objective of the BTF Research Program (see Section 4.3)		Section 2.6, Section 3 and Section 4 of the Research Program
	... b) A baseline research program to establish whether the BTF at the project site are sedentary, locally migratory or regionally migratory.			
	The submitted BTF SMP plan must include:	Section 5 of the BTF Management Plan describes the adaptive management framework that will be applied to deal with uncertainty and incomplete knowledge using systematic monitoring to reduce uncertainty and improve management actions over time. Section 6 provides details of how the learnings from this research will be applied to minimise project impacts on BTF, and Section 9.1 provides details of how this will be reported to the Department. Further details on the adaptive management approach to applying research findings are also provided in Section 6.1 of the BTF Research Program.	Sections 5, 6 and 9.1	Section 6.1
	... c) A description of how the results of baseline research are to be used to determine any changes of classification of and/or impact on BTF habitat.			

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
	The submitted BTF SMP plan must include: ... d) Details of proposed impacts to BTF habitat from each project stage including impacts from clearing, subsidence, ecological function changes, hydrological changes and weed and pest infestation changes.	Details of potential project impacts are provided in Section 4.6 of the BTF Management Plan, including Table 4. Direct impacts from vegetation clearing and subsidence are provided for each stage of the project, consistent with the project Biodiversity Offset Strategy. The scale of indirect impacts are discussed, where this is possible to describe in a qualitative manner.	Section 4.6	
	The submitted BTF SMP plan must include: ... e) Mitigation measures to be undertaken to avoid, mitigate and manage impact resulting from each stage of the project, including rehabilitation of habitat.	Detailed mitigation measures are provided in Section 6 of the BTF Management Plan. These cover issues such as clearing and fragmentation of habitat, injury to BTF during works, habitat degradation, loss of water resources and contamination of water sources. Rehabilitation of disturbed areas is addressed in Table 7 and Table 8.	Section 6 and Table 7 and Table 8	
	The submitted BTF SMP plan must include: ... f) Monitoring of watering points that must be conducted for a minimum six (6) hour period commencing from dawn, to accurately capture BTF utilisation of water points.	Section 7.1.2.1 describes the approach to water source watches, which involve six continuous hours of survey commencing from dawn at 16 water sources where BTF have previously been recorded.	Section 7.1.2.1	
	The submitted BTF SMP plan must include: ... g) Detailed botanical assessment that must occur at all BTF sighting locations in the Project Area to record habitat values at those locations.	Vegetation assessments are described in Sections 7.1.2.6 and 7.1.2.7 of the BTF Management Plan. They include vegetation transects, foraging plots and groundcover monitoring. Detailed research activities on BTF habitat are also outlined in Section 4.4 of the Research Program.	Section 7.1.2.6 and Section 7.1.2.7.	Section 4.4
	The submitted BTF SMP plan must include: ... h) Detailed survey that must occur across the mining lease area and approved offset areas and must include information on BTF movements. The survey method and effort must be sufficient to accurately describe the BTF home range and detail BTF resource usage patterns between seasons and years (for up to 10 years) and allow robust management actions to be developed for the maintenance of a viable local BTF population.	Estimating the home range and movements of BTF is a key aim of the Research Program. Objectives, methods, variables to be monitored, resources and timing are outlined in Section 4.3 of the Research Program. Section 7.2 of the BTF Management also discusses this program of surveys.	Section 7.2	Section 4.3
	The submitted BTF SMP plan must include: ... i) Survey work that should incorporate the usage of call playback and identify all birds present when BTF are encountered.	Call playback has been utilised in previous surveys as described in Section 4.5 of the BTF Management Plan and Section 2.6 of the Research Program. Section 7.1.2 of the BTF Management Plan describes monitoring methods and specifies that all birds are to be identified when BTF are encountered. This is also specified in Section 4.4.4 of the Research Program.	Section 4.5 and Section 7.1.2.	Section 2.6 and Section 4.4.4
	The submitted BTF SMP plan must include: ... j) Specific surveys that must be undertaken during the BTF breeding season and include nest location and assessment of the habitat attributes associated with the breeding locations. The survey method and effort must be sufficient to accurately describe the BTF breeding requirements with consideration to spatial and temporal variation of resources of up to 10 years.	Determining the breeding habitat requirements of the BTF and the relationship with vegetation structure and composition and water is part of a key aim of the Research Program. Details of the objectives, variables to be monitored, methods, resources and timing are outlined in Section 4.4 of the Research Program. Section 7.2 of the BTF Management also discusses this program of surveys. Baseline monitoring activities described in Section 2.6 of the Research Program have also collecting information on nests, if present.	Section 7.2	Section 4.4
	The submitted BTF SMP plan must include: ... k) Survey and monitoring that must be undertaken by experienced ecologists.	The qualifications and experience required by ecologists implementing the BTF Management Plan are outlined in Section 9.3. The involvement of suitably qualified and experienced professionals in the implementation of the Research Program is also discussed in Section 4.1 of the Research Program.	Section 9.3	Section 4.1
Environmental Authority, condition 17	The BTF SMP under condition 16 must be reviewed by an appropriately qualified person annually and a report prepared on 1 July each year. The report must: a) Assess the plan against the requirements under condition 16.	As outlined in Section 4.1 of the Research Program, The BTF Management Plan and Research Program will be reviewed annually by an appropriately qualified person, and revisions of the survey and monitoring program will be carried out in consultation with the BTF Recovery Team. Any revisions must be independently peer reviewed. An annual report of research findings and the results of the independent peer review will be provided to DES.		Section 4.1
	... b) Include recommended actions to ensure actual and potential environmental impacts are effectively managed for the coming year.			

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
	...c) Identify any amendments made to the BTF SMP following the review.			
	... d) All revisions of the survey and monitoring program must be carried out in consultation with the BTF recovery team.			
	e) Any revisions must be independently peer reviewed.			
Environmental Authority, condition 18	The baseline research program must fund a research project to determine the relationship between water sources, woody habitat and the BTF food sources within the mining lease area and approved offset areas to determine the inter-relationships among these factors.	The Research Program will determine the relationship between water sources, woody habitat and the BTF food sources within the mining lease area and approved offset areas, and the inter-relationships among these factors. This is explained in Section 4.2 of the Research Program, with further details provided in Sections 4.4 and 4.5 of the Research Program.		Sections 4.2, 4.4, and 4.5
Environmental Authority, condition 19	The baseline research program under Condition 16 must:	Surveys completed by Adani to date have identified that BTF are particularly abundant in the area around Ten Mile bore (Section 4.5 of BTF Management Plan). Section 4.4 of the Research Program outlines the objective of determining whether Ten Mile Bore and surrounds are high value habitat for BTF. The research will also determine the characteristics of Ten Mile Bore and surrounds that contribute to its frequency of use and compare this with other waterholes and woodlands, through equivalent frequency monitoring.	Section 4.5	Section 4.4
	a) Establish whether Ten Mile Bore and surrounds are high value habitat for the species, and b) Establish management actions to maintain the current BTF population of Ten Miles Bore and surrounds	Currently Ten Mile Bore and surrounds are managed under the certified environmental management system. Routine checks of the water sources at Ten Mile Bore are carried out. The agistee for the Moray Downs pastoral lease also carry out checks of water sources as a part of their monitoring program. Interim management of the Ten Mile Bore area is discussed in Section 6.4.7. Monitoring and management actions for the Ten Mile Bore area will be reviewed and modified in line with BTF Research Program outcomes, as described in Section 4.6.1 of the Research Program.	Section 6.4.7	Section 4.6.1
Environmental Authority, condition 110	The holder of this environmental authority must maintain water troughs for BTF within undisturbed areas and surface areas of underground mining footprint, and repair where necessary troughs, pipes and tanks to a standard that maintains a constant source of water.	Troughs are identified as an important water source for BTF in the study area (e.g. Section 4.6.3 of BTF Research Program). Table 10 (Section 6.1) of the BTF Management Plan states that known water sources will be avoided, or alternative water sources established outside of disturbance footprint, if avoidance is not possible. Section 6.4.4 of the BTF Management Plan also states that current water sources outside of the clearing footprint are to be maintained. Where it is necessary to remove a particular water source within or nearby to BTF habitat, a new water source will be created.	Section 6.3.3, Section 6.4.4 and Table 10	Section 4.6.3
Adani Commitment, M4.29	Management actions will seek to maintain and where possible enhance Black-throated finch habitats and populations (e.g. pest control, water source, grazing and fire management) in unmined parts of the Mine Area, as well as in offset areas.	Section 6.1 of the BTF Management Plan states "Monitor BTF habitat values through annual groundcover assessments during May to maintain and where possible enhance BTF habitat within the Mining Lease". Table 8 also states as a mitigation measure – Manage non-mined and offset areas to maintain and improve BTF habitat values. This work will be guided by results from annual vegetation assessments, annual BTF surveys and the BTF Research Program.	Section 6.1, Table 8	
Adani Commitment, M4.30	Black-throated finch surveys will continue so as to provide data on temporal and spatial variation of habitat use in the Mine Area and will contribute significant local data for incorporation into the Black-throated Finch Species Management Plan for the Mine Area, which will assist in refinement of species recovery actions and mitigation of impacts on the Mine Area.	BTF surveys have continued as outlined in this commitment. This work is summarised in Section 2.6 of the Research Program. This work will continue as described in Section 7 of the BTF Management Plan and the Research Program.	Section 7	Section 2.6, entire document
Adani Commitment, P6.30	Monitoring events will commence at least one year before mining operations (in order to continue a baseline understanding of existing conditions), and continue for at least two years after mining operations are completed.	Monitoring of BTF has been ongoing since the project EIS, as outlined in Section 2.6 of the BTF Research Program. A long-term program of research and monitoring has been established.	Section 7.1	Section 2.6
Adani Commitment, P6.51	The loss of habitat for the Black-throated finch (southern) will occur in stages, in accordance with the staged development of the operational components of the Mine Area. Management actions to encourage dispersal away from areas that will be cleared for staged Mine operations will also be developed.	Section 6.3.1 of the BTF Management Plan describes the staged approach to clearing of vegetation in accordance with this commitment.	Section 6.3.1	
Adani Commitment, P6.52	Management actions for Black-throated finch will seek to maintain and where possible enhance habitats and populations (e.g. through pest control, provision of water sources, appropriate grazing and fire management) in unmined parts of the Mine Area, as well as in offset areas.	Section 6.1 of the BTF Management Plan states "Monitor BTF habitat values through annual groundcover assessments during May to maintain and where possible enhance BTF habitat within the Mining Lease". Table 8 also states as a mitigation measure – Manage non-mined and offset areas to maintain and improve BTF habitat values. This work will be guided by results from annual vegetation assessments, annual BTF surveys and the BTF Research Program.	Section 6.1, Table 8	

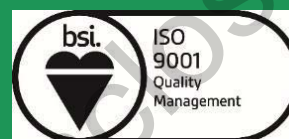
Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
Adani Commitment, P6.53	Important population, movement and habitat information for Black-throated finch will be collected, particularly with respect to seasonal use, key areas, nest sites, important feeding areas and management of threatening processes.	Section 7 of the BTF Management Plan and Section 4 of the Research Program outline research and monitoring tasks that are consistent with this commitment.	Section 7	Section 4
Adani Commitment, P6.54	Adani will provide a Draft Black-throated Finch Management Plan for approval prior to the commencement of mine construction. The Plan will include the following: <ol style="list-style-type: none"> 1. A management framework that aligns with the other project management plans 2. Clear statements regarding the intent, approval requirements, objectives and actions 3. Details of how the management plan will be applied across the project phases – pre construction / construction / operation / post operations, 4. Offset areas 5. Details of the current and proposed adaptive monitoring program to support the plan objectives. 6. Details of how experts will be used in a review capacity to inform ongoing monitoring and management 7. Incorporates all proposed management and mitigation measures, including reference to how these will align with the Significant Impact Guidelines and the National Recovery Plan. 8. Specific performance targets and how these will be measured and reported. 	This BTF Management Plan and Research Program address these requirements.	Details are addressed in the following sections: <ol style="list-style-type: none"> 1) Section 1.3 2) Section 1 3) Section 6 4) Section 6.5 5) Section 5 6) Section 9 7) Section 6 8) Section 6 and Section 9 	5) Section 6.1 6) Sections 4.1 and 6
Adani Commitment, P6.55	Black-throated finch surveys will continue over time to provide data on temporal and spatial variation of habitat use in the Mine Area and will contribute significant local data for incorporation into the Black-throated Finch Species Management Plan for the Mine Area, which will assist in refinement of species recovery actions and mitigation of impacts on the Mine Area. In the case of subsidence, which will occur gradually and in a complex and partly unpredictable manner, the data being collected by this monitoring will provide information regarding the best strategies over time to mitigate negative effects and manage key resources for Black-throated finch on the Mine Area.	BTF surveys have continued in accordance with this commitment. A program for future monitoring and research is outlined in this plan.	Section 7	Entire document
Adani Commitment, P6.56	The onsite and offsite (offset areas) habitat management and complementary monitoring program, as described above, will be developed and implemented in consultation with relevant stakeholders (i.e. Black-throated Finch Recovery Team, Commonwealth and State governments).	This plan has been developed in consultation with relevant stakeholders. Implementation of the plan will be conducted as described in Section 9.2 of this plan and Section 6.2 of the Research Program. This involves sharing the findings of the research with the BTF Recovery Team for use and updating of the recovery plan and ongoing engagement with Commonwealth and state governments.	Section 9.2	Section 6.2
Adani Commitment, P6.57	Adani's overarching commitments in regards to the Black-throated Finch are: <ol style="list-style-type: none"> 1. Implementing management measures across the Project Mining Lease where there are indirect impacts including land management activities, water management, habitat maintenance, pest control, fire management, survey and recording. This commitment would continue through the duration of mining operations. 2. Implementing management measures across a proposed like for like mitigation area within those property areas mapped in Figure 1 below, including land management activities, water management, habitat maintenance, pest control, fire management, survey and recording. This commitment would continue for a period of 20 years. 3. Securing and maintaining appropriate offsets including land management activities, water management, habitat maintenance, pest control, fire management, survey and recording. This commitment would continue for the duration of the offset agreement, nominated as 20 years. 4. Ongoing monitoring programs locally, and contributing to regional monitoring programs including utilising and assisting where possible monitoring effort from the BTFRT. This commitment would continue for a period of 10 years, commencing from 2014. 5. Contributing time and resources to a government-led regional management program. In the order of an in-kind contribution of \$100,000 per year, over a period of 10 years, commencing from Mining Operations. 	Adani has met these commitments to the BTF, as summarised in the BTF Management Plan and associated Research Program. Indirect impacts are addressed in Section 6 of the BTF Management Plan, and include a range of land and water management activities and offsets. A long term program of research and monitoring has been established.	1-3) Section 6 4) Section 7 5) Government-led regional management program not yet established.	4) Entire document

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
Adani Commitment, P6.60	<p>Project Species Specific Management Plan(s)</p> <p><u>Key actions</u></p> <ul style="list-style-type: none"> Develop and implement programs to provide a greater level of detail on the ecology of threatened species at the Study Area – to be undertaken in collaboration with applicable research organisations, conservation groups and government agencies. <p><u>Timeframes</u></p> <ul style="list-style-type: none"> Implement targeted ecology and threatened species programs prior to and during Mine operations. Five yearly revisions and updating of this plan based on currency of information available. 	The BTF Research Program outlines a comprehensive program to provide greater level of detail on the ecology of the BTF in the study area, in collaboration with relevant stakeholders.	Section 7	Entire document

Appendix E Summary of baseline research on BTF nesting and foraging habitat in the project area (E2M Consulting)

Appendix F Summary of baseline groundcover characteristics to assist with future management of grazing

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Date : 3/12/2018 4:02:26 PM
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To : "Melinda Bergmann" , "BENNINK Kate"
Cc : [redacted]oved at External Re
Subject : RE: Black-throated Finch Management Plan and Research Program
Attachment : image002.jpg;
Thank you, [redacted]at Extern

Ciao for now

Juliana

From: [redacted]oved at External Re [redacted]sch4p4(6) Personal information
Sent: Monday, 3 December 2018 3:55 PM
To: BENNINK Kate
Cc: MCCOSKER Juliana; [redacted]ed at External f
Subject: RE: Black-throated Finch Management Plan and Research Program

COMMERCIAL IN CONFIDENCE

Good afternoon Kate

Adani reviewed the Black-throated Finch Management Plan and Research Program and found some minor wording errors that have now been corrected. These are not material changes to the document.

As such, I attach version 7a to replace version 7 of the document submitted on 2 November 2018, for your consideration.

Also attached is a Word "tracked changes" version showing where changes have been made.

Regards
[redacted]at Extern

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Sent: Friday, 2 November 2018 5:15 PM
To: kate.bennink@des.qld.gov.au
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Subject: Black-throated Finch Management Plan and Research Program
Importance: High

COMMERCIAL IN CONFIDENCE

Good morning

Please find attached correspondence from [redacted]Removed at External Review [redacted]about the Black-throated Finch Management Plan and Research Program.

Is the department able to please confirm receipt via return email?

If you have any questions, please do not hesitate to contact me on 07 3037 5510.

Regards
Melinda

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Date : 17/12/2018 4:20:14 PM

From : [redacted]

To : "BENNINK Kate"

Cc : "MCCOSKER Juliana" , [redacted]

Subject : RE: Black-throated Finch Management Plan and Research Program

Attachment : BTF Management Plan_v7B 20181217 final.pdf;BTF Management Plan_v7B 20181217

TrackedChanges.docx;image002.jpg;

COMMERCIAL IN CONFIDENCE

Good afternoon Kate

Adani reviewed the Black-throated Finch Management Plan and Research Program and have made some final edits. These are not material changes.

As such, I attach version 7b to replace any other version submitted prior, for your consideration. Also attached is a Word [redacted] tracked changes [redacted] version showing where changes have been made.

The updated version 7b has also been sent to the Commonwealth Government and Queensland Coordinator-General.

Regards

[redacted]

From: [redacted]

Sent: Monday, 3 December 2018 3:55 PM

To: kate.bennink@des.qld.gov.au

Cc: MCCOSKER Juliana; [redacted]

Subject: RE: Black-throated Finch Management Plan and Research Program

COMMERCIAL IN CONFIDENCE

Good afternoon Kate

Adani reviewed the Black-throated Finch Management Plan and Research Program and found some minor wording errors that have now been corrected. These are not material changes to the document.

As such, I attach version 7a to replace version 7 of the document submitted on 2 November 2018, for your consideration.

Also attached is a Word [redacted] tracked changes [redacted] version showing where changes have been made.

Regards

[redacted]

From: [redacted]

Sent: Friday, 2 November 2018 5:15 PM

To: kate.bennink@des.qld.gov.au

Cc: MCCOSKER Juliana <Juliana.Mccosker@des.qld.gov.au>; [redacted] sch4p4(6) Personal information

Subject: Black-throated Finch Management Plan and Research Program

Importance: High

COMMERCIAL IN CONFIDENCE

Good morning

Please find attached correspondence from [redacted] about the Black-throated Finch Management Plan and Research Program.

Is the department able to please confirm receipt via return email?

If you have any questions, please do not hesitate to contact me on [redacted] 6) Personal inf

Regards

[redacted]

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Black-throated Finch Management Plan

Carmichael Coal Mine and Offsite Infrastructure

Prepared for
Adani Mining Pty Ltd

December 2018



DOCUMENT TRACKING

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Date	17 December 2018

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ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Niche Environment and Heritage Consultants.

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Template 08/05/2014

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Abbreviations

Abbreviation	Description
Adani	Adani Mining Pty Ltd
BioCondition	A vegetation condition assessment tool which provides a measure of how well a terrestrial ecosystem is functioning for the maintenance of biodiversity values at a local or property scale.
BOS	Biodiversity Offset Strategy
BTF	Black-throated Finch
CEMP	Construction Environmental Management Plan
CG	Coordinator-General
DES	Queensland Department of Environment and Science (formerly known as the Department of Environment and Heritage Protection (DEHP))
DoE	Commonwealth Department of the Environment
EA	Environmental Authority issued under the <i>Environmental Protection Act 1994</i>
EIS	Environmental Impact Statement
ELA	Eco Logical Australia Pty Ltd
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
EPBC Approval	Approval granted by the Commonwealth under the EPBC Act
ER	Environmental Representative
MNES	Matters of National Environmental Significance, as defined under the EPBC Act
MNESMP	Matters of National Environmental Significance plan/s for the management of direct and indirect impacts of mining operations
NC Act	<i>Queensland Nature Conservation Act 1992</i>
NGBR	North Galilee Basin Rail Project; a 311 km section of the Carmichael Rail Network located between Mistake Creek and the Port of Abbot Point
OEMP	Operations Environmental Management Plan
RE	Regional Ecosystem
SDPWO Act	<i>State Development and Public Works Organisation Act 1971</i> (Queensland).
SEIS	Supplementary Environmental Impact Statement, prepared in response to comments on the draft EIS.
SMP	Species Management Plan
SP1	Separable Portion 1; a 77 km section of the Carmichael Rail Network located between the Carmichael Mine and Mistake Creek
TEC	Threatened Ecological Community as defined under the EPBC Act
VMP	Vegetation Management Plan

1 Introduction

1.1 Background

Eco Logical Australia (ELA) has been engaged by Adani Mining Pty Ltd (Adani) to develop a Black-throated Finch (BTF) Management Plan for the construction and operation of the Carmichael Coal Mine and Rail Infrastructure Project in the Galilee Basin of central Queensland. The Carmichael Coal Mine and Rail Infrastructure Project is one of two components of the overall project proposed by Adani, which includes:

1. Carmichael Coal Mine and Rail Infrastructure Project, comprising the Carmichael Coal Mine (open cut and underground coal mine) and 189 km of rail link and associated infrastructure; and
2. North Galilee Basin Rail (NGBR) Project, comprising 310 km of rail from approximately 70 km east of the Carmichael Mine, to the Port of Abbot Point.

The Carmichael Coal Mine and Rail Project and the NGBR Project have been assessed by the Commonwealth and Queensland governments through separate Environmental Impact Statement (EIS) processes. Conditional approval of the Carmichael Coal Mine and Rail Project was granted by the Queensland Coordinator-General on 8 May 2014 and the Commonwealth Minister for the Environment on 14 October 2015 (EPBC 2010/5736). Conditional approval of the NGBR Project was granted by the Queensland Coordinator-General on 12 August 2014 and the Commonwealth Minister for the Environment on 14 October 2015 (EPBC 2013/6885).

The development of a BTF Management Plan is a requirement of the Commonwealth and Queensland approval conditions (refer to **Section 1.5** of this document), to protect BTF and its habitat from avoidable impacts associated with the mine and rail projects.

1.2 Scope and purpose of management plan

This BTF Management Plan is specific to the Carmichael Coal Mine and associated infrastructure component of Adani's overall mine and rail project. This document is a BTF Management Plan for the Carmichael Coal Mine (which includes open cut and underground mining) and required associated infrastructure which includes workers' accommodation, an airport, and water supply infrastructure. These combined components of the development are hereafter referred to as the Project (**Figure 1**). This management plan describes the proposed management of direct and indirect impacts of mining operations on BTF which will be implemented throughout the Project.

The management of the BTF for the rail link component of the Carmichael Coal Mine and Rail Project and the NGBR are addressed in separate documents. Additionally, Species Management Plans for other threatened species and ecological communities, groundwater dependent ecosystems are also addressed in separate documents.

The purpose of the BTF Management Plan is to meet the conditions of approval granted by the Queensland and Commonwealth governments, and commitments made by Adani in securing these approvals. The BTF Management Plan is consistent with relevant guidelines and policies on the protection of Matters of National Environmental Significance (MNES) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and the management of threatened species listed under the Queensland *Nature Conservation Act 1992* (NC Act).

The BTF Management Plan details the management actions and monitoring requirements for the Carmichael Mine to minimise and mitigate impacts prior to and during construction. Management and monitoring actions apply to mining-related activities across the Project area, including those conducted on ML70505, ML70506 and ML70441. Conceptually, the adaptive management approach to be implemented applies to areas that will be disturbed by mining activities, areas of mining leases where no mining impacts are proposed, and offset areas where BTF habitat will be improved (**Figure 1**).

However, in relation to the management of offset areas, it should be noted that a detailed Offset Area Management Plan: Moray Downs West (OAMP; C02 2017), has been developed with specific management actions to achieve offsets for a range of environmental values, including BTF. While the BTF management plan includes some reference to management of the offset area, reference should be made to the OAMP for details of specific management actions.

Objectives of the BTF Management Plan are as follows:

- Describe management objectives, performance criteria and practical measures (management actions) to mitigate impacts of the Project on BTF
- Describe monitoring measures that will be implemented to assess the effectiveness of mitigation measures, and inform adaptive management actions
- Describe triggers for the implementation of adaptive management and corrective actions
- Provide a consistent framework across the Project for the mitigation of risks to BTF
- Collate relevant Project commitments relating to mitigation and monitoring of BTF ecological values, to assist in streamlining their implementation, the monitoring of compliance and reporting
- Achieve consistency with other management plans for the Project, related to biodiversity offsets, groundwater dependent ecosystems, construction activities and operations
- Achieve compliance with relevant Commonwealth and Queensland approval conditions (**Appendix D**).

As required under Condition 16a) to c) and 18 of the EA the BTF Management Plan includes a BTF Research Program (**Appendix C**). The purpose of the BTF Research Program is to increase the knowledge of the ecological requirements of BTF populations within and adjacent to the Carmichael Coal Mine and by doing so, inform and improve management of the local populations. The Research Program outlines the studies to be undertaken to identify:

- Specific nesting and feeding requirements of the species
- Whether BTF in the Project Area are sedentary, local migratory or regionally migratory
- Any changes in of classification and / or impact on BTF habitat
- The relationship between water sources, woody habitat and food sources
- Population dynamics, including dietary requirements, home range, nesting requirements
- Responses of the BTF and its habitat to grazing management practices, fire management practices and water body locations

The Research Program will primarily focus on studies that will provide results and information that facilitate improving suitable BTF habitat within the Moray Downs West offset area as well as habitat within ML70506 where no impacts from mining are proposed.

1.3 Relationship with other management plans

Other plans and strategies have been developed and there will be some interaction among the outputs during construction and operation, as illustrated in **Figure 2**.

This BTF Management Plan has been prepared to be consistent, where appropriate, with the following management plans:

- Biodiversity Offset Strategy for the Carmichael Coal Mine and Rail Project
- Moray Downs West Offset Area Management Plan
- Species Management Plan for the Carmichael Coal Mine
- Environment Management Plan for the Carmichael Coal Mine (Mine; for both construction and operations)
- Groundwater Dependent Ecosystems Management Plan for the Carmichael Coal Mine.

Other management plans will also be developed and implemented where required as part of the mine and offsite infrastructure construction and operation, and align with this plan.

This BTF Management Plan should not be confused with a Species Management Program required under the *Nature Conservation Act 1992*, for tampering with a protected animal breeding place in Queensland. A Species Management Program authorises activities that will impact on breeding places of animals protected under the *Nature Conservation Act 1992*. Adani will undertake a survey of animal breeding places prior to clearing activities and develop a Species Management Program for approval, consistent with guidelines provided by the Queensland Department of Environment and Science (DES).

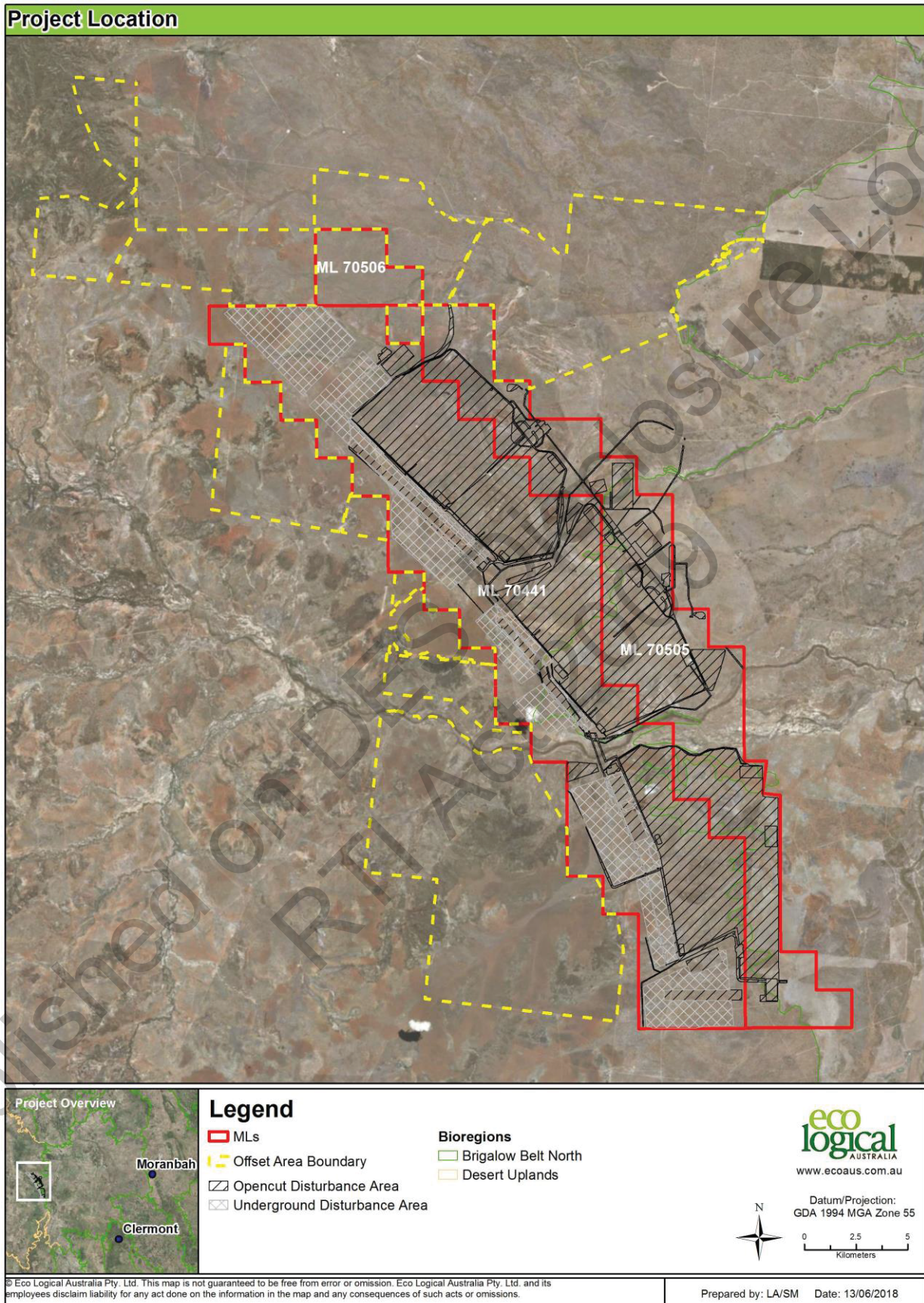


Figure 1 Project Location

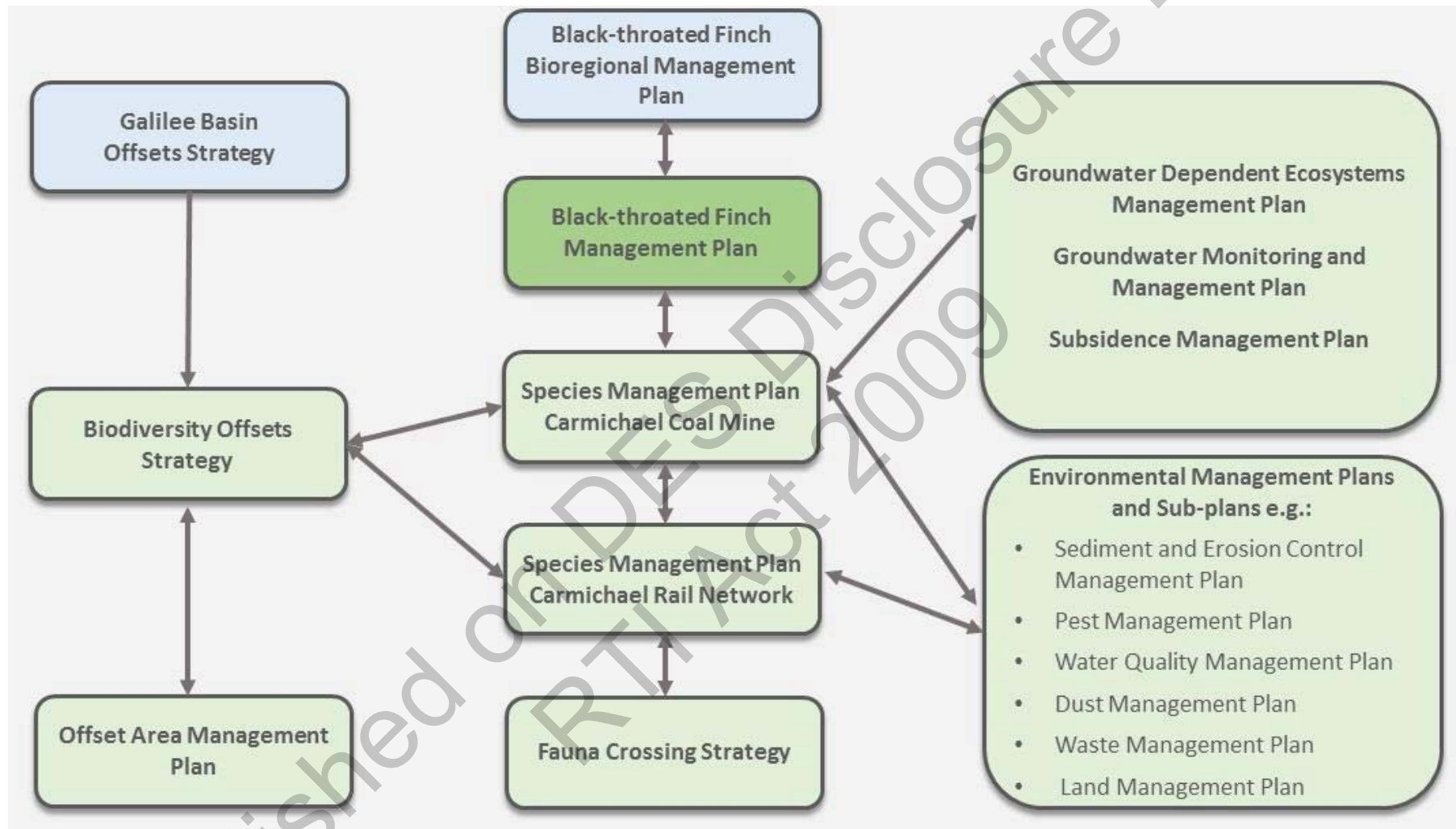


Figure 2 Flow chart showing the interactions among examples of key management plans and sub-plans for the Carmichael Coal Mine. The BTF Management Plan is shaded green, with regional plans and strategies covering multiple projects shaded blue.

1.4 Structure of this report

This report has been structured to address the requirements of relevant approval conditions and to facilitate practical implementation of management measures 'on the ground'. A summary of key sections is provided below:

- A contextual description of the Project (**Section 2**)
- Overview of the legislative framework and approval conditions to be addressed within the BTF Management Plan (**Section 3**)
- General description of BTF ecology and known threats to the sub-species (**Section 4**)
- Adaptive management framework (**Section 5**)
- Mitigation and management measures for BTF (**Section 6**)
- Monitoring Program for BTF (**Section 7**)
- A discussion of the key outcomes of the management planning process (**Section 8**)
- Arrangements for reporting and monitoring compliance with Species Management Plan actions (**Section 9**)
- A register of key mitigation and monitoring commitments within the Species Management Plan (**Section 10**)

Appendix A provides an overview of project management plans, **Appendix B** shows the location of sites where monitoring will be conducted during BTF surveys and the BTF Research Program is provided in **Appendix C**. **Appendix E** provides a summary of the results of baseline research on BTF nesting and foraging habitat. **Appendix F** provides a summary of baseline groundcover characteristics to assist with future management of grazing.

1.5 Compliance with approval conditions

Compliance matrices indicating where approval conditions and commitments relevant to the BTF Management Plan have been addressed within this report are outlined in **Appendix D**.

1.6 Environmental setting

The Carmichael Coal Mine is located in central Queensland within the Burdekin catchment. It covers the boundary of the Brigalow Belt and Desert Uplands bioregions of Queensland. The Brigalow Belt North and Desert Uplands bioregions are semi-arid, and located in the tropics where summer rainfall dominates, with distinct wet and dry seasons.

The Brigalow Belt North Bioregion is a large and complex area characterised by clay soils with forests and woodlands dominated by Brigalow (*Acacia harpophylla*), eucalypts and grasslands. The general land types include undulating rugged ranges to alluvial plains (Removed at External Review 2008). The Desert Uplands Bioregion is characterised by sandstone ranges and sand plains, with thick eucalypt and acacia woodlands, often with a spinifex understory at Extern 2008). Each of these bioregions is further divided into subregions based on land forms.

The Project Area is located in the Belyando Downs subregion of the Brigalow Belt North Bioregion, and the Alice Tableland subregion of the Desert Uplands. The dominant vegetation communities in these subregions are Silver-leaved Ironbark (*Eucalyptus melanophloia*) and Poplar Box (*E. populnea*) woodlands on alluvial deposits, and Lancewood (*Acacia shirleyi*) and Bendee (*A. catenulata*) woodlands on rocky hills and sandstone ranges (Removed at External Review 1999). The Brigalow Belt North Bioregion is also dominated by Brigalow and Gidgee (*A. cambagei*) woodlands on fine soils, and Queensland Bluegrass (*Dichanthium sericeum*) grasslands on alluvial deposits; whilst the northern reaches of the

Alice Tablelands are dominated by White's Ironbark (*E. whitei*) and Reid River Box (*E. brownie*; at External Re 999).

The predominant land use of the region is beef cattle grazing, which covers over 90% of the total area (at External 2008). Other land uses include conservation and minimal use, forestry, dryland agriculture, horticulture, mining, and urban centres (at External 2009). There are few major urban centres in the region, with the largest being Bowen, Barcaldine, Collinsville, Alpha, Clermont, and Pentland (at External 2008).

The mine is located within the Carmichael River sub-catchment of the Belyando Basin in the Burdekin Catchment. The Belyando Basin is characterised by generally low relief floodplains drained by braided channels and surrounded by wide alluvial plains (at External 2009).

1.7 Method

Utilising outcomes of previous monitoring surveys conducted during and post the EIS, a team of experienced ecologists was established with local knowledge of the Project Area to develop an effective approach to BTF management (this document). The BTF Management Plan was developed with guidance from relevant Commonwealth and State approval conditions, other legislative requirements for native flora and fauna, relevant species recovery plans occurring within the Project Area, and best-practice approaches to species management. The following key steps were taken to develop the management plan for BTF:

- A review of the ecological requirements relating to BTF was conducted, drawing upon the EIS studies, surveys completed after the EIS, published literature and relevant database searches
- The impacts from a range of activities associated with construction and operation of the Project were considered, including vegetation clearing, subsidence, mine dewatering, earthworks, the generation of noise and vibration, emissions such as dust, light spill and other visual impacts, stream diversion and flood levees and the spread of weed and pest species.
- Measures to mitigate the impacts of the Project on BTF were described, including at locations adjacent to areas of direct disturbance. Mitigation measures were informed by commitments within the EIS and associated Project approvals, and the technical knowledge and experience of ecologists developing this management plan.
- An approach to monitoring BTF was developed for a variety of project stages. These included before the commencement of work (baseline monitoring and pre-clearance surveys), monitoring of impacts during construction, assessing recovery post-construction and monitoring the impacts of ongoing operations.
- Goals, triggers and corrective actions were developed for mitigation measures, to establish a framework of adaptive management for BTF with the potential to be affected by the Project.
- An ongoing system of monitoring was described to determine the effectiveness of the mitigation measures.

Consideration was also given to the potential for impacts at a landscape level and groups of similar species, as Project impacts may not necessary be manifested on individual BTF or species in isolation.

2 Project Description

2.1 Project overview

The Project involves construction of a greenfield coal mine in the Galilee Basin over Mining Leases 70441, 70505 and 70506. The mine site is located approximately 160 km north-west of Clermont, with mining to be conducted using both open cut and underground mining methods. Offsite infrastructure to support the mine will include a workers accommodation village, a permanent airport site and water supply infrastructure (associated infrastructure). The total disturbance area will be approximately 28,000 ha for the mine and 1,300 ha for the offsite infrastructure. Coal will be transported by rail to the Port of Abbot Point for export. The operational mine life will be approximately 60 years, with a production rate peaking at 60 Mtpa.

The open cut mine will have a capacity of 40 Mtpa and will be located along the eastern section of Mining Lease 70441. The open cut mine will be operated primarily using truck shovel/excavator methods. A series of open cut pits will be progressively mined. During the early stages of developing each mine pit, overburden will be transported to pit dumps, where it will be profiled and rehabilitated. A proportion of this material will be used to re-profile the high-wall of the final voids (Adani 2012).

The underground mine will operate concurrently with the open cut pits, to provide for coal blending and ensure continuity of production. The underground mine will comprise independent underground longwall mines, producing approximately 20 Mtpa of product. Each underground mine will be serviced by above ground infrastructure.

All run of mine coal will be transported by truck and/or overland conveyor to a centralised coal handling facility, where the high-ash portion will be washed for blending with the bypass coal (un-washed coal). Coal will be stockpiled prior to loading on trains for transportation by rail. The channel and riparian zone of the Carmichael River will be preserved and the adjacent pits protected from flooding events by a levee (Adani 2012).

All offsite infrastructure to support the operation of the mine will be located on the Moray Downs Pastoral Lease (Lot 662 on SP282172) to the east of the mine. The workers accommodation village will be located approximately 12 km east of the Mine and accessed via the upgraded Moray-Carmichael Road. The village will accommodate construction and operational workforces for the Mine. All recreational, health and safety requirements to support workers will be provided at the village.

The permanent airport will be located approximately 5 km west of the workers accommodation village and will provide access for fly-in-fly-out workers. Offsite water supply infrastructure will enable the extraction, storage and delivery of water during the construction and operation phases of the mine.

2.2 Mine staging

The Project will be implemented in several stages. An understanding of the project stages and their relative timing is important for developing appropriate management and mitigation measures to address potential impacts of the Project on BTF and their habitat. The total Project Area (Mining Lease Area) is about 45,000 Ha out of which 28,016 Ha (62%) will be disturbed in several stages for open cut mining, underground mining and mine infrastructure (including, water storage, tailings drying cells, diversion drains and levees). The initial areas of disturbance will be required for opening up of box cut areas for open cut and underground mining and areas required for mine infrastructure. The details of the staged disturbance are provided in **Table 1**. It is evident from **Table 1** that areas will be disturbed in a phased

manner and will only be cleared commensurate with development of the project within each stage. Some areas of the mining lease will not be impacted by mining activities as evident from **Figure 3**. Where BTF habitat occurs in these areas, management will be to maintain and/or aim to improve the habitat condition.

Key elements of the Project and their relative timing are summarised in the following sections.

Table 1 Details of staged disturbance areas (note: relates to all areas – not only BTF habitat)

Disturbance domain	Area (Ha)	Disturbance Areas (Ha)		
		Year 1-10	Year 11-20	Year 21-30
Open cut Mining (Including pits, slopes voids and out of pit spoil dumps)	16,640.24	10332.66	3682.75	2624.83
Underground Mining(subsidence areas)	7786.76	1931.95	3030.16	2824.65
Infrastructure Area (including, water storage, tailings drying cells, diversion drains and levees)	3589.93	3403.89	174.82	11.22
Total	28,016.93	15,668.50	6,887.73	5,460.70
% disturbance		56%	25%	19%

2.2.1 Open cut Mining Operations

Open cut Mining operations include extraction of coal from the ground as well as any immediately associated activities, including initial clearing of vegetation, removal and storage of overburden, storage of coal and dewatering, but not including exploratory surveys or the construction or operation of transport, accommodation or power generation infrastructure.

- The Open cut mines consist of six pits from North to south of the Mining Lease area
- Pits B, C, D and E are located to the north of the Carmichael River.
- Pits F and G are located to the south of the Carmichael River.

Open cut mining activities will be carried out in three stages of the project across 60 years of life of the project. Stage 1 of Open cut mining is defined as year 1-10 and includes all associated activities such as box cut excavation, formation of haul roads, forming of out of pit spoil dumps and building mine related infrastructure like CHPP, ROM, Product coal storage areas, water infrastructure and waste storage facilities.

Activities associated with mining operations north of the Carmichael River are anticipated to commence in Year 1 (early stages of the Project). In this area open cut Pits D and E will be opened up initially during the first year of the start of mining. During later years, additional Pits B and C will be opened up to the north of the Mining Lease area. As shown in **Figure 3**, there is minimal BTF habitat in areas immediately north of Carmichael River (Pits D and E), which will be the focus of early stages of the Project. This delay in the disturbance of BTF habitat will coincide with improvements to BTF habitat in the offset area, minimising Project impacts on BTF habitat values overall.

Mining operations south of the Carmichael River are anticipated to commence in Year 8 (i.e., 7 years after the commencement of mining operations north of the Carmichael River). In this area open cut Pits F and G will be opened up and will continue till the end of project life.

2.2.2 Underground Mining

Underground mining will be completed in three stages across the 60 year life of the Project. Stage 1 of underground mining is defined as Years 1-10 and includes all associated activities including box cut excavation, portal construction, long wall construction and longwall panel mining. Multi seam mining within the first underground mine will occur during this time. Stage 2 of underground mining will occur from approximately Year 11-23 and Stage 3 will occur from approximately Year 24 and beyond.

2.3 Moray Downs West

The Moray Downs West offset area has been identified in the approved BOS as a priority offset to acquit most of the Project's offset requirements, including those required for BTF (CO2 2016). The offset area for offset delivery stage 1 is located on the western portion of the Moray Downs property (Lot 662 on SP282172; **Figure 1**).

Parts of Moray Downs West are mapped as priority 1 areas in the Queensland Government's Galilee Basin Offset Strategy (DEHP 2013). Priority 1 areas contain high levels of conservation value and are likely to have the lowest risk of future development through mining. Moray Downs West also borders priority 1, 2 and 3 Galilee Basin Offset Strategy areas.

The offset area includes 20,274 ha of BTF habitat. It is anticipated that the management objectives will be achieved within the 20 year management period through the implementation of adaptive management. However, if required additional management will be considered at the end of the management period should any of the objectives not be met (CO2 2016). Monitoring is likely to be required beyond 20 years to clearly demonstrate the effectiveness of the offset, and to achieve compliance with EPBC Act approval conditions, which require monitoring for the life of the project.

3 Legislative and Regulatory Framework

3.1 Project approval conditions

The Project Area provides habitat for a variety of threatened species, listed under the EPBC Act or the NC Act. State and Commonwealth approval conditions require the development of management plans for those species and ecological communities that were considered most likely to be affected by the Project.

For the Commonwealth approval, these species and communities are as follows:

- Black-throated Finch (southern; *Poephila cincta cincta*) - Endangered
- Squatter Pigeon (southern; *Geophaps scripta scripta*) - Vulnerable
- Ornamental Snake (*Denisonia maculata*) - Vulnerable
- Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC - Endangered
- Yakka Skink (*Egernia rugosa*) - Vulnerable
- Waxy Cabbage Palm (*Livistona lanuginosa*) - Vulnerable
- Doongmabulla Springs Complex – Nationally Important Wetland and a community of native species dependent on natural discharge of groundwater from the Great Artesian Basin TEC - Endangered

For the State approval, the Coordinator-General recommended in Section 2 of Appendix 2 of its report that a Species Management Plan be prepared for all threatened species known, or likely to, occur within the Project Area. Within the mining lease, Adani has committed to a range of environmental management measures to reduce impacts on threatened species.

3.2 Approval conditions relevant to BTF management plan

There are multiple Commonwealth and Queensland approval conditions that require Adani to prepare a BTF Management Plan, describing how potential impacts of the Project on ecological values will be mitigated and monitored. This report addresses the requirements of these conditions for both Commonwealth and Queensland legislation. This document is specific to the Carmichael Coal Mine and associated infrastructure and addresses the approval conditions relating to BTF for this component of Adani's overall mine and rail project. Conditions relevant to the rail components of the Carmichael Coal Mine and Rail Project have been addressed separately (ELA 2015c; ELA 2015d).

An inventory of all relevant Commonwealth and State approval conditions is provided in **Appendix D**, with a description of the location within this report where each condition has been addressed.

3.3 Key legislation

Assessment of the Project by the Commonwealth Government occurred through the EIS process under the Commonwealth EPBC Act. This assessment considered potential impacts of the Project on MNES, such as federally-listed threatened species, migratory species, and threatened ecological communities.

Assessment of the Project by the Queensland Government occurred through the EIS process under the *State Development and Public Works Organisation Act 1971* (SDPWO Act). This act provides for the assessment of 'coordinated projects' by the Coordinator-General, while considering other Queensland legislation relevant to the proposed activity, including the:

- *Environmental Protection Act 1994*

- *Nature Conservation Act 1992*
- *Vegetation Management Act 1999*

Adani began formal environmental assessment of the Carmichael Coal Mine and Rail Project in 2010, through preparation of an EIS, to address the Commonwealth and Queensland government approval requirements. The Project was declared a 'significant project' under the SDPWO Act requiring an EIS and was assessed to be a 'controlled action' requiring assessment and approval under the EPBC Act.

An EIS was prepared in accordance with the bilateral agreement between the Commonwealth of Australia and the State of Queensland, with the objective of avoiding or mitigating potentially adverse impacts on environmental, social and economic values and enhancing positive impacts. Where there were unavoidable residual impacts, offsets were proposed in accordance with State and Federal government policies.

Adani prepared an SEIS in accordance with Section 35 (2) of the SDPWO Act and the bilateral agreement between the Commonwealth of Australia and the State of Queensland. The SEIS provided revised and additional environmental studies undertaken to reflect the amendments made to the Project since the EIS publication and to address matters raised in submissions. It included revised technical studies, impact assessment and management plans for a range of project issues.

The Carmichael Coal Mine and Rail Project was subsequently approved by the Queensland Coordinator-General on 8 May 2014, subject to conditions. The project was approved by DoE on 14 October 2015, subject to conditions (EPBC 2010/5736).

Adani was granted an Environmental Authority (EA) EPML01470513 for the Carmichael Coal Mine on 2 February 2016 in which conditions relating to the Black-throated Finch were also imposed. These conditions require a management plan and research program.

In addition to State and Federal approval conditions, Adani made commitments in regards to the management of BTF within the Coordinator-General report. **Appendix D** describes the relevant approval conditions and / or commitment relating to the monitoring and management of BTF and where the condition is addressed within this management plan.

3.4 Other guiding documents

In accordance with the Environmental Authority (EA) Condition I6 and Adani company commitment P6.54 the BTF Management Plan has been developed to align with the following references:

- National recovery plan for the Black-throated Finch southern subspecies *Poephila cincta cincta*. Report to the Department of the Environment and Water Resources, Canberra (Black-throated Finch Recovery Team, 2007)
- Significant impact guidelines for the Endangered Black-throated Finch (southern; *Poephila cincta cincta*) - EPBC Act policy statement 3.13 (Department of the Environment, Water, Heritage and the Arts (DEWHA), 2009)
- Two threat abatement plans that specifically reference the Black-throated Finches, being:
 - o for competition and land degradation by rabbits (DEWHA, 2008)
 - o to reduce the impacts on northern Australia's biodiversity by the five listed grasses DSEWPAC (2012)
- Commonwealth Listing Advice on Southern Black-throated Finch (*Poephila cincta cincta*; Department of the Environment, 2005), and

- Queensland Government Bio-regional BTF Management Plan as required under the Coordinator-General's report about the Project, currently under development by DES.

Published on DES Disclosure Log
RTI Act 2009

4 Black-throated Finch (southern) Ecology

EPBC Condition 6a) requires that all MNES management plans include a description of the environmental values for each particular MNES.

4.1 Status

The Black-throated Finch (southern; BTF) is listed as endangered under the EPBC Act and the NC Act. The primary reason for the listing is the decline in size and extent of the population of the southern subspecies.

4.2 Regional populations

The southern subspecies of the BTF lives in the Brigalow Belt North and Desert Uplands bioregions of Queensland, which cover 135,500 km² and include the towns of Townsville, Bowen, Emerald, Clermont and Collinsville (at External R 2011).

Based on mapping of all records of BTF up to 2010 and a comparison with post-2000 records, the distribution of BTF is estimated to have contracted by 50-80% of its historical range and is now rarely recorded south of Clermont (160 km south of the Project Area; at External R 2011). BTF have also disappeared from several sites around Townsville (ved at External R 2011).

4.3 Habitat requirements

A summary of baseline research on the characteristics of BTF nesting and foraging habitat within the project area is provided in **Appendix D**. Black-throated Finch habitat typically consists of grassy eucalypt woodlands adjacent to water or riparian corridors (at External R 1976; at External R 2007; d at External R 1996; d at External R 2006; NRA 2007; d at External R 1970). Preferred habitat consists of patches with suitable grasses, low vegetation density or bare ground to allow access to the seed bank and an open tree layer that does not have a continuously dense shrubby understorey (ved at External R 2015). d at External R (1996) noted that the southern subspecies requires a mosaic of different habitats during the wet season in which to find seed. This subspecies has also been recorded in degraded habitats, including cultivated areas near woodlands and heavily grazed paddocks (DoE 2016).

The species can be found in a range of woody plant communities with records known from at least 21 Regional Ecosystems (RE; ved at External R et al. 2016). Woodland vegetation typically consists of ironbark (e.g. *Eucalyptus melanophloia*, *E. crebra* and *E. drepanophylla*), bloodwood (*Corymbia dallachiana*, *C. erythrophloia* and *C. clarksoniana*) and gums (*E. platyphylla* and *E. brownii*). Records from other vegetation communities includes wetlands, riparian paperbark woodlands and native grasslands (ved at External R et al. 2016). Approximately 78% of records within the Galilee Basin region are associated with Broad Vegetation Group (BVG) 17b which is described as 'woodlands to open woodlands dominated by *Eucalyptus melanophloia* (Silver-leaved ironbark; or *E. shirleyi*; Shirley's silver-leaved ironbark) on sand plains and footslopes of hills and ranges' (at External R unpublished).

In the Project Area, grassy open-woodland communities dominated by *Eucalyptus melanophloia* (RE 10.5.5a) are preferred, though the species is not restricted to this community (ELA 2017a, Niche 2015a, Niche 2015b, Niche 2016a, Niche 2016b). Other habitats where BTF have been recorded on multiple occasions include *Eucalyptus brownii* open-woodland (RE 10.3.6ax1), and less commonly in *Eucalyptus similis* and *Corymbia brachycarpa* open-woodland (RE 10.5.1a) and *Corymbia setosa* open-woodland

(RE 10.5.1d; ELA 2017a). **Table 2** lists all REs identified in the Project Area that are considered as potential habitat.

BTF habitat within the Project Area generally consists of an open-woodland (approximately 17 % canopy cover) with moderately low canopy (approximately 12 m) and low canopy species richness. The shrub layer is typically low (2 to 2.5 m) and sparse (less than 10 % cover) but a moderately high species diversity. The ground cover is dominated by native grasses (approximately 35% cover and 8 species) with moderate bare ground (34% cover). Exotic grass and herb / forb cover are typically low (less than 5%; **Appendix E**).

Table 2 Regional Ecosystem associations for the BTF within the Project Area

RE	Description	Habitat Code
10.5.5a	<i>Eucalyptus melanophloia</i> dominates the very sparse canopy. <i>Corymbia plena</i> and <i>C. dallachiana</i> are occasionally co-dominants in the canopy. <i>Petalostigma pubescens</i> and <i>Acacia spp.</i> occasionally occur as dominants or as scattered trees in the very sparse to mid-dense low tree layer. <i>Carissa lanceolata</i> , <i>Psydrax oleifolia</i> and <i>Denhamia cunninghamii</i> frequently occur in the very sparse to sparse shrub layer. <i>Triodia pungens</i> is often dominant in the very sparse to mid-dense ground layer. <i>Aristida spp.</i> , <i>Bothriochloa ewartiana</i> , <i>Eriachne mucronata</i> , <i>Eragrostis lacunaria</i> and <i>Heteropogon contortus</i> occasionally occur as dominant or codominant graminoids. Occurs on sandplain.	<i>Eucalyptus melanophloia</i> dominant
10.3.6ax1	<i>Eucalyptus brownii</i> dominates the very sparse tree layer with scattered shrubs and very sparse ground layer frequently dominated by <i>Aristida contorta</i> . Occurs on flat to gently undulating sandplain.	<i>Eucalyptus brownii</i> dominant
10.3.13a	Riverine wetland or fringing riverine wetland. <i>Eucalyptus camaldulensis</i> dominates the very sparse to sparse canopy. <i>E. coolabah</i> , <i>Casuarina cunninghamiana</i> and <i>Melaleuca leucadendra</i> are frequently present in the canopy. <i>Corymbia tessellaris</i> is occasionally present. <i>Melaleuca spp.</i> are frequently present in the mostly very sparse low tree layer. Graminoid <i>Lomandra longifolia</i> is commonly present in the very sparse to sparse ground layer. Occurs along watercourses.	Riverine
10.5.1a	<i>Eucalyptus similis</i> dominates the usually very sparse canopy. <i>Corymbia brachycarpa</i> is frequently present in the canopy. <i>Eucalyptus drepanophylla</i> can occasionally occur as a codominant. The low tree layer is very sparse or composed of scattered small trees including <i>Bursaria incana</i> , <i>Acacia sericophylla</i> , <i>Alphitonia excelsa</i> and <i>Grevillea glauca</i> . A very sparse to mid-dense tall shrub layer is often present and dominated by <i>Acacia spp.</i> <i>Petalostigma pubescens</i> and <i>Persoonia falcata</i> are commonly present. A low shrub layer is usually present and dominated by <i>Carissa lanceolata</i> . <i>Triodia pungens</i> usually dominates the very sparse to mid-dense ground layer. Occurs on sandplains.	<i>Eucalyptus</i> or <i>Corymbia spp.</i> dominant with shrub layer
10.5.1d	<i>Corymbia setosa</i> dominates the very sparse canopy. <i>Melaleuca nervosa</i> , <i>Acacia sericophylla</i> , <i>A. elachantha</i> , <i>Bursaria incana</i> , <i>Grevillea glauca</i> and <i>Petalostigma pubescens</i> are frequently present in the very sparse low trees layer or occur as scattered small trees. <i>Acacia spp.</i> and <i>Carissa lanceolata</i> dominate the very sparse shrub layer. The ground layer is usually dominated by <i>Triodia pungens</i> . Occurs on sandplains.	

Grazing and fire are important drivers of the composition and structure of both the woody and ground layers of the vegetation (at Extern 2011, NRA 2007). Details on how grazing and fire impact the structure and composition of vegetation relevant to the BTF are provided in **Sections 4.6.4** and **4.6.5** respectively. Managing these factors is therefore important for the maintenance and management of BTF habitat. The optimal grazing and fire regimes required to maintain or improve habitat quality for the BTF are yet to be determined. Trials to determine the appropriate management of habitat with grazing and fire are proposed

as part of the Carmichael Coal Mine BTF Research Program (**Appendix C**), the results of which will feed back into the BTF Management Plan.

Permanent water is critical for the BTF as it provides refuge during dry periods and because they need to drink every day (at Extern 011, NRA 2007). This water may be in the form of natural springs, perennial streams, waterholes in ephemeral creeks or man-made water sources such as farm dams and troughs. Therefore water must be within an accessible distance from their foraging and nesting habitat, and nests within the Townsville Coastal Plains populations are typically constructed in trees within 400 m of water sources (at Extern 2011, NRA 2007). However BTF monitoring results from the Project Area have identified a mean distance of approximately 2.5 km between nests and known permanent water sources, with the closest nest 280 m from water and the furthest almost 7 km from water (**Appendix E**).

Foraging habitat must provide suitable seeds, principally of grasses (at Extern 2011, NRA 2007). There must be an appropriate density and diversity of grasses, with seeds available and accessible on the surface as the birds predominantly feed on fallen seeds. A mix of grass species that seed at different times is important to provide year round food supply as BTF can experience food shortages particularly in the lead up to the wet season (at Extern 2011). The ground layer of the vegetation is ideally dominated by a diversity of annual and perennial grasses with sufficient inter-tussock spacing to allow the birds to forage efficiently for grass seeds present on the soil surface. Studies in the Project Area have identified a ground layer containing a mosaic of approximately 37% native grass cover and 34% bare ground as well as at least 8 native grass species and less than 5% exotic grass cover is preferred. BTF have not been recorded foraging in areas with more than 50% exotic grass cover (**Appendix E**).

Grass seed abundance usually peaks around the early dry season (May to June) and gradually declines through until the next wet season. Consequently, BTF can experience food shortages at particular times of year. The onset of wet season rains causes any remaining seed to germinate or rot, resulting in a significant food shortage (at Extern 2011) that can cause BTF to forage for longer in order to meet their needs. **Table 3** lists preferred grass species for the BTF based on research and studies in the Townsville Coastal Plains, Cape York Peninsula and Mareeba. Most are derived from observations of where BTF individuals were seen foraging. A summary of baseline groundcover and grass species at selected monitoring sites across the Project Area is provided in **Appendix F**.

Table 3: Grass species preferred by Black-throated Finches

Grass species	Location	Method	Reference
Favoured			
<i>Setaria surgens</i> *	Cape York Peninsula Mareeba West of Townsville	Direct observation of feeding by <i>P. c. atropygialis</i> and <i>P. c. cincta</i>	(at Extern 1976)
<i>Digitaria ciliaris</i> *			
<i>Stylosanthes humilis</i> *			
<i>Dactyloctenium radulans</i> *			
<i>Setaria surgens</i> *	Cape York Peninsula Mareeba West of Townsville	Observed to be dominant at sites used by Black-throated finches	(at Extern 1976)
<i>Melinis repens</i>			
<i>Schizachyrium fragile</i>			
<i>Panicum seminudum</i>			
<i>Aristida superpendens</i>			
<i>Aristida ingrata</i>			
<i>Aristida calycina</i>			

<i>Urochloa mosambicensis</i>	Townsville Coastal Plain	Direct observation of feeding birds	at External (1996)
<i>Digitaria ciliaris</i>*			
<i>Alloteropsis cimicina</i>	Townsville Coastal Plain	Abundant on plots where Black-throated finches were foraging	at External (2007)
<i>Alloteropsis semialata</i>			
<i>Chloris</i> spp.			
<i>Setaria apiculata</i>			
<i>Urochloa mosambicensis</i>	Townsville Coastal Plain	Abundant on plots where BTF were foraging	at External (2015)
<i>Chrysopogon fallax</i>			
<i>Eragrostis</i> spp.			
<i>Setaria surgens</i>*			

Bold species indicate those that have been recorded in the Project Area

* Indicates species which BTF have been observed foraging on in the Project Area

Within the Project Area BTF have been observed foraging on similar species as indicated in **Table 3**, as well as additional grasses including:

- *Enteropogon ramosus* (GHD 2012)
- *Paspalidium rarum* (GHD 2012 and Niche 2016)
- *Schizachyrium fragile* (GHD 2012)
- *Cymbopogon bombycinus* (ELA 2017)
- *Triodia pungens* (ELA 2017)
- *Eriachne mucronata* (ELA 2017 and E2M 2018)
- *Bothriochloa ewartiana* (E2M 2018)
- *Panicum effusum* (E2M 2018)
- *Enneapogon polyphyllus* (E2M 2018)
- *Sehima nervosum* (E2M 2018)
- *Digitaria brownii* (E2M 2018).

During the 2016 dry season survey BTF were observed foraging on the seeds of the introduced woody herb *Stylosanthes scabra* (ELA 2017a).

The BTF monitoring surveys for the Project Area have indicated some differences with grass species that have been previously identified as being avoided in research undertaken on the Townsville Coastal Plains. In particular, the “avoided” species *Heteropogon contortus* and *Aristida* spp. have been commonly found at foraging sites in the Project Area, at varying percentage cover. At this stage the nature and scale of these differences are unknown, with monitoring programs currently underway to provide further clarity. In this regard, there remains ecological behaviours that are not fully understood for the local BTF population and their foraging requirements. Further surveys dedicated to analysing foraging behaviours of BTF within the Project Area, and comparison of the data, are required to identify the key factors that define preferred foraging habitat for the local BTF population and form part of the Research Program (ELA, 2017b). Initial findings from baseline monitoring are provided in **Appendix E** and **Appendix F**.

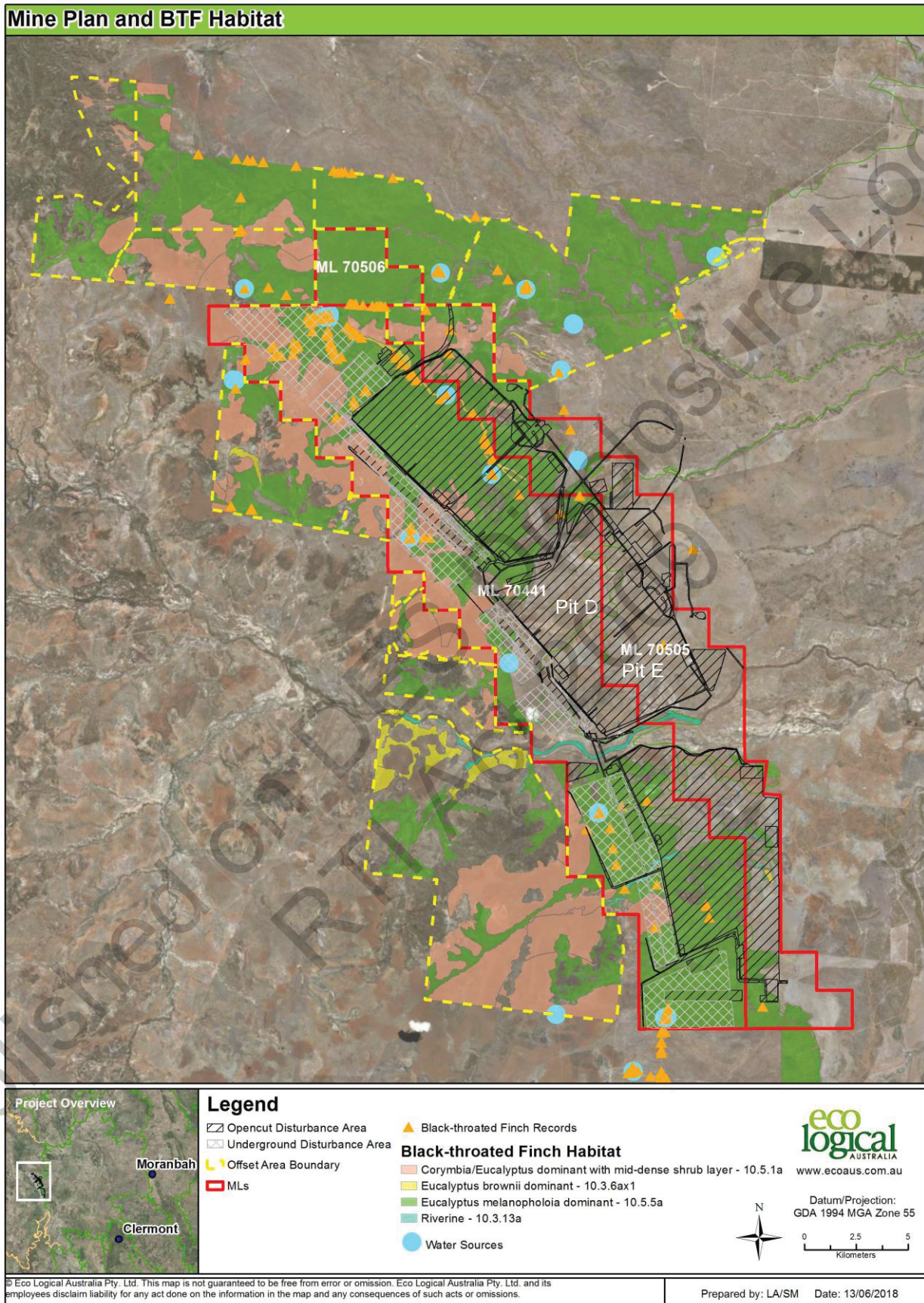


Figure 3 Black-throated Finch Habitat within the Project Area and adjacent areas (note this plan does not cover the Moran Downs West Offset Area, which is regulated by the OAMP)

4.4 Breeding ecology

BTF breeding season is from October to April, with seasonal and geographic variations (at External 2011). The timing and duration of the breeding season appears to be contingent on food resources and is therefore likely to vary annually and geographically according to rainfall patterns, temperature and land condition. Commencement of the wet season is the likely trigger for breeding.

Around Townsville, breeding tends to occur from December to May, which generally encompasses the wet season and the period of most prolific seeding of grasses (at External pers. comm.), but there is considerable variation in this timing throughout the bird's range. Breeding will continue throughout grass seeding generated by the wet season.

NRA (2005a) recorded BTFs breeding in Townsville from January to July; analysis of data contained in (at External 1996) recorded breeding in Townsville from March to May; and (at External 1970) recorded breeding on the Atherton Tableland from September to January. Although under optimal conditions the species can probably breed continuously throughout the year, the core breeding season around Townsville is believed to begin sometime after the onset of the wet season and continue until ground-stored food resources (fallen grass seed) fall below an undetermined threshold (c. February to June). Usually five or six eggs are laid at one time (at External 2011).

There is little published information regarding the timing of the breeding cycle of this species. In a study of relatively few captive individuals (at External 1976) observed the timing of the breeding cycle of this species to be 15 days for incubation, 22 days from hatching to fledging and 18 days from fledging to independence. This indicates they are 40 days old at independence. With respect to independence, (at External 2011) notes that BTF juveniles may remain with their parents for a number of months after fledging.

Nests are mostly built high in the outer branches of trees and tall shrubs, in tree-hollows, in mistletoes, and in the base of raptor nests (BTFRT 2007). However, nests have also been recorded in large shrubs within 1 m of the ground. Occasionally nests are constructed beneath active raptor nests, of species such as Wedge-tailed Eagle (*Aquila audax*), Whistling Kite (*Haliastur spheurnus*), Swamp Harrier (*Circus approximans*) and Collared Sparrowhawk (*Accipiter cirrocephalus*) (at External et al. 2006). Nests may also be built in neighbouring trees within the colony, usually less than 50 m from other nest trees (at External et al. 2006; NRA 2006) and on occasion an outlier may be up to 250 m from the main colony (at External 2007; NRA 2007).

Within the Project Area, BTF nests have been recorded in various vegetation strata and species, with an apparent preference for the tall shrub layer dominated by *Acacia sericophylla*, typically at 2 to 4 m in height. Other nests have been recorded in the canopy layer at 7 m in height. BTF nests were most commonly found in *Acacia sericophylla* (12 records), followed by *Grevillea parallela* (2 records) and *Eucalyptus melanophloia* (1 record; E2M 2018; **Appendix E**).

The minimum area of nesting habitat required to sustain a viable breeding colony is unknown (NRA 2007). Most known nesting colonies are connected to larger areas of remnant vegetation. Following observations of a single colony, it has been suggested that a minimum remnant habitat patch of 40 to 50 ha within 500 m of a nesting colony may be required for that colony to remain viable, at least in the short-term (NRA 2006; NRA 2007). Nests are typically constructed from grass stems with feathers or plant down lining (at External et al. 2006; NRA 2006), and are used for breeding and roosting (NRA 2007).

The breeding season is an opportunity for BTF populations to recover from losses sustained during the dry season / early wet season (when resource bottlenecks occur as grass seed supply is low). During the breeding season, parents first need to gain sufficient body condition to breed and, then, once the young have hatched, be in a condition in which they can forage for both themselves and their young. Activities

or events that reduce resource availability during this time may reduce reproductive success. If breeding success is unable to off-set mortality over consecutive years then population declines and, ultimately, local extinctions will occur (at Extern2011).

4.5 Carmichael population

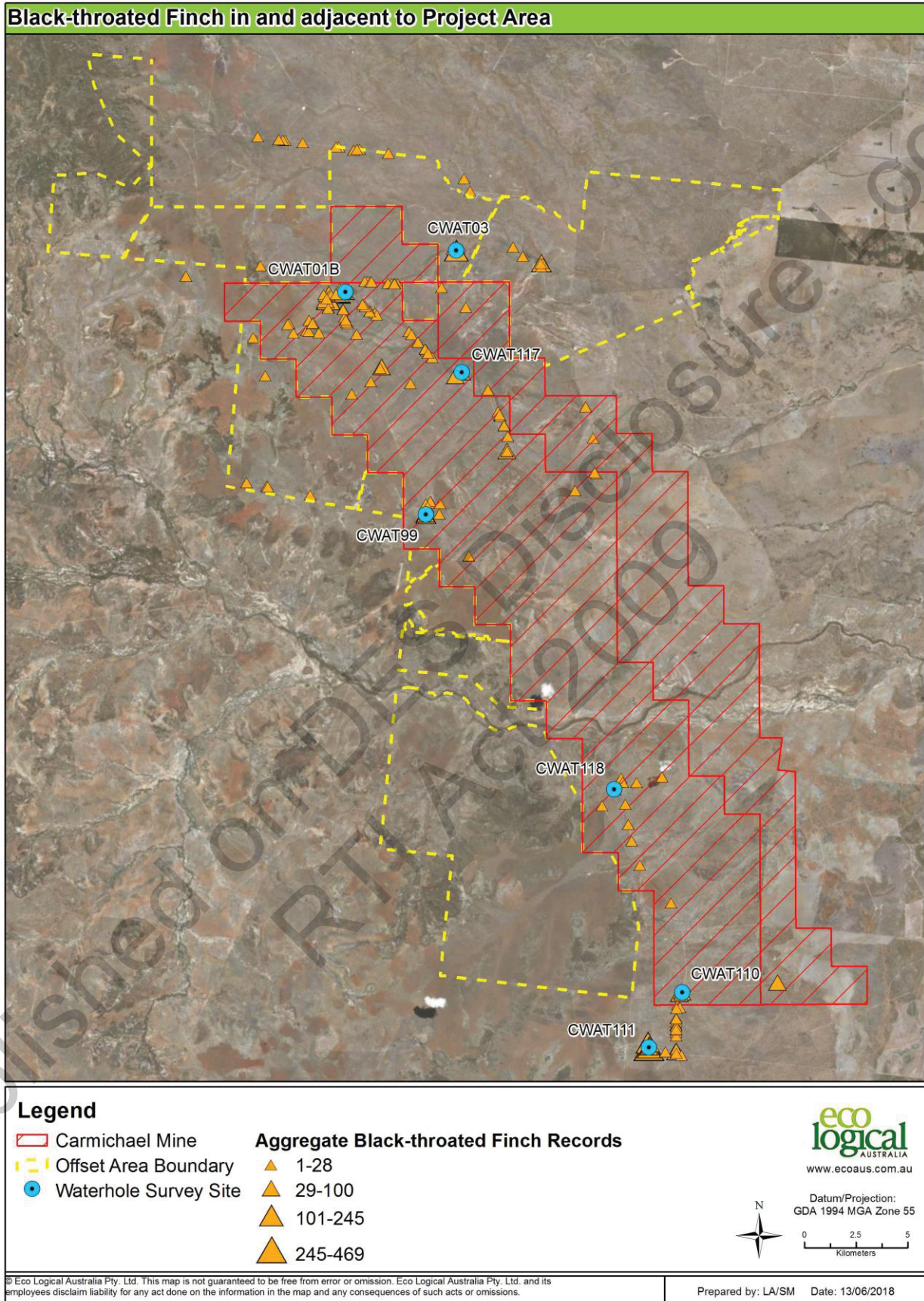
Over a period of nine years (2010 to 2018), Adani has commissioned 13 surveys and associated reports assessing the habitat preferences, ecology and population presence of BTF with the Project Area. The most recent BTF surveys undertaken within the Project Area were in March 2015 (Niche 2015a), August 2015 (Niche 2016a), April 2016 (Niche 2016a), October 2016 (ELA 2017a), November 2017 (E2M 2017) and April 2018 (E2M 2018), and have included surveys within the Moray Downs West offset area. Prior to that, surveys had focussed on the mining lease.

The methodology adopted in the most recent monitoring surveys consisted of timed fixed point water source watches; habitat searches in the immediate vicinity of the water sources (600 m radius); slow drive line transects with defined call playback stations; and opportunistic observations gathered whilst traversing the Project Area. The key findings from the monitoring surveys include:

- Aggregate BTF totals have ranged from 84 to 1,145 with an average of 480. Dry season surveys have generally yielded the largest aggregate totals (1,145, 846 and 610 in 2015, 2018 and 2016 respectively), although a wet season survey in 2015 yielded records of 600 BTF.
- Surveys to date have focused on the mining lease where the greatest aggregates have been recorded, in particular in the northern area of the mining lease and around Four Mile and Ten Mile Bores.
- The 2016 dry season survey included the greatest survey effort within the Moray Downs West offset area to date where an aggregate total of 151 BTF were recorded from 14 locations
- Monitoring surveys have identified a strong association between BTF records and vegetation communities dominated by remnant RE 10.5.5a *Eucalyptus melanophloia* open woodland on sand plains (Niche 2016a; ELA 2017a). BTF have also been recorded in four other REs (**Table 2**).
- A majority of BTF records have been identified during waterhole surveys with this survey method accounting for 37% of the aggregate total in the October 2016 dry season survey (ELA 2017a).
- Foraging BTF have been predominantly observed in woodland or open woodland dominated by *E. melanophloia* with a mean canopy height of 12 m. Areas used for foraging were characterised by sparse to mid-dense ground cover with a mean ground cover recorded of 40%. Grass species diversity at foraging sites was high with a mean grass species richness of 8. Exotic grass cover is typically less than 5 % (**Appendix E**). The species recorded are typical of grassy woodlands of the bioregion, of which the Project Area supports some high quality examples (Niche 2015a).
- Based on the data available for dry season surveys, it appears that in dry conditions records are concentrated in the central-north and central-south areas of the Project Area where large stretches of suitable habitat area are present and water sources were available at the time of survey (Niche 2016a; ELA 2017a). In particular, large numbers were recorded during the August 2015 BTF monitoring survey in the vicinity of the large dam on the Lignum property (CWAT111), the dam at CWAT03, Four Mile Bore (CWAT99), #2 Dam (CWAT117), the Turkey Nest dam at Ten Mile Bore (CWAT01B) and troughs at Lignum (CWAT110B) and Carmichael Bore (CWAT118; Niche 2016a).

- A total of 60 BTF nests have been identified during monitoring surveys to date. This includes 15 nests that were identified during the 2018 dry season survey which is the largest number to date (E2M 2018).
- A pair of BTF were observed during the 2016 dry season surveys preparing a nest within the outer-branches of a Silver-leaved Ironbark. This tree was approximately 14m in height and within remnant RE 11.5.5.a.
- Surveys have identified preferred foraging habitat to consist of a grassy understorey with a mosaic of patches of dense grass with open bare patches containing a diversity of native grasses.
- BTF have directly observed foraging on seeds of at least nine grass species as well as the woody shrub *Stylosanthes scabra* within the Project Area (GHD 2012; Niche 2016; ELA 2017a). Another two grasses have been identified as potential foraging species (GHD 2012).

BTF are most regular and most abundant in the northern third and the southern quarter of the Project Area (**Figure 4**). The area around Ten Mile Bore (CWAT01B; in the north-west of the mining lease area) appears especially favourable, possibly due to the combination of open grassy *Eucalyptus melanophloia* woodland and the water that it provides. In general, this area has a low shrub cover in the understorey. Areas north of the Carmichael Road in the far west of the Project Area (Four Mile Bore and surrounds) are also favourable, though the numbers of birds are generally lower than around Ten Mile Bore. The Four Mile Bore (CWAT99) area tends to have reasonably extensive patches of understorey shrubs, particularly just north of the Carmichael Road. In addition, large numbers of BTF have been recorded between 2015 and 2018 at a large dam and surrounding habitats on Lignum Station. The floristic composition and structure representative of the area surrounding this large dam is also consistent with the vegetation assemblages shown to support BTF foraging and nesting habitat.



4.6 Threats, potential direct / indirect project impacts

Threats and potential direct / indirect project impacts that are required to be addressed as they apply to the BTF on the Project Area are:

- threats to the BTF as identified in **Table 4** and the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007; BTF Recovery Plan)
- direct and indirect project impacts outlined in the EIS (GHD 2012a; Adani 2012)
- matters outlined in Condition 6 of the EPBC Approval (2010/5736).

EPBC Condition 6c) and EA Condition 16d) require details for all impacts and threats MNES to be included in this plan. Known threats to BTF from the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007) are listed in **Table 4**.

The potential sedentary lifestyle of the BTF may make it vulnerable to any loss, disturbance or modification to any of the three key resources of water sources, grass seeds and trees providing suitable nesting habitat (DEWHA 2009). Particularly, the synergistic effects of pastoralism, drought and fire are thought to have the greatest impact on the species by increasing the period of resource shortage and decreasing the quality and availability of breeding habitat (at External *et al.* 2011). However, some aspects of pastoralism may also benefit the species (e.g. stocking rates, fire fuel management and artificial water sources).

Other potential threats to the BTF (southern) are illegal trapping, hybridisation with escapees of the northern subspecies, resource bottlenecks associated with drought and changes in land management practices and impacts on seasonal breeding success from cyclonic activity (i.e. destruction of nests; BTF Recovery Team, DECC & NPWS 2007; DoE 2015).

Whilst there is information available helping to identify likely threats to BTF, there are still gaps in the knowledge of how these threats operate, and how they may vary in their impact in different geographical areas that the species inhabits, and how the threats interact with each other.

Impacts resulting directly from the removal of coal include initial clearing of vegetation, removal and storage of topsoil, overburden, coal, rejects and dry tailings, dewatering, and clearing and construction of haul roads. Key impacts on BTF from these activities will be the loss of suitable habitat, direct loss of birds, loss of water sources and uncontrolled fires. As required by Condition 6 of the EPBC approval (2010/5736), potential impacts including area of impact to BTF must be addressed in this plan.

Indirect impacts as a result of clearing and construction for mining and associated activities include weed spread (especially of grass species that are unpalatable to BTF and / or tend to form monocultures), change in species diversity and composition of the grass layer, potential for contamination of water sources and habitat degradation through light spill, noise and dust. Threats, potential direct and indirect project impacts to the BTF are described in detail in the following sections.

Table 4 BTF threats, potential direct / indirect project impacts and matters required to be addressed by conditions

#	Potential Threat or Impact	Threat identified in the BTF Recovery Plan	Potential direct project impact identified in SEIS	Potential indirect threat or impact identified in SEIS	EPBC Approval, condition 6	Project Phase/s	Description of threat and potential project impact	Impact addressed
1	Vegetation clearing / habitat loss, including fragmentation of key habitat areas and potential fatalities from clearing	Yes	Yes	-	(c)(i)	Construction	Section 4.6.1	Table 8
2	Habitat alteration through subsidence	-	Yes	-	-	Operations	Section 4.6.2	Table 8
3	Increased exotic pasture and weed invasion of key habitat areas	Yes	-	Yes	(c)(ix)	Construction Operations	Section 4.6.3	Table 9
4	Grazing in key habitat areas that changes the ground cover composition	Yes	-	Yes	-	Construction Operations	Section 4.6.4	Table 9
5	Wildfire or inappropriate fire management to key habitat areas that changes the ground cover composition	Yes	-	Yes	-	Construction Operations	Section 4.6.5	Table 9
6	Feral animal impacts	Yes	-	Yes	-	Construction Operations	Section 4.6.6	Table 9
7	Loss or degradation of water sources	Yes	-	Yes	(c)(ii)	Construction Operations	Section 4.6.7	Table 10
8	Mine dewatering	-	-	-	(c)(iii)	Operations	Section 4.6.8	Table 10
9	Earthworks	-	-	-	(c)(iv)	Construction	Section 4.6.9	Table 10
10	Noise and vibration	-	-	-	(c)(v)	Construction	Section 4.6.10	Table 10
11	Emissions (including dust)	-	-	-	(c)(vi)	Construction	Section 4.6.11	Table 10
12	Light spill and other visual impacts	-	-	-	(c)(vii)	Construction	Section 4.6.12	Table 10
13	Stream diversion and flood levees	-	-	-	(c)(vii)	Construction	Section 4.6.13	Table 10

Each of the threats to BTF, potential direct / indirect project impacts and matters required to be addressed by EPBC Approval, Condition 6 are described in detail in the following sections.

4.6.1 #1: Vegetation clearing / habitat loss, including fragmentation of key habitat areas

Clearing of vegetation is the primary threat that would affect the availability of breeding and foraging habitat for the BTF. Habitat loss, fragmentation and degradation are the main threats to the BTF (removed at External Review 2000; Department of the Environment 2005; BTFRT 2007).

The most probable cause of decline from the southern parts of the historic range are overgrazing and habitat clearing (removed at External Review 1999; Department of the Environment 2005). Declines have been less severe in the northern part of the subspecies range where clearing is not yet as widespread and grazing is predominately by cattle (removed at External Review 2000; BTFRT 2007).

A total of 9,492 ha of identified BTF habitat are proposed to be impacted by vegetation clearing over the life of the Project (CO2 2016). This represents 0.16 percent of the total potential habitat within the Desert Uplands and Brigalow Belt bioregions within which the Project occurs. Details of habitat disturbance across the project stages are summarised in **Table 5**, with the sum of critical, core and marginal habitat disturbance totalling 9,492 ha.

Table 5 Summary of disturbance to BTF habitat at the Mine, off lease and Rail West aspects of the project over Stage 1 and 2 (CO2 2016)

BTF Habitat type	Stage 1 (ha)	Stage 2 (ha)	Total (ha)
Very High (Critical)	4,628	3,080	7,708
High (Core)	726	288	1,014
Marginal	739	31	770
Low	344	634	978

The area of direct impact has been minimised as far as possible throughout the design and development of the mine plan. Through relocation of the out of pit stockpiles, the area of direct impact was reduced by approximately 7,000 ha. This change to the mine plan resulted in an approximately 40% reduction in the potential area of direct impact (GHD, 2013).

High quality BTF habitat within the mining lease area is considered to be located generally in the northern third and the southern quarters of the Project Area (**Figure 3** and **Figure 4**). While delivery of the Project will be a staged process, each stage covers large areas of remnant vegetation and will have effects on the behaviour and movements of the local BTF population, reducing areas of suitable habitat.

Fragmentation of woodland and grassland vegetation associated with the Project development may reduce habitat availability due to the sedentary nature of the BTF as well as causing an alteration in grass species composition or seed availability, affecting the ability of the BTF to find food throughout the seasons. Fragmentation within 5 km of water sources may also reduce habitat availability due to loss of critical resources.

Planning and development of the mine will aim to minimise vegetation clearing in areas considered to be higher value habitat and where high concentrations of BTF occur. The approach of underground mining has been adopted in areas of *Eucalyptus melanophloia* dominant vegetation communities (RE 10.5.5a) and *Eucalyptus brownii* dominant vegetation communities (RE 10.3.6ax1), where possible, to minimise impacts to habitat known to be utilised by BTF in the Project Area (**Figure 3**).

It is anticipated that approximately 20,230 ha of vegetation will be cleared within the open cut mine footprint which includes open cut mining (including pits, slopes, voids and out of sit spoil dumps) and Infrastructure Area (including water storage, tailings drying cells, diversion drains and levees), of which approximately 9,492 ha is BTF habitat. This clearing is expected to occur over a period of life of open cut pits (approximately 40 years). A mine plan and schedule has been developed for the Project. The mine schedule is broken into 13 time periods, with a mine life of approximately 50 years. Periods 1- 5 are on a yearly basis and periods 6 – 13 are based on 5 years.

As shown in **Table 1**, the area required for clearing of vegetation in the first 10 years of the project life is only approximately 56% of the total disturbance area. As the open cut pit workings proceed towards the midlife (approximately 10-15 years), the rehabilitation of spoil dump areas will commence and hence the net disturbance areas will be reduced.

Portions of the Project Area will also be cleared for storage of earthen materials such as topsoil, overburden, coal, and tailings. An area of approximately 9,200 ha will be impacted by the placement of top soil and overburden. This area extends from the north-eastern to south-eastern corner of the mine footprint, along its eastern edge, over an area approximately 32 km long by 3 km wide. This will result in some direct loss of BTF habitat, particularly in the north-eastern section of the Project Area where large groups of BTF were recorded (Niche 2015a and Niche 2015b).

The proposed mine plan in relation to BTF habitat and records is shown in **Figure 3**.

Management objectives about the threat and impacts include minimising habitat loss and fauna death during vegetation clearing, progressive habitat restoration of disturbed areas and improving awareness of BTF by site personnel. **Table 8** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.2 #2: Habitat alteration through subsidence

Habitat alteration through subsidence as a result of underground mining at Carmichael Mine has the potential to degrade BTF habitat. Subsidence can cause surface movement, cracking and hydrological changes and lead to tree slumping, root damage, vegetation stress and dieback and ultimately alter grass species diversity and composition to those that may be unpalatable to BTF (Adani 2013).

A subsidence assessment was undertaken in 2013 and describes impacts to vegetation and fauna (Adani 2013). The assessment determined:

- Surface movement due to subsidence may lead to areas of destabilisation causing vegetation slumping, tree falls, erosion and root exposure
- Localised variable impacts for mine sites may occur under native vegetation, but were difficult to predict
- Tension cracks may leave soil vulnerable to erosion, leading to damage to root systems
- Impacts to changes in hydrology include loss or changes to the flow and direction through the subsurface, and depression of the surface may lead to water ponding after rain.

The study determined that ponding duration was predicted to range from less than a day to several months. The assessment was based on a typical wet year. The study detailed the subsidence impact area for each environmental value which intersected with the total cumulative layer of subsidence. The study determined the rankings for impacts for assessment of subsidence in **Table 6**.

Table 6 Ranking of impacts for subsidence, cracking, ponding and infrastructure

Impacts	Ranking of impacts
Subsidence	High: slope change of more than 2% (>5 m) Low: slope change of less than 2% (<5 m)
Cracking	High: > 100 mm (width) Low: < 100 mm (width)
Ponding	High: duration of ponding greater than 2 days Low: duration of ponding less than 2 days
Infrastructure	High: impacted by infrastructure Low: not impacted by infrastructure

The following quantity of subsidence impacts were predicted for BTF habitat (Adani 2013):

- High impact – 163.32 hectares
- Low impact – 6,145.39 hectares
- No impact – 574 hectares.

A management objective under this plan is to minimise habitat alteration through subsidence. **Table 8** describes how the management objective will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.3 #3: Increased exotic pasture and weed invasion of key habitat areas

The main non-native grass present in the Project Area is Buffel Grass which tends to form a monoculture and is associated with a depleted diversity of grasses. This grass dominates cleared areas in the east of the Project Area but is less prevalent in the intact woodlands favoured by BTF in the Project Area. BTF are not known to eat the seeds of Buffel Grass. A monoculture of any species will not provide quality foraging habitat as it reduces the diversity of species whose seeds can collectively provide continuity of supply through the year and during different seasons. The introduced forage legume *Stylosanthes* spp., especially *S. scabra*, is also likely to be detrimental if it becomes a common component of the ground layer of the vegetation, as it has a negative impact on native plant species richness and diversity (DSITIA 2014).

The introduction and / or spread of weeds is acknowledged as a threat to BTF (BTF Recovery Team, DECC & NPWS 2007). Buffel Grass is the primary existing threat to BTF habitat degradation in the Project Area. However other weeds, such as Parthenium, Prickly Acacia and other exotic grasses that are also known from the Project Area (Adani 2015) also have the potential to degrade BTF habitat if allowed to spread through mining activities. Vehicles and machinery also have the potential to import new weeds into the Project Area, with detrimental effects on BTF habitat.

A management objective under this plan is to reduce weed competition within BTF habitat. **Table 9** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.4 #4: Grazing in key habitat areas that changes the ground cover composition

The most probable cause of BTF decline from the southern parts of the historic range are overgrazing and habitat clearing (Adani 1999; Department of the Environment 2005). Pastoralism was typically concentrated in areas containing suitable habitat for the southern BTF subspecies, such as grassy, riparian woodlands on alluvial plains (NRA 2007). Declines have been less severe in the northern part of

the subspecies range, where clearing is not yet as widespread and grazing is predominately by cattle removed at External Review (2000; BTFRT 2007).

BTF are known to persist in pastoral landscapes due to the prevalence of open eucalypt woodlands with suitable water resources and grasses (DEWHA 2009). The abundance of BTF and the viability of their populations in the landscape are influenced by the grazing regime that is in place (DEWHA 2009).

The grazing regime influences the composition and structure of the herbaceous layer of the vegetation. Long-term heavy grazing will selectively remove perennial grass species that are less tolerant of grazing removed at External Review (2011). This is likely to increase the prevalence of species such as *Aristida* spp. (Wire grasses), *Cenchrus ciliaris* (Buffel Grass) and *Bothriochloa pertusa* (Indian Bluegrass), annual grasses in general, and unpalatable weeds. Grass species richness is also likely to decrease under long-term heavy grazing.

Currently, the Project Area is being predominantly used for cattle grazing. The Project activities do not specifically include grazing, however, parts of the mining leases not being used for the construction and operation of the mine will be used for grazing. Long-term heavy grazing is likely to decrease the grass species richness and increase the prevalence of annual grasses and unpalatable weeds, and therefore decrease habitat quality for BTF removed at External Review (2011). Strategically managed grazing can 'open up' the grass layer, increasing the amount of bare ground on which BTF often forage as well as prevent thickening of a woody shrub layer. Particular cattle grazing regimes can also be used to manipulate the grass layer and manage fire by reducing fuel loads and therefore fire intensity. Grazing by cattle can be used strategically to reduce fuel loads in order to reduce the risk of hot extensive fires.

Sustainable grazing practices will be used in the Project Area as a management tool to manage threats to BTF habitat. Grazing will be used to decrease the abundance and presence of weeds, including Buffel Grass and other exotic pasture grasses, and control fuel loads so as to reduce the risk of an uncontrolled fire.

A management objective under this plan is to use strategic and sustainable grazing to manipulate the grass layer and manage fire by reducing fuel loads and therefore fire intensity. However, the objective is to also ensure grazing itself does not become a threat. **Table 9** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.5 #5: Wildfire or inappropriate fire management to key habitat areas that changes the ground cover composition

Fire is inevitable in the grassy woodlands of central Queensland and a natural component of these ecosystems. Historically, ignition sources include lightning-strike, low intensity wet season fires, or under traditional indigenous management (DEWHA 2009). Changes in the fire regimes can alter the habitat and food resource availability for the subspecies removed at External Review (1999); season-dependent diets have been documented in related finch species such as the Gouldian Finch (*Erythrura gouldiae*), Long-tailed Finch (*Poephila acuticauda*) and Masked Finch (*Poephila personata*); removed at External Review (2002).

Fire frequency can have the biggest impact on ecological function. High frequency, low intensity, patchy fire regimes can be beneficial to BTF by reducing the thickness of the shrub layer removed at External Review (2001). However, European settlement has caused a shift towards frequent, extensive and high intensity fires in the dry season resulting in large uniform areas being subject to fire removed at External Review (2015). Inappropriate fire regimes can impact on the quality of habitat for the BTF by affecting the production of seeds and the diversity of grass species impacting on food availability. Fire will generally not reduce densities of *Eucalyptus* spp., such as Silver-leaved Ironbark, though it can change canopy structure.

Alternatively, fire exclusion can also lead to thickening of woody shrubs, decreasing the quality of BTF habitat.

BTF tend to favour habitat with a sparse cover (less than 5%) of shrubs (**Appendix E**). Short-lived *Acacia* spp. or dense areas of *Carissa ovata* and / or *C. lanceolata* will suppress the grass layer and grazing, and an altered fire regime will also increase woody thickening, diminishing both the forage supply and the quality of foraging habitat (at External Review 2000; DSITIA 2014).

BTF require open patches between grass tussocks to feed on fallen grass seed. If the understorey is shrubby, the supply of grass seeds is likely to be diminished. Extensive areas of dense shrubs are likely to be detrimental to the species as the shrubs suppress grass growth and the exclusion of fire can facilitate the development of these areas (at External Review 2001). Small patches of shrubs and low trees may be used to rest and for shelter.

Fires in woodlands of the type that occur in the Project Area are fuelled principally by grass biomass rather than by woody material. Fire intensity will be greater with high fuel biomass, continuity of the fuel layer, a high degree of curing (drying) of the grassy fuel and ambient conditions, including high temperatures, low humidity and high wind speeds. Lower intensity fires will occur when fuel biomass is low and / or discontinuous, fuel moisture levels are high, ambient temperatures and wind speeds are low and atmospheric humidity is high.

Fire frequency, scale and intensity may also impact on habitat quality for BTF through numerous mechanisms. Large uncontrolled wildfires have the potential to destroy large areas of BTF habitat with consequential long recovery times. Fire frequency can also affect BTF habitat with inappropriate fire regimes impacting on the quality by affecting the production of seeds and the diversity of grass species and food availability (in the case of overly frequent fires) or by causing thickening of woody shrubs where fire is excluded from the landscape.

Management objectives under this plan are to reduce the risk of bushfire ignition, maintain a mosaic of fire history in BTF habitat and reduce the risk of bushfire spread. **Table 9** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.6 #6: Feral animal impacts

Domestic stock and rabbits can degrade habitat through grazing, trampling and altering the fuel loads (Removed at External Review). Woodland bird communities often feed in mixed flocks which is a predator vigilance and avoidance behaviour (at External Review 2012; Adani 2012). Flocks may be reduced in size when the abundance of seeding grasses is low, and as a consequence can increase predation on bird species through loss of predator vigilance when feeding (at External Review 2011).

Invasive animals are known to occur in the Brigalow Belt North and Desert Uplands bioregions. Feral cats (*Felis catus*), were recorded in the Project Area in 2010 and 2011 and are likely to prey on BTF (GHD 2012a). There are currently no data on cat presence or predation rates within Moray Downs West or the Project Area. Studies near Townsville found that nests were abandoned or became inactive when they were destroyed by predators (NRA 2005 in DoE 2016). Foraging and watering areas may also be disturbed by wallowing and uprooting of feral pigs.

Management objectives under this plan are to reduce habitat degradation from grazing by introduced herbivores, minimise predation risk by invasive mammals and use adaptive management of weed and

pest controls to minimise threats to BTF and their habitat. **Table 9** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.7 #7: Loss or degradation of water sources

BTF need to drink water on at least a daily basis and drink more frequently during the drier times of the year. The importance of water to BTF is highlighted by the fact that they typically nest and breed near water. The species is thought to undertake local movements in response to rainfall patterns, with some populations utilising seasonally (wet season) available water to access breeding grounds then contracting back to permanent water sources during the dry season (observed at External Reservoirs).

Activities that reduce the availability (location and duration) of water or detrimentally alter water quality in areas of BTF habitat may negatively impact on the species. This impact will be greatest in breeding areas and / or dry season refugia. The availability of vegetation in the immediate vicinity of the water is important, to provide shelter for perching prior to drinking, and trees through which they can travel to and from the water are important. Pressures on the availability of water will be most pronounced during periods of drought. Conversely, the creation of water sources in certain parts of the landscape may create habitat for the BTF.

Numerous occurrences of BTF drinking from water troughs were recorded within the Project Area during surveys completed in the period 2013 to 2018 (GHD 2012; Niche 2015a and 2015b, ELA 2017a, E2M 2018). Vegetation in close proximity to water sources is important as it provides shelter for birds (observed at External Reservoirs 2011). It is likely that additional anthropogenic water sources in BTF habitat will assist the species in drought conditions by providing a more reliable and permanent source of water.

Within areas to be open cut mined, existing natural and artificial surface water sources will be lost. There are six dams within the Project Area where BTF have been identified (Niche 2015a, Niche 2015b, Niche 2015c and ELA 2017a) that will be lost due mining activities (**Figure 3**). BTF have been recorded consistently utilising some of these water sources, in particular #1 Dam and #2 Dam. Removal of these permanent water sources from the Project Area will decrease the overall availability of water for the BTF across the broader landscape.

Availability of drinking water in proximity to good quality habitat is critical for BTF persistence. Contamination of potential BTF water resources surrounding the mine from sources such as hydrocarbon leaks or spills, spoil disposal, release of sediments through clearing and earthworks, or draining of low quality water from existing farm dams, could impact on the species. These impacts are unlikely to occur due to the alignment and location of mining activities and the implementation of adequate control measures. Such changes to water quality may reduce the suitability of aquatic and riparian habitats for terrestrial species.

Management objectives under this plan are to:

- ensure water quality in known BTF water sources outside disturbance footprint remain within acceptable limits
- reduce degradation of suitable water sources
- protect environmental values within waterways of the receiving environment
- minimise siltation of water resources
- maintain access to water, with no net loss of suitable permanent water sources
- reduce the risk of contamination of BTF habitat by chemicals, fuel, heavy metals

Table 10 describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.8 #8: Mine dewatering

Mine dewatering has the potential to negatively impact on groundwater-fed BTF watering sources. Drawdown may reduce the temporal and spatial availability of water by restricting or removing the base flow that persists in the Carmichael River during the dry season or increase the low flow periods as well as impacting spring wetland areas which BTF may use (ELA, 2015b). However, it should be noted that BTF have not been observed to utilise the Carmichael River (**Figure 4**).

A management objective under this plan is to manage the impacts of mine dewatering. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.9 #9: Earthworks

Earthworks carried out as a part of mine construction will lead to increased exposure to light, noise, dust, vehicles and people. Animals may also become more vulnerable to predation, because of increased light making it easier for predators to locate prey or noise levels making it harder for prey to detect approaching predators (Adani 2012).

Increased exposure to light, noise, dust, vehicles and people are dealt with in other sections. The other possible impact to BTF as a result of earthworks are the mortality and injury of individuals due to machinery strike.

Vehicles and machinery used to undertake land clearing have the potential to lead to direct mortality of fauna in the event that individuals are struck. Those animals that are unable to disperse away from areas under active clearing are also particularly susceptible to injury or death. This includes amphibians, reptiles, small ground-dwelling mammals, arboreal mammals and nocturnal species that are inactive during daylight hours.

Other potential causes of mortality include animals becoming trapped in excavations, and carrion eaters being struck when feeding on road kill. However, as the BTF are able to disperse away from areas subject to earthworks, fauna mortality and injury to individuals due to machinery strike is not expected to be a common occurrence (Adani 2012).

A management objective under this plan is to minimise the risk of light vehicle and machinery strike during earthworks and operations. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.10#10: Noise and vibration

As the Project Area is currently exposed to some disturbance as a working cattle property, the BTF that occur there exhibit a degree of disturbance tolerance. BTF are known to inhabit areas exposed to anthropogenic disturbance (peri-urban Townsville including habitat directly adjacent to military training areas and numerous towns in central Queensland).

The BTF may exhibit initial fright behaviour in response to the increased intensity of disturbance at the Project Area, and will either adapt to the disturbance levels, or move away from the areas of activity into

similar habitat that is extensively available in the adjacent landscape. Dispersal will be facilitated by active management and where possible enhancement of habitats occurring onsite (outside the mine footprint) and offsite (offset areas; Adani 2012).

The project will use standard construction equipment, general trade equipment and specialised equipment as required. Some blasting will be required to prepare overburden for removal and also coal extraction (Adani 2012).

Noise and vibration disturbance from coal transport may reduce the quality of resources for BTF, both within the Project Area and in adjacent areas. Noise from mining operations may increase BTF stress and flushing responses, change foraging behaviours, reduce reproductive success and communication at Extern (2012).

A management objective under this plan is to minimise habitat modification as a result of noise and vibration. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.11#11: Emissions (including dust)

Vegetation clearing has the potential to facilitate erosion (by water and wind). This can have a localised impact on species and habitat suitability by reducing the quality and abundance of refuges, microhabitats and food availability through the smothering of native vegetation with sediment.

Earthworks will result in dust emissions. Excessive dust settling on vegetation could also suppress vegetation growth by limiting the photosynthesis potential of plants in close proximity to the construction area (Nanos and Ilias, 2007). Plants with dust on leaves may also be less palatable as a food source for animals. Dust deposition associated with earthwork activities will generally occur relatively close to areas of disturbance and hence, plants within 50 m – 100 m of construction activities may be affected by dust. As construction activities are temporary, effects will be short lived, and rainfall will generally remove dust from plants (Adani 2012).

Dust emissions from coal transport may reduce the quality of resources for BTF, both within the Project Area and in adjacent areas. Dust may also affect plant health and palatability, particularly for native grasses within foraging habitat.

A management objective under this plan is to minimise emissions, particularly dusts. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.12#12: Light spill and other visual impacts

Development of the project will necessitate the installation of lighting for safety and security of operations as the proposed mine will operate 24 hours per day. Impacts from lighting will involve static floodlights associated with mine operations, lighting around the mine infrastructure area, workshops and ancillary buildings, vehicle lights moving around the site. Artificial night lighting levels are expected to be very low indeed, if present at all, and this is considered to be an impact of minor significance on fauna generally, including the BTF (Adani 2012).

A management objective under this plan is to minimise light spill and other visual impacts. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.13 #13: Stream diversion and flood levees

Existing hydrology will be altered as a result of the mine operations through realignment of watercourses as well as removal of some existing farm dams and cattle troughs. Diversion drains around the perimeter of the mine site as well as areas of ponding and drainage management within the subsidence area provide water sources. The provision and security of surface water in those potential habitat areas may provide additional localised access to drinking water for the subspecies.

A management objective under this plan is to reduce the impact of stream diversion and flood levees. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

5 Adaptive Management Framework

This section describes the adaptive management framework that will be applied to the management of BTF, as originally outlined in the BTF Management Plan prepared during the environmental impact assessment process (Adani 2014).

Adaptive management is a process that deals with uncertainty and incomplete knowledge by using systematic monitoring to reduce uncertainty and improve management actions over time. The monitoring program that will provide data to inform and improve the management actions in this plan are outlined in **Section 7** and **Appendix C**. In general, the monitoring framework will:

- Address key questions regarding BTF ecology and distribution. The new knowledge will be systematically reviewed and used to refine the monitoring and management of BTF in the Project Area. Improved knowledge about BTF ecology and distribution will allow understanding of the potential project impacts to be further refined.
- Employ appropriate regular review and analysis of the monitoring data to refine the monitoring program and refine management actions.

Adaptive management emphasises the iterative feedback between the implementation of management actions and the assessment of their effectiveness via continuous improvement of knowledge via monitoring and evaluation of the monitoring data (at Externet *et al.* 2012). In particular, the results of the BTF Research Program and monitoring completed under the BTF Management Plan will provide a basis for review of the management actions, and ensure that mitigation measures are appropriately targeted and based on the best available science.

The key management actions are outlined in **Section 6**. Management actions, and the monitoring that provides information for the management, will be based largely on the main themes within **Section 6**, and may be expanded as new knowledge of BTF at the Project Area becomes available. Specific management objectives, performance criteria, management actions, monitoring, triggers for adaptive management, and corrective actions have been established (see **Table 8** to **Table 10**), consistent with the framework for adaptive management outlined in **Figure 5**. The monitoring program will inform the management actions over time, which in turn will help develop more effective monitoring programs. All of these steps will allow ongoing revision and improvement of the BTF Management Plan.

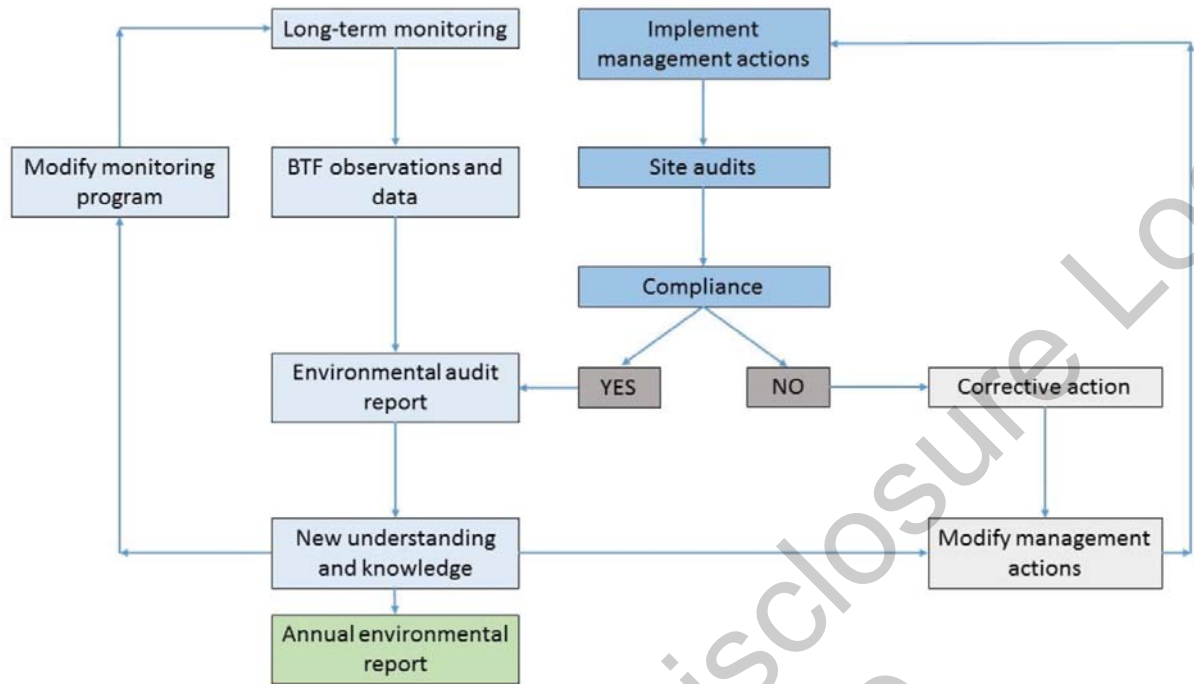


Figure 5 Adaptive management framework

6 Mitigation and Management Measures

The mitigation and management measures are required under EPBC conditions 6d) to f) and EA condition 16e) and have been developed in accordance with relevant guidance documents and best available knowledge regarding BTF ecology and habitat use within the Project Area.

An adaptive management approach will also be implemented where:

1. monitoring identifies that mitigation and management measures are not achieving the performance criteria
2. in response to triggers identified by the monitoring process and from information gathered in the field from the pre-clearance survey and fauna spotter-catchers, and
3. implementation of the BTF Research Program.

Measures intended to mitigate and / or manage the potential impacts to BTF are described in **Section 6.1**. As per EPBC Act approval condition 6j) and EA condition 16k), monitoring will be undertaken by a suitably qualified person (see **Section 9.3** for details), to determine the effectiveness of mitigation measures. This process is referred to as the adaptive management loop. The results of monitoring, and associated assessments of the effectiveness of mitigation measures, will be reported to DoE and DES.

6.1 Mitigation measures

Mitigation measures described are either those specific to BTF or for other ecological values of significance (i.e. TECs and other threatened species) of relevance to the BTF occurring in the Project Area. Generic mitigation measures are included as they provide an important approach to whole of ecosystem protection, which will also enable management of impacts to specific species, such as BTF.

Pre-clearance surveys are a collective mitigation measure proposed across this and other management plans as the surveys will provide information on the composition and area of vegetation and habitat to be disturbed prior to construction works. These surveys provide opportunities for avoidance of further impacts, as well as enabling accurate determination of disturbance areas to ensure these are not greater than approved disturbance limits.

A description of the generic mitigation measures that are applicable to the management of BTF is provided in **Table 7**.

Table 7 Generic mitigation measures to be implemented across the Project Area

Objectives	Actions
Educate site personnel and contractors about the presence and identification of threatened species, and maintain awareness during construction and operations.	Education <ul style="list-style-type: none"> • Induction program for site personnel and contractors about threatened species, their habitats and identification. • Identification posters in prominent work locations to maintain awareness. • Implement sound land management practices.
Reduce the magnitude of disturbance to threatened communities and threatened species within the Project Area where possible.	<ul style="list-style-type: none"> • There will be some discretion in the precise location of some infrastructure. Where possible, such infrastructure will be located in areas which avoid disturbance to threatened species habitat.

Objectives	Actions
Determine the environmental condition, immediately prior to construction activities. Monitor compliance with approval conditions as required by Condition 6g) of EPBC2010/5736.	Undertake pre-clearance surveys <ul style="list-style-type: none"> Conduct surveys of vegetation and threatened species habitat extent and condition, prior to the commencement of any clearing or disturbance activities. Define the area (hectares) of threatened ecological communities and threatened species habitat to be cleared.
Minimise impacts of construction on threatened communities and species.	Use licensed fauna spotter-catchers during vegetation clearing <ul style="list-style-type: none"> Fauna to be recorded and translocated to suitable habitat adjacent to the disturbance area, where practical. Fauna spotter-catchers are qualified professionals trained in competencies to handle animals, minimise capture myopathy and shock in birds and reptiles. Under the <i>Nature Conservation Act 1992</i> (Qld), fauna spotter-catchers hold permits for dispersing, removing and relocating wildlife. Fauna deaths and injuries to be recorded, and managed in accordance with relevant guidelines.
Minimise impacts on threatened communities and species, and their habitat. Promote post-construction recovery of the natural ecosystem.	Rehabilitate all temporarily disturbed areas (e.g. lay down areas and turning circles) <ul style="list-style-type: none"> All temporarily disturbed areas will be rehabilitated as soon as possible following completion of use, where such activity does not compromise the ongoing operation of the project (e.g. increase bushfire risk). The timing of rehabilitation actions after disturbance will be outlined in the Plan of Operations, developed in accordance with the EA. The ongoing program of rehabilitation works will be developed on the basis of environmental objectives, local site conditions and logistical requirements.
No net loss of threatened communities and species. Maintain the integrity of ecological habitats within the region.	Implement environmental offsets (for selected species and ecological communities) <ul style="list-style-type: none"> Offset the habitat values of threatened ecological communities and used by threatened species, within the Project Area by securing ecologically equivalent areas elsewhere. Monitor BTF habitat values through annual groundcover assessments during May to maintain and where possible enhance BTF habitat within the Mining Lease. Maintain BTF habitat values in non-mined areas
Reduce the impact of lighting on threatened species during construction and operation.	Manage light pollution <ul style="list-style-type: none"> Use directional lighting and strategic timing and placement of lights to minimise light spill into known threatened species habitat and TECs.

The results of all mitigation actions will be recorded as specified in approval condition 6g) of EPBC2010/5736. Further details of such reporting are provided in **Section 9**. A register of all commitments arising from the management planning process is provided in **Section 10**.

Tables 8 to 10 summarise the proposed mitigation and management measures specific to BTF which will be implemented during planning, pre-construction, construction, operation and decommissioning phases of the Project that address potential impacts specific to BTF. They include management actions for Ten Mile Bore, and the management of water sources. Within the approved level of disturbance, if there are management practices that can be taken to avoid, or reduce impacts to BTF and their habitat, such practices will be implemented.

6.2 Impact mitigation and management

In accordance with EPBC conditions 6d) to f) and EA condition 16e), measures will be implemented to mitigate and manage impacts to BTF during the Project.

To address the impacts to important BTF habitat in the northern section of the Project Area, Adani altered the mine plan during the EIS process to access coal reserves in this northern section via underground mining, thereby reducing the clearing requirements in this area. Where possible, associated mining infrastructure and disturbances (such as linear infrastructure, spoil and / or stockpiling) have been located in locations where there is no confirmed BTF habitat. In particular, this applies to the northern section of the Project Area where stockpiling and chemical storage will be within and / or adjoining locations where BTF have been recorded.

Mitigation measures associated with clearing will be implemented strategically in accordance with the staging of Project activities (**Section 2.2**). Prior to any clearing commencing, clearing requirements for mine and other infrastructure will be reviewed in order to identify opportunities to reduce clearing of native vegetation and utilise existing cleared areas wherever possible. Spoil and topsoil stockpiling will be avoided in areas where BTF have been recorded or within known or potential habitat, where possible.

Threatened species and vegetation mapping will be consulted prior to planning spoil pile placement to minimise the potential for impacts to BTF habitat. Rehabilitation of BTF habitat will occur in areas that are subject to temporary disturbance, and in areas that are no longer required for mining operations. Offsets are in place for areas of BTF habitat that can't be rehabilitated (see **Section 6.5**). Management activities for areas subject to offsets are described in the OAMP, and include the provision of water supplies to support BTF. At the completion of the Project, parts of the Project Area are likely to be utilised for pastoral activities, providing similar habitat values for BTF that existed prior to the Project commencing, including the provision of water for cattle grazing.

6.3 Impact minimisation measures

In accordance with EPBC conditions 6d) to f) and EA condition 16e), measures will be implemented to minimise impacts to BTF during the Project.

6.3.1 Vegetation clearing protocols

Planning phase – whole-of-project staging

The development of the Project will be a staged process throughout the life of the Project and is expected to result in impacts of up to 9,492 ha of BTF habitat (CO2 2016). In order to mitigate these impacts, the development and clearing will be staged (see **Table 1** for different Project stages causing disturbance).

Generally, clearing will commence from the middle of the Project Area which largely consists of non-remnant vegetation that does not provide habitat for BTF, before gradually progressing towards the north and south, respectively. Clearing of important habitat located in the northern third (i.e. between Four Mile Bore and Ten Mile Bore) and the southern quarter (south from Carmichael Bore) of the Project Area, will occur as late as possible during the construction and operational phases. The rationale behind this staged approach is:

- The existing breeding population of BTF within the Project Area will be protected for as long as possible, allowing for ongoing recovery and redistribution of the population;
- Clearing disturbed areas first will allow birds to remain in areas of good habitat rather than be directed into the mid-sections of the Project Area, where habitats are less favourable; and

- Staging will allow time for BTF habitat in the surrounding offset areas to improve such that birds may be attracted to these areas prior to clearing impacts occurring and / or have areas of suitable habitat to move into during construction.

Clearing will be minimised as far as practicable during the wet season, which is the known breeding season for BTF. The wet season is nominally December to March each year, and Adani will use its best endeavours to plan and implement clearing activities to occur outside the breeding season. However, the actual timing of the wet season will be determined on an annual basis depending on local weather conditions.

Management measures to achieve the clearing outcome will be through long term planning process according to the stages of mine plan that will allow these timing restrictions to be adhered to. However, if operational constraints (particularly in the early stages of the mine construction) necessitate clearing during the wet season, additional measures will be required and will be implemented during the pre-construction phase (see below).

Pre-construction phase – stage scale planning for vegetation clearing

A range of measures will be implemented prior to vegetation clearing for each stage, in order to further avoid and / or reduce impacts to BTF. Collectively, these measures are aimed at encouraging birds still present in the clearing zone to leave the area without human intervention.

A clearing plan will be developed for each stage. The development of this plan will require up-to-date information on the habitat quality and utilisation of the area by BTF. This information will be gathered during baseline and pre-clearance surveys, to be undertaken by suitably qualified ecologists, with demonstrated experience in the survey and management of BTF. Additional information gathered during the monitoring and research components of the Project must also be utilised.

The clearing plan for each stage will be developed and must consider/include:

- Mapping depicting disturbed areas, vegetated areas that are not potential BTF habitat, potential BTF habitat, areas where there have been sightings of BTF within the last five years, and areas showing breeding records.
- Structuring works in a way that specifies daily clearing extents within BTF habitats to allow BTF to fly to other habitat areas while habitat is cleared. Currently, it is conservatively assumed that BTF are able to travel at least 0.5 km in one day to escape clearing activities (BTF may travel several km in a day to access water). However these clearing limits will need to be tested as part of the on-going monitoring and adaptive management process.
- Structuring clearing so that wherever possible habitat connectivity can be maintained by providing stepping stones of habitat the BTF can travel through when escaping the clearing front.
- Site plans and maps depicting exclusion zones for vegetation clearance and machinery within areas of BTF habitat. Access to these zones must be restricted in order to prevent any unnecessary damage to BTF habitat.

Prior to the commencement of site works, any conditions listed in the “Permit to Disturb” must be implemented (e.g. clearing extents clearly marked and trees / areas requiring protection clearly marked).

Construction phase – clearing

Vegetation clearing will be undertaken in accordance with the clearing plan for each stage. All BTF habitat clearing operations will be monitored for compliance by suitably qualified fauna spotter-catchers during clearing activities (see below).

6.3.2 Fauna spotter-catcher

The use of fauna spotter-catchers prior to and during all vegetation clearing activities within BTF habitat will be implemented to ensure impacts on BTF are minimised. This role is not specific to the BTF and will be implemented in accordance with the requirements of the overarching Species Management Plan and relevant approvals to protect fauna during clearing activities. The fauna spotter-catcher will instruct contractors on the most appropriate technique for felling habitat trees to minimise harm to undetected fauna and also inspect felled vegetation for fauna and relocate individuals as required.

If clearing is to occur during the wet season (to be avoided where possible), the role of the fauna spotter-catcher with respect to the BTF is to:

- Identify active nests not picked up by the pre-clearance surveys;
- Assess whether breeding places (i.e. nests) contain eggs or young;
- Establish and implement relocation requirements.

The fauna spotter-catcher will utilise expert advice from a BTF specialist to assist in the development of fauna handling/relocation plans to ensure consideration of life-cycle or ecological constraints. In circumstances where avoidance has been assessed but impacts on an isolated nest are unavoidable during the clearing process, with relevant approval from authorities for tampering with the breeding place of a threatened species, the fauna spotter-catcher would be responsible for removing the nest and placing young / eggs into care in captivity.

6.3.3 Summary of mitigation and management measures

The threats to the BTF relevant to the Project and potential project impacts and actions minimising impacts to the BTF are summarised in **Tables 8 to 10**. The tables address the following:

- management objectives
- performance criteria
- management actions
- monitoring
- triggers for adaptive management and corrective actions
- specific, measurable and time-bound corrective actions.

Baseline and impact monitoring measures will be implemented, including control and impact sites to be monitored throughout the life of the Project. Monitoring will provide sufficient data to quantify likely impacts, already approved, resulting from mining operations to set habitat management goals.

When adaptive management and corrective actions are triggered, the first step is to investigate the cause of the trigger. The investigation will be carried out as soon as possible, but within 2 days, after the trigger is identified and will focus on the reasons and causes of the triggers, and identify appropriate corrective actions in a timely way. The investigation will be:

- Carried out in accordance with the Environmental Management System (certified ISO 14001)

- Assessing actual or potential, short and long term impacts
- Determining the root and contributing causes
- Recording details on approved templates
- Identifying appropriate corrective actions, as per the last column in **Tables 8 to 10**. Notification of relevant managing agencies and a revision to the BOS will be proposed if an increased impact cannot be avoided.

Table 8 Management objectives, performance criteria, adaptive management triggers and corrective actions – Vegetation clearing / habitat loss, including fragmentation of key habitat areas

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
Minimise habitat loss	No unnecessary clearing	<p>No-go zones for vegetation clearance and machinery will be developed for areas of BTF habitat outside of the clearing footprint and will be depicted on site plans and maps to restrict access and prevent unapproved clearing.</p> <p>Prior to the commencement of site works, any conditions listed in the "Permit to Disturb" must be implemented (e.g. clearing extents clearly marked, trees/areas requiring protection clearly marked).</p>	<p>Regular site inspections in accordance with the Environmental Management Plan and System.</p> <p>Close out report for the Permit to Disturb process includes check for compliance with:</p> <ul style="list-style-type: none"> clearing only in the approved footprint no clearing in the no-go zone/s. 	<p>Clearing in BTF habitat:</p> <ul style="list-style-type: none"> outside approved clearing footprint in no-go zone/s without a "Permit to Disturb" issued 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> When clearing outside approved clearing footprint, no go zones or without a "Permit to Disturb Permit" issued, <ul style="list-style-type: none"> Environment Manager ensure that all clearing activities cease immediately Area assessed by a suitably qualified ecologist/person within 15 business days of investigation Reviewing and modifying "Permit to Disturb" process and no-go zone identification and communication protocols Rehabilitation of the impacted area.
	Clearing of BTF habitat does not exceed 9,492 ha as approved in EIS and referral documentation	<p>Prior to the commencement of site works, any conditions listed in the "Permit to Disturb" must be implemented (e.g. clearing extents clearly marked, trees/areas requiring protection clearly marked).</p>	<p>Monitoring of vegetation proposed to be cleared by the Environmental Manager, via the Permit to Disturb process.</p> <p>Ongoing monitoring and reporting on the amount of BTF habitat that is cleared annually, and predicted to be cleared.</p>	<p>Reach 75% of the clearing BTF habitat approved area for stage 1</p>	<p>The trigger of reaching 75% of clearing BTF habitat does not require correction as the clearing is approved to be carried out, however the following actions will be triggered:</p> <ul style="list-style-type: none"> Contact with nominated representatives from compliance teams of DoE and DES under the EPBC and Environmental Protection Acts when clearing reaches 75% of approved area for stage 1 Provision of maps and data showing clearing in approved impact areas, and calculations showing quantity of approved clearing Provide advice demonstrating how the clearing will not exceed approved limits. <p>If the assessment finds that the actual area of impact differs from the area of impact as detailed in the BOS, within 30 days of this determination the BOS will be revised and submitted to the Department. If an increased offset is required by the revised BOS, this will be delivered within 12 months of the revised BOS being submitted to the Department.</p>

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
	Minimise habitat fragmentation	<p>The area of direct impact has been minimised as far as possible throughout the design and development of the mine plan. In 2012, the relocation of the out of pit stockpiles was reduced by approximately 7,000 ha. This change to the mine plan resulted in approximately 40 percent reduction in the potential area of direct impact.</p> <p>Where practical, spoil and / or stockpiling will be preferentially located in areas of previously disturbed environment or areas of future disturbance, rather than within BTF habitat. The assessment of practicality will consider issues such as the proximity and accessibility of alternative areas, safety of personnel and logistical requirements of transporting spoil.</p> <p>Manage non-mined and offset areas to maintain and improve BTF habitat values. This work will be guided by results from annual vegetation assessments, annual BTF surveys and the BTF Research Program. Ensure the pre-disturbance condition of BTF habitat adjacent to the development is maintained</p>	<p>Monitoring of vegetation proposed to be cleared by the Environmental Manager, via the Permit to Disturb process.</p> <p>Annual vegetation assessments, annual BTF surveys and the BTF Research Program.</p>	Direct impacts occur outside of approved impact areas particularly in non-mined areas.	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Impacts assessed by a suitably qualified ecologist/person within 15 business days of investigation Reviewing and modifying "Permit to Disturb" process and no-go zone identification and communication protocols Review of activities with respect to potential direct and indirect impacts outside of approved areas. Rehabilitation of the impacted area. <p>If the assessment finds that the actual area of impact differs from the area of impact as detailed in the BOS, within 30 days of this determination the BOS will be revised and submitted to the Department. If an increased offset is required by the revised BOS, this will be delivered within 12 months of the revised BOS being submitted to the Department.</p>
	Minimise the impacts of habitat alteration through subsidence	<p>Ameliorate impacts of ponding and cracking in subsidence areas to mitigate any negative impacts on BTF habitat values, in accordance with the Subsidence Management Plan.</p> <p>Subsidence is not predicted to potentially impact BTF habitat values until year 20 of mining operations.</p> <p>This plan will be updated with additional detail about control and impact sites to be monitored throughout the life of the Project, when the Subsidence Management Plan has been updated.</p> <p>Establish exclusion zones and remove cattle from underground mining footprint, when subsidence is predicted. Construct fences outside subsidence footprint to keep cattle from the subsided area.</p>	<p>Develop a numerical model based on the geological data to refine predicted cracking and subsidence impacts. Modelling to inform detailed monitoring methodologies.</p> <p>Use of baseline habitat quality for comparison during monitoring, including control monitoring points.</p> <p>Conduct annual monitoring of the condition of BTF habitat in subsidence areas, using methodologies identified in the Subsidence Management Plan.</p>	<p>Impacts to BTF habitat, including ponding and cracking, found in subsidence areas.</p> <p>Weeds found in subsidence cracking and ponding areas.</p>	<p>The appropriate corrective actions will commence within 2 days of identification of cause and may include:</p> <ul style="list-style-type: none"> Reviewing and redesigning the monitoring program, increasing monitoring events, changing monitoring methodology Rectifying impacts (e.g. pumping out ponds) Re designing and implementing and water diversions Actively control weeds to maintain and enhance BTF habitat values in the cracking and ponding areas.

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
Minimise fauna death during vegetation clearing	BTF living near the clearance zone have time to move out of the areas of disturbance without human intervention	<p>Stages will be structured in a way that limits clearing extents to allow BTF to fly to other habitat areas when habitat is cleared.</p> <p>Clearing limits are untested and will be developed based on the likely ability of the BTF to travel a conservative minimum of 0.5 km in one day to escape clearing impacts to where suitable habitat is present in adjoining areas to be retained.</p> <p>Where possible, the overall direction of sequential vegetation clearance will be away from threatening processes (i.e. mining operations/roads cleared land) to direct fauna towards areas of retained native vegetation.</p> <p>The general progress of clearance will be towards habitat to be retained in the north and/or west of the Project Area for areas north of the Carmichael River and towards habitat to be retained in the south and/or west of the Project Area for areas south of the Carmichael River.</p>	<p>Record the areas of occupancy for all BTF prior to clearing activities that occur within the Project Area, adjacent to Project Area and areas for suitable BTF habitat rehabilitation.</p> <p>Confirm and identify the spatial extent and condition of BTF habitat to be disturbed prior to any clearing or disturbance commencing, through pre-clearance surveys. BTF surveys will focus on confirming species presence throughout the Project Area, identifying species presence in proximity, but outside (adjacent to) Project Area and identifying areas of potential rehabilitation for BTF habitat values inside the Project Area, but outside the disturbance footprint.</p> <p>Record observed BTF fatality, including suspected nests / eggs of BTF.</p>	<ul style="list-style-type: none"> Insufficient adjacent habitat within 500m from clearance areas to allow refuge from impacts. Fauna spotter-catchers and monitoring results indicating that BTF are not able to move away from cleared areas in sufficient time. BTF death or injury during vegetation clearing. 	<p>The appropriate corrective actions will commence within 2 days of identification of cause and may include:</p> <ul style="list-style-type: none"> Redesign of activities associated with observed mortality to avoid causal and contributing factors Re-planning / adjusting clearing progression timeframes and locations with respect to refuge availability Third party review by suitably qualified ecologist/person of management and monitoring actions to provide input on effectiveness Modifying the strategic grazing regime, or fire management measures, to better support enhancement of values Divert clearing to other habitat to provide time for BTF to adjust Re-evaluate the suitability of the relevant management and monitoring actions in this plan The installation and maintenance of additional artificial watering points for the black-throated finch.
	No injury or death to BTF individuals, nests or their young during vegetation clearing	<p>Pre-clearance surveys will be conducted by a suitably qualified ecologist throughout BTF habitat prior to the commencement of each stage of clearing to identify and map significant areas for the BTF.</p> <p>Where active nests or other sensitive habitat areas are identified during the pre-clearing</p>	<p>Confirm and identify the spatial extent and condition of BTF habitat to be disturbed prior to any clearing or disturbance commencing, through pre-clearance surveys.</p> <p>BTF surveys will focus on confirming species presence throughout the Project Area, identifying species presence in</p>	<ul style="list-style-type: none"> Vegetation clearance undertaken without a pre-clearance survey. Clearance of vegetation does not follow vegetation clearance protocols with no progressive clearing plan developed prior to each stage of clearing. 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Depending on the extent of any injuries, injured BTFs will either immediately be taken to the nearest qualified veterinary practitioner or wildlife carer, or humanely euthanized on site by an authorised and trained person Rectifying impacts of vegetation loss Review and re design to avoid reoccurrence and address actual cause

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
		<p>surveys specific actions will be implemented to address these areas.</p> <p>Suitably qualified and experienced fauna spotter-catchers will be present during vegetation clearance works within areas of BTF habitat and remnant vegetation.</p> <p>No tampering with BTF breeding places is to occur without the relevant approvals / permits. Any removal of nests will be required to be undertaken in accordance with the requirements of approvals.</p> <p>BTF deaths and injuries will be recorded, and managed in accordance with relevant guidelines.</p> <p>Record the areas of occupancy for all BTF prior to clearing activities that occur within the Project Area, adjacent to Project Area and areas suitable for BTF habitat rehabilitation.</p>	<p>proximity, but outside (adjacent to) Project Area and identifying areas of potential rehabilitation for BTF habitat values inside the Project Area, but outside the disturbance footprint.</p> <p>After BTF habitat clearing, a search for remaining BTF will be conducted as soon as practicable.</p>	<ul style="list-style-type: none"> BTF death or injury during vegetation clearing Vegetation clearance undertaken without a qualified fauna spotter-catcher present during BTF habitat clearing 	<ul style="list-style-type: none"> Communication with personnel involved and across all site team members (for example, via toolbox meetings) Incidents will be reported to DES and DoE within 24 hours by the Environmental Manager as per Species Management Program conditions.
	No entangled BTFs	No mine-related equipment or infrastructure with the potential to entangle fauna (e.g. bundled mesh fencing) will be left in sensitive areas such as near water bodies or potential BTF foraging areas.	Regular site inspections in accordance with the Environmental Management Plan and System.	<p>Notification of BTF found entangled.</p> <p>BTF death or injury</p>	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Depending on the extent of any injuries, injured BTFs will be either taken to the nearest qualified veterinary practitioner or wildlife carer, or humanely euthanized on site by an authorised and trained person Reviewing procedures and fencing protocols Actions to avoid entanglement re occurrence Incidents will be reported to DES and DoE within 24 hours by the Environmental Manager as per Species Management Program conditions.

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
	Areas for BTF to relocate to remain available and in suitable condition concurrent with proposed clearing activities	<p>Ensure the pre-disturbance condition of BTF habitat in non-mined areas and adjacent to the development is maintained and condition of Offset Areas is being improved as per the OAMP.</p> <p>Offset Area condition adjacent to the mining leases is being improved as per the OAMP.</p>	<p>Habitat quality in non-mined BTF habitat will be monitored, including recording areas suitable for occupancy by BTF prior to clearing activity areas.</p> <p>The spatial extent and condition of BTF habitat to be disturbed will be confirmed and identified prior to any clearing or disturbance commencing, through pre-clearance surveys. BTF surveys will focus on confirming species presence throughout the Project Area, identifying species presence in proximity, but outside (adjacent to) Project Area and identifying areas of potential rehabilitation for BTF habitat values inside the Project Area, but outside the disturbance footprint.</p> <p>Deliver the Moray Downs West Offset Area Management Plan, as approved.</p> <p>The monitoring methods included in the <i>Moray Downs West Offset Area Management Plan</i> for the offset area are as follows:</p> <ul style="list-style-type: none"> method for determining monitoring locations is to apply the Guide to Determining Terrestrial Habitat Quality to calculate habitat quality scores For the species stocking rate component, the monitoring method for BTF as outlined in this plan For sites being monitored under the BTFMP within the offset area, use survey results to inform the habitat quality scoring under the OAMP (rather than duplicating survey effort at these sites). 	<p>Prior to clearing commencing, the quality of BTF habitat to which BTF displaced by clearing could be expected to relocate, is not suitable for BTF to relocate to.</p>	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Delay clearing until sufficient suitable habitat is available Review and redesign the monitoring and/or management program, increasing monitoring events, changing monitoring/management methodology Review and redesign the clearing program Assessment of the quality of BTF habitat in areas adjacent to proposed clearing (in mine site and offset areas) by a suitably qualified ecologist/person within 15 business days Review of activities with respect to potential direct and indirect impacts.
Progressive habitat restoration of disturbed areas	All temporarily disturbed areas rehabilitated within 12 months of activity	<p>The time between clearing BTF habitat, and the next construction activity will be as short as possible. However, the time between BTF habitat clearing and next activities will be a maximum of 12 months.</p> <p>All temporarily disturbed areas will be rehabilitated as soon as possible following completion of use, where such activity does not compromise the ongoing operation of the project (e.g. increase bushfire risk).</p>	<p>Regular site inspections in accordance with the Environmental Management Plan and System.</p> <p>Measure the effectiveness of mitigation measures involving rehabilitation. Compare to relevant control sites or benchmarks for RE.</p> <p>Identify areas where rehabilitation effectiveness needs to be improved to achieve environmental objectives.</p> <p>Targeted searches during monitoring events for rehabilitation areas.</p>	<p>Cleared BTF habitat area exposed for 11 months.</p> <p>Temporary disturbance areas that are no longer required not rehabilitated, leading to excessive dust or other environmental nuisance or disturbance triggers.</p>	<p>When cleared BTF habitat area exposed for 11 months, rehabilitation of the impacted area.</p> <p>The appropriate corrective actions for disturbance triggers, will be in accordance with the Environmental Management System, implemented and may include:</p> <ul style="list-style-type: none"> Review of process for temporary disturbance and monitoring to improve response time Rehabilitation activities to be undertaken in areas of temporary disturbance.

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
	Rehabilitation of disturbed areas that are no longer required for operations	<p>Progressive rehabilitation of disturbed areas will commence as soon as possible and generally within 6 months of the completion of operations activities in each area, in accordance with the Rehabilitation Management Plan. Rehabilitation will only commence later than 6 months if there will be benefits in coinciding commencement with the wet season.</p> <p>Rehabilitated areas must include food and water resources, and open foraging areas.</p>	<p>Monitoring surveys will be conducted biannually for a 10 year period by suitably qualified ecologists in accordance with standard methodology to identify changes in BTF population size and movements over time. Banding and re-sighting techniques will provide a basis for assessing movement patterns and assessment of population dynamics. Targeted searches for BTFs in each rehabilitated area.</p> <p>Monitoring measures as shown on previous page (same row of table)</p>	<p>Annual rehabilitation monitoring report determines rehabilitated areas do not achieve outcomes as specified in Environmental Authority conditions.</p>	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Delivering recommendations by a suitably qualified ecologist/expert for the reason for rehabilitation not achieving outcomes Review of weather conditions / seasons and timing of rehabilitation activities Trials of new rehabilitation methods.
	Disturbed habitat is restored or enhanced as soon as practicable (See also Performance Criterion "All temporarily disturbed areas rehabilitated within 12 months of activity")	<p>Management of habitat within the Project and offset areas will occur concurrently. The management will increase the carrying capacity of the adjoining habitat and provide refuge to BTF no longer able to utilise cleared areas.</p> <p>Rehabilitated areas must include food and water resources, and open foraging areas. A combination of short-term fast acting habitat modification activities (such as shrub layer reductions and grass layer improvements) to improve habitat qualities for BTF foraging, and longer-term activities such as weed management replanting programs to rehabilitate heavily disturbed areas over time.</p>		<p>Disturbance areas that are no longer required not rehabilitated, leading to excessive dust or other environmental nuisance or disturbance triggers. (See also Triggers for Performance Criterion for "All temporarily disturbed areas rehabilitated within 12 months of activity")</p>	<p>The appropriate corrective actions in accordance with the Environmental Management System will be implemented and may include:</p> <ul style="list-style-type: none"> Review of process for temporary disturbance and monitoring to improve response time Rehabilitation activities to be undertaken in areas of temporary disturbance.
Improve awareness of site personnel	All site personnel aware of management requirements with respect to BTF	<p>Incorporate information regarding BTF (such as map of habitat areas within the Project Area) and BTF management requirements into site inductions, toolboxes and pre-starts, particularly where working in or around BTF habitat.</p> <p>Identification posters for all threatened species with the potential to occur in the Project Area will be displayed in prominent positions.</p>	Records kept as a part of the Environmental Management System of inductions, training and toolbox meetings to ensure site personnel receive the appropriate environmental training.	Environmental harm to BTF or their habitat as a result of site personnel activities.	<p>The appropriate corrective actions in accordance with the Environmental Management System will be implemented and may include:</p> <ul style="list-style-type: none"> Depending on the extent of any injuries, injured BTFs will be either taken to the nearest qualified veterinary practitioner or wildlife carer, or humanely euthanized on site by an authorised and trained person Rectifying impacts of vegetation loss Review of induction information and implementation processes to ensure BTF management requirements are addressed and distributed to all site team members Additional educational awareness training for site personnel Incidents will be reported to DES and DoE within 24 hours by the Environmental Manager as per Species Management Program conditions.

Table 9 Management objectives, performance criteria, adaptive management triggers and corrective actions – Potential indirect project impacts

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
3	Increased exotic pasture and weed invasion of key habitat areas	Reduce weed competition	<p>No introduction of pest plants, invasive understorey species into BTF habitat.</p> <p>No significant increase in the abundance of weeds across the Project Area and into / from adjacent habitat.</p>	<p>Weed control will focus on managing declared pest plants and invasive species during construction and operations, in accordance with the project pest management plan.</p> <p>Weed hygiene controls, including the use of weed wash down stations, will be implemented in accordance with the project pest management plan to prevent the introduction and spread of declared pest plants and other invasive weeds.</p> <p>Weed free areas within sensitive BTF habitat will be identified and mapped with strict weed control requirements for entering weed free areas.</p> <p>The establishment of new tracks through BTF habitat outside of the clearing areas will be minimised to prevent transport of weed seeds into BTF management areas.</p> <p>Provide weed wash-down stations at all Project Area entry and exit points, and tracks through known weed-infested areas.</p> <p>Enforce the use of weed wash-down stations at all times.</p> <p>Adaptive management of weed controls to minimise threats to BTF and their habitat.</p>	<p>Monitoring of weeds will be conducted yearly (including photo monitoring) or as per the project pest management plan. Monitoring will be for pest plants in BTF habitat in, and adjacent to, the Project Area (consistent with the OAMP).</p> <p>Monitoring will occur at the optimal time for detecting and identifying pest plant species.</p> <p>Monitoring will include for the presence of declared weeds, and abundance of environmental weeds.</p>	<ul style="list-style-type: none"> • Introduction or establishment of declared pest plants, and invasive species into previously unaffected areas. • Results of weed monitoring indicate a degradation of BTF habitat values, due to a proliferation of weeds. • A significant increase in the abundance of weeds, or pests or identification of new infestations. • Infestation of new weed species. 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> • Eliminate potential sources or reasons that may have attributed to an increase in species richness and/or relative abundance of weeds • Amending weed hygiene restrictions • Providing additional educational awareness training for site personnel to ensure weed hygiene restrictions are adhered to • Revising weed control methods in accordance with the <i>Biosecurity Act 2014</i> • Take action to protect and restore BTF habitat values through implementation of site-specific measures such as weed control, fire management or grazing • Actively manage weeds to maintain and enhance BTF habitat values • Increasing the frequency and intensity of weed controls • Updating weed control methods in targeted weed control programs and plans.

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
4	Grazing of key habitat areas that changes the ground cover composition	Strategic use of grazing to manipulate the grass layer and manage fire by reducing fuel loads and therefore fire intensity. Do not allow grazing itself to become a threat.	Grass load is managed to reduce fire risk in accordance with controlled grazing methods. Grazing does not become an impact to grass layers and grass composition	The management of grazing within non-mined areas will be based on existing pastoral management practices under land agistment agreements, pastoral holding lease conditions and associated legislation. Management actions will seek to maintain and where possible enhance BTF habitats and populations (e.g. pest control, water source, grazing and fire management) in unmined parts of the Mine Area, as well as in offset areas.	Native perennial ground cover and ground composition assessed annually against the baseline data Monitor the condition of BTF habitat adjacent to the development and the Offsets Area. This will be undertaken using standard BioCondition monitoring surveys (see <i>Extet al. 2011</i> for details) and species habitat index. The quality of known BTF water sources will be monitored. Annual BTF habitat vegetation assessments will occur during May within 2 ha plots at the following locations: CHAB02, CHAB03, CHAB22, CHAB23, CHAB24, CHAB25, CHAB37, CHAB45, CHAB47, CHAB48, CHAB52 (Open cut disturbance areas) and CHAB01, CHAB04, CHAB05, CHAB09, CHAB10, HAB44 and CHAB46 (Underground disturbance areas). Vegetation assessments will use methodologies described within baseline 'Report for Black Throated Finch On-site Monitoring Survey' dated 12 July 2013 to assess ground cover and ground composition based on Queensland BioCondition Framework: <i>Extet al. 2011</i>) and the Queensland Herbarium flora survey methods <i>at Extet al. 2005</i>).	<ul style="list-style-type: none"> Annual vegetation assessment demonstrates a loss of native perennial species and / or cover from baseline conditions A significant increase in the abundance of non-native species such as Buffel Grass Incidence of uncontrolled bushfire 	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Additional fencing Spelling of paddocks to control grazing Additional controlled grazing to reduce biomass levels Additional pest controls Further fire management.

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
					<p>Moray Downs West Offset Area The monitoring methods included in the <i>Moray Downs West Offset Area Management Plan</i> for the offset area are as follows:</p> <ul style="list-style-type: none"> method for determining monitoring locations is to apply the Guide to Determining Terrestrial Habitat Quality to calculate habitat quality scores For the species stocking rate component, the monitoring method for BTF as outlined in this plan For sites being monitored under the BTFMP within the offset area, use survey results to inform the habitat quality scoring under the OAMP (rather than duplicating survey effort at these sites) <p>Further monitoring methods for BTF in the offset area are consistent with this plan, such as:</p> <ul style="list-style-type: none"> water source watches active searches incidental observations remote cameras vegetation condition assessments foraging plot assessments. 		

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
5	Wildfire or inappropriate fire management of key habitat areas that changes ground cover composition	Maintain a mosaic of fire history in BTF habitat. Reduce the risk of bushfire spread	No uncontrolled fires (bushfires) in the Project Area. Fire management is conducted in accordance with the Fire Management Plan	Where possible, planned burns within BTF habitat will be undertaken outside of the BTF breeding season. This will depend on seasonal conditions from year to year. The fire regime will be managed to utilise a patchwork of areas of different fire frequencies and times but biased toward low intensity fires. This regime would also help to reduce the risk of widespread hot fires by reducing fuel loading at the landscape scale. Higher intensity fires can be used strategically to reduce dense stands of <i>Acacia</i> spp., which may affect BTF foraging habitat. Two fires, approximately 2-3 years apart, could reduce the abundance of these species but it would be important to then allow several years for recovery of the community. The existing network of roads and tracks will be used to manage fire, rather than establishing additional firebreaks. This will help reduce the risk of weed incursion through movement of traffic into intact grasslands. Avoid the planning of scheduled burns in BTF habitat during the wet season where possible. Any planned burns during the breeding season that cannot be avoided will be carefully managed with respect to location relative to water sources and preferred breeding areas so as to seek opportunity to exclude these areas.	Monitoring of fuel load levels and native perennial ground cover and ground composition will be assessed at least annually against the baseline data. Additional monitoring actions as per the Fire Management Plan.	<ul style="list-style-type: none"> Unplanned burn during the breeding season. Dense shrub layers forming in BTF habitat due to fire promoted germination. Incidence of uncontrolled bushfire 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Review of fire regime based on monitoring results and aim to achieve appropriate balance of groundcover/shrub layer management without degrading foraging habitat Increasing the frequency of biomass monitoring Amending the strategic grazing regime Reviewing effectiveness of firebreaks, and establishment of additional fire breaks Modifying the timing and/or intensity of controlled burns.

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
		Reduce the risk of bushfire ignition	No bushfires sparked by project activities.	<p>Prior to site entry, all relevant site personnel, including contractors, will be made aware of fire safety and risks, including compliance with the Fire Management Plan.</p> <p>Bushfire mitigation measures will be specified in the Fire Management Plan and will include but not be limited to:</p> <ul style="list-style-type: none"> Monitoring of weather conditions to identify high fire risk days, with controls upgraded on these days Restrictions on vehicles being left idling with the exhaust in contact with dry grass Designation of smoking areas Development of bushfire fuel management practices in the Project Area Minimise the residency time of accumulated coal around coal handling facilities to reduce the risk of spontaneous combustion Ensure all crews are equipped to deal with fires. This includes both fire-fighting equipment and training Monitor pasture biomass at the beginning of the wet season Work sites will be provided with adequate fire-fighting equipment (water cart) and training implement actions to prevent and suppress the spread of fire, should bushfire be ignited. 	<p>Monitoring of fuel load levels and native perennial ground cover and ground composition will be assessed at least annually against the baseline data.</p> <p>Additional monitoring actions as per the Fire Management Plan.</p>	<ul style="list-style-type: none"> Bushfire sparked by project activities. 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Mitigate the established source, arising from the investigation, as to why and how the bushfire was sparked by project activities Review existing Fire Management Plan, ensuring consideration of ecological values and Rural Fire Service recommendations Greater monitoring of adherence to fire management measures Amending the strategic grazing regime Modifying the timing and/or intensity of controlled burns Re-training of site team members Delayed additional BTF habitat clearing Assess the benefits of strategic burning prior to the storm season to address pasture biomass that is unfavourable to BTF.
6	Feral animal impacts	<p>Reduce habitat degradation from grazing by introduced herbivores</p> <p>Minimise predation risk by invasive mammals</p> <p>Adaptive management of weed and pest controls to minimise threats to BTF and their habitat.</p>	No measured increase in rabbit, goat, fox and / or cat numbers in the Project Area.	<p>Adaptive management of pest controls to minimise threats to BTF and their habitat.</p> <p>A project pest management plan will be developed and implemented prior to construction and operations, including measures for controlling rabbits, goats, foxes, cats and weeds. The project pest management plan will be developed in conjunction with neighbouring land owners, and will focus on tracks, waterways and habitat edges.</p> <p>Feral cat control outlined in the project pest management plan will focus on areas where BTF will be exposed and vulnerable to predation including on the interface of the clearing front and remnant vegetation and at water sources where BTF are vulnerable to attack while drinking.</p>	Monitor the presence and population abundance of invasive fauna will be yearly as per the project pest management plan.	<ul style="list-style-type: none"> Significant increase in the population of any invasive predator species from baseline scores. Observed (or evidence of) predation of BTF by pest species Observed habitat degradation attributed to threatening pest species 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Increasing the frequency and intensity of pest animal control. Revising methods of pest animal control in accordance with Queensland Department of Agriculture and Fisheries (DAF) guidelines, and coordinate with neighbouring land owners to ensure a consistent approach Reviewing actions and methods included in the project pest management plan Updating pest animal control methods in targeted pest animal control programs Increase feral herbivore management efforts, in conjunction with neighbouring land owners Increase invasive predator management efforts, in conjunction with neighbouring land owners.

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
				Feral cat control, as specified in the project pest management plan will focus on areas where BTF will be exposed and vulnerable to predation including on the interface of the clearing front and remnant vegetation and at water sources where BTF are vulnerable to attack while drinking.		>Significant increase in the population of any invasive predator species from baseline scores.	
				Domestic animals will not be permitted into the Project Area, except for cattle and, when required for mustering, horses and dogs.	Regular site inspections in accordance with the Environmental Management Plan and System.	Domestic animals not permitted are observed in the Project Area	<p>The appropriate corrective actions in accordance with the Environmental Management System will be implemented and may include:</p> <ul style="list-style-type: none"> Rectifying impacts Communication with personnel involved and across all site team members (for example, via toolbox meetings) Review the project pest management plan.

Table 10 Management objectives, performance criteria, adaptive management triggers and corrective actions – Matters required to be addressed under EPBC Approval, condition 6

#	Matters under EPBC Approval, condition 6	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
7	Loss or degradation of water sources	<p>Ensure water quality in known BTF water sources outside disturbance footprint remain within acceptable limits.</p> <p>Reduce degradation of suitable water sources</p>	<p>Emissions (i.e. dust, coal and heavy metals) do not degrade water source quality in BTF habitat.</p> <p>Water sources not disturbed by other processes, such as overuse by cattle</p>	<p>Project impacts like, dust and cattle access will be minimised by the implementation of the Environment Management Plan, using standard procedures typical of large infrastructure projects.</p> <p>Maintain the required condition of water sources.</p> <p>Erosion and sediment control measures will be implemented where required, to reduce the potential for contamination of water sources prior to commencement of construction activities.</p>	<p>Annual monitoring, including photo monitoring, of water source availability, in the driest season</p> <p>Water and sediment samples will be collected in areas with the potential to be impacted by mining activities to test for the presence of heavy metals and chemical contaminants (annually during the dry season).</p>	<p>Physical evidence of dust degradation to water sources outside active mining areas.</p> <p>Water and sediment samples of water quality do not meet guideline triggers.</p>	<p>The appropriate corrective actions in accordance with the Environmental Management System will be implemented and may include:</p> <ul style="list-style-type: none"> • More frequent chemistry testing to confirm water quality against relevant standards, in the event that visual inspection of dust impacts fails • Review and re design to avoid reoccurrence and address actual cause • Review adherence to control procedures to ensure compliance • Take remedial action where compliance has not been adhered to • Communication with personnel involved and across all site team members (for example, via toolbox meetings) • Reporting to DES as per statutory and project requirements where incidents trigger reporting thresholds.
		<p>Protection of environmental values within waterways of the receiving environment.</p> <p>Minimise siltation of water resources</p>	<p>No contamination of surface waters by effluent outside the active Mining Areas</p> <p>No degradation by siltation of permanent water sources.</p>	<p>Sewage waste for the operation workforce will be treated in a package treatment plant to a Class A standard. All effluent will be recycled onsite for reuse or controlled discharge.</p> <p>Vegetation clearing near, or within ephemeral waterways will be avoided when rain is falling, or imminent.</p> <p>Management of erosion and sedimentation will be undertaken in accordance with a Project Erosion and Sediment Management Plan. This plan will identify all practices to be implemented prior to, during, and post-construction to minimise the potential for erosion to occur, including (but not limited to) timing of clearing activities, sediment and erosion control measures to be implemented, performance criteria and corrective actions.</p> <p>Implement dust control measures.</p> <p>Erosion and sediment control measures will be implemented where required, to reduce the potential for contamination of water sources prior to commencement of construction activities.</p>	<p>Monitor the efficacy of erosion control measures (at least monthly), such that measures can be constantly improved throughout life of Mine.</p> <p>Water and sediment samples will be collected in areas with the potential to be impacted by mining activities to test for the presence of heavy metals and chemical contaminants (annually during the dry season).</p>	<p>Monitoring results record exceedance and contamination of surface water.</p>	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> • Review and re design to avoid reoccurrence and address actual cause • Review adherence to control procedures to ensure compliance • Take remedial action where compliance has not been adhered to • Communication with personnel involved and across all site team members (for example, via toolbox meetings) • Reporting to DES as per statutory and project requirements where incidents trigger reporting thresholds.

#	Matters under EPBC Approval, condition 6	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
		Maintain access to water	No net loss of suitable permanent water sources.	<p>Permanent water sources in retained suitable BTF habitat in the Project Area will not be drained or lost as a result of drought unless suitable alternative water supplies (such as permanent water with gently sloping, bare ground at the edge) are available within suitable habitat within 3 km, or connected habitat outside of the ML. This includes permanent water sources in waterways and dams.</p> <p>Maintain water troughs for BTF within undisturbed areas and surface areas of underground mining footprint and repair where necessary troughs, pipes and tanks to a standard that maintains a constant source of water.</p> <p>Known water sources will be avoided, or alternative water sources established outside the disturbance footprint, if avoidance is not possible.</p>	<p>Weekly inspections of water infrastructure at Ten Mile Bore, to ensure suitable water supply available to BTF.</p> <p>Monitoring of water levels and availability across all water sources (fortnightly inspections at all sites other than Ten Mile Bore).</p>	Draining of suitable permanent water source in retained BTF habitat, without an offset water source provided.	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Review and re design to avoid reoccurrence and address actual cause Review adherence to control procedures to ensure compliance Undertake chemical testing of any water source that fails a visual inspection or increased monitoring events Take remedial action where compliance has not been adhered to; including repairs where necessary troughs, pipes and tanks to a standard that maintains a constant source of water Implement remedial actions to provide supplementary water sources, where possible.
		Reduce the risk of contamination of BTF habitat by chemicals, fuel, heavy metals etc.	No pollution of BTF habitat by contaminants (e.g. chemicals, fuel etc.).	<p>Any sites used for chemical and fuel storage will be located a safe distance away from BTF habitat, with bunding or other raised barrier, resistant to normal flood events, between chemicals and habitat.</p> <p>All vehicles and machinery will be cleaned and maintained to minimise the introduction of contaminants such as oil and fuel.</p>	<p>Design and implement a monitoring program, in accordance with the Water Management Plan. The monitoring program will target key areas with low flow, and water sources of known BTF locations.</p> <p>Water and sediment samples will be collected in areas with the potential to be impacted by mining activities to test for the presence of heavy metals and chemical contaminants (annually during the dry season).</p> <p>Erosion and sediment control measures will be implemented where required, to reduce the potential for contamination of water sources prior to commencement of construction activities.</p>	Pollution of BTF habitat by contaminants.	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Minimising and rectifying impacts Training and / or communication with personnel involved and across all site team members Reporting to DES as per statutory and project requirements where incidents trigger reporting thresholds.

#	Matters under EPBC Approval, condition 6	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
8	Mine dewatering	Manage the impacts of mine dewatering	Permanent water sources in retained suitable BTF habitat in the Project Area not drained or lost as a result of changes in hydrology, unless suitable alternative water supplies (such as permanent water with gently sloping, bare ground at the edge) are available within suitable habitat within 3 km, or connected habitat outside of the MLA. This includes permanent water sources in waterways and dams.	<p>Maintain water troughs for BTF within undisturbed areas and surface areas of underground mining footprint and repair where necessary troughs, pipes and tanks to a standard that maintains a constant source of water.</p> <p>Known water sources will be avoided, or alternative water sources established outside the disturbance footprint, if avoidance is not possible.</p> <p>Erosion and sediment control measures will be implemented where required, to reduce the potential for contamination of water sources prior to commencement of construction activities.</p>	<p>Design and implement a monitoring program, in accordance with the Water Management Plan. The monitoring program will target key areas with low flow, and water sources of known BTF locations.</p> <p>Water and sediment samples will be collected in areas with the potential to be impacted by mining activities to test for the presence of heavy metals and chemical contaminants (annually during the dry season).</p>	Draining of suitable permanent water source in retained BTF habitat, without an offset water source provided.	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Review and re design to avoid reoccurrence and address actual cause Review adherence to control procedures to ensure compliance Undertake chemical testing of any water source that fails a visual inspection or increased monitoring events Take remedial action where compliance has not been adhered to; including repairs where necessary troughs, pipes and tanks to a standard that maintains a constant source of water Implement remedial actions to provide supplementary water sources, where possible.
9	Earthworks	Minimise the risk of light vehicle and machinery strike during earthworks and operations	Vehicles only drive on designated access tracks, and the access tracks are defined in relevant overarching management plans (e.g. Environmental Management Plan).	<p>All relevant site personnel, including contractors, will be made aware of the locations of BTF populations and the potential for birds to be foraging adjacent road sides.</p> <p>Vehicles and plant will drive on pre-determined roads only, and adhere to all speed limits, which will be clearly communicated.</p>	<p>Monitoring surveys will be conducted biannually for a 10 year period by suitably qualified ecologists in accordance with standard methodology to identify changes in BTF population size and movements over time.</p> <p>Banding and re-sighting techniques will provide a basis for assessing movement patterns and assessment of population dynamics.</p> <p>Fauna spotter-catcher observations and results during the BTF habitat clearing progress will be fed into the monitoring results and adaptive management of clearing progression plans.</p>	<ul style="list-style-type: none"> Vehicles observed driving outside designated areas Light vehicle or machinery strike during other activities 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Rectifying impacts Review and re design to avoid reoccurrence and address actual cause Communication with personnel involved and across all site team members (for example, via toolbox meetings).
10	Noise and vibration	Minimise habitat modification	No abandonment of BTF nests due to noise, and vibration disturbance	Project impacts like noise, dust and lighting will be minimised by the implementation of the Environment Management Plan, using standard procedures typical of large infrastructure projects.	<p>During the breeding season the Environment Manager will monitor verified BTF nests within 1 km of active operational areas (weekly at a minimum)</p> <p>Any signs of possible abandonment will be verified by a suitably qualified ecologist, who will consider the role of noise and vibration in the abandonment.</p>	Abandonment of a BTF nest without signs of predation, which is likely to have been caused by noise and vibration.	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Assessment to establish (a) abandonment of a BTF nest was without signs of predation; and (b) determine the root and contributing causes as being likely caused by noise and vibration Review and re design to avoid reoccurrence and address actual cause Communication with personnel involved where appropriate and across all site team members (for example, via toolbox meetings).

#	Matters under EPBC Approval, condition 6	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
11	Emissions, including dust	Minimise emissions (dusts)	The photosynthetic ability of grasses in BTF habitat are not inhibited by dust emissions from the Project Area.	Regular watering of project areas in accordance with procedures under the Environmental Management Plan. Vehicles will be cleaned regularly and are not to be overloaded. Coal dust will be managed in accordance with the Environmental Management Plan	Regular site inspections in accordance with the Project Environmental Management Plan and Management System. Emissions and dust monitoring undertaken under the construction and Environmental Management Plan.	Growth of grasses in known BTF habitat in, and adjacent to, the Project Area are inhibited due to dust emissions.	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Where monitoring shows a reduction in habitat condition due to dust, mitigate source of dust Review and re design to avoid reoccurrence and reduce dust emissions impacts on habitat. Communication with personnel involved and across all site team members (for example, via toolbox meetings).
12	Light spill and other visual impacts	Minimise light spill	Light disturbance in known BTF habitat adjacent to works limited to <100 m.	Install light controlling devices to deflect lighting away from adjacent habitats. Avoid using unnecessary lighting.	Regular site inspections in accordance with the Environmental Management System.	Direct light spill >100 m into known BTF breeding habitat.	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Review and re design of light controlling devices, or adjust location of light, to reduce light spill and lighting levels below trigger levels Communication with personnel involved and across all site team members (for example, via toolbox meetings).
13	Stream diversion and flood levees	Reduce the impact of stream diversion and flood levees	All suitable permanent water sources are maintained.	As per the management actions included in items 9 to 12.	Annual monitoring, including photo monitoring, of water source availability, in the driest season	Draining of suitable permanent water source in retained BTF habitat, without an offset water source provided.	The appropriate corrective actions in accordance with the Environmental Management System will be implemented and may include: <ul style="list-style-type: none"> Review and re design to avoid reoccurrence and address actual cause Review adherence to control procedures to ensure compliance Take remedial action where compliance has not been adhered to; including repairs where necessary troughs, pipes and tanks to a standard that maintains a constant source of water Implement remedial actions to provide supplementary water sources, where possible.

6.4 Habitat management measures

In accordance with EPBC conditions 6d) to f) and EA condition 16e), measures will be implemented to manage BTF habitat to prevent further decline and, in the case of the offsets area, improve the condition. These management actions are also required to address potential Project impacts identified in EPBC condition 6c).

Managing BTF habitat requires management of three broad elements: the woody layer of the vegetation, the herbaceous layer of the vegetation and water sources. Grazing and fire are important drivers of the composition and structure of both woody and ground layers of the vegetation and managing grazing and fire is important for the maintenance and management of habitat quality for the BTF (at External 2011). While useful tools, these factors cannot be used to shift from one vegetation community to another as the vegetation community that occupies a particular location is largely driven by soil type and rainfall regime. Management measures are described below in relation to the threats outlined in **Section 4**.

6.4.1 Grazing management

Grazing will be used in the Project Area as a management tool to manage threats to BTF habitat. Grazing will be used to decrease the abundance and presence of weeds, including Buffel Grass and other exotic pasture grasses, and control fuel loads so as to reduce the risk of an uncontrolled fire.

The management of grazing within non-mined areas will be based on existing pastoral management practices under land agistment agreements, pastoral holding lease conditions and associated legislation. Sustainable grazing guides such as the 'Sustainable management of the Burdekin grazing lands' (at External 2012) will also guide the management of grazing activities. The following actions will be delivered under the legislation, agreements and conditions:

- Adani will complete annual BTF habitat vegetation assessments at approved monitoring locations during May to maintain and where possible enhance BTF habitat
- The baseline groundcover and native perennial species composition at 23 established baseline monitoring sites are included in Appendix F. Baseline characteristics are:
 - o 34% cover native perennial grass cover (minimum). Baseline standard deviation is 12.1%
 - o 27% bare ground
 - o four native grass species per site (minimum)
 - o 2.4% native perennial forb cover
 - o 1.8% native annual grass and forbs
- Vegetation assessments will use methodologies described within the 'Carmichael Coal Mine and Rail SEIS Report for Black-throated finch On-site Monitoring Survey 2' dated February 2014 to assess native perennial groundcover and ground composition based on Queensland BioCondition Framework (at External *et al.* 2011) and the Queensland Herbarium flora survey methods (at External *et al.* 2005)
- Groundcover and species composition will be assessed annually against the baseline data (established in 2012/13) from when this Management Plan commences (each May)
- If the annual vegetation assessment demonstrates a loss of native perennial species and cover from baseline conditions, an investigative review will be completed and relevant corrective management actions will be taken to ensure the maintenance or enhance of these perennial pasture species
- Corrective actions may include additional fencing or spelling of paddocks to control grazing, controlled grazing to maintain biomass levels, pest control (e.g. rabbits, weed eradication) and fire management.

Since BTF have been shown to access a range of artificial water sources, including drinking at troughs visited by cattle, it would not be necessary to restrict cattle from existing troughs or watering points. However, in accordance with EA Condition I8, water troughs for BTF must be maintained within undisturbed areas and surface areas of the underground mining footprint. Also, the condition includes a requirement to repair, where necessary, troughs, pipes and tanks to a standard that maintains a constant source of water. The retention or provision of some trees / shrubs within a suitable distance to water may increase utilisation of water sources, by providing shelter for birds if they are disturbed by the arrival of large groups of cattle, allowing them to return to drink when the cattle depart.

6.4.2 Fire management

Fire and grazing can be considered competitors of one another for the available grass fuel / forage. In considering the use of cattle grazing to manipulate the grass fuel load and distribution it is also important to address other aspects of the herbaceous layer that will be affected by grazing, namely species composition and seed production. Breeding of BTF must be monitored in terms of location and timing so that breeding locations are not burnt when birds are nesting (constructing breeding nests, incubating and feeding nestlings).

Given the uncertainty around and complexity of the relationship between fire and habitat quality, it is important that all parts of a landscape being managed for BTF are not subject to the same fire regime. In general, the overall fire regime of the Project Area will aim to be one of periodic, small scale, low intensity fires being used to target areas that are developing a shrubby understorey. However, the outcomes of the BTF Research Program will also study the relationship between fire and habitat quality. The outcomes of that research will inform fire management in the Project Area and this plan, once finalised.

Low intensity fires will temporarily open up the grass layer but generally are not known to kill tussocks. These types of fires will create foraging patches by improving accessibility to the grass seed that is present. Burning should not be carried out too soon after seed set, though BTF may forage on recently burnt land (ed at External 016).

Fire will reduce the density of the shrub layer by killing obligate seeders and removing stems from re-sprouting species. Fire may also promote the germination of obligate seeders and other species, particularly *Acacia* spp. Currently there are areas of the Project Area that have dense stands of short-lived *Acacia* spp. as a result of fire-stimulated germination. BTF tend to avoid extensive areas of woodlands with a dense shrubby understorey, though they do use patches of shrubs or smaller trees for resting and shelter (at Extern 2011). Dense shrubby understoreys also tend to have fewer grasses and so are less productive in terms of the seeds upon which BTF forage.

Dense stands of these species can be reduced by fire frequencies shorter than the time between germination and seed production. Some of these species probably produce seeds within 3 to 4 years of germination (e.g. *Acacia holosericea*).

The existing network of roads and tracks will be used to manage fire, rather than establishing additional firebreaks. This will help reduce the risk of weed incursion through movement of traffic into intact understorey. The numerous existing tracks that were created during mine exploration and development, especially in the northern sector of the Project Area, provide firebreaks that can help ensure that prescribed fires are not extensive. The value of maintaining these tracks as firebreaks needs to be weighed up against the value of minimising the risk they present in terms of weed incursion and as useful foraging habitat. It is worth noting that BTF often forage on or in close proximity to tracks and other surfaces with low cover. The usefulness of these bare areas for foraging is dependent upon there being

seed production in their immediate vicinity, so extensive bare areas are not valuable to BTF (Rechetelo 2016).

6.4.3 Pests

Weed management is addressed in a project specific Pest Management Plan (Adani 2015), which covers weeds and feral animals (pests). The Pest Management Plan has an overarching strategy, as follows:

- Identification of current and potential pest animals and plants for the area, and current locations of populations of pest animals and plants
- Avoidance of travel through or establishing infrastructure in areas of known pest plant infestation
- Prevention of the introduction of new weed and pest animal species to the area
- Minimisation of the increase in distribution and abundance of currently present pest plants or animals
- Control of identified weeds and pest animals to contain, reduce or eradicate pest populations.

Actions associated with weed management align with this strategy. Weed management issues specific to BTF are the control of introduced grasses and other herbs that have a tendency to dominate the herbaceous vegetation and affect the seeding of grass species on which BTF rely. Incursions of weeds into new areas will be prevented. Existing weeds, including non-native grasses, will be managed, with the intent of reducing further incursion (Adani 2015).

Non-native plant species that are considered potentially detrimental to BTF habitat include Buffel Grass, Indian Couch, *Stylosanthes scabra*, *Parthenium hysterophorus* (Parthenium) and other high biomass non-native grasses. Native understorey shrubs such as *Carissa ovata* and *C. lanceolata* can also be detrimental as they may increase in association with heavy grazing and little burning. Some of the short-lived *Acacia* spp. would be detrimental to BTF if they form extensive thickets.

Non-native invasive shrubs such as *Vachellia nilotica* (Prickly Acacia), *Ziziphus mauritiana* (Chinese Apple), *Jatropha gossypifolia* (Bellyache Bush), *Stylosanthes humilis* and *Lantana camara* (Lantana), while not currently prevalent in the Project Area, will be prevented from establishing.

The risk of further incursions by high biomass grasses will be minimised by effective hygiene measures that include minimising traffic into BTF habitat, use of wash down facilities for vehicles, control of new infestations, avoiding movement of soil potentially bearing weed seeds or other propagules and minimising soil disturbance. The species of greatest concern is Buffel Grass. However *Themeda quadrivalvis*, *Hypharrhenia* spp. and Indian Couch are also a concern, though they are not currently common in the Project Area. Indian Couch is present but the health of the native perennials is probably sufficient to prevent it taking over.

The landscaping plan and rehabilitation plans for the Project will use native species where possible. No invasive species will be used in landscaping.

Habitat management measures for feral cats and feral pigs are provided in **Sections 6.4.5** and **6.4.6** respectively.

6.4.4 Water supply

Water bodies known or considered likely to be used by BTF, in as yet unmined and underground mining areas, must be identified to alert to their environmental significance. Controls to prevent contaminated

run-off or fuel / chemical spills will be implemented to protect water quality for these sources. Controls to manage the protection of BTF water sources include the following:

- Storage of fuels and chemicals must be bunded to 110% the capacity of the storage facility. Storage areas must be at least 300 m from known watering points, waterbodies and waterways.
- Effective erosion and sediment controls must be installed around all topsoil and spoil piles, unless a native cover has been established which prevents run-off of materials.

Current water sources outside of the clearing footprint are to be maintained. Where it is necessary to remove a particular water source within or nearby to BTF habitat, a new water source will be created. These can be relatively small, have intact woodland in their immediate vicinity and have a few trees and / or shrubs close to their margins for BTF to perch on. It is also important to have canopied trees (especially Eucalypts) in which the birds can rest while travelling to and from the water source. Construction of BTF water sources to provide alternative watering points will be undertaken in conjunction with construction of water storage dams early in the mine implementation program.

In order to ensure that the watering points in the Moray Downs West offset area do not interfere with research but also provide water for finches, the following actions will be delivered:

- maintenance of the existing seven water points in the Moray Downs West offset area, as per the Moray Downs West Offset Area Management Plan
- new artificial water sources will be installed in locations within the Moray Downs West offset area in accordance with this research program
- assessment of BTF responses to new water sources and their effectiveness
- results used to inform specific requirements and location of permanent artificial watering points
- permanent artificial watering points will be installed and adequately maintained within the Moray Downs West offset management area within the sooner of one year after the completion of the three-year Research Program, or five years after the commencement of mining operations.

6.4.5 Feral cats

Feral cats are considered one of the threats to local populations of BTF. Ongoing feral cat control will be carried out as it would benefit many other native species in addition to BTF, including the threatened Squatter Pigeon. Feral cat control will be carried out in accordance with the Pest Management Plan for the Project. The key areas to be targeted for feral cat control to protect the BTF are those where birds are likely to be exposed and vulnerable to predation including on the interface of the clearing front and remnant vegetation and at water sources where BTF are vulnerable to attack whilst drinking.

6.4.6 Feral pigs

Feral pigs have the potential to damage BTF habitat and are therefore a threat to the species. Damage to BTF habitat is caused by disturbance of the soil while feeding, trampling of habitat, tusking or rubbing trees and the consumption of plants and soil organisms. Feral pig control will be carried out in accordance with the Pest Management Plan for the Project. Targeted site monitoring for pigs will focus on water courses and BTF feeding areas, where greatest impacts to BTF habitat are likely to occur. Humane pest control measures will be implemented to reduce pig numbers.

6.4.7 Management of Ten Mile Bore

Condition I9b of the EA states that the BTF Research Program must establish management actions to maintain the current BTF population of Ten Mile Bore and surrounds. Management of BTF habitat in the vicinity of Ten Mile Bore will therefore be informed by the findings of the BTF Research Program (**Appendix C**). Until such time as findings of the Research Program are available (3 to 5 years from

approval of the plan), existing management activities at Ten Mile Bore will continue to be implemented, to maintain the BTF population of the area. These interim management measures include:

- Avoiding mining-related disturbance of the area until as late as possible (see **Section 6.3.1**)
- Maintaining water for BTF, to be monitored through weekly water infrastructure inspections
- Managing grazing activities in the vicinity of Ten Mile Bore to enhance and maintain BTF habitat values

6.4.8 Summary of mitigation and management measures

The mitigation and management measures to be implemented for the Project to minimise impacts to BTF for activities other than clearing are summarised in **Table 9** and **Table 10**. These are relevant across all project stages and will be implemented prior to commencement of Project Stage 2 activities as defined by the Carmichael Coal Mine Environmental Authority. Regular monitoring across the site will identify any deterioration in BTF habitat values and trigger a site-specific corrective action. Such a response may involve the control of weeds, implementation of fire management actions or changes to grazing practices, to improve and restore BTF habitat values.

Mitigation of impacts on BTF and its habitat will in part be achieved through implementation of other plans including the CEMP and OEMP. These plans are regularly updated based on site conditions, the results of on-site monitoring and progression of project tasks. A summary of key elements of environmental management, as outlined in the project EIS, is provided in **Appendix A**.

6.5 Offsets

Conditions of approval for the Carmichael Coal Mine and Rail Project under the EPBC Act and within the Coordinator-General report require Adani to address offset requirements for significant residual impacts on MNES and Matters of State Environmental Significance. The approach to be taken by Adani to achieve the required offsets is outlined in the approved BOS (C02 2016) under Condition 8 of EPBC Act approval 2010/5736. Offsets will be delivered in stages, with Stage 1 offsets to be delivered through implementation of an offset area management plan.

A key mechanism for achieving offsets for BTF is management of the Moray Downs West offset area, which includes extensive areas of BTF habitat. The Moray Downs West offset area will be managed under the approved *Offset Area Management Plan: Moray Downs West*, (CO2 2017) including regular assessment to identify any future management and monitoring requirements until offset management objectives are achieved. The area provides an offset for the expected loss of BTF habitat from Stage 1 of the Project including potential impacts from subsidence caused by underground mining.

In the event that additional impacts are proposed, or occur unexpectedly, additional offsets will be provided, subject to approval from Commonwealth and State governments. This would include circumstances where the corrective management measures have not achieved the goals within specified timeframes, and resulted in impacts beyond those that were originally approved. Likewise, if Adani is able to minimise its disturbance of BTF habitat to a smaller area than approved, a corresponding reduction in offsets will be sought from the Commonwealth and State Governments.

7 Monitoring and Research Programs

The management of the BTF population will be supported by targeted monitoring and research that will be undertaken for the Project. The results of monitoring and research will feed back into the management measures to guide adaptive management. The ongoing monitoring will be focussed on describing spatial and temporal patterns of occurrence while the research will focus on explaining spatial and temporal patterns and ecological relationships.

A BTF Research Program has been developed concurrently and provides a program for addressing specific scientific questions about BTF and its habitat (**Appendix C**). The Research Program details the objectives and methodologies to explain and predict patterns and processes relating to the distribution and abundance of BTF in the Project Area. This research will inform future management and monitoring of the BTF population within the Project Area.

7.1 Monitoring program

As required by Condition 6(b) of the EPBC Act approval, a monitoring program will be implemented upon approval of the management plan to inform assessments of the effectiveness of mitigation measures. The level of disturbance of Project activities on BTF habitat will also be measured and the success of rehabilitation activities evaluated. As committed during the EIS process, Adani will collaborate with research institutions for aspects of the monitoring program, where such an approach would add value (e.g. identification of remnant vegetation changes resulting from subsidence).

The proposed monitoring regime will be used to provide feedback on the effectiveness of mitigation measures and to evaluate the success of rehabilitation activities. Monitoring of the BTF has already commenced as part of the baseline research program for the Project and ongoing monitoring programs locally. Initial monitoring will continue for a period of 10 years as required in the conditions of the Environmental Authority. A major review of the monitoring results will be completed at this time (after 10 years). This will result in the development of a long-term monitoring method that will be implemented for the life of the project. This will ensure compliance with EPBC Act approval conditions, which require monitoring for the life of the Project.

As with mitigation measures, some monitoring activities will be generic and broadly applicable across multiple ecological values, including BTF. Other monitoring activities will be species-specific and tailored to measure the effectiveness of mitigation measures at reducing the impacts of the Project on BTF. The design of specific monitoring tasks will be tailored to the variables being measured, and have sufficient replication to provide statistical power to detect significant change. Indicative monitoring sites have been chosen and the location of these will be confirmed through on site investigations during pre-clearance surveys.

Monitoring measures to be implemented across the Project Area are detailed in **Tables 8 to 10**. **Table 11** provides an overview of monitoring measures.

Table 11 Summary of monitoring measures to be implemented across the Project Area

Monitoring	Description
Pre-clearance surveys	Confirm and identify the spatial extent and condition of BTF habitat to be disturbed prior to any clearing or disturbance commencing, through pre-clearance surveys. BTF surveys will focus on confirming species presence throughout the Project Area, identifying species presence in proximity, but outside (adjacent to) Project Area and

Monitoring	Description
	identifying areas of potential rehabilitation for BTF habitat values inside the Project Area, but outside the disturbance footprint.
Clearing	Monitoring surveys to be conducted biannually for a 10 year period by suitably qualified ecologists in accordance with standard methodology to identify changes in BTF population size and movements over time. Banding and re-sighting techniques will provide a basis for assessing movement patterns and assessment of population dynamics.
Condition	<p>Monitor the condition of BTF habitat adjacent to the development and the Offsets Area. This will be undertaken using standard BioCondition monitoring surveys (see Eyre <i>et al.</i> 2011 for details) and species habitat index.</p> <p>The quality of known BTF water sources will be monitored.</p> <p>Additionally, annual BTF habitat vegetation assessments will occur during May within 2 ha plots at the following locations: CHAB02, CHAB03, CHAB22, CHAB23, CHAB24, CHAB25, CHAB37, CHAB45, CHAB47, CHAB48, CHAB52 (Open cut disturbance areas) and CHAB01, CHAB04, CHAB05, CHAB09, CHAB10, CHAB44 and CHAB46 (Underground disturbance areas).</p> <p>Vegetation assessments will use methodologies described within baseline 'Report for Black Throated Finch On-site Monitoring Survey' dated 12 July 2013 to assess ground cover and ground composition based on Queensland BioCondition Framework at Exter <i>et al.</i> 2011) and the Queensland Herbarium flora survey methods at Externa <i>et al.</i> 2005).</p> <p>Moray Downs West Offset Area</p> <p>The monitoring methods included in the <i>Moray Downs West Offset Area Management Plan</i> for the offset area are as follows:</p> <ul style="list-style-type: none"> • method for determining monitoring locations is to apply the Guide to Determining Terrestrial Habitat Quality to calculate habitat quality scores • For the species stocking rate component, the monitoring method for BTF as outlined in this plan • For sites being monitored under the BTFMP within the offset area, use survey results to inform the habitat quality scoring under the OAMP (rather than duplicating survey effort at these sites) <p>Further monitoring methods for BTF in the offset area are consistent with this plan, such as:</p> <ul style="list-style-type: none"> • water source watches • active searches • incidental observations • remote cameras • vegetation condition assessments • foraging plot assessments.
Weeds	Monitor the presence of declared weeds, and abundance of environmental weeds.
Pests	Monitor the presence and population abundance of invasive fauna.
Vegetation rehabilitation areas	Monitor the effectiveness of rehabilitation activities through BioCondition or similar assessment methods.
Water quality	Measure the effectiveness of rehabilitation activities, by monitoring water quality in accordance with the EMP.
Offset areas	Measure the effectiveness of offset management, by monitoring the quality of offset areas in accordance with the OAMP.
Fauna mortality and injuries	Record BTF fatality, including suspected nests / eggs of BTF.
Dust	Monitor dust within and adjacent to construction activities in accordance with the EMP.
Fire	Monitor incidence and extent of Project related fire, and determine impacts through BioCondition assessments.

7.1.1 Survey timing and frequency

Seasonal surveys will be undertaken biannually for a period of at least 10 years in order to satisfy relevant approval requirements and provide useful feedback into the management plan. Surveys will be undertaken to coincide with the end of the dry season (approximately late October) and the latter part of the breeding season (March to April). A major review of the monitoring results will be completed after 10 years. This will result in the development of a long-term monitoring method that will be implemented for the life of the project.

Surveys will occur across all areas of known BTF habitat in the Project Area and adjacent to the Project Area, as well as all areas established for rehabilitation and offsets for BTF. The purpose of the surveys will be to document changes in distribution and abundance of BTF in the Project Area, relate that to habitat condition, quantify use of offset areas and provide feedback for adaptive management.

7.1.2 Survey methodology

The survey methodology for ongoing monitoring is based on the results and recommendations arising from baseline monitoring surveys undertaken to date and the specifications of Commonwealth and State approval conditions (e.g. Condition I6 of the EA). The monitoring methodology is to transition from a methodology aimed at gathering presence / absence data alone, to one gathering data that will better explain BTF movements across the landscape as well as identify any trends in populations and monitor the effectiveness of management actions.

The methodology for BTF monitoring will include the following:

- Water source watches
- Call play-back
- Identification of all birds present when BTF are encountered
- Active searches
- Opportunistic incidental observations gathered whilst traversing the Project Area
- Surveillance cameras
- Monitoring of subsidence areas
- Monitoring of pasture biomass
- Vegetation transects and plots.
- Annual monitoring of 2 ha groundcover plots

Indicative monitoring sites are shown in **Appendix B**. These sites will be reviewed following approval of the management plan, with additional vegetation sites included in the offset areas and subsidence areas. These additional sites will provide representation of critical BTF habitat, core BTF habitat and marginal BTF habitat. Input from the research team appointed to implement the BTF Research Program will be sought on the location of additional monitoring sites. The sites include areas outside of the disturbance footprint (control sites) and areas that will be subject to disturbance in the future (impact sites).

In the case of some monitoring methods, such as fixed point waterhole surveys, the exact location of these are known. However for some survey types, the placement of the permanent monitoring sites will be finalised during the implementation of the monitoring program. The BTF Management Plan will be subsequently updated to include the final locations of monitoring sites.

7.1.2.1 Water source watches

Water source watches are one of the primary survey methods recommended in the Significant Impact Guidelines for the Endangered Black-throated Finch (southern; *Poephila cincta cincta*; DEWHA, 2009a;

the Guidelines). They have also been the most successful survey technique in recording BTF across the Project Area in most surveys undertaken to date.

Fixed point water source watches will be conducted for six continuous hours commencing from dawn at up to 16 water sources where BTF have been previously recorded (**Table 12** and **Appendix B**). Note that some of the sites have been found to be unsuitable for monitoring at times in the past, due to an absence of water. As water sources are removed as a result of mining activities, monitoring at these locations will cease. New water sources will be substituted for monitoring, particularly in the offset areas.

Where BTF are observed during waterhole watches, the following information will be collected:

- Time of observation
- Number of individuals
- Other species present in mixed flocks
- Behaviour (e.g. foraging, drinking, perching, flying, etc).

Table 12 Water source monitoring sites (those sites marked # have been found to have little to no water during monitoring over the past three years)

Site ID	Site Common Name
CWAT01a	Ten mile bore dam (lower)
CWAT01b	Ten mile bore turkey nest
CWAT01c	Ten mile bore dam
CWAT02	16 mile tank dam
CWAT03	Ten mile tank dam
CWAT07	Number 1 dam
CWAT99	Four mile bore
CWAT101 #	Beenboona hole
CWAT104 #	Unnamed waterhole
CWAT105 #	Rocky Dam
CWAT110	Lignum yards dam / trough
CWAT111	Lignum large dam
CWAT116 #	New Laguna dam
CWAT117	Number 2 dam
CWAT118	Carmichael bore tank and troughs
CWAT120	Dingo dam

Characteristics of the water sources that BTF are observed utilising will also be noted in order to build on the existing understanding of use and utilisation of water sources. Any seasonal or longer term changes that may influence suitability for BTF will also be determined. The following information will be documented:

- Approximate size of water source
- Slope of bank
- Surrounding vegetation

- Water retention dynamics (permanent vs seasonal).

7.1.2.2 Active searches

Active searches are to be conducted within suitable habitat to collect BTF population data and search for nests (**Appendix B**). In particular these surveys will focus on areas that are known to be good quality habitat for BTF as well as areas of habitat within the offset area.

Active searches will include random meanders within 1 km of each water point monitoring site for at least three hours with specific effort devoted to areas with grassy open-woodland habitat. 1 km transects will also be undertaken during active searches.

Information collected during active searches will include:

- Location and quantity of BTF
- Behaviour (e.g. foraging, drinking, perching, flying, etc)
- Regional Ecosystem (RE) type and condition
- Presence / absence of mixed-flocks and associated species
- BTF nests (including photographic evidence and GPS location)
- Characteristics of BTF nest including host tree or shrub species, height of nest, active or inactive
- Groundcover measurements of perennial grass cover, non-native grass cover, litter, bare ground and ground cover composition.

Wherever possible, the active search information collection methods will be similar to previous annual BTF vegetation assessments, in order to increase the data comparison value.

7.1.2.3 Slow-drive transects

Slow-drive transects have been undertaken throughout BTF habitat during some previous monitoring surveys. The technique involves using a vehicle driving at a maximum speed of 20 km/hr along a 3 km predefined transect (**Appendix B**). Where BTF were observed, the following information was collected:

- Location and quantity of BTF
- Behaviour (e.g. foraging, drinking, perching, flying, etc)
- Regional Ecosystem (RE) type and condition
- Presence / absence of mixed-flocks and associated species.

However, slow-drive transects have been found to be of limited value in previous surveys in the Project Area, and will not be continued as part of the ongoing monitoring program.

7.1.2.4 Incidental observations

Opportunistic incidental sightings of BTF are to be undertaken whilst travelling between survey sites. Where BTF are observed, the following information will be collected.

- Location and quantity of BTF
- Behaviour (e.g. foraging, drinking, perching, flying, etc)
- Regional Ecosystem (RE) type and condition
- Presence / absence of mixed-flocks and associated species
- Assessment of groundcover characteristics and species composition
- BTF nests (including photographic evidence and GPS location)

- Characteristics of BTF nest including host tree or shrub species, height of nest, active or inactive.

7.1.2.5 Remote cameras

Fixed remote cameras will be set-up at water sources where water source monitoring is not undertaken. In particular these will be used to monitor cattle troughs as well as any new watering points installed throughout the Project Area and including the Moray Downs West offset area. Cameras will be installed for the duration of the monitoring surveys. Photos and recordings of BTF are to be included in the survey results.

7.1.2.6 Vegetation assessments

Vegetation transects will be established throughout the Project Area to monitor the condition of BTF habitats (**Appendix B**). Foraging plots will also be conducted during BTF monitoring in locations where BTF were identified foraging in order to identify the floristic characteristics of habitat and flora species foraged.

Vegetation transects

Vegetation transects will consist of a modified BioCondition survey with indicators that are not important to BTF excluded (such as fallen woody debris). Fixed 100 m x 50 m vegetation transects will be established and monitored throughout the Project Area with the following information recorded in regards to vegetation structure:

- RE
- Canopy species and relative abundance
- Canopy minimum, maximum and average height
- Crown cover
- Shrub species and relative abundance
- Shrub average height
- Shrub canopy cover
- Weed cover
- Ground cover
- Ground layer species and individual percentage cover
- Percentage cover of bare ground and organic material.

Foraging plots

2 m x 2 m foraging plots will be undertaken at locations where BTF are observed foraging. These plots will aim to determine important grass species for BTF in the Project Area as well as seasonal dietary variation. Flora plot information to be collection at each plot will include:

- RE
- Ground cover species including abundance (number of the whole), of each ground cover plant species including exotic and weed species, whether seeding, or not and whether dead or alive
- Cover of each ground cover species
- Total cover of ground cover species
- Bare ground cover
- Forb cover
- Litter cover.

7.1.2.7 Groundcover, species composition and biomass monitoring

Monitoring of groundcover and species composition will be undertaken to assist with the management of grazing to maintain and enhance BTF habitat values. Baseline groundcover and composition have been established, as described in **Appendix F**. If annual vegetation assessments demonstrate a loss of native perennial species number and cover, an investigative review will be completed and relevant corrective management actions will be determined to ensure the maintenance of these species. An increase in invasive species such as Buffel Grass will also be a trigger for investigation. Corrective actions may include additional fencing or spelling of paddocks to control grazing, controlled grazing to reduce biomass levels, pest control (e.g. rabbits, weed eradication) and fire management.

Groundcover biomass monitoring will be conducted in May each year within 2 ha sites at the following monitoring locations:

- CHAB02, CHAB03, CHAB22, CHAB23, CHAB24, CHAB25, CHAB37, CHAB45, CHAB47, CHAB48, CHAB52 (Open cut disturbance areas) and
- CHAB01, CHAB04, CHAB05, CHAB09, CHAB10, CHAB44 and CHAB46 (Underground disturbance areas).

These sites were originally monitored during the Project EIS.

Vegetation assessments will use methodologies described within 'Report for Black Throated Finch On-site Monitoring Survey' dated 12 July 2013 to assess groundcover and ground composition based on Queensland BioCondition Framework (at Externa *et al.* 2011) and the Queensland Herbarium flora survey methods (at Externa *et al.* 2005). Annual vegetation assessments will be reviewed and modified in line with approved Mine Plan changes and improved assessment methodologies. Monitoring will also focus on identifying potential increases in exotic grass composition, such as Buffel Grass.

Groundcover biomass monitoring will also be conducted at representative sites across the offset area. Monitoring will be conducted to determine the biomass and composition of groundcover and appropriate management requirements to optimise BTF habitat values, including specific cattle grazing practices to manage pasture biomass.

In December 2013, ecological equivalence assessments were conducted of the mine area in order to determine baseline condition of impact areas and inform the suitability of offsets (ELA 2014). That report described habitat quality as defined within the Offset Assessment Guidelines under the EPBC Act Environmental Offset Policy. Potential habitat and quality of that habitat were mapped for BTF and guided the establishment of future management objectives for offsets.

In the Moray Downs West Offset Area, the use of strategic grazing within offset management areas will be guided by biomass monitoring. In the Moray Downs West Offset Area, biomass monitoring will be undertaken twice a year, at the end of the wet season (approximately April) and at the end of the dry season (approximately October) using the Department of Natural Resources, Mines and Energy Queensland GRASS Check – Grazier Rangeland Assessment for Self-Sustainability DNRQ97002, Second edition-revised methodology. Monitoring will be undertaken at monitoring sites established as part of the baseline surveying in year 1. Monitoring events will assess pasture composition, pasture biomass and pasture ground cover. These assessments will be used to set stocking rates for the dry season for any strategic grazing to reduce fuel loads or for weed control. Strategic grazing implemented within Moray Downs West Offset Area will aim to retain a biomass of 1,500 kg/ha at the end of the dry season.

7.1.2.8 Bioacoustic monitoring

Bioacoustic Audio Recorders (BARs) have been successfully implemented during BTF surveys of the Project Area in 2017 and 2018 (E2M 2017, 2018). A pilot study was undertaken in 2017 with the objective of developing a recogniser to facilitate automated recognition of BTF calls using Sound ID software.

Two different BTF calls were identified, of which one call was found to be suitable for automated recognition. The pilot study found that automated recognition of BTF calls was a viable method to detect BTF presence, particularly for sites that are impractical to monitor by an ecologist due to the scarcity of BTF use or their remote location. The method had a 69% detection rate of the most characteristic BTF call. However, in approximately 50% of BTF occurrences, BTF did not produce their characteristic call and were therefore not present in acoustic recordings. The method detected 33% of all BTF occurrences recorded by ecologists (including occurrences where BTF did not call).

Following the pilot study for the automated recognition of BTF calls, BAR devices were again deployed during a 2018 survey. BAR devices were used to detect BTF presence/absence at water sources that would otherwise have not been monitored and where remote cameras were not an adequate means of detection. Acoustic data was screened for BTF calls using a combination of automated recognition with manual verification.

BARs will continue to be used as a survey method, with a focus on remote survey sites or locations where other survey techniques are not likely to be an adequate means of detection.

7.1.3 Impact monitoring actions and outcomes

The monitoring will also aim to determine the effectiveness of mitigation measures implemented for management of BTF in the Project Area. The potential impacts of the proposed activities on BTF will be monitored in accordance with the monitoring program outlined in **Tables 8 to 10**, which has monitoring tasks specifically linked to corrective actions.

7.2 Research program

The objectives, indicators and actions for BTF research across the Project Area and the broader area will be undertaken in accordance with the Carmichael Coal Mine BTF Research Program (ELA 2017b; see **Appendix C**) which is summarised in the following sections.

The objective of the Research Program is to determine critical ecological requirements for the BTF in accordance with the conditions of approval for the mine development. In particular the research will aim to identify the movement patterns, habitat requirements and population dynamics, dietary requirements, home range and nesting requirements for the BTF as well as the relationship between water sources, woody habitat and food sources.

The research will also aim to determine the species response to grazing management, fire management and water body locations within the mining lease area and approved offset areas to facilitate appropriate management of these areas. Specific grazing trials will be proposed via the Research Program. The location and timeframe of the trials will be determined at the scoping phase of the research. Further detail is outlined in **Appendix C: BTF Research Program**. Population estimates will also be improved, particularly for key sites such as Ten Mile Bore.

The results of the research will inform and improve management and mitigation measures adopted for the Project to minimise impacts to the local population of BTF as well as enhance habitat within the Moray Downs West offset area in such a way to increase the carrying capacity for BTF in these areas.

7.2.1 Grazing management

BTF can persist in pastoral landscapes even though [at External \(2011\)](#) demonstrated that birds on pastoral lands had higher stress levels than birds on conservation lands. The abundance of BTF and the viability of their populations, however, are likely to be influenced by the actual grazing regime including stocking rates, land management practices and paddock rotation. The key impacts of grazing are on the composition and structure of the ground layer.

By determining the composition and structure of the ground layer where BTF are known to breed and forage within the Project Area, grazing trials can be implemented within other areas of *Eucalyptus melanophloia* open-woodland that the species appears to utilise less frequently to use grazing as a tool to establish similar composition and structure characteristics which may encourage BTF breeding and foraging. Controlled grazing may also be a suitable means for improving habitat by thinning areas of very dense grass cover as well as assisting in managing bushfire risks. These trials will aim to identify appropriate grazing strategies for managing BTF habitat, especially within the Moray Downs West offset area.

Grazing trials will consist of various cattle stocking densities and wet season resting. These trials will be assessed in terms of the ground layer composition and structure with reference to areas of known high value BTF habitat in the Project Area. The trials will aim to identify the optimal grazing strategy for maintaining good condition BTF habitat that incorporates important food resources including diversity and cover of preferred grass species as well as adequate seed output.

Proposed research methods for this aim are provided in **Appendix C**.

7.2.2 Fire management

Fire is inevitable in the grassy woodlands of central Queensland and a natural component of these ecosystems. European settlement has caused a shift towards frequent, extensive and high intensity fires in the dry season resulting in large uniform areas [ed at External \(2016\)](#). Fire will generally not reduce densities of canopy tree densities, though it can change canopy structure. The most notable impact of fire on BTF habitat is through modification of the ground layer.

While it is apparent that BTF will forage on recently burnt country, it is not known how the fire regime affects the resources available to the birds. Inappropriate fire regimes can impact on the quality of BTF habitat by affecting the production of seeds, reducing the cover and diversity of grass species and causing a decline in food availability. Fire exclusion can lead to thickening of woody shrubs, decreasing the quality of BTF habitat. Therefore high frequency, low intensity, patchy fire regimes may be beneficial to BTF by reducing the thickness of the shrub layer [ved at External R et al. 2001](#)).

This research will include a detailed analysis of fire history across the Project Area to ascertain the frequency and intensity of fires within BTF habitat across the Project Area. Trials will then be considered for implementation and include various regimes of fire frequency and inter-fire interval, fire intensity, the season in which fires occur and the extent (area) of individual fires. However, any fire management trials will need to consider other management strategies and BTF research methods as well as safety and asset protection.

Proposed research methods for this aim are provided in **Appendix C**.

7.2.3 Water sources

BTF need to drink water on at least a daily basis and drink more frequently during the drier times of the year. The importance of water to BTF is highlighted by the fact that they typically nest and breed near water. Within the Project Area this is demonstrated with 68% of BTF records in grassy woodlands within 3 km of known water sources. Therefore the absence of water may preclude BTF from areas that otherwise provide suitable habitat. The addition of water may increase the area of suitable habitat that is available.

BTF surveys and monitoring within the Project Area have also identified the species' ability to utilise natural and artificial water sources. During these surveys they have been regularly observed to drink from cattle troughs, dams and 'turkey nests'.

A key management strategy for the Moray Downs West offset area is to provide additional water sources within areas of suitable woodland habitat for BTF. They will be installed throughout the offset area at locations greater than 3 km from existing water sources.

Artificial water sources will initially be installed in several locations of the Moray Downs West offset area. Research will assess the response of BTF to new water sources and the effectiveness of this strategy by identifying the following:

- Ability to attract BTF
- Frequency of use by BTF
- Change in usage of nearest water sources
- Proximity to existing vegetation especially trees / shrubs

Proposed research methods for this aim are provided in **Appendix C**.

8 Discussion

8.1 Summary of key management issues

The following management approaches will be implemented to minimise impacts of the Project on BTF:

- Pre-clearance surveys to confirm the area of habitat to be disturbed, identify BTF locations not previously recorded in the Project Area and monitor compliance with disturbance limits.
- Vegetation clearing protocols to include staged and sequential clearing of BTF.
- Minimise impacts to BTF breeding by avoiding and buffering known nests where possible and also avoiding vegetation clearing, where possible, during the breeding period (October to April).
- Fire management to prevent accumulation of fuel loads leading to uncontrolled wildfires. Controlled cool burns will be undertaken in accordance with the Fire Management Plan (Adani 2015) to provide a mosaic of fire history and to prevent thickening of the shrub layer in BTF habitat.
- Weed management to prevent the introduction and / or spread of weeds that have the potential to degrade BTF habitat.
- Control and monitoring of pest species, especially predatory species, such as cats, that may impact on BTF.
- Prevent contamination of watering points by bunding fuels and chemical storage areas and buffering these areas from known watering points, waterbodies and waterways. Erosion and sediment controls will be implemented to prevent run-off of materials.
- Use of spotter-catchers before and during clearing activities to mitigate the direct impacts of construction activities on wildlife and record and report fauna mortality and injuries.
- Limit disturbance to pre-defined areas and implement controls to minimise noise, lighting, vibrations and dust.
- Rehabilitate areas that are to be disturbed, to restore habitat values where practicable. Monitor the effectiveness of rehabilitation activities.
- Seasonal monitoring of BTF within the Project Area to identify population trends and important breeding and foraging habitat.
- Monitor the direct and indirect impacts of construction and operations on threatened communities and species (and their habitats), both within and adjacent to the Project Area.
- Evaluate the effectiveness of mitigation measures, and revise them if necessary to improve environmental outcomes.

The BTF Management Plan will be implemented in conjunction with several other management plans specific to threatened species, habitats (groundwater dependent ecosystems) or threats (pest management plan). Collectively, the management plans will achieve a high standard of environmental management.

8.2 Implementation

Responsibility for implementing the BTF Management Plan will lie with Adani's Head of Environment and Sustainability. Mitigation and management measures will be incorporated into site management procedures and the scope of relevant construction activities. Some management tasks described in the management plan will be completed directly by Adani staff, while other tasks may be contracted out to consultants or contractors. Where the support of contractors is required, services will be procured through

Adani's purchasing procedures. Monitoring and research programs will be implemented by suitably qualified environmental suppliers, as described in **Section 9.3**.

Adani recognises the importance of taking a whole-of-ecosystem approach to the implementation of this plan and the minimisation of environmental impacts, including BTF, arising from the Project. During implementation of this plan, and in particular at the construction planning stage, Adani will take the following approach to increasing the effectiveness of the management plan:

- Identify locations where multiple BTF habitat values require management and / or monitoring, and ensure such measures are effectively implemented in parallel.
- Give consideration to the management of environmental impacts for all threatened species (at an ecosystem scale), rather than particular species in isolation.
- Maintain awareness of the changes in the vulnerability of threatened species during different seasons. In particular for the BTF, the breeding season is a critical period to maintain a sustainable local population in the Project Area.

9 Reporting and Compliance

9.1 Updating this plan

Implementation of this BTF Management Plan will commence immediately from the date of its approval by DoE and DES. The plan will be reviewed annually from commencement.

The annual review of the BTF Management Plan will include consideration of:

- delivery and outcomes of any Bioregional BTF Management Plan, including that led by the Queensland Government under the Coordinator-General's Report about the project;
- relevant requirements under the EPBC Act 1999, including the BTF Recovery Plan, conservation advices and threat abatement plans; and
- any amendments to the above or as required in response to outcomes of research, monitoring and management actions.

Further details of the annual review process are provided in **Section 9.2**.

An adaptive management approach will be taken, considering documented impacts of management activities and the results of the approved research and monitoring program. Feedback from the monitoring program that indicates mitigation and management measures are not meeting targets will trigger a review of the relevant goals, performance criteria and triggers to ensure that they are adjusted in response to suit the results of the monitoring program. Updates to the management plan will be made in consultation with DoE and DES. Revisions of the survey and monitoring program will be carried out in consultation with the BTF Recovery Team, in accordance with Condition I7 of the EA.

If pre-clearance surveys identify habitat for BTF not previously identified and reported to DoE and DES, Adani will notify the Departments in accordance with requirements in project conditions.

Work that has the potential to generate new and/or unapproved impacts to BTF must cease until the updated management plan has been considered by DoE. The updated management plan will detail how impacts to the newly identified communities will be avoided, mitigated and/or offset. Once approved, the revised management plan will be implemented.

9.2 Reporting

Adani will prepare an annual report on 1 July each year and will be made available to the administering authority for the *Environmental Protection Act 1994* on request. The annual report will summarise the activities implemented under the plan, and discuss the effectiveness of mitigation measures, based on the results of monitoring activities. The results of research and monitoring activities will be used to inform an annual reassessment of project risks on BTF, as part of the annual reporting process. This assessment will consider the following:

- Has new information become available about vulnerabilities of BTF to project impacts?
- Are mitigation measures still considered to be appropriate, given new knowledge gained through research and monitoring?
- What adaptive changes to mitigation and monitoring measures are recommended on the basis of new information collected during the past 12 months?

In accordance with Condition 17 of the EA, the BTF Management Plan will be reviewed annually by an appropriately qualified person, with findings included in the annual report. The independent review will:

- Assess the plan against the following requirements of Condition 16 of the EA:
 - o A baseline research program on the specific nesting and feeding requirements of the species that will be undertaken prior to and during project stage 1
 - o A baseline research program to establish whether the BTF at the project site are sedentary, locally migratory or regionally migratory
 - o A description of how the results of baseline research are to be used to determine any changes of classification of and/or impact on BTF habitat
 - o Details of proposed impacts to BTF habitat from each project stage including impacts from clearing, subsidence, ecological function changes, hydrological changes and weed and pest infestation changes
 - o Mitigation measures to be undertaken to avoid, mitigate and manage impact resulting from each stage of the project, including rehabilitation of habitat
 - o Monitoring of watering points that must be conducted for a minimum six (6) hour period commencing from dawn, to accurately capture BTF utilisation of water points
 - o Detailed botanical assessment that must occur at all BTF sighting locations in the Project Area to record habitat values at those locations
 - o Detailed survey that must occur across the mining lease area and approved offset areas and must include information on BTF movements. The survey method and effort must be sufficient to accurately describe the BTF home range and detail BTF resource usage patterns between seasons and years (for up to 10 years) and allow robust management actions to be developed for the maintenance of a viable local BTF population
 - o Survey work that should incorporate the usage of call playback and identify all birds present when BTF are encountered
 - o Specific surveys that must be undertaken during the BTF breeding season and include nest location and assessment of the habitat attributes associated with the breeding locations. The survey method and effort must be sufficient to accurately describe the BTF breeding requirements with consideration to spatial and temporal variation of resources of up to 10 years
 - o Survey and monitoring that must be undertaken by experienced ecologists.
- Include recommended actions to ensure actual and potential environmental impacts are effectively managed for the coming year
- Identify any amendments made to the BTF SMP following the review.

All revisions of the survey and monitoring program must be carried out in consultation with the BTF recovery team. Any revisions must be independently peer reviewed.

In addition, Adani will publish a report on its website addressing compliance with each of the conditions of EPBC 2010/5736, including implementation of the BTF Management Plan. The report will be published within three months of every 12 month anniversary of the commencement of the project, in accordance with the requirements of Condition 31 of EPBC 2010/5736. Details of the date of publication and any non-compliance with approval conditions will also be provided to DoE.

Adani will conduct periodic audits to monitor compliance with management plan commitments, in accordance with the Adani quality system. Adani will integrate the management plan commitments with other aspects of the mine construction and operations, to avoid actions being overlooked. It should be noted that reporting timeframes outlined in this plan apply only BTF.

This plan will be available to all employees, contractors and subcontractors. Adani will amend the management measures as necessary in response to regular reviews, monitoring results and changes in legislation, in consultation with regulatory authorities.

9.3 Qualifications

Persons implementing key tasks described in this management plan will have appropriate training, skills and professional qualifications relevant to their role and responsibility. BTF ecologists must be able to provide authoritative assessment, advice and analysis on performance relating to the BTF using the relevant protocols, standards, methods or literature. It is expected that suitably qualified personnel involved in the implementation, review and amendments to this plan will include an ecologist / ornithologist with recent field experience with the species and a knowledge of the habitat and ecological requirements of the BTF.

Fauna spotter-catchers must have demonstrable identification and handling skills, and behaviour knowledge (including nesting requirements) relevant to the BTF, and all threatened fauna species that may, are likely, or are known to occur in the Project Area. Fauna spotter-catchers must be suitably qualified and working under a valid permit from DES.

10 Commitments and actions included in this plan to be delivered by Adani

Table 13 provides a register of key reporting, mitigation and monitoring commitments arising from this plan. This will assist Adani and its contractors to monitor progress with implementation of the plan. Aspects of the monitoring design that should be considered for BTF are described in **Section 7**. These will be taken into consideration by ecologists implementing the management plan.

Table 13 Commitments and actions included in this management plan to be delivered by Adani

Issue	Number	Commitment
Reporting and Notifications	1	Prepare an annual report on 1 July each year and make available to the Administering Authority upon request. .
	2	Conduct periodic audits on compliance with this plan.
	3	Non-compliances with the BTF Management Plan will be identified and recorded through an auditing process.
	4	Work that has the potential to generate new and/or unapproved negative impacts to BTF must cease until the updated management plan has been considered by DoE. The updated management plan will detail how impacts to the newly identified communities will be avoided, mitigated and/or offset. Once approved, the revised management plan will be implemented.
Mitigation	5	Use discretion where possible in the placement of some infrastructure to avoid disturbance to BTF habitats and populations.
	6	Prior to the commencement of site works, any conditions listed in the “Permit to Disturb” will be implemented - e.g. clearing extents clearly marked, trees/areas requiring protection clearly marked, or barricaded. All BTF habitat clearing operations are to be monitored for compliance by a suitably qualified person.
	7	Undertake pre-clearance surveys prior to the commencement of clearing activities, to confirm and identify known areas of occurrence.
	8	Surveys of the area to be disturbed prior to and during construction are to be conducted by a fauna spotter-catcher in BTF habitat areas and remnant vegetation areas. Fauna to be recorded and translocated to suitable habitat adjacent to the disturbance area, where practical. Fauna deaths and injuries to be recorded and managed in accordance with relevant Permit Conditions (e.g. Rehabilitation (Spotter-catcher) Permit) and guidelines. BTF nesting areas observed in areas not to be disturbed will be marked and mapped and monitored during construction and operations works.
	9	Rehabilitate disturbed areas following construction activities where such activity does not compromise the ongoing operation of the project. Progressive rehabilitation of disturbed areas will be undertaken in accordance with the Rehabilitation Management Plan.
	10	Progressive rehabilitation of disturbed areas will be commenced as soon as practical after it has been confirmed that no further activities will occur in each area. Rehabilitation will generally commence within 6 months, unless it is considered more effective to align with the next wet season.
	11	Implement environmental offsets to enhance habitat values used by BTF.

Issue	Number	Commitment
	12	Implement an induction program for staff and contractors about BTF and other threatened species, their habitats and identification. Use posters in prominent work locations to maintain awareness. Implement sound land management practices.
	13	Use directional lighting and strategic timing and placement of lights to minimise light spill into adjacent habitat.
	14	Ensure all plant and equipment is serviced and maintained to minimise machinery noise and vibration.
	15	Management of erosion and sedimentation will be undertaken in accordance with a Project Erosion and Sediment Management Plan.
	16	Mine-related wire and mesh material near water sources will be removed and/or covered to prevent entrapment, if practical
	17	Domestic animals will not be permitted into the Project Area apart from cattle (including horses and dogs during mustering activities).
	18	Monitor BTF populations and their habitats in areas where subsidence occurs.
	19	Weed and pest animal control will be implemented during construction and operations.
	20	Permanent water sources in retained habitat areas will not be drained during construction and operations, unless suitable alternative water supplies are available.
	21	Monitoring BTF populations and their habitats in areas where subsidence occurs.
Monitoring	22	Monitor the presence and population abundance of invasive fauna.
	23	Measure the effectiveness of offset investments by monitoring the quality of offset areas.
	24	Any injured wildlife will be either taken to the nearest qualified veterinary practitioner or wildlife carer, or humanely euthanised on site by a suitably qualified person.
	25	Monitor dust level impacts on BTF habitat, and in water bodies within and adjacent to construction activities.
	26	Monitor water quality in BTF habitat, in accordance with the Surface Water Monitoring Plan.
	27	Annual monitoring (including photo monitoring) of water source availability, in the driest season, in known BTF habitat.
	28	Monitor the incidence of Project-related fire.
	29	Pre-clearance and annual BioCondition assessments and photo monitoring will be completed to determine the condition of retained BTF habitat in impact and control sites. Monitoring will be in conjunction with a research program to monitor remnant vegetation changes over subsidence areas.
	30	Measure the effectiveness of rehabilitation activities through BioCondition monitoring.

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Appendix A Overview of Project Management Plans

This section provides a summary of the EMP prepared to support an EIS process for the Carmichael Coal Project under the EPBC Act and SDPWO Act. The summary is intended to assist readers of the Species Management Plan understand the other management plans in place and how they relate to the management of threatened species and communities. The summary reflects the findings and recommendations of studies undertaken for the EIS. Further details of the management plans can be found at this link <http://www.adanimining.com/aeis-documents>

Each management plan covers design and construction requirements, operational activities and decommissioning. The management plans consider open cut mining, underground mining, mine infrastructure areas, out of pit waste rock dumps, mine water management dams, office, workshop and other facilities and power, water distribution and offsite infrastructure (e.g. worker's accommodation, airport, water supply infrastructure and road upgrades).

The overall project EMP provides details and implementation details for the following aspects: air quality, greenhouse gas emissions, noise and vibration, surface water, groundwater, mine waste management, general and hazardous waste management, terrestrial ecology, aquatic ecology, biosecurity management, scenic amenity, erosion and sediment control, contaminated land, soil resources, aboriginal cultural heritage, non-indigenous cultural heritage, subsidence management, emergency management and response and community. A summary of those plans most relevant to the protection of MNES is summarised below.

The project EMP is a working document and will be updated as required to reflect changes in impacts or mining activities, changes in legal and other obligations and changes from learning and corrective actions through monitoring activities.

Air quality

The management objectives for air quality include protection of biodiversity through avoiding nuisance from dust deposition and meeting EPP (Air) objectives for dust emissions at sensitive receptors. Particulate matter could affect fauna and plants through coating of plant leaves, making them less palatable for fauna and affecting photosynthesis.

Key measures include prevention of dust through planning and sequencing of exposed soils; stockpile design and stabilisation; suppression activities for coal stockpiles and haul roads, access tracks and work areas; and progressive rehabilitation of disturbed areas.

Dust generation will be monitored visually and through and corrective action applied where train loading is generating dust or dust lift off is travelling beyond the lease boundary.

Noise and vibration

The Noise and Vibration Plan aims to protect the qualities of the acoustic environment that are conducive to protecting biodiversity. Potential impacts are possible due to civil works during construction, increased traffic, pile driving, rock breaking, blasting and other mining related activities. In general most of these activities are not expected to affect sensitive receptors.

Airblast overpressure monitoring will be undertaken at sensitive receptors during initial blasting activities as well as other mitigations and monitoring controls that are largely aimed at protection of acoustic quality for surrounding homesteads.

Surface water

The Surface Water Management Plan aims to ensure that Environmental values relating to aquatic ecosystems, stock and domestic use and cultural values are maintained and that discharge and overflow events are undertaken in accordance with the relevant conditions under an environmental authority issued by DES.

Contamination of surface water resources could result from release of mine affected water, wastewater generation and treatment, hydrocarbon leaks or spills, spoil disposal, release of sediments through clearing and earthworks, or draining of low quality water from existing farm dams.

A mine water management system will be implemented based on segregation of water streams into clean, dirty and mine affected streams. Clean water will be managed by diverting around disturbed areas or through the proposed mine in watercourse diversions. Dirty water will be directed to sediment dams to allow sediment to settle out. This water can then be used for dust suppression.

The key management actions to be employed in the prevention of surface water loss and contamination include:

- Prepare and implement a Water Management Plan in accordance with the guideline Preparation of Water Management Plans for Mining Activities
- Preparation and implementation of a Receiving Environment Management Plan including water quality objectives, trigger levels, monitoring and contingency procedures
- Design all watercourse crossings to maintain flow and minimise afflux where this may affect sensitive receptors;
- Design of infrastructure to appropriate standards based on relevant guidelines and all available data to minimise impacts to surface water
- Prohibition of construction water sourced from the Carmichael River
- Controls on design and construction of dams
- Controls for draining of farm dams
- Preparation and implementation of a Plan of Operations for Mine Affected Water and sediment dams, including monitoring and requirements and procedures for discharge

Monitoring will include surface water levels and quality across a network of monitoring sites with at least twelve months of baseline data.

Groundwater

This Plan aims to ensure that impacts on groundwater dependent ecosystems do not cause unacceptable or unapproved losses of biodiversity values including impacts to fauna habitat. Potential threats to groundwater include drawdown from dewatering activities and contamination from spills or leaks.

Key management actions to be employed in the prevention of impacts to groundwater include:

- Groundwater quality trigger levels
- Identify potential impacts before excavation to inform measures required in work permits prevent contaminated runoff through development and implementation of a Surface Water Management Plan
- Laydown and storage areas to be located away from creeks and rivers or sensitive receptors

- On-going monitoring of groundwater levels and updates to models

Monitoring will include groundwater flows to the Carmichael River, groundwater levels and quality across a network of bores.

Pests and Weeds (Biosecurity Management)

Management objectives are to achieve no increase or spread of weeds beyond pre-development conditions as a result of project activities and no unapproved biosecurity management activities. The scope of activities under the plan includes 22 introduced plant species recorded during surveys of the Project Area, of which Parthenium and Prickley Pear are most significant. Eight introduced fauna species are also addressed, including the feral cat, pig, cane toad, dingo, house mouse and rabbit. The plan will manage potential environmental impacts from pests and weeds through vehicle movements, construction activities and ongoing operations. Proposed controls include the following activities:

- Mapping of weeds prior to commencement of construction activities
- Containment of food scraps in sealed containers
- Limitations on the movement of vegetation and soil waste
- Use of weed wash down areas for vehicles and equipment
- No domestic animals in the Project Area
- Feral animal control programs, if necessary.

There will be ongoing monitoring of pests and weeds throughout the Project Area, using baseline and reference sites.

Erosion and Sediment Control

A total of 19 soil types were identified within the Project Area based on geology, landform, native vegetation and soil profile features. It is important to reduce soil loss from the site for the management environmental values relating to both soil and water. Vegetation clearing, topsoil stripping, earthworks, and stockpiling will result in disturbance and exposure of soils to erosive forces from either overland flows of water or wind action. Soil loss reduces soil productivity and removes nutrients and organic matter. Sediment mobilised by overland flow can affect adjacent watercourses through increased turbidity, deposition of sediment on aquatic ecosystems, geomorphological changes and reduced water quality for other water users. Plan objectives are to avoid degradation of aquatic ecosystems and water supply values downstream as a result of sediment releases, and that topsoil resources will not be lost through erosion. Proposed controls include the following activities:

- Preparation of detailed erosion and sediment control plans for each aspect of the project
- Design stormwater systems to include sediment retention basins
- Locate infrastructure away from drainage lines and steep slopes, where ever practicable
- Where practical, schedule works to avoid wet conditions, or if in streams, outside times of flow
- Minimise the areas to be disturbed
- All disturbed areas will be revegetated or protected from erosion using suitable control measures

Monitoring activities will include the inspection of sediment control devices and stormwater systems, including diversion drains and outlets.

Subsidence Management

The management plan objective is that a stable and sustainable landform is created over subsided areas which maximises opportunities for the subsided areas to support native vegetation and fauna. Waterways are important considerations when addressing the potential environmental impacts from subsidence. The Carmichael River is the regional drainage line in the area, and a 500 m buffer from subsided areas will be maintained on either side of the river. Potential impacts from subsidence include altered topography and drainage patterns, tension cracks in the ground surface and disturbance to the root zones of vegetation. Proposed controls include the following activities:

- Develop a detailed management plan in accordance with the mine Environmental Authority
- Design creek diversions around the open cut areas to remain functional after subsidence
- Establish monitoring locations including transects of topographical features and habitat values
- Exclude cattle from subsidence areas.

Monitoring activities will include regular inspections of subsided areas, vegetation health assessments, inspections of ponding in subsidence troughs and groundwater assessments.

Bushfire Management

The Fire Management Plan provides a framework and guidance for:

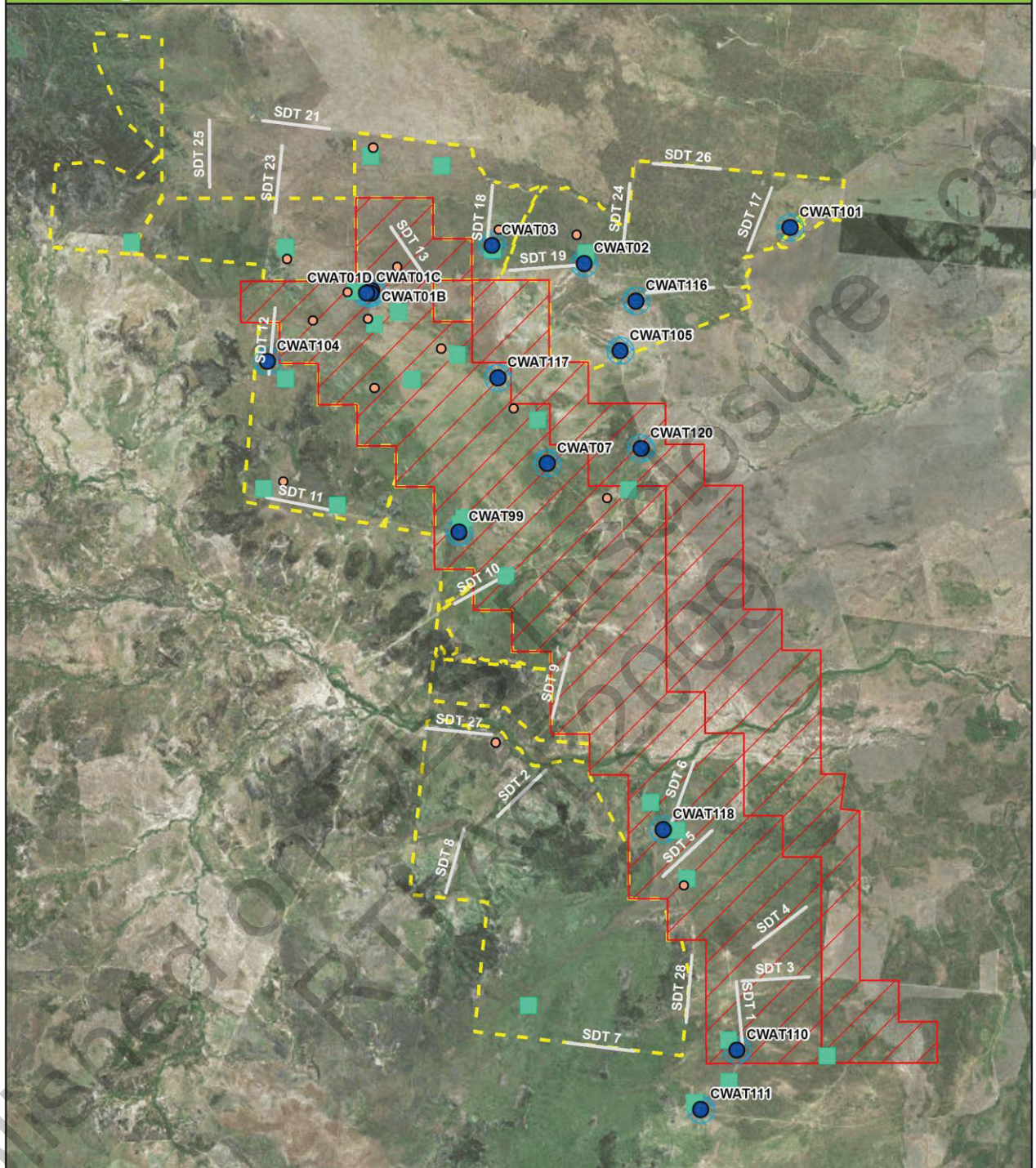
- Identifying, monitoring and prioritising the management of fire risk in the Operational Area
- Preventing bushfires and managing fires throughout the Operational Area
- Developing site-specific and/or activity specific fire management procedures across the life of the project.

The plan is focussed on an overarching strategy to identify, avoid, prevent, minimise and control bushfires. Specific measures are provided on how this will be achieved, and include mapping of relevant environmental features, maintain fire infrastructure (e.g. fire breaks) and levels of fire preparedness. The use of fire in environmentally or culturally sensitive areas is also discussed.

Appendix B Location of Monitoring Sites

The location of monitoring sites are shown on maps on the following pages. The first map shows the location of waterhole surveys sites, 1 km transects, vegetation (BioCondition) transect sites, slow drive transects (historic) and active search areas. The second map shows the location of 2 ha groundcover biomass monitoring sites, which will be monitored in May of each year.

Monitoring Sites



Legend

The Project

■ Carmichael Mine

■ Offset Area Boundary

● Waterhole Survey Sites

● 1km Transects

■ Vegetation Transect Sites

— Slow-drive Transects

■ Active Search Areas

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Datum/Projection:
GDA 1994 MGA Zone 55

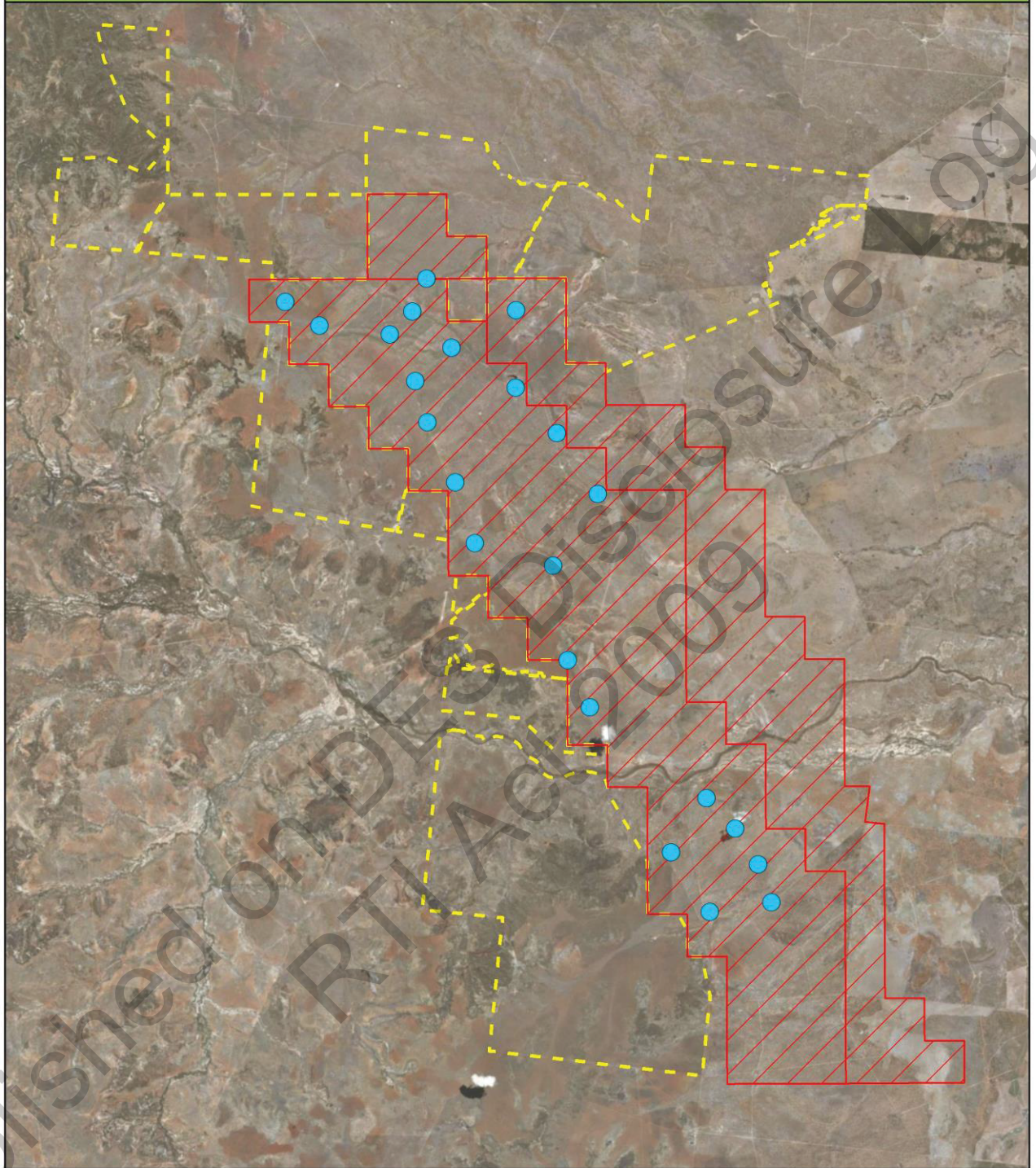


0 2.5 5
Kilometers

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2ha Groundcover and Composition Monitoring Sites

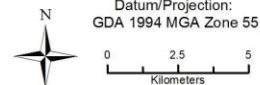


Legend

- Carmichael Mine
- Offset Area Boundary
- 2ha Groundcover and Composition Monitoring Sites

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Appendix C Black-throated Finch Research Program

Published on DES Disclosure Log
RTI Act 2009

Black-throated Finch Research Program

Carmichael Coal Mine

Prepared for
Adani Mining Pty Ltd

October 2018



DOCUMENT TRACKING

Item	Detail
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Template 08/05/2014

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Abbreviations

Abbreviation	Description
Adani	Adani Mining Pty Ltd
BioCondition	A vegetation condition assessment tool which provides a measure of how well a terrestrial ecosystem is functioning for the maintenance of biodiversity values at a local or property scale.
BOS	Biodiversity Offsets Strategy
BTF	Black-throated Finch
DAF	Queensland Department of Agriculture and Fisheries
DEHP	Queensland Department of Environment and Heritage Protection (now known as the Department of Environment and Science; DES)
DoE	Commonwealth Department of the Environment
EA	Environmental Authority issued under the <i>Environmental Protection Act 1994</i>
EIS	Environmental Impact Statement
ELA	Eco Logical Australia Pty Ltd
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
EPBC Approval	Approval granted by the Commonwealth under the EPBC Act
ER	Environmental Representative
MNES	Matters of National Environmental Significance, as defined under the EPBC Act
NC Act	Queensland <i>Nature Conservation Act 1992</i>
NGBR	North Galilee Basin Rail Project; a 311 km section of the Carmichael Rail Network located between Mistake Creek and the Port of Abbot Point
RE	Regional Ecosystem
SDPWO Act	<i>State Development and Public Works Organisation Act 1971</i> (Queensland).
SEIS	Supplementary Environmental Impact Statement, prepared in response to comments on the draft EIS.
SP1	Separable Portion 1; a 77 km section of the Carmichael Rail Network located between the Carmichael Mine and Mistake Creek
TEC	Threatened Ecological Community as defined under the EPBC Act
ToR	Terms of Reference

1 Introduction

1.1 Background

Adani Mining Pty Ltd (Adani) is required to develop a Black-throated Finch (BTF) Research Program associated with the Carmichael Coal Mine project (the Project) in the Galilee Basin of central Queensland, as part of the Project approval conditions.

The Carmichael Coal Mine and Rail Project was assessed by the Commonwealth and Queensland governments through an Environmental Impact Statement (EIS) process. Conditional approval of the Carmichael Coal Mine and Rail Project was granted by the Queensland Coordinator-General on 8 May 2014 and the Commonwealth Minister for the Environment on 14 October 2015 (EPBC 2010/5736).

The development of a BTF Research Program is a requirement of the Commonwealth and Queensland approval conditions (refer to **Section 1.5** of this document), to increase the knowledge of the ecological requirements of BTF populations likely to be directly and indirectly impacted by the Project. While the BTF Research Program forms part of the BTF Management Plan (as an appendix), it is intended to be read and implemented as a standalone document.

1.2 Project overview

The Project involves construction of a greenfield coal mine in the Galilee Basin over Mining Leases 70441, 70505 and 70506. The mine site is located approximately 160 km north-west of Clermont, with mining to be conducted using both open cut and underground mining methods. Offsite infrastructure to support the mine will include a workers accommodation village, a permanent airport site and water supply infrastructure. The total disturbance area will be approximately 28,000 ha for the mine and 1,300 ha for the offsite infrastructure. Coal will be transported by rail to the Port of Abbot Point for export (**Figure 1**). The operational mine life will be approximately 60 years, with a production rate peaking at 60 million tonnes per annum (Mtpa).

1.3 Purpose of the research program

The purpose of the BTF Research Program is to meet the conditions of approval granted by the Queensland and Commonwealth governments, and commitments made by Adani in securing approvals. This will include undertaking studies that will increase the knowledge of the ecological requirements of BTF populations within and adjacent to the Carmichael Coal Mine and by doing so, inform and improve management of the local BTF populations. The Research Program will also improve understanding of the biology and ecology of BTF across its current range.

The Research Program is relevant to the population/s of BTF occurring on the Project area (i.e. the mining lease and Moray Downs West offset area) and possibly the immediate adjacent properties (**Figure 1**).

1.4 Relationship with other management plans

Various other management plans will be developed and implemented to address the requirements of approval conditions under Commonwealth and Queensland legislation. There will be some interaction among the plans during construction and operations. The BTF Research Program will also have an interaction with some of these management plans including:

- BTF Management Plan for the Carmichael Coal Mine
- Moray Downs West Offset Area Management Plan.

Data collected during BTF monitoring will be used to inform the implementation of the Research Program. The results of the Research Program, especially with regards to habitat management, BTF behaviour and breeding, will be used to inform and enhance management of BTF across the Project area.

The BTF Research Program will be implemented in parallel with other studies on listed threatened species and communities. Monitoring of BTF will be coordinated with monitoring of other threatened species, which is carried out in accordance with approved Species Management Plans. This coordination will provide for management of threatened species and communities at a landscape scale, in addition to monitoring and implementation of actions for species or communities individually. Such an approach will assist in identifying any synergies in management actions (where one action benefits multiple species) or any areas of conflict (where an action may assist one threatened species but hinder another).

The BTF Research Program will be funded by Adani as part of its operating budget for the mine. In determining priorities for funding, Adani will take advice from technical specialists on the BTF research team, the independent reviewer, the BTF Recovery Team and the Department of Environment and Science (DES).

1.5 Compliance with approval conditions

Appendix D of the BTF Management Plan provides a summary of how compliance with all relevant BTF approval conditions and project commitments has been achieved. This includes a section showing how compliance has been achieved in the development of the BTF Research Program.

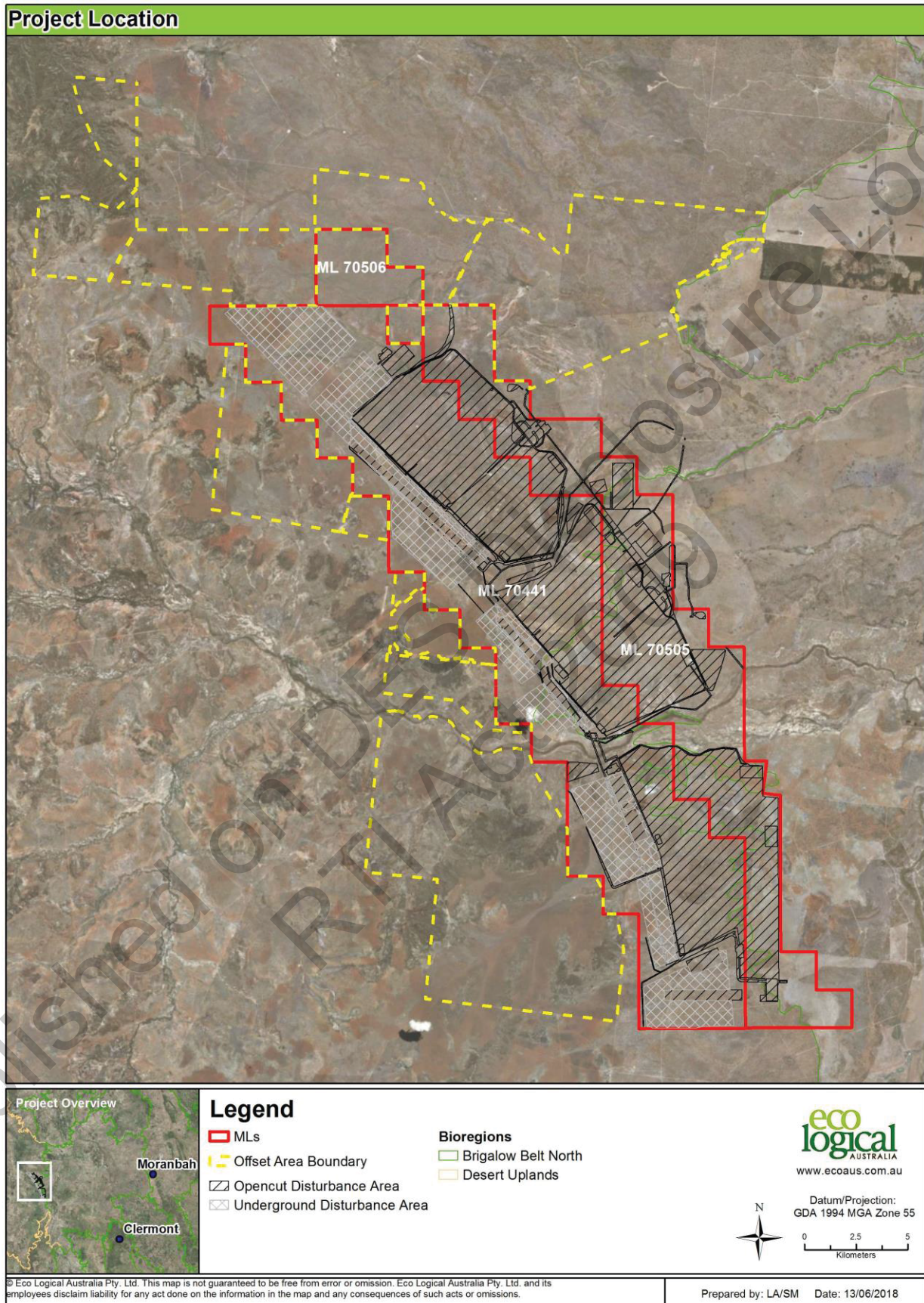


Figure 1 Map showing the location of the Carmichael Mining Lease and Offset Area

2 Black-throated Finch (southern)

2.1 Status

The BTF (southern subspecies) is listed as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Nature Conservation Act 1992* (NC Act). The primary reason for the listing is the decline in size and extent of the population of the southern subspecies, estimated to have declined by approximately 80% since the early 1980s (DoE 2016). Reasons for the decline include loss of habitat from vegetation clearing, degradation of remaining habitat and invasion of exotic weed species.

Large flocks of the southern subspecies of BTF were once seen in discontinuous areas from about the Atherton Tablelands in the north, to northern New South Wales in the south, and up to 700 km inland from the coast. The northern subspecies is found from the Atherton Tablelands, north to Cape York Peninsula, and west to the Gulf of Carpentaria. Removed at External Review 1999, in National Recovery Plan 2007).

It appears that the southern subspecies is now confined to the northern part of its former range and analysis of historical records suggests that a contraction of range has been occurring for several decades. BTF began disappearing from southern areas early in the 20th century and by the 1940s they had mostly disappeared from the south-east of their former range. Declines in their southern extent continued in the following decades, with major declines around Rockhampton reported in the mid-1970s. The subspecies is now patchily distributed within an area extending 500 km inland from the coast between Mareeba in the north and Rockhampton in the south.

2.2 Regional populations

The southern subspecies of the BTF lives in the Brigalow Belt North and Desert Uplands bioregions of Queensland, which cover 135,500 km² and include the towns of Townsville, Bowen, Emerald, Clermont and Collinsville. at External Review 2011). Based on mapping of all records of BTF up to 2010 and a comparison with post-2000 records, the distribution of BTF is estimated to have contracted by 50-80% of its historical range and the species is now rarely recorded south of Clermont (160 km south of the Project area; at External Review 2011). BTF have also disappeared from several sites around Townsville. d at External Review 2011).

Assessments undertaken as part of the process for listing of the southern subspecies of BTF identified a severe reduction in numbers, with an observed decline in extent of occurrence of up to 59% in the 10 years prior to the release of the listing advice in 2005 (Threatened Species Scientific Committee 2005). Other studies estimated a decline of up to 80% in the 30 years prior to 2007. d at External Review 2011; BTF Recovery Team 2007).

The Action Plan for Australian Birds. at External Review 2011) lists the subspecies as Vulnerable C2a(i) and cites the reason for the listing as 'population <10,000 mature individuals and continuing to decline, <1,000 in largest known subpopulation.' Between the 1990 and 2000 listings, the status of the subspecies declined from Near Threatened to Vulnerable on the basis of an increased rate of decline in the extent of occurrence as distant subpopulations disappeared.

2.3 Previous research

The majority of research undertaken on BTF has been carried out since the mid-1990s and has been focused on the population on the Townsville Coastal Plain. It is likely that there are differences in the ecology of BTF between the higher rainfall coastal region and the more arid, Desert Uplands Bioregion due to distinct differences in the vegetation and habitat that the BTF occupy in these areas. The vegetation of the Townsville Coastal Plain is generally more highly modified than that of the Project area, with a higher proportion (in terms of species and biomass) of introduced plants. The Carmichael Project area appears to support a much larger population of BTF in a more intact landscape compared with the Townsville Coastal Plain.

A synopsis of previous research on BTF is provided in the following sections.

2.3.1 [redacted] (1976)

[redacted] (1976) provided results of about 70 hours of observations made in October 1967, May 1970 and June 1970 on the two subspecies *P. c. cincta* and *P. c. atropygialis* at various sites on Cape York Peninsula and further south in far north Queensland. He described the species' habitat as ranging from dry open woodland with a few tall eucalypts to closed woodland.

He stated that "seeding grasses and locally accessible water were common features of all habitats". He identified that small flocks of birds feed in the early morning and late afternoon, taking seeds that had fallen to the ground and occasionally feeding on half-ripe seeds that were taken from the seed-head.

[redacted] identified some of the grass species whose seeds were being eaten; *Setaria surgens*, *Digitaria ciliaris*, *Stylosanthes humilis* and *Dactyloctenium radulans*.

Flocks were typically of 12-30 individuals but "nomadic flocks of several hundred may aggregate around water-holes during droughts". The presence of many newly fledged birds on Cape York Peninsula in the October observation period indicated recent breeding, whereas further south there was a large proportion of juvenile birds in June. Birds were reported to nest in colonies, with examples of 30 and 37 nests being observed. Nests were placed in *Melaleuca* spp. and *Eucalyptus* spp. Captured aviary birds had clutch sizes of around five eggs.

2.3.2 [redacted] (1996)

Twenty years later [redacted] (1996) completed a one-year study of BTF near Townsville. He compared the foraging ecology between wet and dry seasons. During his study, a greater diversity of habitats was used after August. He noted that food availability declined following rainfall and seeds of two introduced grass species, *Urochloa mosambicensis* and *Digitaria ciliaris*, were important food sources, the latter also being noted by [redacted] (1976).

2.3.3 [redacted] (unpublished)

During the 1990s, [redacted] undertook studies of BTF around Townsville in connection with environmental impact assessments. He made observations on BTF distribution, abundance and breeding behaviour. He also attempted to estimate the size of the population of BTF in the Townsville Local Government Area, though there was limited information available to provide the basis of such an estimate. Importantly, he modelled BTF breeding habitat on the Townsville Coastal Plain based on the proximity of water and preferred Regional Ecosystems. [redacted] (2013) also modelled the present and future distributions of BTF at the range scale, exploring the potential for impact from climate change.

2.3.4 [redacted] (2007)

In 2007 [redacted] submitted an Honours Thesis based on field work on the BTF on the Townsville Coastal Plain. She studied foraging behaviour of two breeding colonies, during a period when birds are

constrained by their need to remain close to their nests. One of the colonies consisted of three breeding pairs. The nests and associated foraging areas were within 300 m of permanent water. The composition of the herbaceous vegetation where birds were observed foraging was described. In this study, the birds preferred patches dominated by *Alloteropsis cimicina*, *Chloris* spp. and, the introduced *Urochloa mosambicensis*. BTF tended to avoid patches dominated by *Heteropogon contortus*, *Themeda triandra* and *Aristida* spp.

2.3.5 [redacted] (2010)

A second honours thesis [redacted] (2010) compared the abundance of granivorous birds, including BTF, in peri-urban versus rural areas around Townsville. It demonstrated that all the finch species studied were less abundant in the more highly modified peri-urban areas than they were in the rural areas that were generally used for pastoralism. BTF were severely affected by the changes that occurred with peri-urban development, as indicated by comparison of their abundance in the two zones.

2.3.6 [redacted] (2011)

[redacted] (2011) conducted a study of the health of grass finches, including BTF, in northern Australia in relation to season, land tenure (land-use) and conservation status, quantifying health in terms of stress levels and blood chemistry. Stress levels were greater, on average, in birds on pastoral versus conservation lands.

2.3.7 [redacted] (2016)

The most comprehensive field study of BTF was that conducted by [redacted] (2016), based on the Townsville Coastal Plain. It examined daily and seasonal movement patterns, habitat requirements and foraging ecology.

A large number ($n = 102$) of birds in several sub-populations were colour banded and, for the first time, a small number of birds ($n = 18$) were radio-tracked for periods up to 2 weeks. Individual birds appeared to return to areas of just a few hectares over periods of 600 days or more with home ranges of 10-50 ha in the short-medium term. A small number of individuals were recorded at distances of 5-6 km from the location at which they were banded. Three individuals moved more than 15 km from the banding location but there were insufficient data to say much about the frequency of these longer distance movements.

This study suggested that the preferred habitats of BTF on the Townsville Coastal Plain are those with a high percentage of native grasses, low shrub cover, low shrub and tree diversity, some standing trees present and an abundance of *Chrysopogon fallax*, *Eragrostis* spp. and *Setaria surgens*.

2.3.8 [redacted] (2017)

Another study has investigated the genetics of BTF, comparing wild and captive birds [redacted] (2017). Samples were taken from several sub-populations on the Townsville Coastal Plain, the Mareeba district and within the Carmichael Mine Project area. The study also incorporated samples collected by [redacted] on Cape York Peninsula and the Townsville Coastal Plain. The captive birds were obtained from the collections of private aviculturists.

2.3.9 Black-throated Finch Recovery Team

Since 2004, the BTF Recovery Team has organised annual “waterhole counts” during which water sources that are prospective drinking locations for BTF are surveyed on two consecutive days in the late dry season each year. All sites are on the Townsville Coastal Plain. This is more of a monitoring exercise than research. The results indicate that numbers coming to water are affected by conditions at the time of the survey and this variability may exceed that from inter-annual variation and other population trends.

2.4 Habitat requirements

BTF habitat typically consists of grassy eucalypt woodlands adjacent to water or riparian corridors ^{at External}

Removed at External Review

Preferred habitat consists of patches with suitable grasses, low vegetation density or bare ground to allow access to the seed bank and an open tree layer that does not have a continuously dense shrubby understorey ^{at External} (2015).

^{at External} (1996) noted that the southern subspecies requires a mosaic of different habitats during the wet season in which to find seed. This subspecies has also been recorded in degraded habitats, including cultivated areas in the vicinity of woodlands and a heavily grazed paddock (DoE 2015), most likely to access fallen or available seed.

BTF can be found in a range of woody plant communities with records known from at least 21 Regional Ecosystems ^{at External} ^{et al.} 2016). Woodland vegetation typically consists of ironbark (e.g. *Eucalyptus melanophloia*, *E. crebra* and *E. drepanophylla*), bloodwood (*Corymbia dallachiana*, *C. erythrophloia* and *C. clarksoniana*) and gums (*E. platyphylla* and *E. brownii*). Records from other vegetation communities include wetlands, riparian paperbark woodlands and native grasslands ^{at External} ^{et al.} 2016). Approximately 78% of records within the Galilee Basin region are associated with Broad Vegetation Group (BVG) 17b, which is described as 'woodlands to open woodlands dominated by *Eucalyptus melanophloia* (Silver-leaved ironbark; or *E. shirleyi*; Shirley's silver-leaved ironbark) on sand plains and foot slopes of hills and ranges' ^{at External} unpublished).

In the Project Area, grassy open-woodland communities dominated by *Eucalyptus melanophloia* (RE 10.5.5a) are preferred, though the species is not restricted to this community (ELA 2017a; ELA 2017b; Niche 2015a, Niche 2015b, Niche 2016a, Niche 2016b). Other habitats where BTF have been recorded on multiple occasions include *Eucalyptus brownii* open-woodland (RE 10.3.6ax1) and *Eucalyptus similis* and *Corymbia brachycarpa* open-woodland (RE 10.5.1a).

BTF habitat within the Project Area generally consists of an open-woodland (approximately 17 % canopy cover) with moderately low canopy (approximately 12 m) and low canopy species richness. The shrub layer is typically low (2 to 2.5 m) and sparse (less than 10 % cover) but a moderately high species diversity. The ground cover is dominated by native grasses (approximately 35% cover and 8 species) with moderate bare ground (34% cover). Exotic grass and herb / forb cover are typically low (less than 5%).

Foraging habitat must provide suitable seeds, principally of grasses. There must be an appropriate density and diversity of grasses, with seeds available and accessible on the surface as the birds predominantly feed on fallen seeds. A mix of grass species that seed at different times is important to provide year-round food supply as BTF can experience food shortages particularly in the lead up to the wet season ^{at External} (2011). The ground layer of the vegetation is ideally dominated by a diversity of annual and perennial grasses, with sufficient inter-tussock spacing to allow the birds to forage efficiently for grass seeds present on the soil surface.

Access to water is critical for the BTF. During the wet season, they utilise ephemeral water and move into new feeding areas. During the dry season, permanent water provides refuge, because BTF need to drink every day. Permanent water may be in the form of natural springs, perennial streams, waterholes in ephemeral creeks or man-made water sources such as farm dams and troughs. Therefore, water must be within an accessible distance from BTF foraging and nesting habitat and nests are typically constructed in trees within 400 m of water sources ^{at External} (2011, NRA 2007). However BTF monitoring results from the Project Area have identified a mean distance of approximately 2.5 km between nests and known permanent water sources with the closest nest 280 m from water and the furthest almost 7 km.

2.5 Breeding ecology

BTF breeding season is from October to April, with seasonal and geographic variations (at External 2011). The timing and duration of the breeding season appears to be contingent on food resources and is therefore likely to vary annually and geographically according to rainfall patterns, temperature and land condition. Commencement of the wet season is the likely trigger for breeding.

Around Townsville, breeding tends to occur from December to May, which generally encompasses the wet season and the period of most prolific seeding of grasses (Removed at External Review). However, there is considerable variation in this timing throughout the bird's range. Breeding will continue throughout the period of grass seeding generated by the wet season.

NRA (2005a) recorded BTFs breeding in Townsville from January to July; analysis of data contained in (at External 1996) recorded breeding in Townsville from March to May; and (at External 1970) recorded breeding on the Atherton Tableland from September to January. Although under optimal conditions the species can probably breed continuously throughout the year, the core breeding season around Townsville is believed to begin sometime after the onset of the wet season and continue until ground-stored food resources (fallen grass seed) fall below an undetermined threshold (February to June). Usually five or six eggs are laid at one time (at External 2011).

There is little published information regarding the timing of the breeding cycle of this species. In a study of relatively few captive individuals (at External 1976) observed the timing of the breeding cycle to be 15 days for incubation, 22 days from hatching to fledging and 18 days from fledging to independence. This indicates BTF are 40 days old at independence. With respect to independence, (at External 2011) noted that BTF juveniles may remain with their parents for a number of months after fledging.

BTF have been recorded returning to the same nesting location each breeding season (within hundreds of metres). However, nesting location (dozens of metres) tends to change from year to year (at External 2015). BTF tend to form loose colonies and multiple nests may be found in a single tree (at External et al. 2006; NRA 2006; NRA 2007b). Nests are used for breeding and roosting, with individuals returning each night to roost. During the non-breeding season, some nests may be used as dormitory nests housing multiple adult pairs and young.

Nests are mostly built high in the outer branches of trees and tall shrubs, in tree-hollows, in mistletoes, and in the base of raptor nests (at External et al. 2006; BTFRT 2007; DoE 2015). However, nests have also been recorded in large shrubs within 1 m of the ground. Occasionally nests are constructed beneath active raptor nests, of species such as Wedge-tailed Eagle (*Aquila audax*), Whistling Kite (*Haliastur sphenurus*), Swamp Harrier (*Circus approximans*) and Collared Sparrowhawk (*Accipiter cirrocephalus*) (at External et al. 2006). Nests may also be built in neighbouring trees within the colony, usually less than 50 m from other nest trees (at External et al. 2006; NRA 2006). On occasion, an outlier may be up to 250 m from the main colony (at External 2007; NRA 2007b).

The minimum area of nesting habitat required to sustain a viable breeding colony is unknown (NRA 2007). Most known nesting colonies are connected to larger areas of remnant vegetation. Following observations of a single colony on the Townsville Coastal Plains, it has been suggested that a minimum remnant habitat patch of 40–50 ha within 500 m of a nesting colony may be required for that colony to remain viable, at least in the short-term (NRA 2006; NRA 2007). Nests are typically constructed from grass stems with a feather or plant down lining (at External et al. 2006; NRA 2006).

The breeding season is an opportunity for BTF populations to recover from losses that may have been sustained during the dry season / early wet season (when resource bottlenecks occur as grass seed supply is low). During the breeding season, parents first need to gain sufficient body condition to breed

and, then, once the young have hatched, be in a condition in which they can forage for both themselves and their young. Activities or events that reduce resource availability during this time may reduce reproductive success. If breeding success is unable to off-set mortality over consecutive years then population declines and, ultimately, local extinctions will occur (at Extern 2011).

2.6 Summary of project surveys

There have been numerous surveys undertaken between 2010 and 2018 to assess the distribution and abundance of BTF within the project area (**Table 1**). This work, conducted as part of the EIS studies and as baseline surveys required by conditions of approval for the Project, is the most comprehensive effort to quantify distribution and abundance of the species across a defined area. Previous surveys conducted across the Project area incorporating or focussed on the BTF are summarised in **Table 1**. Collectively, these surveys provide baseline data to assist with reporting on life history, movement patterns, habitat requirements and population dynamics (see Condition 18a of EPBC 2010/5736).

In order to standardise reference to the wet season and dry season for BTF monitoring in the project area, the following definitions have been developed in consultation with regulatory agencies:

- Wet season: December to March inclusive
- Dry season: April to November inclusive

This allows the standardisation of previous monitoring to an allocated season, to assist with data analysis.

Table 1 Summary of BTF surveys undertaken for Carmichael Mine

Survey period	Assessment process	Consultant	Methodology
Dry season 2012 (May 2012)	BTF survey for EIS	GHD	Water source watches: nine separate sites for almost 28 person hours over a 3-day period. Three of the sites were surveyed twice over two days and the remainder of the sites were surveyed once. Survey effort at each site varied from 90 minutes to 288 minutes. Remote camera traps: nine camera traps deployed at water sources to monitor use by BTF. 2 hectare plots: thirty one 20-minute searches conducted within the study area with a total of 21 person hours.
Dry season 2013 (May 2013)	BTF monitoring survey for SEIS	GHD	Water source watches: a total of eight sites by at least two people and up to four. Included at least one person watching for the full duration of the watch and one person surveying the surrounding habitat (600 m radius of water source). Remote camera traps: twenty remote camera traps deployed at water sources to monitor use by BTF. 2 hectare plots: two 20-minute searches of 2 hectare plots were conducted at fifty-two sites located throughout the study area.
Dry season 2013 (October 2013)	BTF monitoring survey as additional information to EIS	GHD	Water source watches: a total of 16 sites by at least two people and up to four, and included at least one person watching for the full duration of the watch and one person surveying the surrounding habitat (600 m radius of water source). Remote camera traps: seventeen remote camera traps deployed at water sources to monitor use by BTF. 2 hectare plots: two 20-minute searches of 2 hectare plots were conducted at sixty-seven sites located throughout the study area.

Survey period	Assessment process	Consultant	Methodology
Wet season 2014 (December 2014)	Baseline BTF monitoring survey to meet approval conditions	Niche	<p>Water source watches: a total of ten sites where 1 x three hr early morning (i.e. starting from sunrise) and 1 x one hr late afternoon (i.e. between 1500 hrs and 1830 hrs) water source watches were undertaken. Each water source watch was accompanied by a simultaneous habitat search in a 600 m radius of the water source.</p> <p>Remote camera traps: eleven remote camera traps were deployed at water sources to monitor use by BTF.</p> <p>2 hectare plots: Fifty-two 20-minute searches of 2 hectare plots were surveyed using the same BA (2012) methodology as the October survey and an additional 42 supplementary 20-minute searches of 2 hectare plots were established.</p>
Wet Season 2015 (March 2015)	Baseline BTF monitoring survey to meet approval conditions	Niche	<p>Water source watches: a total of 21 sites where 1 x three hr water source watches were undertaken during the three hours immediately after first light. Searches of areas within a 600 m radius of water sources were conducted at nine sites.</p> <p>Remote camera traps: Four remote camera traps were deployed at water sources to monitor use by BTF.</p> <p>Slow drive transects with call playback stations: incorporated into the methodology in this survey to replace the 20-minute searches of 2 hectare plots used in previous surveys to systematically sample a larger area for monitoring movement and habitat use. Slow drive transects were undertaken at 29 sites with 111 call playback stations totalling 20.4 hours of call playback.</p>
Dry Season 2015 (August 2015)	Baseline BTF monitoring survey to meet approval conditions	Niche	<p>Water source watches: a total of 23 sites where 1 x three hr water source watches were undertaken during the three hours immediately after first light. Searches of areas within a 600 m radius of water sources were conducted at 13 sites.</p> <p>Remote camera traps: Three remote camera traps were deployed at water sources to monitor use by BTF.</p> <p>Slow drive transects with call playback stations: Slow drive transects were undertaken at 26 sites with 108 call playback stations totalling 18 hours of call playback.</p>
Dry Season 2016 (April 2016)	Baseline BTF monitoring survey to meet approval conditions	Niche	<p>Water source watches: a total of 25 sites where 3 hr water source watches were conducted at each site immediately after first light. Searches of areas within a 600 m radius of water sources were conducted at seven sites.</p> <p>Remote camera traps: Four remote camera traps were deployed at water sources to monitor use by BTF.</p> <p>Slow drive transects with call playback stations: Slow drive transects were undertaken at 28 sites with 128 call playback stations totalling 21.3 hours of call playback.</p>
Dry Season 2016 (October 2016)	Baseline BTF monitoring survey to meet approval conditions	ELA	<p>Water source watches: a total of 16 sites were surveyed for 6 hr immediately after first light. Searches of areas within a 600 m radius of water sources were conducted at all 16 sites.</p> <p>1 km transects: Five 1 km transects were also undertaken during active searches.</p> <p>Remote camera traps: Five remote camera traps were deployed at water sources to monitor use by BTF.</p> <p>Slow drive transects with call playback stations: Slow drive transects were undertaken at 19 sites with 57 call playback stations totalling approximately 9.5 hours of call playback.</p>
Dry Season 2017 (November 2017)	Baseline BTF monitoring survey to meet	E2M	<p>Water source watches: a total of 14 sites were surveyed for 6 hr immediately after first light. Searches of areas within a 1 km radius of water sources were also conducted.</p>

Survey period	Assessment process	Consultant	Methodology
	approval conditions		Remote camera traps: Five remote camera traps were deployed at water sources to monitor use by BTF. Slow drive transects with call playback stations: A total of 37 slow drive transects were conducted, with 60 call playback stations. Two bioacoustics recorders were deployed for the purpose of developing acoustic recognition tools for BTF.
Dry Season 2018 (April 2018)	Baseline BTF monitoring survey to meet approval conditions	E2M	Water source watches: a total of 11 sites were surveyed for 3 hr immediately after first light. A total of 67 active searches were conducted for a period of 30 to 60 mins. Remote camera traps: Five remote camera traps were deployed at water sources to monitor use by BTF. Slow drive transects with call playback stations: A total of 12 slow drive transects were conducted, with 36 call playback stations. Two bioacoustics recorders were deployed at water sources within the study area.

Surveys undertaken for the Project have adopted a variety of methods including timed fixed point water source watches, habitat searches in the immediate vicinity of the water sources (600 m radius), 2 ha area searches, slow drive line transects with defined call playback stations and opportunistic observations gathered whilst traversing the Project area. Slow drive transects have generally been found to be an ineffective method of conducting surveys for the species, when compared with other methods.

The results from 10 targeted BTF surveys have consistently recorded moderate to large numbers of BTF (**Table 2**). The largest aggregate total of BTF records during these surveys was 1,145 during the August 2015 survey. Variation in observations between the nine surveys is likely to be due to varying survey effort, locations and methodology rather than a trend population size. Collectively these survey results indicate that the Project area provides high quality habitat for the species and that BTF are consistently present.

Table 2 Summary of BTF survey results

Survey	Aggregate total	Number of sightings	Minimum flock size	Maximum flock size	Mean flock size	Number of nests
Dry season 2012 (May 2012)	97	10	1	30	9.7	0
Dry season 2013 (May 2013)	276	26	1	41	10.6	3
Dry season 2013 (October 2013)	84	12	1	31	7	0
Wet season 2014	320	40	1	40	8	6

Survey	Aggregate total	Number of sightings	Minimum flock size	Maximum flock size	Mean flock size	Number of nests
(December 2014)						
Wet Season 2015 (March 2015)	600	108	1	50	5.6	5
Dry Season 2015 (August 2015)	1,145	120	1	36	10.5	5
Dry Season 2016 (April 2016)	431	124	1	32	3.5	5
Dry Season 2016 (October 2016)	610	82	1	30	7.4	8
Dry Season 2017 (November 2017)	390	70	1	100	not reported	13
Dry Season 2018 (April 2018)	846	138	1	40	4 (median)	15

Monitoring results indicate that the Project area, particularly the northern portion of Moray Downs, has consistently supported a large and relatively abundant population of BTF. This part of the Project area, referred to as Ten Mile Bore (in the north-west of the mining lease), appears especially favourable for the BTF due to the combination of large areas of grassy *Eucalyptus melanophloia* open-woodland and reliable water sources.

Areas north of the Carmichael Road in the far west of the Project Area (Four Mile Bore and surrounds) are also favourable, though the numbers of birds are generally lower than around Ten Mile Bore. In addition, large numbers of BTF have been recorded during surveys to the south of the Project Area at a large dam on Lignum Station. The floristic composition and structure representative of the area surrounding this large dam is also consistent with the vegetation assemblages shown to support BTF foraging and nesting habitat to the north.

The key findings from the monitoring surveys include:

- Aggregate BTF totals have ranged from 84 to 1,145 with an average of 480. Dry season surveys have generally yielded the largest aggregate totals (1,145, 846 and 610 in 2015, 2018 and 2016 respectively), with a wet season survey in 2015 yielding 600.

- Surveys to date have focused on the mining lease where the greatest aggregates have been recorded, in particular in the northern area of the mining lease and around Four Mile and Ten Mile bores.
- The 2016 dry season survey included the greatest survey effort within the Moray Downs West offset area to date where an aggregate total of 151 BTF were recorded from 14 locations.
- Monitoring surveys have identified a strong association between BTF records and vegetation communities dominated by remnant RE 10.5.5a *Eucalyptus melanophloia* open woodland on sand plains (Niche 2016a; ELA 2017a). BTF have also been recorded in four other RES (10.3.6ax1, 10.3.13a, 10.5.1a and 10.5.1d).
- The majority of BTF records have been identified during waterhole surveys with this survey method accounting for 37% of the aggregate total in the October 2016 dry season survey (ELA 2017a).
- Foraging BTF have been predominantly observed in woodland or open woodland dominated by *E. melanophloia* with a mean canopy height of 12 m. Areas used for foraging were characterised by sparse to mid-dense ground cover with a mean ground cover recorded of 40%. Grass species diversity at foraging sites was high with a mean grass species richness of 8. Exotic grass cover is typically less than 5 %The species recorded are typical of grassy woodlands of the bioregion, of which the Project area supports some high quality examples (Niche 2015a).
- Based on the data available for dry season, it appears that in dry conditions, records are concentrated in the central-north and central-south areas of the Project area where large stretches of suitable habitat are present and water sources were available at the time of survey (Niche 2016a; ELA 2017a). In particular, large numbers were recorded during the August 2015 BTF monitoring survey in the vicinity of the large dam on the Lignum property (CWAT111), the dam at CWAT03, Four Mile Bore (CWAT99), #2 Dam (CWAT117), the Turkey Nest dam at Ten Mile Bore (CWAT01B) and troughs at Lignum (CWAT110B) and Carmichael Bore (CWAT118) (Niche 2016a).
- A total of 60 BTF nests have been identified during monitoring surveys to date. This includes 15 nests that were found during the 2018 dry season survey which is the largest number to date (E2M 2018).
- A pair of BTF were observed during the 2016 dry season surveys preparing a nest within the outer-branches of a Silver-leaved Ironbark. This tree was approximately 14 m in height and within remnant RE 11.5.5.a.
- Surveys have identified preferred foraging habitat to consist of a grassy understorey with a mosaic of patches of dense grass with open bare patches containing a diversity of native grasses.
- BTF have been observed foraging on seeds of at least nine grass species as well as the woody shrub *Stylosanthes scabra* within the Project area (GHD 2012; Niche 2016; ELA 2017a). Another two grasses have been identified as potential foraging species (GHD 2012).

2.7 Other Relevant Documents

Several other documents provide relevant information regarding the ecology of the BTF as well as recommended survey and assessment techniques and management measures.

These include:

- National recovery plan for the BTF southern subspecies *Poephila cincta cincta*. Report to the Department of the Environment and Water Resources, Canberra (BTF Recovery Team, 2007);

- Significant impact guidelines for the Endangered BTF (southern) (*Poephila cincta cincta*) - EPBC Act policy statement 3.13 (Department of the Environment, Water, Heritage and the Arts (DEWHA), 2009);
- Threat abatement plan for competition and land degradation by rabbits (DEWHA, 2008); and
- Commonwealth Listing Advice on Southern BTF (*Poephila cincta cincta*) (Department of the Environment, 2005).

3 Research scope and objectives

3.1 Scope

The scope of the Research Program is limited to the population/s of BTF occurring primarily on the Project area (i.e. the mining lease and Moray Downs West offset area) and immediately adjacent properties (subject to landowner consent). The research will focus on answering key questions that are relevant for the management and conservation of the BTF population/s occurring in this vicinity, in the context of the Project. The aim of the Research Program is to support management actions that will prevent any declines in the BTF population or habitat quality on the Project area, caused by the mine, land clearing and general degradation to the regional landscape due to this change in land use.

It is envisaged that the outcomes of this research will also be applicable for the management and conservation of BTF (southern) throughout its range and in particular, to the conservation and recovery of populations occurring within the Galilee Basin including the Desert Uplands Bioregion and the southern portion of the Northern Brigalow Belt Bioregion.

Much of the contemporary knowledge of BTF and recommended management measures are based on studies undertaken on the Townsville Coastal Plains population. Given the difference in habitats between the Project area and the Townsville Coastal Plains, it is likely that there will be some differences in the ecology and biology (e.g. key grass species in diet), due to the contrasting nature of the two locations. Overall, core facets of the ecology of the two populations will overlap. However, the degree and nature of the threats to each population will be different, as might be their response. As a result, there may be synergies and differences in management measures for these different populations.

3.2 Objectives

The objective of the Research Program is linked to conditions of approvals and involves determining the critical ecological requirements for the BTF. The research is focussed on the spatial and temporal movement patterns, habitat requirements and population dynamics, dietary requirements, home range and nesting requirements for the BTF as well as the relationship between water sources, woody habitat and food sources. The research will also aim to determine the species response to grazing management, fire management and water body locations within the mining lease area and approved offset areas, to facilitate appropriate management of these areas.

The results of the research will inform and improve management and mitigation measures adopted for the Project to minimise impacts to the local population of BTF as well as enhance habitat within the Moray Downs West offset area in such a way to increase the carrying capacity for BTF in these areas. The Research Program will establish whether Ten Mile Bore and surrounding areas are high value habitat for BTF and establish management actions to maintain the current BTF population in this area.

3.3 Application of research for BTF management

The research aims have been developed to further the understanding of the ecology of the BTF, and more specifically, the relationship with land management activities that can be applied on the Project area. Management actions, and the research and monitoring that provide information for the management, will be based largely on three main themes – grazing management, fire management and water management. These will be reviewed and, if required, expanded depending on the outcomes of the research and monitoring, incorporating new knowledge regarding the ecology of BTF within the Project area. The data collected will avoid where possible, minimise and mitigate any impacts on BTF throughout

the development, operation and decommissioning of the mine, as well as preserve the BTF populations on the offset areas.

3.3.1 Grazing management

BTF can persist in pastoral landscapes even though Maute (2011) demonstrated that birds on pastoral lands had higher stress levels than birds on conservation lands. The abundance of BTF and the viability of their populations, however, are likely to be influenced by the intensity of the grazing, which can range from heavy to absent within the Project area. The key effects of grazing can be direct – the reduction or homogenisation of the composition and structure of the ground layer and woody layer, or indirect – clearing, changes to the fire pattern through reduction in fuel loads or promotion of woody thickening.

Small scale experimental trials will be implemented with the aim of identifying appropriate grazing strategies for managing BTF habitat, especially within the Moray Downs West offset area. Research will assist in understanding how absent, low and high cattle stocking densities and different grazing strategies (e.g. wet season resting) effect ground cover and grass composition (positively or negatively).

The trials will aim to identify the optimal grazing strategy for maintaining good condition BTF habitat that incorporates important food resources, including diversity and cover of preferred grass species as well as adequate seed output.

3.3.2 Fire management

Fire is a natural component of tropical savanna woodlands where the BTF occurs. European settlement and the removal of traditional fire practice, has caused a shift in some areas to frequent, extensive and high intensity fires in the dry season. In other rangelands in Queensland, fire is actively excluded and grazing of stock prevents wildfire from occurring. Both these circumstances result in shifts in the ground cover and woody composition and structure, which can in turn degrade BTF habitat.

However, judicious use of fire, and natural patterns of fire are important for recovery and germination of many grasses, especially if associated with rainfall. Alternatively, heavy grazing, that alters the ground cover composition, that is also burnt regularly, can shift the dominance from perennial tussock grasses and spinifex, to annuals and species that benefit from modification to habitat removed at External Review 2007, removed at External Review 2012).

Many finches, including the BTF will forage on recently burnt country, due to the availability of fallen seed. However, the relationship between local and landscape fire regimes, BTF foraging patterns and the long-term impact on food resources available to birds is not well understood. Inappropriate fire regimes (i.e., frequent, large) may impact on the quality of BTF habitat by affecting the production of seeds, reducing the cover and diversity of grass species and causing a decline in food availability. Conversely, fire exclusion can lead to thickening of woody shrubs, decreasing the quality of BTF habitat. Therefore, as is the case elsewhere in tropical savanna, regular, low intensity (late wet season), small patchy fires may be beneficial to BTF removed at External Review *et al.* 2001).

At the Project area, there are several potential impacts from fire that need to be considered in the Research Program, namely;

- Large scale wildfire that can reduce, homogenise and change the ground cover from preferred food species, especially at key periods in the dry season and just after the wet season (when grass curing is sufficient) can destroy significant seed sources on the ground;
- The combination of drought (long periods of rainfall deficit) in concert with poor fire management can reduce habitat and food resources.

Research will include a detailed analysis of fire history across the Project area to ascertain the frequency and intensity of fires within BTF habitat across the Project area and the relationship with recorded distribution and abundance. Fire management and manipulation trials will then be considered for implementation and include careful small scale testing of fuel reduction burns and different spatial and temporal approaches to fire management. However, fire management trials will need to consider other management strategies and BTF research methods as well as safety and asset protection.

3.3.3 Water sources

BTF need to drink water on at least a daily basis and drink more frequently during the dry season (DEWHA 2009). The importance of water to BTF is highlighted by the fact that they typically nest and breed near water. When breeding, regular water is essential, whereas when the BTF are not with young, they can be more mobile across the landscape. Within the Project area this is demonstrated with 68% of BTF records in grassy woodlands within 3 km of known water sources. However, the absence of water may preclude BTF from areas that otherwise provide suitable habitat and conversely, the addition of water may increase the area of suitable habitat that is available.

Though the data are limited, the “3 km waterhole limit” proposed as a factor in determining BTF habitat, is likely to be very conservative, as BTF are known to disperse up to 15 km, and in the wet season, they utilise small water sources. Granivorous birds in general can travel large distance between water points and foraging sites.

BTF surveys and monitoring within the Project Area have identified the species ability to utilise natural and artificial water sources. During these surveys they have been regularly observed to drink from cattle troughs, dams and ‘turkey nests’. Conversely, other surveys (GHD 2012) have indicated that when it has rained or it is the wet season, BTF disperse and utilise ephemeral water sources (e.g. drainage lines, puddles) to access and utilise other feeding areas.

A key management strategy for the Moray Downs West offset area is to provide additional water sources within areas of suitable woodland habitat for BTF. They will be installed throughout the offset area at locations greater than 3 km from existing water sources.

Artificial water sources will initially be installed in several locations of the Moray Downs West offset area. Research will assess the response of BTF to new water sources and the effectiveness of this strategy by identifying the following:

- Ability to attract BTF
- Frequency of use by BTF
- Change in usage of nearest water sources
- Proximity to existing vegetation especially trees / shrubs

4 Proposed research methods

4.1 General requirements

The BTF Research Plan presented here provides a framework for the proposed work. The successful implementation will be enhanced by engagement with and involvement of BTF specialists in the detailed design, planning and implementation of research activities. Adani will consult with suitably qualified and experienced professionals to finalise the design of scientific studies through detailed project plans, implement research programs and complete associated reporting. These professionals will comprise experts in bird research and ecology, and may be sourced from research institutions, government agencies, consulting firms and the wider community.

On commencement of Project Stage 2, Adani will commence appointing a research team and will finalise appointments within 3 months of commencing Project Stage 2 activities. The first step of implementation by the research team will involve development of a detailed project plan for each aim (Section 4) of the Research Program. The project plans will be consistent with the objectives, method, environmental variables, resources and timing of research actions described in Section 4.3 to 4.6. Expert advice will inform the project plans for each aim, with a focus on the statistical design of surveys, refinement of monitoring site locations and timing and duration of field activities. Project plans for each research aim will be completed within 6 months of commencing Project Stage 2 activities and will be provided to DES for comment and approval, prior to implementation.

The Research Program and Management Plan will be reviewed regularly, with the input of specialists in accordance with Condition 17 of the EA. Specifically, the documents will be reviewed annually by an appropriately qualified person and revisions of the survey and monitoring program must be carried out in consultation with the BTF Recovery Team. Any revisions must be independently peer reviewed. An annual report of research findings and the results of the independent peer review will be provided to DES.

Engagement of personnel to implement the Research Program will be in accordance with Adani's purchasing procedures, and involve a financial commitment of five years (see Section 5.1). A timetable for implementation is included in **Figure 2**. Findings of the Research Program will be reported through the annual reporting process and will inform improvements in BTF survey methods and management of BTF and their habitat. An independent review will be completed annually, to provide further scientific rigour and inform the adoption of research findings into management actions.

Adani is working with other stakeholders of the Galilee Basin to develop a Bioregional BTF Management Plan. Information derived from the Adani BTF Research Plan will inform the development and implementation of the broader Bioregional BTF Management Plan. This approach will facilitate future management of BTF at the regional scale, informed by the findings of Research Program activities.

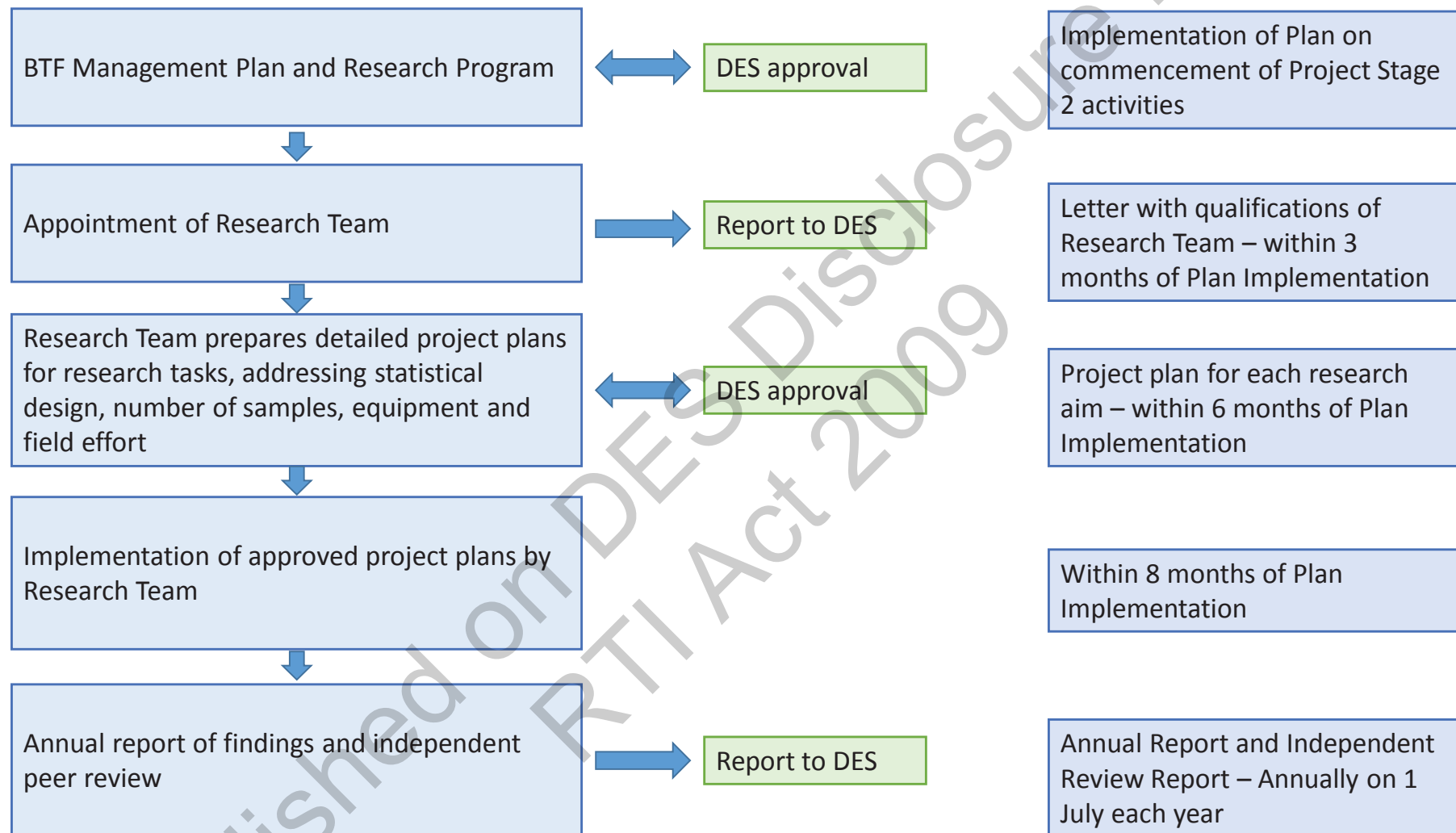


Figure 2 Timetable for implementation of the BTF Research Program

4.2 Approach

The research will build upon existing work that has occurred, such as that undertaken in the Townsville Coastal Plain population (e.g. [ed at External 2016](#)). However, some of the approaches will differ at the Project area, due to the different environment and threats that are present in this location (e.g. mine development, fire and grazing). The Research Program will follow two broad approaches:

- Local monitoring, observational and experimental work, that in part links to the existing monitoring that has been on-going since 2012. The aim of this component of the monitoring is to undertake repeated and systematic surveys of BTF distribution and habitat at the Project area, which investigate responses to management, and provide data on distribution, habitat and diet. This research will link to the BTF Management Plan and investigate:
 - o Habitat preferences, local habitat use (i.e. hot spots), preferred habitat structure and vegetation composition, diet, nesting sites and reliance on mixed species flocks
 - o Temporal variation in habitat use
 - o Coarse population estimates and any spatial and temporal variation in numbers
 - o Response to land management effects (i.e. grazing, fire, weeds, water array)
- Detailed, more intrusive research of BTF via the capture, banding, radio-tracking or GPS collaring of birds. This research will complement the observational and experimental work (and overlap via monitoring of banded birds) and will investigate:
 - o habitat use, home range sizes, fine scale distribution changes over seasons,
 - o the genetic status of the local population and physiological health of the BTF populations over time and especially in times of resource bottlenecks
 - o diet via crop analysis.

The two components of the Research Program will utilise data collected through the BTF monitoring program and link these to the BTF Management Plan.

The relationship between water sources, woody habitat and the BTF food sources within the mining lease area and approved offset areas, and the inter-relationships among these factors, will be determined through a synthesis of Aims 2 and 3 (Sections 4.4 and 4.5). This work will achieve compliance with Condition 18 of the EA.

4.3 Aim 1: Estimate the home range and movements of BTF in the Project Area

To manage the population of BTF occurring in the Project Area and surrounding landscape, it is important to understand their movements (spatially and temporally) and local population dynamics. BTF is thought to be a sedentary species with home ranges in the Townsville Coastal Plain identified to be small (ranging from 25.15 ha to 120.88 ha [ed at External 2016](#)). However, it should be noted that this environment is more fragmented, and diverse than the Project area, with more available water supplies. Despite the small home ranges, some individuals were recorded to move relatively large distances (>15 km; [ed at External 2016](#)), suggesting that their home range over the course of a year may be much larger.

To estimate the home range and movements of BTF in the Project Area, a number of methods will be employed and are described below. Radio-tracking and banding will require the capture of birds by mist-netting to allow for radio transmitters and bands to be attached to birds (**Table 3**). GPS collaring technology should also be considered, as this allows real time tracking of movement patterns of birds.

Table 3 Details of monitoring task – home range and movements

Objectives	Determine spatial and temporal variation in the movement patterns and home range of BTF in the Project Area.
Methods	Attach bands and radio transmitters to BTF captured by mist netting at multiple water sources across different seasons. Track the location of birds with radio transmitters, and conduct monitoring of individual birds with bands (re-sightings).
Environmental variables to be monitored	<p>Fine-scale spatial and temporal habitat use (i.e. daily and weekly patterns) and across the Project area.</p> <p>Fine-scale spatial and temporal diet shifts (Link to Aims 2 and 3).</p> <p>Home range and distances travelled between nesting, feeding locations, and watering sites over time and season (Link to Aim 2).</p> <p>Improved population estimates, including key locations such as Ten Mile Bore.</p>
Resources	During periods of mist netting and radio tracking, several personnel will be required to implement the research methods. Radio tracking tags of a suitable design, and associated equipment, will also be required. This project may be suitable for a PhD student or similar study.
Timing	Ongoing for three years following approval of the project plan. Field research activities to occur during different seasons to identify associated variability.

4.3.1 Radio-tracking

Radio-tracking of individual birds is the most effective way to gather detailed information on movement patterns. Information available from the Townsville Coastal Plain indicates that BTF may remain within a fairly confined area for extended periods of time.

Radio-tracking will be undertaken over multiple periods to account for seasonal variations (inter-year) and different years. The work will also be conducted at multiple locations across the Project Area (including Ten Mile Bore, Four Mile Bore and Lignum areas) to allow examination of local differences as well as relationships between sub-populations.

There are some constraints to the use of radio-transmitters. First, given the small size of devices (<5 g) suitable for small birds, the equipment has a short field life (ca. 2 weeks or less) before batteries expire. If most movements of BTF in the Galilee Basin region are relatively short-distance (an hypothesis that is yet to be tested), radio-tracking of individuals is mainly likely to deliver information on movements within a "home range" and less likely to provide information on long-distance movements. As birds move further from the point at which they were first captured, there will be a lower probability that they can be relocated and increased effort would be required to relocate them. The application of GPS collar technology will be investigated as a means of overcoming these difficulties.

4.3.2 Banding

Some important questions can only be addressed if individual birds can be distinguished. These relate specifically to movement patterns at various scales. This is best done by leg banding in accordance with the Australian Bird and Bat Banding Scheme (ABBBS) guidelines. Banding of BTF has been successfully incorporated as a method in two previous studies, those of Kimberly Maute and Juliana Rechetelo (see Section 3). Only the study by Rechetelo, where banding was followed by an extended period of field

observation, provided data from resighting of banded birds. Birds will be trapped using mist nets and banded by qualified operators in line with the ABBBS and Queensland guidelines.

Banding will provide a capacity to identify individual birds. It will be necessary to spend sufficient time in the field to provide re-sightings of these known individuals. It should be noted that it is often difficult to read the leg bands of BTF but the work of Juliana Rechetelo near Townsville indicates that very useful information can be gathered by this means. Records of re-sightings will provide information on movement patterns and some indication of longevity.

Banding should be undertaken at multiple sites (e.g. $n = 10$) with large numbers (e.g. a total of 50 birds) banded at each location if possible. Given the mean flock size of <11 birds (**Table 2**), this will require the capture of several flocks at each site. This will provide a reasonable chance that individuals may be resighted and the prospect of information on the regional connectedness of different sub-populations. Banding has the advantage that large numbers of individuals can be marked simultaneously, something that is probably not possible with radio-tracking unless there is an enormous investment in labour to allow frequent relocation of individuals.

4.4 Aim 2: Determine the foraging and breeding habitat requirements and the relationship with vegetation structure and composition and water

Guidelines and information for the identification, description and management of BTF are currently largely based on studies undertaken in the Townsville Coastal Plain population. BTF records occur across at least 21 Regional Ecosystems (Vanderduys *et al.* 2016). Within the Project Area there is a strong association with *Eucalyptus melanophloia* open woodlands (RE 10.5.5a), and the adjacent *E. brownii* (10.3.6) and *E. simillis* (10.5.1) woodlands. However, BTF records are not uniformly distributed throughout this habitat, with large areas of 10.5.5 habitat in the east seemingly unoccupied. This is related to grazing history, clearing and habitat quality.

In order to manage and minimise the impacts on BTF within the Project Area, it is important to have a strong understanding of the specific requirements for breeding and foraging habitat within the large areas of *Eucalyptus melanophloia* open woodland habitat. This will require continued analysis of the structure and composition of vegetation where BTF consistently occur, feed and breed, as well as the proximity to water, foraging and nest locations (**Table 4**).

Table 4 Details of monitoring task – foraging and breeding habitat

Objectives	Identify and describe the breeding locations of BTF in the Project area. Describe the characteristics of foraging habitat utilised by BTF within the Project area, spatially and temporally. Characterise the differences between identified BTF habitat and similar locations which are not used by BTF. Conduct a detailed botanical assessment at all BTF sighting locations, to determine the characteristics that make the habitat suitable. Establish whether Ten Mile Bore and surrounds are high value habitat for BTF. Determine the characteristics of Ten Mile Bore and surrounds that contribute to its frequency of use and compare this with other waterholes and woodlands, through equivalent frequency monitoring.
Environmental variables to be monitored	Landscape, habitat, floristic composition, cover and structure of breeding and foraging habitat (Link to Aims 1 and 3). Spatial and temporal distribution of landscape, habitat, floristic composition, cover and structure of breeding and foraging habitat. Spatial and temporal variation of BTF habitat in the Project area (Link to Aim 1).

Methods	Structured and well stratified search, surveys, census and count methods across the Project area (not biased to only known locations or waterholes), that build on the existing bird, habitat and vegetation methods (i.e., transects off road and random, repeated area searches, targeted transects and searches, standard quadrat methods, camera traps).
Resources	The primary resource for this task will be a suitably qualified individual or small monitoring team, or a well-defined student project.
Timing	Ongoing for three years following approval of the project plan. Results of monitoring will build as the task progresses and seek to achieve objectives by Year 4.

4.4.1 Breeding biology

Systematic searches of areas occupied during the breeding season will aim to locate nests and breeding colonies. As well as identifying nest locations, these surveys will aim to identify evidence of breeding activities including nest preparation, courtship, presence of juveniles and feeding. This will aim to determine the timing and conditions of breeding and, in conjunction with habitat descriptions and floristic surveys described below, the factors governing nest site selection and breeding success for the local BTF population. These surveys will also aim to distinguish between nests that are being used for breeding and those that are being used for roosting.

4.4.2 Habitat description

The systematic monitoring program that is being conducted within the Project area aims to provide information on distribution and abundance of birds. It also aims to provide some capacity to relate distribution and abundance to environmental variables by being linked to habitat descriptions. This will operate at both coarse and fine scales. At the coarse scale it will help identify which broad vegetation types (i.e. Regional Ecosystems) are being utilised by BTF. At the finer scale, it can help determine what constitutes favourable foraging habitat. The vegetation of feeding locations identified during the monitoring program will be described in terms of herbaceous species composition, herbaceous biomass and plant community structure. It will be important to document vegetation characteristics at the time foraging is observed and provide a basis for maintaining quality foraging habitat.

Surveys undertaken as part of the Research Program will collect similar information where BTF are recorded. Regional Ecosystem and vegetation data collected during the management plan monitoring and Research Program will be analysed to determine key habitat factors for breeding and foraging. Potential correlations between water source, woody habitat and Poaceae food resources across the Project area will be examined, to determine the interrelationships between these factors.

4.4.3 Floristic surveys

Floristics of sites provide understanding of habitat requirements. The floristics of the tree, shrub and ground strata will be described at sites that are regularly used by BTF, as well as at random sites where no BTF have been recorded. Vegetation survey sites will cover the Project area including Moray Downs West offsets areas and where possible, neighbouring properties. A detailed botanical assessment will occur at all BTF sighting locations in the Project area.

These surveys will aim to provide a greater understanding of the vegetation characteristics of foraging and breeding sites with regard to species composition and structure of all vegetation strata. By quantifying

abundance of different grass species, this task aims to help determine some of the resources exploited by the birds and how those resources vary seasonally and spatially. Floristic data in the vicinity of nest sites will help relate breeding success to essential foraging resources. Floristic data could also be used to assess the effectiveness of management carried out to improve habitat quality.

This data will be collected by transects and plots to determine the following characteristic of BTF foraging and breeding habitat:

- Canopy species and relative abundance
- Canopy height
- Canopy crown cover
- Shrub species, height and cover
- Ground layer and grass cover
- Ground layer and grass species and individual percentage cover
- Percentage cover of bare ground and organic material
- Weed cover.

An example of the data sheet proforma relating to floristics surveys is provided in Appendix A.

4.4.4 General field observations

General observations of BTF ecology and behaviour will be made during the collective research and monitoring programs. These observations include locations of BTF, flock sizes, nest locations, and phase of breeding cycle. They also provide a basis for relating distribution and abundance to landscape and regional scale patterns of vegetation and other environmental variables. Call playback will be utilised during monitoring programs, and all birds present will be identified when BTF are encountered.

4.5 Aim 3: Determine the dietary requirements for BTF in the Project Area

Knowledge of BTF diet is mostly based on studies undertaken in the Townsville Coastal Plain population. Observations during BTF monitoring in the Project area has provided some evidence of diet within this population. However, observations have also identified some apparent preferences in composition of the ground layer which differ from the Townsville region. For example, studies in the Townsville Coastal Plain revealed that BTF were generally not recorded in patches dominated by *Heteropogon contortus*, *Themeda triandra* and *Aristida* spp. (at Exter 2007), which are all common species at BTF foraging sites within the Project area.

Seasonal variation in grass availability is an important factor in identifying important BTF habitat and for the management of these areas to improve habitat value of offset areas. Surveys within the Project area have recorded BTF foraging on at least eight grass species (ELA 2017a) including:

- *Enteropogon ramosus* (GHD 2012)
- *Paspalidium rarum* (GHD 2012 and Niche 2016)
- *Schizachyrium fragile* (GHD 2012)
- *Digitaria ciliaris* (Niche 2016)
- *Setaria surgens* (ELA 2017b)
- *Cymbopogon bombycinus* (ELA 2017b)
- *Triodia pungens* (ELA 2017b)
- *Eriachne mucronata* (ELA 2017b).

There are several methods to determine important food resources of BTF within the Project area as described in **Table 5**.

Table 5 Details of monitoring task - diet

Objectives	Collect further data on the dietary requirements and foraging preferences of BTF within the Project area.
Environmental variables to be monitored	Species of grasses on which BTF are observed to be feeding (Link to Aims 1 and 2). Spatial and temporal variation in the locations where BTF are feeding (Link to Aims 1 and 2). Variation in food resources used seasonally (Link to Aim 1).
Methods	Direct observation of feeding behaviour. Sampling of seeds from the crop of birds (during mist netting). Well stratified collection and analysis of seeds from the ground where BTF are observed, or randomly near nests or areas identified where BTF are regularly sighted (Link to Aim 2).
Resources	Personnel experienced in the collection of seeds from the crop of birds.
Timing	Ongoing for three years following approval of the project plan.

4.5.1 Direct observation

Direct observations may allow a definitive determination of diet where birds are observed foraging by removing seeds from the inflorescences of grasses which can then be identified, or where birds are observed feeding on distinctive seeds on the ground.

Observations of birds feeding from seeds on the ground may also indicate food resources by identifying grass species in these locations. However, this assumes a close correlation between the composition of the grasses and BTF diets, but may not accurately represent the seed species the birds are feeding on.

4.5.2 Crop sampling

Extraction of samples from the crops of birds that have recently been feeding and identification of the seeds to species level is another definitive method to determine BTF diet. This would need to be done in such a way that there was minimum risk to the individual birds and in line with the requirements of animal ethics approvals. Laboratory analysis of seed material would be required to determine the species of each seed type.

4.5.3 Seed collection and analysis

Observations will be taken of precisely where birds are feeding on the soil surface, followed by gathering of surface soil samples from which seeds can subsequently be extracted and then identified to species level. This approach assumes a close correlation between the composition of surface soil samples and finch diets, but may not accurately represent the seed species the birds are feeding on. Laboratory analysis of seed material would be required to determine the species of each seed type.

This method is not as definitive as crop sampling but it less intrusive on birds.

4.6 Aim 4: Identify management strategies for BTF habitat in the Project Area regarding fire, grazing and water

This research aim requires careful identification of a research approach through expert consultation, prior to the commencement of any work, to avoid potential impacts on BTF. Broad-scale habitat manipulations should be implemented with a careful review of the existing landscape and management patterns on the sites, with respect to BTF distribution and abundance, and with reference to other research activities.

The link between fire, grazing, water distribution and habitat quality should be understood before any change in management is adopted to improve outcomes for BTF. There are several aspects of habitat that could be manipulated which vary in spatial and temporal scales, and which are interactive (**Table 6**). Weather patterns and extreme conditions (wet or dry) can severely affect the relative impact or effect of fire and grazing influences on habitat.

Table 6 Details of monitoring task – management strategies

Objectives	<p>Understand the relative effects of grazing, fire, water distribution and their interactions on BTF habitat, and the current spatial and temporal variation and impacts of these factors on BTF.</p> <p>Determine the effect of cattle grazing on BTF habitat by undertaking small scale experimental trials to understand how absent, low and high cattle stocking densities and different strategies effect ground cover and grass composition (positively or negatively).</p> <p>Determine the effects of various fire regimes on the quality of BTF habitat, and the best fire regimes to enhance or protect existing high quality habitat, under different weather scenarios.</p> <p>Determine the influence of establishing new artificial water sources on the utilisation of adjacent habitat by BTF, via cautious small-scale experimental trials.</p> <p>Use the information gained in these experimental trials to guide management actions that will maintain or enhance BTF habitat across the Project area, and in key, high priority BTF populations and locations (e.g. Ten Mile Bore and surrounds).</p>
Environmental variables to be monitored	<p>Plant species composition, biomass and seed output (for important BTF food sources).</p> <p>BTF abundance, distribution and use of habitat under existing grazing regimes, and small scale experimental trials or manipulations.</p> <p>Changes in BTF habitat in relation to fire frequency and inter-fire interval, fire intensity, the season in which fires occur and the extent (area) of individual fires, using existing data and small-scale manipulations.</p> <p>Presence and absence of BTF before and after the establishment of artificial water sources, and also in control sites.</p>
Methods	<p>Landscape scale review of existing information and spatial and temporal patterns with respect to fire, grazing and water distribution.</p>

	Design small scale experiments, with careful replication and BACI (before-after, control-impact) type design to test the effects of management manipulation on BTF habitat, abundance and distribution (Link to Aims 1 and 2). Monitor BTF habitat utilisation using remote cameras, census, observations and water source surveys (Link to Aims 1 and 2).
Resources	Infrastructure and planning associated with establishing new water sources. Operational resources and planning associated with varying fire regimes and grazing management approaches.
Timing	Ongoing for at least three years following approval of the project plan. Some aspects of the task will be seasonal (e.g. timing of planned burns).

4.6.1 Grazing regimes

BTF largely occur in pastoral landscapes even though [at Extern \(2011\)](#) demonstrated that birds on pastoral lands had higher stress levels than birds on conservation lands. The abundance of BTF and the viability of their populations in the Project area, however, are likely to be influenced by the historical and current grazing regimes.

There are three strategies to examining the effects of grazing on BTF:

- a thorough review of the patterns of BTF across the Project area, with respect to current and historical grazing patterns and pressures
- clear descriptions of the habitat and floristic patterns of paired sites that represent the same RE, but are lightly or not grazed, and more heavily grazed, and
- small scale experiments to test whether removal of cattle, wet season spelling or different grazing strategies can enhance features of the ground cover and composition important for BTF habitat, or whether cattle removal and the use of fire to promote grass growth is more effective.

Stocking densities for grazing trials could be determined in relation to documented stocking rates in the recent past (last ten years) on Moray Downs and the typical stocking densities for the district. These will be compared to the Queensland Department of Agriculture and Fisheries (DAF) recommended rates for commercial grazing in the area to determine stocking rates to be used in the trial. The use of cattle grazing to reduce grass biomass as a means of managing fire and / or opening the ground layer to facilitate feeding by BTF will also be tested. This may involve increasing stocking rates in areas of *Eucalyptus melanophloia* open woodlands where BTF are yet to be recorded and where the grass layer is dense.

Wet season spelling strategies to be tested include a six-week rest period over the wet season and incorporating the main seeding period of the native perennial grasses that BTF are known or thought to forage.

In conjunction with tests of specific grazing systems, detailed records will be kept of actual grazing regimes at the paddock scale to allow analysis of BTF utilisation.

A baseline research program will be established to determine whether Ten Mile bore and surrounds are high value BTF habitat. Ten Mile bore and surrounds is the area within a 3 km radius of Ten Mile bore.

During the baseline research program, the management of grazing will be based on existing pastoral management practices in accordance with land agistment agreements, pastoral holding lease conditions and associated legislation pertaining to pastoral management activities.

Adani will also complete annual BTF habitat vegetation assessments at approved monitoring locations in the vicinity of Ten Mile Bore during May to maintain and where possible enhance BTF habitat within the Ten Mile Bore area. Vegetation assessments will use methodologies described within 'Carmichael Coal Mine and Rail SEIS Report for Black-throated finch On-site Monitoring Survey 2' dated February 2014 to assess ground cover and ground composition based on Queensland BioCondition Framework (at Externat et al., 2011) and the Queensland Herbarium flora survey methods (at Externat et al. 2005).

Groundcover and species composition will be assessed annually against the baseline data (established in 2012/13) from when this Management Plan commences (each May). If the annual vegetation assessment demonstrates a loss of native perennial species and cover from baseline conditions, an investigative review will be completed and relevant corrective management actions will be taken to ensure the maintenance or enhance of these perennial pasture species. Corrective actions may include additional fencing or spelling of paddocks to control grazing, controlled grazing to reduce biomass levels, pest control (e.g. rabbits, weed eradication) and fire management. Monitoring and management actions for the Ten Mile Bore area will be reviewed and modified in line with baseline research program outcomes.

4.6.2 Fire regimes

Fire and cattle grazing are both consumers of fuels, and they interact in complex ways. For example, heavy grazing will reduce fuel loads and therefore reduce the likelihood and intensity of fire – thus causing impacts such as woody vegetation thickening, and the loss of key plant species reliant on fire for reproduction and vigour. Conversely, reduced grazing and increased biomass will increase the risk of large wildfire, removing ground cover, seeds and some species over time. The relationships are complex and variable depending on land use history, land type and long-term weather patterns. While it is apparent that BTF will forage on recently burnt country similarly to other threatened finches, it is not known how the fire regime affects the resources available to the birds.

Fire variables to be tested in experimental work include fire frequency and inter-fire interval, fire intensity, the season in which fires occur and the extent (area) of individual fires. This will initially require analysis of the historical fire for the Project area using available satellite imagery to determine any correlation between BTF utilisation and current fire history.

Trials of various fire regimes (generally small and low intensity fires) will then be undertaken in areas with dense shrub and ground layers, particularly within the Moray Downs West offsets area. Trials will aim to reduce the density of the understorey vegetation in selected areas to open up the ground layer and improve the quality of foraging habitat for BTF. Burning undertaken for the purposes of BTF habitat improvement will be implemented with caution with the input of experts, and involve intensive monitoring.

4.6.3 Water sources

Absence of water may impede BTF from utilising areas that otherwise provide suitable habitat, most notably in the dry season. In the wet season, BTF utilise small ephemeral water sources to access wider areas of the landscape, when many grass species that are preferred food sources are flowering and seeding. There is a hypothesis that the addition of water can therefore increase the area of habitat that is available to the BTF for longer periods. The effectiveness of this manipulation can be tested in terms of the characteristics of the water source provided and the capacity of added water sources to provide access to habitat.

BTF can use many different types of water sources. These include natural streams and springs, ephemeral surface water present immediately after rain, various in-ground structures (earth “tanks”, “turkey nest” dams) and cattle troughs. The addition of small but permanent water sources will be tested for their capacity to attract and support BTF and other granivores. They will be placed in areas that support suitable vegetation, that currently do not have permanent water sources (at least 3 km from water) but which are within 10 km of areas known to support the species.

Areas in the Moray Downs West offsets area are suitable for testing the effects of adding water to the landscape on BTF use. These artificial water sources will be designed to reduce the likelihood of attracting pigs or feral cats that might then prey on the BTF. Troughs should have water close to the lip and internal structures on which birds might perch whilst drinking. Any artificial water source should have trees and shrubs nearby (e.g. within 10 m) on which birds can shelter as they travel to water and use as an intermediate perch while accessing water. Where additional water sources are introduced in potential BTF habitat, utilisation will be assessed by appropriate monitoring methods including remote camera’s and waterhole surveys.

In order to ensure that the watering points in the Moray Downs West offset area do not interfere with research but also provide water for finches, the following actions will be delivered:

- maintenance of the existing seven water points in the Moray Downs West offset area, as per the Moray Downs West Offset Area Management Plan
- new artificial water sources will be installed in locations within the Moray Downs West offset area in accordance with this research program
- assessment of BTF responses to new water sources and their effectiveness
- results used to inform specific requirements and location of permanent artificial watering points
- permanent artificial watering points will be installed and adequately maintained within the Moray Downs West offset management area within the sooner of one year after the completion of the three-year research program, or five years after the commencement of mining operations.

5 Implementation

5.1 Time-line

An indicative time-line of research activities is provided in **Table 7**. It indicates major activities only and will need to be responsive to environmental, logistical, and regulatory factors. The Research Program will be implemented over 3 to 4 years, commencing after DES approval of project plans (**Table 7**).

Table 7 Timeline for research program

	Years after DES approval of project plans				
Monitoring Task	1	2	3	4	5
Home range studies					
Foraging and breeding requirements					
Dietary requirements					
Management strategies for BTF habitat					
Consolidation of research program results					

The research will be conducted in conjunction with implementation of monitoring and management plans for the Project.

5.2 Qualifications

The research proposed in this plan will be conducted by suitably skilled and qualified persons. This is defined as a person who has professional qualifications (such as environmental science, biology or ecology), training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis on performance relating to the subject matter using the relevant protocols, standards, methods or literature.

Adani will explore opportunities to work collaboratively with a university or similar institutions in implementing the Research Plan. This will assist in providing detailed and thorough work, under the technical supervision of a skilled senior researcher. Opportunities to leverage industry funding provided by Adani through research grant schemes will also be explored.

6 Reporting

6.1 Adaptive management

Adaptive management is a process of decision-making that deals with uncertainty and incomplete knowledge that evolves over time using systematic monitoring data to reduce uncertainty and improve future management objectives. Such a process incorporates learning from new data and improved management outcomes, and involves the development of strategic ecological and political consensus for contested management objectives (Holling 1973). Adaptive management emphasises the iterative feedback between the implementation of management actions and the assessment of their effectiveness via continuous improvement of knowledge via monitoring and evaluation of the monitoring data (Holling *et al.* 2012).

The concept of adaptive management aims to resolve many of the problems that have undermined previous attempts to establish long-term research and monitoring by recommending a sensible framework for monitoring. There are four key elements: (i) the requirement to pose tractable (flexible and evolving) questions; (ii) the need to employ a statistical design at the outset; (iii) the use of a conceptual model of the ecosystem or entity being examined; and (iv) acknowledgment that land managers need to know about ecosystem change.

The Research Program will follow this framework as it will:

- Address key questions regarding BTF ecology and distribution, for which data are systematically reviewed and used to refine the monitoring and management at the Project area, the potential impact on BTF during the Project construction, operation and decommissioning, and any offset sites;
- Employ appropriate regular review and analysis of the monitoring data, to refine the monitoring program and refine the Species Management Plan and associated management actions;
- Use a conceptual model for BTF life history and ecology, to underpin monitoring questions and implementation of the Species Management Plan; and
- Address the need by Adani, the Australian and Queensland Governments, and the wider community, to understand effects of the Project on BTF and how best to manage and mitigate these during the long-term operation of the Project.

The results of the research will be applied under this adaptive management framework and the BTF Management Plan will be updated in consultation between Adani, Commonwealth and Queensland Governments and researchers.

6.2 Reporting and scientific permits

Annual reports summarising the monitoring and Research Program's plans will be prepared and submitted by Adani on 1 July each year and will be made available to the Commonwealth and Queensland Governments. Where results of monitoring are likely to be of interest to the scientific community and/or the public, Adani will make relevant information available through appropriate means, such as the submission of scientific papers to peer-reviewed journals (e.g. scientific community) or the provision of research findings on the Adani website or within community newsletters.

All research will be conducted under the requirements of;

- a DAF Animal Ethics Approval to Use Animals for a Scientific Purpose which ensure that conduct of the Project is in accordance with AEC approval, the *Animal Care and Protection Act 2001*, the *Australian code for the care and use of animals for scientific purposes* (the Code) and all other relevant Commonwealth and State legislation. This approval requires the submission of all necessary reports, notices and advices as required by the AEC, and thus the Queensland Government.
- Scientific purposes permit under the *Nature Conservation Act 1992* which requires an annual report and return of all data collected under this permit to the Queensland Government, for lodgement on Wildnet.

Adani will share the findings of the research with the BTF Recovery Team for use and updating of the revised BTF Recovery Plan, of which a revised version is currently being prepared.

Where there are close links in objectives, monitoring activities implemented under the BTF Research Program will be integrated with those completed under the BTF Management Plan. This will provide for the integration of data for a variety of purposes, ranging from building baseline scientific information to informing Adani about the effectiveness of mitigation measures.

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Appendix A Floristics data sheet proforma

Site flora data collection

Date	Site ID	Time	RE	Canopy Species	Canopy relative ab.	Canopy min	Canopy max	Canopy av.	FPC%	Shrub species	Shrub relative ab.	Shrub av.	FPC%	Comments
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Quadrat ground cover data collection

Date	Site ID	Time	RE	Species1	Sp.1 Cover %	Tussock%	Hummock%	Bare Ground%	Litter%	Rock%	Comments
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Quadrat ground cover estimations data collection

Site Name	Structural Formation	Median Height (m)	Min Height (m)	Max Height (m)	Ecologically Dom. Layer	Basal Area (m ² /ha)	Native grass herb and forbs (%)	Woody shrubs and sub-shrubs (%)	Litter (leaf, twigs, grass etc) (%)	Litter (logs >10cm dia) (%)	Bare Ground (%)	Rock (%)	Check
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Structural Formations:

OW - Open woodland

W - Woodland

R - Regrowth (scattered shrubs/small trees)

OF - Open Forest

Rd – Road drain and immediate woodland grass edge

Gm - Grassland modified -cleared/heavily grazed

Gm - Grassland (natural)

Check percentages add together to equal 100



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Appendix D Compliance with Approval Conditions

A table demonstrating compliance with relevant approval conditions is provided on the following pages.

Published on DES Disclosure Log
RTI Act 2009

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
EPBC Act Approval, condition 5	At least three months prior to commencement of mining operations, the approval holder must submit to the Minister for approval Matters of National Environmental Significance plan/s for the management of direct and indirect impacts of mining operations on (MNESMP). Note: If the MNESMP does not address any specific future activities (e.g. possible additional seismic surveys or specific mining stages) it should be updated in accordance with Condition 33.	The BTF Management Plan was lodged on 11 May 2017. This plan addresses the management of direct impacts of mining construction and operations on the BTF. Specifically, management actions of direct impacts are located in Table 8. This plan addresses the management of indirect impacts of mining construction and operations on the BTF. Specifically management actions of indirect impacts are located in Table 9 and Table 10. If this management plan does not address any specific future activities (e.g. possible additional seismic surveys or specific mining stages) it will be updated in accordance with condition 33 of the EPBC Act approval.	Section 6.3.3 (Table 8) Section 6.3.3 (Tables 9 and 10)	
EPBC Act Approval, condition 6	The MNESMP must be consistent with relevant recovery plans, threat abatement plans and approved conservation advices and must include:	This plan is consistent with the BTF Recovery Plan. Threats identified in the BTF Recovery Plan are addressed specifically in Section 4.6 and Table 4. These threats include clearing and fragmentation of vegetation, degradation of habitat by stock and pest species, alteration of habitat by fire regime, invasion by exotic weeds including grasses and predation by introduced predators. Potential project impacts are discussed in Section 4.6. Monitoring and research activities of the BTF Management Plan closely align with recovery objectives described in Section 5 of the BTF Recovery Plan (e.g. investigate breeding requirements, quantify distribution and abundance, investigate feeding and other habitat requirements). Further details of these measures are provided in Section 7 of the BTF Management Plan. There are 2 current threat abatement plan or conservation advices in force for the BTF that were considered in the development of this plan. These are with regard to: <ul style="list-style-type: none"> • competition and land degradation by rabbits (DEWHA, 2008) • reducing the impacts on northern Australia's biodiversity by the five listed grasses DSEWPAC (2012). 	Section 3.4 Section 4.6 and Table 4 Section 7	
	a) A description of environmental values for each of the Matters of National Environmental Significance addressed in the plan	A description of environmental values for the BTF is provided in Section 4 of the BTF Management Plan. The description includes the status under Commonwealth and State legislation, regional populations, habitat requirements, breeding ecology, occurrence in the vicinity of the project area.	Section 4	
	b) Details of baseline and impact monitoring measures to be implemented for each of the Matters of National Environmental Significance including control and impact sites to be monitored throughout the life of the project. The monitoring must provide sufficient data to quantify likely impacts resulting from mining operations, including subsidence and changes in groundwater levels, to set habitat management goals (conditions 6e) and 6f)	A description of baseline and impact monitoring measures for the BTF is provided in Section 7 of the BTF Management Plan. The section describes the need for monitoring to occur prior to project commencement, as well as during construction and operations. The location of monitoring sites is provided in Appendix B, with control and impact sites to be established (Section 7.1.2). The monitoring will quantify impacts resulting from mining activities and provide feedback on the effectiveness of mitigation measures. The monitoring will include consideration of the impacts from subsidence, and groundwater draw down on BTF habitat values and water availability (see Section 7.1.2). Habitat management goals are set in Section 6.	Section 7, Appendix B Section 7.1.2, Section 6.	
	c) Details of potential impacts, including area of impact on each of the Matters of National Environmental Significance from mining operations, including impacts from:	Details of potential impacts of the project on the BTF are addressed in Section 4.6 of the BTF Management Plan. An area of impact is provided in relevant subsections of Section 4.6 for potential impacts for which a quantitative estimate can be provided (e.g. vegetation clearing and subsidence). Potential impacts are also discussed in Section 6 in the context of mitigation measures to minimise impacts.	Section 4.6, Section 6.	
	(i) Vegetation clearing		Section 4.6.1	
	(ii) Subsidence from underground mining, including subsidence induced fracturing and any changes to groundwater or surface water flow		Section 4.6.2	
	(iii) Mine dewatering		Section 4.6.8	
	(iv) Earthworks		Section 4.6.9	
	(v) Noise and vibration		Section 4.6.10	
	(vi) Emissions (including dust)		Section 4.6.11	
	(vii) Light spill and other visual impacts		Section 4.6.12	
	(viii) Stream diversion and flood levees		Section 4.6.13	

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
	(ix) Weeds and pests		Section 4.6.3 and 4.6.6	
	d) Measures that will be undertaken to mitigate and manage impacts on Matters of National Environmental Significance resulting from mining operations. These measures must include but not be limited to:	A description of measures that will be undertaken to mitigate and manage impacts on the BTF resulting from mining operations is provided in Section 6.	Section 6	
	(i) The use of fauna spotters prior to and during all vegetation clearing activities to ensure impacts on Matters of National Environmental Significance are minimised	All BTF habitat clearing operations will be monitored for compliance by a suitably qualified fauna spotter-catcher during clearing activities, to ensure impacts on BTF are minimised. The approach is outlined in Tables 7 and 8 of the BTF Management Plan and Section 6.3.2.	Table 7, Table 8, Section 6.3.2	
	(ii) Measures to avoid impacts on Matters of National Environmental Significance and their habitat located in the Project Area, but outside areas to be cleared, constructed upon and / or undermined, including adjacent to cleared areas	Measures to avoid impacts on BTF and their habitat outside areas to be cleared around described in Section 6.4 and Table 9 of the BTF Management Plan. They include matters such as the management of grazing, fire, water and pests.	Section 6.4, Table 9	
	(iii) Measures to rehabilitate all areas of Matters of National Environmental Significance habitat	Details of rehabilitation of disturbed areas are provided in Section 6.1 and Table 8 of the BTF Management Plan. Monitoring initiatives to determine the success of rehabilitation activities are described in Section 7.	Section 6.1, Table 8, Section 7.	
	(iv) Habitat management measures including but not limited to management of subsidence and groundwater impacts of the project	Mitigation measures for subsidence are provided in Table 8 and address subsidence. Table 10 provides details for mine dewatering.	Table 8 and Table 10.	
	e) Goals for habitat management for each relevant Matters of National Environmental Significance	Goals for habitat management of the BTF are provided in Section 6.4 of the BTF Management Plan. These include maintaining the three main habitat elements: woody layer of vegetation, herbaceous layer of vegetation and water sources. Factors affecting these values are also discussed (e.g. grazing and fire). Table 9 provides further details on how goals will be achieved.	Section 6.4 and Table 9	
	f) A table of specific criteria for assessing the success of management measures against goals, and triggers for implementing corrective measures if criteria are not met within specified timeframes. This table must include but not be limited to measures relating to subsidence and groundwater impacts, including early warning triggers for impacts on groundwater at the Doongmabulla Springs Complex and the Carmichael River. Goals and triggers must be based on the baseline condition of the relevant Matters of National Environmental Significance as determined through baseline monitoring (see Conditions 3b) and 6b)). Corrective measure must include provision of offsets where it is determined that corrective management measures have not achieved goals within specified timeframes (see Conditions 11m) and 11o))	Table 8, Table 9 and Table 10 of the BTF Management Plan provides goals, performance criteria, mitigation measures, triggers and correction actions. The effects of subsidence and groundwater impacts on BTF habitat (i.e., habitat modification) are included in Table 8, Table 9 and Table 10. Goals and triggers are based on the baseline condition of BTF habitat as determined from several years of baseline monitoring surveys. These focus on a range of vegetation and floristics data collected since the EIS. See Table 8, Table 9, Table 10 and Appendix E and F (summary of baseline nesting and analysis). Section 6.5 of the BTF Management Plan describes the approach to achieving offsets and states that if additional impacts are proposed, or occur unexpectedly, then additional offsets will be provided, subject to approval from government agencies. This is stated to include circumstances where the corrective management measures have not achieved the goals within specified timeframes, and resulted in impacts beyond those that were originally approved. Table 8 also states a corrective action that may include the provision of offsets.	Section 6.4, Table 8, Table 9 and Table 10. Table 8, Table 9 and Table 10. Table 8, Table 9, Table 10 and Appendix E and F Section 6.5 and Table 8.	
	g) An ongoing monitoring program to determine the success of mitigation and management measures against the stated criteria in Condition 6f), including monitoring locations, parameters and timing. Monitoring for water resources Matters of National Environmental Significance must include hydrogeological, hydrological and ecological parameters	Details of the ongoing monitoring program are provided in Section 7 of the BTF Management Plan, and specifically Tables 8 to 10 address evaluating the success of mitigation measures. There are objectives to assess the success of mitigation and management measures.	Section 7 and Tables 8 to 10	
	h) Details of how compliance will be reported	Reporting and compliance procedures are described in Section 9 of the BTF Management Plan. Section 9.2 provides details of periodic reporting and audits to monitor compliance with management plan requirements.	Section 9	

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
	i) Details of how the MNESMP will be updated to incorporate and address outcomes from research undertaken for Matters of National Environmental Significance under this and any state approvals, including updating of goals, criteria and triggers (as required under Conditions 3c), 3d) 6e) and 6f))	Section 9.1 of the BTF Management Plan provides details of how the plan will be updated in response to outcomes of research, monitoring and management actions. An adaptive management approach will be taken and revisions to the survey and monitoring program will be carried out in consultation with the BTF recovery team, in accordance with Condition 17 of the EA. Section 6.1 of the BTF Research Program provides details of how the adaptive management process will be applied to BTF research.	Section 9.1	Section 6.1
	j) Provisions to ensure that suitably qualified and experienced persons are responsible for undertaking monitoring, review and implementation of the MNESMP	Section 9.3 of the BTF Management Plan outlines the qualifications of persons responsible for monitoring, reviewing and implementing the plan. This relates primarily to the qualifications of ecologists conducting field surveys and of spotter-catchers that may be involved in handling or managing the impacts of clearing on the species.	Section 9.3	
	k) In the event that future baseline research required by the Queensland Coordinator-General (Appendix 1, Section 3, Condition 1 of the Coordinator-General's Assessment Report) identifies that the Mellaluka Springs Complex provides high value habitat for the Black-throated finch, the approval holder must include management measures to address impacts resulting from drawdown at the Mellaluka Springs Complex in the MNESMP	Studies have determined that the Mellaluka Springs Complex does not provide BTF habitat. A letter from the Office of the Coordinator-General, dated 22 July 2016, has been received confirming the Commonwealth and Queensland government's acceptance of this finding.	Not applicable	
	l) Details of how, where habitat for an EPBC Act listed threatened species or community not previously identified and reported to the Department is found in the Project Area, the approval holder will notify the Department in writing within five business days of finding this habitat, and within 20 business days of finding this habitat will outline in writing how the conditions of this approval will still be met (refer Condition 11j)).	This condition is addressed in the approved threatened species management plan for the Carmichael Mine. Section 5.1 of that plan says "In the event that new species or Threatened Ecological Communities are found, then DoE and/or DES will be notified within five business days and Adani will outline how the conditions of this approval will still be met within 20 business days". The BTF Management Plan deals only with the BTF.	Not applicable	
EPBC Act Approval, condition 7	Mining operations must not commence until the required MNESMP have been approved by the Minister in writing. The approved plan must be implemented. Note – Management plans such as the Black-throated Finch Management Plan and the Groundwater Dependent Ecosystems Management Plan may also be required under state approvals. Wherever possible a combined document should be prepared to address both state government and EPBC Act approval conditions. Note – Impacts of the action other than mining operations will be offset as required in accordance with Conditions 8 to 11, but will be otherwise managed in accordance with state approvals – this is of particular relevance when impacts may occur prior to approval of the MNESMP.	Mining operations will not commence until this plan has been approved. This plan addresses the combined requirements of the Commonwealth and Queensland governments in one document, as encouraged by the condition.	Not applicable.	
Carmichael Coal Mine and Rail Infrastructure Project Coordinator-General's Report, Imposed Condition 1.	Black-throated Finch (southern) baseline research for the Carmichael project	Adani has undertaken extensive baseline research and monitoring since the EIS, and prior to the commencement of Project Stage 2. This work is ongoing and is summarised in Section 2.6 of the BTF Research Program.		Section 2.6
	a) To increase the knowledge of the ecological requirements of BTF populations likely to be directly and indirectly impacted by the project, the proponent must undertake further baseline research prior to the commencement of Project Stage 2.			
	(b) Prior to continuing the baseline research, a suitably qualified person must finalise a baseline research plan to the satisfaction of the authority responsible for administering threatened species provisions of the <i>Nature Conservation Act 1992</i> that includes a description of chosen methodologies.	A Research Program is established in Appendix C of the BTF Management Plan. This provides details of the chosen methodologies and research objectives. Adani has maintained ongoing consultation with DES on the progress of baseline monitoring surveys (Section 2.6 of BTF Research Program) and incorporated feedback into the development of the Research Program.		Entire document
	(c) The baseline research must include: (i) a minimum of two wet season surveys of the project area (ii) a minimum of two dry season surveys of the Mellaluka Springs Complex (iii) the collection of floristic data to enable the identification and mapping of key seasonal (wet and dry season) food sources.	To date, baseline research work conducted by Adani includes 10 surveys across both wet and dry seasons between 2012 and 2018, as summarised in Section 2.6 of the BTF Research Program. Surveys of the Mellaluka Springs Complex have been completed to the satisfaction of DES and DoE, as outlined in letter from the Office of the Coordinator-General, dated 22 July 2016. Monitoring has included floristic data to enable the identification and mapping of key seasonal food sources. This baseline research is ongoing, as outlined in Section 7 of the BTF Management Plan and Section 4 of the BTF Research Program.		Section 2.6, Section 4

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
	<p>(d) The baseline research must determine:</p> <p>(i) whether the Mellaluka Springs Complex provides BTF habitat, particularly as a refuge during the dry season</p> <p>(ii) movement patterns, habitat requirements and population dynamics, including dietary requirements, home range, nesting requirements</p> <p>(iii) responses to grazing management, fire management and water body locations.</p>	<p>In July 2016, the Office of the Coordinator-General confirmed the baseline research work undertaken by Adani has satisfied the requirements of Imposed Condition 1: part (d)(i).</p> <p>To date, baseline research work conducted by Adani includes 13 surveys across both wet and dry seasons between 2010 and 2018, as summarised in Section 2.6 of the BTF Research Program. Findings of this work in relation to nesting, feeding habitat and dietary requirements are summarised in Appendix E and F. This work is ongoing, as outlined in the BTF Research Program.</p> <p>Responses of the BTF to grazing management, fire management and water body locations are key research objectives as outlined in Section 4 of the BTF Research Program.</p>	Appendix E and F	Section 4
Carmichael Coal Mine and Rail Infrastructure Project Coordinator-General's Report, Imposed Condition 4 and Condition 5 (apportionment of costs).	Proponent contribution to BTF Bioregional Management Plan	<p>The BTF Management Plan includes an ongoing monitoring program (Section 7) and Research Program (Appendix C) for BTF. There is not yet any bioregional management plan established by government to address regional impacts to the BTF arising from multiple mines proposed for the Galilee Basin. Adani is committed to participating in the BTF Bioregional Management Plan should this be established in the future.</p>	Section 7	Entire document
	<p>a) To address project impacts and maximise the ongoing protection and long-term conservation of the Black-throated finch (BTF) southern subspecies (<i>Poephila cincta cincta</i>), and its habitat in the Galilee Basin and Desert Uplands bioregion, the proponent must, when required by the administering authority responsible for the threatened species provisions of the <i>Nature Conservation Act 1992</i>:</p> <p>(i) Prepare, to the satisfaction of the administering authority, an ongoing BTF monitoring program that takes into account the relevant requirements of any BTF Bioregional Management Plan specified in Appendix 1, Section 2, Part B and the outputs of baseline research required in Appendix 1, Section 3, Condition 1</p>			
	<p>(ii) Provide baseline and survey results in the format and at intervals specified for the coordination of bioregional survey data to the administering authority for any BTF Bioregional Management Plan</p>			
	<p>(iii) Contribute to the operation of any BTF Bioregional Management Plan including pro-rata funding.</p> <p>Detailed condition about apportionment of costs for bioregional management plan.</p>			
Environmental Authority, condition 16	Black-throated finch (BTF) Species Management Plan (SMP) at Carmichael project	<p>The BTF Management Plan has been prepared and certified by Eco Logical Australia, a national environmental consulting company with ~200 staff. Correspondence has been provided to DES outlining the qualifications and experience of the management plan authors (demonstrating that they are suitably qualified), and providing certification. Project Stage 2 will not commence until the BTF Management Plan is approved by the administering authority. The BTF Management Plan will be published online within 10 days of approval by the administering authority and will be implemented.</p>	Entire document	Entire document
	<p>The holder of this environmental authority must submit a BTF SMP prepared and certified by a suitably qualified person to the administering authority prior to commencement of Project Stage 2 for approval. The holder must publish the BTF SMP on its website within 10 business days of receiving the administering authority's approval in writing. The approved BTF SMP must be implemented.</p>			
	<p>The holder must align the SMP with any Bioregional BTF Management Plan and relevant documentation requirements under the <i>Environmental Protection and Biodiversity Conservation Act 1999</i> including BTF Recovery Plan, conservation advice and the threat abatement plan.</p>			
	<p>The submitted BTF SMP plan must include:</p> <p>a) A baseline research program on the specific nesting and feeding requirements of the species that will be undertaken prior to and during project stage 1.</p>	<p>Adani has undertaken extensive and ongoing baseline monitoring of BTF, including the specific nesting and feeding requirements of the species. This work has been undertaken prior to and during project stage 1, since the wet season of 2012. Details of the monitoring program are provided in Section 2.6 of the BTF Research Program. Appendix E also summarises the findings of this monitoring.</p>	Appendix E	Section 2.6

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
...	The submitted BTF SMP plan must include: b) A baseline research program to establish whether the BTF at the project site are sedentary, locally migratory or regionally migratory.	Adani has undertaken extensive and ongoing baseline monitoring of BTF. Determining the home range and movement patterns of BTF in the project area is a major objective of the BTF Research Program (see Section 4.3)		Section 2.6, Section 3 and Section 4 of the Research Program
...	The submitted BTF SMP plan must include: c) A description of how the results of baseline research are to be used to determine any changes of classification of and/or impact on BTF habitat.	Section 5 of the BTF Management Plan describes the adaptive management framework that will be applied to deal with uncertainty and incomplete knowledge using systematic monitoring to reduce uncertainty and improve management actions over time. Section 6 provides details of how the learnings from this research will be applied to minimise project impacts on BTF, and Section 9.1 provides details of how this will be reported to the Department. Further details on the adaptive management approach to applying research findings are also provided in Section 6.1 of the BTF Research Program.	Sections 5, 6 and 9.1	Section 6.1
...	The submitted BTF SMP plan must include: d) Details of proposed impacts to BTF habitat from each project stage including impacts from clearing, subsidence, ecological function changes, hydrological changes and weed and pest infestation changes.	Details of potential project impacts are provided in Section 4.6 of the BTF Management Plan, including Table 4. Direct impacts from vegetation clearing and subsidence are provided for each stage of the project, consistent with the project Biodiversity Offset Strategy. The scale of indirect impacts are discussed, where this is possible to describe in a qualitative manner.	Section 4.6	
...	The submitted BTF SMP plan must include: e) Mitigation measures to be undertaken to avoid, mitigate and manage impact resulting from each stage of the project, including rehabilitation of habitat.	Detailed mitigation measures are provided in Section 6 of the BTF Management Plan. These cover issues such as clearing and fragmentation of habitat, injury to BTF during works, habitat degradation, loss of water resources and contamination of water sources. Rehabilitation of disturbed areas is addressed in Table 7 and Table 8.	Section 6 and Table 7 and Table 8	
...	The submitted BTF SMP plan must include: f) Monitoring of watering points that must be conducted for a minimum six (6) hour period commencing from dawn, to accurately capture BTF utilisation of water points.	Section 7.1.2.1 describes the approach to water source watches, which involve six continuous hours of survey commencing from dawn at 16 water sources where BTF have previously been recorded.	Section 7.1.2.1	
...	The submitted BTF SMP plan must include: g) Detailed botanical assessment that must occur at all BTF sighting locations in the Project Area to record habitat values at those locations.	Vegetation assessments are described in Sections 7.1.2.6 and 7.1.2.7 of the BTF Management Plan. They include vegetation transects, foraging plots and groundcover monitoring. Detailed research activities on BTF habitat are also outlined in Section 4.4 of the Research Program.	Section 7.1.2.6 and Section 7.1.2.7.	Section 4.4
...	The submitted BTF SMP plan must include: h) Detailed survey that must occur across the mining lease area and approved offset areas and must include information on BTF movements. The survey method and effort must be sufficient to accurately describe the BTF home range and detail BTF resource usage patterns between seasons and years (for up to 10 years) and allow robust management actions to be developed for the maintenance of a viable local BTF population.	Estimating the home range and movements of BTF is a key aim of the Research Program. Objectives, methods, variables to be monitored, resources and timing are outlined in Section 4.3 of the Research Program. Section 7.2 of the BTF Management also discusses this program of surveys.	Section 7.2	Section 4.3
...	The submitted BTF SMP plan must include: i) Survey work that should incorporate the usage of call playback and identify all birds present when BTF are encountered.	Call playback has been utilised in previous surveys as described in Section 4.5 of the BTF Management Plan and Section 2.6 of the Research Program. Section 7.1.2 of the BTF Management Plan describes monitoring methods and specifies that all birds are to be identified when BTF are encountered. This is also specified in Section 4.4.4 of the Research Program.	Section 4.5 and Section 7.1.2.	Section 2.6 and Section 4.4.4
...	The submitted BTF SMP plan must include: j) Specific surveys that must be undertaken during the BTF breeding season and include nest location and assessment of the habitat attributes associated with the breeding locations. The survey method and effort must be sufficient to accurately describe the BTF breeding requirements with consideration to spatial and temporal variation of resources of up to 10 years.	Determining the breeding habitat requirements of the BTF and the relationship with vegetation structure and composition and water is part of a key aim of the Research Program. Details of the objectives, variables to be monitored, methods, resources and timing are outlined in Section 4.4 of the Research Program. Section 7.2 of the BTF Management also discusses this program of surveys. Baseline monitoring activities described in Section 2.6 of the Research Program have also collecting information on nests, if present.	Section 7.2	Section 4.4

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
	The submitted BTF SMP plan must include: ... k) Survey and monitoring that must be undertaken by experienced ecologists.	The qualifications and experience required by ecologists implementing the BTF Management Plan are outlined in Section 9.3. The involvement of suitably qualified and experienced professionals in the implementation of the Research Program is also discussed in Section 4.1 of the Research Program.	Section 9.3	Section 4.1
Environmental Authority, condition 17	The BTF SMP under condition 16 must be reviewed by an appropriately qualified person annually and a report prepared on 1 July each year. The report must: a) Assess the plan against the requirements under condition 16. ... b) Include recommended actions to ensure actual and potential environmental impacts are effectively managed for the coming year. ...c) Identify any amendments made to the BTF SMP following the review. ... d) All revisions of the survey and monitoring program must be carried out in consultation with the BTF recovery team. e) Any revisions must be independently peer reviewed.	As outlined in Section 4.1 of the Research Program, The BTF Management Plan and Research Program will be reviewed annually by an appropriately qualified person, and revisions of the survey and monitoring program will be carried out in consultation with the BTF Recovery Team. Any revisions must be independently peer reviewed. An annual report of research findings and the results of the independent peer review will be provided to DES.		Section 4.1
Environmental Authority, condition 18	The baseline research program must fund a research project to determine the relationship between water sources, woody habitat and the BTF food sources within the mining lease area and approved offset areas to determine the inter-relationships among these factors.	The Research Program will determine the relationship between water sources, woody habitat and the FBT food sources within the mining lease area and approved offset areas, and the inter-relationships among these factors. This is explained in Section 4.2 of the Research Program, with further details provided in Sections 4.4 and 4.5 of the Research Program.		Sections 4.2, 4.4, and 4.5
Environmental Authority, condition 19	The baseline research program under Condition 16 must: a) Establish whether Ten Mile Bore and surrounds are high value habitat for the species, and b) Establish management actions to maintain the current BTF population of Ten Miles Bore and surrounds	Surveys completed by Adani to date have identified that BTF are particularly abundant in the area around Ten Mile bore (Section 4.5 of BTF Management Plan). Section 4.4 of the Research Program outlines the objective of determining whether Ten Mile Bore and surrounds are high value habitat for BTF. The research will also determine the characteristics of Ten Mile Bore and surrounds that contribute to its frequency of use and compare this with other waterholes and woodlands, through equivalent frequency monitoring. Currently Ten Mile Bore and surrounds are managed under the certified environmental management system. Routine checks of the water sources at Ten Mile Bore are carried out. The agistee for the Moray Downs pastoral lease also carry out checks of water sources as a part of their monitoring program. Interim management of the Ten Mile Bore area is discussed in Section 6.4.7. Monitoring and management actions for the Ten Mile Bore area will be reviewed and modified in line with BTF Research Program outcomes, as described in Section 4.6.1 of the Research Program.	Section 4.5 Section 6.4.7	Section 4.4 Section 4.6.1
Environmental Authority, condition 110	The holder of this environmental authority must maintain water troughs for BTF within undisturbed areas and surface areas of underground mining footprint, and repair where necessary troughs, pipes and tanks to a standard that maintains a constant source of water.	Troughs are identified as an important water source for BTF in the study area (e.g. Section 4.6.3 of BTF Research Program). Table 10 (Section 6.1) of the BTF Management Plan states that known water sources will be avoided, or alternative water sources established outside of disturbance footprint, if avoidance is not possible. Section 6.4.4 of the BTF Management Plan also states that current water sources outside of the clearing footprint are to be maintained. Where it is necessary to remove a particular water source within or nearby to BTF habitat, a new water source will be created.	Section 6.3.3, Section 6.4.4 and Table 10	Section 4.6.3
Adani Commitment, M4.29	Management actions will seek to maintain and where possible enhance Black-throated finch habitats and populations (e.g. pest control, water source, grazing and fire management) in unmined parts of the Mine Area, as well as in offset areas.	Section 6.1 of the BTF Management Plan states "Monitor BTF habitat values through annual groundcover assessments during May to maintain and where possible enhance BTF habitat within the Mining Lease". Table 8 also states as a mitigation measure – Manage non-mined and offset areas to maintain and improve BTF habitat values. This work will be guided by results from annual vegetation assessments, annual BTF surveys and the BTF Research Program.	Section 6.1, Table 8	
Adani Commitment, M4.30	Black-throated finch surveys will continue so as to provide data on temporal and spatial variation of habitat use in the Mine Area and will contribute significant local data for incorporation into the Black-throated Finch Species Management Plan for the Mine Area, which will assist in refinement of species recovery actions and mitigation of impacts on the Mine Area.	BTF surveys have continued as outlined in this commitment. This work is summarised in Section 2.6 of the Research Program. This work will continue as described in Section 7 of the BTF Management Plan and the Research Program.	Section 7	Section 2.6, entire document

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
Adani Commitment, P6.30	Monitoring events will commence at least one year before mining operations (in order to continue a baseline understanding of existing conditions), and continue for at least two years after mining operations are completed.	Monitoring of BTF has been ongoing since the project EIS, as outlined in Section 2.6 of the BTF Research Program. A long-term program of research and monitoring has been established.	Section 7.1	Section 2.6
Adani Commitment, P6.51	The loss of habitat for the Black-throated finch (southern) will occur in stages, in accordance with the staged development of the operational components of the Mine Area. Management actions to encourage dispersal away from areas that will be cleared for staged Mine operations will also be developed.	Section 6.3.1 of the BTF Management Plan describes the staged approach to clearing of vegetation in accordance with this commitment.	Section 6.3.1	
Adani Commitment, P6.52	Management actions for Black-throated finch will seek to maintain and where possible enhance habitats and populations (e.g. through pest control, provision of water sources, appropriate grazing and fire management) in unmined parts of the Mine Area, as well as in offset areas.	Section 6.1 of the BTF Management Plan states "Monitor BTF habitat values through annual groundcover assessments during May to maintain and where possible enhance BTF habitat within the Mining Lease". Table 8 also states as a mitigation measure – Manage non-mined and offset areas to maintain and improve BTF habitat values. This work will be guided by results from annual vegetation assessments, annual BTF surveys and the BTF Research Program.	Section 6.1, Table 8	
Adani Commitment, P6.53	Important population, movement and habitat information for Black-throated finch will be collected, particularly with respect to seasonal use, key areas, nest sites, important feeding areas and management of threatening processes.	Section 7 of the BTF Management Plan and Section 4 of the Research Program outline research and monitoring tasks that are consistent with this commitment.	Section 7	Section 4
Adani Commitment, P6.54	Adani will provide a Draft Black-throated Finch Management Plan for approval prior to the commencement of mine construction. The Plan will include the following: <ol style="list-style-type: none"> 1. A management framework that aligns with the other project management plans 2. Clear statements regarding the intent, approval requirements, objectives and actions 3. Details of how the management plan will be applied across the project phases – pre construction / construction / operation / post operations, 4. Offset areas 5. Details of the current and proposed adaptive monitoring program to support the plan objectives. 6. Details of how experts will be used in a review capacity to inform ongoing monitoring and management 7. Incorporates all proposed management and mitigation measures, including reference to how these will align with the Significant Impact Guidelines and the National Recovery Plan. 8. Specific performance targets and how these will be measured and reported. 	This BTF Management Plan and Research Program address these requirements.	Details are addressed in the following sections: 1) Section 1.3 2) Section 1 3) Section 6 4) Section 6.5 5) Section 5 6) Section 9 7) Section 6 8) Section 6 and Section 9	5) Section 6.1 6) Sections 4.1 and 6
Adani Commitment, P6.55	Black-throated finch surveys will continue over time to provide data on temporal and spatial variation of habitat use in the Mine Area and will contribute significant local data for incorporation into the Black-throated Finch Species Management Plan for the Mine Area, which will assist in refinement of species recovery actions and mitigation of impacts on the Mine Area. In the case of subsidence, which will occur gradually and in a complex and partly unpredictable manner, the data being collected by this monitoring will provide information regarding the best strategies over time to mitigate negative effects and manage key resources for Black-throated finch on the Mine Area.	BTF surveys have continued in accordance with this commitment. A program for future monitoring and research is outlined in this plan.	Section 7	Entire document
Adani Commitment, P6.56	The onsite and offsite (offset areas) habitat management and complementary monitoring program, as described above, will be developed and implemented in consultation with relevant stakeholders (i.e. Black-throated Finch Recovery Team, Commonwealth and State governments).	This plan has been developed in consultation with relevant stakeholders. Implementation of the plan will be conducted as described in Section 9.2 of this plan and Section 6.2 of the Research Program. This involves sharing the findings of the research with the BTF Recovery Team for use and updating of the recovery plan and ongoing engagement with Commonwealth and state governments.	Section 9.2	Section 6.2

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
Adani Commitment, P6.57	<p>Adani's overarching commitments in regards to the Black-throated Finch are:</p> <ol style="list-style-type: none"> 1. Implementing management measures across the Project Mining Lease where there are indirect impacts including land management activities, water management, habitat maintenance, pest control, fire management, survey and recording. This commitment would continue through the duration of mining operations. 2. Implementing management measures across a proposed like for like mitigation area within those property areas mapped in Figure 1 below, including land management activities, water management, habitat maintenance, pest control, fire management, survey and recording. This commitment would continue for a period of 20 years. 3. Securing and maintaining appropriate offsets including land management activities, water management, habitat maintenance, pest control, fire management, survey and recording. This commitment would continue for the duration of the offset agreement, nominated as 20 years. 4. Ongoing monitoring programs locally, and contributing to regional monitoring programs including utilising and assisting where possible monitoring effort from the BTFRT. This commitment would continue for a period of 10 years, commencing from 2014. 5. Contributing time and resources to a government-led regional management program. In the order of an in-kind contribution of \$100,000 per year, over a period of 10 years, commencing from Mining Operations. 	Adani has met these commitments to the BTF, as summarised in the BTF Management Plan and associated Research Program. Indirect impacts are addressed in Section 6 of the BTF Management Plan, and include a range of land and water management activities and offsets. A long term program of research and monitoring has been established.	<p>1-3) Section 6</p> <p>4) Section 7</p> <p>5) Government-led regional management program not yet established.</p>	4) Entire document
Adani Commitment, P6.60	<p>Project Species Specific Management Plan(s)</p> <p><u>Key actions</u></p> <ul style="list-style-type: none"> • Develop and implement programs to provide a greater level of detail on the ecology of threatened species at the Study Area – to be undertaken in collaboration with applicable research organisations, conservation groups and government agencies. <p><u>Timeframes</u></p> <ul style="list-style-type: none"> • Implement targeted ecology and threatened species programs prior to and during Mine operations. • Five yearly revisions and updating of this plan based on currency of information available. 	The BTF Research Program outlines a comprehensive program to provide greater level of detail on the ecology of the BTF in the study area, in collaboration with relevant stakeholders.	Section 7	Entire document

Appendix E Summary of baseline research on BTF nesting and foraging habitat in the project area (E2M Consulting)

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Black-throated Finch Habitat Assessment

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File A

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1 Introduction

1.1 Background

Adani Mining Pty Ltd (Adani) is planning and preparing for development of the Carmichael Coal Mine (CCM), herein referred to as 'the Project', which was granted conditional approval by the Queensland Coordinator-General on 8 May 2014 and the Commonwealth Minister for the Environment on 14 October 2015 (EPBC 2010/5736). The Department of Environment and Heritage Protection (DEHP), now the Department of Environment and Science (DES), issued the Environmental Authority (EA) EPML01470513 (herein referred to as 'the EA') for the Mining Leases (ML) 70441, 70505 and 70506 on 5 June 2017.

The EA contains numerous requirements relating to management, monitoring and research of the black-throated finch (southern) (BTF) (*Poephila cincta cincta*) that occur within the Project area. In particular, Condition I6 (a) of the Environmental Authority (EA) states that:

A baseline research program on the specific nesting and feeding requirements of the species that will be undertaken prior to and during project stage 1.

Current literature and research regarding the habitat and dietary preferences of BTF are largely based on populations in the Townsville Coastal Plains region. The habitat that the species occupies in the Desert Uplands region is notably different. The data collected during surveys undertaken for the Project provides important information for the specific habitat requirements for BTF in the Desert Uplands.

1.2 Scope and objectives

E2M Pty Ltd (E2M) has been engaged by Adani to undertake an analysis of BTF habitat based on the data collected during surveys and monitoring undertaken during the Project in order to satisfy Condition I6(a) of the EA. The objective of the assessment is to analyse this vegetation and habitat data to determine the specific nesting and feeding habitat requirements for BTF residing in the Project area.

The scope of this assessment was to:

- collate habitat assessment and vegetation survey data collected during BTF surveys for the Project
- analyse data to identify characteristics of BTF breeding and feeding habitat within the Project area
- identify key attributes and limiting factors of BTF habitat utilisation within the Project area; and
- provide recommendations for ongoing BTF habitat assessment during Stage 1 of the Project.



2 Survey history

2.1 Review of BTF surveys

Since 2010 Adani has undertaken 13 surveys within the mining lease and the Moray Downs West offset area, including associated reports assessing the presence, habitat preferences, ecology, population and spatial patterns of BTF with the Project area. Two of these surveys did not include vegetation surveys of BTF habitat. Table 1 outlines the previous studies and vegetation survey methodologies undertaken.

Table 1 Habitat assessment and vegetation survey methods for BTF surveys on CCM

Survey period	Consultant	Habitat and Vegetation Survey Methodology
Wet season 2011 (April 2011)	GHD	No vegetation surveys undertaken.
Dry season 2011 (May 2011)	GHD	No vegetation surveys undertaken.
Dry season 2012 ¹ (May 2012)	GHD	Quaternary level vegetation assessments were undertaken at each water source and 2 ha BTF survey site. Vegetation data collected included vegetation structure, cover of dominant plant species, relative dominance and strata, ground cover estimates (native and non-native grass and forb cover, litter, rock and bare ground cover).
Dry season 2012 ¹ (June 2012)	Environment & Heritage Partners	No vegetation surveys undertaken.
Dry season 2013 ¹ (May 2013)	GHD	Quaternary level vegetation assessments were undertaken at 52 x 2 ha BTF survey sites. Vegetation data collected included vegetation structure, cover of dominant plant species, relative dominance and strata, ground cover estimates (native and non-native grass and forb cover, litter, rock and bare ground cover).
Dry season 2013 ¹ (October 2013)	GHD	Quaternary level vegetation assessments were undertaken at 15 x 2 ha BTF survey sites. Vegetation data collected included vegetation structure, cover of dominant plant species, relative dominance and strata, ground cover estimates (native and non-native grass and forb cover, litter, rock and bare ground cover).
Wet season 2014 ¹ (December 2014)	Niche	Quaternary level vegetation assessments were undertaken at 52 sites. Vegetation structure and floristic assemblage were recorded, with specific focus placed on the presence / absence of food source and characteristics for BTF.

¹ Naming of previous surveys has been amended to reflect the season they were conducted within. Surveys conducted from April to October are considered dry season, while surveys conducted from November to March are considered wet season.



Survey period	Consultant	Habitat and Vegetation Survey Methodology
Wet Season 2015 ² (March 2015)	Niche	Twenty-nine flora survey sites were assessed during the March 2015 survey, 27 of which were determined based on BTF observations. Vegetation structure and floristic assemblage were recorded, with specific focus placed on the presence / absence of food source and characteristics for BTF.
Dry Season 2015 ² (August 2015)	Niche	Eighteen flora survey sites were assessed consisting of Quaternary level vegetation surveys to record vegetation structure and the flora, and their relative dominance according to strata.
Dry Season 2016 ² (April 2016)	Niche	Nineteen flora survey sites were assessed consisting of Quaternary level vegetation surveys to record vegetation structure and the flora, and their relative dominance according to strata.
Wet Season 2016 ² (December 2016)	Eco Logical Australia	Eight 100 m x 50 m vegetation transects were conducted throughout the Study Area. The vegetation transects consisted on two components, vegetation structure and ground cover. Fourteen 2 m x 2 m foraging plots were undertaken throughout the Study Area at direct locations where BTF were observed foraging.
Wet Season 2017 (November 2017)	E2M	Eight vegetation assessments were undertaken during the field assessment. The objective of vegetation assessment was to record data on floristic characteristics of BTF habitat. Vegetation assessments used a 100 m x 50 m transect
Dry Season 2018 (April 2018)	E2M	Fifteen vegetation assessments were undertaken during the field assessment. The objective of vegetation assessment was to record data on floristic characteristics of BTF habitat. Vegetation assessments used a 100 m x 50 m transect

2.2 Survey timing and conditions

Surveys have been undertaken at different times throughout the year to account for seasonal variation in BTF activities and availability of food sources (i.e. seed of different preferred dietary grass species). Survey timing may also affect the results of vegetation surveys due to the presence (or otherwise) of annual species and / or lack of fertile material for the identification of grass species.

Of the 11 BTF surveys to have featured vegetation assessments, seven were undertaken during the dry season (April to October) and four during the wet season (November to March). Vegetation data has been collected from eight months of the year with April, May and December having two surveys in each.

² Naming of previous surveys has been amended to reflect the season they were conducted within. Surveys conducted from April to October are considered dry season, while surveys conducted from November to March are considered wet season.



3 Methods

3.1 Data collation

Data was collated from the following studies and sources undertaken during the Project:

- EIS surveys (GHD)
 - Dry season 2012³ (May 2012)
 - Dry season 2013³ (May 2013)
 - Dry season 2013³ (October 2013)
- BTF monitoring program (Niche)
 - Wet season 2014³ (December 2014)
 - Wet season 2015³ (March 2015)
 - Dry season 2015³ (August 2015)
 - Dry season 2016³ (April 2016)
- Wet Season survey 2016³ (December 2016) (Eco Logical Australia)
- Wet Season survey 2017 (November 2017) (E2M)
- Dry Season survey 2018 (April 2018) (E2M)

BTF and vegetation survey data (Table 2) from surveys undertaken during the Project was collated, cleaned and formatted into a single Microsoft Excel database. BTF records from water sources were filtered out as these records do not correspond with nesting or foraging habitat. Information that was not relevant to the analysis (e.g. observer and survey type) was removed at this time as well.

Table 2 BTF survey datasets utilised

Dataset name	Consultant	Content
CCP BTF 2013	GHD	Location of BTF and BTF nests recorded during EIS surveys between 2011 and 2013
2313 BTF DATA DEC 2014 – APR 2016	Niche	Location of BTF and BTF nests recorded during 2014 and 2016 surveys
2313 Floristic Data Dec 2014 – Aug 2015	Niche	Vegetation survey data collected during 2014 and 2015 surveys
2313 Floristic Data Apr 2016	Niche	Vegetation survey data collected during 2016 dry season survey
Black-throated Finch Data Collection_v2	ELA	Location of BTF nests recorded during 2016 wet season survey

³ Naming of previous surveys has been amended to reflect the season they were conducted within. Surveys conducted from April to October are considered dry season, while surveys conducted from November to March are considered wet season.



Dataset name	Consultant	Content
Black-throated Finch Floristics	ELA	Vegetation survey data collected during 2016 wet season survey
BTF_SIGHTING	E2M	Location of BTF recorded during 2017 and 2018 surveys
BTF_NEST	E2M	Location of BTF nests recorded during 2017 and 2018 surveys
BTF_VegPlot	E2M	Vegetation survey data collected during 2017 and 2018 surveys

3.2 Data analysis

3.2.1 BTF records

BTF surveys undertaken to date have yielded a total of 651 separate BTF observations and 69 nest records. The location of these has been depicted in Figure 1. BTF drinking records (169) were deleted from the analysis as the birds will use water sources that are not necessarily located within suitable breeding or foraging habitat. Furthermore the concentration of survey effort and BTF records at water sources would bias the results of the analysis.

The remaining 354 BTF records were used in the analysis. Where the data for BTF records did not identify the activity, they were assumed to be foraging records. Activities such as preening, perching and flying were also assumed to be associated with foraging habitat.

3.2.2 BTF habitat characteristics

Vegetation data was reviewed to determine which characteristics had suitable and sufficient data to analyse. The following thirteen vegetation characteristics were identified as suitable for the analysis:

- Canopy height
- Canopy cover
- Canopy species richness
- T2 layer cover
- Shrub height
- Shrub cover
- Shrub species richness
- Native grass cover
- Native grass richness
- Herb and forb cover
- Exotic grass cover
- Leaf litter cover; and
- Bare ground cover.

Other habitat factors that were identified as being appropriate for the habitat analysis were:

- Regional Ecosystem (RE); and
- Proximity to permanent water sources.



3.2.3 Vegetation survey sites

Vegetation surveys have been undertaken at 162 unique sites of which 52 have been surveyed twice. The location of these survey sites has been depicted in Figure 2. Therefore a total of 214 vegetation surveys have been completed for the data analysis to be based upon. The majority (152) of these have been undertaken during the dry season.

A spatial analysis was undertaken on BTF records and vegetation survey sites to identify the spatial relationships between key habitat areas (such as nests and areas with multiple foraging records) and factors such as Regional Ecosystems (REs) and proximity to permanent water. This process was also used to assign each vegetation survey site as representing foraging or nest (or both) habitat based on the following criteria:

- Sites within 100 m of a nest record were assigned as breeding habitat
- Sites within 400 m of a BTF foraging record were assigned as foraging habitat; and
- Sites within 100 m of a nest record and 400 m of a BTF foraging record were assigned as breeding and foraging habitat.

Twenty-four vegetation sites were attributed to breeding habitat and 115 to foraging habitat.

The 400 m buffer from foraging records was based on a 50 ha home range for BTF in the Townsville Coastal Plains population (ed at External 2015). The number of BTF records within a 400 m buffer of each foraging and breeding vegetation survey site was calculated (see Figure 3 for example).

3.2.4 Foraging and breeding habitat analysis

The typical habitat characteristics for BTF foraging and breeding habitat was determined by calculating the minimum, maximum and mean values for each of the 13 habitat characteristics listed in Section 3.2.2. The proximity to a known permanent water source was calculated in GIS. The minimum, maximum and mean distances were then determined.

The analysis also aimed to identify the statistical relationship of each characteristic with foraging and breeding habitat by undertaking a linear regression for each characteristic. The regression used each of the 13 characteristics as the predictor variables and a response variable of BTF observations within 400 m of the corresponding vegetation survey site. The following results of the regression analysis were used to determine the strength and nature of the relationships with these variables:

- Multiple R – indicates how strong the linear relationship is (a value of 1 means a perfect positive relationship and a value of zero means no relationship at all)
- Coefficient – a positive number indicates a positive relationship (i.e. as the variable increases so does the response) and vice versa; and
- P-value – indicates whether the relationships are statistically significant (P-value <0.05 indicates a significant difference).

3.2.5 Native grass analysis

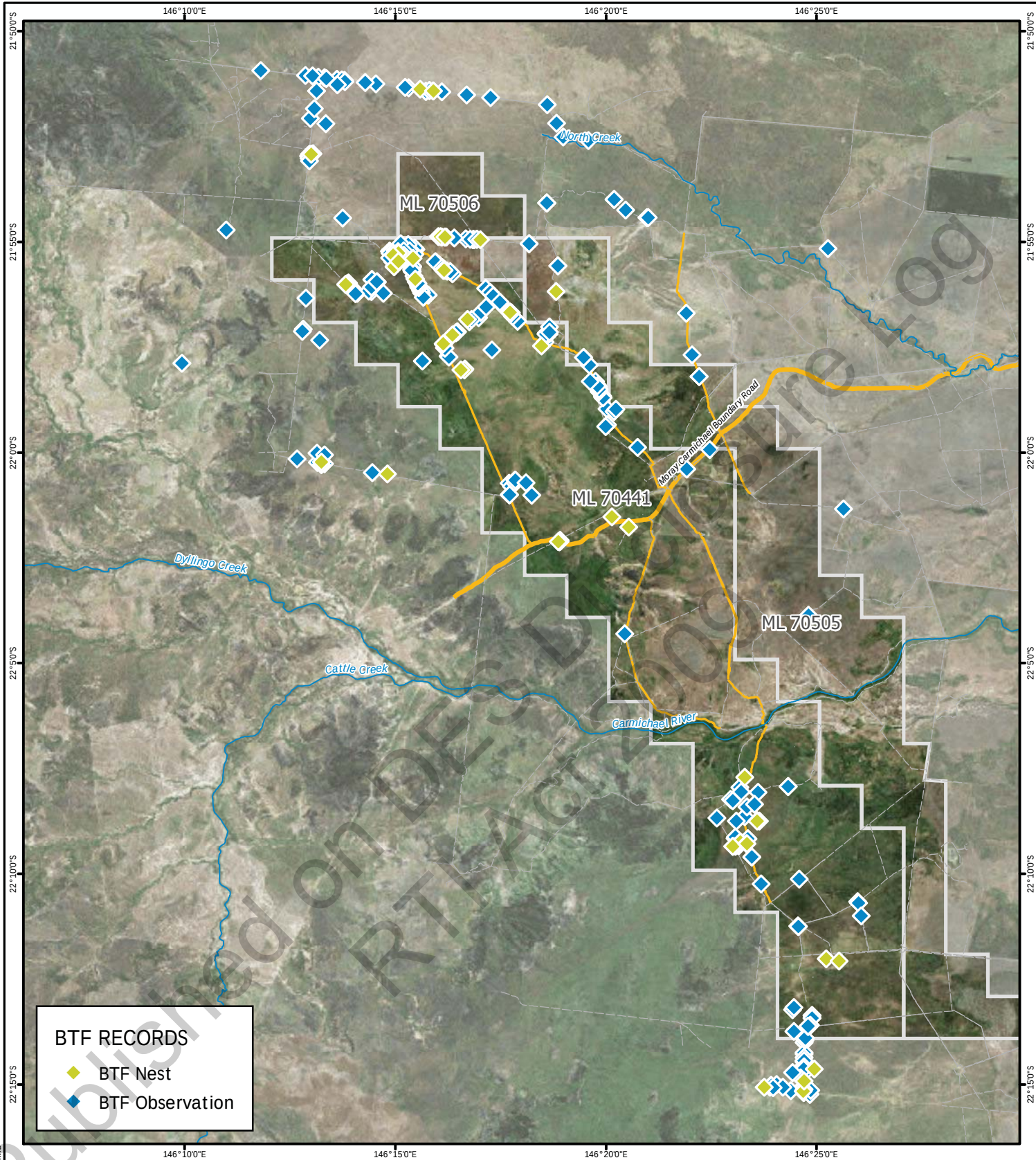
Vegetation data was reviewed to determine the most commonly recorded native grasses within BTF foraging and breeding habitat. Twelve species were identified as recorded at more than 10% of breeding and foraging vegetation sites. For these species the frequency (percentage of sites recorded), minimum, maximum and mean covers were calculated.



A linear regression was also undertaken for each species for foraging habitat to determine whether a statistical relationship could be identified for each species. Insufficient quantitative grass species cover was available to do this for breeding sites.

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BTF RECORDS

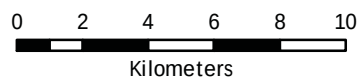
- ◆ BTF Nest
- ◆ BTF Observation

Legend

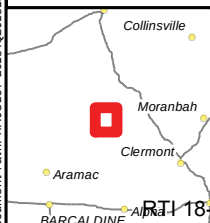
- Major Road
- Minor Road
- Track
- Watercourse
- Mining Lease



Scale 1:230,000 (A4)



Coordinate System: GCS GDA 1994



Notes:
 Aerial Imagery: © ESRI 2018
 Watercourse: © Geoscience Australia 2016
 Road: © Adani 2017
 Mining Lease: © DNRME 2018

Rev	Description	Drawn	Approved	Date
A	Issued for Review	CD	CO	21/09/2018

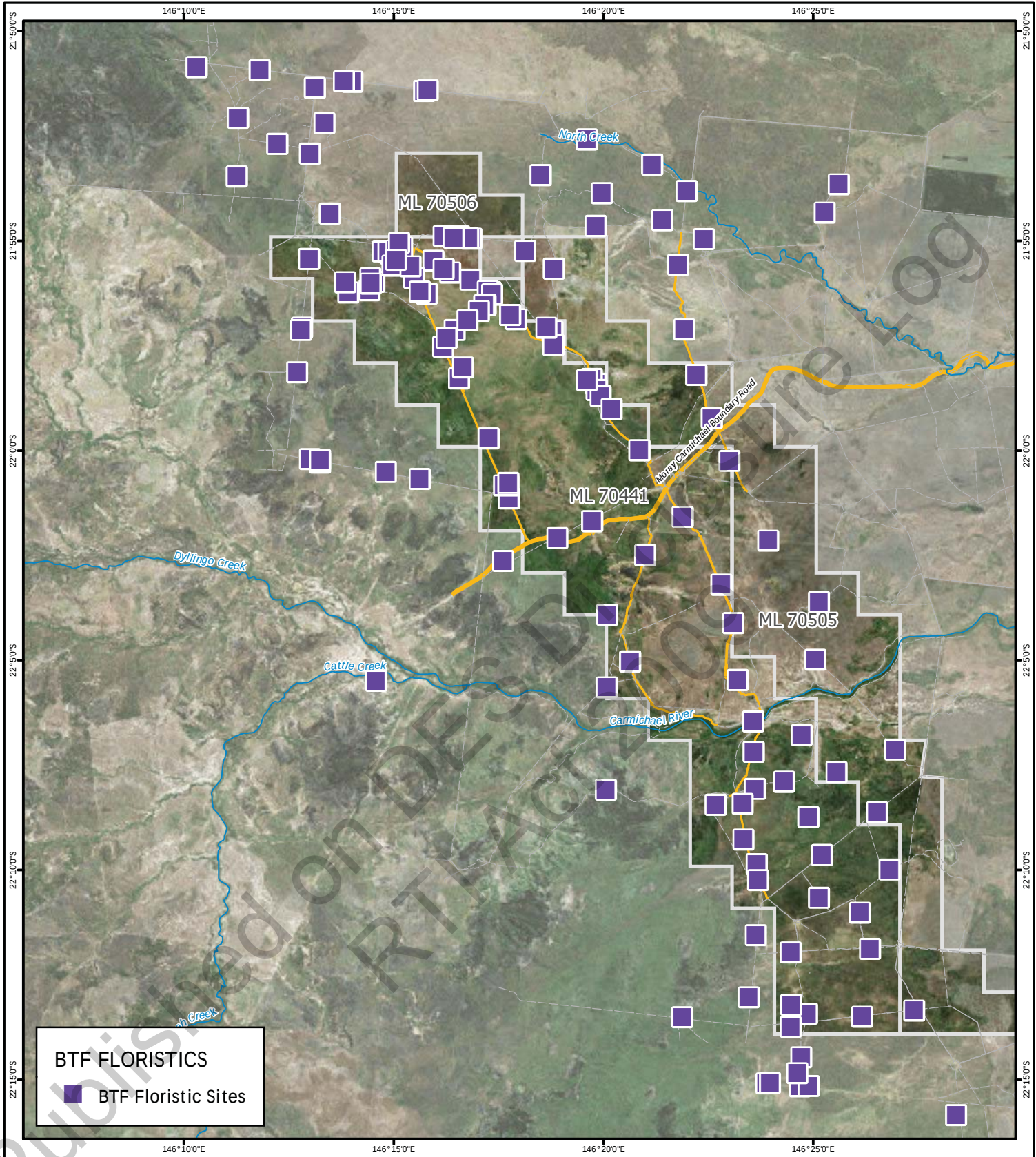
File A



FIGURE 1: BTF OBSERVATION RECORDS AND NEST SITES

2018 BTF Dry Season Survey
 Adani Mining Pty Ltd

Map Number	Job Number	Rev
1 of 1	QE118120	A



Legend

- Major Road
- Minor Road
- Track
- Watercourse
- Mining Lease

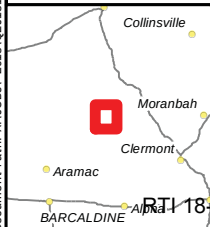


Scale 1:230,000 (A4)

0 2 4 6 8 10

Kilometers

Coordinate System: GCS GDA 1994



Notes:
 Aerial Imagery: © ESRI 2018
 Watercourse: © Geoscience Australia 2016
 Road: © Adani 2017
 Mining Lease: © DNRME 2018

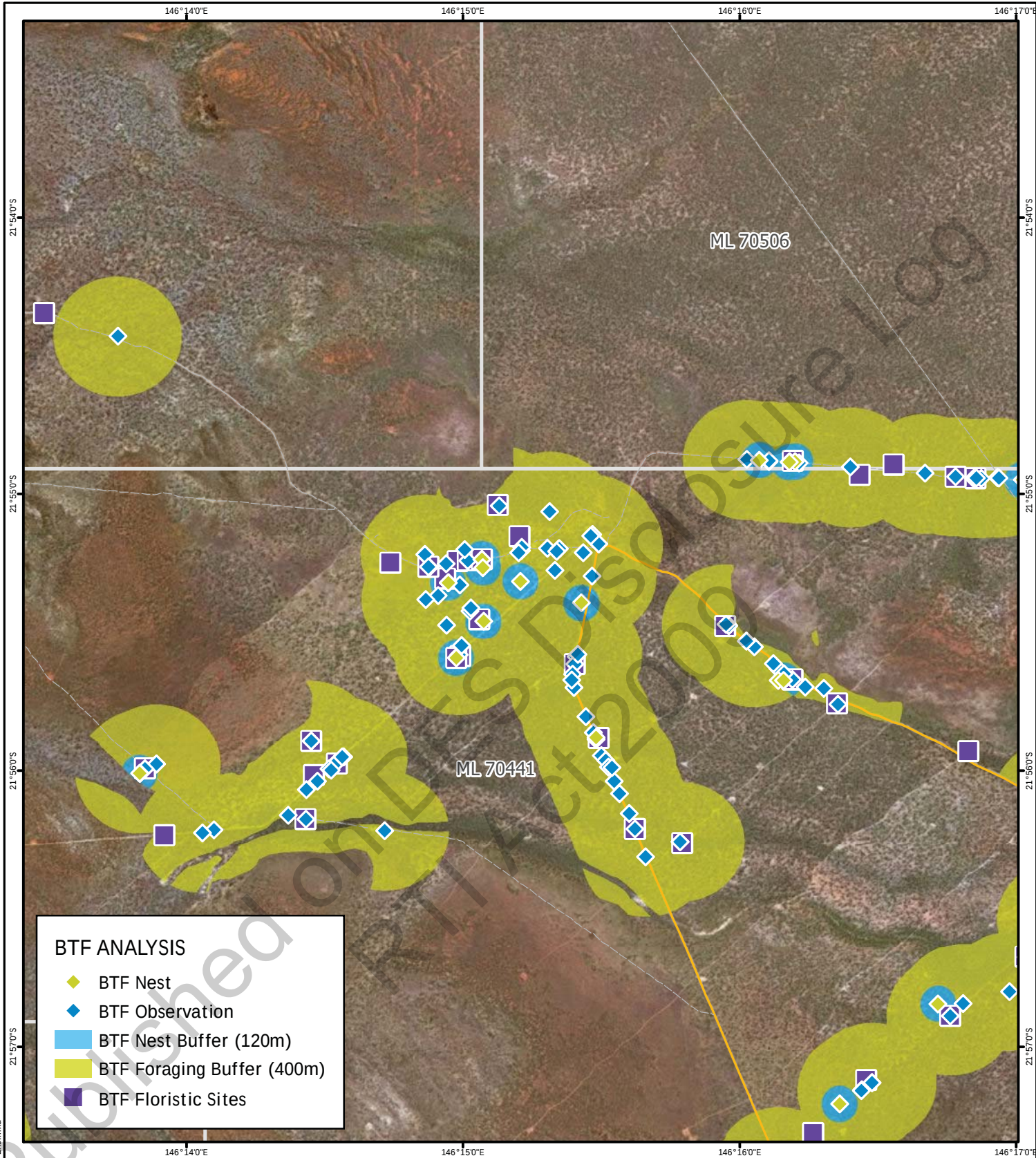
Rev	Description	Drawn	Approved	Date
1	Issued for Review	CD	CO	21/09/2018



FIGURE 2: BTF FLORISTIC SURVEY SITES

2018 BTF Dry Season Survey
 Adani Mining Pty Ltd

Map Number	Job Number	Rev
1 of 1	QE118120	A



BTF ANALYSIS

- ◆ BTF Nest
- ◆ BTF Observation
- BTF Nest Buffer (120m)
- BTF Foraging Buffer (400m)
- BTF Floristic Sites

Legend

- Major Road
- Minor Road
- Track
- Watercourse
- Mining Lease

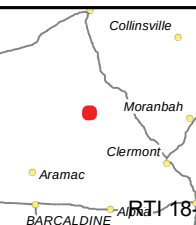


Scale 1:35,000 (A4)

0 0.5 1 1.5

Kilometers

Coordinate System: GCS GDA 1994



Notes:
 Aerial Imagery: © ESRI 2018
 Watercourse: © Geoscience Australia 2016
 Road: © Adani 2017
 Mining Lease: © DNRME 2018

Rev	Description	Drawn	Approved	Date
A	Issued for Review	CD	CO	21/09/2018



FIGURE 3: INDICATIVE BTF BUFFERS AND FLORISTIC SITES

2018 BTF Dry Season Survey
 Adani Mining Pty Ltd

Map Number	Job Number	Rev
1 of 1	QE118120	A

4 Results

4.1 BTF habitat characteristics

Preferred habitat for BTF typically consists of grassy eucalypt woodlands in proximity to water or riparian corridors Removed at External Review. High value habitats comprise areas of grassy woodland containing key seeding grass species and low vegetation density or bare ground to allow access to the seed bank and an open tree layer that does not have a continuously dense shrubby understorey (Black-throated Finch Recovery Team Department of Environment and Climate Change (NSW) and Queensland Parks and Wildlife Service, 2007 ed at External 2015).

In the Project area, BTF demonstrate a strong association with vegetation communities dominated by RE 10.5.5a (*Eucalyptus melanophloia* open woodland on sandplains, with a sparse shrub layer) and a mosaic of ground cover, which included a diversity in grass species present and bare inter-tussock patches (E2M 2018). The data analysis identified that 58% of BTF records occur with REs dominated by 10.5.5a. However when only foraging and breeding records are considered, this increases to 80%.

Other habitats where BTF have been recorded include *Eucalyptus brownii* open-woodland (RE 10.3.6ax1) (9%), *Eucalyptus similis*, *Corymbia brachycarpa* and *Corymbia setosa* open-woodland (RE 10.5.1) (7%) and non-remnant vegetation (12%).

4.2 Foraging habitat

BTF foraging habitat characteristics were analysed based on data collected from 115 vegetation survey sites between 2013 and 2018. For the majority of these sites all 13 habitat features listed in Section 3.2.2 were assessed, however for some surveys canopy height, T2 and shrub cover were not recorded and therefore these were omitted from the linear regression analysis.

The results of the analysis of BTF foraging habitat are shown in Table 3. The results demonstrate that BTF have a preference to forage in areas dominated by RE 10.5.5a (81% of foraging records), however they will utilise a wide range of habitat conditions in these areas, including three sites where native grass cover was recorded as 0%. Similarly the results indicate that BTF will forage in areas with no tree cover or no shrub cover.

The results indicate that BTF foraging habitat generally consists of an open-woodland (17.3 % canopy cover) with moderately low canopy (approximately 12 m) and low canopy species richness (2). The shrub layer is typically low (2.4m) and sparse (6.2% cover) but a moderately high species diversity (6). The ground cover is dominated by native grasses (36.6% cover and 8 species) with moderate bare ground (33.6% cover). Exotic grass and herb / forb cover are typically low (4.2% and 4% respectively). BTF have not been recorded foraging in areas with more than 50% exotic grass cover.

The results of the linear regression identified that two habitat characteristics had a significant relationship with BTF foraging. Both canopy species richness (0.0002) and shrub cover (0.0275) have a P-value of less than 0.05. Native grass richness (0.0892) and exotic grass cover (0.1083) were the only other variables that were close to having a significant relationship with BTF foraging records.



Canopy species richness has a moderately strong negative relationship indicated by a Multiple R of 0.3378 and a Coefficient of -1.6511. Shrub cover also has a moderately strong negative relationship indicated by a Multiple R of 0.2132 and a Coefficient of -0.1618. Native grass richness has a moderately strong positive relationship indicated by a Multiple R of 0.1592 and a Coefficient of 0.2166. Exotic grass cover has a moderately strong negative relationship indicated by a Multiple R of 0.1506 and a Coefficient of -0.0867.

Table 3 BTF Foraging Habitat Characteristics and Linear Regression Results

Habitat Feature	Values			Regression Results		
	Mean	Minimum	Maximum	Multiple R	Coefficient	P-value
Canopy Height (m)	12.1	0	18	-	-	-
Canopy cover	17.3	0	48	0.0221	-0.0124	0.8144
Canopy species richness	2	0	5	0.3378	-1.6511	0.0002
T2 cover	10.4	0	30	-	-	-
Shrub height (m)	2.4	1	6	-	-	-
Shrub cover	6.2	0	34.8	0.2132	-0.1618	0.0275
Shrub species richness	6	0	12	0.0444	-0.0898	0.6373
Native grass cover	36.6	0	85	0.0605	-0.0170	0.5208
Herb and forb cover	4.0	0	39	0.0122	-0.0088	0.8975
Exotic grass cover	4.2	0	50	0.1506	-0.0867	0.1083
Native grass richness	8	0	18	0.1592	0.2166	0.0892
Leaf litter cover	16.6	0	57	0.0982	-0.0378	0.2964
Bare ground cover	33.6	0	90	0.0983	0.0277	0.2958
10.5.5.a dominated RE's		81%			-	

Twelve grass species were identified as being recorded at more than 10% of the vegetation survey sites. *Aristida spp.* were the most commonly recorded grass in foraging habitat, occurring at 60% of sites. Other species recorded at more than 20% of foraging habitat survey sites were *Heteropogon contortus* (34%), *Themeda triandra* (33%), *Eriachne mucronata* (26%), *Panicum effusum* (25%) and *Triodia pungens* (24%) (Table 4). However *Bothriochloa ewartiana* (16%), *Triodia pungens* (13.2%) and *Heteropogon contortus* (9.3%) have the highest mean covers at sites where they have been recorded. The linear regression did not identify a statistically significant or strong relationship with any individual grass species. The P-value for all grasses was well above 0.05 (Table 4).

BTF have also been observed foraging on numerous grass species during the surveys including:

- *Bothriochloa ewartiana*
- *Enneapogon polyphyllus*
- *Themeda triandra*
- *Panicum effusum*
- *Digitaria brownii*
- *Schizachyrium fragile*



- *Sehima nervosum*
- *Chrysopogon fallax*
- *Enteropogon ramosus*
- *Paspalidium rarum*
- *Schizachyrium fragile*
- *Cymbopogon bombycinus*
- *Triodia pungens*
- *Eriachne mucronata*
- *Setaria surgens**
- *Digitaria ciliaris**
- *Aristida* spp.; and
- *Stylosanthes humilis* * (GHD 2012, Niche 2016, ELA 207, E2M 2017 and E2M 2018).

Table 4 BTF Foraging Habitat Native Grass and Linear Regression Results

Species	Values			Regression Results		
	Frequency (%)	Mean cover (%)	Maximum cover (%)	Multiple R	Coefficient	P-value
<i>Aristida</i> spp.	60	6.7	50	0.0802049	0.02657714	0.646949
<i>Bothriochloa ewartiana</i>	15	16.0	20	0.0148753	0.01051751	0.932411
<i>Chrysopogon fallax</i>	19	4.6	10	0.0824834	-0.0882015	0.637598
<i>Cymbopogon bombycinus</i>	16	2.6	10	0.1373041	-0.1644413	0.431553
<i>Enneapogon polyphyllus</i>	19	4.1	10	0.2361793	-0.246901	0.171962
<i>Eriachne mucronata</i>	26	5.4	20	0.0606496	0.04742036	0.729271
<i>Eulalia aurea</i>	12	0.5	10	0.1733716	-0.4508659	0.319251
<i>Heteropogon contortus</i>	34	9.3	20	0.1317142	0.08140311	0.450713
<i>Panicum effusum</i>	25	4.1	10	0.0713383	0.07077159	0.683835
<i>Sehima nervosum</i>	19	3.1	10	0.2021374	0.20742707	0.244222
<i>Themeda triandra</i>	33	6.7	10	0.1511338	0.1238827	0.386139
<i>Triodia pungens</i>	24	13.2	30	0.0125656	-0.006378	0.942887

4.3 Breeding habitat

BTF breeding habitat characteristics were analysed based on data collected from 24 vegetation survey sites between 2013 and 2018. For the majority of these sites all 13 habitat features listed in Section 3.2.2 were assessed, however for some surveys canopy height, T2 and shrub cover were not recorded and therefore these were omitted from the linear regression analysis.

The results of the analysis of BTF breeding habitat are shown in Table 5. The results again demonstrate that BTF have a preference to breed in areas dominated by RE 10.5.5a (79% of nest records). However unlike the foraging areas, BTF demonstrate a narrower range of habitat conditions for breeding habitat. In particular the range of values for canopy height and shrub cover were much lower than foraging areas.

An additional variable, proximity to known permanent water, was also analysed for breeding habitat. These results identified a mean distance of approximately 2.5 km between nests and permanent water sources. The closest nest to a water source was 280m and the furthest was almost 7 km.



The results indicate that BTF breeding habitat generally consists of an open-woodland (17 % canopy cover) with moderately low canopy (approximately 11.6 m) and low canopy species richness (2). The shrub layer is typically low (2.5 m) and sparse (5.2% cover) but a moderately high species diversity (6). The ground cover is dominated by native grasses (37.7% cover and 8 species) with moderate bare ground (33.9% cover). Exotic grass and herb / forb cover are typically low (3.5% and 4.3% respectively). BTF nests have not been recorded in areas with more than 15% exotic grass cover.

The results of the linear regression identified that only one habitat characteristic had a significant relationship with BTF nest sites with native grass richness (0.0256) having a P-value of less than 0.05. Shrub cover (0.1319) was the only other variable that was close to having a significant relationship with BTF nests based on the existing data.

Native grass richness has a moderately strong positive relationship indicated by a Multiple R of 0.4546 and a Coefficient of 0.7591. Shrub cover has a moderately strong negative relationship indicated by a Multiple R of 0.3164 and a Coefficient of -0.4255.

Table 5 BTF Nesting Habitat Characteristics and Linear Regression Results

Habitat Feature	Values			Regression Results		
	Mean	Minimum	Maximum	Multiple R	Coefficient	P-value
Distance to water (m)	2,495	280	6,965	-	-	-
Canopy height (m)	11.6	9	15	-	-	-
Canopy cover	17.0	7	35	0.1883	-0.1423	0.3781
Canopy species richness	2	1	5	0.1398	-0.8473	0.5148
T2 cover	9.8	0	20	-	-	-
Shrub height (m)	2.5	2	4		-	-
Shrub cover	5.2	0	19	0.3164	-0.4255	0.1319
Shrub species richness	6.0	2	11	0.1647	0.4208	0.4417
Native grass cover	37.7	9.6	85	0.1441	-0.0476	0.5017
Herb and forb cover	4.3	0	25	0.0457	-0.0350	0.8321
Exotic grass cover	3.5	0	15	0.1296	-0.1639	0.5462
Native grass richness	8	3	17	0.4546	0.7591	0.0256
Leaf litter cover	18.8	0	50	0.0959	-0.0446	0.6558
Bare ground cover	33.9	7	80.4	0.0781	-0.0250	0.7168
10.5.5.a dominated RE's		79%			-	

BTF nests recorded during the 2018 dry season survey indicated a preference to construct nests in the tall shrub layer dominated by *Acacia sericophylla*, typically at 2 to 4 m in height. Other nests were observed



low in the canopy layer at 7 m in height. BTF nests were most commonly found in *Acacia sericophylla* (12 records), followed by *Grevillea parallela* (2 records) and *Eucalyptus melanophloia* (1 record) (E2M 2018).

Aristida spp. were the most commonly recorded grass in foraging habitat, occurring at all nesting vegetation sites. Other species recorded at more than 20% of breeding habitat survey sites were *Themeda triandra* (38%), *Triodia pungens* (33%), *Heteropogon contortus* (29%), *Cymbopogon bombycinus* (24%), *Panicum effusum* (24%) and (Table 6). No individual cover data was available for two species (*Cymbopogon bombycinus* and *Eulalia aurea*) to identify the mean and maximum covers in breeding habitat. Of the other ten species, the mean covers were all generally similar with a mean between 10 and 17%.

Table 6 BTF Nesting Habitat Native Grass Results

Species	Frequency (%)	Mean cover (%)	Maximum cover (%)
<i>Aristida spp.</i>	100	15	30
<i>Bothriochloa ewartiana</i>	10	10	10
<i>Chrysopogon fallax</i>	19	10	10
<i>Cymbopogon bombycinus*</i>	24	n/a	n/a
<i>Enneapogon polyphyllus</i>	19	10	10
<i>Eriachne mucronata</i>	14	17	20
<i>Eulalia aurea*</i>	10	n/a	n/a
<i>Heteropogon contortus</i>	29	10	10
<i>Panicum effusum</i>	24	10	10
<i>Sehima nervosum</i>	19	10	10
<i>Themeda triandra</i>	38	10	10
<i>Triodia pungens</i>	33	13	20

* No quantitative cover data was recorded for these species at breeding vegetation sites

5 Discussion

The results of the BTF habitat analysis indicate that the typical habitat characteristics for foraging and breeding habitat are generally similar (Table 7). The mean values for the majority of the 13 variables that were assessed during this analysis were very similar for both habitat types. This is likely to be partially due to some vegetation surveys being located in areas that were defined as breeding and foraging habitat. However the minimum and maximum values for each variable indicate there is a greater tolerance for variation in the habitat conditions for foraging habitat.

The results confirm that BTF in the Project area have a strong association with RE 10.5.5a, especially in areas where the canopy is approximately 12 m tall and 17% cover. A low and sparse shrub layer is preferred with a diversity of species, especially *Acacia sericophylla* and *Grevillea parallela* in which they have been recorded nesting in on multiple occasions. A ground layer containing a mosaic of approximately 37% native grass cover and 34% bare ground as well as at least 8 native grass species and less than 5% exotic grass cover is preferred. Table 7 provides a summary of the key characteristics of BTF foraging and breeding habitats.

The analysis failed to identify a strong relationship with any individual grass species. This is likely due to the importance of native grass richness, which indicates that BTF require a variety of native grasses for foraging and nest site selection. The results also suggest that BTF prefer to forage and breed in areas that are not dominated by a single grass species and prefer habitat where a more even cover of native grasses occurs.

Twelve grass species were identified as being recorded at more than 10% of the vegetation survey sites. Further native grass cover data is required to undertake a linear regression for individual grass species in BTF breeding habitat, however it is unlikely that any single species is likely to be identified as statistically significant given the similarity in results for foraging and breeding habitat.



Table 7 BTF foraging habitat vegetation attributes

Attribute	Foraging Habitat	Breeding Habitat
Canopy		
Average height (m)	12.1	11.6
Foliage projected cover (%)	17.3	17
Key species	<i>Eucalyptus melanophloia</i> <i>Corymbia dallachiana</i> <i>Corymbia clarksoniana</i> <i>Eucalyptus brownii</i> <i>Eucalyptus whitei</i>	<i>Eucalyptus melanophloia</i> <i>Corymbia dallachiana</i> <i>Corymbia clarksoniana</i> <i>Eucalyptus brownii</i> <i>Eucalyptus whitei</i>
Shrub layer		
Average height (m)	2.4	2.5
Foliage projected cover (%)	6.2	5.2
Key species	<i>Acacia sericophylla</i> <i>Acacia bidwillii</i> <i>Acacia elachantha</i> <i>Acacia excelsa</i> <i>Acacia laccata</i> <i>Acacia tenuissima</i> <i>Capparis lasiantha</i> <i>Carissa lanceolata</i> <i>Grevillea parallela</i> <i>Grewia latifolia</i> <i>Hakea lorea</i> <i>Maytenus cunninghamii</i>	<i>Acacia sericophylla</i> <i>Acacia bidwillii</i> <i>Acacia elachantha</i> <i>Acacia excelsa</i> <i>Acacia laccata</i> <i>Carissa lanceolata</i> <i>Grevillea parallela</i> <i>Grewia latifolia</i> <i>Hakea lorea</i> <i>Maytenus cunninghamii</i>

Attribute	Foraging Habitat	Breeding Habitat
Ground layer		
Native grass cover (%)	36.6	37.7
Bare ground cover (%)	33.6	33.9
Exotic grass cover (%)	4.2	3.5
Key species	<i>Aristida</i> spp., <i>Bothriochloa ewartiana</i> , <i>Chrysopogon fallax</i> , <i>Cymbopogon bombycinus</i> , <i>Enneapogon polyphyllus</i> , <i>Eriachne mucronata</i> , <i>Eulalia aurea</i> , <i>Heteropogon contortus</i> , <i>Panicum effusum</i> , <i>Sehima nervosum</i> , <i>Themeda triandra</i> , <i>Triodia pungens</i>	<i>Aristida</i> spp., <i>Bothriochloa ewartiana</i> , <i>Chrysopogon fallax</i> , <i>Cymbopogon bombycinus</i> , <i>Enneapogon polyphyllus</i> , <i>Eriachne mucronata</i> , <i>Eulalia aurea</i> , <i>Heteropogon contortus</i> , <i>Panicum effusum</i> , <i>Sehima nervosum</i> , <i>Themeda triandra</i> , <i>Triodia pungens</i>

The results only identified a significant statistical relationship with a few habitat variables, however it is considered likely that additional data collected during ongoing surveys will identify more, particularly for breeding habitat where there is still relatively less habitat data. The analysis indicates that native grass richness is a critical factor in the selection of BTF foraging and breeding habitat. Other variables that had a strong relationship with BTF occurrence were canopy species richness, shrub cover and exotic grass cover. However further analysis that also considers the relationships between each variable may also identify significant relationships for BTF foraging and breeding habitat.

BTF nests in the study area demonstrate a much greater distance from water than the current literature and government guidelines indicate. This may be due to the relative scarcity of water in the Desert Uplands region compared to the Townsville Coastal Plains region where current literature and guidelines have been based upon. This has implications for the monitoring and management of BTF in the Project area as there is a need to survey and manage areas of important habitat for a greater area.



6 Conclusion and recommendations

Condition I6 (a) of the EA requires that Adani undertake 'a baseline research program on the specific nesting and feeding requirements of the species that will be undertaken prior to and during project stage 1'. E2M was engaged by Adani to undertake an analysis of BTF habitat based on the data collected during surveys and monitoring undertaken during the Project. The objective of the assessment is to analyse this vegetation and habitat data to determine the specific nesting and feeding habitat requirements for BTF residing in the Project area.

Since 2010 Adani has undertaken a comprehensive assessment of BTF within the Project area consisting of 13 surveys within the mining lease and the Moray Downs West offset area. These surveys have assessed the presence, habitat preferences, ecology, population and spatial patterns of BTF with the Project area. Eleven of the surveys have included vegetation surveys to capture data relating to BTF habitat in the Project area. These surveys have been undertaken at different times throughout the year to account for seasonal variation in BTF activities and availability of food sources.

The BTF surveys have recorded a total of 651 separate BTF observations and 69 nests. Vegetation surveys have been undertaken at 162 unique sites of which 52 have been surveyed twice to give a total of 214 vegetation surveys for the data analysis to be based upon.

The analysis was based on 13 vegetation variables, 12 native grass species and a response variable of BTF records within 400 m of the vegetation survey site to determine the key habitat characteristics for BTF foraging and breeding habitat. The minimum, maximum and mean values for each variable was calculated and a linear regression completed to identify the statistical relationship of each characteristic with foraging and breeding habitat. The proximity to a known permanent water source was also calculated as well as the percentage of records within each RE in the Project area.

The results of the BTF habitat analysis indicate that the typical habitat characteristics for foraging and breeding habitat are generally similar with the mean values for most of the 13 variables very similar. However the minimum and maximum values for each variable indicate BTF have a greater tolerance for variation in the habitat conditions for foraging habitat.

Approximately 80% of BTF foraging and breeding records were located in RE 10.5.5a where they typically prefer areas where the canopy is approximately 12 m tall and 17% cover. A low and sparse shrub layer is preferred with a diversity of species, especially *Acacia sericophylla* and *Grevillea parallela* in which they have been recorded nesting in on multiple occasions. A ground layer containing a mosaic of approximately 37% native grass cover and 34% bare ground as well as at least 8 native grass species and less than 5% exotic grass cover is preferred.

The mean distance of BTF nests to known permanent water was approximately 2.5 km. The closest nest to a water source was 280 m and the furthest was almost 7 km.

Twelve grass species were identified as being recorded at more than 10% of the vegetation survey sites. *Aristida spp.* were the most commonly recorded grass in foraging and breeding habitat. Other species that were recorded often were *Heteropogon contortus*, *Themeda triandra*, *Eriachne mucronata*, *Panicum effusum* and *Triodia pungens*. The linear regression did not identify a statistically significant or strong relationship with any individual grass species, rather they indicated a requirement for a variety of native grasses for foraging and breeding habitat. The results also suggest that BTF prefer to forage and breed in areas that are not dominated by a single grass species and prefer habitat where a more even cover of native grasses occurs.

The results only identified a significant statistical relationship with a few habitat variables. The analysis indicates that native grass richness is a critical factor in the selection of BTF foraging and breeding habitat. Other variables that had a strong relationship with BTF occurrence were canopy species richness,



shrub cover and exotic grass cover. However further analysis that also considers the relationships between each variable may also identify significant relationships for BTF foraging and breeding habitat.

The following recommendations are made for future BTF monitoring and habitat analysis for the Project:

- Increase the number of vegetation surveys undertaken during the wet season as the current dataset has a bias towards dry season survey data
- Undertake further vegetation surveys in areas of RE 10.5.5a where BTF are absent in order to undertake a statistical comparison of the differences between occupied and unoccupied 10.5.5a habitat. This may also assist in the management of offset areas by identifying limiting factors for BTF habitat
- Undertake further vegetation assessments of recorded BTF breeding sites, particularly during the wet season when ground cover species identification is improved
- Undertake further analysis during future BTF monitoring and research to explore the relationship between individual grass species and combinations of grass species; and
- Undertake further analysis (such as a Principal Component Analysis) during future BTF monitoring and research that also considers the relationships between each habitat variable.



Appendix F Summary of baseline groundcover characteristics to assist with future management of grazing

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Background

The Carmichael Coal Mine and Rail Infrastructure Project comprises the Carmichael Coal Mine (open-cut and underground coal mine) and 189 km of rail line and associated infrastructure in the Galilee Basin of central Queensland. As a requirement of Commonwealth and State approval conditions, a Black-throated Finch (BTF) Management Plan (ELA 2018) has been developed for the project. The BTF Management Plan is specific to the coal mine component of the project and details management actions and monitoring requirements to mitigate potential impacts on BTF.

Management actions described in the plan include measures related to the management of grazing within the project area. Risks to BTF habitat associated with heavy grazing include decreased grass species richness and increased prevalence of annual grasses and unpalatable weeds. However, appropriately managed grazing may be beneficial for maintenance of BTF habitat within the project area, as it can prevent thickening of a woody shrub layer, open up the grass layer and increase the amount of bare ground which BTF use to forage. BTF foraging habitat must provide suitable seeds, which are principally of grasses, with fallen seeds accessible on the ground.

This memorandum outlines the results from a review of baseline (prior to mining) BTF habitat data collected at the project area. The data will be useful to monitor the influence of grazing on BTF habitat values, as described in the BTF Management Plan. Adani provided Eco Logical Australia (ELA) vegetation survey data collected across the project area by four consultants since 2012. Data was collated and assessed for its suitability to establish a baseline of groundcover conditions, with which future monitoring results can be compared.

Purpose

The purpose of this memorandum is to determine a baseline from the period of the project's Environmental Impact Statement (2011-2013), for the following key BTF habitat variables:

1. Groundcover, with specific reference to the percent cover of native grasses, litter and bare ground
2. Groundcover species composition; that is the number of native grass species
3. The fixed locations at which ongoing monitoring for comparison with the baseline will be conducted

Analysis of vegetation data (2012-2018)

A monitoring program is included in the BTF Management Plan with targeted BTF population surveys as well as a habitat assessment component. Habitat assessments include key ground layer characteristics relevant to BTF, including groundcover type (native perennial cover, litter and bare ground), proportion and composition (native grass species richness). The monitoring program includes seasonal surveys undertaken on a biannual basis, with ten surveys completed since 2013. Prior to this, in 2011 and 2012, some initial surveys were completed. However, the quantity and type of groundcover data collected was limited. In this regard, for the purposes of establishing a baseline for future comparisons, this analysis has focussed on data collected from May 2013 onwards.

A structured approach was used to determine the location of baseline monitoring sites established during the first two biannual surveys, completed in May and August 2013 by consultants GHD. Prior to the selection of sites by GHD, the project area was stratified by factors known to influence BTF presence or absence, including vegetation type, level of vegetation disturbance, elevation and distance to water. Monitoring sites were then located across the range of habitat types present within the project area, including habitat that is suitable and unsuitable for BTF. As explained in GHD (2013), the intent of targeting a range of habitat values was to gain an understanding of spatial variation in habitat use over time and to determine whether certain habitat areas are utilised by BTF more consistently than others.

A total of 67 monitoring sites were established during surveys undertaken in May and August 2013 (GHD 2014; **Table 1**). Repeat monitoring of all 67 sites was undertaken in October 2013 and a subset of these sites was monitored in December 2014 by consultants Niche. These fixed sites provide a suitable baseline of groundcover conditions across the project area. As seasonal variation can be expected in the results for various groundcover variables, data from surveys were allocated to a category of wet season (November to March) or dry season (April to October).

Table 1: Number of BTF habitat assessment sites monitored

Consultant	Date	Survey season	Number of habitat assessment sites
GHD (2014)	May 2013	Dry season	52
	August 2013	Dry season	15
	October 2013	Dry season	67
Niche (2015a, b; 2016a, b)	December 2014	Wet season	52

Surveys March 2015 to April 2018

The survey methodology was modified for surveys completed after December 2014, with the location of habitat assessments selected based on BTF presence. In this regard, monitoring sites departed from being fixed to a particular location, but rather established at sites where BTF were observed. The majority of habitat assessments were located in areas where BTF were observed to be foraging or where BTF nests were identified. In instances when the number of BTF records was low, additional habitat assessments were generally undertaken in areas of suitable habitat where a habitat assessment had not been completed previously, for the purpose of improving the spatial stratification of habitat assessment data.

A total of 95 unique habitat assessment sites were monitored during surveys between March 2015 and April 2018 (**Table 2**). A list of all monitoring site names from 2013 to 2018 are provided in **Appendix A**. A map showing the location of all monitoring sites from 2013 to 2018 are provided in **Appendix B**.

The objective of the revised approach from March 2015 was to collect data on the floristic characteristics of known BTF habitat (being utilised at the time of the survey). Information on known BTF habitat is important as it increases understanding of the habitat requirements, diet, nesting requirements and relationship between water sources and food sources specific to BTF within the project area. Data from these monitoring sites provides information on the groundcover conditions of areas that were observed to be actively used by BTF for foraging and/or nesting. However, data from these sites are not suitable to be used as a baseline for fixed sites to monitor groundcover over time. This is because establishment of the sites was stratified to areas of BTF habitat utilisation at the time of data collection, which presents a strong bias in the results. Future comparisons of these data should therefore be made with areas that are also observed to be used by BTF for foraging and/or nesting at the time of survey.

Table 2: Summary of BTF presence monitoring sites and number of monitoring sites assessed

Consultant	Date	Survey type	Number of habitat assessment sites
Niche (2015a, b; 2016a, b)	March 2015	Wet season	29
	August 2015	Dry season	18
	April 2016	Dry season	19
ELA (2017)	October 2016	Dry season	8
E2M (2017, 2018)	November 2017	Wet season	6
	April 2018	Dry season	15

Groundcover and ground composition baseline values

1. *Groundcover*

The groundcover component of the habitat assessment included an assessment of groundcover type and percentage cover within five 1 m² quadrats at each site. The results were then averaged to give a mean groundcover score for the site.

Groundcover data collected at each of the proposed baseline monitoring sites in 2013 and 2014 was analysed to determine the average score for each of the key BTF habitat characteristics. These include native perennial grass cover, non-native grass cover, litter and bare ground. These habitat characteristics have been selected as baseline values based on known BTF habitat requirements. These include areas with an appropriate density and diversity of grasses and patches of bare ground which provide access to fallen grass seeds which the species feeds on (at Extern 2011 & ELA, 2018).

A summary of all baseline data is provided in **Appendix C**. Average native perennial grass cover ranged between 12.8% and 50% during monitoring in 2013 (**Figure 1**). Native perennial grass cover was higher during monitoring in 2014, ranging between 24% and 85%. Such seasonal variations are consistent with those expected, with a higher percent cover of native grasses in the wet season than the dry season. Grazing management practices in 2013 and 2014 may also have influenced the result.

Non-native grass cover was highly variable during both the 2013 and 2014 survey periods. Non-native grass cover ranged between 0% and 22% during monitoring in 2013 and between 0% and 30% in 2014 (**Figure 2**). The number of sites where no non-native grass cover was recorded was a total of 12 sites in 2013 and 14 sites in 2014.

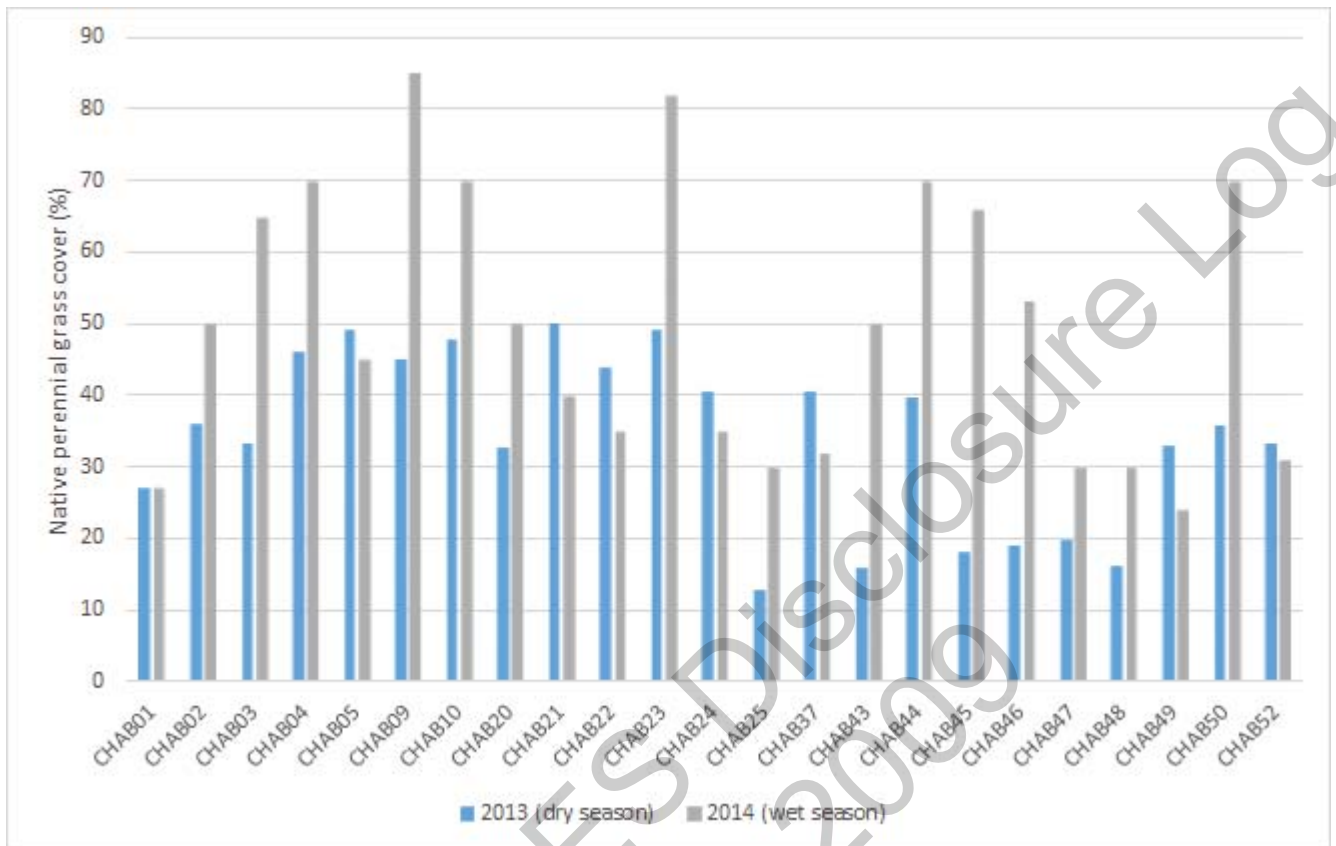


Figure 1: Native perennial grass cover at baseline monitoring sites in 2013 and 2014

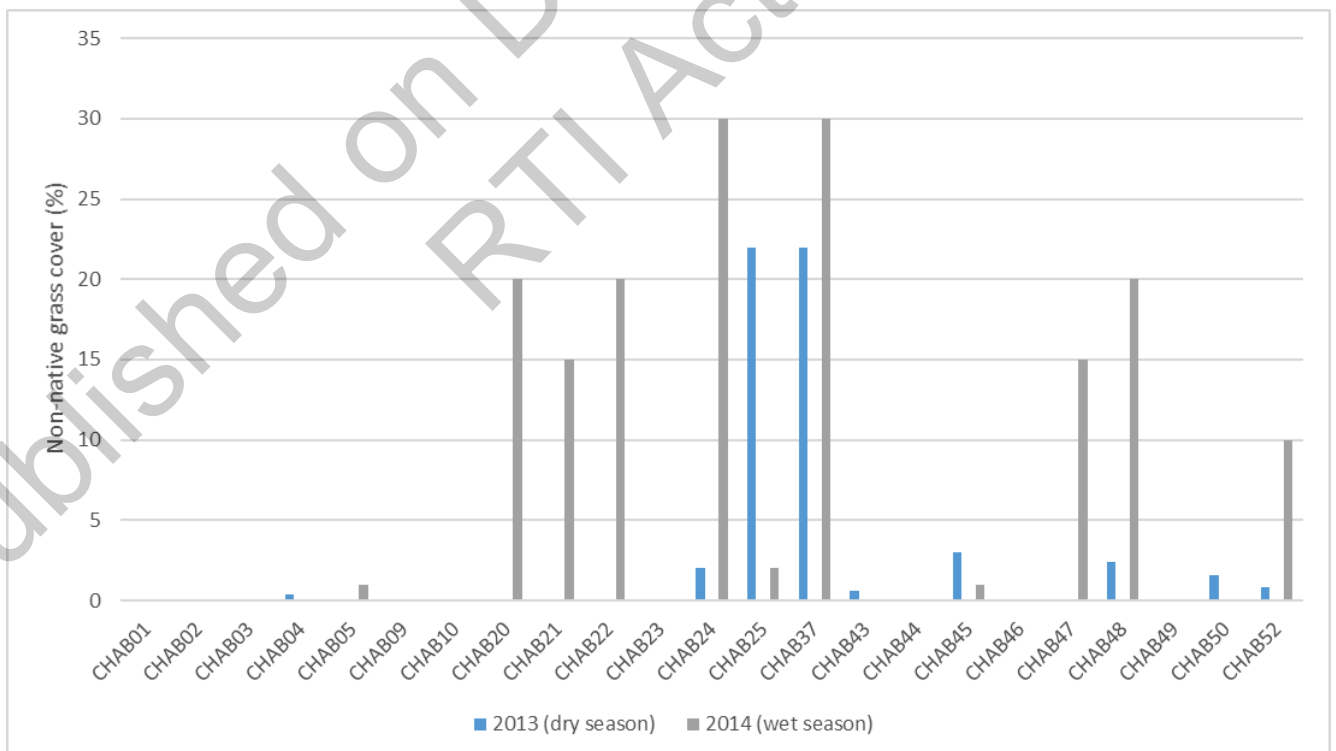


Figure 2: Non-native grass cover at baseline monitoring sites in 2013 and 2014

Litter cover was highly variable among sites during both survey periods (**Figure 3**). Litter cover ranged from 0% to 36.4% in 2013 and from 3% to 31% in 2014. Such results are as expected due to seasonal variation, with litter increasing during the dry season as grasses die back and trees lose their leaves.

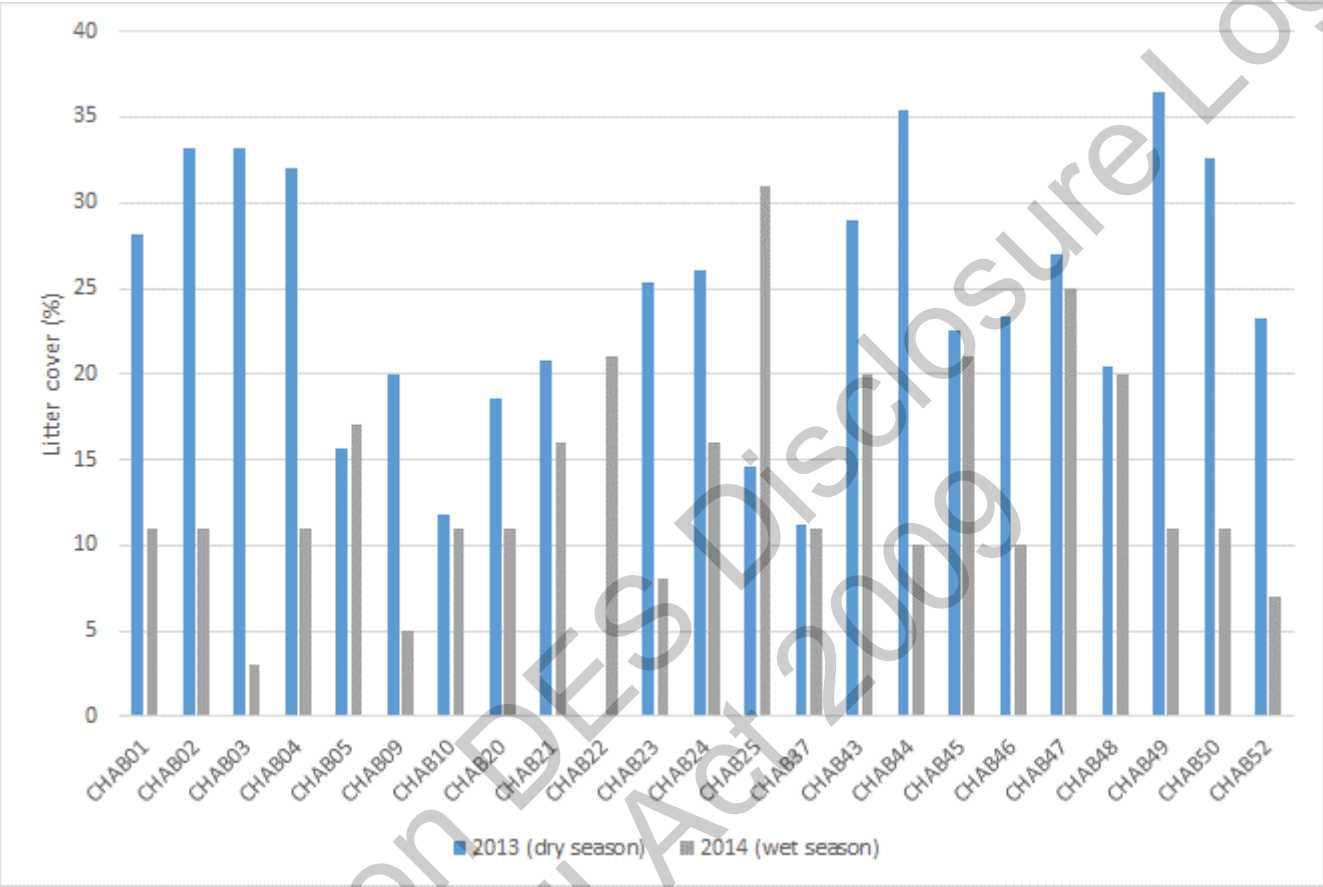


Figure 3: Litter cover at baseline monitoring sites in 2013 and 2014

The proportion of bare ground ranged between 17.6% and 57.2% in 2013 (**Figure 4**). The proportion of bare ground, ranged between 10% and 65% in 2014.

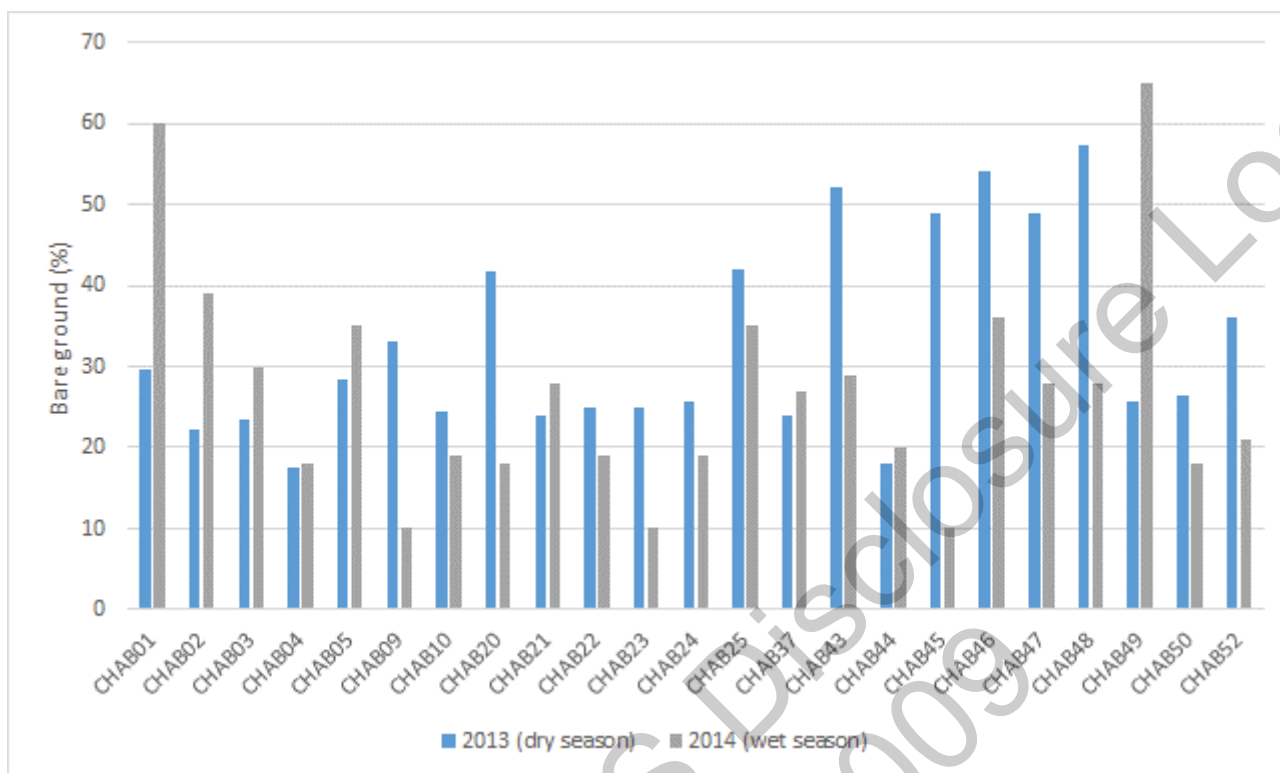


Figure 4: Proportion of bare ground at baseline monitoring sites in 2013 and 2014

The native perennial grass cover, non-native grass cover, litter and bare ground data for each proposed baseline monitoring site was averaged separately for the 2013 and 2014 survey periods to control for variation in the data due to seasonality (**Table 3**). As noted above, native perennial grass cover can be expected to increase during the wet season and decrease during the dry season. Litter can also be expected to be higher in the dry season than the wet season. Baseline results are consistent with these trends, and may also have been influenced by grazing management practices during 2013 and 2014.

Table 3: Average seasonal groundcover values at baseline monitoring sites in 2013 & 2014

Groundcover type	2013 Dry season survey average cover (%)	2014 Wet season survey average cover (%)
Native perennial grass cover	34.16 (Standard Deviation 12.1)	49.57
Non-native grass cover	2.38 (Standard Deviation 6.3)	7.13
Litter	23.50	13.83
Bare ground	32.77	27.04

2. Ground composition

The composition of the ground layer was assessed within the same five 1 m² quadrats at each site. Groundcover composition was assessed by recording the number of species in the ground layer within the plot. The results for each plot were then averaged to give a mean ground composition score for the site.

Native grass species richness ranged from 5 species to 14 species per monitoring site in 2013 (**Figure 5**). Native grass species richness ranged from 2 species to 5 species per monitoring site in 2014.

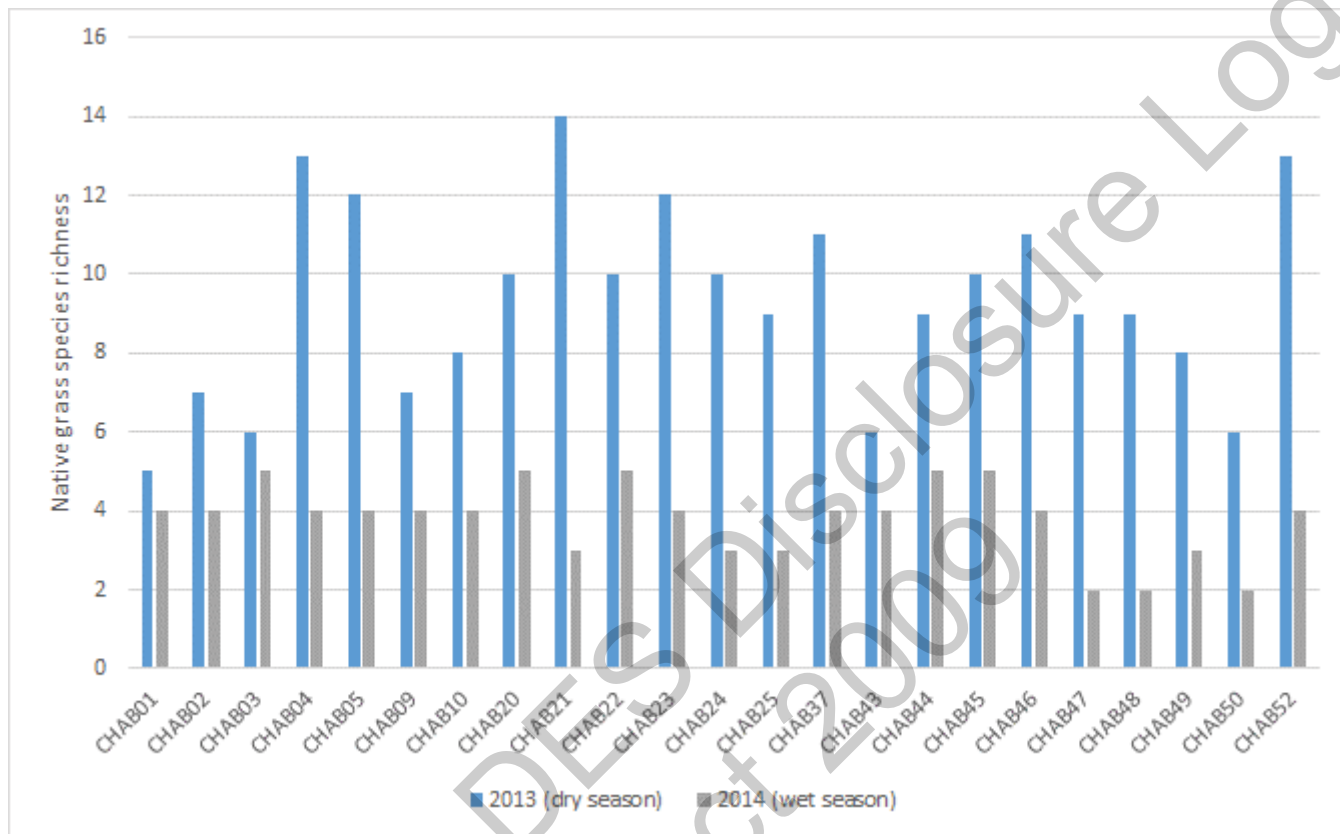


Figure 5: Number of species recorded at baseline monitoring sites in 2013 and 2014

The average number of species recorded at each monitoring site during the 2013 survey period (dry season) was much higher than the average number of species recorded during the 2014 survey period (wet season; **Table 4**). This may be due to varying seasonality of the survey periods, with monitoring conducted after the wet season in 2013 and in the early phase of the wet season in 2014. There was 197 mm of rainfall in the three months prior to the May 2013 survey. Rainfall records prior to the December 2014 survey are incomplete. The ability to identify many plants, particularly grasses, can vary greatly with seasonality as many grass species can only be identified to species level if reproductive material is present. It is likely that seasonal timing of the survey has affected the observed species diversity, particularly during the 2014 survey period.

Table 4: Average species diversity during the 2013 and 2014 survey periods

Monitoring variable	2013 Dry season survey average species richness	2014 Wet season survey average species richness
All groundcover species	15	6
Native grass species	9	4

Native and non-native grass species recorded at baseline monitoring sites during surveys in 2013 and 2014 are shown in **Table 5**. Percent cover data for grass species were recorded in 2013 only.

Buffel Grass

The non-native grass species *Cenchrus ciliaris* (Buffel Grass) was recorded at a total of nine sites in 2013 (average 5.87% cover) and at 13 sites in 2014 (out of a total of 23 sites). Buffel Grass is a potential threat to BTF habitat values as it can form a monoculture, reducing the diversity of native grasses utilised as foraging resources and colonising bare ground. Grazing can be an effective tool in managing Buffel Grass.

Table 5: Native and non-native grass species recorded at baseline monitoring sites during surveys in 2013 and 2014

Scientific name	Survey period	
	2013 Dry Season – average cover when present (%) and number of sites present	2014 Wet Season Present / Absent (% cover not recorded)
<i>Alloteropsis semialata</i>	0.2 (1 site)	
<i>Aristida calycina</i>	1.99 (16 sites)	
<i>Aristida contorta</i>	4.18 (8 sites)	✓
<i>Aristida holathera</i>	0.68 (5 sites)	
<i>Aristida hygrometrica</i>	1.00 (1 site)	
<i>Aristida ingrata</i>	2.80 (17 sites)	✓
<i>Aristida jerichoensis</i>	1.76 (5 sites)	✓
<i>Aristida latifolia</i>	1.07 (3 sites)	✓
<i>Aristida queenslandica</i>	1.20 (1 site)	
<i>Aristida</i> sp.	X	✓
<i>Bothriochloa ewartiana</i>	5.23 (12 sites)	
<i>Bothriochloa pertusa</i> *	0.80 (1 site)	
<i>Cenchrus ciliaris</i> *	5.87 (9 sites)	✓
<i>Chrysopogon fallax</i>	5.30 (16 sites)	✓
<i>Cleistochloa subjuncea</i>	1.80 (1 site)	
<i>Cymbopogon obtectus</i>	3.56 (8 sites)	
<i>Dichanthium sericeum</i>	0.80 (1 site)	
<i>Digitaria brownii</i>	1.78 (12 sites)	
<i>Digitaria divaricatissima</i>	0.53 (8 sites)	
<i>Digitaria</i> sp.	X	✓
<i>Enneapogon polyphyllus</i>	1.75 (11 sites)	
<i>Enneapogon robustissimus</i>	0.80 (1 site)	
<i>Enteropogon ramosus</i>	0.20 (1 site)	

Scientific name	Survey period	
	2013 Dry Season – average cover when present (%) and number of sites present	2014 Wet Season Present / Absent (% cover not recorded)
<i>Eragrostis lacunaria</i>	0.75 (4 sites)	
<i>Eragrostis</i> sp.	X	✓
<i>Eragrostis speciosa</i>	0.8 (1 site)	
<i>Eriachne mucronata</i>	3.03 (7 sites)	✓
<i>Eriachne</i> sp.	X	✓
<i>Heteropogon contortus</i>	8.86 (19 sites)	✓
<i>Imperata cylindrica</i>	X	✓
<i>Ischaemum australe</i>	X	✓
<i>Melinis repens</i> *	1.80 (1 site)	
<i>Panicum decompositum</i>	0.60 (1 site)	
<i>Panicum effusum</i>	0.90 (4 sites)	
<i>Sarga plumosum</i>	1.12 (5 sites)	✓
<i>Setaria plumosum</i>	X	✓
<i>Schizachyrium fragile</i>	1.20 (1 site)	
<i>Sehima nervosum</i>	4.31 (9 sites)	
<i>Sporobolus australasicus</i>	X	✓
<i>Themeda avenacea</i>	0.60 (2 sites)	
<i>Themeda triandra</i>	6.22 (11 sites)	✓
<i>Triodia pungens</i>	11.03 (13 sites)	✓
<i>Tripogon loliiformis</i>	1.07 (6 sites)	

*non-native species

3. Proposed baseline monitoring sites

A total of 23 fixed monitoring sites have been selected as baseline habitat monitoring sites, to assist in the management of BTF habitat in areas subject to grazing. The 23 sites have been selected as a subset of the 52 sites established in May 2013, for consistency. The sites represent an even spread across the mining leases, both north and south of the Carmichael River. They include areas that are not proposed to be impacted by mining activities, as well as areas that will be impacted by mining activities.

The proposed baseline sites are spatially distributed across the project area (see **Appendix B**) and are listed as follows:

- Unmined areas - CHAB20, CHAB21, CHAB43, CHAB49 and CHAB50.
- Mine areas - CHAB02, CHAB03, CHAB22, CHAB23, CHAB24, CHAB25, CHAB37, CHAB45, CHAB47, CHAB48, CHAB52 (Open cut disturbance areas) and CHAB01, CHAB04, CHAB05, CHAB09, CHAB10, CHAB44 and CHAB46 (Underground disturbance areas).

These 23 sites are appropriate to use for long-term monitoring to demonstrate that BTF habitat is being maintained within the project area. These sites have been selected to provide data on a range of habitat types and quality throughout the project area.

Monitoring has been undertaken at these baseline monitoring sites on three occasions, in May and October 2013 and in December 2014. Data for the October 2013 survey period is not available, so only data from the May 2013 (Wet Season) and December 2014 (Dry Season) survey periods has been included in this analysis.

Data from 2012 and from the period 2015 to 2018 is not suitable for the establishment of long-term monitoring sites at fixed locations. However, these data will be useful for other purposes, including determining the characteristics of habitat being actively utilised by BTF at the time of future surveys for foraging and nesting.

Summary and Conclusions

Ten biannual seasonal monitoring surveys have been undertaken across the Carmichael Coal Mine project area since 2013, utilising a range of monitoring methods. A total of 52 baseline monitoring sites were established in May 2013 to assess BTF habitat quality across the project area. Repeated monitoring was undertaken at these sites in October 2013 and December 2014. A subset of these sites has been selected for ongoing monitoring and establishing a baseline, for the purpose of demonstrating the maintenance of BTF habitat values within the project mining leases.

After December 2014, the habitat assessment methodology was modified to focus on areas where BTF were observed to be feeding and nesting at the time of the survey. These sites were not fixed, but established to capture data on BTF habitat being actively used on the day of the survey. Data from these subsequent sites are considered unsuitable for use as fixed baseline monitoring sites as they are biased to areas of active feeding or nesting of BTF at the time of the survey. Comparisons of these data with those collected in a similar manner at other locations in the future are likely to be useful to understand the salient features of BTF habitat within the project area. Data collected in 2012 also had limited application to the objective of establishing a baseline for long-term monitoring of groundcover conditions.

An analysis of groundcover and ground composition data collected at the proposed baseline monitoring sites during the May 2013 and December 2014 indicates that the following baseline targets would be appropriate (averaged across all sites):

- 34% cover native perennial grass cover (minimum). Baseline standard deviation is 12.1%
- 27% bare ground
- four native grass species per site (minimum)
- 2.4% native perennial forb cover
- 1.8% native annual grass and forbs

Some seasonal variability in the results are to be expected, with higher native perennial grass cover and native grass species richness following periods of rainfall during warm seasonal conditions.

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Appendix A: Monitoring Sites

Habitat condition monitoring sites assessed during Black-throated Finch monitoring surveys 2013 - 2018

Sites Monitored	GHD			Niche				ELA	E2M	
	May 2013	August 2013	October 2013	December 2014	March 2015	August 2015	April 2016	October 2016	November 2017	April 2018
CHAB01	✓		✓	✓						
CHAB02	✓		✓	✓						
CHAB03	✓		✓	✓						
CHAB04	✓		✓	✓						
CHAB05	✓		✓	✓						
CHAB06	✓		✓	✓						
CHAB07	✓		✓	✓						
CHAB08	✓		✓	✓						
CHAB09	✓		✓	✓						
CHAB10	✓		✓	✓						
CHAB11	✓		✓	✓						
CHAB12	✓		✓	✓						
CHAB13	✓		✓	✓						
CHAB14	✓		✓	✓						
CHAB15	✓		✓	✓						
CHAB16	✓		✓	✓						
CHAB17	✓		✓	✓						
CHAB18	✓		✓	✓						
CHAB19	✓		✓	✓						
CHAB20	✓		✓	✓						

Sites Monitored	GHD			Niche				ELA	E2M	
	May 2013	August 2013	October 2013	December 2014	March 2015	August 2015	April 2016	October 2016	November 2017	April 2018
CHAB21	✓		✓	✓						
CHAB22	✓		✓	✓						
CHAB23	✓		✓	✓						
CHAB24	✓		✓	✓						
CHAB25	✓		✓	✓						
CHAB26	✓		✓	✓						
CHAB27	✓		✓	✓						
CHAB28	✓		✓	✓						
CHAB29	✓		✓	✓						
CHAB30	✓		✓	✓						
CHAB31	✓		✓	✓						
CHAB32	✓		✓	✓						
CHAB33	✓		✓	✓						
CHAB34	✓		✓	✓						
CHAB35	✓		✓	✓						
CHAB36	✓		✓	✓						
CHAB37	✓		✓	✓						
CHAB38	✓		✓	✓						
CHAB39	✓		✓	✓						
CHAB40	✓		✓	✓						
CHAB41	✓		✓	✓						
CHAB42	✓		✓	✓						
CHAB43	✓		✓	✓						

Sites Monitored	GHD			Niche				ELA	E2M	
	May 2013	August 2013	October 2013	December 2014	March 2015	August 2015	April 2016	October 2016	November 2017	April 2018
CHAB44	✓		✓	✓						
CHAB45	✓		✓	✓						
CHAB46	✓		✓	✓						
CHAB47	✓		✓	✓						
CHAB48	✓		✓	✓						
CHAB49	✓		✓	✓						
CHAB50	✓		✓	✓						
CHAB51	✓		✓	✓						
CHAB52	✓		✓	✓						
CHAB53		✓	✓							
CHAB54		✓	✓							
CHAB55		✓	✓							
CHAB56		✓	✓							
CHAB57		✓	✓							
CHAB58		✓	✓							
CHAB59		✓	✓							
CHAB60		✓	✓							
CHAB61		✓	✓							
CHAB62		✓	✓							
CHAB63		✓	✓							
CHAB64		✓	✓							
CHAB65		✓	✓							
CHAB66		✓	✓							

Sites Monitored	GHD			Niche				ELA	E2M	
	May 2013	August 2013	October 2013	December 2014	March 2015	August 2015	April 2016	October 2016	November 2017	April 2018
CHAB67		✓	✓							
CFS1					✓					
CFS2					✓					
CFS3					✓					
CFS4					✓					
CFS5					✓					
CFS6					✓					
CFS7					✓					
CFS8					✓					
CFS9					✓					
CFS10					✓					
CFS11					✓					
CFS12					✓					
CFS13					✓					
CFS14					✓					
CFS15					✓					
CFS16					✓					
CFS17					✓					
CFS18					✓					
CFS19					✓					
CFS20					✓					
CFS21					✓					
CFS22					✓					

Sites Monitored	GHD			Niche				ELA	E2M	
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CFS24					✓					
CFS25					✓					
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CFS27					✓					
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CFS29					✓					
CFS30						✓				
CFS31						✓				
CFS32						✓				
CFS33						✓				
CFS34						✓				
CFS35						✓				
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CFS37						✓				
CFS38						✓				
CFS39						✓				
CFS40						✓				
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CFS42						✓				
CFS43						✓				
CFS44						✓				
CFS45					File A	✓				

RTI 18-378

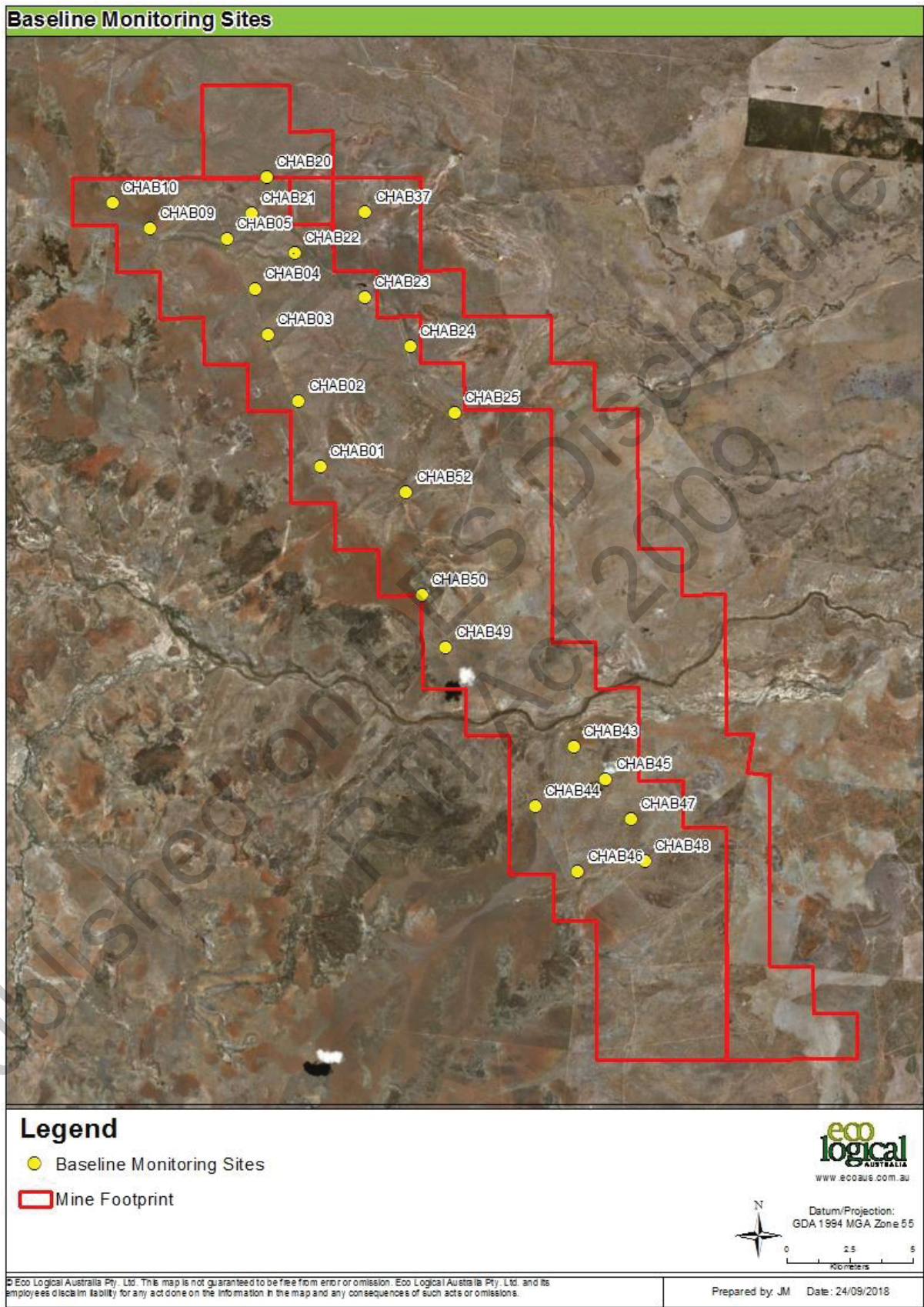
Page 5

Sites Monitored	GHD			Niche				ELA	E2M	
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CFS47						✓				
CFS48							✓			
CFS49							✓			
CFS50							✓			
CFS51							✓			
CFS52							✓			
CFS53							✓			
CFS54							✓			
CFS55							✓			
CFS56							✓			
CFS57							✓			
CFS58							✓			
CFS59							✓			
CFS60							✓			
CFS61							✓			
CFS62							✓			
CFS63							✓			
CFS64							✓			
CFS65							✓			
CFS66							✓			
CVN1								✓		
CVN2								✓		

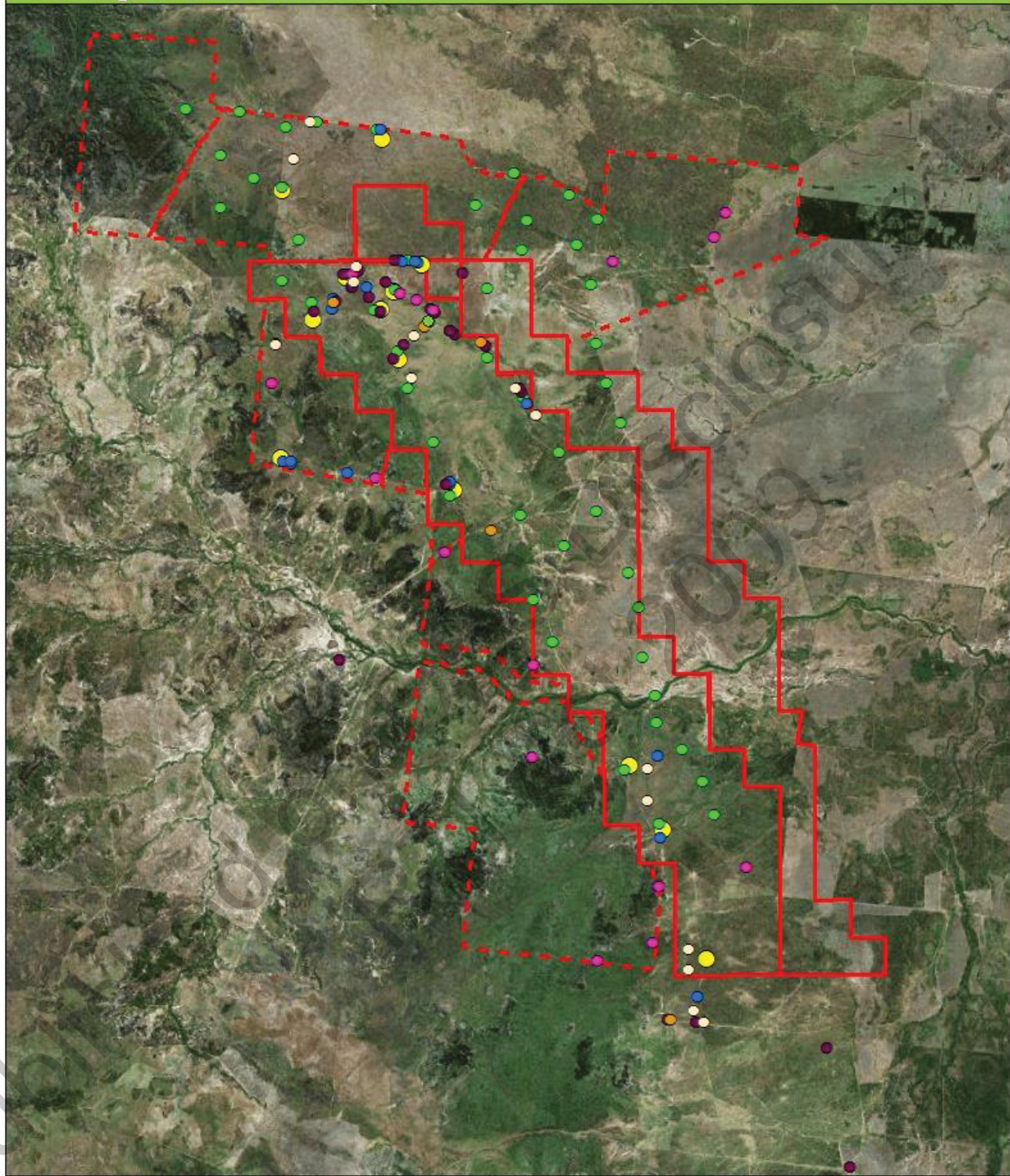
Sites Monitored	GHD			Niche				ELA	E2M	
	May 2013	August 2013	October 2013	December 2014	March 2015	August 2015	April 2016	October 2016	November 2017	April 2018
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CVN4								✓		
CVN5								✓		
CVN6								✓		
CVN7								✓		
CVN8								✓		
VP01									✓	
VP02									✓	
VP03									✓	
VP04									✓	
VP05									✓	
VP06									✓	
1										✓
2										✓
3										✓
4										✓
5										✓
6										✓
7										✓
8										✓
9										✓
10										✓
11 RTI 18-378					File A					✓ Page 509 of 631

Sites Monitored	GHD			Niche				ELA	E2M	
	May 2013	August 2013	October 2013	December 2014	March 2015	August 2015	April 2016	October 2016	November 2017	April 2018
12										✓
13										✓
14										✓
15										✓
Total sites monitored:	52	15	67	52	29	18	19	8	6	15

Appendix B: Maps – 23 fixed monitoring sites (this page) and other sites (next page)



Monitoring sites 2013 - 2018



Legend

- GHD - May + October 2013 & Niche - December 2014
- Niche - March 2015
- Niche - August 2015
- Niche - April 2016
- ELA - October 2016
- E2M - November 2017
- E2M - April 2018
- ▭ Mine Footprint
- ▭ IMDW Boundary Final

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Datum/Projection:
GDA 1994 MGA Zone 55

0 3 6
Kilometers

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Prepared by: JM Date: 20/09/2018

Appendix C – Baseline data summary (only available for May 2013 and December 2014 surveys)

Baseline monitoring sites groundcover data analysis – May 2013

Groundcover type (%)	Monitoring site																								
	CHAB01	CHAB02	CHAB03	CHAB04	CHAB05	CHAB09	CHAB10	CHAB20	CHAB21	CHAB22	CHAB23	CHAB24	CHAB25	CHAB37	CHAB43	CHAB44	CHAB45	CHAB46	CHAB47	CHAB48	CHAB49	CHAB50	CHAB52	Average	SD
Native perennial grass cover – tussock	10.8	25.0	27.4	20.6	36.8	21.8	40.6	15.8	50.0	43.2	49.2	40.6	12.8	37.6	15.8	27.8	18.2	16.2	19.8	16.2	33.0	32.8	33.4	28.1	11.9
Native perennial grass cover – hummock	16.4	11.0	6.0	25.4	12.4	23.2	7.2	17.0	0.0	0.8	0.0	0.0	0.0	3.0	0.0	12.0	0.0	2.8	0.0	0.0	0.0	3.0	0.0	6.1	8.0
Native perennial forb cover	5.4	2.2	1.4	1.4	4.8	0.4	5.8	2.0	2.4	1.4	0.8	3.4	1.0	1.6	2.4	1.8	4.4	2.2	1.0	2.6	3.6	1.2	2.2	2.4	1.5
Native annual grass and forbs	5.6	5.8	6.6	1.6	0.4	0.6	3.0	4.4	0.8	0.0	1.2	1.6	0.6	0.0	0.0	0.4	1.6	1.4	1.2	3.2	0.8	0.0	0.0	1.8	2.0
Non-native grass	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	22.0	22.0	0.6	0.0	3.0	0.0	0.0	2.4	0.0	1.6	0.8	2.4	6.3
Litter (<10cm diameter)	28.2	33.2	33.2	32.0	15.6	20.0	11.8	18.6	20.8	0.0	25.4	0.0	14.0	11.2	27.0	35.4	20.6	23.4	27.0	20.4	36.4	32.6	23.2	22.2	10.2
Litter (> 10cm diameter)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.0	0.6	0.0	2.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	5.4
Rock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	6.1
Bare ground	29.6	22.2	23.4	17.6	28.4	33.0	24.4	41.8	24.0	25.0	25.0	25.8	42.0	24.0	52.2	18.0	49.0	54.0	49.0	57.2	25.8	26.4	36.0	32.8	12.2

Baseline monitoring sites groundcover data analysis – December 2014

Groundcover type (%)	Monitoring site																								
	CHAB01	CHAB02	CHAB03	CHAB04	CHAB05	CHAB09	CHAB10	CHAB20	CHAB21	CHAB22	CHAB23	CHAB24	CHAB25	CHAB37	CHAB43	CHAB44	CHAB45	CHAB46	CHAB47	CHAB48	CHAB49	CHAB50	CHAB52	Average	SD
Native perennial grass cover – tussock	10	20	25	15	40	35	30	40	40	30	80	34	30	30	50	35	66	28	30	30	24	40	30	34.4	15.1
Native perennial grass cover – hummock	17	30	40	55	5	50	40	10	0	5	2	1	0	2	0	35	0	25	0	0	0	30	1	15.1	18.5
Native perennial forb cover	2	0	2	0	2	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	0	0	30	1.7	6.2
Native annual grass and forbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Non-native grass	0	0	0	0	1	0	0	20	15	20	0	30	2	30	0	0	1	0	15	20	0	0	10	7.1	10.4
Litter (<10cm diameter)	10	10	2	10	16	5	10	10	15	20	7	15	30	10	15	10	20	8	20	15	10	10	5	12.3	6.2
Litter (> 10cm diameter)	1	1	1	1	1	0	1	1	1	1	1	1	1	1	5	0	1	2	5	5	1	1	2	1.5	1.4
Rock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Bare ground	60	39	30	18	35	10	19	18	28	19	10	19	35	27	29	20	10	36	28	28	65	18	21	27.0	14.0



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Black-throated Finch Management Plan

Carmichael Coal Mine and Offsite Infrastructure

Prepared for
Adani Mining Pty Ltd

~~November~~ December 2018



DOCUMENT TRACKING

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Status	Final
Version Number	7 ba
Date	3017 Nov December 2018

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Template 08/05/2014

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Abbreviations

Abbreviation	Description
Adani	Adani Mining Pty Ltd
BioCondition	A vegetation condition assessment tool which provides a measure of how well a terrestrial ecosystem is functioning for the maintenance of biodiversity values at a local or property scale.
BOS	Biodiversity Offset Strategy
BTF	Black-throated Finch
CEMP	Construction Environmental Management Plan
CG	Coordinator-General
DES	Queensland Department of Environment and Science (formerly known as the Department of Environment and Heritage Protection (DEHP))
DoE	Commonwealth Department of the Environment
EA	Environmental Authority issued under the <i>Environmental Protection Act 1994</i>
EIS	Environmental Impact Statement
ELA	Eco Logical Australia Pty Ltd
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
EPBC Approval	Approval granted by the Commonwealth under the EPBC Act
ER	Environmental Representative
MNES	Matters of National Environmental Significance, as defined under the EPBC Act
MNESMP	Matters of National Environmental Significance plan/s for the management of direct and indirect impacts of mining operations
NC Act	<i>Queensland Nature Conservation Act 1992</i>
NGBR	North Galilee Basin Rail Project; a 311 km section of the Carmichael Rail Network located between Mistake Creek and the Port of Abbot Point
OEMP	Operations Environmental Management Plan
RE	Regional Ecosystem
SDPWO Act	<i>State Development and Public Works Organisation Act 1971</i> (Queensland).
SEIS	Supplementary Environmental Impact Statement, prepared in response to comments on the draft EIS.
SMP	Species Management Plan
SP1	Separable Portion 1; a 77 km section of the Carmichael Rail Network located between the Carmichael Mine and Mistake Creek
TEC	Threatened Ecological Community as defined under the EPBC Act
VMP	Vegetation Management Plan

1 Introduction

1.1 Background

Eco Logical Australia (ELA) has been engaged by Adani Mining Pty Ltd (Adani) to develop a Black-throated Finch (BTF) Management Plan for the construction and operation of the Carmichael Coal Mine and Rail Infrastructure Project in the Galilee Basin of central Queensland. The Carmichael Coal Mine and Rail Infrastructure Project is one of two components of the overall project proposed by Adani, which includes:

1. Carmichael Coal Mine and Rail Infrastructure Project, comprising the Carmichael Coal Mine (open cut and underground coal mine) and 189 km of rail link and associated infrastructure; and
2. North Galilee Basin Rail (NGBR) Project, comprising 310 km of rail from approximately 70 km east of the Carmichael Mine, to the Port of Abbot Point.

The Carmichael Coal Mine and Rail Project and the NGBR Project have been assessed by the Commonwealth and Queensland governments through separate Environmental Impact Statement (EIS) processes. Conditional approval of the Carmichael Coal Mine and Rail Project was granted by the Queensland Coordinator-General on 8 May 2014 and the Commonwealth Minister for the Environment on 14 October 2015 (EPBC 2010/5736). Conditional approval of the NGBR Project was granted by the Queensland Coordinator-General on 12 August 2014 and the Commonwealth Minister for the Environment on 14 October 2015 (EPBC 2013/6885).

The development of a BTF Management Plan is a requirement of the Commonwealth and Queensland approval conditions (refer to **Section 1.5** of this document), to protect BTF and its habitat from avoidable impacts associated with the mine and rail projects.

1.2 Scope and purpose of management plan

This BTF Management Plan is specific to the Carmichael Coal Mine and associated infrastructure component of Adani's overall mine and rail project. This document is a BTF Management Plan for the Carmichael Coal Mine (which includes open cut and underground mining) and required associated infrastructure which includes workers' accommodation, an airport, and water supply infrastructure. These combined components of the development are hereafter referred to as the Project (**Figure 1**). This management plan describes the proposed management of direct and indirect impacts of mining operations on BTF which will be implemented throughout the Project.

The management of the BTF for the rail link component of the Carmichael Coal Mine and Rail Project and the NGBR are addressed in separate documents. Additionally, Species Management Plans for other threatened species and ecological communities, groundwater dependent ecosystems are also addressed in separate documents.

The purpose of the BTF Management Plan is to meet the conditions of approval granted by the Queensland and Commonwealth governments, and commitments made by Adani in securing these approvals. The BTF Management Plan is consistent with relevant guidelines and policies on the protection of Matters of National Environmental Significance (MNES) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and the management of threatened species listed under the Queensland *Nature Conservation Act 1992* (NC Act).

The BTF Management Plan details the management actions and monitoring requirements for the Carmichael Mine to minimise and mitigate impacts prior to and during construction. Management and monitoring actions apply to mining-related activities across the Project area, including those conducted on ML70505, ML70506 and ML70441. Conceptually, the adaptive management approach to be implemented applies to areas that will be disturbed by mining activities, areas of mining leases where no mining impacts are proposed, and offset areas where BTF habitat will be improved ([Figure 1](#)).

However, in relation to the management of offset areas, it should be noted that a detailed Offset Area Management Plan: Moray Downs West (OAMP; C02 2017), has been developed with specific management actions to achieve offsets for a range of environmental values, including BTF. While the BTF management plan includes some reference to management of the offset area, reference should be made to the OAMP for details of specific management actions.

Objectives of the BTF Management Plan are as follows:

- Describe management objectives, performance criteria and practical measures (management actions) to mitigate impacts of the Project on BTF
- Describe monitoring measures that will be implemented to assess the effectiveness of mitigation measures, and inform adaptive management actions
- Describe triggers for the implementation of adaptive management and corrective actions
- Provide a consistent framework across the Project for the mitigation of risks to BTF
- Collate relevant Project commitments relating to mitigation and monitoring of BTF ecological values, to assist in streamlining their implementation, the monitoring of compliance and reporting
- Achieve consistency with other management plans for the Project, related to biodiversity offsets, groundwater dependent ecosystems, construction activities and operations
- Achieve compliance with relevant Commonwealth and Queensland approval conditions ([Appendix D](#)).

As required under Condition 16a) to c) and 18 of the EA the BTF Management Plan includes a BTF Research Program ([Appendix C](#)). The purpose of the BTF Research Program is to increase the knowledge of the ecological requirements of BTF populations within and adjacent to the Carmichael Coal Mine and by doing so, inform and improve management of the local populations. The Research Program outlines the studies to be undertaken to identify:

- Specific nesting and feeding requirements of the species
- Whether BTF in the Project Area are sedentary, local migratory or regionally migratory
- Any changes in of classification and / or impact on BTF habitat
- The relationship between water sources, woody habitat and food sources
- Population dynamics, including dietary requirements, home range, nesting requirements
- Responses of the BTF and its habitat to grazing management practices, fire management practices and water body locations

The Research Program will primarily focus on studies that will provide results and information that facilitate improving suitable BTF habitat within the Moray Downs West offset area as well as habitat within ML70506 where no impacts from mining are proposed.

1.3 Relationship with other management plans

Other plans and strategies have been developed and there will be some interaction among the outputs during construction and operation, as illustrated in [Figure 2](#).

This BTF Management Plan has been prepared to be consistent, where appropriate, with the following management plans:

- Biodiversity Offset Strategy for the Carmichael Coal Mine and Rail Project
- Moray Downs West Offset Area Management Plan
- Species Management Plan for the Carmichael Coal Mine
- Environment Management Plan for the Carmichael Coal Mine (Mine; for both construction and operations)
- Groundwater Dependent Ecosystems Management Plan for the Carmichael Coal Mine.

Other management plans will also be developed and implemented where required as part of the mine and offsite infrastructure construction and operation, and align with this plan.

This BTF Management Plan should not be confused with a Species Management Program required under the *Nature Conservation Act 1992*, for tampering with a protected animal breeding place in Queensland. A Species Management Program authorises activities that will impact on breeding places of animals protected under the *Nature Conservation Act 1992*. Adani will undertake a survey of animal breeding places prior to clearing activities and develop a Species Management Program for approval, consistent with guidelines provided by the Queensland Department of Environment and Science (DES).

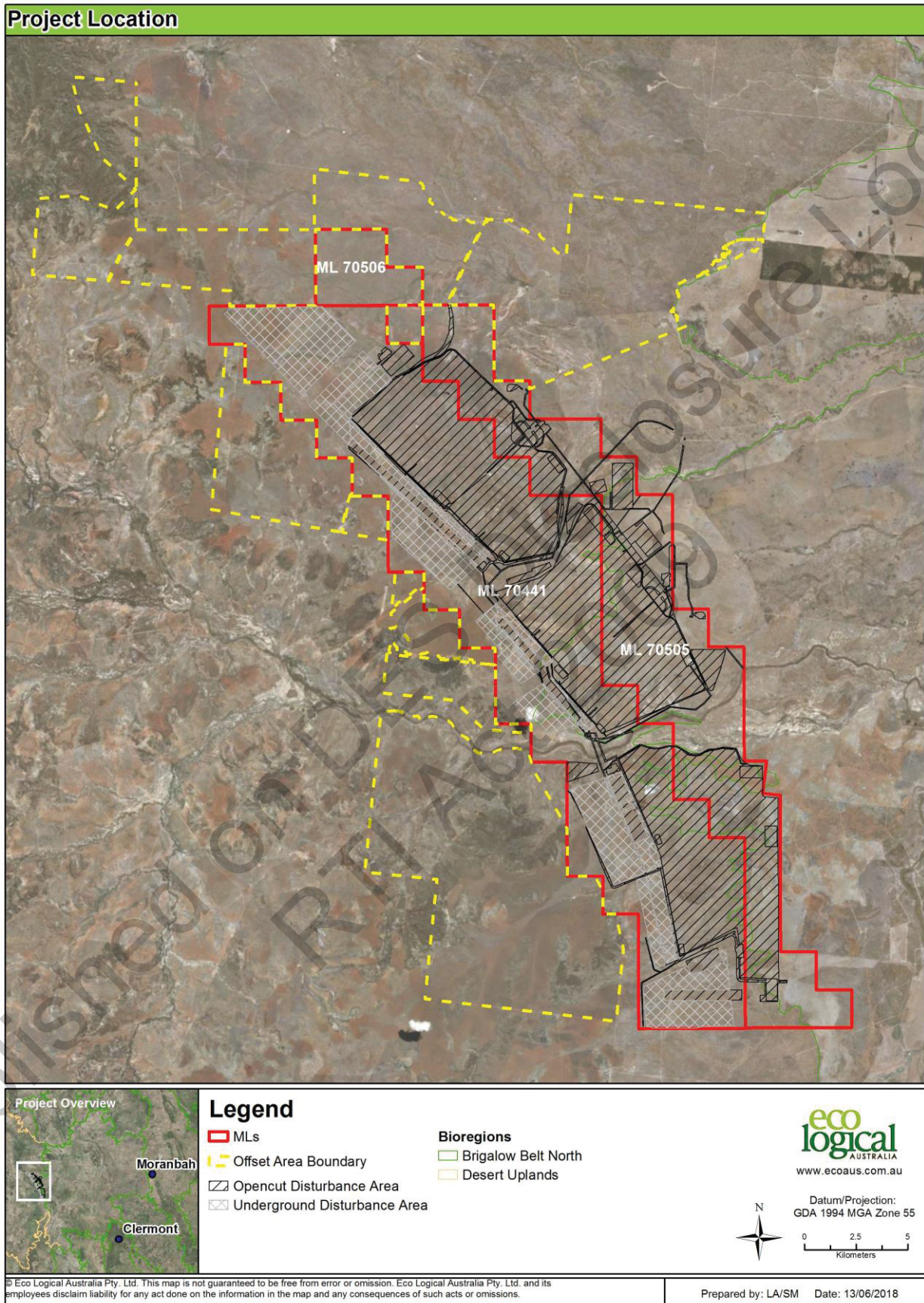


Figure 1 Project Location

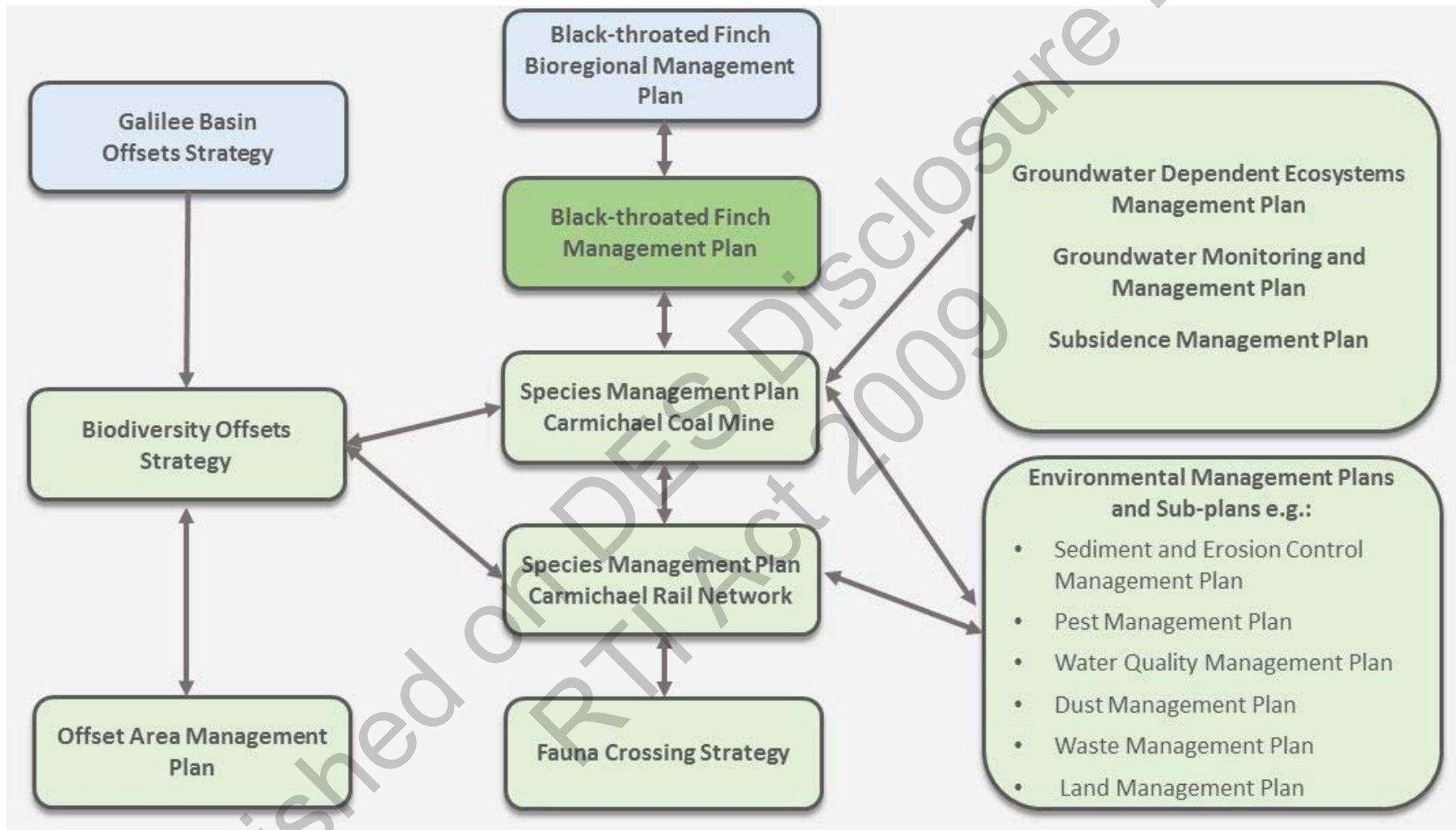


Figure 2 Flow chart showing the interactions among examples of key management plans and sub-plans for the Carmichael Coal Mine. The BTF Management Plan is shaded green, with regional plans and strategies covering multiple projects shaded blue.

1.4 Structure of this report

This report has been structured to address the requirements of relevant approval conditions and to facilitate practical implementation of management measures ‘on the ground’. A summary of key sections is provided below:

- A contextual description of the Project (**Section 2**)
- Overview of the legislative framework and approval conditions to be addressed within the BTF Management Plan (**Section 3**)
- General description of BTF ecology and known threats to the sub-species (**Section 4**)
- Adaptive management framework (**Section 5**)
- Mitigation and management measures for BTF (**Section 6**)
- Monitoring Program for BTF (**Section 7**)
- A discussion of the key outcomes of the management planning process (**Section 8**)
- Arrangements for reporting and monitoring compliance with Species Management Plan actions (**Section 9**)
- A register of key mitigation and monitoring commitments within the Species Management Plan (**Section 10**)

Appendix A provides an overview of project management plans, **Appendix B** shows the location of sites where monitoring will be conducted during BTF surveys and the BTF Research Program is provided in **Appendix C**. **Appendix E** provides a summary of the results of baseline research on BTF nesting and foraging habitat. **Appendix F** provides a summary of baseline groundcover characteristics to assist with future management of grazing.

1.5 Compliance with approval conditions

Compliance matrices indicating where approval conditions and commitments relevant to the BTF Management Plan have been addressed within this report are outlined in **Appendix D**.

1.6 Environmental setting

The Carmichael Coal Mine is located in central Queensland within the Burdekin catchment. It covers the boundary of the Brigalow Belt and Desert Uplands bioregions of Queensland. The Brigalow Belt North and Desert Uplands bioregions are semi-arid, and located in the tropics where summer rainfall dominates, with distinct wet and dry seasons.

The Brigalow Belt North Bioregion is a large and complex area characterised by clay soils with forests and woodlands dominated by Brigalow (*Acacia harpophylla*), eucalypts and grasslands. The general land types include undulating rugged ranges to alluvial plains [Removed at External Review]. The Desert Uplands Bioregion is characterised by sandstone ranges and sand plains, with thick eucalypt and acacia woodlands, often with a spinifex understory [at External Review] (2008). Each of these bioregions is further divided into subregions based on land forms.

The Project Area is located in the Belyando Downs subregion of the Brigalow Belt North Bioregion, and the Alice Tableland subregion of the Desert Uplands. The dominant vegetation communities in these subregions are Silver-leaved Ironbark (*Eucalyptus melanophloia*) and Poplar Box (*E. populnea*) woodlands on alluvial deposits, and Lancewood (*Acacia shirleyi*) and Bendee (*A. catenulata*) woodlands on rocky hills and sandstone ranges [removed at External Review] (1999). The Brigalow Belt North Bioregion is also dominated by Brigalow and Gidgee (*A. cambagei*) woodlands on fine soils, and Queensland Bluegrass (*Dichanthium sericeum*) grasslands on alluvial deposits; whilst the northern reaches of the

Alice Tablelands are dominated by White's Ironbark (*E. whitei*) and Reid River Box (*E. brownie*; at External R1999).

The predominant land use of the region is beef cattle grazing, which covers over 90% of the total area (at External 2008). Other land uses include conservation and minimal use, forestry, dryland agriculture, horticulture, mining, and urban centres (at External 2009). There are few major urban centres in the region, with the largest being Bowen, Barcaldine, Collinsville, Alpha, Clermont, and Pentland (at External 2008).

The mine is located within the Carmichael River sub-catchment of the Belyando Basin in the Burdekin Catchment. The Belyando Basin is characterised by generally low relief floodplains drained by braided channels and surrounded by wide alluvial plains (at External 2009).

1.7 Method

Utilising outcomes of previous monitoring surveys conducted during and post the EIS, a team of experienced ecologists was established with local knowledge of the Project Area to develop an effective approach to BTF management (this document). The BTF Management Plan was developed with guidance from relevant Commonwealth and State approval conditions, other legislative requirements for native flora and fauna, relevant species recovery plans occurring within the Project Area, and best-practice approaches to species management. The following key steps were taken to develop the management plan for BTF:

- A review of the ecological requirements relating to BTF was conducted, drawing upon the EIS studies, surveys completed after the EIS, published literature and relevant database searches
- The impacts from a range of activities associated with construction and operation of the Project were considered, including vegetation clearing, subsidence, mine dewatering, earthworks, the generation of noise and vibration, emissions such as dust, light spill and other visual impacts, stream diversion and flood levees and the spread of weed and pest species.
- Measures to mitigate the impacts of the Project on BTF were described, including at locations adjacent to areas of direct disturbance. Mitigation measures were informed by commitments within the EIS and associated Project approvals, and the technical knowledge and experience of ecologists developing this management plan.
- An approach to monitoring BTF was developed for a variety of project stages. These included before the commencement of work (baseline monitoring and pre-clearance surveys), monitoring of impacts during construction, assessing recovery post-construction and monitoring the impacts of ongoing operations.
- Goals, triggers and corrective actions were developed for mitigation measures, to establish a framework of adaptive management for BTF with the potential to be affected by the Project.
- An ongoing system of monitoring was described to determine the effectiveness of the mitigation measures.

Consideration was also given to the potential for impacts at a landscape level and groups of similar species, as Project impacts may not necessary be manifested on individual BTF or species in isolation.

2 Project Description

2.1 Project overview

The Project involves construction of a greenfield coal mine in the Galilee Basin over Mining Leases 70441, 70505 and 70506. The mine site is located approximately 160 km north-west of Clermont, with mining to be conducted using both open cut and underground mining methods. Offsite infrastructure to support the mine will include a workers accommodation village, a permanent airport site and water supply infrastructure (associated infrastructure). The total disturbance area will be approximately 28,000 ha for the mine and 1,300 ha for the offsite infrastructure. Coal will be transported by rail to the Port of Abbot Point for export. The operational mine life will be approximately 60 years, with a production rate peaking at 60 Mtpa.

The open cut mine will have a capacity of 40 Mtpa and will be located along the eastern section of Mining Lease 70441. The open cut mine will be operated primarily using truck shovel/excavator methods. A series of open cut pits will be progressively mined. During the early stages of developing each mine pit, overburden will be transported to pit dumps, where it will be profiled and rehabilitated. A proportion of this material will be used to re-profile the high-wall of the final voids (Adani 2012).

The underground mine will operate concurrently with the open cut pits, to provide for coal blending and ensure continuity of production. The underground mine will comprise independent underground longwall mines, producing approximately 20 Mtpa of product. Each underground mine will be serviced by above ground infrastructure.

All run of mine coal will be transported by truck and/or overland conveyor to a centralised coal handling facility, where the high-ash portion will be washed for blending with the bypass coal (un-washed coal). Coal will be stockpiled prior to loading on trains for transportation by rail. The channel and riparian zone of the Carmichael River will be preserved and the adjacent pits protected from flooding events by a levee (Adani 2012).

All offsite infrastructure to support the operation of the mine will be located on the Moray Downs Pastoral Lease (Lot 662 on SP282172) to the east of the mine. The workers accommodation village will be located approximately 12 km east of the Mine and accessed via the upgraded Moray-Carmichael Road. The village will accommodate construction and operational workforces for the Mine. All recreational, health and safety requirements to support workers will be provided at the village.

The permanent airport will be located approximately 5 km west of the workers accommodation village and will provide access for fly-in-fly-out workers. Offsite water supply infrastructure will enable the extraction, storage and delivery of water during the construction and operation phases of the mine.

2.2 Mine staging

The Project will be implemented in several stages. An understanding of the project stages and their relative timing is important for developing appropriate management and mitigation measures to address potential impacts of the Project on BTF and their habitat. The total Project Area (Mining Lease Area) is about 45,000 Ha out of which 28,016 Ha (62%) will be disturbed in several stages for open cut mining, underground mining and mine infrastructure (including, water storage, tailings drying cells, diversion drains and levees). The initial areas of disturbance will be required for opening up of box cut areas for open cut and underground mining and areas required for mine infrastructure. The details of the staged disturbance are provided in [Table 1Table 1](#). It is evident from [Table 1Table 1](#) that areas will be

disturbed in a phased manner and will only be cleared commensurate with development of the project within each stage. Some areas of the mining lease will not be impacted by mining activities as evident from **Figure 3**. Where BTF habitat occurs in these areas, management will be to maintain and/or aim to improve the habitat condition.

Key elements of the Project and their relative timing are summarised in the following sections.

Table 1 Details of staged disturbance areas (note: relates to all areas – not only BTF habitat)

Disturbance domain	Area (Ha)	Disturbance Areas (Ha)		
		Year 1-10	Year 11-20	Year 21-30
Open cut Mining (Including pits, slopes voids and out of pit spoil dumps)	16,640.24	10332.66	3682.75	2624.83
Underground Mining(subsidence areas)	7786.76	1931.95	3030.16	2824.65
Infrastructure Area (including, water storage, tailings drying cells, diversion drains and levees)	3589.93	3403.89	174.82	11.22
Total	28,016.93	15,668.50	6,887.73	5,460.70
% disturbance		56%	25%	19%

2.2.1 Open cut Mining Operations

Open cut Mining operations include extraction of coal from the ground as well as any immediately associated activities, including initial clearing of vegetation, removal and storage of overburden, storage of coal and dewatering, but not including exploratory surveys or the construction or operation of transport, accommodation or power generation infrastructure.

- The Open cut mines consist of six pits from North to south of the Mining Lease area
- Pits B, C, D and E are located to the north of the Carmichael River.
- Pits F and G are located to the south of the Carmichael River.

Open cut mining activities will be carried out in three stages of the project across 60 years of life of the project. Stage 1 of Open cut mining is defined as year 1-10 and includes all associated activities such as box cut excavation, formation of haul roads, forming of out of pit spoil dumps and building mine related infrastructure like CHPP, ROM, Product coal storage areas, water infrastructure and waste storage facilities.

Activities associated with mining operations north of the Carmichael River are anticipated to commence in Year 1 (early stages of the Project). In this area open cut Pits D and E will be opened up initially during the first year of the start of mining. During later years, additional Pits B and C will be opened up to the north of the Mining Lease area. As shown in **Figure 3**, there is minimal BTF habitat in areas immediately north of Carmichael River (Pits D and E), which will be the focus of early stages of the Project. This delay in the disturbance of BTF habitat will coincide with improvements to BTF habitat in the offset area, minimising Project impacts on BTF habitat values overall.

Mining operations south of the Carmichael River are anticipated to commence in Year 8 (i.e., 7 years after the commencement of mining operations north of the Carmichael River). In this area open cut Pits F and G will be opened up and will continue till the end of project life.

2.2.2 Underground Mining

Underground mining will be completed in three stages across the 60 year life of the Project. Stage 1 of underground mining is defined as Years 1-10 and includes all associated activities including box cut excavation, portal construction, long wall construction and longwall panel mining. Multi seam mining within the first underground mine will occur during this time. Stage 2 of underground mining will occur from approximately Year 11-23 and Stage 3 will occur from approximately Year 24 and beyond.

2.3 Moray Downs West

The Moray Downs West offset area has been identified in the approved BOS as a priority offset to acquit most of the Project's offset requirements, including those required for BTF (CO2 2016). The offset area for offset delivery stage 1 is located on the western portion of the Moray Downs property (Lot 662 on SP282172; [Figure 1](#)).

Parts of Moray Downs West are mapped as priority 1 areas in the Queensland Government's Galilee Basin Offset Strategy (DEHP 2013). Priority 1 areas contain high levels of conservation value and are likely to have the lowest risk of future development through mining. Moray Downs West also borders priority 1, 2 and 3 Galilee Basin Offset Strategy areas.

The offset area includes 20,274 ha of BTF habitat. It is anticipated that the management objectives will be achieved within the 20 year management period through the implementation of adaptive management. However, if required additional management will be considered at the end of the management period should any of the objectives not be met (CO2 2016). Monitoring is likely to be required beyond 20 years to clearly demonstrate the effectiveness of the offset, and to achieve compliance with EPBC Act approval conditions, which require monitoring for the life of the project.

3 Legislative and Regulatory Framework

3.1 Project approval conditions

The Project Area provides habitat for a variety of threatened species, listed under the EPBC Act or the NC Act. State and Commonwealth approval conditions require the development of management plans for those species and ecological communities that were considered most likely to be affected by the Project.

For the Commonwealth approval, these species and communities are as follows:

- Black-throated Finch (southern; *Poephila cincta cincta*) - Endangered
- Squatter Pigeon (southern; *Geophaps scripta scripta*) - Vulnerable
- Ornamental Snake (*Denisonia maculata*) - Vulnerable
- Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC - Endangered
- Yakka Skink (*Egernia rugosa*) - Vulnerable
- Waxy Cabbage Palm (*Livistona lanuginosa*) - Vulnerable
- Doongmabulla Springs Complex – Nationally Important Wetland and a community of native species dependent on natural discharge of groundwater from the Great Artesian Basin TEC - Endangered

For the State approval, the Coordinator-General recommended in Section 2 of Appendix 2 of its report that a Species Management Plan be prepared for all threatened species known, or likely to, occur within the Project Area. Within the mining lease, Adani has committed to a range of environmental management measures to reduce impacts on threatened species.

3.2 Approval conditions relevant to BTF management plan

There are multiple Commonwealth and Queensland approval conditions that require Adani to prepare a BTF Management Plan, describing how potential impacts of the Project on ecological values will be mitigated and monitored. This report addresses the requirements of these conditions for both Commonwealth and Queensland legislation. This document is specific to the Carmichael Coal Mine and associated infrastructure and addresses the approval conditions relating to BTF for this component of Adani's overall mine and rail project. Conditions relevant to the rail components of the Carmichael Coal Mine and Rail Project have been addressed separately (ELA 2015c; ELA 2015d).

An inventory of all relevant Commonwealth and State approval conditions is provided in **Appendix D**, with a description of the location within this report where each condition has been addressed.

3.3 Key legislation

Assessment of the Project by the Commonwealth Government occurred through the EIS process under the Commonwealth EPBC Act. This assessment considered potential impacts of the Project on MNES, such as federally-listed threatened species, migratory species, and threatened ecological communities.

Assessment of the Project by the Queensland Government occurred through the EIS process under the *State Development and Public Works Organisation Act 1971* (SDPWO Act). This act provides for the assessment of 'coordinated projects' by the Coordinator-General, while considering other Queensland legislation relevant to the proposed activity, including the:

- *Environmental Protection Act 1994*

- *Nature Conservation Act 1992*
- *Vegetation Management Act 1999*

Adani began formal environmental assessment of the Carmichael Coal Mine and Rail Project in 2010, through preparation of an EIS, to address the Commonwealth and Queensland government approval requirements. The Project was declared a 'significant project' under the SDPWO Act requiring an EIS and was assessed to be a 'controlled action' requiring assessment and approval under the EPBC Act.

An EIS was prepared in accordance with the bilateral agreement between the Commonwealth of Australia and the State of Queensland, with the objective of avoiding or mitigating potentially adverse impacts on environmental, social and economic values and enhancing positive impacts. Where there were unavoidable residual impacts, offsets were proposed in accordance with State and Federal government policies.

Adani prepared an SEIS in accordance with Section 35 (2) of the SDPWO Act and the bilateral agreement between the Commonwealth of Australia and the State of Queensland. The SEIS provided revised and additional environmental studies undertaken to reflect the amendments made to the Project since the EIS publication and to address matters raised in submissions. It included revised technical studies, impact assessment and management plans for a range of project issues.

The Carmichael Coal Mine and Rail Project was subsequently approved by the Queensland Coordinator-General on 8 May 2014, subject to conditions. The project was approved by DoE on 14 October 2015, subject to conditions (EPBC 2010/5736).

Adani was granted an Environmental Authority (EA) EPML01470513 for the Carmichael Coal Mine on 2 February 2016 in which conditions relating to the Black-throated Finch were also imposed. These conditions require a management plan and research program.

In addition to State and Federal approval conditions, Adani made commitments in regards to the management of BTF within the Coordinator-General report. **Appendix D** describes the relevant approval conditions and / or commitment relating to the monitoring and management of BTF and where the condition is addressed within this management plan.

3.4 Other guiding documents

In accordance with the Environmental Authority (EA) Condition I6 and Adani company commitment P6.54 the BTF Management Plan has been developed to align with the following references:

- National recovery plan for the Black-throated Finch southern subspecies *Poephila cincta cincta*. Report to the Department of the Environment and Water Resources, Canberra (Black-throated Finch Recovery Team, 2007)
- Significant impact guidelines for the Endangered Black-throated Finch (southern; *Poephila cincta cincta*) - EPBC Act policy statement 3.13 (Department of the Environment, Water, Heritage and the Arts (DEWHA), 2009)
- Two threat abatement plans that specifically reference the Black-throated Finches, being:
 - o -for competition and land degradation by rabbits (DEWHA, 2008)
 - o to reduce the impacts on northern Australia's biodiversity by the five listed grasses DSEWPAC (2012)
- Commonwealth Listing Advice on Southern Black-throated Finch (*Poephila cincta cincta*; Department of the Environment, 2005), and

- Queensland Government Bio-regional BTF Management Plan as required under the Coordinator-General's report about the Project, currently under development by DES.

Published on DES Disclosure Log
RTI Act 2009

4 Black-throated Finch (southern) Ecology

EPBC Condition 6a) requires that all MNES management plans include a description of the environmental values for each particular MNES.

4.1 Status

The Black-throated Finch (southern; BTF) is listed as endangered under the EPBC Act and the NC Act. The primary reason for the listing is the decline in size and extent of the population of the southern subspecies.

4.2 Regional populations

The southern subspecies of the BTF lives in the Brigalow Belt North and Desert Uplands bioregions of Queensland, which cover 135,500 km² and include the towns of Townsville, Bowen, Emerald, Clermont and Collinsville (at External 2011).

Based on mapping of all records of BTF up to 2010 and a comparison with post-2000 records, the distribution of BTF is estimated to have contracted by 50-80% of its historical range and is now rarely recorded south of Clermont (160 km south of the Project Area; at External 2011). BTF have also disappeared from several sites around Townsville (at External et al. 2011).

4.3 Habitat requirements

A summary of baseline research on the characteristics of BTF nesting and foraging habitat within the project area is provided in **Appendix D**. Black-throated Finch habitat typically consists of grassy eucalypt woodlands adjacent to water or riparian corridors (Removed at External Review).

(Removed at External Review) Preferred habitat consists of patches with suitable grasses, low vegetation density or bare ground to allow access to the seed bank and an open tree layer that does not have a continuously dense shrubby understorey (Removed at External Review) noted that the southern subspecies requires a mosaic of different habitats during the wet season in which to find seed. This subspecies has also been recorded in degraded habitats, including cultivated areas near woodlands and heavily grazed paddocks (DoE 2016).

The species can be found in a range of woody plant communities with records known from at least 21 Regional Ecosystems (RE; (ved at External et al. 2016). Woodland vegetation typically consists of ironbark (e.g. *Eucalyptus melanophloia*, *E. crebra* and *E. drepanophylla*), bloodwood (*Corymbia dallachiana*, *C. erythrophloia* and *C. clarksoniana*) and gums (*E. platyphylla* and *E. brownii*). Records from other vegetation communities includes wetlands, riparian paperbark woodlands and native grasslands (ved at External et al. 2016). Approximately 78% of records within the Galilee Basin region are associated with Broad Vegetation Group (BVG) 17b which is described as 'woodlands to open woodlands dominated by *Eucalyptus melanophloia* (Silver-leaved ironbark; or *E. shirleyi*; Shirley's silver-leaved ironbark) on sand plains and footslopes of hills and ranges (at External unpublished).

In the Project Area, grassy open-woodland communities dominated by *Eucalyptus melanophloia* (RE 10.5.5a) are preferred, though the species is not restricted to this community (ELA 2017a, Niche 2015a, Niche 2015b, Niche 2016a, Niche 2016b). Other habitats where BTF have been recorded on multiple occasions include *Eucalyptus brownii* open-woodland (RE 10.3.6ax1), and less commonly in *Eucalyptus similis* and *Corymbia brachycarpa* open-woodland (RE 10.5.1a) and *Corymbia setosa* open-woodland

(RE 10.5.1d; ELA 2017a). **Table 2** lists all REs identified in the Project Area that are considered as potential habitat.

BTF habitat within the Project Area generally consists of an open-woodland (approximately 17 % canopy cover) with moderately low canopy (approximately 12 m) and low canopy species richness. The shrub layer is typically low (2 to 2.5 m) and sparse (less than 10 % cover) but a moderately high species diversity. The ground cover is dominated by native grasses (approximately 35% cover and 8 species) with moderate bare ground (34% cover). Exotic grass and herb / forb cover are typically low (less than 5%; **Appendix E**).

Table 2 Regional Ecosystem associations for the BTF within the Project Area

RE	Description	Habitat Code
10.5.5a	<i>Eucalyptus melanophloia</i> dominates the very sparse canopy. <i>Corymbia plena</i> and <i>C. dallachiana</i> are occasionally co-dominants in the canopy. <i>Petalostigma pubescens</i> and <i>Acacia spp.</i> occasionally occur as dominants or as scattered trees in the very sparse to mid-dense low tree layer. <i>Carissa lanceolata</i> , <i>Psydrax oleifolia</i> and <i>Denhamia cunninghamii</i> frequently occur in the very sparse to sparse shrub layer. <i>Triodia pungens</i> is often dominant in the very sparse to mid-dense ground layer. <i>Aristida spp.</i> , <i>Bothriochloa ewartiana</i> , <i>Eriachne mucronata</i> , <i>Eragrostis lacunaria</i> and <i>Heteropogon contortus</i> occasionally occur as dominant or codominant graminoids. Occurs on sandplain.	<i>Eucalyptus melanophloia</i> dominant
10.3.6ax1	<i>Eucalyptus brownii</i> dominates the very sparse tree layer with scattered shrubs and very sparse ground layer frequently dominated by <i>Aristida contorta</i> . Occurs on flat to gently undulating sandplain.	<i>Eucalyptus brownii</i> dominant
10.3.13a	Riverine wetland or fringing riverine wetland. <i>Eucalyptus camaldulensis</i> dominates the very sparse to sparse canopy. <i>E. coolabah</i> , <i>Casuarina cunninghamiana</i> and <i>Melaleuca leucadendra</i> are frequently present in the canopy. <i>Corymbia tessellaris</i> is occasionally present. <i>Melaleuca spp.</i> are frequently present in the mostly very sparse low tree layer. Graminoid <i>Lomandra longifolia</i> is commonly present in the very sparse to sparse ground layer. Occurs along watercourses.	Riverine
10.5.1a	<i>Eucalyptus similis</i> dominates the usually very sparse canopy. <i>Corymbia brachycarpa</i> is frequently present in the canopy. <i>Eucalyptus drepanophylla</i> can occasionally occur as a codominant. The low tree layer is very sparse or composed of scattered small trees including <i>Bursaria incana</i> , <i>Acacia sericophylla</i> , <i>Alphitonia excelsa</i> and <i>Grevillea glauca</i> . A very sparse to mid-dense tall shrub layer is often present and dominated by <i>Acacia spp.</i> <i>Petalostigma pubescens</i> and <i>Persoonia falcata</i> are commonly present. A low shrub layer is usually present and dominated by <i>Carissa lanceolata</i> . <i>Triodia pungens</i> usually dominates the very sparse to mid-dense ground layer. Occurs on sandplains.	<i>Eucalyptus</i> or <i>Corymbia spp.</i> dominant with shrub layer
10.5.1d	<i>Corymbia setosa</i> dominates the very sparse canopy. <i>Melaleuca nervosa</i> , <i>Acacia sericophylla</i> , <i>A. elachantha</i> , <i>Bursaria incana</i> , <i>Grevillea glauca</i> and <i>Petalostigma pubescens</i> are frequently present in the very sparse low trees layer or occur as scattered small trees. <i>Acacia spp.</i> and <i>Carissa lanceolata</i> dominate the very sparse shrub layer. The ground layer is usually dominated by <i>Triodia pungens</i> . Occurs on sandplains.	

Grazing and fire are important drivers of the composition and structure of both the woody and ground layers of the vegetation (at Extern 2011, NRA 2007). Details on how grazing and fire impact the structure and composition of vegetation relevant to the BTF are provided in **Sections 4.6.4** and **4.6.5** respectively. Managing these factors is therefore important for the maintenance and management of BTF habitat. The optimal grazing and fire regimes required to maintain or improve habitat quality for the BTF are yet to be determined. Trials to determine the appropriate management of habitat with grazing and fire are proposed

as part of the Carmichael Coal Mine BTF Research Program (**Appendix C**), the results of which will feed back into the BTF Management Plan.

Permanent water is critical for the BTF as it provides refuge during dry periods and because they need to drink every day (at Extern 2011, NRA 2007). This water may be in the form of natural springs, perennial streams, waterholes in ephemeral creeks or man-made water sources such as farm dams and troughs. Therefore water must be within an accessible distance from their foraging and nesting habitat, and nests within the Townsville Coastal Plains populations are typically constructed in trees within 400 m of water sources (at Extern 2011, NRA 2007). However BTF monitoring results from the Project Area have identified a mean distance of approximately 2.5 km between nests and known permanent water sources, with the closest nest 280 m from water and the furthest almost 7 km from water (**Appendix E**).

Foraging habitat must provide suitable seeds, principally of grasses (at Extern 2011, NRA 2007). There must be an appropriate density and diversity of grasses, with seeds available and accessible on the surface as the birds predominantly feed on fallen seeds. A mix of grass species that seed at different times is important to provide year round food supply as BTF can experience food shortages particularly in the lead up to the wet season (at Extern 2011). The ground layer of the vegetation is ideally dominated by a diversity of annual and perennial grasses with sufficient inter-tussock spacing to allow the birds to forage efficiently for grass seeds present on the soil surface. Studies in the Project Area have identified a ground layer containing a mosaic of approximately 37% native grass cover and 34% bare ground as well as at least 8 native grass species and less than 5% exotic grass cover is preferred. BTF have not been recorded foraging in areas with more than 50% exotic grass cover (**Appendix E**).

Grass seed abundance usually peaks around the early dry season (May to June) and gradually declines through until the next wet season. Consequently, BTF can experience food shortages at particular times of year. The onset of wet season rains causes any remaining seed to germinate or rot, resulting in a significant food shortage (at Extern 2011) that can cause BTF to forage for longer in order to meet their needs. **Table 3** lists preferred grass species for the BTF based on research and studies in the Townsville Coastal Plains, Cape York Peninsula and Mareeba. Most are derived from observations of where BTF individuals were seen foraging. A summary of baseline groundcover and grass species at selected monitoring sites across the Project Area is provided in **Appendix F**.

Table 3: Grass species preferred by Black-throated Finches

Grass species	Location	Method	Reference
Favoured			
<i>Setaria surgens</i> *	Cape York Peninsula Mareeba West of Townsville	Direct observation of feeding by <i>P. c. atropygialis</i> and <i>P. c. cincta</i>	Zann (1976)
<i>Digitaria ciliaris</i> *			
<i>Stylosanthes humilis</i> *			
<i>Dactyloctenium radulans</i> *			
<i>Setaria surgens</i> *	Cape York Peninsula Mareeba West of Townsville	Observed to be dominant at sites used by Black-throated finches	Zann (1976)
<i>Melinis repens</i>			
<i>Schizachyrium fragile</i>			
<i>Panicum seminudum</i>			
<i>Aristida superpendens</i>			
<i>Aristida ingrata</i>			
<i>Aristida calycina</i>			

<i>Urochloa mosambicensis</i>	Townsville Coastal Plain	Direct observation of feeding birds	Mitchell (1996)
<i>Digitaria ciliaris</i>*			
<i>Alloteropsis cimicina</i>	Townsville Coastal Plain	Abundant on plots where Black-throated finches were foraging	Isles (2007)
<i>Alloteropsis semialata</i>			
<i>Chloris</i> spp.			
<i>Setaria apiculata</i>			
<i>Urochloa mosambicensis</i>	Townsville Coastal Plain	Abundant on plots where BTF were foraging	Rechetelo (2015)
<i>Chrysopogon fallax</i>			
<i>Eragrostis</i> spp.			
<i>Setaria surgens</i>*			

Bold species indicate those that have been recorded in the Project Area

* Indicates species which BTF have been observed foraging on in the Project Area

Within the Project Area BTF have been observed foraging on similar species as indicated in [Table 3](#), as well as additional grasses including:

- *Enteropogon ramosus* (GHD 2012)
- *Paspalidium rarum* (GHD 2012 and Niche 2016)
- *Schizachyrium fragile* (GHD 2012)
- *Cymbopogon bombycinus* (ELA 2017)
- *Triodia pungens* (ELA 2017)
- *Eriachne mucronata* (ELA 2017 and E2M 2018)
- *Bothriochloa ewartiana* (E2M 2018)
- *Panicum effusum* (E2M 2018)
- *Enneapogon polyphyllus* (E2M 2018)
- *Sehima nervosum* (E2M 2018)
- *Digitaria brownii* (E2M 2018).

During the 2016 dry season survey BTF were observed foraging on the seeds of the introduced woody herb *Stylosanthes scabra* (ELA 2017a).

The BTF monitoring surveys for the Project Area have indicated some differences with grass species that have been previously identified as being avoided in research undertaken on the Townsville Coastal Plains. In particular, the “avoided” species *Heteropogon contortus* and *Aristida* spp. have been commonly found at foraging sites in the Project Area, at varying percentage cover. At this stage the nature and scale of these differences are unknown, with monitoring programs currently underway to provide further clarity. In this regard, there remains ecological behaviours that are not fully understood for the local BTF population and their foraging requirements. Further surveys dedicated to analysing foraging behaviours of BTF within the Project Area, and comparison of the data, are required to identify the key factors that define preferred foraging habitat for the local BTF population and form part of the Research Program (ELA, 2017b). Initial findings from baseline monitoring are provided in **Appendix E** and **Appendix F**.

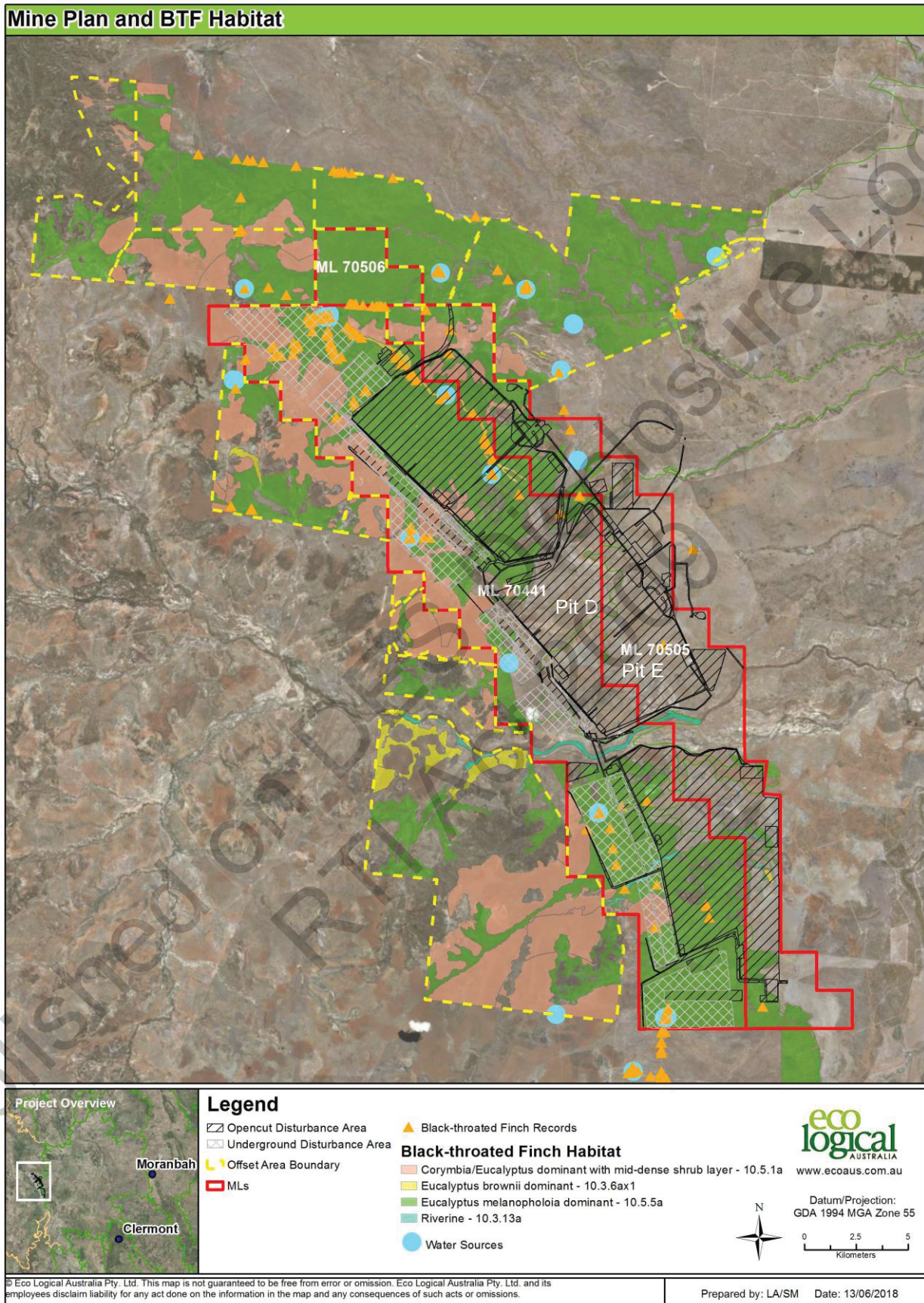


Figure 3 Black-throated Finch Habitat within the Project Area and adjacent areas (note this plan does not cover the Moran Downs West Offset Area, which is regulated by the OAMP)

4.4 Breeding ecology

BTF breeding season is from October to April, with seasonal and geographic variations (at External 2011). The timing and duration of the breeding season appears to be contingent on food resources and is therefore likely to vary annually and geographically according to rainfall patterns, temperature and land condition. Commencement of the wet season is the likely trigger for breeding.

Around Townsville, breeding tends to occur from December to May, which generally encompasses the wet season and the period of most prolific seeding of grasses (at External pers. comm.), but there is considerable variation in this timing throughout the bird's range. Breeding will continue throughout grass seeding generated by the wet season.

NRA (2005a) recorded BTFs breeding in Townsville from January to July; analysis of data contained in (at External 1996) recorded breeding in Townsville from March to May; and (at External 1970) recorded breeding on the Atherton Tableland from September to January. Although under optimal conditions the species can probably breed continuously throughout the year, the core breeding season around Townsville is believed to begin sometime after the onset of the wet season and continue until ground-stored food resources (fallen grass seed) fall below an undetermined threshold (c. February to June). Usually five or six eggs are laid at one time (at External 011).

There is little published information regarding the timing of the breeding cycle of this species. In a study of relatively few captive individuals (at External 1976) observed the timing of the breeding cycle of this species to be 15 days for incubation, 22 days from hatching to fledging and 18 days from fledging to independence. This indicates they are 40 days old at independence. With respect to independence, (at External 2011) notes that BTF juveniles may remain with their parents for a number of months after fledging.

Nests are mostly built high in the outer branches of trees and tall shrubs, in tree-hollows, in mistletoes, and in the base of raptor nests (BTFRT 2007). However, nests have also been recorded in large shrubs within 1 m of the ground. Occasionally nests are constructed beneath active raptor nests, of species such as Wedge-tailed Eagle (*Aquila audax*), Whistling Kite (*Haliastur sphenurus*), Swamp Harrier (*Circus approximans*) and Collared Sparrowhawk (*Accipiter cirrocephalus*; Higgins *et al.* 2006). Nests may also be built in neighbouring trees within the colony, usually less than 50 m from other nest trees (at External 2006; NRA 2006) and on occasion an outlier may be up to 250 m from the main colony (NRA 2007).

Within the Project Area, BTF nests have been recorded in various vegetation strata and species, with an apparent preference for the tall shrub layer dominated by *Acacia sericophylla*, typically at 2 to 4 m in height. Other nests have been recorded in the canopy layer at 7 m in height. BTF nests were most commonly found in *Acacia sericophylla* (12 records), followed by *Grevillea parallela* (2 records) and *Eucalyptus melanophloia* (1 record; E2M 2018; **Appendix E**).

The minimum area of nesting habitat required to sustain a viable breeding colony is unknown (NRA 2007). Most known nesting colonies are connected to larger areas of remnant vegetation. Following observations of a single colony, it has been suggested that a minimum remnant habitat patch of 40 to 50 ha within 500 m of a nesting colony may be required for that colony to remain viable, at least in the short-term (NRA 2006; NRA 2007). Nests are typically constructed from grass stems with feathers or plant down lining (at External *et al.* 2006; NRA 2006), and are used for breeding and roosting (NRA 2007).

The breeding season is an opportunity for BTF populations to recover from losses sustained during the dry season / early wet season (when resource bottlenecks occur as grass seed supply is low). During the breeding season, parents first need to gain sufficient body condition to breed and, then, once the young have hatched, be in a condition in which they can forage for both themselves and their young. Activities

or events that reduce resource availability during this time may reduce reproductive success. If breeding success is unable to off-set mortality over consecutive years then population declines and, ultimately, local extinctions will occur (at Extern 2011).

4.5 Carmichael population

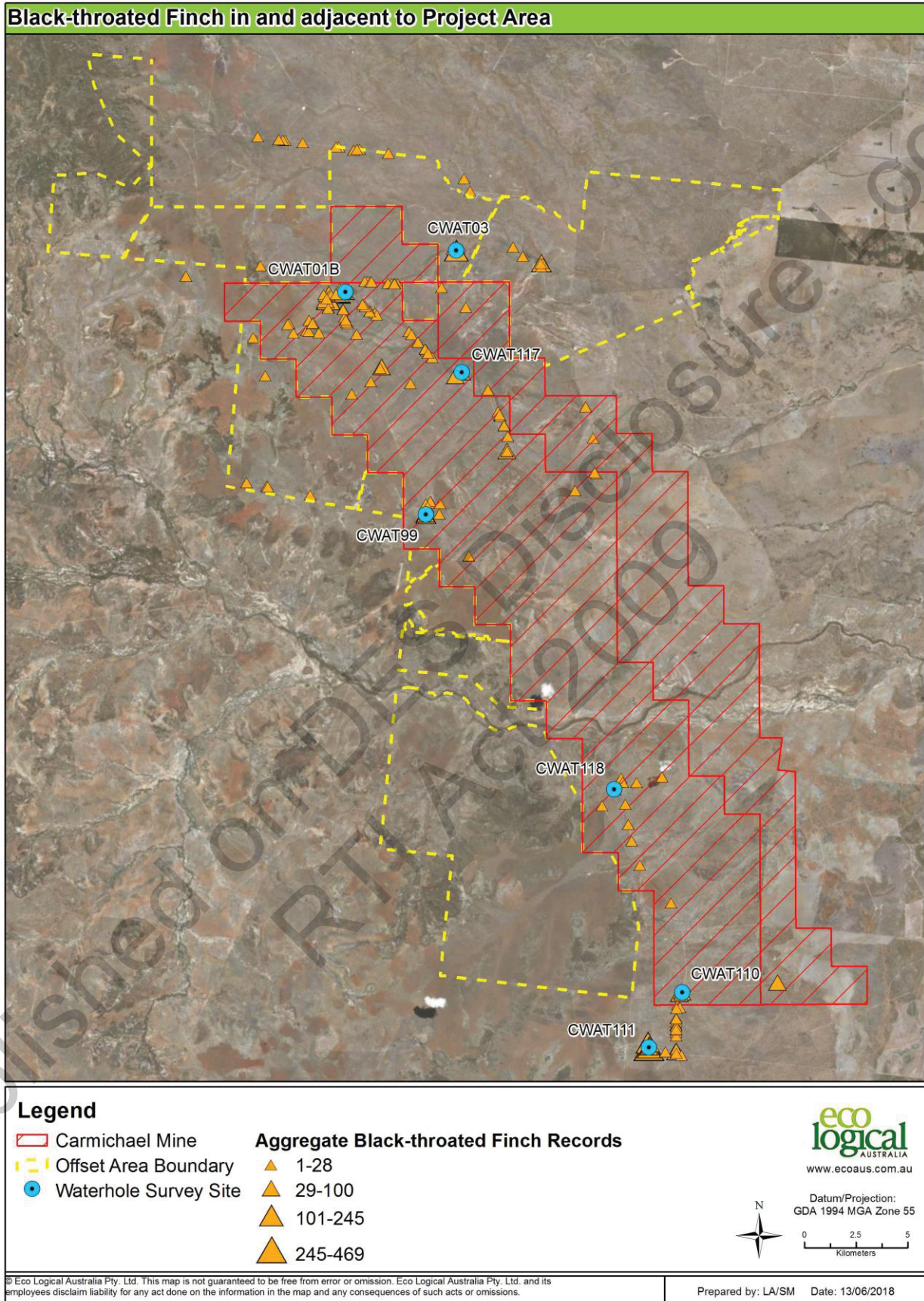
Over a period of nine years (2010 to 2018), Adani has commissioned 13 surveys and associated reports assessing the habitat preferences, ecology and population presence of BTF with the Project Area. The most recent BTF surveys undertaken within the Project Area were in March 2015 (Niche 2015a), August 2015 (Niche 2016a), April 2016 (Niche 2016a), October 2016 (ELA 2017a), November 2017 (E2M 2017) and April 2018 (E2M 2018), and have included surveys within the Moray Downs West offset area. Prior to that, surveys had focussed on the mining lease.

The methodology adopted in the most recent monitoring surveys consisted of timed fixed point water source watches; habitat searches in the immediate vicinity of the water sources (600 m radius); slow drive line transects with defined call playback stations; and opportunistic observations gathered whilst traversing the Project Area. The key findings from the monitoring surveys include:

- Aggregate BTF totals have ranged from 84 to 1,145 with an average of 480. Dry season surveys have generally yielded the largest aggregate totals (1,145, 846 and 610 in 2015, 2018 and 2016 respectively), although a wet season survey in 2015 yielded records of 600 BTF.
- Surveys to date have focused on the mining lease where the greatest aggregates have been recorded, in particular in the northern area of the mining lease and around Four Mile and Ten Mile Bores.
- The 2016 dry season survey included the greatest survey effort within the Moray Downs West offset area to date where an aggregate total of 151 BTF were recorded from 14 locations
- Monitoring surveys have identified a strong association between BTF records and vegetation communities dominated by remnant RE 10.5.5a *Eucalyptus melanophloia* open woodland on sand plains (Niche 2016a; ELA 2017a). BTF have also been recorded in four other REs ([Table 2](#)).
- A majority of BTF records have been identified during waterhole surveys with this survey method accounting for 37% of the aggregate total in the October 2016 dry season survey (ELA 2017a).
- Foraging BTF have been predominantly observed in woodland or open woodland dominated by *E. melanophloia* with a mean canopy height of 12 m. Areas used for foraging were characterised by sparse to mid-dense ground cover with a mean ground cover recorded of 40%. Grass species diversity at foraging sites was high with a mean grass species richness of 8. Exotic grass cover is typically less than 5 % ([Appendix E](#)). The species recorded are typical of grassy woodlands of the bioregion, of which the Project Area supports some high quality examples (Niche 2015a).
- Based on the data available for dry season surveys, it appears that in dry conditions records are concentrated in the central-north and central-south areas of the Project Area where large stretches of suitable habitat area are present and water sources were available at the time of survey (Niche 2016a; ELA 2017a). In particular, large numbers were recorded during the August 2015 BTF monitoring survey in the vicinity of the large dam on the Lignum property (CWAT111), the dam at CWAT03, Four Mile Bore (CWAT99), #2 Dam (CWAT117), the Turkey Nest dam at Ten Mile Bore (CWAT01B) and troughs at Lignum (CWAT110B) and Carmichael Bore (CWAT118; Niche 2016a).

- A total of 60 BTF nests have been identified during monitoring surveys to date. This includes 15 nests that were identified during the 2018 dry season survey which is the largest number to date (E2M 2018).
- A pair of BTF were observed during the 2016 dry season surveys preparing a nest within the outer-branches of a Silver-leaved Ironbark. This tree was approximately 14m in height and within remnant RE 11.5.5.a.
- Surveys have identified preferred foraging habitat to consist of a grassy understorey with a mosaic of patches of dense grass with open bare patches containing a diversity of native grasses.
- BTF have directly observed foraging on seeds of at least nine grass species as well as the woody shrub *Stylosanthes scabra* within the Project Area (GHD 2012; Niche 2016; ELA 2017a). Another two grasses have been identified as potential foraging species (GHD 2012).

BTF are most regular and most abundant in the northern third and the southern quarter of the Project Area ([Figure 4](#)). The area around Ten Mile Bore (CWAT01B; in the north-west of the mining lease area) appears especially favourable, possibly due to the combination of open grassy *Eucalyptus melanophloia* woodland and the water that it provides. In general, this area has a low shrub cover in the understorey. Areas north of the Carmichael Road in the far west of the Project Area (Four Mile Bore and surrounds) are also favourable, though the numbers of birds are generally lower than around Ten Mile Bore. The Four Mile Bore (CWAT99) area tends to have reasonably extensive patches of understorey shrubs, particularly just north of the Carmichael Road. In addition, large numbers of BTF have been recorded between 2015 and 2018 at a large dam and surrounding habitats on Lignum Station. The floristic composition and structure representative of the area surrounding this large dam is also consistent with the vegetation assemblages shown to support BTF foraging and nesting habitat.



4.6 Threats, potential direct / indirect project impacts

Threats and potential direct / indirect project impacts that are required to be addressed as they apply to the BTF on the Project Area are:

- threats to the BTF as identified in [Table 4](#) and the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007; BTF Recovery Plan)
- direct and indirect project impacts outlined in the EIS (GHD 2012a; Adani 2012)
- matters outlined in Condition 6 of the EPBC Approval (2010/5736).

EPBC Condition 6c) and EA Condition 16d) require details for all impacts and threats MNES to be included in this plan. Known threats to BTF from the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007) are listed in [Table 4](#).

The potential sedentary lifestyle of the BTF may make it vulnerable to any loss, disturbance or modification to any of the three key resources of water sources, grass seeds and trees providing suitable nesting habitat (DEWHA 2009). Particularly, the synergistic effects of pastoralism, drought and fire are thought to have the greatest impact on the species by increasing the period of resource shortage and decreasing the quality and availability of breeding habitat (at External *et al.* 2011). However, some aspects of pastoralism may also benefit the species (e.g. stocking rates, fire fuel management and artificial water sources).

Other potential threats to the BTF (southern) are illegal trapping, hybridisation with escapees of the northern subspecies, resource bottlenecks associated with drought and changes in land management practices and impacts on seasonal breeding success from cyclonic activity (i.e. destruction of nests; BTF Recovery Team, DECC & NPWS 2007; DoE 2015).

Whilst there is information available helping to identify likely threats to BTF, there are still gaps in the knowledge of how these threats operate, and how they may vary in their impact in different geographical areas that the species inhabits, and how the threats interact with each other.

Impacts resulting directly from the removal of coal include initial clearing of vegetation, removal and storage of topsoil, overburden, coal, rejects and dry tailings, dewatering, and clearing and construction of haul roads. Key impacts on BTF from these activities will be the loss of suitable habitat, direct loss of birds, loss of water sources and uncontrolled fires. As required by Condition 6 of the EPBC approval (2010/5736), potential impacts including area of impact to BTF must be addressed in this plan.

Indirect impacts as a result of clearing and construction for mining and associated activities include weed spread (especially of grass species that are unpalatable to BTF and / or tend to form monocultures), change in species diversity and composition of the grass layer, potential for contamination of water sources and habitat degradation through light spill, noise and dust. Threats, potential direct and indirect project impacts to the BTF are described in detail in the following sections.

Table 4 BTF threats, potential direct / indirect project impacts and matters required to be addressed by conditions

#	Potential Threat or Impact	Threat identified in the BTF Recovery Plan	Potential direct project impact identified in SEIS	Potential indirect threat or impact identified in SEIS	EPBC Approval, condition 6	Project Phase/s	Description of threat and potential project impact	Impact addressed
1	Vegetation clearing / habitat loss, including fragmentation of key habitat areas and potential fatalities from clearing	Yes	Yes	-	(c)(i)	Construction	Section 4.6.1	Table 8
2	Habitat alteration through subsidence	-	Yes	-	-	Operations	Section 4.6.2	Table 8
3	Increased exotic pasture and weed invasion of key habitat areas	Yes	-	Yes	(c)(ix)	Construction Operations	Section 4.6.3	Table 9
4	Grazing in key habitat areas that changes the ground cover composition	Yes	-	Yes	-	Construction Operations	Section 4.6.4	Table 9
5	Wildfire or inappropriate fire management to key habitat areas that changes the ground cover composition	Yes	-	Yes	-	Construction Operations	Section 4.6.5	Table 9
6	Feral animal impacts	Yes	-	Yes	-	Construction Operations	Section 4.6.6	Table 9
7	Loss or degradation of water sources	Yes	-	Yes	(c)(ii)	Construction Operations	Section 4.6.7	Table 10
8	Mine dewatering	-	-	-	(c)(iii)	Operations	Section 4.6.8	Table 10
9	Earthworks	-	-	-	(c)(iv)	Construction	Section 4.6.9	Table 10
10	Noise and vibration	-	-	-	(c)(v)	Construction	Section 4.6.10	Table 10
11	Emissions (including dust)	-	-	-	(c)(vi)	Construction	Section 4.6.11	Table 10
12	Light spill and other visual impacts	-	-	-	(c)(vii)	Construction	Section 4.6.12	Table 10
13	Stream diversion and flood levees	-	-	-	(c)(vii)	Construction	Section 4.6.13	Table 10

Each of the threats to BTF, potential direct / indirect project impacts and matters required to be addressed by EPBC Approval, Condition 6 are described in detail in the following sections.

4.6.1 #1: Vegetation clearing / habitat loss, including fragmentation of key habitat areas

Clearing of vegetation is the primary threat that would affect the availability of breeding and foraging habitat for the BTF. Habitat loss, fragmentation and degradation are the main threats to the BTF (Department of the Environment 2000; Department of the Environment 2005; BTFRT 2007).

The most probable cause of decline from the southern parts of the historic range are overgrazing and habitat clearing (Department of the Environment 1999; Department of the Environment 2005). Declines have been less severe in the northern part of the subspecies range where clearing is not yet as widespread and grazing is predominately by cattle (Department of the Environment 2000; BTFRT 2007).

A total of 9,492 ha of identified BTF habitat are proposed to be impacted by vegetation clearing over the life of the Project (CO2 2016). This represents 0.16 percent of the total potential habitat within the Desert Uplands and Brigalow Belt bioregions within which the Project occurs. Details of habitat disturbance across the project stages are summarised in [Table 5](#), with the sum of critical, core and marginal habitat disturbance totalling 9,492 ha.

Table 5 Summary of disturbance to BTF habitat at the Mine, off lease and Rail West aspects of the project over Stage 1 and 2 (CO2 2016)

BTF Habitat type	Stage 1 (ha)	Stage 2 (ha)	Total (ha)
Very High (Critical)	4,628	3,080	7,708
High (Core)	726	288	1,014
Marginal	739	31	770
Low	344	634	978

The area of direct impact has been minimised as far as possible throughout the design and development of the mine plan. Through relocation of the out of pit stockpiles, the area of direct impact was reduced by approximately 7,000 ha. This change to the mine plan resulted in an approximately 40% reduction in the potential area of direct impact (GHD, 2013).

High quality BTF habitat within the mining lease area is considered to be located generally in the northern third and the southern quarters of the Project Area ([Figure 3](#) and [Figure 4](#)). While delivery of the Project will be a staged process, each stage covers large areas of remnant vegetation and will have effects on the behaviour and movements of the local BTF population, reducing areas of suitable habitat.

Fragmentation of woodland and grassland vegetation associated with the Project development may reduce habitat availability due to the sedentary nature of the BTF as well as causing an alteration in grass species composition or seed availability, affecting the ability of the BTF to find food throughout the seasons. Fragmentation within 5 km of water sources may also reduce habitat availability due to loss of critical resources.

Planning and development of the mine will aim to minimise vegetation clearing in areas considered to be higher value habitat and where high concentrations of BTF occur. The approach of underground mining has been adopted in areas of *Eucalyptus melanophloia* dominant vegetation communities (RE 10.5.5a) and *Eucalyptus brownii* dominant vegetation communities (RE 10.3.6ax1), where possible, to minimise impacts to habitat known to be utilised by BTF in the Project Area ([Figure 3](#)).

It is anticipated that approximately 20,230 ha of vegetation will be cleared within the open cut mine footprint which includes open cut mining (including pits, slopes, voids and out of sit spoil dumps) and Infrastructure Area (including water storage, tailings drying cells, diversion drains and levees), of which approximately 9,492 ha is BTF habitat. This clearing is expected to occur over a period of life of open cut pits (approximately 40 years). A mine plan and schedule has been developed for the Project. The mine schedule is broken into 13 time periods, with a mine life of approximately 50 years. Periods 1- 5 are on a yearly basis and periods 6 – 13 are based on 5 years.

As shown in [Table 1](#), the area required for clearing of vegetation in the first 10 years of the project life is only approximately 56% of the total disturbance area. As the open cut pit workings proceed towards the midlife (approximately 10-15 years), the rehabilitation of spoil dump areas will commence and hence the net disturbance areas will be reduced.

Portions of the Project Area will also be cleared for storage of earthen materials such as topsoil, overburden, coal, and tailings. An area of approximately 9,200 ha will be impacted by the placement of top soil and overburden. This area extends from the north-eastern to south-eastern corner of the mine footprint, along its eastern edge, over an area approximately 32 km long by 3 km wide. This will result in some direct loss of BTF habitat, particularly in the north-eastern section of the Project Area where large groups of BTF were recorded (Niche 2015a and Niche 2015b).

The proposed mine plan in relation to BTF habitat and records is shown in [Figure 3](#).

Management objectives about the threat and impacts include minimising habitat loss and fauna death during vegetation clearing, progressive habitat restoration of disturbed areas and improving awareness of BTF by site personnel. **Table 8** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.2 #2: Habitat alteration through subsidence

Habitat alteration through subsidence as a result of underground mining at Carmichael Mine has the potential to degrade BTF habitat. Subsidence can cause surface movement, cracking and hydrological changes and lead to tree slumping, root damage, vegetation stress and dieback and ultimately alter grass species diversity and composition to those that may be unpalatable to BTF (Adani 2013).

A subsidence assessment was undertaken in 2013 and describes impacts to vegetation and fauna (Adani 2013). The assessment determined:

- Surface movement due to subsidence may lead to areas of destabilisation causing vegetation slumping, tree falls, erosion and root exposure
- Localised variable impacts for mine sites may occur under native vegetation, but were difficult to predict
- Tension cracks may leave soil vulnerable to erosion, leading to damage to root systems
- Impacts to changes in hydrology include loss or changes to the flow and direction through the subsurface, and depression of the surface may lead to water ponding after rain.

The study determined that ponding duration was predicted to range from less than a day to several months. The assessment was based on a typical wet year. The study detailed the subsidence impact area for each environmental value which intersected with the total cumulative layer of subsidence. The study determined the rankings for impacts for assessment of subsidence in [Table 6](#).

Table 6 Ranking of impacts for subsidence, cracking, ponding and infrastructure

Impacts	Ranking of impacts
Subsidence	High: slope change of more than 2% (>5 m) Low: slope change of less than 2% (<5 m)
Cracking	High: > 100 mm (width) Low: < 100 mm (width)
Ponding	High: duration of ponding greater than 2 days Low: duration of ponding less than 2 days
Infrastructure	High: impacted by infrastructure Low: not impacted by infrastructure

The following quantity of subsidence impacts were predicted for BTF habitat (Adani 2013):

- High impact – 163.32 hectares
- Low impact – 6,145.39 hectares
- No impact – 574 hectares.

A management objective under this plan is to minimise habitat alteration through subsidence. **Table 8** describes how the management objective will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.3 #3: Increased exotic pasture and weed invasion of key habitat areas

The main non-native grass present in the Project Area is Buffel Grass which tends to form a monoculture and is associated with a depleted diversity of grasses. This grass dominates cleared areas in the east of the Project Area but is less prevalent in the intact woodlands favoured by BTF in the Project Area. BTF are not known to eat the seeds of Buffel Grass. A monoculture of any species will not provide quality foraging habitat as it reduces the diversity of species whose seeds can collectively provide continuity of supply through the year and during different seasons. The introduced forage legume *Stylosanthes* spp., especially *S. scabra*, is also likely to be detrimental if it becomes a common component of the ground layer of the vegetation, as it has a negative impact on native plant species richness and diversity (DSITIA 2014).

The introduction and / or spread of weeds is acknowledged as a threat to BTF (BTF Recovery Team, DECC & NPWS 2007). Buffel Grass is the primary existing threat to BTF habitat degradation in the Project Area. However other weeds, such as Parthenium, Prickly Acacia and other exotic grasses that are also known from the Project Area (Adani 2015) also have the potential to degrade BTF habitat if allowed to spread through mining activities. Vehicles and machinery also have the potential to import new weeds into the Project Area, with detrimental effects on BTF habitat.

A management objective under this plan is to reduce weed competition within BTF habitat. **Table 9** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.4 #4: Grazing in key habitat areas that changes the ground cover composition

The most probable cause of BTF decline from the southern parts of the historic range are overgrazing and habitat clearing (Franklin 1999; Department of the Environment 2005). Pastoralism was typically concentrated in areas containing suitable habitat for the southern BTF subspecies, such as grassy, riparian woodlands on alluvial plains (NRA 2007). Declines have been less severe in the northern part of

the subspecies range, where clearing is not yet as widespread and grazing is predominately by cattle removed at External Review (2000; BTFRT 2007).

BTF are known to persist in pastoral landscapes due to the prevalence of open eucalypt woodlands with suitable water resources and grasses (DEWHA 2009). The abundance of BTF and the viability of their populations in the landscape are influenced by the grazing regime that is in place (DEWHA 2009).

The grazing regime influences the composition and structure of the herbaceous layer of the vegetation. Long-term heavy grazing will selectively remove perennial grass species that are less tolerant of grazing removed at External Review (2011). This is likely to increase the prevalence of species such as *Aristida* spp. (Wire grasses), *Cenchrus ciliaris* (Buffel Grass) and *Bothriochloa pertusa* (Indian Bluegrass), annual grasses in general, and unpalatable weeds. Grass species richness is also likely to decrease under long-term heavy grazing.

Currently, the Project Area is being predominantly used for cattle grazing. The Project activities do not specifically include grazing, however, parts of the mining leases not being used for the construction and operation of the mine will be used for grazing. Long-term heavy grazing is likely to decrease the grass species richness and increase the prevalence of annual grasses and unpalatable weeds, and therefore decrease habitat quality for BTF removed at External Review (2011). Strategically managed grazing can 'open up' the grass layer, increasing the amount of bare ground on which BTF often forage as well as prevent thickening of a woody shrub layer. Particular cattle grazing regimes can also be used to manipulate the grass layer and manage fire by reducing fuel loads and therefore fire intensity. Grazing by cattle can be used strategically to reduce fuel loads in order to reduce the risk of hot extensive fires.

Sustainable grazing practices will be used in the Project Area as a management tool to manage threats to BTF habitat. Grazing will be used to decrease the abundance and presence of weeds, including Buffel Grass and other exotic pasture grasses, and control fuel loads so as to reduce the risk of an uncontrolled fire.

A management objective under this plan is to use strategic and sustainable grazing to manipulate the grass layer and manage fire by reducing fuel loads and therefore fire intensity. However, the objective is to also ensure grazing itself does not become a threat. **Table 9** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.5 #5: Wildfire or inappropriate fire management to key habitat areas that changes the ground cover composition

Fire is inevitable in the grassy woodlands of central Queensland and a natural component of these ecosystems. Historically, ignition sources include lightning-strike, low intensity wet season fires, or under traditional indigenous management (DEWHA 2009). Changes in the fire regimes can alter the habitat and food resource availability for the subspecies removed at External Review (1999); season-dependent diets have been documented in related finch species such as the Gouldian Finch (*Erythrura gouldiae*), Long-tailed Finch (*Poephila acuticauda*) and Masked Finch (*Poephila personata*) removed at External Review (2002).

Fire frequency can have the biggest impact on ecological function. High frequency, low intensity, patchy fire regimes can be beneficial to BTF by reducing the thickness of the shrub layer removed at External Review (2001). However, European settlement has caused a shift towards frequent, extensive and high intensity fires in the dry season resulting in large uniform areas being subject to fire (Rechetelo 2015). Inappropriate fire regimes can impact on the quality of habitat for the BTF by affecting the production of seeds and the diversity of grass species impacting on food availability. Fire will generally not reduce densities of *Eucalyptus* spp., such as Silver-leaved Ironbark, though it can change canopy structure.

Alternatively, fire exclusion can also lead to thickening of woody shrubs, decreasing the quality of BTF habitat.

BTF tend to favour habitat with a sparse cover (less than 5%) of shrubs (**Appendix E**). Short-lived *Acacia* spp. or dense areas of *Carissa ovata* and / or *C. lanceolata* will suppress the grass layer and grazing, and an altered fire regime will also increase woody thickening, diminishing both the forage supply and the quality of foraging habitat (at External Review 2000; DSITIA 2014).

BTF require open patches between grass tussocks to feed on fallen grass seed. If the understorey is shrubby, the supply of grass seeds is likely to be diminished. Extensive areas of dense shrubs are likely to be detrimental to the species as the shrubs suppress grass growth and the exclusion of fire can facilitate the development of these areas (Removed at External Review et al. 2001). Small patches of shrubs and low trees may be used to rest and for shelter.

Fires in woodlands of the type that occur in the Project Area are fuelled principally by grass biomass rather than by woody material. Fire intensity will be greater with high fuel biomass, continuity of the fuel layer, a high degree of curing (drying) of the grassy fuel and ambient conditions, including high temperatures, low humidity and high wind speeds. Lower intensity fires will occur when fuel biomass is low and / or discontinuous, fuel moisture levels are high, ambient temperatures and wind speeds are low and atmospheric humidity is high.

Fire frequency, scale and intensity may also impact on habitat quality for BTF through numerous mechanisms. Large uncontrolled wildfires have the potential to destroy large areas of BTF habitat with consequential long recovery times. Fire frequency can also affect BTF habitat with inappropriate fire regimes impacting on the quality by affecting the production of seeds and the diversity of grass species and food availability (in the case of overly frequent fires) or by causing thickening of woody shrubs where fire is excluded from the landscape.

Management objectives under this plan are to reduce the risk of bushfire ignition, maintain a mosaic of fire history in BTF habitat and reduce the risk of bushfire spread. **Table 9** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.6 #6: Feral animal impacts

Domestic stock and rabbits can degrade habitat through grazing, trampling and altering the fuel loads (Removed at External Review). Woodland bird communities often feed in mixed flocks which is a predator vigilance and avoidance behaviour (Removed at External Review 2012; Adani 2012). Flocks may be reduced in size when the abundance of seeding grasses is low, and as a consequence can increase predation on bird species through loss of predator vigilance when feeding (Garnett et al. 2011).

Invasive animals are known to occur in the Brigalow Belt North and Desert Uplands bioregions. Feral cats (*Felis catus*), were recorded in the Project Area in 2010 and 2011 and are likely to prey on BTF (GHD 2012a). There are currently no data on cat presence or predation rates within Moray Downs West or the Project Area. Studies near Townsville found that nests were abandoned or became inactive when they were destroyed by predators (NRA 2005 in DoE 2016). Foraging and watering areas may also be disturbed by wallowing and uprooting of feral pigs.

Management objectives under this plan are to reduce habitat degradation from grazing by introduced herbivores, minimise predation risk by invasive mammals and use adaptive management of weed and

pest controls to minimise threats to BTF and their habitat. **Table 9** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.7 #7: Loss or degradation of water sources

BTF need to drink water on at least a daily basis and drink more frequently during the drier times of the year. The importance of water to BTF is highlighted by the fact that they typically nest and breed near water. The species is thought to undertake local movements in response to rainfall patterns, with some populations utilising seasonally (wet season) available water to access breeding grounds then contracting back to permanent water sources during the dry season. Removed at External Review

Activities that reduce the availability (location and duration) of water or detrimentally alter water quality in areas of BTF habitat may negatively impact on the species. This impact will be greatest in breeding areas and / or dry season refugia. The availability of vegetation in the immediate vicinity of the water is important, to provide shelter for perching prior to drinking, and trees through which they can travel to and from the water are important. Pressures on the availability of water will be most pronounced during periods of drought. Conversely, the creation of water sources in certain parts of the landscape may create habitat for the BTF.

Numerous occurrences of BTF drinking from water troughs were recorded within the Project Area during surveys completed in the period 2013 to 2018 (GHD 2012; Niche 2015a and 2015b, ELA 2017a, E2M 2018). Vegetation in close proximity to water sources is important as it provides shelter for birds at External (2011). It is likely that additional anthropogenic water sources in BTF habitat will assist the species in drought conditions by providing a more reliable and permanent source of water.

Within areas to be open cut mined, existing natural and artificial surface water sources will be lost. There are six dams within the Project Area where BTF have been identified (Niche 2015a, Niche 2015b, Niche 2015c and ELA 2017a) that will be lost due mining activities (**Figure 3****Figure-3**). BTF have been recorded consistently utilising some of these water sources, in particular #1 Dam and #2 Dam. Removal of these permanent water sources from the Project Area will decrease the overall availability of water for the BTF across the broader landscape.

Availability of drinking water in proximity to good quality habitat is critical for BTF persistence. Contamination of potential BTF water resources surrounding the mine from sources such as hydrocarbon leaks or spills, spoil disposal, release of sediments through clearing and earthworks, or draining of low quality water from existing farm dams, could impact on the species. These impacts are unlikely to occur due to the alignment and location of mining activities and the implementation of adequate control measures. Such changes to water quality may reduce the suitability of aquatic and riparian habitats for terrestrial species.

Management objectives under this plan are to:

- ensure water quality in known BTF water sources outside disturbance footprint remain within acceptable limits
- reduce degradation of suitable water sources
- protect environmental values within waterways of the receiving environment
- minimise siltation of water resources
- maintain access to water, with no net loss of suitable permanent water sources
- reduce the risk of contamination of BTF habitat by chemicals, fuel, heavy metals

Table 10 describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.8 #8: Mine dewatering

Mine dewatering has the potential to negatively impact on groundwater-fed BTF watering sources. Drawdown may reduce the temporal and spatial availability of water by restricting or removing the base flow that persists in the Carmichael River during the dry season or increase the low flow periods as well as impacting spring wetland areas which BTF may use (ELA, 2015b). However, it should be noted that BTF have not been observed to utilise the Carmichael River ([Figure 4](#)).

A management objective under this plan is to manage the impacts of mine dewatering. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.9 #9: Earthworks

Earthworks carried out as a part of mine construction will lead to increased exposure to light, noise, dust, vehicles and people. Animals may also become more vulnerable to predation, because of increased light making it easier for predators to locate prey or noise levels making it harder for prey to detect approaching predators (Adani 2012).

Increased exposure to light, noise, dust, vehicles and people are dealt with in other sections. The other possible impact to BTF as a result of earthworks are the mortality and injury of individuals due to machinery strike.

Vehicles and machinery used to undertake land clearing have the potential to lead to direct mortality of fauna in the event that individuals are struck. Those animals that are unable to disperse away from areas under active clearing are also particularly susceptible to injury or death. This includes amphibians, reptiles, small ground-dwelling mammals, arboreal mammals and nocturnal species that are inactive during daylight hours.

Other potential causes of mortality include animals becoming trapped in excavations, and carrion eaters being struck when feeding on road kill. However, as the BTF are able to disperse away from areas subject to earthworks, fauna mortality and injury to individuals due to machinery strike is not expected to be a common occurrence (Adani 2012).

A management objective under this plan is to minimise the risk of light vehicle and machinery strike during earthworks and operations. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.10#10: Noise and vibration

As the Project Area is currently exposed to some disturbance as a working cattle property, the BTF that occur there exhibit a degree of disturbance tolerance. BTF are known to inhabit areas exposed to anthropogenic disturbance (peri-urban Townsville including habitat directly adjacent to military training areas and numerous towns in central Queensland).

The BTF may exhibit initial fright behaviour in response to the increased intensity of disturbance at the Project Area, and will either adapt to the disturbance levels, or move away from the areas of activity into

similar habitat that is extensively available in the adjacent landscape. Dispersal will be facilitated by active management and where possible enhancement of habitats occurring onsite (outside the mine footprint) and offsite (offset areas; Adani 2012).

The project will use standard construction equipment, general trade equipment and specialised equipment as required. Some blasting will be required to prepare overburden for removal and also coal extraction (Adani 2012).

Noise and vibration disturbance from coal transport may reduce the quality of resources for BTF, both within the Project Area and in adjacent areas. Noise from mining operations may increase BTF stress and flushing responses, change foraging behaviours, reduce reproductive success and communication (Adani 2012).

A management objective under this plan is to minimise habitat modification as a result of noise and vibration. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.11#11: Emissions (including dust)

Vegetation clearing has the potential to facilitate erosion (by water and wind). This can have a localised impact on species and habitat suitability by reducing the quality and abundance of refuges, microhabitats and food availability through the smothering of native vegetation with sediment.

Earthworks will result in dust emissions. Excessive dust settling on vegetation could also suppress vegetation growth by limiting the photosynthesis potential of plants in close proximity to the construction area (Adani 2007). Plants with dust on leaves may also be less palatable as a food source for animals. Dust deposition associated with earthwork activities will generally occur relatively close to areas of disturbance and hence, plants within 50 m – 100 m of construction activities may be affected by dust. As construction activities are temporary, effects will be short lived, and rainfall will generally remove dust from plants (Adani 2012).

Dust emissions from coal transport may reduce the quality of resources for BTF, both within the Project Area and in adjacent areas. Dust may also affect plant health and palatability, particularly for native grasses within foraging habitat.

A management objective under this plan is to minimise emissions, particularly dusts. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.12#12: Light spill and other visual impacts

Development of the project will necessitate the installation of lighting for safety and security of operations as the proposed mine will operate 24 hours per day. Impacts from lighting will involve static floodlights associated with mine operations, lighting around the mine infrastructure area, workshops and ancillary buildings, vehicle lights moving around the site. Artificial night lighting levels are expected to be very low indeed, if present at all, and this is considered to be an impact of minor significance on fauna generally, including the BTF (Adani 2012).

A management objective under this plan is to minimise light spill and other visual impacts. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

4.6.13 #13: Stream diversion and flood levees

Existing hydrology will be altered as a result of the mine operations through realignment of watercourses as well as removal of some existing farm dams and cattle troughs. Diversion drains around the perimeter of the mine site as well as areas of ponding and drainage management within the subsidence area provide water sources. The provision and security of surface water in those potential habitat areas may provide additional localised access to drinking water for the subspecies.

A management objective under this plan is to reduce the impact of stream diversion and flood levees. **Table 10** describes how the management objectives will be met, including performance criteria, management actions, monitoring, triggers for adaptive management and corrective actions.

5 Adaptive Management Framework

This section describes the adaptive management framework that will be applied to the management of BTF, as originally outlined in the BTF Management Plan prepared during the environmental impact assessment process (Adani 2014).

Adaptive management is a process that deals with uncertainty and incomplete knowledge by using systematic monitoring to reduce uncertainty and improve management actions over time. The monitoring program that will provide data to inform and improve the management actions in this plan are outlined in **Section 7** and **Appendix C**. In general, the monitoring framework will:

- Address key questions regarding BTF ecology and distribution. The new knowledge will be systematically reviewed and used to refine the monitoring and management of BTF in the Project Area. Improved knowledge about BTF ecology and distribution will allow understanding of the potential project impacts to be further refined.
- Employ appropriate regular review and analysis of the monitoring data to refine the monitoring program and refine management actions.

Adaptive management emphasises the iterative feedback between the implementation of management actions and the assessment of their effectiveness via continuous improvement of knowledge via monitoring and evaluation of the monitoring data (External *et al.* 2012). In particular, the results of the BTF Research Program and monitoring completed under the BTF Management Plan will provide a basis for review of the management actions, and ensure that mitigation measures are appropriately targeted and based on the best available science.

The key management actions are outlined in **Section 6**. Management actions, and the monitoring that provides information for the management, will be based largely on the main themes within **Section 6**, and may be expanded as new knowledge of BTF at the Project Area becomes available. Specific management objectives, performance criteria, management actions, monitoring, triggers for adaptive management, and corrective actions have been established (see **Table 8** to **Table 10**), consistent with the framework for adaptive management outlined in **Figure 5**. The monitoring program will inform the management actions over time, which in turn will help develop more effective monitoring programs. All of these steps will allow ongoing revision and improvement of the BTF Management Plan.

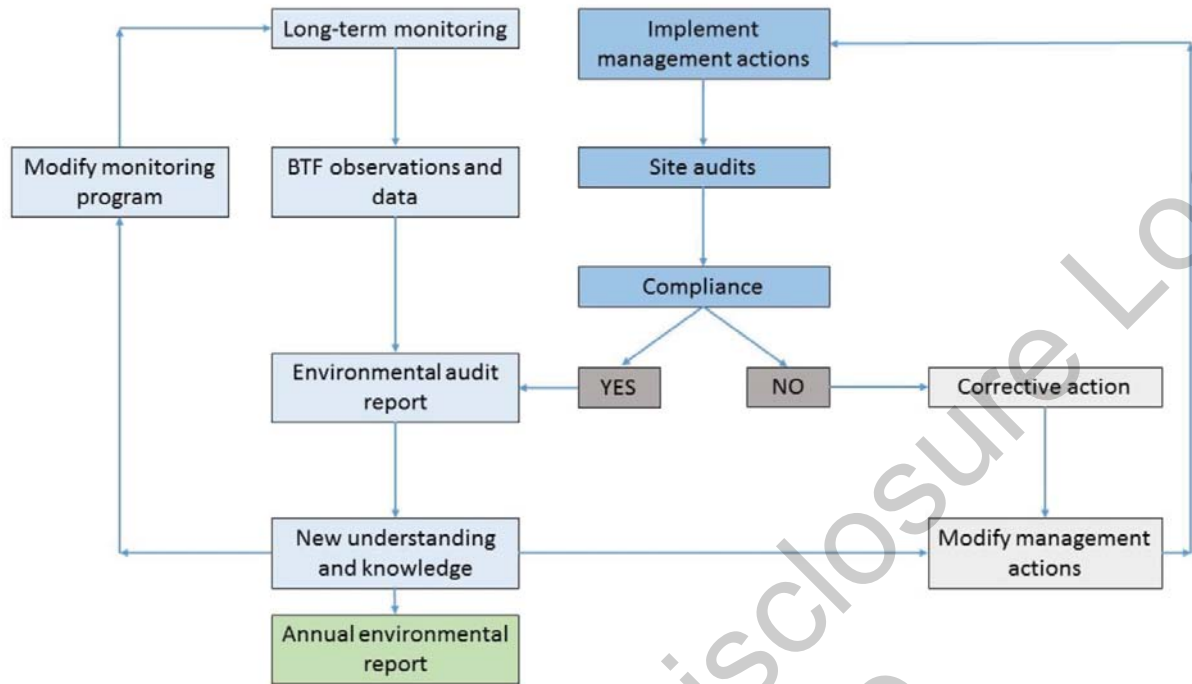


Figure 5 Adaptive management framework

6 Mitigation and Management Measures

The mitigation and management measures are required under EPBC conditions 6d) to f) and EA condition 16e) and have been developed in accordance with relevant guidance documents and best available knowledge regarding BTF ecology and habitat use within the Project Area.

An adaptive management approach will also be implemented where:

1. monitoring identifies that mitigation and management measures are not achieving the performance criteria
2. in response to triggers identified by the monitoring process and from information gathered in the field from the pre-clearance survey and fauna spotter-catchers, and
3. implementation of the BTF Research Program.

Measures intended to mitigate and / or manage the potential impacts to BTF are described in **Section 6.1**. As per EPBC Act approval condition 6j) and EA condition 16k), monitoring will be undertaken by a suitably qualified person (see **Section 9.3** for details), to determine the effectiveness of mitigation measures. This process is referred to as the adaptive management loop. The results of monitoring, and associated assessments of the effectiveness of mitigation measures, will be reported to DoE and DES.

6.1 Mitigation measures

Mitigation measures described are either those specific to BTF or for other ecological values of significance (i.e. TECs and other threatened species) of relevance to the BTF occurring in the Project Area. Generic mitigation measures are included as they provide an important approach to whole of ecosystem protection, which will also enable management of impacts to specific species, such as BTF.

Pre-clearance surveys are a collective mitigation measure proposed across this and other management plans as the surveys will provide information on the composition and area of vegetation and habitat to be disturbed prior to construction works. These surveys provide opportunities for avoidance of further impacts, as well as enabling accurate determination of disturbance areas to ensure these are not greater than approved disturbance limits.

A description of the generic mitigation measures that are applicable to the management of BTF is provided in **Table 7**.

Table 7 Generic mitigation measures to be implemented across the Project Area

Objectives	Actions
Educate site personnel and contractors about the presence and identification of threatened species, and maintain awareness during construction and operations.	Education <ul style="list-style-type: none"> • Induction program for site personnel and contractors about threatened species, their habitats and identification. • Identification posters in prominent work locations to maintain awareness. • Implement sound land management practices.
Reduce the magnitude of disturbance to threatened communities and threatened species within the Project Area where possible.	<ul style="list-style-type: none"> • There will be some discretion in the precise location of some infrastructure. Where possible, such infrastructure will be located in areas which avoid disturbance to threatened species habitat.

Objectives	Actions
Determine the environmental condition, immediately prior to construction activities. Monitor compliance with approval conditions as required by Condition 6g) of EPBC2010/5736.	Undertake pre-clearance surveys <ul style="list-style-type: none"> Conduct surveys of vegetation and threatened species habitat extent and condition, prior to the commencement of any clearing or disturbance activities. Define the area (hectares) of threatened ecological communities and threatened species habitat to be cleared.
Minimise impacts of construction on threatened communities and species.	Use licensed fauna spotter-catchers during vegetation clearing <ul style="list-style-type: none"> Fauna to be recorded and translocated to suitable habitat adjacent to the disturbance area, where practical. Fauna spotter-catchers are qualified professionals trained in competencies to handle animals, minimise capture myopathy and shock in birds and reptiles. Under the <i>Nature Conservation Act 1992</i> (Qld), fauna spotter-catchers hold permits for dispersing, removing and relocating wildlife. Fauna deaths and injuries to be recorded, and managed in accordance with relevant guidelines.
Minimise impacts on threatened communities and species, and their habitat. Promote post-construction recovery of the natural ecosystem.	Rehabilitate all temporarily disturbed areas (e.g. lay down areas and turning circles) <ul style="list-style-type: none"> All temporarily disturbed areas will be rehabilitated as soon as possible following completion of use, where such activity does not compromise the ongoing operation of the project (e.g. increase bushfire risk). The timing of rehabilitation actions after disturbance will be outlined in the Plan of Operations, developed in accordance with the EA. The ongoing program of rehabilitation works will be developed on the basis of environmental objectives, local site conditions and logistical requirements.
No net loss of threatened communities and species. Maintain the integrity of ecological habitats within the region.	Implement environmental offsets (for selected species and ecological communities) <ul style="list-style-type: none"> Offset the habitat values of threatened ecological communities and used by threatened species, within the Project Area by securing ecologically equivalent areas elsewhere. Monitor BTF habitat values through annual groundcover assessments during May to maintain and where possible enhance BTF habitat within the Mining Lease. Maintain BTF habitat values in non-mined areas
Reduce the impact of lighting on threatened species during construction and operation.	Manage light pollution <ul style="list-style-type: none"> Use directional lighting and strategic timing and placement of lights to minimise light spill into known threatened species habitat and TECs.

The results of all mitigation actions will be recorded as specified in approval condition 6g) of EPBC2010/5736. Further details of such reporting are provided in **Section 9**. A register of all commitments arising from the management planning process is provided in **Section 10**.

Tables 8 to 10 summarise the proposed mitigation and management measures specific to BTF which will be implemented during planning, pre-construction, construction, operation and decommissioning phases of the Project that address potential impacts specific to BTF. They include management actions for Ten Mile Bore, and the management of water sources. Within the approved level of disturbance, if there are management practices that can be taken to avoid, or reduce impacts to BTF and their habitat, such practices will be implemented.

6.2 Impact mitigation and management

In accordance with EPBC conditions 6d) to f) and EA condition 16e), measures will be implemented to mitigate and manage impacts to BTF during the Project.

To address the impacts to important BTF habitat in the northern section of the Project Area, Adani altered the mine plan during the EIS process to access coal reserves in this northern section via underground mining, thereby reducing the clearing requirements in this area. Where possible, associated mining infrastructure and disturbances (such as linear infrastructure, spoil and / or stockpiling) have been located in locations where there is no confirmed BTF habitat. In particular, this applies to the northern section of the Project Area where stockpiling and chemical storage will be within and / or adjoining locations where BTF have been recorded.

Mitigation measures associated with clearing will be implemented strategically in accordance with the staging of Project activities (**Section 2.2**). Prior to any clearing commencing, clearing requirements for mine and other infrastructure will be reviewed in order to identify opportunities to reduce clearing of native vegetation and utilise existing cleared areas wherever possible. Spoil and topsoil stockpiling will be avoided in areas where BTF have been recorded or within known or potential habitat, where possible.

Threatened species and vegetation mapping will be consulted prior to planning spoil pile placement to minimise the potential for impacts to BTF habitat. Rehabilitation of BTF habitat will occur in areas that are subject to temporary disturbance, and in areas that are no longer required for mining operations. Offsets are in place for areas of BTF habitat that can't be rehabilitated (see **Section 6.5**). Management activities for areas subject to offsets are described in the OAMP, and include the provision of water supplies to support BTF. At the completion of the Project, parts of the Project Area are likely to be utilised for pastoral activities, providing similar habitat values for BTF that existed prior to the Project commencing, including the provision of water for cattle grazing.

6.3 Impact minimisation measures

In accordance with EPBC conditions 6d) to f) and EA condition 16e), measures will be implemented to minimise impacts to BTF during the Project.

6.3.1 Vegetation clearing protocols

Planning phase – whole-of-project staging

The development of the Project will be a staged process throughout the life of the Project and is expected to result in impacts of up to 9,492 ha of BTF habitat (CO2 2016). In order to mitigate these impacts, the development and clearing will be staged (see [Table 1](#) for different Project stages causing disturbance).

Generally, clearing will commence from the middle of the Project Area which largely consists of non-remnant vegetation that does not provide habitat for BTF, before gradually progressing towards the north and south, respectively. Clearing of important habitat located in the northern third (i.e. between Four Mile Bore and Ten Mile Bore) and the southern quarter (south from Carmichael Bore) of the Project Area, will occur as late as possible during the construction and operational phases. The rationale behind this staged approach is:

- The existing breeding population of BTF within the Project Area will be protected for as long as possible, allowing for ongoing recovery and redistribution of the population;

- Clearing disturbed areas first will allow birds to remain in areas of good habitat rather than be directed into the mid-sections of the Project Area, where habitats are less favourable; and
- Staging will allow time for BTF habitat in the surrounding offset areas to improve such that birds may be attracted to these areas prior to clearing impacts occurring and / or have areas of suitable habitat to move into during construction.

Clearing will be minimised as far as practicable during the wet season, which is the known breeding season for BTF. The wet season is nominally December to March each year, and Adani will use its best endeavours to plan and implement clearing activities to occur outside the breeding season. However, the actual timing of the wet season will be determined on an annual basis depending on local weather conditions.

Management measures to achieve the clearing outcome will be through long term planning process according to the stages of mine plan that will allow these timing restrictions to be adhered to. However, if operational constraints (particularly in the early stages of the mine construction) necessitate clearing during the wet season, additional measures will be required and will be implemented during the pre-construction phase (see below).

Pre-construction phase – stage scale planning for vegetation clearing

A range of measures will be implemented prior to vegetation clearing for each stage, in order to further avoid and / or reduce impacts to BTF. Collectively, these measures are aimed at encouraging birds still present in the clearing zone to leave the area without human intervention.

A clearing plan will be developed for each stage. The development of this plan will require up-to-date information on the habitat quality and utilisation of the area by BTF. This information will be gathered during baseline and pre-clearance surveys, to be undertaken by suitably qualified ecologists, with demonstrated experience in the survey and management of BTF. Additional information gathered during the monitoring and research components of the Project must also be utilised.

The clearing plan for each stage will be developed and must consider/include:

- Mapping depicting disturbed areas, vegetated areas that are not potential BTF habitat, potential BTF habitat, areas where there have been sightings of BTF within the last five years, and areas showing breeding records.
- Structuring works in a way that specifies daily clearing extents within BTF habitats to allow BTF to fly to other habitat areas while habitat is cleared. Currently, it is conservatively assumed that BTF are able to travel at least 0.5 km in one day to escape clearing activities (BTF may travel several km in a day to access water). However these clearing limits will need to be tested as part of the on-going monitoring and adaptive management process.
- Structuring clearing so that wherever possible habitat connectivity can be maintained by providing stepping stones of habitat the BTF can travel through when escaping the clearing front.
- Site plans and maps depicting exclusion zones for vegetation clearance and machinery within areas of BTF habitat. Access to these zones must be restricted in order to prevent any unnecessary damage to BTF habitat.

Prior to the commencement of site works, any conditions listed in the “Permit to Disturb” must be implemented (e.g. clearing extents clearly marked and trees / areas requiring protection clearly marked).

Construction phase – clearing

Vegetation clearing will be undertaken in accordance with the clearing plan for each stage. All BTF habitat clearing operations will be monitored for compliance by suitably qualified fauna spotter-catchers during clearing activities (see below).

6.3.2 Fauna spotter-catcher

The use of fauna spotter-catchers prior to and during all vegetation clearing activities within BTF habitat will be implemented to ensure impacts on BTF are minimised. This role is not specific to the BTF and will be implemented in accordance with the requirements of the overarching Species Management Plan and relevant approvals to protect fauna during clearing activities. The fauna spotter-catcher will instruct contractors on the most appropriate technique for felling habitat trees to minimise harm to undetected fauna and also inspect felled vegetation for fauna and relocate individuals as required.

If clearing is to occur during the wet season (to be avoided where possible), the role of the fauna spotter-catcher with respect to the BTF is to:

- Identify active nests not picked up by the pre-clearance surveys;
- Assess whether breeding places (i.e. nests) contain eggs or young;
- Establish and implement relocation requirements.

The fauna spotter-catcher will utilise expert advice from a BTF specialist to assist in the development of fauna handling/relocation plans to ensure consideration of life-cycle or ecological constraints. In circumstances where avoidance has been assessed but impacts on an isolated nest are unavoidable during the clearing process, with relevant approval from authorities for tampering with the breeding place of a threatened species, the fauna spotter-catcher would be responsible for removing the nest and placing young / eggs into care in captivity.

6.3.3 Summary of mitigation and management measures

The threats to the BTF relevant to the Project and potential project impacts and actions minimising impacts to the BTF are summarised in **Tables 8 to 10**. The tables address the following:

- management objectives
- performance criteria
- management actions
- monitoring
- triggers for adaptive management and corrective actions
- specific, measurable and time-bound corrective actions.

Baseline and impact monitoring measures will be implemented, including control and impact sites to be monitored throughout the life of the Project. Monitoring will provide sufficient data to quantify likely impacts, already approved, resulting from mining operations to set habitat management goals.

When adaptive management and corrective actions are triggered, the first step is to investigate the cause of the trigger. The investigation will be carried out as soon as possible, but within 2 days, after the trigger is identified and will focus on the reasons and causes of the triggers, and identify appropriate corrective actions in a timely way. The investigation will be:

- Carried out in accordance with the Environmental Management System (certified ISO 14001)
- Assessing actual or potential, short and long term impacts
- Determining the root and contributing causes
- Recording details on approved templates
- Identifying appropriate corrective actions, as per the last column in **Tables 8 to 10**. Notification of relevant managing agencies and a revision to the BOS will be proposed if an increased impact cannot be avoided.

Table 8 Management objectives, performance criteria, adaptive management triggers and corrective actions – Vegetation clearing / habitat loss, including fragmentation of key habitat areas

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
Minimise habitat loss	No unnecessary clearing	<p>No-go zones for vegetation clearance and machinery will be developed for areas of BTF habitat outside of the clearing footprint and will be depicted on site plans and maps to restrict access and prevent unapproved clearing.</p> <p>Prior to the commencement of site works, any conditions listed in the "Permit to Disturb" must be implemented (e.g. clearing extents clearly marked, trees/areas requiring protection clearly marked).</p>	<p>Regular site inspections in accordance with the Environmental Management Plan and System.</p> <p>Close out report for the Permit to Disturb process includes check for compliance with:</p> <ul style="list-style-type: none"> clearing only in the approved footprint no clearing in the no-go zone/s. 	<p>Clearing in BTF habitat:</p> <ul style="list-style-type: none"> outside approved clearing footprint in no-go zone/s without a "Permit to Disturb" issued 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> When clearing outside approved clearing footprint, no go zones or without a "Permit to Disturb Permit" issued, <ul style="list-style-type: none"> Environment Manager ensure that all clearing activities cease immediately Area assessed by a suitably qualified ecologist/person within 15 business days of investigation Reviewing and modifying "Permit to Disturb" process and no-go zone identification and communication protocols <u>Rehabilitation of the impacted area.</u>
	Clearing of BTF habitat does not exceed 9,492 ha as approved in EIS and referral documentation	<p>Prior to the commencement of site works, any conditions listed in the "Permit to Disturb" must be implemented (e.g. clearing extents clearly marked, trees/areas requiring protection clearly marked).</p>	<p>Monitoring of vegetation proposed to be cleared by the Environmental Manager, via the Permit to Disturb process.</p> <p>Ongoing monitoring and reporting on the amount of BTF habitat that is cleared annually, and predicted to be cleared.</p>	<p>Reach 75% of the clearing BTF habitat approved area for stage 1</p>	<p>The trigger of reaching 75% of clearing BTF habitat does not require correction as the clearing is approved to be carried out, however the following actions will be triggered:</p> <ul style="list-style-type: none"> Contact with nominated representatives from compliance teams of DoE and DES under the EPBC and Environmental Protection Acts when clearing reaches 75% of approved area for stage 1 Provision of maps and data showing clearing in approved impact areas, and calculations showing quantity of approved clearing Provide advice demonstrating how the clearing will not exceed approved limits. <p>If the assessment finds that the actual area of impact differs from the area of impact as detailed in the BOS, within 30 days of this determination the BOS will be revised and submitted to the Department. If an increased offset is required by the revised BOS, this will be delivered within 12 months of the revised BOS being submitted to the Department.</p>

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
	Minimise habitat fragmentation	<p>The area of direct impact has been minimised as far as possible throughout the design and development of the mine plan. In 2012, the relocation of the out of pit stockpiles was reduced by approximately 7,000 ha. This change to the mine plan resulted in approximately 40 percent reduction in the potential area of direct impact.</p> <p>Where practical, spoil and / or stockpiling will be preferentially located in areas of previously disturbed environment or areas of future disturbance, rather than within BTF habitat. The assessment of practicality will consider issues such as the proximity and accessibility of alternative areas, safety of personnel and logistical requirements of transporting spoil.</p> <p>Manage non-mined and offset areas to maintain and improve BTF habitat values. This work will be guided by results from annual vegetation assessments, annual BTF surveys and the BTF Research Program. Ensure the pre-disturbance condition of BTF habitat adjacent to the development is maintained</p>	<p>Monitoring of vegetation proposed to be cleared by the Environmental Manager, via the Permit to Disturb process.</p> <p>Annual vegetation assessments, annual BTF surveys and the BTF Research Program.</p>	Direct impacts occur outside of approved impact areas particularly in non-mined areas.	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Impacts assessed by a suitably qualified ecologist/person within 15 business days of investigation Reviewing and modifying "Permit to Disturb" process and no-go zone identification and communication protocols Review of activities with respect to potential direct and indirect impacts outside of approved areas. Rehabilitation of the impacted area. <p>If the assessment finds that the actual area of impact differs from the area of impact as detailed in the BOS, within 30 days of this determination the BOS will be revised and submitted to the Department. If an increased offset is required by the revised BOS, this will be delivered within 12 months of the revised BOS being submitted to the Department.</p>
	Minimise the impacts of habitat alteration through subsidence	<p>Ameliorate impacts of ponding and cracking in subsidence areas to mitigate any negative impacts on BTF habitat values, in accordance with the Subsidence Management Plan.</p> <p><u>Subsidence is not predicted to potentially impact BTF habitat values until year 20 of mining operations.</u> <u>This plan will be updated with additional detail about control and impact sites to be monitored throughout the life of the Project, when the Subsidence Management Plan has been updated.</u></p> <p>Establish exclusion zones and remove cattle from underground mining footprint, when subsidence is predicted. Construct fences outside subsidence footprint to keep cattle from the subsided area.</p>	<p>Develop a numerical model based on the geological data to refine predicted cracking and subsidence impacts. Modelling to inform detailed monitoring methodologies.</p> <p>Use of baseline habitat quality for comparison during monitoring, including control monitoring points.</p> <p>Conduct annual monitoring of the condition of BTF habitat in subsidence areas, using methodologies identified in the Subsidence Management Plan.</p>	<p>Impacts to BTF habitat, including ponding and cracking, found in subsidence areas.</p> <p>Weeds found in subsidence cracking and ponding areas.</p>	<p>The appropriate corrective actions will commence within 2 days of identification of cause and may include:</p> <ul style="list-style-type: none"> Reviewing and redesigning the monitoring program, increasing monitoring events, changing monitoring methodology Rectifying impacts (e.g. pumping out ponds) Re designing and implementing and water diversions Actively control weeds to maintain and enhance BTF habitat values in the cracking and ponding areas.

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
Minimise fauna death during vegetation clearing	BTF living near the clearance zone have time to move out of the areas of disturbance without human intervention	<p>Stages will be structured in a way that limits clearing extents to allow BTF to fly to other habitat areas when habitat is cleared.</p> <p>Clearing limits are untested and will be developed based on the likely ability of the BTF to travel a conservative minimum of 0.5 km in one day to escape clearing impacts to where suitable habitat is present in adjoining areas to be retained.</p> <p>Where possible, the overall direction of sequential vegetation clearance will be away from threatening processes (i.e. mining operations/roads cleared land) to direct fauna towards areas of retained native vegetation.</p> <p>The general progress of clearance will be towards habitat to be retained in the north and/or west of the Project Area for areas north of the Carmichael River and towards habitat to be retained in the south and/or west of the Project Area for areas south of the Carmichael River.</p>	<p>Record the areas of occupancy for all BTF prior to clearing activities that occur within the Project Area, adjacent to Project Area and areas for suitable BTF habitat rehabilitation.</p> <p>Confirm and identify the spatial extent and condition of BTF habitat to be disturbed prior to any clearing or disturbance commencing, through pre-clearance surveys. BTF surveys will focus on confirming species presence throughout the Project Area, identifying species presence in proximity, but outside (adjacent to) Project Area and identifying areas of potential rehabilitation for BTF habitat values inside the Project Area, but outside the disturbance footprint.</p> <p>Record observed BTF fatality, including suspected nests / eggs of BTF.</p>	<ul style="list-style-type: none"> Insufficient adjacent habitat within 500m from clearance areas to allow refuge from impacts. Fauna spotter-catchers and monitoring results indicating that BTF are not able to move away from cleared areas in sufficient time. BTF death or injury during vegetation clearing. 	<p>The appropriate corrective actions will commence within 2 days of identification of cause and may include:</p> <ul style="list-style-type: none"> Redesign of activities associated with observed mortality to avoid causal and contributing factors Re-planning / adjusting clearing progression timeframes and locations with respect to refuge availability Third party review by suitably qualified ecologist/person of management and monitoring actions to provide input on effectiveness Modifying the strategic grazing regime, or fire management measures, to better support enhancement of values Divert clearing to other habitat to provide time for BTF to adjust Re-evaluate the suitability of the relevant management and monitoring actions in this plan The installation and maintenance of additional artificial watering points for the black-throated finch.
	No injury or death to BTF individuals, nests or their young during vegetation clearing	<p>Pre-clearance surveys will be conducted by a suitably qualified ecologist throughout BTF habitat prior to the commencement of each stage of clearing to identify and map significant areas for the BTF.</p> <p>Where active nests or other sensitive habitat areas are identified during the pre-clearing</p>	<p>Confirm and identify the spatial extent and condition of BTF habitat to be disturbed prior to any clearing or disturbance commencing, through pre-clearance surveys.</p> <p>BTF surveys will focus on confirming species presence throughout the Project Area, identifying species presence in</p>	<ul style="list-style-type: none"> Vegetation clearance undertaken without a pre-clearance survey. Clearance of vegetation does not follow vegetation clearance protocols with no progressive clearing plan developed prior to each stage of clearing. 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Depending on the extent of any injuries, injured BTFs will either immediately be taken to the nearest qualified veterinary practitioner or wildlife carer, or humanely euthanized on site by an authorised and trained person Rectifying impacts of vegetation loss Review and re design to avoid reoccurrence and address actual cause

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
		<p>surveys specific actions will be implemented to address these areas.</p> <p>Suitably qualified and experienced fauna spotter-catchers will be present during vegetation clearance works within areas of BTF habitat and remnant vegetation.</p> <p>No tampering with BTF breeding places is to occur without the relevant approvals / permits. Any removal of nests will be required to be undertaken in accordance with the requirements of approvals.</p> <p>BTF deaths and injuries will be recorded, and managed in accordance with relevant guidelines.</p> <p>Record the areas of occupancy for all BTF prior to clearing activities that occur within the Project Area, adjacent to Project Area and areas suitable for BTF habitat rehabilitation.</p>	<p>proximity, but outside (adjacent to) Project Area and identifying areas of potential rehabilitation for BTF habitat values inside the Project Area, but outside the disturbance footprint.</p> <p>After BTF habitat clearing, a search for remaining BTF will be conducted as soon as practicable.</p>	<ul style="list-style-type: none"> BTF death or injury during vegetation clearing Vegetation clearance undertaken without a qualified fauna spotter-catcher present during BTF habitat clearing 	<ul style="list-style-type: none"> Communication with personnel involved and across all site team members (for example, via toolbox meetings) Incidents will be reported to DES and DoE within 24 hours by the Environmental Manager as per Species Management Program conditions.
	No entangled BTFs	No mine-related equipment or infrastructure with the potential to entangle fauna (e.g. bundled mesh fencing) will be left in sensitive areas such as near water bodies or potential BTF foraging areas.	Regular site inspections in accordance with the Environmental Management Plan and System.	<p>Notification of BTF found entangled.</p> <p>BTF death or injury</p>	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Depending on the extent of any injuries, injured BTFs will be either taken to the nearest qualified veterinary practitioner or wildlife carer, or humanely euthanized on site by an authorised and trained person Reviewing procedures and fencing protocols Actions to avoid entanglement re occurrence Incidents will be reported to DES and DoE within 24 hours by the Environmental Manager as per Species Management Program conditions.

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
	Areas for BTF to relocate to <u>are remain available and in suitable condition concurrent with proposed during clearing activities</u>	<p>Ensure the pre-disturbance condition of BTF habitat <u>in non-mined areas and</u> adjacent to the development is maintained and condition of Offset Areas is being improved as per the OAMP.</p> <p>Offset Area condition adjacent to the mining leases is being improved as per the OAMP.</p>	<p><u>Habitat quality in non-mined BTF habitat will be monitored, including recording areas suitable for occupancy by BTF prior to clearing activity areas.</u></p> <p><u>The spatial extent and condition of BTF habitat to be disturbed will be confirmed and identified prior to any clearing or disturbance commencing, through pre-clearance surveys. BTF surveys will focus on confirming species presence throughout the Project Area, identifying species presence in proximity, but outside (adjacent to) Project Area and identifying areas of potential rehabilitation for BTF habitat values inside the Project Area, but outside the disturbance footprint.</u></p> <p>Deliver the Moray Downs West Offset Area Management Plan, as approved.</p> <p>The monitoring methods included in the <i>Moray Downs West Offset Area Management Plan</i> for the offset area are as follows:</p> <ul style="list-style-type: none"> method for determining monitoring locations is to apply the Guide to Determining Terrestrial Habitat Quality to calculate habitat quality scores For the species stocking rate component, the monitoring method for BTF as outlined in this plan For sites being monitored under the BTFMP within the offset area, use survey results to inform the habitat quality scoring under the OAMP (rather than duplicating survey effort at these sites). 	<p>At 12 months after commencement of specified component of the action, no progress in legally securing an offset area. <u>Prior to clearing commencing, the quality of BTF habitat to which BTF displaced by clearing could be expected to relocate, is not suitable for BTF to relocate to.</u></p>	<p><u>The appropriate corrective actions will be implemented and may include:</u></p> <ul style="list-style-type: none"> <u>Delay clearing until sufficient suitable habitat is available</u> <u>Review and redesign the monitoring and/or management program, increasing monitoring events, changing monitoring/management methodology</u> <u>Review and redesign the clearing program</u> <u>Assessment of the quality of BTF habitat in areas adjacent to proposed clearing (in mine site and offset areas) by a suitably qualified ecologist/person within 15 business days</u> <u>Review of activities with respect to potential direct and indirect impacts.</u> <p>Submission of application for alternative legal security with the Queensland and Commonwealth Governments, within the 12 months of trigger.</p>
Progressive habitat restoration of disturbed areas	All temporarily disturbed areas rehabilitated within 12 months of activity	<p>The time between clearing BTF habitat, and the next construction activity will be as short as possible. However, the time between BTF habitat clearing and next activities will be a maximum of 12 months.</p> <p>All temporarily disturbed areas will be rehabilitated as soon as possible following completion of use, where such activity does not compromise the ongoing operation of the project (e.g. increase bushfire risk).</p>	<p>Regular site inspections in accordance with the Environmental Management Plan and System.</p> <p>Measure the effectiveness of mitigation measures involving rehabilitation. Compare to relevant control sites or benchmarks for RE.</p> <p>Identify areas where rehabilitation effectiveness needs to be improved to achieve environmental objectives.</p> <p>Targeted searches during monitoring events for rehabilitation areas.</p>	<p>Cleared BTF habitat area exposed for 11 months.</p> <p>Temporary disturbance areas that are no longer required not rehabilitated, leading to excessive dust or other environmental nuisance or disturbance triggers.</p>	<p>When cleared BTF habitat area exposed for 11 months, rehabilitation of the impacted area.</p> <p>The appropriate corrective actions for disturbance triggers, will be in accordance with the Environmental Management System, implemented and may include:</p> <ul style="list-style-type: none"> Review of process for temporary disturbance and monitoring to improve response time Rehabilitation activities to be undertaken in areas of temporary disturbance.

Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
	Rehabilitation of disturbed areas that are no longer required for operations	Progressive rehabilitation of disturbed areas will commence as soon as possible and generally within 6 months of the completion of operations activities in each area, in accordance with the Rehabilitation Management Plan. Rehabilitation will only commence later than 6 months if there will be benefits in coinciding commencement with the wet season. Rehabilitated areas must include food and water resources, and open foraging areas.	Monitoring surveys will be conducted biannually for a 10 year period by suitably qualified ecologists in accordance with standard methodology to identify changes in BTF population size and movements over time. Banding and re-sighting techniques will provide a basis for assessing movement patterns and assessment of population dynamics. Targeted searches for BTFs in each rehabilitated area. Monitoring measures as shown on previous page (same row of table)	Annual rehabilitation monitoring report determines rehabilitated areas do not achieve outcomes as specified in Environmental Authority conditions. Disturbance areas that are no longer required not rehabilitated, leading to excessive dust or other environmental nuisance or disturbance triggers. (See also Triggers for Performance Criterion for "All temporarily disturbed areas rehabilitated within 12 months of activity")	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Delivering recommendations by a suitably qualified ecologist/expert for the reason for rehabilitation not achieving outcomes Review of weather conditions / seasons and timing of rehabilitation activities Trials of new rehabilitation methods.
	Disturbed habitat is restored or enhanced as soon as practicable (See also Performance Criterion "All temporarily disturbed areas rehabilitated within 12 months of activity")	Management of habitat within the Project and offset areas will occur concurrently. The management will increase the carrying capacity of the adjoining habitat and provide refuge to BTF no longer able to utilise cleared areas. Rehabilitated areas must include food and water resources, and open foraging areas. A combination of short-term fast acting habitat modification activities (such as shrub layer reductions and grass layer improvements) to improve habitat qualities for BTF foraging, and longer-term activities such as weed management replanting programs to rehabilitate heavily disturbed areas over time.			The appropriate corrective actions in accordance with the Environmental Management System will be implemented and may include: <ul style="list-style-type: none"> Review of process for temporary disturbance and monitoring to improve response time Rehabilitation activities to be undertaken in areas of temporary disturbance.
Improve awareness of site personnel	All site personnel aware of management requirements with respect to BTF	Incorporate information regarding BTF (such as map of habitat areas within the Project Area) and BTF management requirements into site inductions, toolboxes and pre-starts, particularly where working in or around BTF habitat. Identification posters for all threatened species with the potential to occur in the Project Area will be displayed in prominent positions.	Records kept as a part of the Environmental Management System of inductions, training and toolbox meetings to ensure site personnel receive the appropriate environmental training.	Environmental harm to BTF or their habitat as a result of site personnel activities.	The appropriate corrective actions in accordance with the Environmental Management System will be implemented and may include: <ul style="list-style-type: none"> Depending on the extent of any injuries, injured BTFs will be either taken to the nearest qualified veterinary practitioner or wildlife carer, or humanely euthanized on site by an authorised and trained person Rectifying impacts of vegetation loss Review of induction information and implementation processes to ensure BTF management requirements are addressed and distributed to all site team members Additional educational awareness training for site personnel Incidents will be reported to DES and DoE within 24 hours by the Environmental Manager as per Species Management Program conditions.

Table 9 Management objectives, performance criteria, adaptive management triggers and corrective actions – Potential indirect project impacts

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
3	Increased exotic pasture and weed invasion of key habitat areas	Reduce weed competition	<p>No introduction of pest plants, invasive understorey species into BTF habitat.</p> <p>No significant increase in the abundance of weeds across the Project Area and into / from adjacent habitat.</p>	<p>Weed control will focus on managing declared pest plants and invasive species during construction and operations, in accordance with the project pest management plan.</p> <p>Weed hygiene controls, including the use of weed wash down stations, will be implemented in accordance with the project pest management plan to prevent the introduction and spread of declared pest plants and other invasive weeds.</p> <p>Weed free areas within sensitive BTF habitat will be identified and mapped with strict weed control requirements for entering weed free areas.</p> <p>The establishment of new tracks through BTF habitat outside of the clearing areas will be minimised to prevent transport of weed seeds into BTF management areas.</p> <p>Provide weed wash-down stations at all Project Area entry and exit points, and tracks through known weed-infested areas.</p> <p>Enforce the use of weed wash-down stations at all times.</p> <p>Adaptive management of weed controls to minimise threats to BTF and their habitat.</p>	<p>Monitoring of weeds will be conducted yearly (including photo monitoring) or as per the project pest management plan. Monitoring will be for pest plants in BTF habitat in, and adjacent to, the Project Area (consistent with the OAMP).</p> <p>Monitoring will occur at the optimal time for detecting and identifying pest plant species.</p> <p>Monitoring will include for the presence of declared weeds, and abundance of environmental weeds.</p>	<ul style="list-style-type: none"> • Introduction or establishment of declared pest plants, and invasive species into previously unaffected areas. • Results of weed monitoring indicate a degradation of BTF habitat values, due to a proliferation of weeds. • A significant increase in the abundance of weeds, or pests or identification of new infestations. • Infestation of new weed species. 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> • Eliminate potential sources or reasons that may have attributed to an increase in species richness and/or relative abundance of weeds • Amending weed hygiene restrictions • Providing additional educational awareness training for site personnel to ensure weed hygiene restrictions are adhered to • Revising weed control methods in accordance with the <i>Biosecurity Act 2014</i> • Take action to protect and restore BTF habitat values through implementation of site-specific measures such as weed control, fire management or grazing • Actively manage weeds to maintain and enhance BTF habitat values • Increasing the frequency and intensity of weed controls • Updating weed control methods in targeted weed control programs and plans.

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
4	Grazing of key habitat areas that changes the ground cover composition	Strategic use of grazing to manipulate the grass layer and manage fire by reducing fuel loads and therefore fire intensity. Do not allow grazing itself to become a threat.	Grass load is managed to reduce fire risk in accordance with controlled grazing methods. Grazing does not become an impact to grass layers and grass composition	The management of grazing within non-mined areas will be based on existing pastoral management practices under land agistment agreements, pastoral holding lease conditions and associated legislation. Management actions will seek to maintain and where possible enhance BTF habitats and populations (e.g. pest control, water source, grazing and fire management) in unmined parts of the Mine Area, as well as in offset areas.	Native perennial ground cover and ground composition assessed annually against the baseline data Monitor the condition of BTF habitat adjacent to the development and the Offsets Area. This will be undertaken using standard BioCondition monitoring surveys (see Eyre <i>et al.</i> 2011 for details) and species habitat index. The quality of known BTF water sources will be monitored. Annual BTF habitat vegetation assessments will occur during May within 2 ha plots at the following locations: CHAB02, CHAB03, CHAB22, CHAB23, CHAB24, CHAB25, CHAB37, CHAB45, CHAB47, CHAB48, CHAB52 (Open cut disturbance areas) and CHAB01, CHAB04, CHAB05, CHAB09, CHAB10, HAB44 and CHAB46 (Underground disturbance areas). Vegetation assessments will use methodologies described within baseline 'Report for Black Throated Finch On-site Monitoring Survey' dated 12 July 2013 to assess ground cover and ground composition based on Queensland BioCondition Framework (Eyre <i>et al.</i> 2011) and the Queensland Herbarium flora survey methods (Neldner <i>et al.</i> 2005).	<ul style="list-style-type: none"> Annual vegetation assessment demonstrates a loss of native perennial species and / or cover from baseline conditions A significant increase in the abundance of non-native species such as Buffel Grass Incidence of uncontrolled bushfire 	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Additional fencing Spelling of paddocks to control grazing Additional controlled grazing to reduce biomass levels Additional pest controls Further fire management.

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
					<p>Moray Downs West Offset Area The monitoring methods included in the <i>Moray Downs West Offset Area Management Plan</i> for the offset area are as follows:</p> <ul style="list-style-type: none"> method for determining monitoring locations is to apply the Guide to Determining Terrestrial Habitat Quality to calculate habitat quality scores For the species stocking rate component, the monitoring method for BTF as outlined in this plan For sites being monitored under the BTFMP within the offset area, use survey results to inform the habitat quality scoring under the OAMP (rather than duplicating survey effort at these sites) <p>Further monitoring methods for BTF in the offset area are consistent with this plan, such as:</p> <ul style="list-style-type: none"> water source watches active searches incidental observations remote cameras vegetation condition assessments foraging plot assessments. 		

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
5	Wildfire or inappropriate fire management of key habitat areas that changes ground cover composition	Maintain a mosaic of fire history in BTF habitat. Reduce the risk of bushfire spread	No uncontrolled fires (bushfires) in the Project Area. Fire management is conducted in accordance with the Bushfire Fire Management Plan	Where possible, planned burns within BTF habitat will be undertaken outside of the BTF breeding season. This will depend on seasonal conditions from year to year. The fire regime will be managed to utilise a patchwork of areas of different fire frequencies and times but biased toward low intensity fires. This regime would also help to reduce the risk of widespread hot fires by reducing fuel loading at the landscape scale. Higher intensity fires can be used strategically to reduce dense stands of <i>Acacia</i> spp., which may affect BTF foraging habitat. Two fires, approximately 2-3 years apart, could reduce the abundance of these species but it would be important to then allow several years for recovery of the community. The existing network of roads and tracks will be used to manage fire, rather than establishing additional firebreaks. This will help reduce the risk of weed incursion through movement of traffic into intact grasslands. Avoid the planning of scheduled burns in BTF habitat during the wet season where possible. Any planned burns during the breeding season that cannot be avoided will be carefully managed with respect to location relative to water sources and preferred breeding areas so as to seek opportunity to exclude these areas.	Monitoring of fuel load levels and native perennial ground cover and ground composition will be assessed at least annually against the baseline data. Additional monitoring actions as per the Bushfire Fire Management Plan .	<ul style="list-style-type: none"> Unplanned burn during the breeding season. Dense shrub layers forming in BTF habitat due to fire promoted germination. Incidence of uncontrolled bushfire 	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Review of fire regime based on monitoring results and aim to achieve appropriate balance of groundcover/shrub layer management without degrading foraging habitat Increasing the frequency of biomass monitoring Amending the strategic grazing regime Reviewing effectiveness of firebreaks, and establishment of additional fire breaks Modifying the timing and/or intensity of controlled burns.

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
		Reduce the risk of bushfire ignition	No bushfires sparked by project activities.	<p>Prior to site entry, all relevant site personnel, including contractors, will be made aware of fire safety and risks, including compliance with the Fire Management Plan.</p> <p>Bushfire mitigation measures will be specified in the Bushfire-Fire Management Plan and will include but not be limited to:</p> <ul style="list-style-type: none"> Monitoring of weather conditions to identify high fire risk days, with controls upgraded on these days Restrictions on vehicles being left idling with the exhaust in contact with dry grass Designation of smoking areas Development of bushfire fuel management practices in the Project Area Minimise the residency time of accumulated coal around coal handling facilities to reduce the risk of spontaneous combustion Ensure all crews are equipped to deal with fires. This includes both fire-fighting equipment and training Monitor pasture biomass at the beginning of the wet season Work sites will be provided with adequate fire-fighting equipment (water cart) and training implement actions to prevent and suppress the spread of fire, should bushfire be ignited. 	<p>Monitoring of fuel load levels and native perennial ground cover and ground composition will be assessed at least annually against the baseline data.</p> <p>Additional monitoring actions as per the Fire Management Plan.</p>	<ul style="list-style-type: none"> Bushfire sparked by project activities. 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Mitigate the established source, arising from the investigation, as to why and how the bushfire was sparked by project activities Review existing Bushfire-Fire Management Plan, ensuring consideration of ecological values and Rural Fire Service recommendations Greater monitoring of adherence to fire management measures Amending the strategic grazing regime Modifying the timing and/or intensity of controlled burns Re-training of site team members Delayed additional BTF habitat clearing Assess the benefits of strategic burning prior to the storm season to address pasture biomass that is unfavourable to BTF.
6	Feral animal impacts	<p>Reduce habitat degradation from grazing by introduced herbivores</p> <p>Minimise predation risk by invasive mammals</p> <p>Adaptive management of weed and pest controls to minimise threats to BTF and their habitat.</p>	<p>No measured increase in rabbit, goat, fox and / or cat numbers in the Project Area.</p>	<p>Adaptive management of pest controls to minimise threats to BTF and their habitat.</p> <p>A project pest management plan will be developed and implemented prior to construction and operations, including measures for controlling rabbits, goats, foxes, cats and weeds. The project pest management plan will be developed in conjunction with neighbouring land owners, and will focus on tracks, waterways and habitat edges.</p> <p>Feral cat control outlined in the project pest management plan will focus on areas where BTF will be exposed and vulnerable to predation including on the interface of the clearing front and remnant vegetation and at water sources where BTF are vulnerable to attack while drinking.</p>	<p>Monitor the presence and population abundance of invasive fauna will be yearly as per the project pest management plan.</p>	<ul style="list-style-type: none"> Significant increase in the population of any invasive predator species from baseline scores. Observed (or evidence of) predation of BTF by pest species Observed habitat degradation attributed to threatening pest species 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Increasing the frequency and intensity of pest animal control. Revising methods of pest animal control in accordance with Queensland Department of Agriculture and Fisheries (DAF) guidelines, and coordinate with neighbouring land owners to ensure a consistent approach Reviewing actions and methods included in the project pest management plan Updating pest animal control methods in targeted pest animal control programs Increase feral herbivore management efforts, in conjunction with neighbouring land owners Increase invasive predator management efforts, in conjunction with neighbouring land owners.

#	Potential indirect project impact	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
				Feral cat control, as specified in the project pest management plan will focus on areas where BTF will be exposed and vulnerable to predation including on the interface of the clearing front and remnant vegetation and at water sources where BTF are vulnerable to attack while drinking.		>Significant increase in the population of any invasive predator species from baseline scores.	
				Domestic animals will not be permitted into the Project Area, except for cattle and, when required for mustering, horses and dogs.	Regular site inspections in accordance with the Environmental Management Plan and System.	Domestic animals not permitted are observed in the Project Area	<p>The appropriate corrective actions in accordance with the Environmental Management System will be implemented and may include:</p> <ul style="list-style-type: none"> Rectifying impacts Communication with personnel involved and across all site team members (for example, via toolbox meetings) Review the project pest management plan.

Table 10 Management objectives, performance criteria, adaptive management triggers and corrective actions – Matters required to be addressed under EPBC Approval, condition 6

#	Matters under EPBC Approval, condition 6	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
7	Loss or degradation of water sources	<p>Ensure water quality in known BTF water sources outside disturbance footprint remain within acceptable limits.</p> <p>Reduce degradation of suitable water sources</p>	<p>Emissions (i.e. dust, coal and heavy metals) do not degrade water source quality in BTF habitat.</p> <p>Water sources not disturbed by other processes, such as overuse by cattle</p>	<p>Project impacts like, dust and cattle access will be minimised by the implementation of the Environment Management Plan, using standard procedures typical of large infrastructure projects.</p> <p>Maintain the required condition of water sources.</p> <p>Erosion and sediment control measures will be implemented where required, to reduce the potential for contamination of water sources prior to commencement of construction activities.</p>	<p>Annual monitoring, including photo monitoring, of water source availability, in the driest season</p> <p>Water and sediment samples will be collected in areas with the potential to be impacted by mining activities to test for the presence of heavy metals and chemical contaminants (annually during the dry season).</p>	<p>Physical evidence of dust degradation to water sources outside active mining areas.</p> <p>Water and sediment samples of water quality do not meet guideline triggers.</p>	<p>The appropriate corrective actions in accordance with the Environmental Management System will be implemented and may include:</p> <ul style="list-style-type: none"> • More frequent chemistry testing to confirm water quality against relevant standards, in the event that visual inspection of dust impacts fails • Review and re design to avoid reoccurrence and address actual cause • Review adherence to control procedures to ensure compliance • Take remedial action where compliance has not been adhered to • Communication with personnel involved and across all site team members (for example, via toolbox meetings) • Reporting to DES as per statutory and project requirements where incidents trigger reporting thresholds.
		<p>Protection of environmental values within waterways of the receiving environment.</p> <p>Minimise siltation of water resources</p>	<p>No contamination of surface waters by effluent outside the active Mining Areas</p> <p>No degradation by siltation of permanent water sources.</p>	<p>Sewage waste for the operation workforce will be treated in a package treatment plant to a Class A standard. All effluent will be recycled onsite for reuse or controlled discharge.</p> <p>Vegetation clearing near, or within ephemeral waterways will be avoided when rain is falling, or imminent.</p> <p>Management of erosion and sedimentation will be undertaken in accordance with a Project Erosion and Sediment Management Plan. This plan will identify all practices to be implemented prior to, during, and post-construction to minimise the potential for erosion to occur, including (but not limited to) timing of clearing activities, sediment and erosion control measures to be implemented, performance criteria and corrective actions.</p> <p>Implement dust control measures.</p> <p>Erosion and sediment control measures will be implemented where required, to reduce the potential for contamination of water sources prior to commencement of construction activities.</p>	<p>Monitor the efficacy of erosion control measures (at least monthly), such that measures can be constantly improved throughout life of Mine.</p> <p>Water and sediment samples will be collected in areas with the potential to be impacted by mining activities to test for the presence of heavy metals and chemical contaminants (annually during the dry season).</p>	<p>Monitoring results record exceedance and contamination of surface water.</p>	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> • Review and re design to avoid reoccurrence and address actual cause • Review adherence to control procedures to ensure compliance • Take remedial action where compliance has not been adhered to • Communication with personnel involved and across all site team members (for example, via toolbox meetings) • Reporting to DES as per statutory and project requirements where incidents trigger reporting thresholds.

#	Matters under EPBC Approval, condition 6	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
		Maintain access to water	No net loss of suitable permanent water sources.	<p>Permanent water sources in retained suitable BTF habitat in the Project Area will not be drained or lost as a result of drought unless suitable alternative water supplies (such as permanent water with gently sloping, bare ground at the edge) are available within suitable habitat within 3 km, or connected habitat outside of the ML. This includes permanent water sources in waterways and dams.</p> <p>Maintain water troughs for BTF within undisturbed areas and surface areas of underground mining footprint and repair where necessary troughs, pipes and tanks to a standard that maintains a constant source of water.</p> <p>Known water sources will be avoided, or alternative water sources established outside the disturbance footprint, if avoidance is not possible.</p>	<p>Weekly inspections of water infrastructure at Ten Mile Bore, to maintain ensure suitable water supply available to BTF.</p> <p>Monitoring of water levels and availability across all water sources (fortnightly inspections at all sites other than Ten Mile Bore).</p>	Draining of suitable permanent water source in retained BTF habitat, without an offset water source provided.	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Review and re design to avoid reoccurrence and address actual cause Review adherence to control procedures to ensure compliance Undertake chemical testing of any water source that fails a visual inspection or increased monitoring events Take remedial action where compliance has not been adhered to; including repairs where necessary troughs, pipes and tanks to a standard that maintains a constant source of water Implement remedial actions to provide supplementary water sources, where possible.
		Reduce the risk of contamination of BTF habitat by chemicals, fuel, heavy metals etc.	No pollution of BTF habitat by contaminants (e.g. chemicals, fuel etc.).	<p>Any sites used for chemical and fuel storage will be located a safe distance away from BTF habitat, with bunding or other raised barrier, resistant to normal flood events, between chemicals and habitat.</p> <p>All vehicles and machinery will be cleaned and maintained to minimise the introduction of contaminants such as oil and fuel.</p>	<p>Design and implement a monitoring program, in accordance with the Water Management Plan. The monitoring program will target key areas with low flow, and water sources of known BTF locations.</p> <p>Water and sediment samples will be collected in areas with the potential to be impacted by mining activities to test for the presence of heavy metals and chemical contaminants (annually during the dry season).</p> <p>Erosion and sediment control measures will be implemented where required, to reduce the potential for contamination of water sources prior to commencement of construction activities.</p>	Pollution of BTF habitat by contaminants.	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Minimising and rectifying impacts Training and / or communication with personnel involved and across all site team members Reporting to DES as per statutory and project requirements where incidents trigger reporting thresholds.

#	Matters under EPBC Approval, condition 6	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
8	Mine dewatering	Manage the impacts of mine dewatering	Permanent water sources in retained suitable BTF habitat in the Project Area not drained or lost as a result of changes in hydrology, unless suitable alternative water supplies (such as permanent water with gently sloping, bare ground at the edge) are available within suitable habitat within 3 km, or connected habitat outside of the MLA. This includes permanent water sources in waterways and dams.	<p>Maintain water troughs for BTF within undisturbed areas and surface areas of underground mining footprint and repair where necessary troughs, pipes and tanks to a standard that maintains a constant source of water.</p> <p>Known water sources will be avoided, or alternative water sources established outside the disturbance footprint, if avoidance is not possible.</p> <p>Erosion and sediment control measures will be implemented where required, to reduce the potential for contamination of water sources prior to commencement of construction activities.</p>	<p>Design and implement a monitoring program, in accordance with the Water Management Plan. The monitoring program will target key areas with low flow, and water sources of known BTF locations.</p> <p>Water and sediment samples will be collected in areas with the potential to be impacted by mining activities to test for the presence of heavy metals and chemical contaminants (annually during the dry season).</p>	Draining of suitable permanent water source in retained BTF habitat, without an offset water source provided.	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Review and re design to avoid reoccurrence and address actual cause Review adherence to control procedures to ensure compliance Undertake chemical testing of any water source that fails a visual inspection or increased monitoring events Take remedial action where compliance has not been adhered to; including repairs where necessary troughs, pipes and tanks to a standard that maintains a constant source of water Implement remedial actions to provide supplementary water sources, where possible.
9	Earthworks	Minimise the risk of light vehicle and machinery strike during earthworks and operations	Vehicles only drive on designated access tracks, and the access tracks are defined in relevant overarching management plans (e.g. Environmental Management Plan).	<p>All relevant site personnel, including contractors, will be made aware of the locations of BTF populations and the potential for birds to be foraging adjacent road sides.</p> <p>Vehicles and plant will drive on pre-determined roads only, and adhere to all speed limits, which will be clearly communicated.</p>	<p>Monitoring surveys will be conducted biannually for a 10 year period by suitably qualified ecologists in accordance with standard methodology to identify changes in BTF population size and movements over time.</p> <p>Banding and re-sighting techniques will provide a basis for assessing movement patterns and assessment of population dynamics.</p> <p>Fauna spotter-catcher observations and results during the BTF habitat clearing progress will be fed into the monitoring results and adaptive management of clearing progression plans.</p>	<ul style="list-style-type: none"> Vehicles observed driving outside designated areas Light vehicle or machinery strike during other activities 	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Rectifying impacts Review and re design to avoid reoccurrence and address actual cause Communication with personnel involved and across all site team members (for example, via toolbox meetings).
10	Noise and vibration	Minimise habitat modification	No abandonment of BTF nests due to noise, and vibration disturbance	Project impacts like noise, dust and lighting will be minimised by the implementation of the Environment Management Plan, using standard procedures typical of large infrastructure projects.	<p>During the breeding season the Environment Manager will monitor verified BTF nests within 1 km of active operational areas (weekly at a minimum)</p> <p>Any signs of possible abandonment will be verified by a suitably qualified ecologist, who will consider the role of noise and vibration in the abandonment.</p>	Abandonment of a BTF nest without signs of predation, which is likely to have been caused by noise and vibration.	<p>The appropriate corrective actions will be implemented and may include:</p> <ul style="list-style-type: none"> Assessment to establish (a) abandonment of a BTF nest was without signs of predation; and (b) determine the root and contributing causes as being likely caused by noise and vibration Review and re design to avoid reoccurrence and address actual cause Communication with personnel involved where appropriate and across all site team members (for example, via toolbox meetings).

#	Matters under EPBC Approval, condition 6	Management objective	Performance Criteria	Management Actions	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
11	Emissions, including dust	Minimise emissions (dusts)	The photosynthetic ability of grasses in BTF habitat are not inhibited by dust emissions from the Project Area.	Regular watering of project areas in accordance with procedures under the Environmental Management Plan. Vehicles will be cleaned regularly and are not to be overloaded. Coal dust will be managed in accordance with the Environmental Management Plan	Regular site inspections in accordance with the Project Environmental Management Plan and Management System. Emissions and dust monitoring undertaken under the construction and Environmental Management Plan.	Growth of grasses in known BTF habitat in, and adjacent to, the Project Area are inhibited due to dust emissions.	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Where monitoring shows a reduction in habitat condition due to dust, mitigate source of dust Review and re design to avoid reoccurrence and reduce dust emissions impacts on habitat. Communication with personnel involved and across all site team members (for example, via toolbox meetings).
12	Light spill and other visual impacts	Minimise light spill	Light disturbance in known BTF habitat adjacent to works limited to <100 m.	Install light controlling devices to deflect lighting away from adjacent habitats. Avoid using unnecessary lighting.	Regular site inspections in accordance with the Environmental Management System.	Direct light spill >100 m into known BTF breeding habitat.	The appropriate corrective actions will be implemented and may include: <ul style="list-style-type: none"> Review and re design of light controlling devices, or adjust location of light, to reduce light spill and lighting levels below trigger levels Communication with personnel involved and across all site team members (for example, via toolbox meetings).
13	Stream diversion and flood levees	Reduce the impact of stream diversion and flood levees	All suitable permanent water sources are maintained.	As per the management actions included in items 9 to 12.	Annual monitoring, including photo monitoring, of water source availability, in the driest season	Draining of suitable permanent water source in retained BTF habitat, without an offset water source provided.	The appropriate corrective actions in accordance with the Environmental Management System will be implemented and may include: <ul style="list-style-type: none"> Review and re design to avoid reoccurrence and address actual cause Review adherence to control procedures to ensure compliance Take remedial action where compliance has not been adhered to; including repairs where necessary troughs, pipes and tanks to a standard that maintains a constant source of water Implement remedial actions to provide supplementary water sources, where possible.

6.4 Habitat management measures

In accordance with EPBC conditions 6d) to f) and EA condition 16e), measures will be implemented to manage BTF habitat to prevent further decline and, in the case of the offsets area, improve the condition. These management actions are also required to address potential Project impacts identified in EPBC condition 6c).

Managing BTF habitat requires management of three broad elements: the woody layer of the vegetation, the herbaceous layer of the vegetation and water sources. Grazing and fire are important drivers of the composition and structure of both woody and ground layers of the vegetation and managing grazing and fire is important for the maintenance and management of habitat quality for the BTF (Bousi 2011). While useful tools, these factors cannot be used to shift from one vegetation community to another as the vegetation community that occupies a particular location is largely driven by soil type and rainfall regime. Management measures are described below in relation to the threats outlined in **Section 4**.

6.4.1 Grazing management

Grazing will be used in the Project Area as a management tool to manage threats to BTF habitat. Grazing will be used to decrease the abundance and presence of weeds, including Buffel Grass and other exotic pasture grasses, and control fuel loads so as to reduce the risk of an uncontrolled fire.

The management of grazing within non-mined areas will be based on existing pastoral management practices under land agistment agreements, pastoral holding lease conditions and associated legislation. Sustainable grazing guides such as the 'Sustainable management of the Burdekin grazing lands' (McIvor 2012) will also guide the management of grazing activities. The following actions will be delivered under the legislation, agreements and conditions:

- Adani will complete annual BTF habitat vegetation assessments at approved monitoring locations during May to maintain and where possible enhance BTF habitat
- The baseline groundcover and native perennial species composition at 23 established baseline monitoring sites are included in Appendix F. Baseline characteristics are:
 - o 34% cover native perennial grass cover (minimum). Baseline standard deviation is 12.1%
 - o 27% bare ground
 - o four native grass species per site (minimum)
 - o 2.4% native perennial forb cover
 - o 1.8% native annual grass and forbs
- Vegetation assessments will use methodologies described within the 'Carmichael Coal Mine and Rail SEIS Report for Black-throated finch On-site Monitoring Survey 2' dated February 2014 to assess native perennial groundcover and ground composition based on Queensland BioCondition Framework (at External *et al.* 2011) and the Queensland Herbarium flora survey methods (at External *et al.* 2005)
- Groundcover and species composition will be assessed annually against the baseline data (established in 2012/13) from when this Management Plan commences (each May)
- If the annual vegetation assessment demonstrates a loss of native perennial species and cover from baseline conditions, an investigative review will be completed and relevant corrective management actions will be taken to ensure the maintenance or enhance of these perennial pasture species
- Corrective actions may include additional fencing or spelling of paddocks to control grazing, controlled grazing to maintain biomass levels, pest control (e.g. rabbits, weed eradication) and fire management.

Since BTF have been shown to access a range of artificial water sources, including drinking at troughs visited by cattle, it would not be necessary to restrict cattle from existing troughs or watering points. However, in accordance with EA Condition I8, water troughs for BTF must be maintained within undisturbed areas and surface areas of the underground mining footprint. Also, the condition includes a requirement to repair, where necessary, troughs, pipes and tanks to a standard that maintains a constant source of water. The retention or provision of some trees / shrubs within a suitable distance to water may increase utilisation of water sources, by providing shelter for birds if they are disturbed by the arrival of large groups of cattle, allowing them to return to drink when the cattle depart.

6.4.2 Fire management

Fire and grazing can be considered competitors of one another for the available grass fuel / forage. In considering the use of cattle grazing to manipulate the grass fuel load and distribution it is also important to address other aspects of the herbaceous layer that will be affected by grazing, namely species composition and seed production. Breeding of BTF must be monitored in terms of location and timing so that breeding locations are not burnt when birds are nesting (constructing breeding nests, incubating and feeding nestlings).

Given the uncertainty around and complexity of the relationship between fire and habitat quality, it is important that all parts of a landscape being managed for BTF are not subject to the same fire regime. In general, the overall fire regime of the Project Area will aim to be one of periodic, small scale, low intensity fires being used to target areas that are developing a shrubby understorey. However, the outcomes of the BTF Research Program will also study the relationship between fire and habitat quality. The outcomes of that research will inform fire management in the Project Area and this plan, once finalised.

Low intensity fires will temporarily open up the grass layer but generally are not known to kill tussocks. These types of fires will create foraging patches by improving accessibility to the grass seed that is present. Burning should not be carried out too soon after seed set, though BTF may forage on recently burnt landed at External (2016).

Fire will reduce the density of the shrub layer by killing obligate seeders and removing stems from re-sprouting species. Fire may also promote the germination of obligate seeders and other species, particularly *Acacia* spp. Currently there are areas of the Project Area that have dense stands of short-lived *Acacia* spp. as a result of fire-stimulated germination. BTF tend to avoid extensive areas of woodlands with a dense shrubby understorey, though they do use patches of shrubs or smaller trees for resting and shelter at External (2011). Dense shrubby understoreys also tend to have fewer grasses and so are less productive in terms of the seeds upon which BTF forage.

Dense stands of these species can be reduced by fire frequencies shorter than the time between germination and seed production. Some of these species probably produce seeds within 3 to 4 years of germination (e.g. *Acacia holosericea*).

The existing network of roads and tracks will be used to manage fire, rather than establishing additional firebreaks. This will help reduce the risk of weed incursion through movement of traffic into intact understorey. The numerous existing tracks that were created during mine exploration and development, especially in the northern sector of the Project Area, provide firebreaks that can help ensure that prescribed fires are not extensive. The value of maintaining these tracks as firebreaks needs to be weighed up against the value of minimising the risk they present in terms of weed incursion and as useful foraging habitat. It is worth noting that BTF often forage on or in close proximity to tracks and other surfaces with low cover. The usefulness of these bare areas for foraging is dependent upon there being

seed production in their immediate vicinity, so extensive bare areas are not valuable to BTF (Adani 2016).

6.4.3 Pests

Weed management is addressed in a project specific Pest Management Plan (Adani 2015), which covers weeds and feral animals (pests). The Pest Management Plan has an overarching strategy, as follows:

- Identification of current and potential pest animals and plants for the area, and current locations of populations of pest animals and plants
- Avoidance of travel through or establishing infrastructure in areas of known pest plant infestation
- Prevention of the introduction of new weed and pest animal species to the area
- Minimisation of the increase in distribution and abundance of currently present pest plants or animals
- Control of identified weeds and pest animals to contain, reduce or eradicate pest populations.

Actions associated with weed management align with this strategy. Weed management issues specific to BTF are the control of introduced grasses and other herbs that have a tendency to dominate the herbaceous vegetation and affect the seeding of grass species on which BTF rely. Incursions of weeds into new areas will be prevented. Existing weeds, including non-native grasses, will be managed, with the intent of reducing further incursion (Adani 2015).

Non-native plant species that are considered potentially detrimental to BTF habitat include Buffel Grass, Indian Couch, *Stylosanthes scabra*, *Parthenium hysterophorus* (Parthenium) and other high biomass non-native grasses. Native understorey shrubs such as *Carissa ovata* and *C. lanceolata* can also be detrimental as they may increase in association with heavy grazing and little burning. Some of the short-lived *Acacia* spp. would be detrimental to BTF if they form extensive thickets.

Non-native invasive shrubs such as *Vachellia nilotica* (Prickly Acacia), *Ziziphus mauritiana* (Chinese Apple), *Jatropha gossypifolia* (Bellyache Bush), *Stylosanthes humilis* and *Lantana camara* (Lantana), while not currently prevalent in the Project Area, will be prevented from establishing.

The risk of further incursions by high biomass grasses will be minimised by effective hygiene measures that include minimising traffic into BTF habitat, use of wash down facilities for vehicles, control of new infestations, avoiding movement of soil potentially bearing weed seeds or other propagules and minimising soil disturbance. The species of greatest concern is Buffel Grass. However *Themeda quadrivalvis*, *Hypharrhenia* spp. and Indian Couch are also a concern, though they are not currently common in the Project Area. Indian Couch is present but the health of the native perennials is probably sufficient to prevent it taking over.

The landscaping plan and rehabilitation plans for the Project will use native species where possible. No invasive species will be used in landscaping.

Habitat management measures for feral cats and feral pigs are provided in **Sections 6.4.5 and 6.4.6** respectively.

6.4.4 Water supply

Water bodies known or considered likely to be used by BTF, in as yet unmined and underground mining areas, must be identified to alert to their environmental significance. Controls to prevent contaminated

run-off or fuel / chemical spills will be implemented to protect water quality for these sources. Controls to manage the protection of BTF water sources include the following:

- Storage of fuels and chemicals must be bunded to 110% the capacity of the storage facility. Storage areas must be at least 300 m from known watering points, waterbodies and waterways.
- Effective erosion and sediment controls must be installed around all topsoil and spoil piles, unless a native cover has been established which prevents run-off of materials.

Current water sources outside of the clearing footprint are to be maintained. Where it is necessary to remove a particular water source within or nearby to BTF habitat, a new water source will be created. These can be relatively small, have intact woodland in their immediate vicinity and have a few trees and / or shrubs close to their margins for BTF to perch on. It is also important to have canopied trees (especially Eucalypts) in which the birds can rest while travelling to and from the water source. Construction of BTF water sources to provide alternative watering points will be undertaken in conjunction with construction of water storage dams early in the mine implementation program.

In order to ensure that the watering points in the Moray Downs West offset area do not interfere with research but also provide water for finches, the following actions will be delivered:

- maintenance of the existing seven water points in the Moray Downs West offset area, as per the Moray Downs West Offset Area Management Plan
- new artificial water sources will be installed in locations within the Moray Downs West offset area in accordance with this research program
- assessment of BTF responses to new water sources and their effectiveness
- results used to inform specific requirements and location of permanent artificial watering points
- permanent artificial watering points will be installed and adequately maintained within the Moray Downs West offset management area within the sooner of one year after the completion of the three-year Research Program, or five years after the commencement of mining operations.

6.4.5 Feral cats

Feral cats are considered one of the threats to local populations of BTF. Ongoing feral cat control will be carried out as it would benefit many other native species in addition to BTF, including the threatened Squatter Pigeon. Feral cat control will be carried out in accordance with the Pest Management Plan for the Project. The key areas to be targeted for feral cat control to protect the BTF are those where birds are likely to be exposed and vulnerable to predation including on the interface of the clearing front and remnant vegetation and at water sources where BTF are vulnerable to attack whilst drinking.

6.4.6 Feral pigs

Feral pigs have the potential to damage BTF habitat and are therefore a threat to the species. Damage to BTF habitat is caused by disturbance of the soil while feeding, trampling of habitat, tusking or rubbing trees and the consumption of plants and soil organisms. Feral pig control will be carried out in accordance with the Pest Management Plan for the Project. Targeted site monitoring for pigs will focus on water courses and BTF feeding areas, where greatest impacts to BTF habitat are likely to occur. Humane pest control measures will be implemented to reduce pig numbers.

6.4.7 Management of Ten Mile Bore

Condition I9b of the EA states that the BTF Research Program must establish management actions to maintain the current BTF population of Ten Mile Bore and surrounds. Management of BTF habitat in the vicinity of Ten Mile Bore will therefore be informed by the findings of the BTF Research Program (**Appendix C**). Until such time as findings of the Research Program are available (3 to 5 years from

approval of the plan), existing management activities at Ten Mile Bore will continue to be implemented, to maintain the BTF population of the area. These interim management measures include:

- Avoiding mining-related disturbance of the area until as late as possible (see **Section 6.3.1**)
- Maintaining water for BTF, to be monitored through weekly water infrastructure inspections
- Managing grazing activities in the vicinity of Ten Mile Bore to enhance and maintain BTF habitat values

6.4.8 Summary of mitigation and management measures

The mitigation and management measures to be implemented for the Project to minimise impacts to BTF for activities other than clearing are summarised in **Table 9** and **Table 10**. These are relevant across all project stages and will be implemented prior to commencement of Project Stage 2 activities as defined by the Carmichael Coal Mine Environmental Authority. Regular monitoring across the site will identify any deterioration in BTF habitat values and trigger a site-specific corrective action. Such a response may involve the control of weeds, implementation of fire management actions or changes to grazing practices, to improve and restore BTF habitat values.

Mitigation of impacts on BTF and its habitat will in part be achieved through implementation of other plans including the CEMP and OEMP. These plans are regularly updated based on site conditions, the results of on-site monitoring and progression of project tasks. A summary of key elements of environmental management, as outlined in the project EIS, is provided in **Appendix A**.

6.5 Offsets

Conditions of approval for the Carmichael Coal Mine and Rail Project under the EPBC Act and within the Coordinator-General report require Adani to address offset requirements for significant residual impacts on MNES and Matters of State Environmental Significance. The approach to be taken by Adani to achieve the required offsets is outlined in the approved BOS (C02 2016) under Condition 8 of EPBC Act approval 2010/5736. Offsets will be delivered in stages, with Stage 1 offsets to be delivered through implementation of an offset area management plan.

A key mechanism for achieving offsets for BTF is management of the Moray Downs West offset area, which includes extensive areas of BTF habitat. The Moray Downs West offset area will be managed under the approved *Offset Area Management Plan: Moray Downs West*, (CO2 2017) including regular assessment to identify any future management and monitoring requirements until offset management objectives are achieved. The area provides an offset for the expected loss of BTF habitat from Stage 1 of the Project including potential impacts from subsidence caused by underground mining.

In the event that additional impacts are proposed, or occur unexpectedly, additional offsets will be provided, subject to approval from Commonwealth and State governments. This would include circumstances where the corrective management measures have not achieved the goals within specified timeframes, and resulted in impacts beyond those that were originally approved. Likewise, if Adani is able to minimise its disturbance of BTF habitat to a smaller area than approved, a corresponding reduction in offsets will apply to be sought from the Commonwealth and State Governments.

7 Monitoring and Research Programs

The management of the BTF population will be supported by targeted monitoring and research that will be undertaken for the Project. The results of monitoring and research will feed back into the management measures to guide adaptive management. The ongoing monitoring will be focussed on describing spatial and temporal patterns of occurrence while the research will focus on explaining spatial and temporal patterns and ecological relationships.

A BTF Research Program has been developed concurrently and provides a program for addressing specific scientific questions about BTF and its habitat (**Appendix C**). The Research Program details the objectives and methodologies to explain and predict patterns and processes relating to the distribution and abundance of BTF in the Project Area. This research will inform future management and monitoring of the BTF population within the Project Area.

7.1 Monitoring program

As required by Condition 6(b) of the EPBC Act approval, a monitoring program will be implemented upon approval of the management plan to inform assessments of the effectiveness of mitigation measures. The level of disturbance of Project activities on BTF habitat will also be measured and the success of rehabilitation activities evaluated. As committed during the EIS process, Adani will collaborate with research institutions for aspects of the monitoring program, where such an approach would add value (e.g. identification of remnant vegetation changes resulting from subsidence).

The proposed monitoring regime will be used to provide feedback on the effectiveness of mitigation measures and to evaluate the success of rehabilitation activities. Monitoring of the BTF has already commenced as part of the baseline research program for the Project and ongoing monitoring programs locally. Initial monitoring will continue for a period of 10 years as required in the conditions of the Environmental Authority. A major review of the monitoring results will be completed at this time (after 10 years). This will result in the development of a long-term monitoring method that will be implemented for the life of the project. This will ensure compliance with EPBC Act approval conditions, which require monitoring for the life of the Project.

As with mitigation measures, some monitoring activities will be generic and broadly applicable across multiple ecological values, including BTF. Other monitoring activities will be species-specific and tailored to measure the effectiveness of mitigation measures at reducing the impacts of the Project on BTF. The design of specific monitoring tasks will be tailored to the variables being measured, and have sufficient replication to provide statistical power to detect significant change. Indicative monitoring sites have been chosen and the location of these will be confirmed through on site investigations during pre-clearance surveys.

Monitoring measures to be implemented across the Project Area are detailed in **Tables 8 to 10**. **Table 11** provides an overview of monitoring measures.

Table 11 Summary of monitoring measures to be implemented across the Project Area

Monitoring	Description
Pre-clearance surveys	Confirm and identify the spatial extent and condition of BTF habitat to be disturbed prior to any clearing or disturbance commencing, through pre-clearance surveys. BTF surveys will focus on confirming species presence throughout the Project Area, identifying species presence in proximity, but outside (adjacent to) Project Area and

Monitoring	Description
	identifying areas of potential rehabilitation for BTF habitat values inside the Project Area, but outside the disturbance footprint.
Clearing	Monitoring surveys to be conducted biannually for a 10 year period by suitably qualified ecologists in accordance with standard methodology to identify changes in BTF population size and movements over time. Banding and re-sighting techniques will provide a basis for assessing movement patterns and assessment of population dynamics.
Condition	<p>Monitor the condition of BTF habitat adjacent to the development and the Offsets Area. This will be undertaken using standard BioCondition monitoring surveys (see at External <i>et al.</i> 2011 for details) and species habitat index.</p> <p>The quality of known BTF water sources will be monitored.</p> <p>Additionally, annual BTF habitat vegetation assessments will occur during May within 2 ha plots at the following locations: CHAB02, CHAB03, CHAB22, CHAB23, CHAB24, CHAB25, CHAB37, CHAB45, CHAB47, CHAB48, CHAB52 (Open cut disturbance areas) and CHAB01, CHAB04, CHAB05, CHAB09, CHAB10, CHAB44 and CHAB46 (Underground disturbance areas).</p> <p>Vegetation assessments will use methodologies described within baseline 'Report for Black Throated Finch On-site Monitoring Survey' dated 12 July 2013 to assess ground cover and ground composition based on Queensland BioCondition Framework at External <i>et al.</i> 2011) and the Queensland Herbarium flora survey methods (Neldner <i>et al.</i> 2005).</p> <p>Moray Downs West Offset Area</p> <p>The monitoring methods included in the <i>Moray Downs West Offset Area Management Plan</i> for the offset area are as follows:</p> <ul style="list-style-type: none"> • method for determining monitoring locations is to apply the Guide to Determining Terrestrial Habitat Quality to calculate habitat quality scores • For the species stocking rate component, the monitoring method for BTF as outlined in this plan • For sites being monitored under the BTFMP within the offset area, use survey results to inform the habitat quality scoring under the OAMP (rather than duplicating survey effort at these sites) <p>Further monitoring methods for BTF in the offset area are consistent with this plan, such as:</p> <ul style="list-style-type: none"> • water source watches • active searches • incidental observations • remote cameras • vegetation condition assessments • foraging plot assessments.
Weeds	Monitor the presence of declared weeds, and abundance of environmental weeds.
Pests	Monitor the presence and population abundance of invasive fauna.
Vegetation rehabilitation areas	Monitor the effectiveness of rehabilitation activities through BioCondition or similar assessment methods.
Water quality	Measure the effectiveness of rehabilitation activities, by monitoring water quality in accordance with the EMP.
Offset areas	Measure the effectiveness of offset management, by monitoring the quality of offset areas in accordance with the OAMP.
Fauna mortality and injuries	Record BTF fatality, including suspected nests / eggs of BTF.
Dust	Monitor dust within and adjacent to construction activities in accordance with the EMP.
Fire	Monitor incidence and extent of Project related fire, and determine impacts through BioCondition assessments.

7.1.1 Survey timing and frequency

Seasonal surveys will be undertaken biannually for a period of at least 10 years in order to satisfy relevant approval requirements and provide useful feedback into the management plan. Surveys will be undertaken to coincide with the end of the dry season (approximately late October) and the latter part of the breeding season (March to April). A major review of the monitoring results will be completed after 10 years. This will result in the development of a long-term monitoring method that will be implemented for the life of the project.

Surveys will occur across all areas of known BTF habitat in the Project Area and adjacent to the Project Area, as well as all areas established for rehabilitation and offsets for BTF. The purpose of the surveys will be to document changes in distribution and abundance of BTF in the Project Area, relate that to habitat condition, quantify use of offset areas and provide feedback for adaptive management.

7.1.2 Survey methodology

The survey methodology for ongoing monitoring is based on the results and recommendations arising from baseline monitoring surveys undertaken to date and the specifications of Commonwealth and State approval conditions (e.g. Condition I6 of the EA). The monitoring methodology is to transition from a methodology aimed at gathering presence / absence data alone, to one gathering data that will better explain BTF movements across the landscape as well as identify any trends in populations and monitor the effectiveness of management actions.

The methodology for BTF monitoring will include the following:

- Water source watches
- Call play-back
- Identification of all birds present when BTF are encountered
- Active searches
- Opportunistic incidental observations gathered whilst traversing the Project Area
- Surveillance cameras
- Monitoring of subsidence areas
- Monitoring of pasture biomass
- Vegetation transects and plots.
- Annual monitoring of 2 ha groundcover plots

Indicative monitoring sites are shown in **Appendix B**. These sites will be reviewed following approval of the management plan, with additional vegetation sites included in the offset areas and subsidence areas. These additional sites will provide representation of critical BTF habitat, core BTF habitat and marginal BTF habitat. Input from the research team appointed to implement the BTF Research Program will be sought on the location of additional monitoring sites. The sites include areas outside of the disturbance footprint (control sites) and areas that will be subject to disturbance in the future (impact sites).

In the case of some monitoring methods, such as fixed point waterhole surveys, the exact location of these are known. However for some survey types, the placement of the permanent monitoring sites will be finalised during the implementation of the monitoring program. The BTF Management Plan will be subsequently updated to include the final locations of monitoring sites.

7.1.2.1 Water source watches

Water source watches are one of the primary survey methods recommended in the Significant Impact Guidelines for the Endangered Black-throated Finch (southern; *Poephila cincta cincta*; DEWHA, 2009a;

the Guidelines). They have also been the most successful survey technique in recording BTF across the Project Area in most surveys undertaken to date.

Fixed point water source watches will be conducted for six continuous hours commencing from dawn at up to 16 water sources where BTF have been previously recorded (**Table 12** and **Appendix B**). Note that some of the sites have been found to be unsuitable for monitoring at times in the past, due to an absence of water. As water sources are removed as a result of mining activities, monitoring at these locations will cease. New water sources will be substituted for monitoring, particularly in the offset areas.

Where BTF are observed during waterhole watches, the following information will be collected:

- Time of observation
- Number of individuals
- Other species present in mixed flocks
- Behaviour (e.g. foraging, drinking, perching, flying, etc).

Table 12 Water source monitoring sites (those sites marked # have been found to have little to no water during monitoring over the past three years)

Site ID	Site Common Name
CWAT01a	Ten mile bore dam (lower)
CWAT01b	Ten mile bore turkey nest
CWAT01c	Ten mile bore dam
CWAT02	16 mile tank dam
CWAT03	Ten mile tank dam
CWAT07	Number 1 dam
CWAT99	Four mile bore
CWAT101 #	Beenboona hole
CWAT104 #	Unnamed waterhole
CWAT105 #	Rocky Dam
CWAT110	Lignum yards dam / trough
CWAT111	Lignum large dam
CWAT116 #	New Laguna dam
CWAT117	Number 2 dam
CWAT118	Carmichael bore tank and troughs
CWAT120	Dingo dam

Characteristics of the water sources that BTF are observed utilising will also be noted in order to build on the existing understanding of use and utilisation of water sources. Any seasonal or longer term changes that may influence suitability for BTF will also be determined. The following information will be documented:

- Approximate size of water source
- Slope of bank
- Surrounding vegetation

- Water retention dynamics (permanent vs seasonal).

7.1.2.2 Active searches

Active searches are to be conducted within suitable habitat to collect BTF population data and search for nests (**Appendix B**). In particular these surveys will focus on areas that are known to be good quality habitat for BTF as well as areas of habitat within the offset area.

Active searches will include random meanders within 1 km of each water point monitoring site for at least three hours with specific effort devoted to areas with grassy open-woodland habitat. 1 km transects will also be undertaken during active searches.

Information collected during active searches will include:

- Location and quantity of BTF
- Behaviour (e.g. foraging, drinking, perching, flying, etc)
- Regional Ecosystem (RE) type and condition
- Presence / absence of mixed-flocks and associated species
- BTF nests (including photographic evidence and GPS location)
- Characteristics of BTF nest including host tree or shrub species, height of nest, active or inactive
- Groundcover measurements of perennial grass cover, non-native grass cover, litter, bare ground and ground cover composition.

Wherever possible, the active search information collection methods will be similar to previous annual BTF vegetation assessments, in order to increase the data comparison value.

7.1.2.3 Slow-drive transects

Slow-drive transects have been undertaken throughout BTF habitat during some previous monitoring surveys. The technique involves using a vehicle driving at a maximum speed of 20 km/hr along a 3 km predefined transect (**Appendix B**). Where BTF were observed, the following information was collected:

- Location and quantity of BTF
- Behaviour (e.g. foraging, drinking, perching, flying, etc)
- Regional Ecosystem (RE) type and condition
- Presence / absence of mixed-flocks and associated species.

However, slow-drive transects have been found to be of limited value in previous surveys in the Project Area, and will not be continued as part of the ongoing monitoring program.

7.1.2.4 Incidental observations

Opportunistic incidental sightings of BTF are to be undertaken whilst travelling between survey sites. Where BTF are observed, the following information will be collected.

- Location and quantity of BTF
- Behaviour (e.g. foraging, drinking, perching, flying, etc)
- Regional Ecosystem (RE) type and condition
- Presence / absence of mixed-flocks and associated species
- Assessment of groundcover characteristics and species composition
- BTF nests (including photographic evidence and GPS location)

- Characteristics of BTF nest including host tree or shrub species, height of nest, active or inactive.

7.1.2.5 Remote cameras

Fixed remote cameras will be set-up at water sources where water source monitoring is not undertaken. In particular these will be used to monitor cattle troughs as well as any new watering points installed throughout the Project Area and including the Moray Downs West offset area. Cameras will be installed for the duration of the monitoring surveys. Photos and recordings of BTF are to be included in the survey results.

7.1.2.6 Vegetation assessments

Vegetation transects will be established throughout the Project Area to monitor the condition of BTF habitats (**Appendix B**). Foraging plots will also be conducted during BTF monitoring in locations where BTF were identified foraging in order to identify the floristic characteristics of habitat and flora species foraged.

Vegetation transects

Vegetation transects will consist of a modified BioCondition survey with indicators that are not important to BTF excluded (such as fallen woody debris). Fixed 100 m x 50 m vegetation transects will be established and monitored throughout the Project Area with the following information recorded in regards to vegetation structure:

- RE
- Canopy species and relative abundance
- Canopy minimum, maximum and average height
- Crown cover
- Shrub species and relative abundance
- Shrub average height
- Shrub canopy cover
- Weed cover
- Ground cover
- Ground layer species and individual percentage cover
- Percentage cover of bare ground and organic material.

Foraging plots

2 m x 2 m foraging plots will be undertaken at locations where BTF are observed foraging. These plots will aim to determine important grass species for BTF in the Project Area as well as seasonal dietary variation. Flora plot information to be collection at each plot will include:

- RE
- Ground cover species including abundance (number of the whole), of each ground cover plant species including exotic and weed species, whether seeding, or not and whether dead or alive
- Cover of each ground cover species
- Total cover of ground cover species
- Bare ground cover
- Forb cover
- Litter cover.

7.1.2.7 Groundcover, species composition and biomass monitoring

Monitoring of groundcover and species composition will be undertaken to assist with the management of grazing to maintain and enhance BTF habitat values. Baseline groundcover and composition have been established, as described in **Appendix F**. If annual vegetation assessments demonstrate a loss of native perennial species number and cover, an investigative review will be completed and relevant corrective management actions will be determined to ensure the maintenance of these species. An increase in invasive species such as Buffel Grass will also be a trigger for investigation. Corrective actions may include additional fencing or spelling of paddocks to control grazing, controlled grazing to reduce biomass levels, pest control (e.g. rabbits, weed eradication) and fire management.

Groundcover biomass monitoring will be conducted in May each year within 2 ha sites at the following monitoring locations:

- CHAB02, CHAB03, CHAB22, CHAB23, CHAB24, CHAB25, CHAB37, CHAB45, CHAB47, CHAB48, CHAB52 (Open cut disturbance areas) and
- CHAB01, CHAB04, CHAB05, CHAB09, CHAB10, CHAB44 and CHAB46 (Underground disturbance areas).

These sites were originally monitored during the Project EIS.

Vegetation assessments will use methodologies described within 'Report for Black Throated Finch On-site Monitoring Survey' dated 12 July 2013 to assess groundcover and ground composition based on Queensland BioCondition Framework at Extern *et al.* 2011) and the Queensland Herbarium flora survey methods at Extern *et al.* 2005). Annual vegetation assessments will be reviewed and modified in line with approved Mine Plan changes and improved assessment methodologies. Monitoring will also focus on identifying potential increases in exotic grass composition, such as Buffel Grass.

Groundcover biomass monitoring will also be conducted at representative sites across the offset area. Monitoring will be conducted to determine the biomass and composition of groundcover and appropriate management requirements to optimise BTF habitat values, including specific cattle grazing practices to manage pasture biomass.

In December 2013, ecological equivalence assessments were conducted of the mine area in order to determine baseline condition of impact areas and inform the suitability of offsets (ELA 2014). That report described habitat quality as defined within the Offset Assessment Guidelines under the EPBC Act Environmental Offset Policy. Potential habitat and quality of that habitat were mapped for BTF and guided the establishment of future management objectives for offsets.

In the Moray Downs West Offset Area, the use of strategic grazing within offset management areas will be guided by biomass monitoring. In the Moray Downs West Offset Area, biomass monitoring will be undertaken twice a year, at the end of the wet season (approximately April) and at the end of the dry season (approximately October) using the Department of Natural Resources, Mines and Energy Queensland GRASS Check – Grazier Rangeland Assessment for Self-Sustainability DNRQ97002, Second edition-revised methodology. Monitoring will be undertaken at monitoring sites established as part of the baseline surveying in year 1. Monitoring events will assess pasture composition, pasture biomass and pasture ground cover. These assessments will be used to set stocking rates for the dry season for any strategic grazing to reduce fuel loads or for weed control. Strategic grazing implemented within Moray Downs West Offset Area will aim to retain a biomass of 1,500 kg/ha at the end of the dry season.

7.1.2.8 Bioacoustic monitoring

Bioacoustic Audio Recorders (BARs) have been successfully implemented during BTF surveys of the Project Area in 2017 and 2018 (E2M 2017, 2018). A pilot study was undertaken in 2017 with the objective of developing a recogniser to facilitate automated recognition of BTF calls using Sound ID software.

Two different BTF calls were identified, of which one call was found to be suitable for automated recognition. The pilot study found that automated recognition of BTF calls was a viable method to detect BTF presence, particularly for sites that are impractical to monitor by an ecologist due to the scarcity of BTF use or their remote location. The method had a 69% detection rate of the most characteristic BTF call. However, in approximately 50% of BTF occurrences, BTF did not produce their characteristic call and were therefore not present in acoustic recordings. The method detected 33% of all BTF occurrences recorded by ecologists (including occurrences where BTF did not call).

Following the pilot study for the automated recognition of BTF calls, BAR devices were again deployed during a 2018 survey. BAR devices were used to detect BTF presence/absence at water sources that would otherwise have not been monitored and where remote cameras were not an adequate means of detection. Acoustic data was screened for BTF calls using a combination of automated recognition with manual verification.

BARs will continue to be used as a survey method, with a focus on remote survey sites or locations where other survey techniques are not likely to be an adequate means of detection.

7.1.3 Impact monitoring actions and outcomes

The monitoring will also aim to determine the effectiveness of mitigation measures implemented for management of BTF in the Project Area. The potential impacts of the proposed activities on BTF will be monitored in accordance with the monitoring program outlined in **Tables 8 to 10**, which has monitoring tasks specifically linked to corrective actions.

7.2 Research program

The objectives, indicators and actions for BTF research across the Project Area and the broader area will be undertaken in accordance with the Carmichael Coal Mine BTF Research Program (ELA 2017b; see **Appendix C**) which is summarised in the following sections.

The objective of the Research Program is to determine critical ecological requirements for the BTF in accordance with the conditions of approval for the mine development. In particular the research will aim to identify the movement patterns, habitat requirements and population dynamics, dietary requirements, home range and nesting requirements for the BTF as well as the relationship between water sources, woody habitat and food sources.

The research will also aim to determine the species response to grazing management, fire management and water body locations within the mining lease area and approved offset areas to facilitate appropriate management of these areas. Specific grazing trials will be proposed via the Research Program. The location and timeframe of the trials will be determined at the scoping phase of the research. Further detail is outlined in **Appendix C: BTF Research Program**. Population estimates will also be improved, particularly for key sites such as Ten Mile Bore.

The results of the research will inform and improve management and mitigation measures adopted for the Project to minimise impacts to the local population of BTF as well as enhance habitat within the Moray Downs West offset area in such a way to increase the carrying capacity for BTF in these areas.

7.2.1 Grazing management

BTF can persist in pastoral landscapes even though (at External 2011) demonstrated that birds on pastoral lands had higher stress levels than birds on conservation lands. The abundance of BTF and the viability of their populations, however, are likely to be influenced by the actual grazing regime including stocking rates, land management practices and paddock rotation. The key impacts of grazing are on the composition and structure of the ground layer.

By determining the composition and structure of the ground layer where BTF are known to breed and forage within the Project Area, grazing trials can be implemented within other areas of *Eucalyptus melanophloia* open-woodland that the species appears to utilise less frequently to use grazing as a tool to establish similar composition and structure characteristics which may encourage BTF breeding and foraging. Controlled grazing may also be a suitable means for improving habitat by thinning areas of very dense grass cover as well as assisting in managing bushfire risks. These trials will aim to identify appropriate grazing strategies for managing BTF habitat, especially within the Moray Downs West offset area.

Grazing trials will consist of various cattle stocking densities and wet season resting. These trials will be assessed in terms of the ground layer composition and structure with reference to areas of known high value BTF habitat in the Project Area. The trials will aim to identify the optimal grazing strategy for maintaining good condition BTF habitat that incorporates important food resources including diversity and cover of preferred grass species as well as adequate seed output.

Proposed research methods for this aim are provided in **Appendix C**.

7.2.2 Fire management

Fire is inevitable in the grassy woodlands of central Queensland and a natural component of these ecosystems. European settlement has caused a shift towards frequent, extensive and high intensity fires in the dry season resulting in large uniform areas (at External 2016). Fire will generally not reduce densities of canopy tree densities, though it can change canopy structure. The most notable impact of fire on BTF habitat is through modification of the ground layer.

While it is apparent that BTF will forage on recently burnt country, it is not known how the fire regime affects the resources available to the birds. Inappropriate fire regimes can impact on the quality of BTF habitat by affecting the production of seeds, reducing the cover and diversity of grass species and causing a decline in food availability. Fire exclusion can lead to thickening of woody shrubs, decreasing the quality of BTF habitat. Therefore high frequency, low intensity, patchy fire regimes may be beneficial to BTF by reducing the thickness of the shrub layer (at External 2001).

This research will include a detailed analysis of fire history across the Project Area to ascertain the frequency and intensity of fires within BTF habitat across the Project Area. Trials will then be considered for implementation and include various regimes of fire frequency and inter-fire interval, fire intensity, the season in which fires occur and the extent (area) of individual fires. However, any fire management trials will need to consider other management strategies and BTF research methods as well as safety and asset protection.

Proposed research methods for this aim are provided in **Appendix C**.

7.2.3 Water sources

BTF need to drink water on at least a daily basis and drink more frequently during the drier times of the year. The importance of water to BTF is highlighted by the fact that they typically nest and breed near water. Within the Project Area this is demonstrated with 68% of BTF records in grassy woodlands within 3 km of known water sources. Therefore the absence of water may preclude BTF from areas that otherwise provide suitable habitat. The addition of water may increase the area of suitable habitat that is available.

BTF surveys and monitoring within the Project Area have also identified the species' ability to utilise natural and artificial water sources. During these surveys they have been regularly observed to drink from cattle troughs, dams and 'turkey nests'.

A key management strategy for the Moray Downs West offset area is to provide additional water sources within areas of suitable woodland habitat for BTF. They will be installed throughout the offset area at locations greater than 3 km from existing water sources.

Artificial water sources will initially be installed in several locations of the Moray Downs West offset area. Research will assess the response of BTF to new water sources and the effectiveness of this strategy by identifying the following:

- Ability to attract BTF
- Frequency of use by BTF
- Change in usage of nearest water sources
- Proximity to existing vegetation especially trees / shrubs

Proposed research methods for this aim are provided in **Appendix C**.

8 Discussion

8.1 Summary of key management issues

The following management approaches will be implemented to minimise impacts of the Project on BTF:

- Pre-clearance surveys to confirm the area of habitat to be disturbed, identify BTF locations not previously recorded in the Project Area and monitor compliance with disturbance limits.
- Vegetation clearing protocols to include staged and sequential clearing of BTF.
- Minimise impacts to BTF breeding by avoiding and buffering known nests where possible and also avoiding vegetation clearing, where possible, during the breeding period (October to April).
- Fire management to prevent accumulation of fuel loads leading to uncontrolled wildfires. Controlled cool burns will be undertaken in accordance with the Fire Management Plan (Adani 2015) to provide a mosaic of fire history and to prevent thickening of the shrub layer in BTF habitat.
- Weed management to prevent the introduction and / or spread of weeds that have the potential to degrade BTF habitat.
- Control and monitoring of pest species, especially predatory species, such as cats, that may impact on BTF.
- Prevent contamination of watering points by bunding fuels and chemical storage areas and buffering these areas from known watering points, waterbodies and waterways. Erosion and sediment controls will be implemented to prevent run-off of materials.
- Use of spotter-catchers before and during clearing activities to mitigate the direct impacts of construction activities on wildlife and record and report fauna mortality and injuries.
- Limit disturbance to pre-defined areas and implement controls to minimise noise, lighting, vibrations and dust.
- Rehabilitate areas that are to be disturbed, to restore habitat values where practicable. Monitor the effectiveness of rehabilitation activities.
- Seasonal monitoring of BTF within the Project Area to identify population trends and important breeding and foraging habitat.
- Monitor the direct and indirect impacts of construction and operations on threatened communities and species (and their habitats), both within and adjacent to the Project Area.
- Evaluate the effectiveness of mitigation measures, and revise them if necessary to improve environmental outcomes.

The BTF Management Plan will be implemented in conjunction with several other management plans specific to threatened species, habitats (groundwater dependent ecosystems) or threats (pest management plan). Collectively, the management plans will achieve a high standard of environmental management.

8.2 Implementation

Responsibility for implementing the BTF Management Plan will lie with Adani's Head of Environment and Sustainability. Mitigation and management measures will be incorporated into site management procedures and the scope of relevant construction activities. Some management tasks described in the management plan will be completed directly by Adani staff, while other tasks may be contracted out to consultants or contractors. Where the support of contractors is required, services will be procured through

Adani's purchasing procedures. Monitoring and research programs will be implemented by suitably qualified environmental suppliers, as described in **Section 9.3**.

Adani recognises the importance of taking a whole-of-ecosystem approach to the implementation of this plan and the minimisation of environmental impacts, including BTF, arising from the Project. During implementation of this plan, and in particular at the construction planning stage, Adani will take the following approach to increasing the effectiveness of the management plan:

- Identify locations where multiple BTF habitat values require management and / or monitoring, and ensure such measures are effectively implemented in parallel.
- Give consideration to the management of environmental impacts for all threatened species (at an ecosystem scale), rather than particular species in isolation.
- Maintain awareness of the changes in the vulnerability of threatened species during different seasons. In particular for the BTF, the breeding season is a critical period to maintain a sustainable local population in the Project Area.

9 Reporting and Compliance

9.1 Updating this plan

Implementation of this BTF Management Plan will commence immediately from the date of its approval by DoE and DES. The plan will be reviewed annually from commencement.

The annual review of the BTF Management Plan will include consideration of:

- delivery and outcomes of any Bioregional BTF Management Plan, including that led by the Queensland Government under the Coordinator-General's Report about the project;
- relevant requirements under the EPBC Act 1999, including the BTF Recovery Plan, conservation advices and threat abatement plans; and
- any amendments to the above or as required in response to outcomes of research, monitoring and management actions.

Further details of the annual review process are provided in **Section 9.2**.

An adaptive management approach will be taken, considering documented impacts of management activities and the results of the approved research and monitoring program. Feedback from the monitoring program that indicates mitigation and management measures are not meeting targets will trigger a review of the relevant goals, performance criteria and triggers to ensure that they are adjusted in response to suit the results of the monitoring program. Updates to the management plan will be made in consultation with DoE and DES. Revisions of the survey and monitoring program will be carried out in consultation with the BTF Recovery Team, in accordance with Condition I7 of the EA.

If pre-clearance surveys identify habitat for BTF not previously identified and reported to DoE and DES, Adani will notify the Departments in accordance with requirements in project conditions.

Work that has the potential to generate new and/or unapproved impacts to BTF must cease until the updated management plan has been considered by DoE. The updated management plan will detail how impacts to the newly identified communities will be avoided, mitigated and/or offset. Once approved, the revised management plan will be implemented.

9.2 Reporting

Adani will prepare an annual report on 1 July each year and will be made available to the administering authority for the *Environmental Protection Act 1994* on request. The annual report will summarise the activities implemented under the plan, and discuss the effectiveness of mitigation measures, based on the results of monitoring activities. The results of research and monitoring activities will be used to inform an annual reassessment of project risks on BTF, as part of the annual reporting process. This assessment will consider the following:

- Has new information become available about vulnerabilities of BTF to project impacts?
- Are mitigation measures still considered to be appropriate, given new knowledge gained through research and monitoring?
- What adaptive changes to mitigation and monitoring measures are recommended on the basis of new information collected during the past 12 months?

In accordance with Condition 17 of the EA, the BTF Management Plan will be reviewed annually by an appropriately qualified person, with findings included in the annual report. The independent review will:

- Assess the plan against the following requirements of Condition 16 of the EA:
 - o A baseline research program on the specific nesting and feeding requirements of the species that will be undertaken prior to and during project stage 1
 - o A baseline research program to establish whether the BTF at the project site are sedentary, locally migratory or regionally migratory
 - o A description of how the results of baseline research are to be used to determine any changes of classification of and/or impact on BTF habitat
 - o Details of proposed impacts to BTF habitat from each project stage including impacts from clearing, subsidence, ecological function changes, hydrological changes and weed and pest infestation changes
 - o Mitigation measures to be undertaken to avoid, mitigate and manage impact resulting from each stage of the project, including rehabilitation of habitat
 - o Monitoring of watering points that must be conducted for a minimum six (6) hour period commencing from dawn, to accurately capture BTF utilisation of water points
 - o Detailed botanical assessment that must occur at all BTF sighting locations in the Project Area to record habitat values at those locations
 - o Detailed survey that must occur across the mining lease area and approved offset areas and must include information on BTF movements. The survey method and effort must be sufficient to accurately describe the BTF home range and detail BTF resource usage patterns between seasons and years (for up to 10 years) and allow robust management actions to be developed for the maintenance of a viable local BTF population
 - o Survey work that should incorporate the usage of call playback and identify all birds present when BTF are encountered
 - o Specific surveys that must be undertaken during the BTF breeding season and include nest location and assessment of the habitat attributes associated with the breeding locations. The survey method and effort must be sufficient to accurately describe the BTF breeding requirements with consideration to spatial and temporal variation of resources of up to 10 years
 - o Survey and monitoring that must be undertaken by experienced ecologists.
- Include recommended actions to ensure actual and potential environmental impacts are effectively managed for the coming year
- Identify any amendments made to the BTF SMP following the review.

All revisions of the survey and monitoring program must be carried out in consultation with the BTF recovery team. Any revisions must be independently peer reviewed.

In addition, Adani will publish a report on its website addressing compliance with each of the conditions of EPBC 2010/5736, including implementation of the BTF Management Plan. The report will be published within three months of every 12 month anniversary of the commencement of the project, in accordance with the requirements of Condition 31 of EPBC 2010/5736. Details of the date of publication and any non-compliance with approval conditions will also be provided to DoE.

Adani will conduct periodic audits to monitor compliance with management plan commitments, in accordance with the Adani quality system. Adani will integrate the management plan commitments with other aspects of the mine construction and operations, to avoid actions being overlooked. It should be noted that reporting timeframes outlined in this plan apply only BTF.

This plan will be available to all employees, contractors and subcontractors. Adani will amend the management measures as necessary in response to regular reviews, monitoring results and changes in legislation, in consultation with regulatory authorities.

9.3 Qualifications

Persons implementing key tasks described in this management plan will have appropriate training, skills and professional qualifications relevant to their role and responsibility. BTF ecologists must be able to provide authoritative assessment, advice and analysis on performance relating to the BTF using the relevant protocols, standards, methods or literature. It is expected that suitably qualified personnel involved in the implementation, review and amendments to this plan will include an ecologist / ornithologist with recent field experience with the species and a knowledge of the habitat and ecological requirements of the BTF.

Fauna spotter-catchers must have demonstrable identification and handling skills, and behaviour knowledge (including nesting requirements) relevant to the BTF, and all threatened fauna species that may, are likely, or are known to occur in the Project Area. Fauna spotter-catchers must be suitably qualified and working under a valid permit from DES.

10 Commitments and actions included in this plan to be delivered by Adani

Table 13 provides a register of key reporting, mitigation and monitoring commitments arising from this plan. This will assist Adani and its contractors to monitor progress with implementation of the plan. Aspects of the monitoring design that should be considered for BTF are described in **Section 7**. These will be taken into consideration by ecologists implementing the management plan.

Table 13 Commitments and actions included in this management plan to be delivered by Adani

Issue	Number	Commitment
Reporting and Notifications	1	Prepare an annual report on 1 July each year and make available to the Administering Authority upon request. .
	2	Conduct periodic audits on compliance with this plan.
	3	Non-compliances with the BTF Management Plan will be identified and recorded through an auditing process.
	4	Work that has the potential to generate new and/or unapproved negative impacts to BTF must cease until the updated management plan has been considered by DoE. The updated management plan will detail how impacts to the newly identified communities will be avoided, mitigated and/or offset. Once approved, the revised management plan will be implemented.
Mitigation	5	Use discretion where possible in the placement of some infrastructure to avoid disturbance to BTF habitats and populations.
	6	Prior to the commencement of site works, any conditions listed in the “Permit to Disturb” will be implemented - e.g. clearing extents clearly marked, trees/areas requiring protection clearly marked, or barricaded. All BTF habitat clearing operations are to be monitored for compliance by a suitably qualified person.
	7	Undertake pre-clearance surveys prior to the commencement of clearing activities, to confirm and identify known areas of occurrence.
	8	Surveys of the area to be disturbed prior to and during construction are to be conducted by a fauna spotter-catcher in BTF habitat areas and remnant vegetation areas. Fauna to be recorded and translocated to suitable habitat adjacent to the disturbance area, where practical. Fauna deaths and injuries to be recorded and managed in accordance with relevant Permit Conditions (e.g. Rehabilitation (Spotter-catcher) Permit) and guidelines. BTF nesting areas observed in areas not to be disturbed will be marked and mapped and monitored during construction and operations works.
	9	Rehabilitate disturbed areas following construction activities where such activity does not compromise the ongoing operation of the project. Progressive rehabilitation of disturbed areas will be undertaken in accordance with the Rehabilitation Management Plan.
	10	Progressive rehabilitation of disturbed areas will be commenced as soon as practical after it has been confirmed that no further activities will occur in each area. Rehabilitation will generally commence within 6 months, unless it is considered more effective to align with the next wet season.
	11	Implement environmental offsets to enhance habitat values used by BTF.

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Issue	Number	Commitment
	12	Implement an induction program for staff and contractors about BTF and other threatened species, their habitats and identification. Use posters in prominent work locations to maintain awareness. Implement sound land management practices.
	13	Use directional lighting and strategic timing and placement of lights to minimise light spill into adjacent habitat.
	14	Ensure all plant and equipment is serviced and maintained to minimise machinery noise and vibration.
	15	Management of erosion and sedimentation will be undertaken in accordance with a Project Erosion and Sediment Management Plan.
	16	Mine-related wire and mesh material near water sources will be removed and/or covered to prevent entrapment, if practical
	17	Domestic animals will not be permitted into the Project Area apart from cattle (including horses and dogs during mustering activities).
	18	Monitor BTF populations and their habitats in areas where subsidence occurs.
	19	Weed and pest animal control will be implemented during construction and operations.
	20	Permanent water sources in retained habitat areas will not be drained during construction and operations, unless suitable alternative water supplies are available.
	21	Monitoring BTF populations and their habitats in areas where subsidence occurs.
Monitoring	22	Monitor the presence and population abundance of invasive fauna.
	23	Measure the effectiveness of offset investments by monitoring the quality of offset areas.
	24	Any injured wildlife will be either taken to the nearest qualified veterinary practitioner or wildlife carer, or humanely euthanised on site by a suitably qualified person.
	25	Monitor dust level impacts on BTF habitat, and in water bodies within and adjacent to construction activities.
	26	Monitor water quality in BTF habitat, in accordance with the Surface Water Monitoring Plan.
	27	Annual monitoring (including photo monitoring) of water source availability, in the driest season, in known BTF habitat.
	28	Monitor the incidence of Project-related fire.
	29	Pre-clearance and annual BioCondition assessments and photo monitoring will be completed to determine the condition of retained BTF habitat in impact and control sites. Monitoring will be in conjunction with a research program to monitor remnant vegetation changes over subsidence areas.
	30	Measure the effectiveness of rehabilitation activities through BioCondition monitoring.

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Appendix A Overview of Project Management Plans

This section provides a summary of the EMP prepared to support an EIS process for the Carmichael Coal Project under the EPBC Act and SDPWO Act. The summary is intended to assist readers of the Species Management Plan understand the other management plans in place and how they relate to the management of threatened species and communities. The summary reflects the findings and recommendations of studies undertaken for the EIS. Further details of the management plans can be found at this link <http://www.adanimining.com/aeis-documents>

Each management plan covers design and construction requirements, operational activities and decommissioning. The management plans consider open cut mining, underground mining, mine infrastructure areas, out of pit waste rock dumps, mine water management dams, office, workshop and other facilities and power, water distribution and offsite infrastructure (e.g. worker's accommodation, airport, water supply infrastructure and road upgrades).

The overall project EMP provides details and implementation details for the following aspects: air quality, greenhouse gas emissions, noise and vibration, surface water, groundwater, mine waste management, general and hazardous waste management, terrestrial ecology, aquatic ecology, biosecurity management, scenic amenity, erosion and sediment control, contaminated land, soil resources, aboriginal cultural heritage, non-indigenous cultural heritage, subsidence management, emergency management and response and community. A summary of those plans most relevant to the protection of MNES is summarised below.

The project EMP is a working document and will be updated as required to reflect changes in impacts or mining activities, changes in legal and other obligations and changes from learning and corrective actions through monitoring activities.

Air quality

The management objectives for air quality include protection of biodiversity through avoiding nuisance from dust deposition and meeting EPP (Air) objectives for dust emissions at sensitive receptors. Particulate matter could affect fauna and plants through coating of plant leaves, making them less palatable for fauna and affecting photosynthesis.

Key measures include prevention of dust through planning and sequencing of exposed soils; stockpile design and stabilisation; suppression activities for coal stockpiles and haul roads, access tracks and work areas; and progressive rehabilitation of disturbed areas.

Dust generation will be monitored visually and through and corrective action applied where train loading is generating dust or dust lift off is travelling beyond the lease boundary.

Noise and vibration

The Noise and Vibration Plan aims to protect the qualities of the acoustic environment that are conducive to protecting biodiversity. Potential impacts are possible due to civil works during construction, increased traffic, pile driving, rock breaking, blasting and other mining related activities. In general most of these activities are not expected to affect sensitive receptors.

Airblast overpressure monitoring will be undertaken at sensitive receptors during initial blasting activities as well as other mitigations and monitoring controls that are largely aimed at protection of acoustic quality for surrounding homesteads.

Surface water

The Surface Water Management Plan aims to ensure that Environmental values relating to aquatic ecosystems, stock and domestic use and cultural values are maintained and that discharge and overflow events are undertaken in accordance with the relevant conditions under an environmental authority issued by DES.

Contamination of surface water resources could result from release of mine affected water, wastewater generation and treatment, hydrocarbon leaks or spills, spoil disposal, release of sediments through clearing and earthworks, or draining of low quality water from existing farm dams.

A mine water management system will be implemented based on segregation of water streams into clean, dirty and mine affected streams. Clean water will be managed by diverting around disturbed areas or through the proposed mine in watercourse diversions. Dirty water will be directed to sediment dams to allow sediment to settle out. This water can then be used for dust suppression.

The key management actions to be employed in the prevention of surface water loss and contamination include:

- Prepare and implement a Water Management Plan in accordance with the guideline Preparation of Water Management Plans for Mining Activities
- Preparation and implementation of a Receiving Environment Management Plan including water quality objectives, trigger levels, monitoring and contingency procedures
- Design all watercourse crossings to maintain flow and minimise afflux where this may affect sensitive receptors;
- Design of infrastructure to appropriate standards based on relevant guidelines and all available data to minimise impacts to surface water
- Prohibition of construction water sourced from the Carmichael River
- Controls on design and construction of dams
- Controls for draining of farm dams
- Preparation and implementation of a Plan of Operations for Mine Affected Water and sediment dams, including monitoring and requirements and procedures for discharge

Monitoring will include surface water levels and quality across a network of monitoring sites with at least twelve months of baseline data.

Groundwater

This Plan aims to ensure that impacts on groundwater dependent ecosystems do not cause unacceptable or unapproved losses of biodiversity values including impacts to fauna habitat. Potential threats to groundwater include drawdown from dewatering activities and contamination from spills or leaks.

Key management actions to be employed in the prevention of impacts to groundwater include:

- Groundwater quality trigger levels
- Identify potential impacts before excavation to inform measures required in work permits prevent contaminated runoff through development and implementation of a Surface Water Management Plan
- Laydown and storage areas to be located away from creeks and rivers or sensitive receptors

- On-going monitoring of groundwater levels and updates to models

Monitoring will include groundwater flows to the Carmichael River, groundwater levels and quality across a network of bores.

Pests and Weeds (Biosecurity Management)

Management objectives are to achieve no increase or spread of weeds beyond pre-development conditions as a result of project activities and no unapproved biosecurity management activities. The scope of activities under the plan includes 22 introduced plant species recorded during surveys of the Project Area, of which Parthenium and Prickley Pear are most significant. Eight introduced fauna species are also addressed, including the feral cat, pig, cane toad, dingo, house mouse and rabbit. The plan will manage potential environmental impacts from pests and weeds through vehicle movements, construction activities and ongoing operations. Proposed controls include the following activities:

- Mapping of weeds prior to commencement of construction activities
- Containment of food scraps in sealed containers
- Limitations on the movement of vegetation and soil waste
- Use of weed wash down areas for vehicles and equipment
- No domestic animals in the Project Area
- Feral animal control programs, if necessary.

There will be ongoing monitoring of pests and weeds throughout the Project Area, using baseline and reference sites.

Erosion and Sediment Control

A total of 19 soil types were identified within the Project Area based on geology, landform, native vegetation and soil profile features. It is important to reduce soil loss from the site for the management environmental values relating to both soil and water. Vegetation clearing, topsoil stripping, earthworks, and stockpiling will result in disturbance and exposure of soils to erosive forces from either overland flows of water or wind action. Soil loss reduces soil productivity and removes nutrients and organic matter. Sediment mobilised by overland flow can affect adjacent watercourses through increased turbidity, deposition of sediment on aquatic ecosystems, geomorphological changes and reduced water quality for other water users. Plan objectives are to avoid degradation of aquatic ecosystems and water supply values downstream as a result of sediment releases, and that topsoil resources will not be lost through erosion. Proposed controls include the following activities:

- Preparation of detailed erosion and sediment control plans for each aspect of the project
- Design stormwater systems to include sediment retention basins
- Locate infrastructure away from drainage lines and steep slopes, where ever practicable
- Where practical, schedule works to avoid wet conditions, or if in streams, outside times of flow
- Minimise the areas to be disturbed
- All disturbed areas will be revegetated or protected from erosion using suitable control measures

Monitoring activities will include the inspection of sediment control devices and stormwater systems, including diversion drains and outlets.

Subsidence Management

The management plan objective is that a stable and sustainable landform is created over subsided areas which maximises opportunities for the subsided areas to support native vegetation and fauna. Waterways are important considerations when addressing the potential environmental impacts from subsidence. The Carmichael River is the regional drainage line in the area, and a 500 m buffer from subsided areas will be maintained on either side of the river. Potential impacts from subsidence include altered topography and drainage patterns, tension cracks in the ground surface and disturbance to the root zones of vegetation. Proposed controls include the following activities:

- Develop a detailed management plan in accordance with the mine Environmental Authority
- Design creek diversions around the open cut areas to remain functional after subsidence
- Establish monitoring locations including transects of topographical features and habitat values
- Exclude cattle from subsidence areas.

Monitoring activities will include regular inspections of subsided areas, vegetation health assessments, inspections of ponding in subsidence troughs and groundwater assessments.

Bushfire Management

The **Bushfire-Fire** Management Plan provides a framework and guidance for:

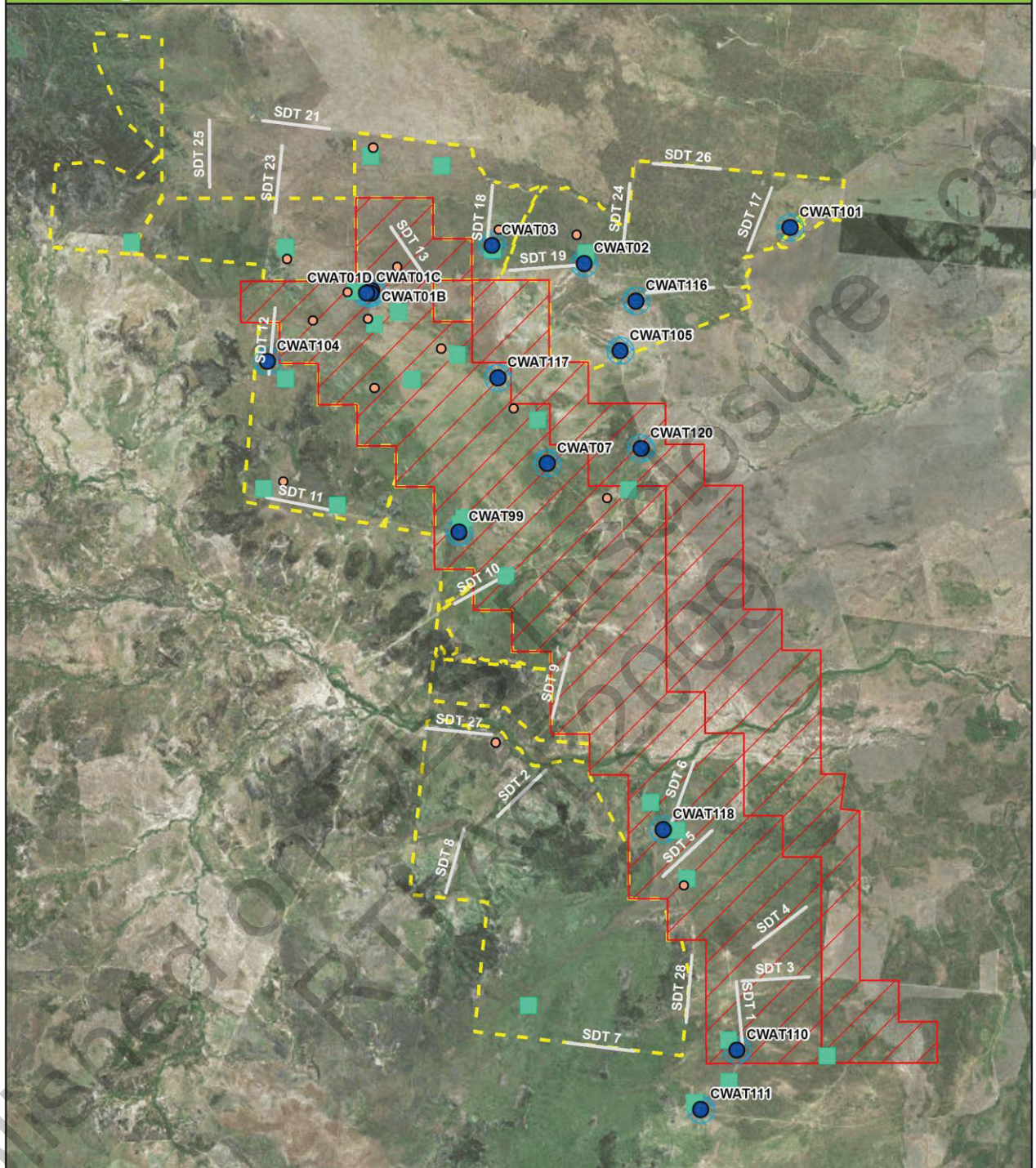
- Identifying, monitoring and prioritising the management of fire risk in the Operational Area
- Preventing bushfires and managing fires throughout the Operational Area
- Developing site-specific and/or activity specific fire management procedures across the life of the project.

The plan is focussed on an overarching strategy to identify, avoid, prevent, minimise and control bushfires. Specific measures are provided on how this will be achieved, and include mapping of relevant environmental features, maintain fire infrastructure (e.g. fire breaks) and levels of fire preparedness. The use of fire in environmentally or culturally sensitive areas is also discussed.

Appendix B Location of Monitoring Sites

The location of monitoring sites are shown on maps on the following pages. The first map shows the location of waterhole surveys sites, 1 km transects, vegetation (BioCondition) transect sites, slow drive transects (historic) and active search areas. The second map shows the location of 2 ha groundcover biomass monitoring sites, which will be monitored in May of each year.

Monitoring Sites



Legend

The Project

- ▬ Carmichael Mine
- ▬ Offset Area Boundary

- Waterhole Survey Sites
- 1km Transects
- Vegetation Transect Sites
- Active Search Areas
- Slow-drive Transects

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Datum/Projection:
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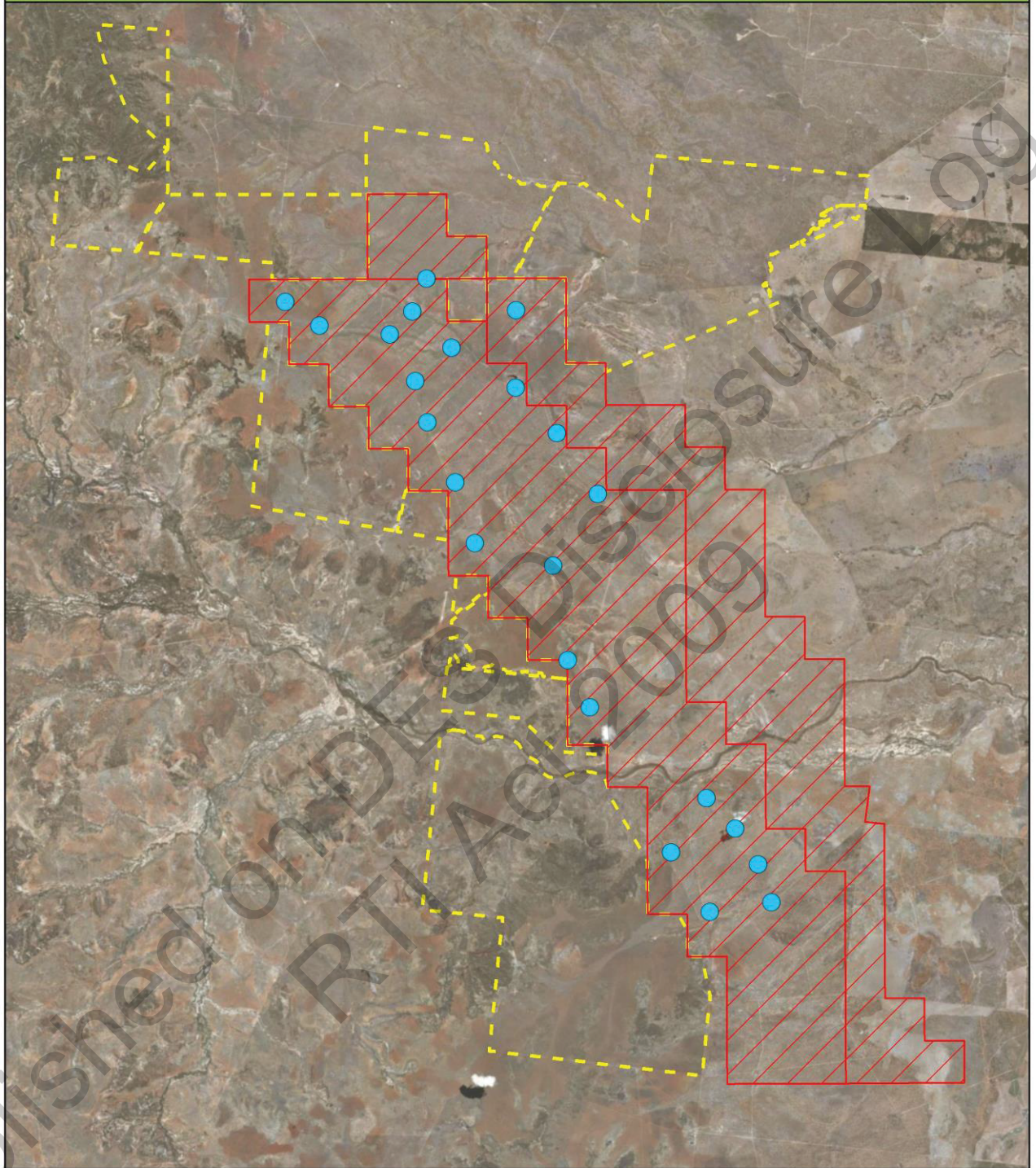


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Prepared by: LA Date: 13/06/2018

2ha Groundcover and Composition Monitoring Sites

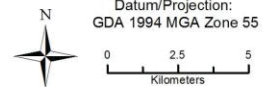


Legend

- Carmichael Mine
- Offset Area Boundary
- 2ha Groundcover and Composition Monitoring Sites

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Prepared by: SM Date: 13/06/2018

Appendix C Black-throated Finch Research Program

Published on DES Disclosure Log
RTI Act 2009

Appendix D Compliance with Approval Conditions

A table demonstrating compliance with relevant approval conditions is provided on the following pages.

Published on DES Disclosure Log
RTI Act 2009

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
EPBC Act Approval, condition 5	At least three months prior to commencement of mining operations, the approval holder must submit to the Minister for approval Matters of National Environmental Significance plan/s for the management of direct and indirect impacts of mining operations on (MNESMP). Note: If the MNESMP does not address any specific future activities (e.g. possible additional seismic surveys or specific mining stages) it should be updated in accordance with Condition 33.	The BTF Management Plan was lodged on 11 May 2017. This plan addresses the management of direct impacts of mining construction and operations on the BTF. Specifically, management actions of direct impacts are located in Table 8. This plan addresses the management of indirect impacts of mining construction and operations on the BTF. Specifically management actions of indirect impacts are located in Table 9 and Table 10. If this management plan does not address any specific future activities (e.g. possible additional seismic surveys or specific mining stages) it will be updated in accordance with condition 33 of the EPBC Act approval.	Section 6.3.3 (Table 8) Section 6.3.3 (Tables 9 and 10)	
EPBC Act Approval, condition 6	The MNESMP must be consistent with relevant recovery plans, threat abatement plans and approved conservation advices and must include:	This plan is consistent with the BTF Recovery Plan. Threats identified in the BTF Recovery Plan are addressed specifically in Section 4.6 and Table 4. These threats include clearing and fragmentation of vegetation, degradation of habitat by stock and pest species, alteration of habitat by fire regime, invasion by exotic weeds including grasses and predation by introduced predators. Potential project impacts are discussed in Section 4.6. Monitoring and research activities of the BTF Management Plan closely align with recovery objectives described in Section 5 of the BTF Recovery Plan (e.g. investigate breeding requirements, quantify distribution and abundance, investigate feeding and other habitat requirements). Further details of these measures are provided in Section 7 of the BTF Management Plan. There are no 2 current threat abatement plan or conservation advices in force for the BTF <u>that were considered in the development of this plan</u> . These are with regard to: <ul style="list-style-type: none"> • <u>competition and land degradation by rabbits (DEWHA, 2008)</u> • <u>reducing the impacts on northern Australia's biodiversity by the five listed grasses DSEWPAC (2012).</u> 	<u>Section 3.4</u> Section 4.6 and Table 4 Section 7	
	a) A description of environmental values for each of the Matters of National Environmental Significance addressed in the plan	A description of environmental values for the BTF is provided in Section 4 of the BTF Management Plan. The description includes the status under Commonwealth and State legislation, regional populations, habitat requirements, breeding ecology, occurrence in the vicinity of the project area.	Section 4	
	b) Details of baseline and impact monitoring measures to be implemented for each of the Matters of National Environmental Significance including control and impact sites to be monitored throughout the life of the project. The monitoring must provide sufficient data to quantify likely impacts resulting from mining operations, including subsidence and changes in groundwater levels, to set habitat management goals (conditions 6e) and 6f)	A description of baseline and impact monitoring measures for the BTF is provided in Section 7 of the BTF Management Plan. The section describes the need for monitoring to occur prior to project commencement, as well as during construction and operations. The location of monitoring sites is provided in Appendix B, with control and impact sites to be established (Section 7.1.2). The monitoring will quantify impacts resulting from mining activities and provide feedback on the effectiveness of mitigation measures. The monitoring will include consideration of the impacts from subsidence, and groundwater draw down on BTF habitat values and water availability (see Section 7.1.2). Habitat management goals are set in Section 6.	Section 7, Appendix B Section 7.1.2, Section 6.	
	c) Details of potential impacts, including area of impact on each of the Matters of National Environmental Significance from mining operations, including impacts from:	Details of potential impacts of the project on the BTF are addressed in Section 4.6 of the BTF Management Plan. An area of impact is provided in relevant subsections of Section 4.6 for potential impacts for which a quantitative estimate can be provided (e.g. vegetation clearing and subsidence). Potential impacts are also discussed in Section 6 in the context of mitigation measures to minimise impacts.	Section 4.6, Section 6.	
	(i) Vegetation clearing		Section 4.6.1	
	(ii) Subsidence from underground mining, including subsidence induced fracturing and any changes to groundwater or surface water flow		Section 4.6.2	
	(iii) Mine dewatering		Section 4.6.8	
	(iv) Earthworks		Section 4.6.9	
	(v) Noise and vibration		Section 4.6.10	
	(vi) Emissions (including dust)		Section 4.6.11	
	(vii) Light spill and other visual impacts		Section 4.6.12	
	(viii) Stream diversion and flood levees		Section 4.6.13	

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
	(ix) Weeds and pests		Section 4.6.3 and 4.6.6	
	d) Measures that will be undertaken to mitigate and manage impacts on Matters of National Environmental Significance resulting from mining operations. These measures must include but not be limited to:	A description of measures that will be undertaken to mitigate and manage impacts on the BTF resulting from mining operations is provided in Section 6.	Section 6	
	(i) The use of fauna spotters prior to and during all vegetation clearing activities to ensure impacts on Matters of National Environmental Significance are minimised	All BTF habitat clearing operations will be monitored for compliance by a suitably qualified fauna spotter-catcher during clearing activities, to ensure impacts on BTF are minimised. The approach is outlined in Tables 7 and 8 of the BTF Management Plan and Section 6.3.2.	Table 7, Table 8, Section 6.3.2	
	(ii) Measures to avoid impacts on Matters of National Environmental Significance and their habitat located in the Project Area, but outside areas to be cleared, constructed upon and / or undermined, including adjacent to cleared areas	Measures to avoid impacts on BTF and their habitat outside areas to be cleared around described in Section 6.4 and Table 9 of the BTF Management Plan. They include matters such as the management of grazing, fire, water and pests.	Section 6.4, Table 9	
	(iii) Measures to rehabilitate all areas of Matters of National Environmental Significance habitat	Details of rehabilitation of disturbed areas are provided in Section 6.1 and Table 8 of the BTF Management Plan. Monitoring initiatives to determine the success of rehabilitation activities are described in Section 7.	Section 6.1, Table 8, Section 7.	
	(iv) Habitat management measures including but not limited to management of subsidence and groundwater impacts of the project	Mitigation measures for subsidence are provided in Table 8 and address subsidence. Table 10 provides details for mine dewatering.	Table 8 and Table 10.	
	e) Goals for habitat management for each relevant Matters of National Environmental Significance	Goals for habitat management of the BTF are provided in Section 6.4 of the BTF Management Plan. These include maintaining the three main habitat elements: woody layer of vegetation, herbaceous layer of vegetation and water sources. Factors affecting these values are also discussed (e.g. grazing and fire). Table 9 provides further details on how goals will be achieved.	Section 6.4 and Table 9	
	f) A table of specific criteria for assessing the success of management measures against goals, and triggers for implementing corrective measures if criteria are not met within specified timeframes. This table must include but not be limited to measures relating to subsidence and groundwater impacts, including early warning triggers for impacts on groundwater at the Doongmabulla Springs Complex and the Carmichael River. Goals and triggers must be based on the baseline condition of the relevant Matters of National Environmental Significance as determined through baseline monitoring (see Conditions 3b) and 6b)). Corrective measure must include provision of offsets where it is determined that corrective management measures have not achieved goals within specified timeframes (see Conditions 11m) and 11o))	Table 8, Table 9 and Table 10 of the BTF Management Plan provides goals, performance criteria, mitigation measures, triggers and correction actions. The effects of subsidence and groundwater impacts on BTF habitat (i.e., habitat modification) are included in Table 8, Table 9 and Table 10. Goals and triggers are based on the baseline condition of BTF habitat as determined from several years of baseline monitoring surveys. These focus on a range of vegetation and floristics data collected since the EIS. See Table 8, Table 9, Table 10 and Appendix E and F (summary of baseline nesting and analysis). Section 6.5 of the BTF Management Plan describes the approach to achieving offsets and states that if additional impacts are proposed, or occur unexpectedly, then additional offsets will be provided, subject to approval from government agencies. This is stated to include circumstances where the corrective management measures have not achieved the goals within specified timeframes, and resulted in impacts beyond those that were originally approved. Table 8 also states a corrective action that may include the provision of offsets.	Section 6.4, Table 8, Table 9 and Table 10. Table 8, Table 9 and Table 10. Table 8, Table 9, Table 10 and Appendix E and F Section 6.5 and Table 8.	
	g) An ongoing monitoring program to determine the success of mitigation and management measures against the stated criteria in Condition 6f), including monitoring locations, parameters and timing. Monitoring for water resources Matters of National Environmental Significance must include hydrogeological, hydrological and ecological parameters	Details of the ongoing monitoring program are provided in Section 7 of the BTF Management Plan, and specifically Tables 8 to 10 address evaluating the success of mitigation measures. There are objectives to assess the success of mitigation and management measures.	Section 7 and Tables 8 to 10	
	h) Details of how compliance will be reported	Reporting and compliance procedures are described in Section 9 of the BTF Management Plan. Section 9.2 provides details of periodic reporting and audits to monitor compliance with management plan requirements.	Section 9	

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
	i) Details of how the MNESMP will be updated to incorporate and address outcomes from research undertaken for Matters of National Environmental Significance under this and any state approvals, including updating of goals, criteria and triggers (as required under Conditions 3c), 3d) 6e) and 6f))	Section 9.1 of the BTF Management Plan provides details of how the plan will be updated in response to outcomes of research, monitoring and management actions. An adaptive management approach will be taken and revisions to the survey and monitoring program will be carried out in consultation with the BTF recovery team, in accordance with Condition 17 of the EA. Section 6.1 of the BTF Research Program provides details of how the adaptive management process will be applied to BTF research.	Section 9.1	Section 6.1
	j) Provisions to ensure that suitably qualified and experienced persons are responsible for undertaking monitoring, review and implementation of the MNESMP	Section 9.3 of the BTF Management Plan outlines the qualifications of persons responsible for monitoring, reviewing and implementing the plan. This relates primarily to the qualifications of ecologists conducting field surveys and of spotter-catchers that may be involved in handling or managing the impacts of clearing on the species.	Section 9.3	
	k) In the event that future baseline research required by the Queensland Coordinator-General (Appendix 1, Section 3, Condition 1 of the Coordinator-General's Assessment Report) identifies that the Mellaluka Springs Complex provides high value habitat for the Black-throated finch, the approval holder must include management measures to address impacts resulting from drawdown at the Mellaluka Springs Complex in the MNESMP	Studies have determined that the Mellaluka Springs Complex does not provide BTF habitat. A letter from the Office of the Coordinator-General, dated 22 July 2016, has been received confirming the Commonwealth and Queensland government's acceptance of this finding.	Not applicable	
	l) Details of how, where habitat for an EPBC Act listed threatened species or community not previously identified and reported to the Department is found in the Project Area, the approval holder will notify the Department in writing within five business days of finding this habitat, and within 20 business days of finding this habitat will outline in writing how the conditions of this approval will still be met (refer Condition 11j)).	This condition is addressed in the approved threatened species management plan for the Carmichael Mine. Section 5.1 of that plan says "In the event that new species or Threatened Ecological Communities are found, then DoE and/or DES will be notified within five business days and Adani will outline how the conditions of this approval will still be met within 20 business days". The BTF Management Plan deals only with the BTF.	Not applicable	
EPBC Act Approval, condition 7	Mining operations must not commence until the required MNESMP have been approved by the Minister in writing. The approved plan must be implemented. Note – Management plans such as the Black-throated Finch Management Plan and the Groundwater Dependent Ecosystems Management Plan may also be required under state approvals. Wherever possible a combined document should be prepared to address both state government and EPBC Act approval conditions. Note – Impacts of the action other than mining operations will be offset as required in accordance with Conditions 8 to 11, but will be otherwise managed in accordance with state approvals – this is of particular relevance when impacts may occur prior to approval of the MNESMP.	Mining operations will not commence until this plan has been approved. This plan addresses the combined requirements of the Commonwealth and Queensland governments in one document, as encouraged by the condition.	Not applicable.	
Carmichael Coal Mine and Rail Infrastructure Project Coordinator-General's Report, Imposed Condition 1.	Black-throated Finch (southern) baseline research for the Carmichael project	Adani has undertaken extensive baseline research and monitoring since the EIS, and prior to the commencement of Project Stage 2. This work is ongoing and is summarised in Section 2.6 of the BTF Research Program.		Section 2.6
	a) To increase the knowledge of the ecological requirements of BTF populations likely to be directly and indirectly impacted by the project, the proponent must undertake further baseline research prior to the commencement of Project Stage 2.			
	(b) Prior to continuing the baseline research, a suitably qualified person must finalise a baseline research plan to the satisfaction of the authority responsible for administering threatened species provisions of the <i>Nature Conservation Act 1992</i> that includes a description of chosen methodologies.	A Research Program is established in Appendix C of the BTF Management Plan. This provides details of the chosen methodologies and research objectives. Adani has maintained ongoing consultation with DES on the progress of baseline monitoring surveys (Section 2.6 of BTF Research Program) and incorporated feedback into the development of the Research Program.		Entire document
	(c) The baseline research must include: (i) a minimum of two wet season surveys of the project area (ii) a minimum of two dry season surveys of the Mellaluka Springs Complex (iii) the collection of floristic data to enable the identification and mapping of key seasonal (wet and dry season) food sources.	To date, baseline research work conducted by Adani includes 10 surveys across both wet and dry seasons between 2012 and 2018, as summarised in Section 2.6 of the BTF Research Program. Surveys of the Mellaluka Springs Complex have been completed to the satisfaction of DES and DoE, as outlined in letter from the Office of the Coordinator-General, dated 22 July 2016. Monitoring has included floristic data to enable the identification and mapping of key seasonal food sources. This baseline research is ongoing, as outlined in Section 7 of the BTF Management Plan and Section 4 of the BTF Research Program.		Section 2.6, Section 4

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
	<p>(d) The baseline research must determine:</p> <p>(i) whether the Mellaluka Springs Complex provides BTF habitat, particularly as a refuge during the dry season</p> <p>(ii) movement patterns, habitat requirements and population dynamics, including dietary requirements, home range, nesting requirements</p> <p>(iii) responses to grazing management, fire management and water body locations.</p>	<p>In July 2016, the Office of the Coordinator-General confirmed the baseline research work undertaken by Adani has satisfied the requirements of Imposed Condition 1: part (d)(i).</p> <p>To date, baseline research work conducted by Adani includes 13 surveys across both wet and dry seasons between 2010 and 2018, as summarised in Section 2.6 of the BTF Research Program. Findings of this work in relation to nesting, feeding habitat and dietary requirements are summarised in Appendix E and F. This work is ongoing, as outlined in the BTF Research Program.</p> <p>Responses of the BTF to grazing management, fire management and water body locations are key research objectives as outlined in Section 4 of the BTF Research Program.</p>	Appendix E and F	Section 4
Carmichael Coal Mine and Rail Infrastructure Project Coordinator-General's Report, Imposed Condition 4 and Condition 5 (apportionment of costs).	Proponent contribution to BTF Bioregional Management Plan	<p>The BTF Management Plan includes an ongoing monitoring program (Section 7) and Research Program (Appendix C) for BTF. There is not yet any bioregional management plan established by government to address regional impacts to the BTF arising from multiple mines proposed for the Galilee Basin. Adani is committed to participating in the BTF Bioregional Management Plan should this be established in the future.</p>	Section 7	Entire document
	<p>a) To address project impacts and maximise the ongoing protection and long-term conservation of the Black-throated finch (BTF) southern subspecies (<i>Poephila cincta cincta</i>), and its habitat in the Galilee Basin and Desert Uplands bioregion, the proponent must, when required by the administering authority responsible for the threatened species provisions of the <i>Nature Conservation Act 1992</i>:</p> <p>(i) Prepare, to the satisfaction of the administering authority, an ongoing BTF monitoring program that takes into account the relevant requirements of any BTF Bioregional Management Plan specified in Appendix 1, Section 2, Part B and the outputs of baseline research required in Appendix 1, Section 3, Condition 1</p>			
	<p>(ii) Provide baseline and survey results in the format and at intervals specified for the coordination of bioregional survey data to the administering authority for any BTF Bioregional Management Plan</p>			
	<p>(iii) Contribute to the operation of any BTF Bioregional Management Plan including pro-rata funding.</p> <p>Detailed condition about apportionment of costs for bioregional management plan.</p>			
Environmental Authority, condition I6	Black-throated finch (BTF) Species Management Plan (SMP) at Carmichael project	<p>The BTF Management Plan has been prepared and certified by Eco Logical Australia, a national environmental consulting company with ~200 staff. Correspondence has been provided to DES outlining the qualifications and experience of the management plan authors (demonstrating that they are suitably qualified), and providing certification. Project Stage 2 will not commence until the BTF Management Plan is approved by the administering authority. The BTF Management Plan will be published online within 10 days of approval by the administering authority and will be implemented.</p>	Entire document	Entire document
	<p>The holder of this environmental authority must submit a BTF SMP prepared and certified by a suitably qualified person to the administering authority prior to commencement of Project Stage 2 for approval. The holder must publish the BTF SMP on its website within 10 business days of receiving the administering authority's approval in writing. The approved BTF SMP must be implemented.</p>			
	<p>The holder must align the SMP with any Bioregional BTF Management Plan and relevant documentation requirements under the <i>Environmental Protection and Biodiversity Conservation Act 1999</i> including BTF Recovery Plan, conservation advice and the threat abatement plan.</p>			
	<p>The submitted BTF SMP plan must include:</p> <p>a) A baseline research program on the specific nesting and feeding requirements of the species that will be undertaken prior to and during project stage 1.</p>	<p>Adani has undertaken extensive and ongoing baseline monitoring of BTF, including the specific nesting and feeding requirements of the species. This work has been undertaken prior to and during project stage 1, since the wet season of 2012. Details of the monitoring program are provided in Section 2.6 of the BTF Research Program. Appendix E also summarises the findings of this monitoring.</p>	Appendix E	Section 2.6

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
...	The submitted BTF SMP plan must include: b) A baseline research program to establish whether the BTF at the project site are sedentary, locally migratory or regionally migratory.	Adani has undertaken extensive and ongoing baseline monitoring of BTF. Determining the home range and movement patterns of BTF in the project area is a major objective of the BTF Research Program (see Section 4.3)		Section 2.6, Section 3 and Section 4 of the Research Program
...	The submitted BTF SMP plan must include: c) A description of how the results of baseline research are to be used to determine any changes of classification of and/or impact on BTF habitat.	Section 5 of the BTF Management Plan describes the adaptive management framework that will be applied to deal with uncertainty and incomplete knowledge using systematic monitoring to reduce uncertainty and improve management actions over time. Section 6 provides details of how the learnings from this research will be applied to minimise project impacts on BTF, and Section 9.1 provides details of how this will be reported to the Department. Further details on the adaptive management approach to applying research findings are also provided in Section 6.1 of the BTF Research Program.	Sections 5, 6 and 9.1	Section 6.1
...	The submitted BTF SMP plan must include: d) Details of proposed impacts to BTF habitat from each project stage including impacts from clearing, subsidence, ecological function changes, hydrological changes and weed and pest infestation changes.	Details of potential project impacts are provided in Section 4.6 of the BTF Management Plan, including Table 4. Direct impacts from vegetation clearing and subsidence are provided for each stage of the project, consistent with the project Biodiversity Offset Strategy. The scale of indirect impacts are discussed, where this is possible to describe in a qualitative manner.	Section 4.6	
...	The submitted BTF SMP plan must include: e) Mitigation measures to be undertaken to avoid, mitigate and manage impact resulting from each stage of the project, including rehabilitation of habitat.	Detailed mitigation measures are provided in Section 6 of the BTF Management Plan. These cover issues such as clearing and fragmentation of habitat, injury to BTF during works, habitat degradation, loss of water resources and contamination of water sources. Rehabilitation of disturbed areas is addressed in Table 7 and Table 8.	Section 6 and Table 7 and Table 8	
...	The submitted BTF SMP plan must include: f) Monitoring of watering points that must be conducted for a minimum six (6) hour period commencing from dawn, to accurately capture BTF utilisation of water points.	Section 7.1.2.1 describes the approach to water source watches, which involve six continuous hours of survey commencing from dawn at 16 water sources where BTF have previously been recorded.	Section 7.1.2.1	
...	The submitted BTF SMP plan must include: g) Detailed botanical assessment that must occur at all BTF sighting locations in the Project Area to record habitat values at those locations.	Vegetation assessments are described in Sections 7.1.2.6 and 7.1.2.7 of the BTF Management Plan. They include vegetation transects, foraging plots and groundcover monitoring. Detailed research activities on BTF habitat are also outlined in Section 4.4 of the Research Program.	Section 7.1.2.6 and Section 7.1.2.7.	Section 4.4
...	The submitted BTF SMP plan must include: h) Detailed survey that must occur across the mining lease area and approved offset areas and must include information on BTF movements. The survey method and effort must be sufficient to accurately describe the BTF home range and detail BTF resource usage patterns between seasons and years (for up to 10 years) and allow robust management actions to be developed for the maintenance of a viable local BTF population.	Estimating the home range and movements of BTF is a key aim of the Research Program. Objectives, methods, variables to be monitored, resources and timing are outlined in Section 4.3 of the Research Program. Section 7.2 of the BTF Management also discusses this program of surveys.	Section 7.2	Section 4.3
...	The submitted BTF SMP plan must include: i) Survey work that should incorporate the usage of call playback and identify all birds present when BTF are encountered.	Call playback has been utilised in previous surveys as described in Section 4.5 of the BTF Management Plan and Section 2.6 of the Research Program. Section 7.1.2 of the BTF Management Plan describes monitoring methods and specifies that all birds are to be identified when BTF are encountered. This is also specified in Section 4.4.4 of the Research Program.	Section 4.5 and Section 7.1.2.	Section 2.6 and Section 4.4.4
...	The submitted BTF SMP plan must include: j) Specific surveys that must be undertaken during the BTF breeding season and include nest location and assessment of the habitat attributes associated with the breeding locations. The survey method and effort must be sufficient to accurately describe the BTF breeding requirements with consideration to spatial and temporal variation of resources of up to 10 years.	Determining the breeding habitat requirements of the BTF and the relationship with vegetation structure and composition and water is part of a key aim of the Research Program. Details of the objectives, variables to be monitored, methods, resources and timing are outlined in Section 4.4 of the Research Program. Section 7.2 of the BTF Management also discusses this program of surveys. Baseline monitoring activities described in Section 2.6 of the Research Program have also collecting information on nests, if present.	Section 7.2	Section 4.4

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
	The submitted BTF SMP plan must include: ... k) Survey and monitoring that must be undertaken by experienced ecologists.	The qualifications and experience required by ecologists implementing the BTF Management Plan are outlined in Section 9.3. The involvement of suitably qualified and experienced professionals in the implementation of the Research Program is also discussed in Section 4.1 of the Research Program.	Section 9.3	Section 4.1
Environmental Authority, condition 17	The BTF SMP under condition 16 must be reviewed by an appropriately qualified person annually and a report prepared on 1 July each year. The report must: a) Assess the plan against the requirements under condition 16. ... b) Include recommended actions to ensure actual and potential environmental impacts are effectively managed for the coming year. ...c) Identify any amendments made to the BTF SMP following the review. ... d) All revisions of the survey and monitoring program must be carried out in consultation with the BTF recovery team. e) Any revisions must be independently peer reviewed.	As outlined in Section 4.1 of the Research Program, The BTF Management Plan and Research Program will be reviewed annually by an appropriately qualified person, and revisions of the survey and monitoring program will be carried out in consultation with the BTF Recovery Team. Any revisions must be independently peer reviewed. An annual report of research findings and the results of the independent peer review will be provided to DES.		Section 4.1
Environmental Authority, condition 18	The baseline research program must fund a research project to determine the relationship between water sources, woody habitat and the BTF food sources within the mining lease area and approved offset areas to determine the inter-relationships among these factors.	The Research Program will determine the relationship between water sources, woody habitat and the FBT food sources within the mining lease area and approved offset areas, and the inter-relationships among these factors. This is explained in Section 4.2 of the Research Program, with further details provided in Sections 4.4 and 4.5 of the Research Program.		Sections 4.2, 4.4, and 4.5
Environmental Authority, condition 19	The baseline research program under Condition 16 must: a) Establish whether Ten Mile Bore and surrounds are high value habitat for the species, and b) Establish management actions to maintain the current BTF population of Ten Miles Bore and surrounds	Surveys completed by Adani to date have identified that BTF are particularly abundant in the area around Ten Mile bore (Section 4.5 of BTF Management Plan). Section 4.4 of the Research Program outlines the objective of determining whether Ten Mile Bore and surrounds are high value habitat for BTF. The research will also determine the characteristics of Ten Mile Bore and surrounds that contribute to its frequency of use and compare this with other waterholes and woodlands, through equivalent frequency monitoring. Currently Ten Mile Bore and surrounds are managed under the certified environmental management system. Routine checks of the water sources at Ten Mile Bore are carried out. The agistee for the Moray Downs pastoral lease also carry out checks of water sources as a part of their monitoring program. Interim management of the Ten Mile Bore area is discussed in Section 6.4.7. Monitoring and management actions for the Ten Mile Bore area will be reviewed and modified in line with BTF Research Program outcomes, as described in Section 4.6.1 of the Research Program.	Section 4.5 Section 6.4.7	Section 4.4 Section 4.6.1
Environmental Authority, condition 110	The holder of this environmental authority must maintain water troughs for BTF within undisturbed areas and surface areas of underground mining footprint, and repair where necessary troughs, pipes and tanks to a standard that maintains a constant source of water.	Troughs are identified as an important water source for BTF in the study area (e.g. Section 4.6.3 of BTF Research Program). Table 10 (Section 6.1) of the BTF Management Plan states that known water sources will be avoided, or alternative water sources established outside of disturbance footprint, if avoidance is not possible. Section 6.4.4 of the BTF Management Plan also states that current water sources outside of the clearing footprint are to be maintained. Where it is necessary to remove a particular water source within or nearby to BTF habitat, a new water source will be created.	Section 6.3.3, Section 6.4.4 and Table 10	Section 4.6.3
Adani Commitment, M4.29	Management actions will seek to maintain and where possible enhance Black-throated finch habitats and populations (e.g. pest control, water source, grazing and fire management) in unmined parts of the Mine Area, as well as in offset areas.	Section 6.1 of the BTF Management Plan states "Monitor BTF habitat values through annual groundcover assessments during May to maintain and where possible enhance BTF habitat within the Mining Lease". Table 8 also states as a mitigation measure – Manage non-mined and offset areas to maintain and improve BTF habitat values. This work will be guided by results from annual vegetation assessments, annual BTF surveys and the BTF Research Program.	Section 6.1, Table 8	
Adani Commitment, M4.30	Black-throated finch surveys will continue so as to provide data on temporal and spatial variation of habitat use in the Mine Area and will contribute significant local data for incorporation into the Black-throated Finch Species Management Plan for the Mine Area, which will assist in refinement of species recovery actions and mitigation of impacts on the Mine Area.	BTF surveys have continued as outlined in this commitment. This work is summarised in Section 2.6 of the Research Program. This work will continue as described in Section 7 of the BTF Management Plan and the Research Program.	Section 7	Section 2.6, entire document

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
Adani Commitment, P6.30	Monitoring events will commence at least one year before mining operations (in order to continue a baseline understanding of existing conditions), and continue for at least two years after mining operations are completed.	Monitoring of BTF has been ongoing since the project EIS, as outlined in Section 2.6 of the BTF Research Program. A long-term program of research and monitoring has been established.	Section 7.1	Section 2.6
Adani Commitment, P6.51	The loss of habitat for the Black-throated finch (southern) will occur in stages, in accordance with the staged development of the operational components of the Mine Area. Management actions to encourage dispersal away from areas that will be cleared for staged Mine operations will also be developed.	Section 6.3.1 of the BTF Management Plan describes the staged approach to clearing of vegetation in accordance with this commitment.	Section 6.3.1	
Adani Commitment, P6.52	Management actions for Black-throated finch will seek to maintain and where possible enhance habitats and populations (e.g. through pest control, provision of water sources, appropriate grazing and fire management) in unmined parts of the Mine Area, as well as in offset areas.	Section 6.1 of the BTF Management Plan states "Monitor BTF habitat values through annual groundcover assessments during May to maintain and where possible enhance BTF habitat within the Mining Lease". Table 8 also states as a mitigation measure – Manage non-mined and offset areas to maintain and improve BTF habitat values. This work will be guided by results from annual vegetation assessments, annual BTF surveys and the BTF Research Program.	Section 6.1, Table 8	
Adani Commitment, P6.53	Important population, movement and habitat information for Black-throated finch will be collected, particularly with respect to seasonal use, key areas, nest sites, important feeding areas and management of threatening processes.	Section 7 of the BTF Management Plan and Section 4 of the Research Program outline research and monitoring tasks that are consistent with this commitment.	Section 7	Section 4
Adani Commitment, P6.54	Adani will provide a Draft Black-throated Finch Management Plan for approval prior to the commencement of mine construction. The Plan will include the following: <ol style="list-style-type: none"> 1. A management framework that aligns with the other project management plans 2. Clear statements regarding the intent, approval requirements, objectives and actions 3. Details of how the management plan will be applied across the project phases – pre construction / construction / operation / post operations, 4. Offset areas 5. Details of the current and proposed adaptive monitoring program to support the plan objectives. 6. Details of how experts will be used in a review capacity to inform ongoing monitoring and management 7. Incorporates all proposed management and mitigation measures, including reference to how these will align with the Significant Impact Guidelines and the National Recovery Plan. 8. Specific performance targets and how these will be measured and reported. 	This BTF Management Plan and Research Program address these requirements.	Details are addressed in the following sections: 1) Section 1.3 2) Section 1 3) Section 6 4) Section 6.5 5) Section 5 6) Section 9 7) Section 6 8) Section 6 and Section 9	5) Section 6.1 6) Sections 4.1 and 6
Adani Commitment, P6.55	Black-throated finch surveys will continue over time to provide data on temporal and spatial variation of habitat use in the Mine Area and will contribute significant local data for incorporation into the Black-throated Finch Species Management Plan for the Mine Area, which will assist in refinement of species recovery actions and mitigation of impacts on the Mine Area. In the case of subsidence, which will occur gradually and in a complex and partly unpredictable manner, the data being collected by this monitoring will provide information regarding the best strategies over time to mitigate negative effects and manage key resources for Black-throated finch on the Mine Area.	BTF surveys have continued in accordance with this commitment. A program for future monitoring and research is outlined in this plan.	Section 7	Entire document
Adani Commitment, P6.56	The onsite and offsite (offset areas) habitat management and complementary monitoring program, as described above, will be developed and implemented in consultation with relevant stakeholders (i.e. Black-throated Finch Recovery Team, Commonwealth and State governments).	This plan has been developed in consultation with relevant stakeholders. Implementation of the plan will be conducted as described in Section 9.2 of this plan and Section 6.2 of the Research Program. This involves sharing the findings of the research with the BTF Recovery Team for use and updating of the recovery plan and ongoing engagement with Commonwealth and state governments.	Section 9.2	Section 6.2

Approval & condition number	Description of Condition or Commitment	How Addressed	Section of BTF Management Plan	Section of BTF Research Program
Adani Commitment, P6.57	<p>Adani's overarching commitments in regards to the Black-throated Finch are:</p> <ol style="list-style-type: none"> 1. Implementing management measures across the Project Mining Lease where there are indirect impacts including land management activities, water management, habitat maintenance, pest control, fire management, survey and recording. This commitment would continue through the duration of mining operations. 2. Implementing management measures across a proposed like for like mitigation area within those property areas mapped in Figure 1 below, including land management activities, water management, habitat maintenance, pest control, fire management, survey and recording. This commitment would continue for a period of 20 years. 3. Securing and maintaining appropriate offsets including land management activities, water management, habitat maintenance, pest control, fire management, survey and recording. This commitment would continue for the duration of the offset agreement, nominated as 20 years. 4. Ongoing monitoring programs locally, and contributing to regional monitoring programs including utilising and assisting where possible monitoring effort from the BTFRT. This commitment would continue for a period of 10 years, commencing from 2014. 5. Contributing time and resources to a government-led regional management program. In the order of an in-kind contribution of \$100,000 per year, over a period of 10 years, commencing from Mining Operations. 	Adani has met these commitments to the BTF, as summarised in the BTF Management Plan and associated Research Program. Indirect impacts are addressed in Section 6 of the BTF Management Plan, and include a range of land and water management activities and offsets. A long term program of research and monitoring has been established.	<p>1-3) Section 6</p> <p>4) Section 7</p> <p>5) Government-led regional management program not yet established.</p>	4) Entire document
Adani Commitment, P6.60	<p>Project Species Specific Management Plan(s)</p> <p><u>Key actions</u></p> <ul style="list-style-type: none"> • Develop and implement programs to provide a greater level of detail on the ecology of threatened species at the Study Area – to be undertaken in collaboration with applicable research organisations, conservation groups and government agencies. <p><u>Timeframes</u></p> <ul style="list-style-type: none"> • Implement targeted ecology and threatened species programs prior to and during Mine operations. • Five yearly revisions and updating of this plan based on currency of information available. 	The BTF Research Program outlines a comprehensive program to provide greater level of detail on the ecology of the BTF in the study area, in collaboration with relevant stakeholders.	Section 7	Entire document

Appendix E Summary of baseline research on BTF nesting and foraging habitat in the project area (E2M Consulting)

Published on DES Disclosure Log
RTI Act 2009

Appendix F Summary of baseline groundcover characteristics to assist with future management of grazing

Published on DES Disclosure Log
RTI Act 2009



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Date : 6/12/2018 8:03:52 AM

From : "MCCOSKER Juliana"

To : [redacted]

Subject : RE: re. BTF survey report

Attachment : image002.png;

Thank you, [redacted]

Ciao for now

Juliana

From: [redacted] sch4p4(6) Personal information

Sent: Thursday, 6 December 2018 7:58 AM

To: MCCOSKER Juliana

Subject: RE: re. BTF survey report

Hello Juliana

I have forwarded your request to [redacted] as he is the lead for this work.

Please let me know if you have not received a response by tomorrow, and I will follow up?

[redacted]

From: MCCOSKER Juliana [<mailto:Juliana.Mccosker@des.qld.gov.au>]

Sent: Wednesday, 5 December 2018 2:08 PM

To: [redacted] sch4p4(6) Personal information

Subject: re. BTF survey report

Hi [redacted]

Can you please send me the last survey report from earlier this year. Has there been another survey this year?

Ciao for now

Juliana



Juliana McCosker

Manager

Coal and Central Queensland Compliance
Department of Environment and Science

P 07 4987 9356 M [redacted] Personal
99 Hospital Road, Emerald QLD 4720
PO Box 3028, Emerald QLD 4720

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Date : 9/01/2019 12:40:37 PM

From : [redacted]oved at External Review

To : "MCCOSKER Juliana"

Cc : "WELLS Melissa"

Subject : RE: re. letter

Attachment : image001.gif;image002.png;

Thankyou Juliana for your response,

As per my letter of the 19th December, Adani would like to understand why the review has been triggered at this time and the basis for its requirement. We respectfully do not believe your letter of the 24th December 2018 provides those reasons.

Additionally, we asked for information from the Department on the individuals undertaking the review of the BTFMP and kindly ask again for that information.

Lastly, can you please confirm the process by which this review will allow for engagement with Adani and the experts that prepared the BTFMP.

Kind regards,

[redacted]
Removed at External Review

Off +61 7 3223 4800 [redacted]sch4p4(6) Personal information www.adaniaustralia.com
Level 25, 10 Eagle Street, Brisbane, QLD 4000 | GPO Box 2569, Brisbane, QLD, 4001

 Please consider the environment before printing this email

From: MCCOSKER Juliana [mailto:Juliana.Mccosker@des.qld.gov.au]

Sent: Monday, 24 December 2018 11:50 AM

To : [redacted]oved at External Review [redacted]sch4p4(6) Personal information

Cc: WELLS Melissa <Melissa.Wells@des.qld.gov.au>

Subject: re. letter

Hi [redacted]oved at External Review

Please see attached response to your letter.

Ciao for now

Juliana



Juliana McCosker

Director

Business Centre Coal - Coal and Central Queensland Compliance

Department of Environment and Science

P 07 4987 9356 M [redacted]sch4p4(6) Personal information

99 Hospital Road, Emerald QLD 4720

PO Box 3028, Emerald QLD 4720

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Date : 5/12/2018 2:07:37 PM
From : "MCCOSKER Juliana"
To : removed at External Review
Subject : re. BTF survey report
Attachment : image001.png;image002.png;
Hi removed at External Review

Can you please send me the last survey report from earlier this year. Has there been another survey this year?

Ciao for now

Juliana



Juliana McCosker
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PO Box 3028, Emerald QLD 4720

Date : 24/12/2018 11:49:39 AM

From : "MCCOSKER Juliana"

To : moved at External Rev

Cc : "WELLS Melissa"

Subject : re. letter

Attachment : BTFMP letter to Adani 24122018.pdf;image001.png;image002.png;

Hi at Extern

Please see attached response to your letter.

Ciao for now

Juliana



Juliana McCosker

Director

Business Centre Coal - Coal and Central Queensland Compliance
Department of Environment and Science

P 07 4987 9356 M) Personal in
99 Hospital Road, Emerald QLD 4720
PO Box 3028, Emerald QLD 4720



Department of
Environment and Science

Our Ref: Black-throated Finch Management Plan

24 December 2018

Removed at External Review

Adani Mining Pty Ltd
Level 25, 10 Eagle Street
Brisbane QLD 4000

Dear [redacted]

Thank you for your letter dated 19 December 2018.

As you are aware the location of the proposed Carmichael Coal Mine hosts the largest and most significant known population of the Black-throated Finch in Australia. The department's engagement of an independent scientific panel review of the submitted Black-throated Finch Management Plan (BTFMP) is considered a necessary measure given the significance of the impact to this threatened species. The review will make certain management and mitigation measures are in line with the best available scientific knowledge by nationally recognised ecologists.

The independent scientific panel review of the BTFMP will ensure that the department's decision on the BTFMP is consistent with the very best threatened species and conservation science, and that the final decision on the BTFMP is highly defensible and beyond reproach.

Should you require any further information, please contact me or Juliana McCosker on telephone (07) 4987 9356 or by email at juliana.mccosker@des.qld.gov.au.

Yours sincerely

[redacted]
sch4p4(6) Personal information

Melissa Wells
Executive Director
Coal and Central Queensland Compliance
Environmental Services and Regulation

Date : 18/12/2018 9:38:58 AM

From : "MCCOSKER Juliana"

To : moved at External Rev

Subject : re. letter

Attachment : BTFMP letter to Adani 18122018.pdf;image001.png;image002.png;

Hi at Extern

Please see letter as discussed.

Ciao for now

Juliana



Juliana McCosker

Director

Business Centre Coal - Coal and Central Queensland Compliance
Department of Environment and Science

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Department of
Environment and Science

Our Ref: Black-throated Finch Management Plan

18 December 2018

Removed at External Review

Adani Mining Pty Ltd
Level 25, 10 Eagle Street
Brisbane QLD 4000

Dear [redacted]

Thank you for the Black-throated Finch Management Plan (BTFMP) submitted to the Department of Environment and Science (the department) on 2 November 2018.

Please be advised that the department has engaged the National Director of the National Environmental Science Program's Threatened Species Recovery Hub to lead an independent scientific panel review of the BTFMP.

The independent scientific panel review of the BTFMP will ensure that the department's decision on the BTFMP is consistent with the very best threatened species and conservation science, and that the final decision on the BTFMP is beyond reproach in terms of its objectivity.

It is expected that the review will be completed within 8 weeks, and the department's decision on the approval of the BTFMP will be made after the department's receives the advice from the independent scientific panel review.

Furthermore, the department reminds Adani that project stage 2 activities at the Carmichael Coal Mine cannot commence prior to approval of the BTFMP and the Groundwater Dependent Ecosystem Management Plan.

Should you require any further information, please contact me on telephone (07) 4987 9356 or by email at juliana.mccosker@des.qld.gov.au.

Yours sincerely

[redacted]
sch4p4(6) Personal information

Juliana McCosker
Director
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