Adani Mining Pty Ltd

NORTH GALILEE BASIN RAIL PROJECT

Environmental Impact Statement

Appendix F Nature conservation

November 2013

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The services undertaken by GHD in connection with preparing the Report were limited to those specifically detailed in Section 1.2 of the Report.

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- *reliance on the Report by a third party, or use of the Report other than for the Purpose.*

Executive summary

This report presents the results of terrestrial and aquatic ecological assessments that were conducted within the preliminaryinvestigation corridor (a 1,000 m wide investigation corridor) and wider study area. The information contained within this report is specific to the existing environment, and discusses the terrestrial and aquatic flora and fauna communities and their habitats.

For the purposes of this report, the study area encompasses the North Galilee Basin Rail Project (the NGBR Project) preliminary investigation corridor which is approximately 300 km in length and 1,000 m in width. In order to understand and describe vegetation communities, landscape-induced patterns and sub-catchment scale processes occurring within the study area, observations of the broader distribution of species and habitat was also undertaken beyond the preliminary investigation corridor.

A combined desktop and field assessment was undertaken to describe the existing terrestrial and aquatic ecological values of the preliminary investigation corridor. The field survey was conducted during May and June 2013 to identify the existing terrestrial and aquatic ecological values, and to supplement and ground truth the information obtained from the desktop assessment. Field surveys focused on identifying and sampling the types of representative vegetation communities and fauna habitats occurring within or of relevance to the preliminary investigation corridor, and describing the attributes of these communities and habitats. In addition, surveys sought to describe the diversity and relative abundance of flora and fauna species in these habitats.

The preliminary investigation corridor crosses a diverse range of vegetation communities, including seven 'endangered' regional ecosystems (RE) (regulated under the *Vegetation Management Act 1999*), 18 'of concern' REs and the constituent REs of three 'endangered' threatened ecological communities (as listed under the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) – natural grassland, brigalow and semi-evergreen vine thicket (only the latter two were actually confirmed as present). One vulnerable plant species under both the EPBC Act and *Nature Conservation Act 1992* (the NC Act) was confirmed present, black ironbox (*Eucalyptus raveretiana*), with several other threatened plant species predicted as potentially occurring.

Five threatened terrestrial fauna species listed under the NC Act and one threatened terrestrial fauna species listed under the EPBC Act were confirmed present. Threatened species confirmed are the squatter pigeon (southern) (*Geophaps scripta scripta*) (EPBC Act and NC Act), the black-necked stork (*Ephippiorhynchus australis*) (NC Act), the cotton pygmy-goose (*Nettapus coramandelianus*) (NC Act), the freckled duck (*Stictonetta naevosa*) (NC Act) and the little pied bat (*Chalinolobus picatus*) (NC Act). An additional 11 threatened fauna species listed under the NC Act and four threatened fauna species listed under the EPBC Act were assessed as likely to occur.

The preliminary investigation corridor includes a number of other ecological values, in particular high value east-west ecological corridors in the north and centre. However, existing disturbance across terrestrial and aquatic habitats in the preliminary investigation corridor is extensive and mainly due to the direct and indirect impacts of land use (cattle grazing), exotic flora and fauna (mostly pigs) and existing infrastructure (particularly roads and waterbody crossings).

High value aquatic habitats within the preliminary investigation corridor include a number of ephemeral and perennial rivers and creeks (such as the southern Suttor River, Bowen River,

Bogie River) and the Caley Valley wetland. With the exception of the estuarine crocodile (*Crocodylus porosus*), vulnerable under both the EPBC Act and the NC Act, no threatened aquatic species known to occur in the region are expected to be present in the preliminary investigation corridor.

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Terms and abbreviations

Terms and abbreviations	Definition
BA	Birds Australia
BAAM	Biodiversity Assessment and Management Pty Ltd
BOM	Bureau of Meteorology
BONN	Convention on the Conservation of Migratory Species of Wild Animals - (Bonn Convention)
BPA	Biodiversity Planning Assessment
BVC	Broad vegetation community
CAMBA	Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment
DAFF	Department of Agriculture, Fisheries and Forestry (Queensland)
DEHP	Department of Environment and Heritage Protection (Queensland)
DERM	Department of Environment and Resource Management (Queensland) (former Queensland Government department)
DEWHA	Department of Environment, Water, Heritage and the Arts (Commonwealth) (former Commnwealth Government department, now Department of Sustainability, Environment, Water, Population and Communities)
DIWA	Directory of Important Wetlands in Australia
DNRM	Department of Natural Resources and Mines (Queensland)
DSITIA	Department of Science, Information Technology, Innovation and the Arts (Queensland)
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency (former Queensland Government department)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
Final NGBR Project footprint	The final NGBR Project footprint will accommodate all rail infrastructure required for construction and operation, scalable to accommodate 100 mtpa product coal transport, including passing loops, a maintenance road, rolling stock maintenance (provisioning, fuel storage and refuelling, maintenance, etc.), water supply and pipeline, track and signalling maintenance facilities, staff crib, accommodation and training facilities and other necessary infrastructure associated with the operational functions of the NGBR Project.
Final rail corridor	The NGBR Project nominal 100 m wide corridor.
GIS	Geographic Information System
GPS	Global Positioning System
IBRA	Interim Biogeographic Regionalisation of Australia
IRC	Isaac Regional Council

Terms and abbreviations	Definition
JAMBA	Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment
LP Act	*Land Protection (Pest and Stock Route Management) Act 2002* (Queensland)
MNES	Matters of National Environmental Significance
NC Act	*Nature Conservation Act 1992* (Queensland)
NGBR Project	North Galilee Basin Rail Project
NRM	Natural Resource Management
PMST	Protected Matters Search Tool
Preliminary investigation corridor	The NGBR Project nominal 1,000 m wide corridor.
QLD	Queensland
QM	Queensland Museum
RE	Regional ecosystem
REDD	Regional ecosystem description database
ROKAMBA	Agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds
SEVT	Semi-evergreen vine thicket
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities (Commonwealth)
SPRAT	Species Profile and Threats database
TEC	Threatened ecological community
TOR	Terms of Reference
TSSC	Threatened Species Scientific Committee
VAST	Vegetation Assets, States and Transitions
VM Act	*Vegetation Management Act 1999* (Queensland)
WO	Wildlife Online database (Queensland)
WONS	Weeds of National Significance
WRC	Whitsunday Regional Council

1. Introduction

1.1 Project overview

Adani Mining Pty Ltd (Adani) proposes the construction and operation of the North Galilee Basin Rail Project (the NGBR Project), a multiuser, standard gauge, greenfield rail line that will transport coal from mines in the northern Galilee Basin to the Port of Abbot Point. The NGBR Project is approximately 300 km in length and connects the proposed Carmichael Coal Mine and Rail Project's east-west rail corridor, approximately 70 km east of the proposed Carmichael Coal Mine in the vicinity of Mistake Creek, with supporting infrastructure at the Port of Abbot Point (refer Figure 2-1). The NGBR Project will have an operational capacity of up to 100 million tonnes per annum (mtpa) of coal product expected to be sourced from both Adani and third-party mines in the northern Galilee Basin. Key features of the NGBR Project include:

- Approximately 300 km of standard gauge, bi-directional rail track located within a nominal 100 m wide rail corridor (the final rail corridor)
- A rail maintenance access road running parallel to the rail track for approximately 300 km and wholly within the final rail corridor
- Seven passing loops, each 4.3 km in length
- Signalling infrastructure
- Approximately 4.5 km of fill greater than 15 m in depth (11 locations) and approximately 3.4 km of cut greater than 15 m in depth (nine locations)
- At-grade and grade-separated road, rail, stock and occupational crossings
- Bridge and culvert structures at major waterways and drainage lines, and various other longitudinal and cross drainage structures
- A rolling stock maintenance facility near the Port of Abbot Point including provisioning line, train maintenance line, wagon and locomotive service sheds, wash bay and queuing line
- Five temporary accommodation camps for construction workers
- A temporary construction depot at the southern end of NGBR Project
- Temporary construction yards, concrete batching plants, bridge and track laydown areas and heavy vehicle turning circles.

During construction, quarries and borrow pits within acceptable haulage distances will be required to provide a cost effective source of fill, gravel, aggregate and ballast. The number and location of borrow pits and quarries will be investigated further during detailed design and each may require screening and crushing plants to process material.

1.2 Scope of report

This report addresses assessment of the exisiting environment for the Nature Conservation, Sensitive Environmental Areas, Terrestrial Flora, Terrestrial Fauna and Aquatic Biology and Ecology sections of the Terms of Reference (TOR) and forms an appendix to the NGBR Project Environmental Impact Statement (EIS). A table that cross-references the contents of this report and the TOR is included as Volume 2 Appendix A TOR cross reference.

Section 2 of this report provides an overview of the study area, methodology, data sources used, and discusses relevant legislation and policies applicable to this study. Section 3 describes the regional context in which the preliminaryinvestigation corridor lies. Section 4 describes the existing nature conservation values in terms of terrestrial and aquatic ecology. Section 5 describes the existing threatening processes impacting upon priority taxa in the region.

Terrestrial and aquatic ecosystems are dependent on other environmental factors and as such this scope is closely aligned with surface water quality and hydrological studies undertaken for the NGBR Project (see Water Resources Technical Report Volume 2 Appendix H1).

An assessment of potential impact to the identified nature conservation values of the preliminary investigation corridor is presented separately in Volume 1 Chapter 6 Nature conservation within the EIS.

1.3 Objectives

Consistent with the TOR, the overall objective of this report is to describe the existing nature conservation values in the study area. Specifically, the objective of the terrestrial and aquatic assessment is to describe the:

- RE types, distribution and extent within and near to the preliminary investigation corridor
- Representative vegetation communities within and near to the preliminary investigation corridor, particularly as identified in previous studies conducted in this area
- Flora species diversity and relative abundance in those vegetation communities that characterise the landscape in which the preliminary investigation corridor occurs
- Condition of vegetation communities at sites surveyed
- Location and relative abundance of threatened and introduced plant species
- The diversity and relative abundance of fauna species (common and conservation significant, including threatened and poorly understood species)
- Habitat requirements, including associations of species with habitats within and near to the preliminary investigation corridor, and the sensitivity of species of relevance to the preliminary investigation corridor to change, and movement corridors in the landscape in which the preliminary investigation corridor occurs
- The presence, distribution, relative abundance and habitat use of conservation significant species within or near to the preliminary investigation corridor
- The existence of migratory species in habitats within and near to the preliminary investigation corridor
- The existence of feral and introduced animals in habitats within and near to the preliminary investigation corridor
- The existing surface water environment and identify aquatic habitats and their potential flora and fauna constituents. This includes identifying sensitive areas, habitat for threatened species or communities, wetlands and protected areas in proximity to and within the preliminary investigation corridor.

2. Methodology

2.1 Overview

A combination of desktop assessment and field surveys were conducted to assess the existing terrestrial and aquatic values of the preliminary investigation corridor. Steps in the methodology are described as follows:

- Review existing studies and available data relevant to terrestrial and aquatic flora and fauna within the preliminary investigation corridor.
- Undertake a field assessment and inspection of a number of sites.
- Describe the existing conditions within the preliminary investigation corridor, including terrestrial and aquatic habitat values.

Scientific and common names for flora and fauna are consistent with those used in the following sources:

- *A Complete Guide to Reptiles of Australia* (Wilson & Swan 2008)
- *A Field Guide to Australian Frogs* (Barker *et al* 1995)
- *A Field Guide to the Mammals of Australia* (Menkhorst & Knight 2004)
- *Census of the Queensland Flora* (Bostock & Holland 2010) and botanical binomials presently accepted by the Queensland Herbarium
- *Freshwater Fishes of North-Eastern Australia* (Pusey *et al* 2004)
- *Handbook of Australian, New Zealand and Antarctic Birds Volume 1 – Volume 7* (Marchant and Higgins 1990 – 2006).

2.2 Climate

A desktop assessment was conducted to assess the rainfall and temperature for the preliminary investigation corridor. Data for the following rainfall stations was extracted from the Bureau of Meteorology website:

- Bowen (Station ID 033257)
- Collinsville (Station ID 33013)
- Moranbah (Station ID 34038 and ID 34035).

2.3 Study area

The focus of this investigation is to identify and describe those ecological values that are of relevance to the NGBR Project. Specifically, this investigation assesses the vegetation communities, terrestrial and aquatic fauna habitats and flora and fauna species that are present or are likely to be present in the preliminary investigation corridor which is approximately 1,000 m in width. In order to understand large-scale vegetation communities, landscape-induced patterns, sub-catchment scale processes and the broader distribution of species and habitat (and the role the preliminary investigation corridor plays in these), it is necessary to extend the study focus beyond the preliminary investigation corridor. Therefore, the study area encompasses the preliminary investigation corridor (see Figure 2-1) (which is approximately 300 km in length) and includes the broader landscape in which this corridor is located. This includes

surface watercourses and their watersheds, floodplains, and lacustrine and palustrine wetlands. However, where the NGBR Project connects with the Adani Terminal 0 balloon loop at the Port of Abbot Point a full identification and description of ecological values has not been undertaken. Values associated with the balloon loop, including coal dumping station for unloading coal trains and its associated surrounding landscape, is being assessed and constructed as part of the Terminal 0 project.

LEGEND

- Population Centres
- Major Port
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourse (Major)
- Local Government Area
- Brigalow Belt Bioregion
- Central Queensland Coast
- Einasleigh Uplands
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

Based on or contains data provided by the State of QLD (DNRM) [2013]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Adani Mining Pty Ltd
North Galilee Basin Rail Project

Job Number	41-26457
Revision	C
Date	06 Aug 2013

Project Location

Figure 2-1

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Data source: GA: Populated Places, Railway, Watercourse, Mainlands/2007; DNRM: Roads/2012, Bioregion Boundaries, Local Government Areas/2010;
Adani: NGBR Corridor 13/05/2013, NGBR Corridor 06/06/2013, Project Rail/2012. Created by:MS

2.4 Desktop assessment

A desktop assessment was conducted so that a targeted and informed field investigation could be planned and undertaken. Historical records from the area were also used to supplement findings from the field investigation. This desktop assessment involved searching publicly available sources for information on the ecological values of the preliminary investigation corridor. A list of these sources is presented in Table 2-1 with information on the nature of the source and any known limitations to its use.

Table 2-1 Data sources utilised

Source and name (alphabetical)	Description of information source	Database/mapping search extent (if applicable)	Age/date of record	Limitations of use	Relevant information
Abbot Point cumulative impact assessment report GHD 2012	Technical studies relating to potential cumulative impacts of development at the Abbot Point State Development Area.	N/A –no search conducted – species lists and other information consulted	Wetland Hydrology and Water Quality (age/date of records not specified – monitoring results from 2006 through to 2012) Migratory Shorebird and Waterbird Surveys (February and March 2012)	Nil	Technical reports provide information about existing ecological values of Abbot Point State Development Area as determined during previous ecological studies and a cumulative impact assessment for a number of previous projects.
Aquatic Conservation Assessments, using AquaBAMM, for the Riverine and Non-Riverine Wetlands of the Great Barrier Reef Catchment Inglis and Howell (2009a); Inglis and Howell (2009b)	The Aquatic Conservation Assessments (ACAs) focus on the Great Barrier Reef (GBR) catchments. Assessments utilise the aquatic Biodiversity Assessment and Mapping Methodology (AquaBAMM) (Clayton et al 2006), which is a uses available data and expert opinion to identify ecological values within a given catchment.	N/A –no search conducted - species lists and other information consulted	Species lists developed using multiple data sources – age/date of records not provided	This publication relies on results based on the opinions of an experienced panel of ecologists, without additional field survey.	Aquatic values identified by a panel of experts for the Burdekin catchment, in which the preliminary investigation corridor occurs.

Source and name (alphabetical)	Description of information source	Database/mapping search extent (if applicable)	Age/date of record	Limitations of use	Relevant information
Bird Atlas data Birds Australia	Birds Australia maintains a database of bird sighting records from across Australia.	Two rectangular search extents encompassing the preliminary investigation corridor were provided to Birds Australia for the purposes of searching the Bird Atlas database.	Not provided	The age and lack of spatial precision of species records limits the accuracy of these records. In addition, these sightings are by Birds Australia members and the general public, whose levels of expertise vary greatly. These records are not confirmed by experts.	These records provide a list of birds previously recorded by Birds Australia in the landscape encompassing the preliminary investigation corridor.
Biodiversity planning assessment (BPA) expert panel report and **BPA mapping – Brigalow Belt bioregion** Department of Environment and Resource Management (DERM) (2008)	Expert panel reports provide information on the landscape-scale values of bioregions, and in some instances identify bioregional priority taxa. This information is mapped at varying levels of significance (local, regional, state). This mapping utilises Department of Natural Resources and Mines RE mapping in identifying the location and extent of vegetation communities and habitats.	Mapping was obtained for the preliminary investigation corridor and surrounding landscape in an electronic data layer using a Geographic Information System (GIS).	Developed using multiple data sources – age/date of records not provided	BPA mapping is heavily reliant on regional ecosystem (RE) mapping, which in the Brigalow Belt may not be ground truthed. Therefore, if the underlying RE polygon on which a BPA map unit is based is incorrect, the BPA map unit may also be incorrect.	BPA expert reports and the associated mapping are primarily terrestrial. They discuss and map corridors and wildlife refugia identified by the expert panel in the preliminary investigation corridor and adjacent areas. This information is used in the report to identify potentially sensitive environmental areas within the preliminary investigation corridor and adjacent areas.

Source and name (alphabetical)	Description of information source	Database/mapping search extent (if applicable)	Age/date of record	Limitations of use	Relevant information
***Burdekin NRM Region Back on Track Actions for Biodiversity* report** Department of Environment and Resource Management (2010)	These documents identify priority species in the Burdekin NRM region, detail the regional threatening processes impacting upon these species, and propose a range of actions to address regional threats. Priority taxa are identified through the DERM (2010) 'back on track' species prioritisation framework, in consultation with a range of stakeholders from the region. The documents seek to guide priority species conservation in the respective regions over the period 2010 – 2015.	N/A - no search conducted - species lists and other information consulted	Species lists developed using multiple data sources – age/date of records not provided	Some species/impacts listed in this document do not occur in the study area, as the NRM region encompasses the entire Burdekin catchment. This document does not cover species found in other catchments in which the prelimenary investigation corridor occurs – the Don, Elliot and Belyando river catchments.	The TOR specifically requests that species identified as being priority species in this document be investigated and discussed if they occur within the preliminary investigation corridor. This report also identifies threatening processes for these species.
Directory of Important Wetlands Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPaC, 2011)	This mapping identifies the location of wetlands that satisfy at least one criterion agreed upon by the Australian and New Zealand Environment and Conservation Council (ANZECC) Wetlands Network in 1994.The SEWPaC Protected Matters Search Tool lists	Line search approximating with the centreline of the rail corridor with a 10 km buffer.	Not provided	The mapping is now almost 20 years old.	The location of wetlands within the investigation corridor and adjacent areas listed and mapped as important wetlands under this directory is requested by the TOR.

Source and name (alphabetical)	Description of information source	Database/mapping search extent (if applicable)	Age/date of record	Limitations of use	Relevant information
	nationally important wetlands occurring within or related to prescribed search extents.				
Essential habitat mapping (Version 3) Department of Natural Resources and Mines (2013)	Essential habitat is defined as 'vegetation in which a species that is endangered, vulnerable or near threatened under the Nature Conservation Act 1992 has been known to occur' (DNRM 2013). DNRM maps essential habitat (and essential regrowth habitat) in conjunction with remnant and regrowth vegetation.	Mapping was obtained for the preliminary investigation corridor and surrounding landscape in an electronic data layer for GIS analysis.	Age /date of mapping not specified	As essential habitat and essential regrowth habitat mapping is underpinned by RE/regrowth mapping, the constraints associated with mapping scale and lack of ground-truthing are applicable to this information source.	Essential habitat factors are determined by an expert panel as those basic factors that define essential habitat for a threatened species, and are used to ground truth essential habitat. Essential habitat layers for remnant and regrowth vegetation were investigated to map the location of essential habitat. Essential habitat factors were collected to assist in the understanding of the habitat requirements of threatened species for which these factors have been published.
Freshwater Fishes of North-Eastern Australia Pusey *et al* 2004	The text includes the fish species composition of all the rivers in north-eastern Australia. Species are listed for each river basin.	N/A - no search conducted - species lists and other information consulted.	Species lists developed using multiple data sets from multiple surveys – age/date	Known distributions of species has been developed using historical through to relatively recent (2004	The specific fish communities of the Burdekin and Don River basins were used to determine potential fish

Source and name (alphabetical)	Description of information source	Database/mapping search extent (if applicable)	Age/date of record	Limitations of use	Relevant information
			of records not provided	at time of publication) times, and so may be out-dated. Some species distributions may have been based on anecdotal evidence.	communities within or near to the preliminary investigation corridor.
Freshwater Fish of Burdekin Dry Tropics Natural Resource Management (NRM) Region Carter and Tait (2008)	This report documents the diversity and distribution of freshwater fish species within the Burdekin Dry Tropics NRM Region.	N/A	Species lists developed using multiple data sets from multiple surveys – age/date of records not provided	The sub-catchments covered in this report include many outside the preliminary investigation corridor and only those relevant to the corridor have been consulted. Species distribution mapping in the report has been developed using pre-2008 data and so may not accurately represent current distribution patterns.	This report was used to assist in determining likely fish communities within the preliminary investigation corridor.
HERBRECS specimen database Queensland Herbarium, Department of Science, Information Technology, Innovation and the Arts (DSITIA)	The HERBRECS database catalogues the label and location information from all flora specimens held by the Queensland Herbarium collection.	Two rectangular search extents encompassing the preliminary investigation corridor was provided to the Queensland Herbarium for purposes of searching the HERBRECS database.	HERBRECS results contain specimens collected from 1870 through to 2012. Specimens are collected from all seasons/months.	This database catalogues records of flora specimens held in the Queensland Herbarium collection – and so is subject to herbarium collection policies and decisions. This means the geographic spread of	The species list provides an indication of the diversity of flora species, and the previously recorded presence of conservation-significant species in the landscape encompassing the preliminary investigation corridor. Label notes

Source and name (alphabetical)	Description of information source	Database/mapping search extent (if applicable)	Age/date of record	Limitations of use	Relevant information
				records may not be indicative of actual on-ground abundance/ occurance. In some instances the age and lack of spatial precision of species records that pre-date GPS may limit their locational value.	from threatened species provides information and observations on the habitats and locations in which those species have been recorded by previous collectors.
Publically available EIS documents for projects in the region	EIS documents for projects in the region were sourced online: Abbot Point Coal Terminal 0 Project (Draft EIS) (Adani Abbot Point Terminal Pty Ltd 2013) Carmichael Coal Mine and Rail Project (EIS) (Adani Mining Pty Ltd 2012) Cumulative Impact Assessment (CIA) Migratory Shorebird and Waterbird Surveys (Biodiversity Assessment and Management (BAAM) Pty Ltd 2012) Caley (Caley) Valley Wetlands – Baseline Report (BMT WBM 2012)	N/A - no search conducted - species lists and other information consulted	**Abbot Point Coal Terminal 0 Project:** aquatic and terrestrial surveys conducted July/August 2012 **Carmichael Coal Mine:** ecological surveys conducted November 2010, November 2011, April/May 2011 Stygofauna surveys October 2011, August 2012 CIA: Wetland Hydrology and Water Quality (age/date of records not specified –	The limitations of using these documents are various and are associated with the accuracy of the intial research reported in these reports, and the limitations declared in each document,.	Data relating to survey methods and results, in particular the location of threatened species and their habitats, where it relates to the preliminary investigation corridor.

Source and name (alphabetical)	Description of information source	Database/mapping search extent (if applicable)	Age/date of record	Limitations of use	Relevant information
	Galilee Coal (Northern Export Facility) Project (Rail) EIS (Waratah Coal Pty Ltd 2011) Alpha Coal Project (Rail) EIS (Hancock Prospecting Pty Ltd 2010) Abbot Point Multi-Cargo Facility EIS (North Queensland Bulk Ports 2009) Water for Bowen EIS (SunWater 2009)		monitoring results from 2006 through to 2012) Migratory Shorebird and Waterbird Surveys (February and March 2012) **Caley Valley Wetlands – Baseline Report:** data collated from numerous sources, dates not specified. **Galilee Coal (Northern Export Facility) Project (Rail) EIS :** aquatic ecology surveys May 2010, surface water surveys October 2009, March/April 2010, terrestrial ecology surveys July 2010 **Alpha Coal Project (Rail) EIS:** ecological surveys April 2010 **Abbot Point Multi-Cargo Facility EIS:** terrestrial		

Source and name (alphabetical)	Description of information source	Database/mapping search extent (if applicable)	Age/date of record	Limitations of use	Relevant information
			ecology surveys October/November 2008, March/April 2009, aquatic ecology surveys March/April 2009. **Water for Bowen EIS:** only executive summary publically available, field survey dates not specified in the document.		
Queensland Museum data search Queensland Museum (QM) (2013)	The Queensland Museum catalogues vertebrate fauna specimen records obtained throughout Queensland.	Two rectangular search extents encompassing the preliminary investigation corridor was provided to Queensland Museum for purposes of search of internal Queensland Museum database.	Queensland Museum results contain specimens collected from 1974 through to 2005. Specimens are collected from all seasons/months.	This database catalogues known records of species in a defined area. The age and lack of spatial precision of species records may limit their value for inclusion in current studies in some instances.	Results consolidated into single species list to provide an indication of vertebrate fauna species previously recorded in the landscape encompassing the preliminary investigation corridor.
Protected Matters Search Tool and Environmental Reporting Tool DSEWPaC	The Protected Matters Search identifies MNES and other matters protected by the EPBC Act that may occur within or relate to the Mine Project Area. The tool predicts the potential presence of a	Line search approximating with the centreline of the rail corridor with a 10 km buffer.	Age/date of predictive modelling not given.	This is a predictive tool identifying species and ecological communities.	Results consolidated into single species list to provide an indication of flora and fauna previously recorded in the landscape encompassing the preliminary investigation corridor. Information source also used to

Source and name (alphabetical)	Description of information source	Database/mapping search extent (if applicable)	Age/date of record	Limitations of use	Relevant information
	species/ecological community in an area based on bioclimatic modeling, known distribution and habitat preferences.				detect threatened species and MNES.
Wildlife Online Database DEHP	The DERM Wildlife Online database maintains a catalogue of animal and plant species records from specific localities across Queensland. As well as common species, records of animals and plants listed as threatened under the NC Act are contained within the database.	Latitude 21.37 to 21.91, and longitude 146.67 to 147.17.	Age/date of records not specified	This database catalogues known records of species in a defined area however DEHP recommend that independent verification of records should be undertaken.	Results consolidated into single species list to provide an indication of flora and fauna previously recorded in the landscape encompassing the preliminary investigation corridor.
Regional ecosystem and regrowth mapping version 6.1 (including the Regional Ecosystem Description Database or REDD) Queensland Herbarium (2013)	Mapping of regional ecosystems (vegetation communities) prepared by the Queensland Herbarium, DSITIA, and held by the Department of Environment and Heritage Protection (DEHP). This includes remnant and regrowth vegetation. The REDD contains the descriptions of the RE units.	Mapping was obtained for the preliminary investigation corridor and surrounding landscape in an electronic data layer for GIS analysis.	Age /date of mapping not specified	Regional ecosystem mapping is primarily based on remote-sensing techniques and is not 100% ground truthed. It is produced at 1:100, 000 scale and is not accurate at scales commonly utilised for the location of built infrastructure.	This mapping provides an indication of the potential diversity and location of vegetation communities in the preliminary investigation corridor. RE units as described in the REDD provide an outline of the vegetation communities present in the investigation corridor, their clearing extent and representation in the

Source and name (alphabetical)	Description of information source	Database/mapping search extent (if applicable)	Age/date of record	Limitations of use	Relevant information
					protectioned area, and some of the major values of these communities.
Wetland mapping DEHP (2013)	Various mapping layers produced by DEHP (including wetland protection areas and wetland management areas).	Mapping obtained for the preliminary investigation corridor and adjacent area.	Age /date of mapping not specified	Wetlands are identified using the DEHP Aquatic Biodiversity Assessment and Mapping Methodology (AquaBAMM) (Clayton et al 2006) which is primarily based on existing literature and expert opinion. Designation does not reveal the relative value of these systems for local flora and fauna. This mapping is most useful in identifying location of wetlands, not in assessing wetland values.	These layers are used to produce maps of the location of wetlands in the baseline preliminary investigation corridor and adjacent area, as requested in the TOR.

Note: database searches were undertaken based on the preliminary investigation corridor provided to GHD by Adani. The buffers incorporated into the desktop database queries generally captured ecological information within a 10 km radius of the preliminary investigation corridor.

2.5 Site assessment

2.5.1 Overview

Field surveys were conducted to provide current, site-specific information on the characteristics and values of the full diversity of terrestrial and aquatic habitats within the preliminary investigation corridor and wider study area. Terrestrial and aquatic ecology surveys were undertaken in May and June 2013. These surveys identified the characteristics and attributes of representative habitats, and gave an indication of the diversity and abundance of terrestrial and aquatic flora and fauna species present within the preliminary investigation corridor and wider study area. This field data supplemented and verified information acquired from the desktop assessment.

The field program was designed to provide an understanding of the terrestrial and aquatic ecological values present in the preliminary investigation corridor, through traverses of the corridor and the survey of representative sites. Ecology assessments undertaken within the preliminary investigation corridor and wider study area allowed for an assessment of vegetation communities, species and their habitats that may be exposed to direct or indirect impacts as a result of developing the NGBR Project. Direct impacts may include vegetation clearing and the installation of watercourse crossings, and indirect impacts could include edge effects and landscape fragmentation. Representative survey data was extrapolated to areas not visited during the survey to provide a wider understanding of the entire study area.

2.5.2 Terrestrial flora assessment

Terrestrial survey sites were selected to target vegetation communities (or REs) and habitat types considered to be representative of the diversity of communities/habitats present within the preliminary investigation corridor. In particular, sites considered as or likely to be 'sensitive' or 'areas of special sensitivity' as defined in the 'Sensitive Environmental Areas' section of the draft TOR (see Volume 2 Appendix A TOR cross reference). Such sites included mapped 'endangered' or 'of concern' remnant vegetation, mapped essential habitat, vegetation that forms important habitat for threatened species, and ecosystems that provide important function such as riparian vegetation and wetlands. In addition, the identity and location of declared weeds and other exotic species was also recorded. Weeds are often clustered in non-remnant areas or other heavily impacted locations, and these were noted where observed.

Flora surveys were undertaken at 350 'quaternary' level survey sites, using the CORVEG methodology developed by the Queensland Herbarium and outlined in *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland* (Neldner *et al* 2012). Quaternary surveys are faster and offer more discretion to the collector than the more detailed secondary surveys, and allow for greater land coverage. The greater coverage of habitat and increased ability to select multiple sites allowed more emphasis on targeted threatened species searches and random meanders.

Targeted searches were undertaken opportunistically where suitable habitat for threatened flora species was observed within the study area. In such locations, two GHD ecologists undertook intensive searches, targeting locations and microhabitats known to be favoured by the threatened species being searched for. Random meanders (Cropper 1993) were also undertaken at many quaternary survey sites and involved random traverses of vegetation while searching for threatened species and other species of interest, such as species not yet observed in the study area, or thought to be unique to the area. Species considered unique or of particular interest included those not previously recorded in the study area during the survey, possible range

extensions, species the ecologist collected samples of because it could not be readily identified, and species identified as of interest in documents listed in the TOR, such as priority species listed in *Back on Track Actions for Biodiversity* (DERM 2010) (see Table 2-1). This technique is particularly suitable for locating species that typically occur at very low densities, or that may be grouped in isolated clumps, as is often the case with many plants listed as rare or threatened.

The results of all targeted and random meander searches were recorded and incorporated into the quaternary survey data. Locations of terrestrial flora survey sites are presented in Figure 2-2 (overview), Figure 2-3 (northern section of preliminary investigation corridor), and Figure 2-4 (southern section of preliminary investigation corridor). Coordinates for each survey site are provided in Appendix A

In addition to searches for species of interest (threatened or unique species), at each survey site RE units were ground truthed using the CORVEG quaternary methodology, as outlined in Neldner *et al* (2012). Information relating to the vegetation community, land zone, species composition and vegetation structure at each site was recorded. As a minimum, dominant species were recorded for the ecologically dominant layer (generally the tallest layer, with the exception of emergent layers). For RE ground-truthing, a CORVEG quaternary level of assessment is the recommended method (Neldner *et al* 2012).

At representative sites within and near the preliminary investigation corridor, the condition of vegetation communities was assessed using the Vegetation Assets, States and Transitions (VAST) methodology (Thackway & Lesslie 2005). The VAST methodology is being utilised at a national level to assess condition in environments ranging from native woodlands to wasteland. For example, it can be used to assess the condition of non-remnant vegetation, and is particularly useful in assessing the impacts of land management on ecosystem services, among other things (Thackway & Lesslie 2005).

For this reason, it is considered to be a more appropriate tool than the Biocondition methodology (Eyre *et al* 2011) for a rapid assessment of vegetation condition at quaternary sites during EIS investigations into linear infrastructure. Biocondition assessments involve the collection of a more detailed record of ecological condition, and typically require a commitment of some time (in many cases, an hour or so). In addition, Biocondition results must be compared against benchmarks recorded by RE type (Eyre *et al* 2011), making them inpractical for use in non-remnant vegetation. However, VAST assessments are more suited to the rapid nature of exploratory investigations (as are quaternary surveys). In situations where the exact location of infrastructure footprints are not yet known, it is more practical to take a larger number of VAST assessments over a broader range of sites, than to take a much smaller number of detailed Biocondition surveys at locations that may ultimately be removed from any impact area.

LEGEND

- Population Centres
- Major Port
- Flora Survey Sites
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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1:1,100,000 Paper Size A4

0 7.5 15 30

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd
North Galilee Basin Rail Project

Flora Survey Sites
- Overview

Job Number	41-26457
Revision	A
Date	06 Aug 2013

Figure 2-2

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Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010; GHD: Flora Survey Sites. Created by:MS

LEGEND

- Population Centres
- Major Port
- Flora Survey Sites
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)

Regional Ecosystems v6.1

- Endangered - Dominant
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- Least Concern
- Non-remnant
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Flora Survey Sites
- Northern Section

Job Number	41-26457
Revision	A
Date	07 Aug 2013

Figure 2-3

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Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010, Regional Ecosystems/2011; GHD: Flora Survey Sites. Created by:MS

LEGEND

- Population Centres
- Flora Survey Sites
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)

Regional Ecosystems v6.1

- Endangered - Dominant
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- Least Concern
- Non-remnant
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd

North Galilee Basin Rail Project

Flora Survey Sites - Southern Section

Job Number	41-26457
Revision	A
Date	07 Aug 2013

Figure 2-4

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Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010, Regional Ecosystems/2011; GHD: Flora Survey Sites. Created by:MS

2.5.3 Terrestrial fauna assessment

An integrated suite of field methods were employed to describe and assess the terrestrial fauna habitat values of the preliminary investigation corridor, in accordance with the *Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland* (Eyre *et al* 2012). The assessment broadly involved two facets:

- Identification of the fauna habitat types occurring within and near the preliminary investigation corridor, including a description of the characteristics, condition and value of these habitats for fauna (common and conservation significant)
- Identification of fauna species in those habitats occurring within and near the preliminary investigation corridor through a suite of standard survey methods.

Survey sites sampled representative vegetation communities and fauna habitat types within and near the preliminary investigation corridor. RE mapping and aerial photography provided a broad indication of the diversity and distribution of habitats across the landscape in which the preliminary investigation corridor occurs, and inform the selection of survey sites. Areas featuring remnant vegetation that had the potential to support conservation significant species or communities and riparian habitats were preferentially targeted, as were those habitats that were more prevalent across the landscape (such as eucalypt woodlands).

In this study, an integrated suite of standard fauna detection methods formed the focus of the fieldwork, with no reliance upon a single methodology. This included habitat assessments (to include condition, species associations with specific vegetation communities and the presence or absence of key micro-habitat features), timed bird surveys, diurnal active searches, nocturnal surveys (spotlighting, call playback, nocturnal active searches, and microchiropteran bat call detection), threatened species surveys, waterbody watches and assessments of habitat values of the eastern fringe of the Caley Valley Wetland, which is adjacent to the preliminary investigation corridor.

A total of 50 terrestrial fauna habitat assessments were undertaken during field surveys. A summary of the terrestrial fauna survey effort is presented in Table 2-2.

Table 2-2 Summary of fauna survey effort

Survey method	Number of sites	Person hours
Terrestrial fauna habitat assessment	50	25
Standardised bird survey	47	28
Diurnal active search	34	37
Nocturnal survey (walking and vehicle transects)	26	21
Nocturnal anabat sites	13	48
Nocturnal call playback	6	3
Bird surveys on eastern fringe of Caley Valley Wetland	3	3
Total number of person hours for fauna surveys		165

Locations of terrestrial fauna assessment sites are presented in Figure 2-5 (overview), Figure 2-6 (northern section of preliminary investigation corridor), and Figure 2-7 (southern section of preliminary investigation corridor). Coordinates for each survey site are provided in Appendix A.

The following parameters were recorded on proforma site sheets during terrestrial habitat assessments:

- Landscape context (size, shape, connectivity or relative isolation of habitat remnants)
- Structural and floristic complexity of vegetation
- Structural complexity and relative heterogeneity of ground-level microhabitats (for example substrate type, vegetation cover, leaf litter, woody debris, presence of rocks, logs or boulders)
- Habitat features (for example hollows, fallen logs, rock outcrops, nests, burrows, waterways)
- Sources of disturbance (for example adjacent land uses, feral animals, predation, weed infestation)
- Potential habitat features for threatened species.

These assessments informed the description of the existing fauna habitat values of the landscape in which the preliminary investigation corridor occurs. This included the *in situ* values of habitats, as well as the inferred value of sites as part of broader (i.e. landscape scale) movement corridors. Fauna species information collected at habitat assessment sites allowed for broad patterns of association between habitats and species to be described.

Survey guidelines for threatened species prepared by the Commonwealth Government were reviewed for those threatened species (Commonwealth listed) considered likely to occur from the desktop assessments, or confirmed present in the landscape in which the preliminary investigation corridor occurs. The Commonwealth prescribed threatened species survey effort applied for these species is summarised in Table 2-3 and the location of the threatened species surveys is shown in Figure 2-11.

Standardised diurnal bird surveys using the method outlined in Eyre *et al* (2012) were undertaken at 47 sites. This involved a timed 20 minute survey of a two hectare (ha) search area, recording the number of birds seen or heard calling.

A total of 34 diurnal active searches were undertaken for reptiles and amphibians in a variety of habitat types. Sites selected included a representative suite of the habitats (and various associated microhabitats) identified as occurring within the preliminary investigation corridor and wider study area. Searches involved looking beneath rocks, logs, bark and among soil and leaf litter. Diurnal active searches were timed in accordance with Eyre *et al* (2012), with each diurnal active search event lasting for a minimum of 30 person-minutes at each survey site (active searches generally averaged around 1 person-hour per site). During diurnal active searches, opportunistic records of wildlife traces (for example bones, hair traces, tracks, scats, diggings, burrows, nests, skins) were also made.

Nocturnal spotlighting surveys were undertaken within the preliminary investigation corridor and wider study area over 8 nights at 26 sites. Figure 2-8 provides an overview, and the northern and southern sections of the preliminary investigation corridor are mapped in Figure 2-9 and Figure 2-10 respectively. Coordinates and details of each survey site are provided in Appendix A. A minimum of two person-hours was invested in nocturnal surveys each night using a combination of high-powered spotlights and head torches on walking transects and vehicular transects as outlined in Eyre *et al* (2012). Visual surveys were undertaken in a minimum 100 m x 100 m search area, searching trees, shrubs and understorey habitats for arboreal mammals, ground mammals, reptiles, frogs and nocturnal birds. In addition, spotlighting was undertaken from vehicles traversing internal property tracks when moving between sites, and when leaving sites.

Call playback surveys were undertaken to detect nocturnal birds at open woodland and grassland habitats. Call playback surveys involved broadcasting the call of individual target species for three minutes. This was followed by a listening period of two minutes as outlined in Eyre *et al* (2012). Species targeted for call playback surveys were selected based on desktop information of their known ranges, previous sightings, individual habitat requirements and and on-site assessment of the likelihood of being present.

Anabat bat detectors were used to survey microchiropteran (insectivorous) bats by recording their echolocation calls. A combination of overnight detection, timed *in situ* detection (up to three hours) and walking transects (lasting up to three hours) was undertaken. Bat call detection focused on habitat types of likely value to bats, such as eucalypt woodlands, acacia woodland and riverine areas. Echolocation call recordings were sent to a qualified bat-call analyst for identification. All species echolocation call recordings have been included in the results analysis and are identified as either positively identified calls or species potentially present, but not reliably idenfied form call analysis.

It is considered that the integrated survey method employed to target Commonwealth listed threatened species was also suitable for those State listed species considered likely to occur, or confirmed present in the landscape in which the preliminary investigation corridor occurs (several reptile and bird species).

An assessment of the habitat values of the eastern fringe of the Caley Valley Wetland was also undertaken. The objective of this survey was to supplement existing information on the characteristics and values of this area for water birds, including migratory species. The survey involved a combination of habitat assessments and timed point observations (one person hour) at three locations where the preliminary investigation corridor occurs adjacent to the wetland. Bird species diversity (and total counts) was recorded at each observation point, while opportunistic records were noted when navigating between sites.

The field survey methodology employed during the field surveys did not involve trapping for small ground-dwelling fauna. The rationale for this approach was based upon a number of drivers, as follows:

- As many sites as possible were assessed to develop a greater level of understanding of the types of habitats within and near the preliminary investigation corridor, including the characteristics and attributes of these habitats, the condition of habitats, species diversity within these habitats, and the likely value of habitats for conservation significant species. This involved increased sampling effort in those habitats that are most widespread (such as open woodland, fringing woodland and non-remnant vegetation), as opposed to focusing on a small number of detailed and localised (trapping) assessment sites.
- More time was invested in alternative fauna survey techniques that have been found to be effective means of detecting fauna including cryptic ground-dwelling species in recent project experiences in the Brigalow Belt bioregion (SEWPaC 2011a; SEWPaC 2013g; Porter 1998).
- More time was invested in targeted surveys for species of conservation significance, especially in consideration of extremely low success rates of trapping for threatened reptiles (Kutt *et al* 2003; Kutt *et al* 2012; Kutt and Fisher 2011; SEWPaC 2011a).
- Broad patterns of association between habitats and fauna species in the landscape in which the preliminary investigation corridor occurs were deciphered, through a combination of greater level of sampling effort (via accessing numerous survey sites) and an integrated

suite of fauna detection methods. As a major impact of the NGBR Project could be habitat fragmentation at the landscape scale, identifying these patterns of association was considered to be an important component of the impact assessment and mitigation process.

Recent project experience and a review of relevant literature would suggest that trapping typically results in the capture of locally-abundant species whose presence could otherwise be detected using alternative survey techniques, such as spotlighting or active searching, or (at least) expected via a habitat suitability or likelihood of occurrence approach underpinned by a review of desktop information.

LEGEND

- Population Centres
- Major Port
- Fauna Habitat Assessment Site
- Diurnal Active Search Site
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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0 7.5 15 30

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd

North Galilee Basin Rail Project

Fauna Habitat Assessment Sites and Diurnal Active Search Locations - Overview

Job Number	41-26457
Revision	A
Date	06 Aug 2013

Figure 2-5

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LEGEND

- Population Centres
- Major Port
- Fauna Terrestrial Habitat Assessment (TH) Site
- Diurnal Active Search (AS) Site
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Adani Mining Pty Ltd

North Galilee Basin Rail Project

Fauna Habitat Assessment Sites and Diurnal Active Search Locations - Northern Section

Job Number	41-26457
Revision	A
Date	06 Aug 2013

Figure 2-6

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LEGEND

- Population Centres
- Fauna Terrestrial Habitat Assessment (TH) Site
- Diurnal Active Search (AS) Site
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd
North Galilee Basin Rail Project
Fauna Habitat Assessment Sites and Diurnal Active Search Locations - Southern Section

Job Number	41-26457
Revision	A
Date	06 Aug 2013

Figure 2-7

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LEGEND

- Population Centres
- Major Port
- Anabat Location
- Call Playback Location
- Nocturnal Active Search Site
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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Map Projection: Transverse Mercator
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Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd

North Galilee Basin Rail Project

Fauna Nocturnal Survey Sites, Anabat and Call Playback Locations - Overview

Job Number	41-26457
Revision	A
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Figure 2-8

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LEGEND

- Population Centres
- Major Port
- Anabat (AB) Location
- Call Playback (CP) Location
- Nocturnal Active Search (NS) Site
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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North Galilee Basin Rail Project

Fauna Nocturnal Survey Sites, Anabat and Call Playback Locations - Northern Section

Job Number	41-26457
Revision	A
Date	06 Aug 2013

Figure 2-9

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LEGEND

- Population Centres
- Anabat (AB) Location
- Call Playback (CP) Location
- Nocturnal Active Search (NS) Site
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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Map Projection: Transverse Mercator
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Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd

North Galilee Basin Rail Project

Fauna Nocturnal Survey Sites, Anabat and Call Playback Locations - Southern Section

Job Number	41-26457
Revision	A
Date	07 Aug 2013

Figure 2-10

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Table 2-3 Field survey methodology undertaken for threatened fauna species

Species	EPBC Act/ NC Act Status	Recommended survey approach and source	Surveys undertaken within and near preliminary investigation corridor
Black-throated finch (southern) *Poephila cincta cincta*	Endangered/ endangered	***Survey Guidelines for Australia's Threatened Birds*** (Department of Environment, Water, Heritage and the Arts (DEWHA) 2010) Land-based area searches (area less than 50 ha) over five days for total of 10 hours. Targeted searches of water bodies and woodswallow nests over two days for total of six hours. ***Significant Impact Guidelines for the Endangered Black-throated Finch (southern) (Poephila cincta cincta) Background Paper*** (DEWHA 2009) Targeted searches: one hour per ha with maximum of 10 hours per search area (within 600 m of water source). Water source observations: minimum of six hours a day for two days for each water source. Habitat assessment surveys to determine the context of the site within the broader landscape (collection of information relating to land use, vegetation (grass species diversity, presence of potential nesting trees), presence and spatial distribution of surface water, connectivity to other areas of potential habitat).	Waterbody/riparian zone standardised bird surveys were undertaken at 19 locations within and near the preliminary investigation corridor during the survey (Figure 2-11). A total of 11.45 person hours were invested in waterbody/riparian zone standardised bird surveys and watches for black-throated finches (southern) during the survey (time per survey ranged between 0.33 and 1.5 person hours). Watches were carried out at water bodies including farm dams, natural creeks and rivers, wetland fringes and stock troughs. Habitat assessments undertaken to describe habitat attributes and context at 50 habitat assessment sites within and near preliminary investigation corridor. Locations of black-throated finch (southern) survey sites are presented in Appendix A.
Squatter pigeon (southern) *Geophaps scripta scripta*	Vulnerable/ vulnerable	***Survey Guidelines for Australia's Threatened Birds*** (DEWHA 2010) Area searches or transects in suitable habitat.	Slow traverses of tracks (by vehicle) were undertaken whilst driving on internal property roads, with details of any squatter pigeons (southern) observed during these traverses recorded. Standardised bird surveys undertaken at 47 sites (27.5 person hours) generally corresponding to the fauna habitat assessment sites. Habitat assessments undertaken to describe habitat attributes and context at 50 habitat assessment sites.

Species	EPBC Act/ NC Act Status	Recommended survey approach and source	Surveys undertaken within and near preliminary investigation corridor
			Squatter pigeon (southern) records were typically opportunistic during slow traverses of tracks (therefore, specific survey locations/details are not mapped for this species. Habitat assessment site locations are provided in Appendix A).
Ornamental snake *Denisonia maculata*	Vulnerable/ vulnerable	***Survey Guidelines for Australia's Threatened Reptiles*** (SEWPaC 2011a) Most likely to be encountered around suitable gilgai habitats when frogs are active. Driving on roads at night when frogs are active. Diurnal searches under sheltering sites (rocks, logs). Pitfall and funnel trap complexes (guideline suggests these methods could be trialled, in addition to measures above). ***Draft referral guidelines for the nationally listed Brigalow Belt reptiles*** (SEWPaC 2011b) Diurnal searches (1.5 hours per ha for minimum of three days) and spotlighting (1.5 hours per ha for minimum of three days). Opportunistic survey of roads. Pitfall and funnel trap complexes (6 x 20 litre buckets under 30 m drift fence, with funnel trap at each end) – two replicates per habitat type, over four days of survey.	Targeted diurnal active searches of brigalow woodlands, brigalow regrowth and riparian habitats south of (approximately) Collinsville at 10 sites (10.5 person hours). Nocturnal searches over six nights on properties containing these sites (8.5 person hours) (Figure 2-11). Habitat assessments undertaken to describe habitat attributes and context at 50 habitat assessment sites. Locations of ornamental snake survey sites are presented in Appendix A.
Brigalow scaly-foot *Paradelma orientalis*	Not listed/ vulnerable	***Survey Guidelines for Australia's Threatened Reptiles*** (SEWPaC 2011a) Most appropriate survey method combines diurnal active searches and nocturnal spotlight searches in appropriate habitats.	Diurnal active searches and nocturnal surveys undertaken in eucalypt woodland, acacia woodland and regrowth habitats south of (approximately) Collinsville targeted detection of this species – this comprised diurnal active searches at 25 sites (26 person hours) and nocturnal searches over six nights on properties containing these sites (12 person hours) (Figure 2-11).

Species	EPBC Act/ NC Act Status	Recommended survey approach and source	Surveys undertaken within and near preliminary investigation corridor
			Habitat assessments undertaken to describe habitat attributes and context at 50 habitat assessment sites. Locations of brigalow scaly-foot survey sites are presented in Appendix A.
Striped-tailed delma *Delma labialis*	Not listed/ vulnerable	***Survey Guidelines for Australia's Threatened Reptiles*** (SEWPaC 2011a) No method known to consistently detect this species – diurnal active searches and pitfall trapping may be suitable.	One diurnal active search (one person hour) was undertaken at a site featuring eucalypt woodland on undulating hilly terrain, north west of Collinsville (Figure 2-11). Habitat assessments undertaken to describe habitat attributes and context at 50 habitat assessment sites. The location of the striped-tailed delma survey site is presented in Appendix A.
Koala *Phascolaractos cinereus*	Vulnerable/ not listed	***Interim koala referral advice for proponents*** (SEWPaC 2012) Collect information on koala population and habitat information ***Habitat assessment*** Determine habitat critical to the survival of the koala including lists of primary and secondary food tree species. ***Koala survey*** Undertake koala surveys using the techniques outlined in Policy 4 (page 72) of the *Nature Conservation (koala) Conservation Plan 2006 and Management Program 2006-2016 (*Queensland Government). Undertake koala surveys for koala utilisation and frequency (faecal pellet surveys) using the spot assessment technique (Phillips & Callaghan 2011).	Targeted koala habitat assessments and faecal pellet surveys were undertaken at 10 locations within eucalypt woodland along the preliminary investigation corridor (Figure 2-11). Locations of koala survey sites are presented in Appendix A.

LEGEND

- Population Centres
- Major Port
- Ornamental snake
- Black-throated finch
- Brigalow scaly-foot
- Koala
- Stripe-tailed delma
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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Kilometres

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Grid: GCS WGS 1984

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Adani Mining Pty Ltd
North Galilee Basin Rail Project

Threatened species survey locations

Job Number	41-26457
Revision	B
Date	06 Aug 2013

Figure 2-11

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2.5.4 Aquatic ecology assessment

The preliminary investigation corridor mainly runs through the Burdekin River Basin and Don River Basin. The Burdekin River Basin can be divided into three dominant catchments (namely the Suttor River, Bowen River and lower Burdekin River) (Figure 2-12). Aquatic survey sites were selected to provide data that represented the diverse range of aquatic habitats in the preliminary investigation corridor – such sites included artificial dams, wetlands, drainage lines, small streams and rivers. A site assessment of waterways took place between 7 and 9 May 2013. The watercourses listed in Table 2-4 were assessed (note that watercourses may have been assessed in a number of places, and that this table does not include isolated waterbodies (e.g. farm dams and gilgais)). Locations of aquatic habitat assessment sites are presented in Figure 2-13 (overview), Figure 2-14 (northern section of preliminary investigation corridor), and Figure 2-15 (southern section of preliminary investigation corridor). Global Positioning System (GPS) coordinates for each survey site are provided in Appendix A.

Table 2-4 Aquatic ecology watercourse survey sites

River Basin	Catchment	Watercourse
Burdekin River Basin	Suttor River	Suttor River Gunn Creek Rockingham Creek Lily Creek
	Bowen River	Bowen River Pelican Creek Five Mile Creek Strathmore Creek Oaky Creek
	Lower Burdekin River	Sandy Creek Bogie River
Don River Basin	-	Splitter's Creek Tabletop Creek Maria Creek Six Mile Creek Saltwater Creek

A field survey was conducted to identify aquatic flora, fauna and habitat characteristics specific to the preliminary investigation corridor and study area. For the purposes of the aquatic ecology assessment, aquatic fauna species were defined to include fish, freshwater turtles, crocodiles and freshwater macroinvertebrates. Aquatic habitat assessments were undertaken to describe the aquatic ecosystems in terms of habitat diversity and extent, suitability for aquatic fauna groups, sensitivity to change, existing disturbances/modifications or barriers, riparian condition and flow characteristics. Assessments were made regardless of whether surface water was present. Where the site was a dam or small lake, an assessment was made of the entire waterbody, where possible. For large lakes and wetlands, an assessment was made of a 100 m section of the margin of the area. All sites were assessed using Queensland River Assessment System protocols. Recorded key features included:

- Aquatic flora and fauna observations
- Substrate type and composition

- Surface water depth
- Type and availability of habitat structure (e.g. woody debris)
- Riparian zone characteristics
- Pest flora and fauna
- Habitat attributes (e.g. macrophytes, substrate anoxia, trailing bank vegetation)
- Odour and turbidity
- Deposition, scouring and erosion
- Existing disturbances.

This information provided a characterisation of the aquatic ecology values for each site. Information gathered from desktop and field assessments was collated to determine and describe the existing aquatic ecological environment and the presence of conservation significant values. This information allowed for an understanding of the dynamics of the aquatic ecosystems present within the preliminary investigation corridor.

LEGEND

- Population Centres
- Major Port
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)

River Basins

- Belyando River
- Suttor River
- Bowen River
- Don River
- Lower Burdekin River
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd
North Galilee Basin Rail Project
Watercourses of Relevance to the Preliminary Investigation Corridor

Job Number	41-26457
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Figure 2-12

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LEGEND

- Population Centres
- Major Port
- Aquatic Habitat Assessment Sites
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses of Relevance
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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North Galilee Basin Rail Project

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Aquatic Habitat Assessment Sites - Overview

Figure 2-13

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LEGEND

- Population Centres
- Major Port
- Aquatic Habitat Assessment (AQ) Sites
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses of Relevance
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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North Galilee Basin Rail Project

Job Number	41-26457
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Aquatic Habitat Assessment Sites - Northern Section

Figure 2-14

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LEGEND

- Population Centres
- Aquatic Habitat Assessment Sites
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses of Relevance
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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North Galilee Basin Rail Project

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Aquatic Habitat Assessment Sites - Southern Section

Figure 2-15

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2.6 Likelihood of occurrence assessment

The information collected from desktop and field assessments was used to identify the existing ecological values of the preliminary investigation corridor. These ecological values were in turn used to develop a likelihood of occurrence assessment for conservation significant flora and fauna species. The likelihood of occurrence assessments incorporated the following considerations for each given species:

- Known distribution
- Habitat preferences
- The presence and availability of suitable habitat in the preliminary investigation corridor
- Relative abundance
- Previous records from desktop sources
- Observations of the species in the preliminary investigation corridor

For each given species, the likelihood of occurrence was assessed using the following categories:

- **Unlikely to occur:** species has not been recorded in the region (no records from desktop searches) ***AND/OR*** current known distribution does not encompass preliminary investigation corridor ***AND/OR*** suitable habitat is generally lacking from the preliminary investigation corridor
- **May occur:** species either has or has not been recorded in the region (desktop searches) although species' distribution incorporates preliminary investigation corridor ***AND*** potentially suitable habitat occurs in the preliminary investigation corridor (but may not be particularly abundant or optimal habitat)
- **Likely to occur:** species has been recorded in the region (desktop searches) ***AND*** suitable habitat is present in the preliminary investigation corridor (species determined to be 'likely to occur' are otherwise known to occur within the preliminary investigation corridor or wider study area, and has suitable habitat present; however were not recorded during field surveys)
- **Confirmed present:** species recorded during field surveys in the preliminary investigation corridor

2.7 Predictive habitat modelling

Predictive modelling of the spatial distribution of potential habitat for threatened species of relevance to the preliminary investigation corridor has been undertaken. Predictive modelling was undertaken for species confirmed present or considered likely to occur based on the likelihood of occurrence assessment for the preliminary investigation corridor. Species mapping took into consideration the length of the preliminary investigation corridor, its context as a narrow corridor in a wider regional landscape, and the relative inaccessibility of parts of the preliminary investigation corridor.

The habitat modelling and mapping involved:

- Determining those EPBC Act and NC Act listed flora and fauna species that were confirmed present during field surveys (or during the desktop assessment if evidence of

presence was found) or assessed as likely to occur in the preliminary investigation corridor from the likelihood of occurrence assessment.

- Identifying habitat attributes for listed species confirmed present or considered likely to occur within the preliminary investigation corridor, based on known information about species' habitat and microhabitat preferences and their tolerance of disturbance.
- Acquiring data characterising habitat types which could be input into a predictive model, to allow for the mapping of the distribution of potential habitat for listed species. Available data included:
  - Certified RE mapping (i.e. approved by DEHP)
  - Altitude, slope and terrain data
  - Soil type data
  - Waterways and wetlands, including characteristics such as wetland type, whether or not these are artificial, extent of inundation.
- Using a multi-criteria analysis to determine relative importance of various habitat characteristics such that a model of likely suitable habitat could be constructed using a GIS platform.
- Where possible, validating the model output (for example potential habitat mapping) using appropriate point data such as field observations and publicly available sighting data.

2.8 Limitations

In order to characterise the ecological values of the landscape in which the preliminary investigation corridor occurs, given the size of the preliminary investigation corridor and variability of terrestrial and aquatic ecosystems, reliance on desktop data was a key component of the assessment. In light of this, a precautionary approach to detailing the values of areas that were not accessed for field assessments was implemented.

Where ground-truthing has not been carried out, the accuracy of the desktop data could not be confirmed. An analysis of the desktop data sources, including the limitations of these sources, is provided in Table 2-1.

Aerial imagery was up to five years old in places. Consequently, imagery age was a limitation in instances where these images where used to determine vegetation patterns in areas not visited during the field survey.

It is considered that the applied dataset is sufficiently robust for the purposes of the description of key ecological values across the NGBR Project, given the combination of:

- Survey data collected to date
- Desktop gap analysis, including
  - Data from other assessments (incorporating seasonality information, where available)
  - Broader historical records and database searches
- The conservative approach to likelihood of occurrence
- The nature of the NGBR Project (linear infrastructure).

One round of post-wet season survey has been carried out to date. Further survey work will be carried out to verify the findings of the impact assessment and survey effort to date, to include data collected during the dry season and extending to detailed pre-clearance surveys prior to construction.

3. Regional context

3.1 Overview

The preliminary investigation corridor runs from the Gregory Developmental Road in the south, northwards to the west of the Bowen Developmental Road, past Collinsville and north of the Don River to finish at the Port of Abbot Point. The preliminary investigation corridor mainly traverses through the Brigalow Belt bioregion and two River Basins (Burdekin & Don). The preliminary investigation corridor transverses the Burdekin River Basin, with a length of approximately 150 km through this basin, and approximately 50 km bisecting the Don River Basin (Figure 2-12). Fifteen kilometres of the preliminary investigation corridor also intersects the Belyando River catchment, however, it does not cross any major watercourses within this basin. A number of wildlife corridors are also intersected by the preliminary investigation corridor.

The majority of the preliminary investigation corridor occurs within the Whitsunday Regional Council local government area, with the southern portion lying within the Isaac Regional Council local government area (Department of Local Government and Planning 2012). The nearest towns to the preliminary investigation corridor are Bowen (approximately 18 km south-east), Collinsville (approximately 19 km east), Glenden (approximately 38 km east) and Moranbah (approximately 77 km south-east) (Figure 2-1).

3.2 Brigalow Belt bioregion

The Brigalow Belt bioregion is a large, complex area covering approximately 365,326 km^2 of central Queensland, extending south from Townsville to Narrabri in New South Wales (Sattler & Williams 1999). The bioregion has a semi-arid to tropical climate with distinct seasonal rainfall patterns and an annual mean rainfall of 590 mm. Land use in the Brigalow Belt is predominantly grazing (SEWPaC 2013d). The Brigalow Belt bioregion is characterised by brigalow (*Acacia harpophylla*) dominated forests and woodlands on clay soils (Sattler & Williams 1999). Prior to European settlement, brigalow vegetation is thought to have covered between 4.7 to 6 million ha in Queensland. However, extensive broadscale clearing, predominantly driven by agricultural practices, has greatly diminished brigalow communities within the bioregion (Sattler & Williams 1999). In addition to brigalow, other communities that characterise the bioregion are eucalypt forests and woodlands, grasslands, dry rainforests, cypress pine woodland and riparian communities (Sattler & Williams 1999).

The NGBR Project is located in the far north of the Brigalow Belt, within five subregions of the Brigalow Belt North bioregion. These subregions neatly correlate to the five major landscapes the preliminary investigation corridor traverses, and are described below in order as encountered from north to south, and only in relation to the sections of the subregion that traverse the preliminary investigation corridor (most of these subregions are very large and comprise a greater diversity of landscapes than is described below).

- Townsville Plains- the lower coastal plain on which the Caley Valley wetland is located. This subregion comprises approximately two per cent of the corridor.
- Bogie River Hills- comprising the upper coastal plain, an intermittent line of granite mountains that forms a backdrop to the coastal plain, and the catchments of a number of rivers and major creeks that flow west to the Burdekin River, which the investigation corridor crosses roughly perpendicular to their flow. The centre of this subregion includes

a low range (the Clarke Range) that forms the watershed between the Bogie River and Strathmore Creek. This range is traversed by the preliminary investigation corridor before it crosses a broad, level to undulating plain as it approaches the Bowen River floodplain. The Bogie River Hills subregion comprises approximately 37 per cent of the investigation corridor – the largest traverse of any subregion in the investigation corridor.

- Northern Bowen Basin- in the vicinity of the preliminary investigation corridor this subregion comprises the Bowen River floodplain, and it accounts for approximately 14 per cent of the preliminary investigation corridor.
- Wyarra Hills - comprises an elevated section of rolling to level country that forms part of the southern catchment of the Bowen River, and the watershed and upper catchment of the Suttor River. The preliminary investigation corridor climbs the Leichhardt Range (which is the Suttor River/Bowen River watershed), crossing a number of gullies, and descends into the Suttor River catchment, whose landscape includes broad, undulating to level sandy plains and rocky rises. The Wyarra Hills subregion comprises approximately 19 per cent of the preliminary investigation corridor.
- Belyando Downs - the preliminary investigation corridor drops in elevation from the Wyarra Hills onto the Belyando Downs subregion approximately 10 km north of the Suttor Development Road. This subregion is characterised by broad, undulating to gently undulating plains, low rocky rolling rises (often with a distinctive strike pattern), and the extensively braided channel system of the lower Suttor River. Approximately 15 km before the southern end, the preliminary investigation corridor crosses a low ridgeline and enters the Belyando River catchment. The Belyando Downs subregion comprises approximately 28 per cent of the preliminary investigation corridor.

3.3 Burdekin River Basin

The Burdekin River Basin is the second largest river basin on the Queensland coast (NWC 2013) and covers approximately 130,109 km^2 (DEHP 2013b). The preliminary investigation corridor runs through the east of the basin, to the west of the Bowen Developmental Road and past Collinsville, ending 7.2 km from Mistake Creek (Figure 2-1). Cattle grazing is the most dominant land use for the area, and covers approximately 96 per cent of the Basin area (Dight 2009). Additional land uses include irrigated cropping, horticulture, aquaculture and mining (Dight 2009). The Burdekin River Basin also contains Queensland's largest dam, the Burdekin Falls Dam, which has a total capacity of 1,860,000 ML (NWC 2013). Aquatic habitats in the area are diverse, and include:

- Ephemeral creeks and drainage lines
- Large, permanently flowing rivers
- Arid and semi-arid lakes and swamps
- Coastal and sub-coastal floodplains
- Grass, sedge and tree swamps
- Wetlands
- Mangrove forests (DEHP 2013b)

The Burdekin River Basin is subject to strong seasonality with mean annual rainfall varying between 600 to 2500 mm, falling predominantly during the wet season (December to April) (Dight 2009; NWC 2013). Water flows within the Burdekin River Basin also exhibit distinct

seasonality, where changes in rainfall result in the basin being predominantly dry during the winter and wet in the summer. Rainfall is highly variable throughout the basin and varies between years. Generally, rainfall is highest and least variable in the coastal uplands, and lowest and most unpredictable in the western and southern parts of the basin (Dight 2009). Severe flooding occasionally occurs within the Burdekin River Basin as a result of severe storms, cyclones and tropical low pressure systems.

However, prolonged dry conditions and drought are also characteristic of the basin. Mean annual discharge from the basin (taken from the Clare Weir in the lower Burdekin River Basin) is approximately 9.4 million ML. This accounts for approximately a third of all coastal mean annual discharge into Great Barrier Reef along the north Queensland coast (NWC 2013). The habitats, flora and fauna in estuarine, coastal and marine areas near to the preliminary investigation corridor is discussed in Volume 1 Chapter 7 Matters of National Environmental Significance. The Burdekin River Basin can be divided into three dominant catchments of relevance to the preliminary investigation corridor, namely the Suttor River, Bowen River and Lower Burdekin River (Figure 2-12).

Suttor River catchment

The preliminary investigation corridor within the Suttor River catchment sits parallel to Suttor River for most of its length, with two major crossings across the River and one across its tributary, Verbena Creek (Figure 2-12). The Suttor River catchment is approximately 18,000 km^2 and comprises almost 14 per cent of the area of the Burdekin River Basin. The Suttor River and its tributaries are ephemeral streams with large waterholes fed from groundwater. The terrain in this basin differs markedly from others within the Burdekin River Basin, lacking the high mountain backdrops and representing a drier, typically semi-arid western landscape. Cattle grazing is the dominant land use of the area and a small percentage of the land is used for dry land cropping of cereals.

The last 30 years of clearing riparian and floodplain vegetation has resulted in altered hydrological regimes and deterioration of the riparian habitat of many of the waterways crossed by the preliminary investigation corridor. This area shows some dry land salinity, which is a potential threat to the ecological and agricultural values of the Suttor River catchment. The practice of land clearing may need to cease to avoid further impacts. Macroinvertebrates have experienced moderate change along the whole river; fish and water quality are moderately affected below the junction of Suttor River with Belyando River (Greiner & Hall 2006).

Lower Burdekin River catchment

The Lower Burdekin River catchment drains an area of approximately 9,300 km^2. The preliminary investigation corridor intersects the Bogie River and Sandy Creek within the Lower Burdekin River catchment (Figure 2-12). Land use in the catchment is predominantly grazing on natural and modified pastures. Clearing along streams and floodplains over the last 30 years has seen a general decline in the condition of riparian habitat. The lower areas of the coastal sub-catchments, approximately 85 km to the northwest of the preliminary investigation corridor, represent a floodplain which is known to be the single most important, healthy and productive wetland system of the Burdekin region and greater Queensland coast. It is internationally recognised as a Ramsar wetland and includes long lengths of perennial creeks and estuarine wetlands through the Bowling Green Bay National Park.

Bowen River catchment

The Bowen River catchment is approximately 8,200 km^2 and forms a major tributary of the Burdekin River. The preliminary investigation corridor intersects Pelican Creek and the Bowen River at its confluence with Rosella Creek (Figure 2-12). The Bowen River, being a major tributary of the Burdekin River, has many perennial waterholes and clear flowing water for most of the year, and provides significant aquatic habitat. The Bowen River Weir (near Collinsville) is an artificial weir that provides a large, non-flowing, deep water habitat. The Bowen River: Biralee – Pelican Creek Wetland, a DIWA listed nationally important wetland is located within the Bowen River catchment and is approximately 10 km downstream of the preliminary investigation corridor.

Land use in this catchment is almost exclusively grazing on natural pastures. The condition of riparian habitat has recently declined (to poor) due to floodplain clearing and gully erosion.

3.4 Don River Basin

The Don River Basin is located along the central coast of Queensland and is bounded by the Clarke Range. It covers an area of approximately 3,736 km^2 from Bowen to Home Hill, south of Ayr (DEHP 2013a). The preliminary investigation corridor runs through the centre of the basin to the north of the Don River, finishing at the Port of Abbot Point where it connects with supporting infrastructure (rail loop/s and port infrastructure) (Figure 2-12). Although the Don River catchment forms part of the Don River Basin, it is not traversed by the preliminary investigation corridor. The preliminary investigation corridor traverses the catchment parallel to the Don River, and intersects many minor tributaries and flow paths within this basin.

Land use within the basin includes cattle grazing, horticulture and commercial fishing (DEHP 2013a). In addition, the Port of Abbot Point is an important industrial centre in the basin (NQBP 2013). The Don River Basin experiences relatively high rainfall with mean annual rainfall ranging from 1,000 to 1,600 mm (DEHP 2013a).

The basin supports a range of aquatic habitats, including coastal and sub-coastal floodplains, tree swamps, grass-sedge wetlands, mangroves and saltmarshes (DEHP 2013a). The major waterways within the basin (and in the vicinity of the preliminary investigation corridor) include the Elliot and Don Rivers (DEHP 2013a). Minor waterways of importance to the preliminary investigation corridor include Splitter's Creek and Saltwater Creek (Figure 2-12).

Nationally important wetlands within the basin (and in the vicinity of the preliminary investigation corridor) include the Caley Valley Wetland at Abbot Point, and the southern extent of Upstart Bay. National parks within the basin include Cape Upstart National Park, Mount Abbot National Park and Mount Aberdeen National Park (DEHP 2013a). The basin also discharges into the Burdekin fish habitat area, which is situated 10 km east of Ayr and over 30 km north of Abbot Point (DEHP 2013a) (Figure 4-2).

3.5 Landscape corridors, connectivity and Biodiversity Planning Assessments

A wildlife corridor is a network of wildlife habitats that are connected in the landscape. They maintain ecological and evolutionary processes (gene flow) at a landscape scale (EPA 2008). Connectivity of habitats and landscape corridors at a bioregional scale is discussed and mapped through the *Brigalow Belt North Landscape Expert Panel Report* (EPA 2008) and DEHP BPA mapping. Each is further detailed below, with relevance to the preliminary investigation corridor.

3.5.1 Brigalow Belt North Landscape Expert Panel Report

The *Brigalow Belt North Landscape Expert Panel Report* (EPA 2008) details information on areas of importance for maintaining ecological values within the Brigalow Belt bioregion. The information presented below is sourced from this report. Items of potential relevance to the preliminary investigation corridor are as follows:

- Mount Abbot is part of a large tract of remnant vegetation between the Bogie and Elliot Rivers. Vegetation on the mountain is characterised by deciduous vine thicket as well as open woodland, rocky granite slopes and scrub on granite outcrops. A number of threatened flora species are associated with the mountain, namely: *Croton magneticus, Ozothamnus eriocephalus and Corchorus hygrophilius.*
- Remnants of semi-evergreen vine thicket in the Brigalow Belt North bioregion are considered to be of State significance, due to the distinct variation in taxa diversity in these flora assemblages.
- The 'Strathmore' and 'Havilah' properties (which are intersected by the preliminary investigation corridor) were identified by the panel as being of particular interest for conservation of remnant semi-evergreen vine thicket (SEVT).
- Spinifex ridges between Collinsville and Mount Coolon are considered to be of significance.
- Parts of the Brigalow Belt North bioregion, including the Leichardt Range and Drummond Range, contain large tracts of continuous remnant vegetation. These areas are very high value for wildlife refugia (criteria 1b). The size of these tracts is a major indicator of ecological significance, and is also strongly correlated with the long-term viability of biodiversity values.
- The eastern range limit of gidgee (Acacia *cambagei*) on alluvials extends to the Kilcummin Road area.
- The ecosystem association on Mt. Aberdeen is SEVT, which is of State significance. One 'rare' plant (*Atalaya rigida*) and one 'vulnerable' (under the EPBC Act) plant (*Taeniophyllum muelleri*) are recorded here. Remnant SEVT also has a very high rating in this region, due to the distinct variation in taxa diversity in these flora assemblages.

3.5.2 Biodiversity Planning Assessment mapping

The BPA mapping for the Brigalow Belt bioregion was reviewed to provide an indication of the quality and value of remnant vegetation within and beyond the preliminary investigation corridor. Specifically, two BPA mapping criteria were applied to the preliminary investigation corridor and surrounding landscape, such that the potential habitat values within and beyond the preliminary investigation corridor could be described.

The preliminary investigation corridor intersects a number of wildlife corridors identified by the DEHP BPA mapping and the *Brigalow Belt North Landscape Expert Panel Report* (EPA 2008) for the Brigalow Belt bioregion (Figure 3-1). A wildlife corridor linking the ranges to the coast is identified between Mount Abbot and Abbot Point. The BPA wildlife corridor is mapped in a north-south direction from the coast to Mount Roundback and is represented by a series of large remnant vegetation 'stepping stone' tracts. The preliminary investigation corridor intersects this wildlife corridor in an east-west direction, parallel to the northern edge of Mount Roundback. The majority of vegetation within this area is classified as non-remnant cleared pasture land. This wildlife corridor then continues in an east-west direction from south of Mt Roundback to

Mount Abbot. Here the corridor connects with the larger Great Eastern Range wildlife corridor which follows remnant vegetation on the Clarke Range north-west into the Brigalow Belt North bioregion to the Sonoma State Forest, where it tracks north to Mount Aberdeen National Park and along the coastal watershed (EPA 2008). The preliminary investigation corridor intersects the Great Eastern Range wildlife corridor in a north-south direction through a large relatively contiguous area of remnant vegetation broadly occurring between the Elliot River and the Bogie River. Vegetation in this area is dominated by eucalypt woodland. Despite the area being used for cattle grazing, the remnant vegetation within this area is likely to facilitate local and regional fauna movement.

The preliminary investigation corridor intersects a number of terrestrial corridor linkages across the bioregion south of the Bogie River. The preliminary investigation corridor intersects a small identified corridor running westward from the Clarke Range to link with the Leichhardt Range in the Einasleigh Uplands bioregion, through grassy eucalypt woodlands and grassland remnant vegetation patches north of the Bowen River. This corridor also links to the more continuous riparian corridor along the Bowen River.

The Leichhardt Range Corridor runs along the watershed between the Suttor and Bowen Rivers from the Denham Range northwest to Redcliffe Tableland, and then along the Leichhardt Range which tracks north to the Einsleigh Uplands bioregion (EPA 2008). The preliminary investigation corridor intersects this wildlife corridor in a north-south direction just north of the Suttor River between the Suttor and the Bowen Rivers (Figure 3-1). This area represents a large contiguous area of remnant vegetation, dominated by relatively undisturbed eucalypt woodland that is of importance for habitat connectivity in the landscape.

The preliminary investigation corridor intersects an important westward link radiating from the Denham Range east of Glenden to the Great Dividing Range in the Desert Uplands bioregion. This corridor link runs westward through fragmented grazing and agricultural landscapes, north of the Suttor River, using patches of remnant vegetation and riparian vegetation of small ephemeral creeks as stepping stones to larger intact vegetation remnants west of the Belyando River.

The following major rivers and creeks of relevance to the preliminary investigation corridor have also been identified as significant riparian corridors in the Burdekin catchment from BPA mapping and EPA (2008):

- Broken and Bowen Rivers and Rosella Creek which flow from the western side of the Clarke Range
- Sections of the Suttor River above Lake Dalrymple
- Logan and Diamond Creeks which flow form the northern and western slopes of the Drummond and Denham Ranges to form a corridor down to the Suttor River.

Much of the remnant vegetation in the landscape through which the preliminary investigation corridor occurs is mapped as containing high or very high context and connection values. Remnant vegetation ranked as having high or very high context and connection values dominates the landscape the preliminary investigation corridor traverses between the Bogie River in the north and Suttor Development Road in the south. Either side of these features, remnant vegetation ranked as having high or very high context and connection values becomes more fragmented.

LEGEND

- Population Centres
- Major Port
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

BPA Biodiversity Significance version 1-3

Central Queensland Coast

J Rating
- Very High
- High

Brigalow Belt and Einasleigh Uplands BPA

J Rating
- Regional
- State

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Job Number	41-26457
Revision	B
Date	07 Aug 2013

Biodiversity Planning Assessment
Mapping - Corridors

Figure 3-1
Sheet 1

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LEGEND

- Population Centres
- Major Port
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- BPA Biodiversity Significane v1-3 G Rating
  - Very High
  - High
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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Map Projection: Transverse Mercator
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North Galilee Basin Rail Project

Biodiversity Planning Assessment Mapping - Context and Connection

Job Number	41-26457
Revision	A
Date	07 Aug 2013

Figure 3-1 Sheet 2

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3.6 Protected area estate

The preliminary investigation corridor does not intersect any mapped protected area estates. GIS assessment identified seven protected areas that occur within 10 km of the preliminary investigation corridor; this includes three national parks, three nature refuges and one resources reserve. The seven protected areas and their locations in relation to the preliminary investigation corridor (from south to north) are:

- Nariana National Park – located approximately 8.5 km west
- Hells Gate Nature Refuge – located approximately 9 km west
- Mount Pleasant Nature Refuge – located approximately 8 km east
- Aberdeen Nature Refuge – located approximately 8 km east
- Mount Aberdeen National Park – located approximately 4 km southeast
- Mount Abbot National Park – located approximately 8 km northwest
- Abbot Bay Resources Reserve – located approximately 7 km north.

The location of the protected areas in relation to the preliminary investigation corridor is presented in Figure 3-2.

LEGEND

- Population Centres
- Major Port
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)

Protected Areas
- Conservation Park
- Forest Reserve
- National Park (Conservation)
- National Park
- National Park (Scientific)
- Resource Reserve
- State Forest
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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North Galilee Basin Rail Project

Job Number	41-26457
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Date	07 Aug 2013

Protected Area Estate

Figure 3-2

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4. Existing environment

4.1 Weather conditions

In the four months (January 2013 to April 2013) leading up to the May/June field survey, the following rainfall totals were observed (long-term average totals in brackets):

- Bowen: 662 mm (593 mm (1987 to 2013))
- Collinsville: 522.4 mm (438.4 mm (1939 to 2013))
- Moranbah: 445.6 mm (296.3 mm (1972 to 2012)).

Rainfall totals were higher than their corresponding long-term averages due to an increased number of low pressure systems and rain depressions occurring across the region during early 2013. Weather conditions during the May/June field survey were typified by warm to hot temperatures, high humidity and mild to warm nights. Rainfall events occurred in the region prior to and during the May/June field survey. Average weather conditions during the survey period are summarised below:

- 7 to 11 May: average temperature range: 16.1 °C – 25.6 °C; rainfall: 12.2 mm (data sourced from Moranbah (Station ID 34035))
- 12 to 15 May: average temperature range: 16.3 °C – 27.5 °C; rainfall: 0.6 mm (data sourced from Collinsville (Station ID 33013))
- 16 to 17 May: average temperature range: 18.2 °C – 25.2 °C; rainfall: 26.4 mm (data sourced from Bowen (Station ID 033257))
- 13 to 14 June: average temperature range: 11.1 °C – 25.8 °C; rainfall: 0.2 mm (data sourced from Moranbah (Station ID 34035)).

Weather conditions both preceding and during field surveys were suitable for detecting the prescence of flora and fauna species during field surveys.

4.2 Vegetation communities and habitats

4.2.1 Overview

A total of 61 REs are mapped by DNRM version 6.1 RE mapping within the preliminary investigation corridor. This comprises seven ‘endangered’ REs, 18 ‘of concern’ REs and 36 ‘least concern’ REs (*Vegetation Management Act 1999* (VM Act) status). These REs occur either as homogenous or mixed polygons (a mixed polygon is where two or more REs are assigned to one area, for example 11.3.4/11.3.2).

Constituent REs of three threatened ecological communities (TEC) listed under the EPBC Act are mapped within the preliminary investigation corridor. The three TECs are:

- Brigalow (*Acacia harpophylla* dominant and co-dominant)
- Natural Grassland of the Queensland Central Highlands and the Northern Fitzroy Basin
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions.

These TECs are addressed further in Volume 1 Chapter 7 Matters of National Environmental Significance Technical Report.

The preliminary investigation corridor contained high value regrowth vegetation on leasehold land. High value regrowth vegetation is regulated under the VM Act and is mature native vegetation that has not been cleared since 31 December 1989. This comprises polygons of high value regrowth vegetation containing 'endangered' dominant regional ecosystems, 'of concern' dominant regional ecosystems, 'of concern' sub-dominant regional ecosystems and 'least concern' regional ecosystems. The majority of regrowth vegetation within the preliminary investigation corridor occurred south of the Bowen River.

One essential habitat polygon (DNRM mapping version 3) was mapped as occurring within 1 km of the preliminary investigation corridor. This mapped essential habitat polygon related to a single species, *Bonamia dietrichiana* ('near threatened' under the NC Act), and is located west of Collinsville. This mapped essential habitat polygon was intersected by the preliminary investigation corridor around chainage 105 km. No mapped essential regrowth habitat polygons were mapped within the Brigalow Belt bioregion or were intersected by, or occurred within 1 km of, the preliminary investigation corridor.

The DEHP declared critical habitat register and areas of major interest register were not made available during time of writing, therefore have not been reviewed in relation to the preliminary investigation corridor. The NC Act defines critical habitat as habitat that is essential for the conservation of a viable population of protected wildlife or community of native wildlife, whether or not special management considerations and protection are required. A critical habitat may include an area of land that is considered essential for the conservation of protected wildlife, even though the area is not presently occupied by the wildlife. A description of the REs mapped, the regulated regrowth vegetation mapping and mapped essential habitat occurring within the preliminary investigation corridor is presented in Appendix B.

A total of 22 threatened flora species (EPBC Act and/or NC Act listed) were identified within the preliminary investigation corridor or broader study area. The desktop database search results are provided in Appendix G. Two priority plant species (*Cochorus hygrophilus* and black ironbox (*Eucalyptus raveretiana*)) were identified in the Burdekin NRM *Back on Track Actions for Biodiversity* report (DERM 2010). A likelihood of occurrence assessment for threatened flora species was undertaken in accordance with the methodology outlined in Section 2.6. A summary of habitat preferences of threatened plants (under the NC Act) and their likelihood of occurrence is provided in Table 4-1.

A total of 333 flora species, including 35 exotic species (of which 10 are declared species), were identified during field surveys. One EPBC Act and NC Act listed 'vulnerable' species, black ironbox (*Eucalyptus raveretiana*), was recorded during the field program (discussed further in Section 4.2.8). Overall, 71 plant families were recorded in the preliminary investigation corridor. The most species-rich plant families represented in the preliminary investigation corridor were:

- Poaceae (75 taxa)
- Myrtaceae (32 taxa)
- Mimosaceae (18 taxa)
- Fabaceae (17 taxa)
- Malvaceae (12 taxa)
- Cyperaceae (11 taxa).

The terrestrial flora field species list is provided in Appendix C.

Table 4-1 Threatened terrestrial flora species – likelihood of occurrence

Species	EPBC Act/ NC Act status	Predicted to occur by PMST	Previously recorded*	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
Acacia armitii	Not listed/ near threatened	-	WO, HERBRECS	x	*Acacia armitii* is found in scattered populations in central and northern Queensland and the Northern Territory (The Council of Heads of Australasian Herbaria 2013). The species occurs on sandy, shallow and rocky soils on creek banks and river flats. The closest record is from 2003 from Blackwood National Park, 45 km north east of Avon Downs Station (The Council of Heads of Australasian Herbaria 2013).	Previously recorded recently in the desktop search extent BUT not inside the preliminary investigation corridor or within its immediate vicinity AND is a widespread species with suitable habitat within the corridor. **May occur**
Aristida granitica	Endangered/ endangered	✓	WO, HERBRECS	x	One population only of *Aristida granitica* is known from the type locality in the foothills of Mt Pring 10 km west of Bowen, Queensland. Within this location it has been reported to be common (TSSC 2008if). It grows in sandy soil derived from granite and in eucalypt woodland (Simon 1984; TSSC 2008if).	Previously recorded in the desktop search extent BUT not inside the preliminary investigation corridor or within its immediate vicinity and it is a highly restricted species. **Unlikely to occur**
Bonamia dietrichiana	Not listed/ near threatened	-	WO, HERBRECS	x	*Bonamia dietrichiana* occurs in vine thickets on granite boulders. It is a scrambling vine which Is often found on low trees, shrubs and boulders (Calvert *et al* 2005). A record for	Previously recorded from within and nearby the preliminary investigation corridor AND suitable habitat common within the

Species	EPBC Act/ NC Act status	Predicted to occur by PMST	Previously recorded*	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
					this species from the foot of Mt Roundback (near Caley Valley) is situated within the preliminary investigation corridor in ironbark woodland, and another near the preliminary investigation corridor beside Pelican Ck (near Collinsville) is located in dry vine thicket (The Council of Heads of Australasian Herbaria 2013). Essential habitat for this species is mapped within the preliminary investigation corridor.	corridor. **Likely to occur**
Miniature moss-orchid ***Bulbophyllum globuliforme***	Vulnerable/ near threatened	✓	x	x	The Miniature moss-orchid is reportedly only found growing on hoop pine (*Araucaria cunninghamii*) throughout the McPherson Range of northeast NSW and southeast Qld communities (TSSC 2008jh). However, the Queensland Herbarium has a record for this species from near Paluma, north west of Townsville (The Council of Heads of Australasian Herbaria 2013). The distribution of this species overlaps with the TEC Semi-evergreen vine thicket and Brigalow (TSSC 2008jh).	Not recorded within the desktop search extent AND suitable habitat is not present (no hoop pines were observed in the preliminary investigation corridor during the field surveys). **Unlikely to occur**

Species	EPBC Act/ NC Act status	Predicted to occur by PMST	Previously recorded*	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
***Brachychiton* sp. (Blackwall Range R.J.Fensham 971)**	Not listed/ endangered	-	WO, HERBRECS	x	This species of Brachychiton has three records in the Australian Virtual Herbarium, all located west of Eugnella National Park near the Bowen River, within dry rainforest on basalt boulder fields. There is limited information available for the species beyond the field notes for these collections – it is a tree to 7 m tall, locally common in semi-evergreen vine thicket on talus slopes, with smooth white bark and bright red flowers (Council of Heads of Australasian Herbaria 2013).	Previously recorded in the desktop search extent BUT not in the preliminary investigation corridor or within its immediate vicinity AND the species appears to be highly localised (only three records from a district that is relatively well surveyed) AND suitable habitat is of limited extent within the preliminary investigation corridor. **Unlikely to occur**
Cajanus mareebensis	Endangered/ endangered	✓	x	x	*Cajanus mareebensis* has been recorded in grassy woodlands dominated by Melaleuca, Acacia, Eucalyptus and Corymbia species within the Cape York and Northern Gulf regions of Queensland (TSSC 2008jl). The species is a perennial trailing herb occurs on sandy soils derived from granite (TSSC 2008jl). It is unclear why it is identified in PMST as it has not been recorded within 400 km of the desktop search extent (Council of Heads of Australasian Herbaria 2013).	Not recorded within 400 km of the desktop search extent. **Unlikely to occur**

Species	EPBC Act/ NC Act status	Predicted to occur by PMST	Previously recorded*	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
Cerbera dumicola	Not listed/ near threatened	-	WO, HERBRECS	x	*Cerbera dumicola* is a shrub or a small tree that is widespread in central Queensland. It grows in vine thickets and lancewood (*Acacia shirleyi*) thickets (Forster 1992). Within the desktop search extent, it has been recorded from the site of the Collinsville mine and from lancewood scrub beside the Cerito-Elphinstone Road, on Byerwen Station (near Figtree and Cerito Stations) (Council of Heads of Australasian Herbaria 2013).	Previously recorded in the desktop search extent AND within 5 km of the preliminary investigation corridor AND suitable habitat is located within the preliminary investigation corridor. **May occur**
Corchorus hygrophilus	Not listed/ vulnerable	-	WO, HERBRECS	x	*Corchorus hygrophilus* is a shrub which occurs on vine forest margins or in sclerophyll forest adjacent to vine forest. It grows on soils derived from granite or limestone among boulders (Halford & Mayhew 1999). In the study area it has been recorded only from the summit and slopes of Mt Abbot (Council of Heads of Australasian Herbaria 2013), just over 5 km west of the preliminary investigation corridor in the vicinity of Thurso Station.	Previously recorded in the desktop search extent AND in habitat present likely to be present within the preliminary investigation corridor BUT not inside the preliminary investigation corridor. **May occur**

Species	EPBC Act/ NC Act status	Predicted to occur by PMST	Previously recorded*	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
Croton magneticus	Not listed/ vulnerable	✓	WO, HERBRECS	x	*Croton magneticus* is a shrub found in vine thickets on skeletal granite, limestone or sandstone soils, including rocky seashores (Calvert *et al* 2005). Common vine thicket species that it is known to grow in association with include Croton arnhemicus and Croton phebalioides. It may be deciduous during the dry season (Calvert *et al* 2005). This species was recorded from vine thicket mixed with brigalow on Havilah Station in 1994, within 2 km of the preliminary investigation corridor (Council of Heads of Australasian Herbaria 2013).	Previously recorded in the desktop search extent AND from near the preliminary investigation corridor AND suitable habitat was recorded from within the preliminary investigation corridor. **May occur**
King blue grass ***Dichanthium queenslandicum***	Endangered/ vulnerable	x	WO, HERBRECS	x	King blue grass can be found throughout central Queensland on black cracking clay soils derived from basalt, in association with other *Dichanthium* and *Bothriochloa* spp. within native grasslands and some open woodlands (Simon 1982). It has been recorded approximately 15km from the corridor in the desktop search extent (Council of Heads of Australasian Herbaria 2013).	Previously recorded in the desktop search extent BUT not from within the preliminary investigation corridor or its immediate vicinity AND suitable habitat (natural grassland) not recorded during surveys. **Unlikely to occur**

Species	EPBC Act/ NC Act status	Predicted to occur by PMST	Previously recorded*	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
Dichanthium setosum	Vulnerable/ not listed	x	WO, HERBRECS	x	Refer to Volume 1 Chapter 7 Matters of National Environmental Significance	**May occur**
Finger panic ***Digitaria porrecta***	Endangered/ near threatened	x	WO, HERBRECS	x	Finger panic occurs within disjunct areas of Queensland, including in the Nebo district (one record), south-west of Mackay; the Central Highlands between Springsure and Rolleston; and from Jandowae south to Warwick (Council of Heads of Australasian Herbaria, 2013). It occurs in grassland and open woodlands communities on undulating plains, often road reserves, with an underlying basaltic geology (TSSC 2008mi). A single record for this species is located in the desktop search extent, more than 45 km from the corridor (Council of Heads of Australasian Herbaria 2013).	Previously recorded in the desktop search extent BUT not within the preliminary investigation corridor or its immediate vicinity AND the species appears to be at its northern-most distribution and rare in this area AND suitable habitat is present. **May occur**
Eucalyptus raveretiana	Vulnerable/ vulnerable	✓	WO, HERBRECS	✓	Black ironbox occurs in riparian woodlands on alluvial flats along creek and river banks on sandy or alluvial soils. It is commonly associated with *Melaleuca* spp., *Casuarina cunninghamiana* and *Eucalyptus tereticornis* in the canopy layer. (Calvert *et al* 2005). It has been recorded from	Previously recorded in the desktop search extent AND within the preliminary investigation corridor AND confirmed present during the field surveys **Confirmed present**

Species	EPBC Act/ NC Act status	Predicted to occur by PMST	Previously recorded*	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
					within the corridor in the Elliot, Bogie and Bowen Rivers, and from Pelican and Sandy Creek. It was recorded during the surveys within the preliminary investigation corridor in Strathmore and Crush Creeks, where it was co-dominant in the canopy with other eucalypts.	
Marsdenia pumila	Not listed/ near threatened	-	WO, HERBRECS	x	*Marsdenia pumila* has been recorded in the South Kennedy district of Queensland. The species occurs within the grassy understorey of *Corymbia leichhardtii*, *C. trachyphloia* and *Lysiana angustifolia* low woodlands (Forster 1995a). The Australian Virtual Herbarium has only two records for this species, both from Cerito Station approximately 6 km west of the corridor (Council of Heads of Australasian Herbaria 2013). Similar habitat to that in which this species has been recorded is located within the preliminary investigation corridor in Cerito Station.	Previously recorded in the desktop search extent within 6 km of the preliminary investigation corridor BUT not from within the preliminary investigation corridor AND suitable habitat for the species exists within the preliminary investigation corridor **May occur**
Paspalidium scabrifolium	Not listed/ near threatened	-	WO, HERBRECS	x	Recognised under the Australian Plant Name Index as synonymous with *Paspalidium distans*, there is some doubt that this taxa deserves recognition as	Previously recorded in the desktop search extent BUT not within the preliminary investigation

Species	EPBC Act/ NC Act status	Predicted to occur by PMST	Previously recorded*	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
					a species (John Thompson, pers.comm. 27/07/2012). A single record for this species exists from the desktop search extent, located approximately 15 km east of the corridor near the Suttor River crossing over the Suttor Development Road (Council of Heads of Australasian Herbaria 2013). There is limited information available for this species besides the label for the record – it was located in open forest/woodland with a tall shrub layer and a species-rich ground layer (Herbrecs search).	corridor or its immediate vicinity AND suitable habitat appears to be present in the preliminary investigation corridor **May occur**
Peripleura scabra	Not listed/ near threatened	-	WO, HERBRECS	x	*Peripleura scabra* is an erect annual herb which occurs in ironbark or lancewood woodland on rocky slopes, usually with skeletal soils (granite or sandstone is most common) (Calvert *et al* 2005). It is also known under the synonym *Vittadinia scabra*, and under this name the Australian Virtual Herbarium has one record from Mt Abbot, just over 5 km west of the preliminary investigation corridor in the vicinity of Thurso Station (Council of Heads of Australasian Herbaria 2013).	Previously recorded in the desktop search extent BUT not from within the preliminary investigation corridor AND suitable habitat exists within the preliminary investigation corridor **May occur**

Species	EPBC Act/ NC Act status	Predicted to occur by PMST	Previously recorded*	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
Polianthion minutiflorum	Vulnerable/ vulnerable	x	WO, HERBRECS	x	*Polianthion minutiflorum* has been recorded in Queensland in five locations ranging from Redcliffe Vale south to Kingaroy. The species has been recorded within Corymbia and Acacia dominated open woodlands and forests on sandstone outcrops and gullies (TSSC 2008wl; Herbrecs search). The single record from within the desktop search extent is from Redcliffe Vale, 40 km east of the preliminary investigation corridor.	Previously recorded in the desktop search extent BUT not from within the preliminary investigation corridor or its immediate vicinity AND suitable habitat exists within the preliminary investigation corridor **May occur**
Omphalea celata	Vulnerable/ vulnerable	✓		x	*Omphalea celata* has been recorded within the North and South Kennedy regions of central Queensland (Forster 1995b). The species occurs within semi evergreen vine thickets along steep gorges and permanent watercourses (Forster 1995b). The nearest records are from Hazelwood Gorge near Eungella National Park, more than 65 km east of the preliminary investigation corridor (Council of Heads of Australasian Herbaria 2013).	Not recorded within the desktop search extent BUT partially suitable habitat exists in the preliminary investigation corridor **Unlikely to occur**
Ozothamnus eriocephalus	Vulnerable/ vulnerable	✓	WO, HERBRECS	x	*Ozothamnus eriocephalus* grows on rocky escarpments, slopes	Previously recorded in the desktop search extent

Species	EPBC Act/ NC Act status	Predicted to occur by PMST	Previously recorded*	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
					and creek gullies in closed rainforest margins and also open eucalypt forest. It is known from the Bowen and Mackay regions of central Queensland (TSSC 2008aas). The nearest record to the preliminary investigation corridor is located on Mt Abbot, just over 5 km west of the corridor in the vicinity of Thurso Station. It is also recorded to the north of Glenden approximately 35 km east of the preliminary investigation corridor (Council of Heads of Australasian Herbaria 2013).	BUT not from within the preliminary investigation corridor AND suitable habitat exists within the preliminary investigation corridor **May occur**
Senna acclinis	Not listed/ near threatened	-	HERBRECS	x	In Queensland, *Senna acclinis* occurs mainly in the south-east, where it is apparently restricted to rainforest margins (Randell & Barlow 1998). However, there are a number of records of this species from the North Kennedy area, near the coast, in beach scrub or rainforest. The nearest of these records is from Cape Upstart National Park, 40 km to the north west of the preliminary investigation corridor (Council of Heads of Australasian Herbaria 2013).	Previously recorded in the desktop search extent BUT not from within the corridor or its immediate vicinity AND suitable habitat exists but is restricted to a small area at Caley Valley **Unlikely to occur**

Species	EPBC Act/ NC Act status	Predicted to occur by PMST	Previously recorded*	Recorded within preliminary investigation corridor during field surveys	Habitat preferences and known distributions	Likelihood of occurrence
Streblus pendulinus	Endangered/ not listed	✓	x	x	Refer to Volume 1 Chapter 7 Matters of National Environmental Significance	Not recorded within the desktop search extent. Suitable habitat for this species may occur within the investigation corridor. **May occur**
Minute orchid ***Taeniophyllum muelleri***	Vulnerable/ not listed	✓	WO, HERBRECS	x	Refer to Volume 1 Chapter 7 Matters of National Environmental Significance	Previously recorded in the desktop search extent west of Bowen (Mt Aberdeen National Park). Suitable habitat for this species may occur within the investigation corridor. **May occur**

* Note that these desktop results are based on historical records (from across all seasons ranging from 1870 through to 2012) from HERBRECS or from historical records from Wildlife Online (where record dates are not specified).

For the purposes of understanding the general vegetation patterns within the preliminary investigative corridor, the 61 mapped REs can be reduced to a set of 8 broad vegetation communities (BVCs) plus 1 BVC that comprises non-remnant areas. The BVCs are based on similarities in the species composition and community structure of the vegetation. Eight broad habitats which correspond with the BVCs were identified as occurring within the preliminary investigation corridor (Table 4-2). Each BVC and the corresponding habitats are discussed below.

Table 4-2 Corresponding broad vegetation communities and broad habitats

Broad vegetation communities	Broad habitats
Natural grassland	Grassland
Vine thicket	Semi-evergreen vine thicket
Brigalow/gidgee	Acacia dominated woodland/shrubland
Sclerophyll woodland/open forest (excluding watercourse associated vegetation)	Eucalypt woodlands
Mixed species shrubland/low woodland	Eucalypt woodlands Acacia dominated woodland/shrubland
Non-remnant areas (including regrowth)	Non-remnant cleared land
Woodland/open forest fringing watercourses	Fringing riparian vegetation
Tidal vegetation	Coastal wetland
Wetland	
	Aquatic habitat

4.2.2 Natural grassland BVC

The natural grassland BVC is comprised of communities dominated by the grass lifeform, where native grasses dominate the ground layer. Five REs mapped within the preliminary investigation corridor meet this description, of which one is ‘endangered’ and one is ‘of concern’ under the VM Act. A number of the REs listed for this BVC are also analogous with the TEC ‘Natural grasslands of the Queensland Central Highlands and Fitzroy Basin’, which is listed as ‘endangered’ under the EPBC Act (only in certain subregions – in the vicinity of the preliminary investigation corridor, only the Northern Bowen Basin subregion, comprising the area between the Suttor Development Road and a point just south of Pelican Creek).

No natural grassland meeting the definition of the REs was located during the field surveys, although this BVC may be present on properties that were not surveyed. The majority of mapped natural grassland in the preliminary investigation corridor is located south of Terang Station, and between the Bowen River and just north of Strathmore Creek on Strathmore Station (survey sites TH31 and TH33, Figure 2-6 (northern section of preliminary investigation corridor), and Figure 2-7 (southern section of preliminary investigation corridor).

Native grassland habitats occurred in scattered patches in the preliminary investigation corridor. These habitats were structurally simple with a low diversity of microhabitat features. However, they supported a diverse range of flora species in the ground layer, including introduced pasture species which can dominate some areas of this habitat type. Ground layer microhabitats were provided through a combination of ground layer vegetation (grasses) (Plate 4-1) and the underlying substrate (e.g. rocks, cracking clays). Fauna habitat values were generally lower in this habitat type, particularly given the lack of forage and shelter resources above the ground

layer. Nonetheless, a variety of reptiles, mammals and birds inhabited these areas. The availability of water resources within this habitat was generally limited. Natural grasslands provided forage resources for ground-dwelling mammals, some reptiles, grassland birds and raptors.

Plate 4-1 Grassland habitat (May 2013)

4.2.3 Vine thicket BVC

The vine thicket BVC comprises communities forming dense tall shrublands or low woodland with a relatively high species diversity of non-sclerophyllous plants (in which there are at least two to three species of vine present). A number of vegetation patches meeting these parameters were located within and adjacent to the preliminary investigation corridor, entirely within the northern section (north of and including Fig Tree Station, on Myuna and Tabletop Stations). In general, vine thickets observed in non-littoral environments within the preliminary investigation corridor were sub-dominated by species including *Drypetes deplanchei,* bush tuckeroo (*Cupaniopsis anacardioides*), Burdekin plum (*Pleiogynium timorense*), pythonwood (*Gossia bidwillii*), native peach (*Ehretia membranifolia*) and wild prune (*Sersalisia sericea*) (among others) (see Appendix C for a full species list). Common emergents included broad-leaved bottletree (*Brachychiton australis*), Burdekin plum, brigalow and narrow-leaved ironbark, and vines. The most common vines were caustic vine (*Sarcostemma viminale*), native jasmine (*Jasminum didymum*) and small-leaved water vine (*Clematocissus opaca*).

In general, vine thicket was in small, discrete patches that appeared to have survived clearing due to being located in inaccessible areas (e.g. on a boulder field, fringing a creek, on the side of a steep hill). However, on Fig Tree, a relatively large area of remnant vegetation contained vine thicket in a mosaic with brigalow and sclerophyll vegetation communities (it was not possible to confirm this during field surveys). In these areas, the vine thicket communities were located on older igneous rocks (indicating land zone 12). However, at no point were hoop pines (*Araucaria cunninghamii*) observed, disqualifying the ‘least concern’ RE 11.12.4 (which is mapped for the preliminary investigation corridor). In addition, no vine thickets meeting the definition of the ‘endangered’ RE 11.11.18 were observed.

In the Caley Valley area immediately north of Saltwater Creek, a littoral vine thicket community was identified on a series of dune and swales. The main body of this vine thicket community was located to the east of the road; however, sections of vine thicket were established within the preliminary investigation corridor on the western side of the railway line/road corridor, in a mosaic with the sclerophyll woodland community defined by the RE 11.2.5. This vine thicket community meets the requirements of the ‘of concern’ RE 11.2.3, and is also analogous with the

TEC 'Semi-evergreen vine thickets of the Brigalow Belt North and Nandewar Bioregions', which is listed as 'endangered' under the EPBC Act.

This habitat type had a limited distribution throughout the preliminary investigation corridor. It occurred adjacent to the eastern fringe of the Caley Valley Wetland at the north of the preliminary investigation corridor at Abbot Point, and also in small isolated patches on hilly terrain north of Collinsville (survey sites TH29 and TH38, Figure 2-6 (northern section of preliminary investigation corridor), and Figure 2-7 (southern section of preliminary investigation corridor).

This habitat type featured two distinct vegetation communities: dense native scrub/vine thicket including low *Melaleuca* sp. (to approximately 5 m) growing on low coastal sand dunes and adjacent swales near Abbot Point; and closed canopy vine thicket with emergent *Brachychiton* sp. eucalypts and brigalow on granite bedrock hillsides (Plate 4-2).

Plate 4-2 Semi-evergreen vine thicket (May 2013)

Both communities had a dense shrub layer of mixed vine thicket species, generally a grassy groundcover and patches of dense leaf litter. The diversity of microhabitats within this habitat type was relatively high, particularly within the shrub and groundlayers. Groundcover was considered consistently dense and variable, with habitat resources available within the substrate, abundant woody debris and decomposition prevalent within the groundlayer. Rocks and tree hollows were also present in sparse to frequent densities.This habitat type provided shelter and forage resources for a variety of reptiles, mammals and birds, and was likely to support bird species which are more often encountered in relatively dense vegetated habitats.

4.2.4 Brigalow/gidgee BVC

The brigalow/gidgee BVC comprises communities dominated by brigalow (*Acacia harpophylla*) or gidgee (*Acacia cambagei*). This community generally forms woodland to open forest 8 – 18 m tall, and is usually restricted to cracking clays or clay loams. Gidgee particularly favours dark cracking clays (Gunn *et al* 1967). In general, these communities occur on plains and undulating lowlands (again, particularly gidgee), but brigalow can be found on slopes below scarps, and on low rises.

Sections of this BVC comprised of gidgee were restricted to the southern third of the corridor, south of the Suttor Development Road. This was the northern-most distribution of *A. cambagei* in this location. Within this section of the corridor, gidgee 'scrubs' were a common component of the heavy clay alluvial plains associated with the Suttor River and Mistake Creek, often growing in a mosaic with brigalow communities. Large sections of the improved pasture lands on the Suttor River floodplain were evidently once comprised of this gidgee/brigalow scrub mosaic,

based on the remnant strips left standing. However, most of the gidgee in the corridor was generally only found in small strips, having been extensively cleared (gidgee grows on soils that are ideal for improved pasture). Most of the gidgee REs in this BVC are listed as 'of concern' under the VM Act. The land on which this mosaic typically occurs was often characterised by gilgai. Gilgai are circular depressions in the ground up to 1 m deep and 20 m in diameter, which form small and species-rich wetlands when inundated. Other species commonly co-occurring with *A. cambagei* in gidgee scrubs included brigalow, yellowwood (*Terminalia oblongata*), red bauhinia (*Lysiphyllum carronii*) and, along watercourses, coolabah (*Eucalyptus coolabah*).

Brigalow communities within the corridor were more widespread, occurring as far north as the Bogie River. Brigalow REs located in the corridor are generally classified under the VM Act as 'endangered', and most are analogous with the 'endangered' TEC 'brigalow (*Acacia harpophylla* dominant and co-dominant)' listed under the EPBC Act.

There were two large patches of brigalow in the corridor. One was identified on Avon Downs, immediately to the south of the Suttor River crossing, where brigalow was present in a mosaic with sclerophyll woodlands and low scarps dominated by bendee (*Acacia catenulata*). Generally, brigalow was present beneath an emergent layer of Dawson's gum (*E. cambageana*) thereby forming the 'endangered' RE 11.4.8 or 11.9.1. To the north of the Bowen Development Road crossing on Fig Tree, large undisturbed stands of brigalow with a dense understorey of characteristic vine thicket species were growing along the margins of watercourses forming the headwaters of Three Mile Creek. This brigalow community was located within a mosaic formed by a number of other REs. Of all the BVCs identified in the preliminary investigation corridor, the brigalow/gidgee BVC has the highest conservation status, with four REs (50 per cent of its total) listed as 'endangered', and two listed as 'of concern', under the VM Act.

Acacia dominated woodland/shrubland habitat was broadly confined to the southern half of the preliminary investigation corridor (survey sites TH1, TH3, TH5, TH8, TH14, TH15, TH20, TH48 and TH49 (Figure 2-6 (northern section of preliminary investigation corridor), and Figure 2-7 (southern section of preliminary investigation corridor). Two distinct acacia dominated shrubland/woodland habitat types were observed in the landscape in which the preliminary investigation corridor occurs. Both shared broadly similar structural attributes; however, some differences were apparent. Brigalow (*Acacia harpophylla*) or gidgee (*Acacia cambagei*) were the dominant species where acacia woodland was associated with low lying black cracking clay plains.

On rockier substrates (often in undulating areas), lancewood (*Acacia shirleyi*) or bendee (*Acacia catenulata*) were the dominant acacia species. These habitats were typified by having a relatively dense canopy, a sparse (to absent) low shrub layer, and diverse ground layer microhabitats associated with abundant fallen woody debris, shedding bark, dense ground layer vegetation, cracking clays (within flat plains) and rocks (in rocky terrain) (Plate 4-3). Water resources, including gilgais and pools associated with braided river channels, were present at some sites.

Plate 4-3 Acacia dominated woodland/shrubland (May 2013)

Acacia dominated woodland/shrubland habitats were structurally denser than the more widespread eucalypt woodland habitat within the broader landscape. The presence of variable ground layer microhabitat features highlights the value of these habitats for fauna of the region, particularly ground-dwelling reptiles and mammals. Forage resources were also available to nectarivorous mammals and birds, granivores and insectivores. Predators including birds of prey, snakes, dogs and dingos were also observed in these habitats.

A summary of habitat characteristics recorded from the acacia dominated woodland/shrubland habitat type within and near the preliminary investigation corridor is provided in Table 4-3. This summary presents the proportions of sites containing various habitat features, based on a total of nine habitat assessments undertaken in acacia dominated woodland/shrubland. The dominant category for each habitat feature is highlighted in bold.

Table 4-3 Habitat summary – acacia dominated woodland/shrubland

Habitat feature	Percentage of sites assessed (n=9)		
Tree hollows	**Absent: 56%**	Sparse (less than 3 per 50 m): 33%	Frequent (greater than 3 per 50 m): 11%
Log piles/woody debris	Absent: 0%	Sparse: 33%	**Frequent: 67%**
Rocky ground cover/rock piles/boulders	**Absent: 67%**	Sparse: 11%	Frequent: 22%
Ground cover/substrate complexity	Sparse/homogenous: 44%	Dense/homogenous: 0%	**Dense/variable: 56%**
Introduced plants	Present (dominant): 33%	**Present (not dominant):44%**	Absent: 22%
Erosion	Extensive: 0%	**Minimal: 56%**	Absent: 44%
Livestock degradation (trampling)	Extensive: 22%	**Observed (not extensive): 67%**	Absent: 11%
Introduced animals	Recorded: 11%	**Likely to occur: 89%**	Unlikely to occur: 0%

4.2.5 Sclerophyll woodland/open forest BVC

The sclerophyll woodland/open forest BVC (excluding sclerophyll vegetation fringing watercourses) was the most widespread of the BVCs in the preliminary investigation corridor, and was comprised of communities dominated by *Eucalyptus* or *Corymbia*. Of the 16 REs mapped in the preliminary investigation corridor that make up this BVC, 8 are of conservation significance, 1 being 'endangered' (RE 11.9.1) and the remainder 'of concern' under the VM Act.

The most common sclerophyll communities recorded in the preliminary investigation corridor during field surveys were grassy woodlands dominated by narrow-leaved ironbark (*Eucalyptus crebra* or *E. drepanophylla*), either in a monoculture or with red bloodwood (*Corymbia erythrophloia*), which occurred primarily in the northern half of the corridor (north of the Bowen River). This community was particular common on older igneous rocks in this section, where it meets the definition of the 'least concern' RE 11.12.1, which is one of the most common REs for this area. The other common sclerophyll community in the northern half of the corridor was grassy woodland or open forest dominated by poplar gum (*E. platyphylla*), most commonly encountered on alluvial plains (in which case it meets the requirements for the 'least concern' RE 11.3.35).

South of the Bowen River, the most common sclerophyll community recorded during the field surveys was grassy or shrubby woodland and open woodland dominated by poplar box or Brown's box (*E. populnea/brownii*), which can meet the definition of a number of REs, including the conservation significant 11.3.2, 11.4.2 and 11.9.10. This community was generally grassy on alluvial landforms and shrubby on poorer soils (often texture contrast soils or colluvium). The alluvial plain RE 11.3.2, listed as 'of concern' under the VM Act and dominated by poplar box, was particularly common within the corridor. Elsewhere within the southern half of the corridor, grassy woodlands and open woodlands dominated by silver-leaved ironbark (*E. melanophloia*) were frequently encountered, generally on soils of lower quality.

A distinctive sclerophyll community recorded within the preliminary investigation corridor between the Disney and Cerito Stations (and known to occur as far north as Sandy Creek) was woodland dominated by *E. persistens*. This community was often in very good condition (very little or no exotic species intrusion and appearing to have not been cleared or heavily grazed), and in places in the far south supported a grass layer dominated by soft spinifex (*Triodia pungens*). Both shrubby and grassy *E. persistens* woodlands were noted, which comply with the definition of the mapped RE 11.12.1 (other REs may also be present where this community occurs, but are not currently mapped).

Other sclerophyll communities that were less commonly encountered, but are of conservation significance (all being 'of concern' REs under the VM Act), were:

- Coolabah woodland on alluvial clay plains (REs 11.3.3 and 11.3.28) – this community was restricted to the southern Suttor River alluvial plain, with the major occurrence (as recorded during the field surveys) located on the anastomotic plains between channels at the southern Suttor River crossing. A common feature of this community was large grassland areas dominated by Mitchell grass (*Astrebla lappacea* and *elymoides*) and Queensland bluegrass (*Dichanthium sericeum*) (forming part of the RE 11.3.28).
- Queensland blue gum grassy open forest on alluvial plains (RE 11.3.4) – this community occurred in strips on sandy alluvial soils associated with flood plains, and was most common in the centre of the preliminary investigation corridor, particularly on Mt. Tabletop

and Cerito (associated with the Suttor River and Rockingham Creek flood plains). It was commonly co-dominated by carbeen (*Corymbia tessellaris*).

- Clarkson's bloodwood (*Corymbia clarksoniana*) woodland on lower slopes of older igneous rocks (RE 11.12.10). This community was not recorded during surveys and its presence could not be confirmed.
- Shrubby woodland dominated by *Lophostemon* spp. (primarily brush box, *L. confertus*), on coastal ranges (RE 11.12.14). This community was not recorded during surveys and its presence could not be confirmed. It is mapped in a mixed polygon associated with the slopes of Mt Abbot, in the far northern section of the preliminary investigation corridor.

Eucalypt woodland was the most widespread fauna habitat type in the landscape in which the preliminary investigation corridor occurs (survey sites TH2, TH4, TH11, TH13, TH17, TH19, TH21, TH22, TH24, TH26, TH28, TH30, TH34, TH39, TH40, TH41, TH43 and TH46 (Figure 2-6 (northern section of preliminary investigation corridor), and Figure 2-7 (southern section of preliminary investigation corridor). The characteristics and values of this habitat type for fauna varied based on the underlying substrate (from flat sand or clay floodplains to undulating rocky terrain) as well as other factors including land use (particularly management), weed and pest species. In general, this habitat type was characterised by a mid-density to sparse tree layer, variable shrub layer (generally sparse to absent), and a dense and homogenous ground layer of native and/or introduced grass species (Plate 4-4). Microhabitat features included log piles, woody debris, dense ground cover, and exposed rocks (dependent on substrate), and provided shelter for ground-dwelling fauna species. Arboreal shelter habitat in the form of tree hollows was also typically present. Small ephemeral waterways and drainage lines frequently occurred within this habitat type. Permanent water sources were occasionally present in the form of surface water in watercourses, farm dams and troughs. Varying levels of degradation, relating to introduced plants, animals, and land management (grazing) impacted on this habitat type.

Plate 4-4 Eucalypt woodlands (May 2013)

In general, the eucalypt woodland habitat type provided foraging and shelter resources for a wide array of common fauna species. Forage resources for folivorous mammals, nectarivorous mammals and birds, granivores, insectivorous mammals, reptiles and birds, and grazing mammals were available. Predators including birds of prey, snakes, dogs and dingos were observed in this habitat type. The value of eucalypt woodland habitat for conservation significant species was constrained in many instances by the lack of requisite species-specific microhabitat features, such as a diversity of native grasses, large diameter hollow-bearing trees, ground-layer microhabitats (hollow logs, woody debris, rock piles) and access to water.

A summary of habitat characteristics recorded from eucalypt woodland habitats within and near the preliminary investigation corridor is provided in Table 4-4. This summary presents the proportions of sites containing various habitat features, based on a total of 18 habitat assessments undertaken in eucalypt woodlands. The dominant category for each habitat feature is highlighted in bold.

Table 4-4 Habitat summary – eucalypt woodlands

Habitat feature	Percentage of sites assessed (n=18)		
Tree hollows	Absent: 0%	**Sparse (less than 3 per 50 m): 56%**	Frequent (greater than 3 per 50 m): 44%
Log piles/woody debris	Absent: 11%	**Sparse: 56%**	Frequent: 33%
Rocky ground cover/rock piles/boulders	Absent: 50%	Sparse: 28%	Frequent: 22%
Ground cover/substrate complexity	Sparse/homogenous: 22%	**Dense/homogenous: 61%**	Dense/variable: 17%
Introduced plants	Present (dominant): 39%	**Present (not dominant): 50%**	Absent: 11%
Erosion	Extensive: 0%	Minimal: 33%	**Absent:** 67%
Livestock degradation (trampling)	Extensive: 11%	**Observed (not extensive):** 50%	Absent: 39%
Introduced animals	Recorded: 17%	**Likely to occur:** 67%	Unlikely to occur: 17%

4.2.6 Mixed species shrubland/low woodland BVC

The mixed species shrubland/low woodland BVC consists of REs dominated by a range of genera including *Acacia*, *Eremophila*, *Allocasuarina* and *Leptospermum*. Two thirds of the total number of REs that comprise this BVC are of conservation significance, all being 'of concern' under the VM Act. However, of these REs, only four (out of nine) were observed or are known to occur in or adjacent to sections of the corridor visited during the field surveys, and it is considered likely that three 'of concern' REs (11.12.15, 11.12.16 and 11.12.18) are absent. Of the four REs observed in the preliminary investigation corridor, three appeared to be restricted to the section north of the Bogie River, with the RE 11.7.2 restricted to those areas south of the Bowen River. The mixed species shrubland/low woodland communities contained both eucalypt woodland and acacia dominated woodland/shrubland habitats. These habitats are described in the brigalow/gidgee and sclerophyll woodland/open forest BVC (Sections 4.2.4 and 0).

The communities contained within the mixed species shrubland/low woodland BVC were very different from each other in terms of species composition, and in some cases the land form on which they occurred. They were generally uncommon shrublands or low woodland communities that were not dominated by eucalyptus or brigalow/gidgee. The most common mixed species low woodland observed in the corridor was that dominated by lancewood (*Acacia shirleyi*) or bendee (*A. catenulata*), meeting the definition of the 'least concern' RE 11.7.2. In general, this community occurred on the sides and scarps of knolls and rises comprised of ancient (Permian or older), frequently laterised, actively eroding sedimentary or igneous rocks, generally with skeletal soils (see photograph in Table 4-6). Species diversity was characteristically low in all

layers. Small patches of RE 11.7.2 occurred throughout the southern half of the corridor, but were particularly prevalent along the margins of the Bulgonunna volcanics on Terang, Mt. Lookout and Fig Tree Stations (Bureau of Mineral Resources, Geology and Geophysics 1967).

The other three mixed species shrubland/low woodland communities known to be present within the preliminary investigation corridor and study area were located on the coastal plain between Splitter's Creek and just west of the Elliot River. The bulloke (*Allocasuarina luehmannii*) dominated low open-woodland community occurred in small patches on texture contrast soils in this area, often in a monoculture with a very sparse ground layer. This bulloke community meets the definition of the 'least concern' RE 11.3.32. Likewise, a low woodland dominated by false sandalwood (*Eremophila mitchellii*) also occurred in this area, meeting the description of the 'of concern' RE 11.3.33. The latter community generally contained beefwood (*Grevillea striata*) with emergents of Dallachy's ghost gum (*Corymbia dallachiana*).

The final community comprising mixed species shrubland/low woodland BVC that is known to occur in the vicinity of the preliminary investigation corridor is *Acacia tephrina* woodland, which has been previously recorded in large patches on Nevada Station, although further north than the current preliminary investigation corridor is proposed. This *A. tephrina* woodland meets the definition of the 'of concern' RE 11.3.34.

4.2.7 Non-remnant areas

A variety of landscapes and vegetation types occurred in areas mapped as non-remnant. Apart from areas mapped as high value regrowth, most non-remnant space in the preliminary investigation corridor was occupied by improved pasture lands for grazing cattle. The main pasture grasses in the corridor were the exotic species buffel grass (*Cenchrus ciliaris*) and creeping bluegrass (*Bothriochloa pertusa*), with signal grass (*Urochloa mosambicensis*) more common towards the coast. In addition, the legume stylo (or Seca) (*Stylosanthes* spp.) was also common, and was becoming a weed in some remnant areas.

Non-remant areas were prevalent throughout the northern and southern parts of the preliminary investigation corridor (survey sites TH6, TH36 and TH50, Figure 2-6 (northern section of preliminary investigation corridor), and Figure 2-7 (southern section of preliminary investigation corridor). Within non-remant larger trees within the canopy layer were generally absent. A sparse to moderately dense shrub layer (1 – 5 m) of regrowth vegetation was often present, and the ground layer was dominated by native and/or introduced grasses and grazing pastures (Plate 4-5).

Plate 4-5 Non-remnant cleared land (May 2013)

Shelter habitat within non-remnant cleared land was generally sparsely distributed with microhabitats of low diversity. Available microhabitats typically included clumps of grass, low shrubs (for example *Carissa ovata*, or low brigalow regrowth where present) some fallen woody debris, and (depending on substrate) exposed rocks or cracking clay. Due to the general absence of trees, hollows were absent. These habitat resources provided habitat and forage resources for some ground-dwelling and arboreal reptiles, woodland birds, raptors and ground-dwelling mammals. Sparsely distributed water resources (e.g. cattle troughs, gilgais or minor ephemeral waterways) provided drinking resources for fauna species.

4.2.8 Woodland/open forest fringing watercourses BVC

The BVC woodland/open forest fringing watercourses are comprised of two main vegetation types. The watercourses in the preliminary investigation corridor north of (but not including) the major Suttor River crossing in the far south were dominated by Queensland blue gum, often with carbeen sub-dominant. Between and including the Bowen and Elliot Rivers, the 'vulnerable' (under both the NC Act and the EPBC Act) black ironbox (*Eucalyptus raveretiana*) often dominated (or was sub-dominant in) watercourse fringing communities. In these instances, the fringing community meets the requirements for the 'least concern' RE 11.3.25. This Queensland blue gum dominated riparian community occurred where rivers and creeks had a sandy or light clay alluvial soil adjacent to the channel, and was often grassy and relatively open. Creeks along the coastal plain to the east of the Elliot River were generally dominated by paperbark species such as weeping paperbark (*Melaleuca leucadendra, M. fluviatilis* and/or *M. dealbata*), with pandanus (*Pandanus cookii*) a conspicuous element of the lower tree layer. This community type meets the requirements of one of the sub-types of the RE 11.3.25.

In contrast, where the alluvium adjacent to the channel formed a heavier clay (such as the lower Suttor River at the southern-most point at which the preliminary investigation corridor crosses it) coolabah dominated the riparian community, often to the exclusion of all other tree species. In these instances, watercourse channels were often anabranching and the coolabah fringing woodlands became contiguous with extensive woodlands that covered the large anastomotic plains between the channels. The coolabah woodland fringing the Suttor River in this location was shrubby, with a lower shrub layer dominated by patches of lignum (*Muehlenbeckia florulenta*) and a lower tree layer dominated by yellowwood (*Terminalia oblongata*), red bauhinia (*Lysiphyllum carronii*) and gidgee. This community meets the definition of the 'of concern' RE 11.3.

One threatened flora species, black ironbox (*E. raveretiana*), was confirmed present during field surveys. Locations where this species was observed are provided in Figure 4-1. Black ironbox (*E. raveretiana*) is a eucalypt tree growing to approximately 30 m, with a characteristic furrowed, hard and dark grey 'box' bark, which extends from the ground to the base of the largest branches only (Calvert *et al 2*005; SEWPaC 2013f) (Plate 4-6). It has a restricted distribution in two areas of coastal and sub-coastal central Queensland: from south of Townsville to Nebo, and then around Rockhampton and areas 100 km west, with a large gap between. Within this range, it has been recorded by the Queensland Herbarium from approximately 23 sites (SEWPaC 2013f).

Black ironbox has been recorded by GHD from a number of watercourses in the Collinsville/Bowen region that do not appear in the Queensland Herbarium records, including the Elliot and Bowen Rivers, and Pelican Creek. During the May/June 2013 field surveys, black ironbox populations were recorded at two watercourses crossed by the preliminary investigation corridor – Strathmore Creek and Pelican Creek.

It was generally present as a dominant canopy species, or as a co-dominant with species such as *Melaleuca leucadendra*, *Casuarina cunninghamiana* and *Eucalyptus tereticornis* (Calvert *et al* 2005; SEWPaC 2013f). In general, the species was dominant or co-dominant in the canopy layer where it was recorded. The condition of riparian habitats was moderate in both creeks in which black ironbox was observed – both Strathmore Creek and Pelican Creek had a relatively sparse canopy layer, and a weedy to very weedy understorey.

Plate 4-6 Black ironbox at Strathmore Creek (left and right)

LEGEND

- Population Centres
- Major Port
- Black-necked Stork
- Cotton Pygmy-goose
- Little Pied Bat
- Freckled Duck
- Squatter Pigeon (Southern)
- *Eucalyptus raveretiana*
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourse (Major)
- Watercourse (Minor)
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd

North Galilee Basin Rail Project

Threatened species records

Job Number	41-26457
Revision	A
Date	26 Sep 2013

Figure 4-1

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Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010; GHD: Fauna Species Records/2013. Created by:MS

Vegetation restricted to riparian zones along ephemeral and perennial waterways was structurally and floristically different to that of the adjacent flood plain. Observations from the field surveys revealed that riparian habitats supported denser canopy vegetation, as a result of the different dominant canopy species occurring in and near the channel(s) of watercourses (survey sites TH16, TH18, TH23, TH27, TH32, TH35, TH37 and TH42 – see Figure 2-6 (northern section of preliminary investigation corridor) and Figure 2-7 (southern section of preliminary investigation corridor)).

In addition to the denser canopy in these habitats and the spatially distinctive dominant canopy tree species, these habitats often featured a dense understorey of woody vegetation – typically characterised by one or more invasive weed species. Ground layer habitat was typified by patches of moderately dense to dense vegetation (grasses) interspersed with areas of bare ground (usually associated with watercourse banks and channels) (Plate 4-7). Shelter habitat was provided by tree hollows, defoliating bark (especially on mature *Melaleuca* spp.), dense thickets of weedy shrub layer vegetation, dense patches of ground cover vegetation, and woody debris (including accumulated flood debris). Water was seasonally available within this habitat within watercourse channels in flowing surface water or isolated pools. Forage resources were provided in this habitat type for folivorous mammals, nectarivorous mammals (including arboreal mammals), granivores, insectivorous mammals, reptiles and birds; predator species included birds of prey, snakes, dogs and dingos. Disturbance in these habitats included erosion (natural, and accelerated by land use), livestock degradation (trampling), introduced animals and invasive weeds.

Plate 4-7 Fringing riparian vegetation (May 2013)

Fringing riparian vegetation acted as localised nodes of fauna activity in the landscape in which the preliminary investigation corridor occurs. These areas were likely to act as corridors to facilitate the movement of fauna (discussed further below) across the landscape. In addition to the species assemblages supported by eucalypt woodland habitats (often occurring on adjacent flood plains), fringing riparian habitats supported species that were less likely to inhabit other habitats within the preliminary investigation corridor due to the variability in habitat composition and structure. This particularly related to a number of bird species which preferentially inhabit denser habitats.

A summary of habitat characteristics recorded from fringing riparian vegetation within and near the preliminary investigation corridor is provided in Table 4-5. This summary presents the proportions of sites recorded to contain various habitat features, based on a total of eight habitat assessments undertaken in fringing riparian vegetation. The dominant category for each habitat feature is highlighted in bold.

Table 4-5 Habitat summary – fringing riparian vegetation

Habitat feature	Percentage of sites assessed (n=8)		
Tree hollows	Absent: 13%	**Sparse (less than 3 per 50 m): 50%**	Frequent (greater than 3 per 50 m): 38%
Log piles/woody debris	Absent: 25%	Sparse: 50%	Frequent: 25%
Rocky ground cover/rock piles/boulders	Absent: 75%	Sparse: 13%	Frequent: 13%
Ground cover/substrate complexity	Sparse/homogenous: 25%	**Dense/homogenous: 50%**	Dense/variable: 25%
Introduced plants	**Present (dominant): 50%**	Present (not dominant): 38%	Absent: 13%
Erosion	Extensive: 25%	**Minimal: 63%**	Absent: 13%
Livestock degradation (trampling)	Extensive: 13%	**Observed (not extensive): 63%**	Absent: 25%
Introduced animals	Recorded: 25%	**Likely to occur: 63%**	Unlikely to occur: 13%

4.2.9 Tidal vegetation and wetland BVCs

The tidal vegetation BVC was restricted to communities that were tidally inundated, which occurred in the Don River Basin at the far northern extremity of the preliminary investigation corridor. Tidal vegetation was comprised of two communities – a mangrove shrubland fringing tidal creeks, and saltpan herblands dominated by a small number of chenopod and grass species. The Wetland BVC was comprised of vegetation that grows in and immediately adjacent to wetlands (either permanent or ephemeral). The vegetation characteristic of this community meets the definition of the 'least concern' RE 11.3.27, which also includes stretches of water in larger rivers and creeks.

Within the preliminary investigation corridor, the species that characterised this community included the shore-based *Acacia humifusa,* broad-leaved paperbark (*Melaleuca viridiflora*), carbeen and Queensland blue gum, and ground layer species such as *Chrysopogon elongatus, Cyperus javanicus* and mat rush (*Lomandra longifolia*). Emergent aquatic species observed included the native waterlily *(Nymphaea gigantea*)*,* monochoria (*Monochoria cyanea*), swamp lily (*Ottelia ovalifolia*) and the wavy marshwort (*Nymphoides crenata*).

Observations made of emergent vegetation growing along the shoreline of Caley Valley Wetland identified grey samphire (*Tecticornia australasica*), beadweed (*Sarcocornia quinqueflora*) and salt couch (*Sporobolus virginicus*) (survey site TH44, see Figure 2-6 (northern section of preliminary investigation corridor), and Figure 2-7 (southern section of preliminary investigation corridor). This latter community meets the definition of RE 11.1.2. The shore line section at Caley Valley Wetland was heavily infested with a number of weeds, the most serious being prickly acacia (*Vachellii nilotica*), parkinsonia (*Parkinsonia aculeata*) and chinee apple (*Ziziphus mauritiana*). In freshwater sections of the Caley Valley Wetland, the aquatic weed para grass (*Urochloa mutica*) was recorded.

The eastern part of the Caley Valley Wetland was characterised by open and closed brackish palustrine wetland and marsh habitat. Vegetation was dominated by groundcover species on

the wetland margins with dense patches of emergent macrophytes in extensive stands, interspersed with areas of open water (Plate 4-8). Saltwater Creek flowed into wetland along eastern fringe of the wetland and was fringed by salt marsh and low sparse mangroves at the creek mouth. The mangrove shrubland fringing Saltwater Creek was narrow, and had a relatively low species diversity (as observed from the Abbot Point access road), with grey mangrove (*Avicennia marina*) dominant along the channel and freshwater mangrove (*Excoecaria agallocha*) most common further up the bank. This community is mapped as the RE 11.1.4. The wetland fringe included exposed, unvegetated mud, densely vegetated grassland and semi-evergreen vine thicket vegetation. The wetland system is dynamic on a seasonal basis with water levels fluctuating during the year.

Plate 4-8 Coastal wetland (May 2013)

Habitats in the Caley Valley Wetland were highly variable, ranging from large expanses of open water to exposed and/or vegetated wetland fringes. These habitats provided a range of values, such as drinking, foraging resources and breeding habitat for an assortment of terrestrial based and aquatic dependant birds. This environment also provided habitat for amphibians, reptiles and small ground-dwelling mammal species. In turn, foraging habitat for predatory birds (raptors) and some snake species was also provided. Pig degradation was prevalent along the wetland fringe; this area of habitat was also exposed to anthropogenic noise, dust and light from nearby rail and coal handling facilities.

Each BVC is summarised in Table 4-6 below.

Table 4-6 Broad vegetation communities identified within the preliminary investigation corridor

BVC name and associated REs[1]	Landforms	Characteristic species	Conditions and notes	Representative photo
Natural grassland 11.3.31, **11.4.4**, **11.4.11**, **11.9.3**, **11.9.12** Includes the EPBC Act TEC 'Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin'	Entirely located on plains and lowlands, mostly on clays.	Queensland blue grass (*Dichanthium sericeum*), white speargrass (*Aristida leptopoda*), curly Mitchell grass (*Astrebla squarrosa*), hoop Mitchell grass (*Astrebla elymoides*), coolabah (*E. coolabah*), mountain coolabah (*Eucalyptus orgadophila*), *Paspalidium globoideum,* red bloodwood (*Corymbia erythrophloia*), red Flinders grass (*Iseilema vaginiflorum*).	Primarily mapped south of Pelican Creek, the natural grasslands within the preliminary investigation corridor have been almost entirely replaced by exotic pasture grasses.	 Mapped natural grassland, Myuna Station.
Vine thicket **11.2.3**, **11.11.18**, 11.12.4 Includes the EPBC Act TEC 'Semi-evergreen vine thicket of the Brigalow Belt North and Nandewar Bioregions'	Occurs on coastal dunes (11.2.3), undulating rises and gentle slopes (11.11.18) and low hills and ranges (11.12.4).	Burdekin plum (*Pleiogynium timorense*), bush tuckeroo (*Cupaniopsis anacardioides*), broad-leaved bottletree (*Brachychiton australis*), caustic vine (*Sarcostemma viminale*), *Drypetes deplanchei*, *Jasminum didymum,* pythonwood (*Gossia bidwillii*), native peach (*Ehretia membranifolia*), small-leaved water vine (*Clematocissus opaca*), wild prune (*Sersalisia sericea*).	Vine thickets on coastal dunes in the Caley Valley section of the preliminary investigation corridor were generally heavily infested with weeds, including the class two weeds prickly acacia (*Vachellia nilotica*), parkinsonia (*Parkinsonia aculeata*) and chinee apple (*Ziziphus mauritiana*). Inland vine thickets were sometimes in better condition, however many have thinned due to grazing and adjacent clearing, and often were infested with the class two weed Harrisia cactus (*Eriocereus* sp.).	 Vine thicket on loose rocks, Tabletop Station.

BVC name and associated REs[1]	Landforms	Characteristic species	Conditions and notes	Representative photo
Brigalow/gidgee **11.3.1**, 11.3.5, 11.4.6, **11.4.8**, **11.4.9**, **11.9.1**, 11.11.13, 11.11.19, **11.12.21** Includes the EPBC Act TEC 'Brigalow (*Acacia harpophylla* dominated and co-dominated)'	Generally plains and lowlands, mostly on clays and loams; sometimes occurs on scarps and low ridges.	Brigalow (*Acacia harpophylla*), currant bush (*Carissa ovata*), Dawson's gum (*E. cambageana*), *Enteropogon* spp., gidgee (*A. cambagei*), false sandalwood (*Eremophila mitchellii*), yellow wood (*Terminalia oblongata*), wilga (*Geijera parviflora*).	Brigalow is located south of Pelican Creek; gidgee occurs south of the Suttor Development Road. Condition for both ranges from slightly - heavily modified. Usually at least the ground layer and sometimes the shrub layer is significantly altered; in some cases, the canopy has been thinned.	 Brigalow, Avon Downs Station.
Sclerophyll woodland/open forest (excluding watercourse associated vegetation) 11.2.5, **11.3.2**, **11.3.3**, **11.3.4**, 11.3.7, 11.3.9, 11.3.10, 11.3.30, 11.3.35, **11.4.2**, 11.5.2, 11.5.3, 11.5.9, 11.5.12, 11.7.1, 11.7.3, **11.9.1**, 11.9.9, **11.9.10**, 11.10.7, 11.11.1, 11.11.9, 11.12.1, 11.12.2,	Occurs on all landform types across the corridor, most commonly on undulating to rolling country.	Browns box (*Eucalyptus brownii*), Dallachy's ghost gum (*Corymbia dallachiana*), Dawson's gum (*E. cambageana*), *E. persistens,* mountain coolabah, narrow-leaved ironbark (*E. crebra/ drepanophylla*), peppermint gum (*E. exserta*), poplar box (*E. populnea*), poplar gum (*E. platyphylla*), red bloodwood, silver-leaved ironbark (*E. melanophloia*).	This diverse BVC is found along the entire preliminary investigation corridor. Grassy woodland/open woodland is the most common type of sclerophyll community, with shrubby woodland occurring less often. Most communities are slightly to heavily modified – that is, at least one layer, almost always the ground layer, has been modified either to some extent through the replacement of species by exotics. In some cases, the shrub layer has been thinned or removed by stock/clearing, which can also affect canopy species recruitment.	 Grassy open woodland, Cerito Station.

BVC name and associated REs[1]	Landforms	Characteristic species	Conditions and notes	Representative photo
11.12.7, 11.12.9, **11.12.10**, 11.12.13, **11.12.14**				Shrubby open woodland, Avon Downs Station.
Mixed species shrubland/low woodland 11.3.32, **11.3.33**, **11.3.34**, **11.4.5**, 11.7.2, 11.11.13, **11.12.15**, **11.12.16**, **11.12.18**	Various landforms – most are on plains and lowlands, some are from ranges and low mesas.	*Acacia argyrodendron, A. catenulata,* beefwood (*Grevillea striata*), lancewood (*A. shirleylii*), *A. tephrina,* bulloke (*Allocasuarina luehmannii*), false sandalwood (*Eremophila mitchellii*), *Oxychloris scariosa.*	Often located in small, discrete patches, little modified from the natural state. These communities are generally located in marginal areas (highly erodible soils of low fertility) and consequently have not often been cleared/ developed. Weed incursion is usually low.	Lancewood tall shrubland, Disney Station.

BVC name and associated REs[1]	Landforms	Characteristic species	Conditions and notes	Representative photo
Non-remnant areas (including regrowth) N/A	Various landforms, but mostly occurs on plains and lowlands (where soils and pasture are more suitable for farming).	Mostly exotic pasture species such as bluegrass (*Dichanthium aristatum*), buffel grass (*Cenchrus ciliaris*), creeping bluegrass (*Bothriochloa pertusa*), signal grass (*Urochloa mosambicensis*).	Non-remnant vegetation in the preliminary investigation corridor (other than in built areas or crops) is generally grazed, and heavily modified from its natural state.	 View over pasture lands, Disney Station.
Woodland/open forest fringing watercourses 11.3.25, 11.3.37	Fringes watercourses.	Belalie (*Acacia stenophylla*), black ironbox (*Eucalyptus raveretiana*), black tea-tree (*M. bracteata*), carbeen (*Corymbia tessellaris*), coolabah (*E. coolabah*), creek mahogany (*Lophostemon grandiflorus*), mat rush, paperbarks (*Melaleuca dealbata, M. leucadendra, M. stenostachya*), Queensland blue gum, (weeping paperbark (*M. fluviatilis*).	This BVC is generally intact, however in areas closer to the coast, the ground and shrub layers are often moderately to heavily infested with environmental weeds, particularly hyptis (*Hyptis suaveolens*), snake weed (*Stachytarpheta jamaicensis*) and *Urena lobata*, and the class three declared weed lantana (*Lantana camara*). This BVC contains the listed 'vulnerable' species (under both the EPBC and NC Acts) black ironbox.	 Rockingham Creek, Cerito Station.

BVC name and associated REs[1]	Landforms	Characteristic species	Conditions and notes	Representative photo
Tidal vegetation 11.1.1, 11.1.2, 11.1.4, 11.2.2	Occurs on level tidally inundated salt pans and creek margins, and on beach foredunes.	Bead weed (*Sarcocornia quinqueflora*), beach spinifex (*Spinifex sericeus*), freshwater mangrove (*Excoecaria aggalocha*), grey mangrove (*Avicennia marina*), grey samphire (*Tecticornia australasica*), *Ipomoea pes-caprae,* prickly saltwort (*Salsola kali*), salt couch (*Sporobolus virginicus*).	This BVC is restricted within the preliminary investigation corridor to small areas subject to tidal inundation in the Caley Valley Wetland, and are intact and generally in good condition.	 Grey samphire on salt pan, Caley Valley.
Wetland 11.3.27	Occurs in or on wetlands.	*Acacia humifusa,* broad-leaved paperbark (*Melaleuca viridiflora*), carbeen (*Corymbia tessellaris*), *Chrysopogon elongatus, Cyperus javanicus,* mat rush (*Lomandra longifolia*)*, Nymphaea gigantea, Ottelia ovalifolia,* Queensland blue gum (*Eucalyptus tereticornis*).	This community includes the water and immediate terrestrial margin of wetland areas, including the Caley Valley Wetland. Caley Valley Wetland has extensive woody weed infestations (prickly acacia, chinee apple, parkinsonia) along the margins, and is being impacted by resident feral pigs.	 Caley Valley Wetland

[1] REs in bold are of conservation significance (‘of concern’ or ‘endangered’ under the VM Act)

4.2.10 Aquatic habitats

The preliminary investigation corridor crosses a variety of aquatic habitats in a number of places. In total, 16 major waterways and approximately 120 minor waterways were intersected by the preliminary investigation corridor. The major waterways crossed by the preliminary investigation corridor include:

- Suttor River
- Verbena Creek
- Gunn Creek
- Murray Creek
- Rockingham Creek
- Lily Creek
- Bowen River
- Pelican Creek
- Strathmore Creek
- Sandy Creek
- Bogie River
- Elliot River
- Splitter's Creek
- Saltwater Creek.

The aquatic habitats assessed within the preliminary investigation corridor were categorised as being either:

Riverine: that is, all wetlands and deep water habitats within a channel (Plate 4-9). Channels may be naturally or artificially created, periodically or continuously contain moving water, or connect two bodies of standing water (EPA 2005). A number of small riverine channels were identified within the study area. These small channels included narrow 1st order streams (hereafter referred to as drainage lines) which provide a pathway for flows during rainfall, but typically do not accommodate surface water for long periods. As drainage lines are isolated and ephemeral, they generally do not support aquatic communities for sustained periods of time. However, drainage lines can facilitate dispersal of aquatic organisms when surface waters are present and hydrologically connected.

Lacustrine: large, open, water-dominated systems (e.g. lakes) (Plate 4-10). Lacustrine habitats also include modified systems (e.g. dams), which have similar characteristics to natural lacustrine systems (e.g. deep, standing or slow-moving waters (EPA 2005).

Palustrine: primarily vegetated off-channel environments (Plate 4-11). Palustrine habitats include billabongs, swamps, bogs, springs and soaks (EPA 2005). It should also be noted that gilgais are included within this category. Gilgais are microrelief depressions in cracking clay soils that form when the cycles of substrate shrinking and swelling create mounds and subsidence in the terrain (EPA 2005). These depressions then fill with rain water, and surface water may persist for some time. As a water source, gilgais can support a range of taxa; however, there are several species that are dependant or closely associated with gilgais, including a range of invertebrates and reptiles.

Plate 4-9 Riverine habitat within the preliminary investigation corridor

Plate 4-10 Lacustrine habitat within the preliminary investigation corridor

Plate 4-11 Palustrine habitat within the preliminary investigation corridor

The riverine, lacustrine and palustrine habitats in the preliminary investigation corridor and wider study area are shown in Figure 4-2. A summary of the aquatic habitats present at each survey site is provided in Table 4-7. No fish habitat areas declared under the *Fisheries Act 1994* occur within 10 km of the preliminary investigation corridor.

LEGEND

- Population Centres
- Major Port
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- Habitats
- Estuarine Habitat
- Lacustrine Habitat
- Palustrine Habitat
- Riverine Habitat
- Fish Habitat Area
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

Based on or contains data provided by the State of QLD (DNRM) [2013]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:1,100,000 Paper Size A4

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Adani Mining Pty Ltd

North Galilee Basin Rail Project

Aquatic Habitats in or of Relevance to the Preliminary Investigation Corridor

Job Number	41-26457
Revision	A
Date	07 Aug 2013

Figure 4-2

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Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010, Fish Habitat Area, Habitat/2012. Created by:MS

Table 4-7 Summary of aquatic habitats surveyed within the study area

Site code and name	Basin/ catchment	Habitat assessment summary	General description and habitat characteristics	Representative photograph
AQ1 **Abbot Point – Caley Valley Wetland**	*Don River Basin*	*Habitat type:* Palustrine *Substrate:* 80 per cent clay, 20 per cent sand *Snags and woody debris:* Some snags and woody debris *Aquatic plants:* Sedges (*Cyperus* spp.), giant waterlily (*Nymphaea gigantea*) and blind-your-eye mangrove (*Excoecaria agallocha*) *Variety of habitat:* Flowing, deep and shallow water. Some woody debris, abundant macrophytes *Disturbance:* Pigs, some anthropogenic noise from nearby rail line	A very diverse aquatic habitat providing abundant cover for aquatic organisms and waterbirds. Huge numbers of waterbirds (including young of some species) were observed on surface water. Large fish population was observed – species positively identified included barramundi (*Lates calcarifer*), seven spot archerfish (*Toxotes chatareus*), spangled perch (*Leiopotherapon unicolor*), Pacific blue-eye (*Pseudomugil signifer*), flyspecked hardyhead (*Craterocephalus stercusmuscarum*) and eastern rainbowfish (*Melanotaenia splendida splendida*). It is likely that the Caley Valley Wetland supports a large and diverse fish population that includes a number of freshwater and estuarine species, and marine vagrants. Site also likely to provide habitat for saltwater crocodile (*Crocodylus porosus*). Generally high value habitat for a broad range of aquatic species.	 *Vegetated margins of the Caley Valley Wetland, May 2013.*

Site code and name	Basin/ catchment	Habitat assessment summary	General description and habitat characteristics	Representative photograph
AQ2 **Saltwater Creek**	*Don River Basin*	*Habitat type:* Riverine *Substrate:* 100 per cent clay/silt *Snags and woody debris:* Little snags and woody debris visible, but submerged logs likely *Aquatic plants:* Giant waterlily (*Nymphaea gigantea*), slender knotweed (*Persicaria* sp.) and blind-your-eye mangrove (*Excoecaria agallocha*) *Variety of habitat:* Deep runs and pools, overhanging vegetation and macrophytes *Disturbance:* Road and railway crossing over creek	A deep, slow flowing creek – depth to ~ 2 m, possibly deeper in parts. Reach dominated by slow runs and deep pools. Erosion and scouring absent. Undercut banks absent. Water fairly turbid. Mangroves provide overhanging and trailing vegetation along banks of creek. Giant waterlily (*Nymphaea gigantea*) established in waterway. Bridge may act as a barrier to dispersal for aquatic organisms as it blocks light filtering through the water column. Waterway provides important connectivity between aquatic populations. Site likely to provide habitat for the estuarine crocodile (*Crocodylus porosus*). Saltwater Creek likely to support a large and diverse fish, turtle and macroinvertebrate community.	 *Deep waters and water lillies of Saltwater Creek, May 2013.*
AQ3 **Unnamed creek near Abbot Point**	*Don River Basin*	*Habitat type:* Riverine *Substrate:* 80 per cent sand, 15 per cent gravel, 5 per cent silt *Snags and woody debris:* Little snags and woody debris present *Aquatic plants: Melaleuca* sp. *Variety of habitat:* Surface water mostly absent along reach. Some shallow and deep pools present with abundant leaf litter *Disturbance:* Pigs, some	Aquatic plants absent, but *Melaleuca* present along bed and banks. Riparian zone very narrow, but dense. Scouring problematic where riparian vegetation has been removed. Banks greater than 60° in many places. Land cleared alongside the waterway. Considerable pig damage observed within bed, and on adjacent banks and floodplain. Several pigs observed. Surface water clear, but tannin stained in some pools. Flood debris observed to 1.2 m depth. Rubbish (mostly plastic) common in creek bed. Large fish population was observed in all isolated	 *Fish habitat in an unnamed creek, May 2013.*

Site code and name	Basin/ catchment	Habitat assessment summary	General description and habitat characteristics	Representative photograph
		anthropogenic noise from nearby rail line and roads	pools. Site may be important as a refuge for fish and turtles during dry periods. Numerous fish were observed, including sooty grunter (*Hephaestus fuliginosus*), spangled perch (*Leiopotherapon unicolor*), sailfin glassfish (*Ambassis agrammus*), eastern rainbowfish (*Melanotaenia splendida splendida*), flyspecked hardyhead (*Craterocephalus stercusmuscarum*) and a number of unidentified gudgeon and goby species. A box culvert upstream may impede the dispersal of fish.	
AQ4 **Maria Creek**	*Don River Basin*	*Habitat type:* Riverine *Substrate:* 70 per cent sand, 20 per cent pebble, 10 per cent gravel *Snags and woody debris:* Some snags and woody debris present *Aquatic plants: Melaleuca* sp. *Variety of habitat:* Surface water absent *Disturbance:* Nearby culvert and highway. Cattle also present	Surface water absent at time of assessment. Some undercut banks with exposed roots along reach. Moderate erosion and scouring along reach, particularly where grasses and herbs are the dominant vegetation. Riparian zone generally dense (riparian zone is absent in some places), but narrow – land cleared either side. *Melaleuca* sp. present. Trees and shrubs growing in bed. Moderate trailing vegetation. Leaf litter common in creek bed. Nearby concrete box culvert may present a barrier to the dispersal of aquatic organisms. Creek itself likely to act as a corridor for dispersal when surface waters are present. Generally poor habitat for aquatic species.	 *Dry sandy bed of Maria Creek, May 2013.*

Site code and name	Basin/ catchment	Habitat assessment summary	General description and habitat characteristics	Representative photograph
AQ5 **Six Mile Creek**	*Don River Basin*	*Habitat type:* Riverine *Substrate:* 70 per cent sand, 10 per cent pebble, 10 per cent cobble, 5 per cent gravel, 5 per cent bedrock *Snags and woody debris:* Little snags and woody debris *Aquatic plants: Melaleuca* sp. *Variety of habitat:* Surface water absent *Disturbance:* Cattle present, nearby box culvert and sealed road	Surface water absent at time of assessment. Moderate erosion of banks. Riparian zone dominated by grasses and herbs in large sections of the reach. *Melaleuca* sp. present. Riparian zone generally narrow. Trailing vegetation present in places. Nearby rail line and concrete box culvert crossing. Culvert may impede the dispersal of aquatic organisms. However, creek likely to provide a pathway for dispersal when surface waters are present and hydrologically connected. Otherwise, generally poor habitat for aquatic species.	 *Dry, sandy bed of Six Mile Creek, May 2013.*
AQ6 **Tabletop Creek**	*Don River Basin*	*Habitat type:* Riverine *Substrate:* 40 per cent sand, 40 per cent cobble, 20 per cent gravel *Snags and woody debris:* Moderate snags and woody debris *Aquatic plants:* Several species observed – *Melaleuca* sp., rushes (*Juncus* sp.), *Fimbristylis* sp. and floating pondweed (*Potamogeton tricarinatus*) *Variety of habitat:* Riffles, runs and pools (both sandy and rocky), shallow and deep water, macrophytes and woody debris *Disturbance:* Pigs present –	Low surface flow present at time of assessment. Diverse habitat with shallow and deep water, riffles, runs, pools and woody debris. Also variable substrate – sandy through to rocky. Small patches of erosion along reach. Undercut banks moderately abundant. Floating algal mats in backwaters of creek. Filamentous algae moderately abundant on substrate and in water column. Emergent cumbungi (*Typha sp.*) in bed of creek. Floating pondweed (*Potamogeton tricarinatus*) and present in surface water. Riparian zone dominated by pandanus and mature *Melaleuca*. Moderate abundance of trailing vegetation. Surface water clear. Several fish species observed – only spangled perch (*Leiopotherapon unicolor*) and eastern	 *Rocky pools in Tabletop Creek, May 2013.*

Site code and name	Basin/ catchment	Habitat assessment summary	General description and habitat characteristics	Representative photograph
		pugging observed on floodplain	rainbowfish (*Melanotaenia splendida splendida*) were positively identified. Variety of habitat likely to accommodate a range of freshwater fish species. Site also likely habitat for turtles.	
AQ7 **Splitter's Creek**	*Don River Basin*	*Habitat type:* Riverine *Substrate:* 90 per cent sand, 10 per cent gravel *Snags and woody debris:* Little snags and woody debris *Aquatic plants: Melaleuca* sp. *Variety of habitat:* Shallow surface water, riffles, undercut banks and trailing vegetation *Disturbance:* Nearby sealed surface bridge and vehicle tracks in creek bed	Shallow creek with clear, flowing water. Riffles present along reach. Moderate amounts of decomposing organic matter in surface water. Leaf litter moderately abundant and some filamentous algae observed in water column and on substrate. Small undercut banks presents in parts of reach. Riparian zone generally intact, but narrow. Moderate trailing vegetation, including *Melaleuca* sp. Site likely to provide habitat for small fish species and aquatic invertebrates. Creek also likely to provide an important corridor for dispersal, particularly when surface water is > 0.5 m.	 *Shallow, flowing surface water at Splitter's Creek, May 2013.*
AQ8 **Unnamed tributary of Finley Creek**	*Don River Basin*	*Habitat type:* Riverine *Substrate:* 85 per cent sand, 5 per cent gravel, 5 per cent cobble, 5 per cent boulder *Snags and woody debris:* Moderate snags and woody debris *Aquatic plants: Melaleuca* sp. *Variety of habitat:* Surface water absent *Disturbance:* Nearby farm track with creek crossing, cattle present	No surface water present at time of assessment, although flood debris was prevalent along creek bed and floodplain. Moderate trailing vegetation, some undercut banks along reach. Banks stable, erosion not evident. Creek may be a valuable pathway for the dispersal of aquatic species when surface waters are present. Site of little habitat value to fish, turtles and macroinvertebrates, but may provide a pathway for dispersal when surface waters are present.	 *Dry creek bed with emergent* Melaleuca*, May 2013.*

Site code and name	Basin/ catchment	Habitat assessment summary	General description and habitat characteristics	Representative photograph
AQ9 **Bogie River**	*Burdekin River Basin* *Lower Burdekin River catchment*	*Habitat type:* Riverine *Substrate:* 100 per cent sand *Snags and woody debris:* Little snags and woody debris *Aquatic plants: Melaleuca* sp. *Variety of habitat:* Shallow riffles, runs and pools *Disturbance:* Pigs and cattle present	A braided channel within a wide, sandy river bed. Small patches of filamentous algae anchored to substrate. Macrophytes absent from site. Stands of *Melaleuca* present in bed of reach, indicating perennial subterranean flow. Moderate presence of trailing and overhanging vegetation. Little leaf litter and woody debris. Water very clear, with low flow. Banks generally stable, with limited erosion. Site likely to provide habitat for small fish and macroinvertebrate. May provide habitat for larger fish and turtles when depth of surface water is greater.	 *Braided channel of the Bogie River, May 2013.*
AQ10 **Sandy Creek**	*Burdekin River Basin* *Lower Burdekin River catchment*	*Habitat type:* Riverine *Substrate:* 80 per cent sand, 10 per cent gravel, 5 per cent pebble, 5 per cent bedrock *Snags and woody debris:* Moderate snags and woody debris *Aquatic plants:* Absent *Variety of habitat:* Undercut banks *Disturbance:* Some cattle disturbance, pump extraction of surface water	Bed very wide in parts, with isolated pools of surface water. Banks fairly stable with limited erosion. Small patches of filamentous algae observed on substrate and water column. Macrophytes absent. Trailing vegetation in some sections of reach. Undercut banks in parts. Fish (spangled perch (*Leiopotherapon unicolor*), flyspecked hardyhead *(Craterocephalus stercusmuscarum*) and eastern rainbowfish (*Melanotaenia splendida splendida*)) observed in small, clear pools.Site likely to be of value to small fish species and aquatic invertebrates, particularly during dry periods. May provide habitat value for larger fish and turtles when surface waters are deeper. Creek also of value for the dispersal of aquatic species.	 *Shallow pools at Sandy Creek, May 2013.*

Site code and name	Basin/ catchment	Habitat assessment summary	General description and habitat characteristics	Representative photograph
AQ11 **Farm dam with flooded timbers**	*Burdekin River Basin Bowen River catchment*	*Habitat type:* Lacustrine *Substrate:* 50 per cent clay, 20 per cent pebbles, 30 per cent gravel *Snags and woody debris:* Moderate snags and woody debris *Aquatic plants:* Sedges (*Cyperus* sp.) and *Lomandra hystrix* *Variety of habitat:* Shallow and deep water, moderate woody debris and macrophytes *Disturbance:* Cattle and deer present, nearby farm tracks	A larger farm dam with submerged standing timbers. Site is heavily used by cattle and deer. Margins of waterbody bare, or with pebbles and gravel. Surface water generally normal with patches of bright green algal scum on surface. Little filamentous algae on substrate and in water column. Water slightly turbid. Erosion generally absent, although moderate areas of bare ground. Riparian zone limited – dominated by grasses, with small sections of tall mature trees. Freshwater mussels (*Alathyria sp.*) observed on substrate. Numerous waterbirds on waterbody. Birds catching spangled perch (*Leiopotherapon unicolor*). Abundant fish activity on surface. Also likely to provide habitat for turtles.	 *Farm dam with standing submerged timbers, June 2013.*
AQ12 **Oaky Creek**	*Burdekin River Basin Bowen River catchment*	*Habitat type:* Riverine *Substrate:* 50 per cent sand, 40 per cent gravel, 10 per cent bedrock *Snags and woody debris:* Little woody debris present *Aquatic plants:* Sedges (*Cyperus* spp.) and *Melaleuca* sp. *Variety of habitat:* Variable habitat – riffles, runs and pools. Shallow and deeper water present *Disturbance:* Pig tracks observed	Surface water clear and flowing. Subterranean flows in much of reach, with upwelling in some parts. Algae abundant where surface water is present. Sedges and *Melaleuca* common in creek bed, which is indicative of perennial sources of water. Site of high value for fish. Very large population of juvenile and sub-adult sooty grunter (*Hephaestus fuliginosus*), and abundant eastern rainbowfish (*Melanotaenia splendida splendida*), gudgeons (*Hypseleotris* sp.) and spangled perch (*Leiopotherapon unicolor*) were observed. Site may provide refugial habitat for turtles during dry periods.	 *Oaky Creek, showing essential riffle habitat for the sooty grunter (*Hephaestus fuliginosus*), May 2013.*

Site code and name	Basin/ catchment	Habitat assessment summary	General description and habitat characteristics	Representative photograph
AQ13 **Strathmore Creek**	*Burdekin River Basin* *Bowen River catchment*	*Habitat type:* Riverine *Substrate:* 55 per cent gravel, 35 per cent sand, 10 per cent concrete *Snags and woody debris:* Little woody debris present *Aquatic plants:* Black ironbox (*Eucalyptus raveretiana*) *Variety of habitat:* Riffles, runs and pools, shallow and deep water, undercut banks *Disturbance:* Road crossing and culvert, cattle and pigs	Site is modified to include a road crossing with box culverts, and one bank has been concreted for a distance of ~ 40 m. Some sand/gravel deposition and formation of bars. Large population of sub-adult and adult sooty grunters (*Hephaestus fuliginosus*) and spangled perch (*Leiopotherapon unicolor*) observed. Site likely to support a number of fish species. Abundant filamentous algae attached to substrate. Creek very clear and flowing. Depth of water shallow (< 0.5 m) in most parts. Turtles likely to be present and sandy banks may be used for nesting.	*Sandy deposits at Strathmore Creek, May 2013.*
AQ14 **Pelican Creek**	*Burdekin River Basin* *Bowen River catchment*	*Habitat type:* Riverine *Substrate:* 80 per cent sand, 10 per cent gravel, 10 per cent bedrock *Snags and woody debris:* Little snags and woody debris *Aquatic plants: Melaleuca* sp. and umbrella sedge (*Cyperus involucratus*) *Variety of habitat:* Shallow and deep water, undercut banks, filamentous algae. Moderate overhanging and trailing vegetation *Disturbance:* Pigs, cattle and wild dogs present. Some disturbance caused by vehicles	Filamentous algae anchored on large section of substrate. Water very clear, mostly shallow with deeper sections alongside undercut banks. Low, sandy benches in bed. *Melaleuca* sp. in bed and banks – indicative of perennial subterranean flow. Likely to provide habitat for a number of fish and turtle species, particularly during dry periods. Snags and woody debris uncommon in waterway.	*Shallow, clear waters of Pelican Creek, May 2013.*

Site code and name	Basin/ catchment	Habitat assessment summary	General description and habitat characteristics	Representative photograph
AQ15 **Bowen River**	*Burdekin River Basin* *Bowen River catchment*	*Habitat type:* Riverine *Substrate:* 30 per cent boulder, 30 per cent cobble, 10 per cent pebble, 10 per cent gravel, 10 per cent sand, 10 per cent clay/silt *Snags and woody debris:* Moderate snags and woody debris *Aquatic plants: Melaleuca* sp. *Variety of habitat:* Rocky riffles, deep water, shallow backwaters *Disturbance:* Nearby road and rail bridges. Cattle present	Large, wide (20 m width), fast flowing river. Small patches of erosion, but banks generally stable. Undercut banks appear absent from reach. River is crossed by a large road/rail bridge, but structure is unlikely to impede the dispersal of aquatic organisms. Surface water slightly turbid. Moderate trailing vegetation, stands of *Melaleuca* in bed (partially submerged) and on banks of reach. Site provides varied aquatic habitat, and is likely to support a diverse and abundant fish, turtle and aquatic invertebrate community.	*Rocky riffle in the Bowen River, May 2013.*
AQ16 **Five Mile Creek at Fig Tree**	*Burdekin River Basin* *Bowen River catchment*	*Habitat type:* Riverine *Substrate:* 60 per cent sand, 35 per cent gravel, 4 per cent boulders, 1 per cent bedrock *Snags and woody debris:* Little snags and woody debris *Aquatic plants: Melaleuca* sp. *Variety of habitat:* Surface water absent *Disturbance:* Nearby farm track, cattle present	Dense riparian zone with trailing and overhanging vegetation. Macrophytes absent, but *Melaleuca* present. Logs and woody debris present, but sparsely distributed. Surface water absent. Substrate very dry. Site unlikely to provide suitable habitat for an aquatic community; however, may act as a corridor for dispersal when surface waters are present.	*Dry sand creek bed at Five Mile Creek, May 2013.*

Site code and name	Basin/ catchment	Habitat assessment summary	General description and habitat characteristics	Representative photograph
AQ17 **Five Mile Creek at Fig Tree (upstream of previous site)**	*Burdekin River Basin* *Bowen River catchment*	*Habitat type:* Riverine *Substrate:* 60 per cent sand, 30 per cent gravel, 10 per cent boulder *Snags and woody debris:* Some snags and woody debris present *Aquatic plants: Melaleuca* sp. *Variety of habitat:* Undercut banks, rocks and cobble *Disturbance:* None observed	Dry creek bed with several small, shallow pools. Pools densely populated with fish – predominantly eastern rainbowfish (*Melanotaenia splendida splendida*), with some spangled perch (*Leiopotherapon unicolor*) and unidentified gudgeons. Numerous freshwater crab (*Austrothelphusa transversa*) burrows in bed and banks. Site unlikely to be used by turtles. Leaf litter abundant. Rocks and cobble may provide riffle habitat when surface water is present. Banks undercut. Erosion on steep banks, but riparian vegetation provides stability. Mosses present and substrate is moist. *Melaleuca* sp. in bed and on banks.	*Creek bed and rocky outcrop at Five Mile Creek, May 2013*
AQ18 **Suttor River at Cerito**	*Burdekin River Basin* *Suttor River catchment*	*Habitat type:* Riverine *Substrate:* 50 per cent clay, 30 per cent gravel, 20 per cent sand *Snags and woody debris:* Moderate woody debris *Aquatic plants:* Moderate *Lomandra hystrix* *Variety of habitat:* Mostly shallow surface water, undercut banks, woody debris, contours provide habitat *Disturbance:* None evident	Moderately open riparian zone with tall, mature trees dominant. Riparian zone intact, and provides shade for waterway. Moss present in sheltered areas. Leaf litter, small sticks and woody debris provide habitat. Undercut banks frequent along reach. Sandy gravel deposits in bed. Water slightly turbid. Surface water a series of isolated pools. Banks steeply incised – banks to 3 m. Evidence of flood debris to ~ 2 m. River provides habitat for fish and turtles. Sandy gravel deposits may be used for turtle nesting. Waterway may also act as a corridor for dispersal for aquatic species.	*Aquatic habitat in the Suttor River, May 2013.*

Site code and name	Basin/ catchment	Habitat assessment summary	General description and habitat characteristics	Representative photograph
AQ19 **Lily Creek**	*Burdekin River Basin* *Suttor River catchment*	*Habitat type:* Riverine *Substrate:* 90 per cent sand, 10 per cent silt *Snags and woody debris:* Some snags and woody debris *Aquatic plants:* Moderate *Lomandra hystrix* and *Melaleuca* sp. *Variety of habitat:* Surface water absent, some woody debris *Disturbance:* Pig pugging observed on banks	A deeply incised creek with substantial erosion and scouring. Little shading and bank stability provided by riparian zone. Canopy very open. Large, mature trees sparsely distributed along banks. Grasses and weedy herbs dominant streamside cover. *Melaleuca* stands in creek bed – indicative of perennial subterranean flows. Surface water absent, but substrate damp in places. Patchy leaf litter and some woody debris may provide habitat when surface water is present. Evidence of flooding to ~ 1.2 m depth. Site may provide habitat values for fish, turtles and macroinvertebrates when surface waters are present.	*Vegetated creek bed at Lily Creek, May 2013.*
AQ20 **Waterhole next to Rockingham Creek**	*Burdekin River Basin* *Suttor River catchment*	*Habitat type:* Lacustrine *Substrate:* 100 per cent clay *Snags and woody debris:* Some woody debris present *Aquatic plants:* Giant waterlily (Nymphaea gigantea) and swamp lily (*Ottelia ovalifolia*) *Variety of habitat:* Deep and shallow surface water. Abundant cover provided by macrophytes *Disturbance:* Cattle and pigs present	A large, shallow waterbody fringed by floating vegetation. Black clay substrate, with sandy banks on floodplain. Numerous ducks, teals and grebes on surface water. Some large woody debris. Fringing riparian vegetation. Fish present – waterbody likely to support a large fish community. Flooding of the nearby creek would assist in the dispersal of fish and turtles to the waterhole. Waterhole of value to fish, turtles and aquatic invertebrates, particularly during dry periods when surface water is scarce.	*Waterhole with abundant macrophytes, May 2013.*

Site code and name	Basin/ catchment	Habitat assessment summary	General description and habitat characteristics	Representative photograph
AQ21 **Rockingham Creek**	*Burdekin River Basin* *Suttor River catchment*	*Habitat type:* Riverine *Substrate:* 50 per cent gravel, 50 per cent sand *Snags and woody debris:* Little snags and woody debris *Aquatic plants:* Extensive *Lomandra hystrix* *Variety of habitat:* Shallow pools, dense vegetation, leaf litter *Disturbance:* Pigs and cattle	Some small pools of clear water, many exhibit iron staining. Substrate damp along whole creek bed. Dense cover provided by *Lomandra hystrix* on both the banks and within the channel. Moderate leaf litter and woody debris. Leaf litter packed in dense conglomerations. Woodland and riparian zone intact and dominated by large mature trees. Banks stabilised by vegetation – erosion and scouring are absent at site (although gully erosion was observed further upstream). Pigs present – pugging on upper banks. Site unlikely to provide permanent habitat for fish or turtles. May provide habitat for aquatic invertebrates.	*Sandy substrate and abundant Lomandra hystrix at Rockingham Creek, May 2013.*
AQ22 **Spring on Mount Lookout**	*Burdekin River Basin* *Suttor River catchment*	*Habitat type:* Palustrine – spring *Substrate:* 80 per cent peat with 20 per cent gravel *Snags and woody debris:* Some snags and woody debris in wetland *Aquatic plants:* Abundant sedges (*Cyperus* spp.) *Variety of habitat:* Surface pools absent *Disturbance:* Cattle, vehicle tracks, feral horses	Rock springs seeping water to wetlands, creeks and drainage lines. Substrate rocky, with peat beds in wetland areas. Sedges abundant, creating dense vegetated mats that obscure surface water. Habitat itself is not suitable for fish or turtles, but may support an aquatic invertebrate community. Springs valuable for inputs to surface water downstream, and may indirectly contribute to refugial waterbodies and flow downstream.	*Wetland spring with sedge cover, May 2013.*

Site code and name	Basin/ catchment	Habitat assessment summary	General description and habitat characteristics	Representative photograph
AQ23 **Unnamed sandy drainage line off Rockingham Creek**	*Burdekin River Basin* *Suttor River catchment*	*Habitat type:* Riverine *Substrate:* 60 per cent sand, 30 per cent gravel, 10 per cent silt *Snags and woody debris:* Moderate snags and woody debris present in drainage line *Aquatic plants:* Some sedges (*Cyperus* spp.) in channel *Variety of habitat:* Small, shallow pools, undercut banks *Disturbance:* Cattle, pigs and feral horses	A small drainage line with a single shallow pool. Surface water of low value to fish and turtles, but may provide habitat for freshwater invertebrates. Drainage line may act as a corridor for dispersal when surface waters are hydrologically connected.	*Sandy creekbed and small pool, May 2013.*
AQ24 **Rock pools in drainage line off Rockingham Creek**	*Burdekin River Basin* *Suttor River catchment*	*Habitat type:* Riverine *Substrate:* 80 per cent bedrock, 15 per cent gravel, 5 per cent sand *Snags and woody debris:* Little snags and woody debris present in drainage line *Aquatic plants:* Some sedges (*Cyperus* spp.) *Variety of habitat:* Deep pools, overhanging rock *Disturbance:* Cattle, pigs and feral horses	Deep, mostly clear standing pools on bedrock substrate. Sedges abundant on the margins of pools. Pools likely to persist through much of the year, and may provide habitat for fish, aquatic invertebrates, and possibly turtles.	*Standing pools in bedrock, May 2013.*

Site code and name	Basin/ catchment	Habitat assessment summary	General description and habitat characteristics	Representative photograph
AQ25 **Unnamed drainage line off Rockingham Creek**	*Burdekin River Basin* *Suttor River catchment*	*Habitat type:* Riverine *Substrate:* 60 per cent bedrock, 20 per cent gravel, 20 per cent silt *Snags and woody debris:* Moderate snags and woody debris *Aquatic plants:* Some sedges (*Cyperus* spp.) present *Variety of habitat:* Shallow standing pools with rocky substrate. Moss and filamentous algae also present *Disturbance:* Cattle, pigs and feral horses present	Most surface water turbid with a milky appearance. Some pools clear. Leaf litter and woody debris common in drainage line. Area appears arid, but the presence of mosses and sedges suggests that water may stand in pools for much of the year. Site unlikely to support a fish or turtle population (due to ephemerality of surface water), but provides habitat values for aquatic invertebrates. Freshwater crab (*Austrothelphusa transversa*) burrows were observed.	*Turbid surface water in drainage line, May 2013.*
AQ26 **Rockingham Creek (adjacent to preliminary investigation corridor)**	*Burdekin River Basin* *Suttor River catchment*	*Habitat type:* Riverine *Substrate:* 55 per cent gravel, 40 per cent sand, 5 per cent silt *Snags and woody debris:* Moderate snags and woody debris *Aquatic plants:* Moderate abundance of *Lomandra hystrix* and *Melaleuca* sp. *Variety of habitat:* Shallow surface water, runs, riffles and pools, undercut banks and woody debris *Disturbance:* Pigs and cattle present. Nearby farm track with creek crossing	Some leaf litter and moderate availability of woody debris. Bed, banks and floodplain mostly consist of sand and gravel, with residual silt. Sandy deposits frequent in bed. *Lomandra hystrix* common in bed and banks of creek. Riparian zone dominated by tall mature trees, with some shrubs (including *Melaleuca* sp.) and grassy groundcover. Creek shallow, but flowing. Average depth ~ 0.1 m. Surface water slightly turbid. Shallow riffles, runs and pools all present. Undercut banks also present along parts of the creek. Reach provides good habitat for a number of small fish and aquatic invertebrates. May provide habitat for larger fish and turtles when surface water is deeper.	*Shallow, flowing surface water at Rockingham Creek, May 2013.*

Site code and name	Basin/ catchment	Habitat assessment summary	General description and habitat characteristics	Representative photograph
AQ27 **Farm dam**	*Burdekin River Basin* *Suttor River catchment*	*Habitat type:* Lacustrine *Substrate:* 100 per cent clay *Snags and woody debris:* Snags and woody debris absent *Aquatic plants:* Absent *Variety of habitat:* Limited – all deep standing water *Disturbance:* Cattle and pig disturbance	A moderately sized farm dam with low retaining walls. Site likely to be of value for turtles and a few fish and macroinvertebrate species. Riparian zone is absent. Overall, low value aquatic habitat.	 *Farm dam, May 2013.*
AQ28 **Gunn Creek**	*Burdekin River Basin* *Suttor River catchment*	*Habitat type:* Riverine *Substrate:* 30 per cent clay, 30 per cent sand, 20 per cent gravel, 10 per cent cobble, 10 per cent bedrock *Snags and woody debris:* Some snags and woody debris present *Aquatic plants:* Absent *Variety of habitat:* Shallow through to deep water. *Disturbance:* Cattle present, nearby farm track with creek crossing	Deep, standing water at time of survey. Water turbid, with some algae on margins of waterway. Undercut banks along most of the reach. Riparian zone open – consisting mostly of grasses and single trees. Little woody debris, but some overhanging and trailing vegetation. Bedrock likely to provide habitat for a number of fish species. Generally suitable habitat for fish, turtles and macroinvertebrates. Evidence of flooding to ~ 1.5 m above bank. Erosion and scouring in parts. Waterway is crossed by a concrete causeway which may inhibit the dispersal of aquatic organisms.	 *Deep, standing water at Gunn Creek, May 2013.*

Site code and name	Basin/ catchment	Habitat assessment summary	General description and habitat characteristics	Representative photograph
AQ29 **Gilgai in brigalow**	*Burdekin River Basin* *Suttor River catchment*	*Habitat type:* Palustrine *Substrate:* 70 per cent clay, 30 per cent sand *Snags and woody debris:* Some fallen timbers *Aquatic plants:* Absent *Variety of habitat:* Shallow, disconnected pools when surface water present. Some cover provided by woody debris *Disturbance:* Cattle and pig disturbance	Freshwater crabs (*Austrothelphusa transversa*) observed in habitat – burrows and exoskeletons common. Habitat of little value to fish and turtles as surface water is highly ephemeral. Surface water absent in most gilgai at the time of the assessment. One small, shallow (~ 0.1 m), turbid pool was observed. Erosion absent. Riparian vegetation consists of tall brigalow forest with an understorey of grasses and herbs. Site likely to be of value to terrestrial fauna (as a drinking point) and aquatic invertebrates.	*Gilgai with surface water in brigalow habitat, May 2013.*
AQ30 **Anabranch of Suttor River**	*Burdekin River Basin* *Suttor River catchment*	*Habitat type:* Riverine *Substrate:* 100 per cent clay *Snags and woody debris:* Moderate snags and woody debris *Aquatic plants:* Sedges (*Cyperus* spp.) *Variety of habitat:* Riffles, runs and pools, shallow and deep water, large woody debris and undercut banks *Disturbance:* Some cattle disturbance, nearby farm track	Suttor River is a very large, anabranching complex at this point. Surface water turbid and flowing at time of survey, although flow appears ephemeral. Evidence of recent flooding to at least 3 m above the creek bed. Flooding seems to be extreme enough that the anabranches of the Suttor River are connected laterally, and well as longitudinally. Scouring and erosion and erosion problematic in reach. Bank stability very low – riparian zone open, with grasses the dominant vegetation. In many places mature trees are being lost to scouring. Some silt deposition – riffles have been filled with fine particles, and deposits are common along reach. Little leaf litter, although flooding may	*Suttor River, May 2013.*

Site code and name	Basin/ catchment	Habitat assessment summary	General description and habitat characteristics	Representative photograph
			have removed any organic matter. River provides suitable habitat for fish, turtles and aquatic invertebrates. The exoskeleton of an unidentified crayfish was observed at this site.	
AQ31 **Suttor River at main channel**	*Burdekin River Basin* *Suttor River catchment*	*Habitat type:* Riverine *Substrate:* 80 per cent clay, 20 per cent sand *Snags and woody debris:* Moderate large snags and woody debris *Aquatic plants:* Sedges (*Cyperus* spp.) present on banks *Variety of habitat:* Riffles, runs and pool. Variety of depths and structures *Disturbance:* Vehicle tracks, minimal cattle impact, evidence of pigs	A riverine habitat with flowing surface waters. Tall, mature riparian trees. Abundant sedges and grasses on banks. Large numbers of mussel shells (*Alathyria sp.*) observed, and some freshwater crab (*Austrothelphusa sp.*) burrows. Krefft's river turtle (*Emydura macquarii krefftii*) was also observed at the site. Numerous frogs observed and heard in fringing grasses and sedges. Erosion is prevalent in reach – banks are extensively undercut, with mature trees being lost to bank erosion. Surface water moderately turbid. Tributary converges with Suttor River at this point. Site likely to be of high value for fish and turtles, particularly as a refuge during dry periods.	 *Suttor River, showing riffle habitat and large woody debris, May 2013.*

Site code and name	Basin/ catchment	Habitat assessment summary	General description and habitat characteristics	Representative photograph
AQ32 **Gilgai habitat**	*Burdekin River Basin* *Suttor River catchment*	*Habitat type:* Palustrine *Substrate:* 100 per cent clay *Snags and woody debris:* Little woody debris within gilgais *Aquatic plants:* Wavy marshwort (*Nymphoides crenata*) and sedges (*Cyperus* spp.) present *Variety of habitat:* Surface water absent, woody debris and macrophytes present *Disturbance:* Pig damage, minimal cattle impact, nearby (but disused) farm track	Gilgai habitat in an elevated, stony landscape with nearby spinifex and tall woodland. Trees provide shade and abundant leaf litter. Pig pug marks common in gilgais, with recent evidence of grubbing. Cattle known to occur, but impact is minimal. Large numbers of freshwater crabs (*Austrothelphusa transversa*) (burrows and shells) observed in and adjacent to gilgais. Numerous frogs observed and heard in the fringing grasses and sedges. Surface water absent at time of assessment, but substrate still moist in some gilgai. Gilgai likely to provide habitat for a range of aquatic invertebrates only, as the connectivity and ephemerality of aquatic habitat provides limited value for fish and turtles.	*Vegetated gilgai habitat, May 2013.*
AQ33 **Small creek in mixed brigalow woodland**	*Burdekin River Basin* *Suttor River catchment*	*Habitat type:* Riverine *Substrate:* 100 per cent clay *Snags and woody debris:* Some snags and woody debris *Aquatic plants:* Abundant sedges (*Cyperus* sp.) *Variety of habitat:* Shallow and deep water, woody debris, undercut banks and overhanging vegetation *Disturbance:* Cattle present and	A small creek with an isolated, turbid waterhole. Surface water seems to be perennial. Variety of depths – shallow through to deep. Some large woody debris. Banks slightly undercut and fringed by dense sedges (*Cyperus sp.*). Some trailing vegetation. Fish and turtles not observed, but likely to occur. Site likely to provide refugial habitat for fish, turtles and aquatic macroinvertebrates during dry periods.	*Dense sedges along the margins of creek, June 2013.*

Site code and name	Basin/ catchment	Habitat assessment summary	General description and habitat characteristics	Representative photograph
		vehicle track crossing creek		
AQ34 **Farm dam and drainage line**	*Burdekin River Basin* *Suttor River catchment*	*Habitat type:* Riverine/lacustrine *Substrate:* 100 per cent clay/silt *Snags and woody debris:* Moderate snags and woody debris *Aquatic plants:* Absent *Variety of habitat:* Shallow and deep water, large woody debris *Disturbance:* Cattle present	A drainage line and farm dam in surrounding woodland. Drainage line provides fairly limited habitat. Macrophytes absent, but dam has a small stand of submerged dead trees. Surface water slightly turbid. Lots of cattle accessing water – pugging and cattle scats abundant. Turtles and fish not observed, although likely to be present in surface water.	*Farm dam with small stand of emergent woody debris, June 2013.*
AQ35 **Complex of three farm dams**	*Burdekin River Basin* *Suttor River catchment*	*Habitat type:* Lacustrine *Substrate:* 100 per cent clay *Snags and woody debris:* Absent *Aquatic plants:* Floating pondweed (*Potamogeton tricarinatus*) and curled dock (*Rumex crispus*) *Variety of habitat:* Shallow and deep surface water, little macrophytes *Disturbance:* Heavily impacted by cattle, nearby farm tracks	A complex of three farm dams within a single area. All dams contain deep, turbid surface water. Algae absent. Moderate abundance of emergent and floating macrophytes. Riparian zone either bare ground or low grasses. Turtles likely to be present, but were not observed. Spangled perch (*Leiopotherapon unicolor*) observed, although site is likely to be of value to a limited range of fish species. Site heavily impacted by cattle. Two macrophytes observed in low abundance – floating pondweed (*Potamogeton tricarinatus*) and curled dock (*Rumex crispus*).	*One of several farm dams within a watering point, June 2013.*

Site code and name	Basin/ catchment	Habitat assessment summary	General description and habitat characteristics	Representative photograph
AQ36 **Small creek crossed by highway**	*Burdekin River Basin* *Suttor River catchment*	*Habitat type:* Riverine *Substrate:* 70 per cent clay, 30 per cent concrete *Snags and woody debris:* Absent *Aquatic plants:* Absent *Variety of habitat:* Shallow and deep water *Disturbance:* Crossed by highway with box culvert, pigs present	Freshwater mussels (*Alathyria sp.*) and fish observed in surface water. Banks very eroded, and surface water turbid. Dead pig observed next to waterbody. Site low value habitat, but may provide refugial habitat for fish and macroinvertebrates. Waterway may also provide dispersal pathway when hydrological connectivity is established.	*Pool of surface water adjacent to highway crossing, June 2013.*
AQ37 **Small drainage line and gilgai in grazing paddock**	*Burdekin River Basin* *Suttor River catchment*	*Habitat type:* Riverine/palustrine *Substrate:* 100 per cent clay *Snags and woody debris:* Little snags and woody debris *Aquatic plants:* Absent *Variety of habitat:* Surface water absent *Disturbance:* Heavily impacted by cattle, farm track runs through site	A highly impacted site that is unlikely to provide habitat for an aquatic community. Extensive cattle pugging along whole length of bed. Small gilgai in drainage line. Site generally of low aquatic habitat value.	*Small, heavily impacted gilgai in grazing paddock, June 2013.*

Aquatic habitats along the preliminary investigation corridor provided valuable habitat for fish, turtles, amphibians, waterbirds and invertebrates. In general, the diversity of the aquatic community is highly influenced by the ephemerality of surface water, the quality of surface water and the habitat diversity (Therriault and Kolasa 2000). Perennial habitats typically support the most diverse and abundant aquatic communities and provide refugial habitat in dry periods. Alternatively, ephemeral habitats are dominated by species that are capable of undergoing periods of dormancy (aestivation) when surface waters disappear (Larned *et al* 2007). Aerial dispersers (e.g. mayflies, dragonflies and waterbirds) are also likely to colonise ephemeral surface waters (Bogan & Boersma 2012).

Lacustrine habitats provide important habitat for many terrestrial species (such as waterbirds and amphibians) that depend on perennial surface water. Waterbirds were commonly observed at lacustrine habitats. Frogs were also frequently observed or were also noted to be calling from the waterbody margins. Waterbodies (and adjacent vegetation) provided drinking resources for numerous terrestrial fauna species, and breeding habitat for amphibians and some bird species. Additionally, foraging habitat was provided for water birds and wading birds (including a number of threatened fauna species). Aquatic habitats also provided potential habitat for aquatic dependant mammals.

Predatory species (including some birds of prey and snakes) also forage within aquatic habitats. However in artificial waterbodies (i.e. farm dams), the general lack of habitat variability, the disturbance from land use practices and the presence of grazing and pest species did reduce the suitability for more specialised species (including some cryptic birds). Disturbance from cattle and pigs was common within aquatic habitats along the preliminary investigation corridor, but was particularly concentrated around farm dams. This disturbance impacted the aquatic habitat values of some watercourses.

Findings from the Great Barrier Reef catchments Aquatic Conservation Assessments (ACAs) for riverine (Inglis & Howell 2009a) and non-riverine wetlands (Inglis and Howell 2009b) identified a number of aquatic dependant flora species within the Burdekin (and Don) River Basin (these species lists use a range of data sources, and the age/date of records is not provided). A total of 179 aquatic dependent flora species (of which 24 are introduced) were identified as occurring in riverine and/or non-riverine wetlands within Burdekin and Don River Basins. These species potentially occur within the preliminary investigation corridor. The ACA documents also identified 7 aquatic flora species that are listed as 'threatened' under the NC Act and/or EPBC Act in the Burdekin and/or Don River Basins. Wildlife Online and HERBRECS searches respectively identified 59 and 65 aquatic flora species occurring within the preliminary investigation corridor (these databases contain historical records of specimens collected from all seasons/months. All of these species are listed as NC Act 'least concern'.

Thirteen aquatic flora species were identified in the field surveys. One species (black ironbox (*Eucalyptus raveretiana*)) is listed as threatened under the NC Act (see Section 4.2.8 for further discussion). Other aquatic flora species identified were:

- Floating pondweed (*Potamogeton tricarinatus*)
- Curled dock (*Rumex crispus*) (introduced)
- Sedges (*Cyperus* sp., including the introduced umbrella sedge (*Cyperus involucratus*))
- Wavy marshwort (*Nymphoides crenata*) (see Plate 4-19)
- *Lomandra hystrix*
- *Melaleuca* sp.

- Giant waterlily (*Nymphaea gigantea*)
- Swamp lily (*Ottelia ovalifolia*)
- Black ironbox (*Eucalyptus raveretiana*) (Plate 4-19)
- Rushes (*Juncus* sp.)
- *Fimbristylis* sp.
- Slender knotweed (*Persicaria* sp.)
- Blind-your-eye mangrove (*Excoecaria agallocha*).

Don River Basin

Within the Don River Basin there are a Riverine Wetland RE (RE 11.3.25) and Great Barrier Reef Wetland Management Area (GBR WMA) which is listed as 'least concern' under the VM Act (Figure 4-3). The Caley Valley Wetland within the Don River Basin is a DIWA and GBR WPA, the aquatic habitat values are discussed below.

The Don River Basin contains a number of ephemeral watercourses which discharge directly into Abbot Bay. These watercourses are tidally influenced at the downstream end. Upstream these watercourses were characterised by a predominately sandy substrate. Diverse habitat was also observed at a number of these watercourses, including shallow and deep waters, riffles, runs, pools, woody debris, undercut banks, filamentous algae, trailing vegetation and several species of macrophytes.

The Elliot River, within the Don River Basin, was surveyed during previous studies and characterised as a broad channel with a sandy to fine gravel substrate (Plate 4-12). The river was considered likely to support run habitats only for short periods during times of high rainfall. No pool or riffle habitats were evident within this river at the survey locations (E3 Consulting 2010; GHD 2010).

Plate 4-12 Elliot River (GHD 2010)

Aquatic habitats at Splitter's Creek have been described by E3 Consulting (2010) as riffles, pools, undercut banks, filamentous algae, woody debris and sand deposits (refer Plate 4-13). The surface water was clear, shallow and flowing. Saltwater Creek was described as an incised, narrow stream channel with an intact riparian zone (refer Plate 4-13). Habitat values were provided by riffles, pools, fringing emergent and submerged macrophyte beds, undercut banks, sand deposits and woody debris (E3 Consulting 2010). Overall, the variety of habitat present in the Don River Basin is likely to accommodate a range of fish species, turtles, invertebrates and the estuarine crocodile.

Plate 4-13 Splitter's Creek (E3 Consulting 2010) (left) and Saltwater Creek (BMT WBM 2010) (right)

Caley Valley Wetland

The Caley Valley Wetland falls in the most northern extent of the preliminary investigation corridor, within the Don River Basin. The Caley Valley Wetland was modified from its natural state using the strategic placement of bunds to retain surface water and increase ponding. Construction of bunds commenced *c.* 1956, with further installations in 1982. The Caley Valley is a DIWA nationally important wetland (refer to Section 4.4). A number of creeks drain directly into the Caley Valley Wetland, including Spring Creek, Table Top Creek, Main Creek, Mount Stuart Creek, Saltwater Creek, Goodbye Creek and Six Mile Creek.

The Wetland drains into Abbot Bay and the Great Barrier Reef. A narrow band of coastal dunes create a barrier between the beach and the Wetland. The Wetland itself is vast, with the total catchment approximately 76,750 ha (GHD 2009). A number of 'functional zones' have been described for the Caley Valley Wetland, as follows (BMT WBM 2012):

- ***Coastal zone*** – a small patch of open coastline between Mount Stuart and Branch Creek. The coastal zone consists of open water, sand beaches, spits and dunes
- ***Western estuarine zone*** – tidally influenced creeks to the west of the Caley Valley Wetland. The estuarine zone is a patchy conglomeration of saltmarshes, saltpans, mangroves and *Casuarina* dominated REs.
- ***Hypersaline zone*** – hypersaline surface water and saltpans lying between the western bund and causeway. The hypersaline zone supports low densities of saltmarsh species.
- ***Wetland basin zone*** – the fresh and brackish region east of the causeway. The wetland basin zone consists of palustrine (where the dominant vegetation is sedges and mangrove clubrush (*Schoenoplectus litoralis*)) and lacustrine habitats.
- ***Saltwater Creek zone*** – Saltwater Creek and its adjacent riparian vegetation and wetlands. Surface water is fresh to brackish, and supports floating macrophytes
- ***Terrestrial zone*** – a number of small, ephemeral streams with narrow, fragmented riparian zones (BMT WBM 2012).

The Caley Valley Wetland had very diverse aquatic habitats, including flowing, deep and shallow water, with woody debris and abundant macrophytes. Sedges (*Cyperus* spp.), giant waterlily (*Nymphaea gigantea*) and blind-your-eye mangrove (*Excoecaria agallocha*) were all observed. The diverse aquatic habitats provide abundant cover for aquatic organisms and waterbirds. Huge numbers of waterbirds (including young of some species) were observed on surface water. The Caley Valley Wetland supported a large and diverse fish population that

includes a number of freshwater and estuarine species, and marine vagrants. The site is also likely to provide habitat for saltwater crocodile (*Crocodylus porosus*). Generally, the Caley Valley Wetland had high value aquatic habitat for a broad range of aquatic species.

Lower Burdekin River catchment

The main watercourses in the lower Burdekin River catchment are the Bogie River and Sandy Creek. The catchment area also contains RE 11.3.25b (riverine wetland and fringing riverine wetland), which is listed as a GBR WMA and 'least concern' under the VM Act. The Bogie River and Sandy Creek were both dominated by sandy substrate. The Bogie River was characterised by a braided river channel with shallow, slow flowing clear waters. The varieties of microhabitats within the watercourses of the catchment were low; this has also been observed in previous studies ((Plate 4-14 and Plate 4-15) (E3 Consulting 2010 and GHD 2010). However, the Bogie River and Sandy Creek provided valuable habitat for fish (a number of fish species were observed at Sandy Creek), turtles and aquatic invertebrates.

Plate 4-14 Bogie River (left) and Brigalow Creek (right) (GHD 2010)

Plate 4-15 Capsize Creek (left) and Herbert Creek (right) (GHD 2010)

Other aquatic habitats previously surveyed in the lower Burdekin River catchment include a lacustrine artificial dam/wetland and palustrine gilgais (Plate 4-16). Both had silt/clay substrates with no overhanging or riparian vegetation (GHD 2010). The artificial dam extended from a deep pool habitat into a shallow wetland with little in-stream debris (GHD 2010). Large and small gilgais were positioned throughout a brigalow forest in a network connected by narrow channels. At the time of the survey (April 2010), larger gilgais contained water but the smaller gilgais and connecting channels were dry.

Plate 4-16 Artificial dam/wetland (left) and gilgai (right) (GHD 2010)

Bowen River catchment

The main watercourses in the Bowen River catchment are the Bowen River and Pelican Creek. The Bowen River catchment is located half way along the preliminary investigation corridor, to the south of Collinsville (Figure 2-12). Within the Bowen River catchment is the Directory of Important Wetlands in Australia (DIWA) listed Birralee-Pelican Creek Wetlands, which branch off Pelican Creek and run for approximately 15 km along the upper Bowen River (SEWPaC 2013e). This wetland is situated 2.6 km west of the preliminary investigation corridor. The RE 11.3.25b (riverine wetland or fringing riverine wetland) was also present, and is listed as a 'least concern' GBR WMA under the VM Act (E3 Consulting 2010).

The Bowen River is a broad river channel (approximately 300 m wide) characterised by sand bars, bed rock and clay margins. Deep pools were present, as well as rocky riffles and shallow backwaters. The water courses in the Bowen River catchment had a dominant sand/gravel substrate and clear water. The creeks within the catchment were characterised by larger perennial pools that provide import drought refuge for aquatic fauna. A variety of aquatic habitats, including riffles, runs, undercut banks and woody debris were present; filamentous algae was also observed within a number of the creeks surveyed. These creeks provided valuable habitat for fish, turtles and invertebrates

Previous studies have also found that the ephemeral creeks within the Bowen River catchment contain a variety habitats for aquatic species and are important refugial habitat (see Plate 4-17 and Plate 4-18) (E3 Consulting 2010 and GHD 2010). The Birralee-Pelican Creek Wetlands also have high ecological value, being a permanent water body with a variety of habitat types and features (SEWPaC 2013e). Overall, the perennial surface waters within the Bowen River catchment are important refugia for freshwater biota.

Plate 4-17 Pelican Creek (GHD 2010)

Plate 4-18 Table Mountain Creek (left) and Cattle Creek (right) (GHD 2010)

Plate 4-19 Black ironbox (*Eucalyptus raveretiana*) at Strathmore Creek (left); wavy marshwort (*Nymphoides crenata*) in gilgai habitat (right)

Suttor River (upper and lower) catchment

The Suttor River is the main waterway in the Suttor River catchment. The river crosses the preliminary investigation corridor at two places, and as such, is described as the upper Suttor River and lower Suttor River (Figure 2-12). Riverine wetlands (RE 11.3.25) and freshwater wetlands with naturalised species (RE 11.3.27f) occur in the catchment. These are listed as 'least concern' under the VM Act and as Great Barrier Reef Wetland Management Areas (GBR WMA) under SPP4/11 (E3 Consulting 2010).

The riverine environments of the catchment have been described as seasonal waterbodies with mainly bed rock to clay substrates (E3 Consulting 2010). The upper Suttor River is a small channel with shallow runs, riffles, pools and woody debris. The lower Suttor River varies from sandy/clay substrate with large, deep pools, shallow runs and some riffles, to bed rock substrates with large waterholes and deeper runs. The lower Suttor River also has a variety of habitats and in-stream debris such as branches, wood logs and undercut banks. Erosion is prevalent in the Suttor River, with banks being extensively undercut and mature trees falling as the soil around their roots is eroded. The May/June 2013 observations at the Suttor River were consistent with previous surveys in 2010, with the predominate substrate observed as silt in the lower Suttor River and sand dominated in the upper Suttor River (Plate 4-20) (E3 Consulting 2010; GHD 2010). No submerged aquatic macrophytes were observed during previous surveys conducted in 2010 at the upper or lower Suttor Rivers, most likely due to the high turbidity of the waters (E3 Consulting 2010). During the May/June 2013 surveys, turtles, mussel shells and freshwater crab burrows were observed, and the Suttor River was found to provide high value aquatic habitat.

Plate 4-20 Upper Suttor River (E3 Consulting 2010) (left) and lower Suttor River (GHD 2010) (right)

Other riverine habitats in the Suttor River catchment (including Rockingham and Gunn Creeks) were observed to have dense sedges and lomandra fringing the banks, and provided habitat for fish, turtles and invertebrates. Smaller drainage lines in the catchment may provide low value aquatic habitat, but are important as corridors for dispersal (and gene flow) of aquatic species. A number of lacustrine habitats were observed in the catchment. Numerous ducks, teals and grebes were identified on a large, shallow waterbody fringed by floating vegetation (adjacent to Rockingham Creek). Several farm dams in the catchment were also surveyed, and these provided aquatic habitat for fish and turtles, particularly during dry periods when surface water is scarce.

Gilgai habitat was also observed in the catchment, with an abundance of freshwater crab burrows and frogs observed. Macrophytes including wavy marshwort and sedges were also present. A groundwater dependant spring was also observed on Mount Lookout with peat beds and abundant sedges. Overall, the catchment contained a number of permanent waterbodies and habitats of high ecological value for a variety of aquatic flora and fauna species.

4.3 Fauna

4.3.1 Terrestrial fauna

Table 4-8 provides a summary of the results of the desktop assessments for terrestrial fauna species that are predicted to occur, or have been previously recorded, within the desktop search extent (as defined in Section 2.4).

Table 4-8 Terrestrial fauna species diversity – desktop assessment*

	Protected Matters Search Tool (predicted to occur)	DEHP Wildlife Online database (historically recorded)	Queensland Museum specimen database (historically recorded)	Birds Australia Atlas (historically recorded)
Species diversity	N/A	23 amphibians 88 reptiles 58 mammals 280 birds	27 amphibians 74 reptiles 17 mammals 12 birds	248 birds
EPBC Act and/or NC Act-listed species	8 reptiles 4 mammals 8 birds	4 reptiles 3 mammals 11 birds	3 reptiles 1 mammals	9 birds
Introduced species	1 amphibians 5 mammals	1 amphibian 1 reptile 9 mammals 5 birds	1 amphibian 2 mammals	4 birds

* Note that these desktop results are based on historical records (of either a known or unknown date) or predictive modelling. Dated specimen collections range in age from 1974 through to 2005, and encompass a range of seasons.

Threatened species are discussed further in Section 4.3.3. During the May/June 2013 field surveys a total of 9 amphibians, 23 reptiles, 40 mammals and 180 bird species were identified from within the preliminary investigation corridor and the wider study area (Table 4-9). These results showed that the eucalypt woodland, fringing riparian vegetation and acacia dominated woodland/shrubland were important habitats for terrestrial fauna. The terrestrial fauna field survey results, including survey (habitat-specific) species lists and the total species list are provided in Appendix C.

Table 4-9 Summary of terrestrial habitat and fauna species observations during May/June 2013

	Amphibians	Reptiles	Mammals	Birds	Total
Total species	9	23	40	180	252
Introduced species	1	0	8	1	10
Threatened species (EPBC Act/NC Act)	0	0	1	4	5
EPBC Act migratory	0	0	0	7	7
EPBC Act marine	0	0	0	36	36
Habitat type					
Eucalypt woodland	7	19	20	114	160

	Amphibians	Reptiles	Mammals	Birds	Total
Fringing riparian vegetation	7	11	28	65	111
Natural and artificial waterbodies	4	4	16	75	99
Acacia dominated woodland/ shrubland	5	15	23	69	112
Semi-evergreen vine thicket	2	7	10	44	63
Grassland	0	0	0	8	8
Coastal wetland	0	0	0	59	59
Non-remnant cleared land	3	2	5	89	99

Amphibians

A total of nine amphibian species from three families were recorded from habitats within and near the preliminary investigation corridor during field surveys. No species of Commonwealth, State or regional significance were recorded. One species, the cane toad (*Rhinella marina*), was detected. This introduced species was widespread and abundant across the landscape, and was the most frequently recorded amphibian species. The cane toad is an adaptable and hardy species, and is likely to occur in virtually all habitats within and near the preliminary investigation corridor. The most diverse genus was the common tree frogs (genus *Litoria*). Bumpy rocket frogs (*Litoria inermis*), broad-palmed frogs (*Litoria latopalmata*), green tree frogs (*Litoria caerulea*) and ornate burrowing frogs (*Platyplectrum ornatum*) were the most commonly observed species, behind the cane toad. Less frequently encountered species included the green-striped frog (*Cyclorana alboguttata*) and the spotted grass frog (*Limnodynastes tasmaniensis*).

Plate 4-21 Bumpy rocket frog (left); eastern stony creek frog (*Litoria wilcoxii*) (right)

Amphibian distribution and habitat use at survey sites was generally, although not exclusively, related to habitats in which surface water was available. Seven species were recorded from fringing riparian vegetation and natural and artificial waterbodies. Eight species were recorded from the eucalypt woodland and acacia dominated woodland/shrubland habitat types. Generally, amphibians were found in association with riparian areas or ephemeral waterways, ephemeral pools and gilgais. Habitats featuring non-remnant, cleared vegetation supported at least two native species. This finding was linked to the presence of microhabitats and surface water, including gilgai depressions in brigalow regrowth. Locally high densities of frogs were

observed at some sites, where breeding and shelter habitat was present. Dense populations were generally in association with rivers and larger ephemeral creeks intersected by the preliminary investigation corridor. At such locations the ornate burrowing frog and bumpy rocket frog were particularly common. One site, Oaky Creek (where large pools of water were present), was observed to support at least three to four native species. Other frog species recorded in desktop database searches are likely to use habitats in the preliminary investigation corridor. These species are listed in Appendix G.

Reptiles

A total of 23 reptile species from 6 families were recorded from habitats within and near the preliminary investigation corridor during field surveys. No species of Commonwealth, State or regional significance were recorded. No introduced reptile species were recorded. Reptile diversity was dominated by the Scincidae family, with 12 species recorded. Of these, the most abundant species were *Carlia pectoralis* and *Cryptoblepharus pulcher pulcher*. Less frequently encountered skink species belonged to the genera *Ctenotus* (Plate 4-22), *Lerista* and *Morethia*. All observed skink species commonly occur in a range of habitats within the Brigalow Belt bioregion. None of the observed species were near the limits of their distribution.

Geckos (family Gekkonidae and Diplodactylidae) were represented by four species from the genera of *Gehyra* and *Heteronotia*. Bynoe's gecko (*Heteronotia binoei*) was frequently recorded during active searches within six habitat types, including eucalypt woodlands (both on flat and rocky terrains), acacia woodland/shrublands (both on flat and rocky terrains), natural and artificial waterbodies and semi-evergreen vine thicket. Other gecko species were less frequently recorded in the same habitat types.

Snake diversity was relatively low with only five species recorded, comprising two species from the Colubridae family and three from the Elapidae family (Plate 4-22). No pythons (family Boidae) or blind snakes (family Typhlopidae) were recorded during field surveys. All five observed snake species were recorded in low densities, generally within eucalypt woodland habitats during active searches or opportunistic records. The infrequent observations of snake species was likely a reflection of the milder weather conditions during the survey period. A total of 28 snake species have been recorded from the preliminary investigation corridor (Appendix G), and so it is expected that the diversity and abundance of snakes is greater that what was detected during field surveys.

The only other terrestrial reptile species recorded from field studies was a single dragon species, the tommy roundhead (*Diporiphora australis*). No monitor/goanna species (family Varanidae), or legless lizards (family Pygopodidae) were recorded in habitats in and near the preliminary investigation corridor. Skink, gecko, snake and dragon species recorded from desktop database searches are located in Appendix G.

Plate 4-22 Black-striped snake (*Cryptophis nigrostriatus*) (left), copper-tailed skink (*Ctenotus taeniolatus*) (right)

Sites where ground layer microhabitats were more complex supported a greater diversity of reptile species as a result of the greater availability of shelter habitat and the availability of prey (for predatory reptiles). The presence of prey (small reptiles (skinks, geckos), frogs and rodents) is in itself related to microhabitat features such as ground layer complexity, availability of water and availability of forage resources (seeds, insects). Therefore, habitat value for prey is indirectly influences the abundance of larger reptiles including legless lizards, goannas and snakes.Habitat types with the greatest reptile diversity included acacia dominated woodlands/shrublands, eucalypt woodland and fringing riparian vegetation. Structurally simple habitats (such as grasslands and non-remnant cleared land) with less variable ground layer microhabitats generally had low reptile diversity. These habitats were typically dominated by common species (such as *Carlia* sp. and *Cryptoblepharus* sp.).

Mammals

A total of 40 mammal species from 17 families were observed in habitats within and near the preliminary investigation corridor. The following two NC Act listed mammals were detected:

- Little pied bat (*Chalinolobus pictatus*) – 'near threatened'
- Echidna (*Tachyglossus aculeatus*) – 'special least concern' – evidence (characteristic diggings and scats) of this species was detected at one location within the preliminary investigation corridor during field surveys.

Eight introduced mammals were recorded from habitats within and near the preliminary investigation corridor: pig (*Sus scrofa*), wild dog (*Canis familiaris*), dingo (*Canis familiaris dingo*), feral cat (*Felis catus*), horse (feral) (*Equus caballus*), chital deer (*Cervus axis*), cattle (wild) (*Bos primigenius*) and European rabbit (*Oryctolagus cuniculus*). These species are discussed further in Section 5.3. While direct observations of introduced ground mammals were infrequent, records of their traces were commonly encountered during the field program. In particular, evidence of dogs, cats (tracks) and pigs (pugging and wallows) was noted at a numerous sites throughout the preliminary investigation corridor. Evidence of rabbits was less conspicuous.

Ground-dwelling mammals

The native ground mammal fauna was dominated by macropods (family Macropodidae). The eastern grey kangaroo (*Macropus giganteus*) was commonly observed in woodland and cleared habitats throughout the preliminary investigation corridor. The red kangaroo (*Macropus rufus*) was only recorded within the southern third of the preliminary investigation corridor, in cleared and eucalypt woodland habitats. Smaller macropods including the agile wallaby (*Macropus*

agilis), common wallaroo (*Macropus robustus*) (Plate 4-23), spectacled hare-wallaby (*Lagorchestes conspicillatus*) and swamp wallaby (*Wallabia bicolor*) were observed in various habitats with denser vegetation including fringing woodlands/forests, eucalypt woodland and acacia woodland/shrubland. These aforementioned more cryptic macropods were not recorded from open cleared habitats. The rufous bettong (*Aepyprymnus rufescens*) was frequently observed during nocturnal surveys within five habitat types, including non-remnant cleared land.

Scats and diggings of two common ground-dwelling mammals, the echidna (scats and diggings in termite mounds) and northern brown bandicoot (*Isoodon macrourus*) (characteristic conical diggings), were observed in semi-evergreen vine thicket and fringing riparian vegetation. However, as these species are widespread habitat generalists they are expected to occur within eucalypt woodland and acacia woodland/shrubland habitats. Water rat (*Hydromys chrysogaster*) tracks were observed in fringing riparian vegetation habitats where suitable habitat (i.e. surface water of sufficient depth) was present. Two species of arboreal mammals were recorded from fringing riparian vegetation habitats. This included five observations of greater glider (*Petauroides volans*) and three observations of the common brushtail possum (*Trichosurus vulpecula*).

Mammalian habitat use in the landscape in which the preliminary investigation corridor occurs is likely driven by a combination of vegetation structure, composition and condition. Larger macropods (eastern grey kangaroo, red kangaroo and wallaroo) were observed in eucalypt woodlands, acacia woodland/shrublands and non-remnant cleared habitats (the latter two species in the southern half of the corridor only). Wallabies were not recorded in non-remnant cleared habitats, likely due to their reliance on habitats providing low-lying cover. Habitat use by smaller ground-dwelling mammals (dasyurids and rodents) is likely to be related to the presence of shelter and foraging habitats. For more generalist species such as the common planigale (*Planigale maculata*), delicate mouse (*Pseudomys delicatulus*), bush rat (*Rattus fuscipes*) and canefield rat (*Rattus sordidus*), suitable habitat is widespread in the landscape in which the preliminary investigation corridor occurs. In addition to habitat composition and structure, the localised distribution and abundance of small ground-dwelling mammals is likely to be influenced by the prevalence of introduced predators. Both cats and dogs are likely to be abundant in the landscape, given the frequency that these animals were observed during field studies.

Plate 4-23 Common wallaroo (left); roost of eastern cave bats (right)

Arboreal mammals

One species of microchiropteran bat was observed during field surveys – the eastern cave bat (*Vespadelus troughtoni*). A large roost of this species was observed within a disused donga during active searches within semi-evergreen vine thicket near Abbot Point (Plate 4-23). No flying-fox species were recorded during field surveys. Twelve microchiropteran bat species were recorded from echolocation call analysis of anabat data from field surveys. These bats comprised a range of common woodland and open country species, including two species from the family Emballonuridae (sheath-tail bats), four species from the family Molossidae (freetail bats) and 11 species of the family Vespertilionidae (evening bats). One NC Act listed bat was recorded – the 'near threatened' little pied bat (*Chalinolobus picatus*) was positively identified in fringing riparian vegetation, natural and artificial waterbodies and acacia dominated woodland/shrubland. The little pied bat is discussed in more detail in Section 4.3.3.

Habitat for arboreal mammals is widespread. Much of the landscape supports eucalypt woodlands which provide forage and shelter resources for possums, gliders and koalas. Fringing riparian vegetation along the larger water courses (Elliot River, Bogie River, Sandy Creek, Bowen River, Suttor River) featured large, mature eucalypts that provided good habitat for arboreal mammals, particularly in times of drought. Tree hollows, defoliating bark and man-made structures (buildings, bridges) all provided roosting habitat for microchiropteran bats. These features occurred in a range of habitat types, including eucalypt woodlands, fringing riparian vegetation, acacia dominated woodland/shrubland and semi-evergreen vine thickets. For the cave-roosting bat species recorded during the field surveys, potential rocky habitat (associated with escarpments and mountains) occurs in the landscape between Pelican Creek and the Bruce Highway, and from the Bowen River to the Suttor River. Foraging habitat for bat species was also present at perennial and ephemeral watercourses. As watercourses are distributed throughout the wider landscape, it is likely that a number of microchiropteran bat species will occur in the preliminary investigation corridor.

Mammals recorded from desktop database searches are likely to use habitats identified in the preliminary investigation corridor. Desktop database species lists containing these species are located in Appendix G.

Birds

A total of 180 bird species from 68 families were recorded from habitats within and near the preliminary investigation corridor during field surveys. One introduced bird species, the rock dove (*Columba livia*), was observed during field surveys. A number of EPBC and/or NC Act birds were detected during field surveys, including the:

- Squatter pigeon (southern) (*Geophaps scripta scripta*)
- Black-necked stork (*Ephippiorhynchus asiaticus*)
- Cotton pygmy-goose (*Nettapus coromandelianus*)
- Freckled duck (*Stictonetta naevosa*)
- Seven birds listed as 'migratory' under the EPBC Act and 'special least concern' under the NC Act
- Thirty-six birds listed as 'marine' under the EPBC Act

Further details on the specific observations and habitat requirements of these listed species are provided in Section 4.3.3.

The avian fauna observed in the study area generally comprised a mix of common and widespread woodland, grassland, wetland and water birds. Honeyeaters (family Meliphagidae) were the most diverse assemblage, with 18 species recorded. Other families included:

- Birds of prey (families Accipitridae and Falconidae) – 13 species
- Ducks, swans, geese, teals (family Anatidae) – 10 species
- Butcherbirds, magpie, woodswallows (Plate 4-24) (family Artamidae) – 10 species
- Gerygones, thornbills, scrubwrens (family Acanthizidae) – 10 species
- Parrots (families Cacatuidae and Psittacidae) – nine species

Bird densities were dominated by species that travel in large flocks and that have broad habitat preferences. Budgerigars (*Melopsittacus undulatus*) (Plate 4-24) were the most frequent bird observed, often being recorded in flocks of greater than 10 individuals within a range of habitat types. Other species recorded at high densities include the diamond dove (*Geopelia cuneata*), galah (*Eolophus roseicapillus*), pale-headed rosella (*Platycercus adscitus*), red-winged parrot (*Aprosmictus erythropterus*) and zebra finch (*Taeniopygia guttata*). Duck species at farm dams and waterbodies including the plumed whistling duck (*Dendrocygna eytoni*), Pacific black duck (*Anas superciliosa*) and the freckled duck (*Stictonetta naevosa*).

Plate 4-24 Black-faced woodswallow and a flock of budgerigars (left); emus (right)

In general, eucalypt woodland habitats were characterised by a sparse or absent shrub layer. The lack of structural complexity in this habitat type, possibly related to a combination of land management and cattle grazing, is likely to reduce its overall bird species diversity, in that those species that forage and/or nest in shrub-layer vegetation are less likely to occur. The characteristic species of this habitat type are common, widespread woodland birds that forage (and nest) in the canopy or on the ground such as weebill (*Smicrornis brevirostris*), pied butcherbird (*Cracticus nigrogularis*), Australian magpie (*Gymnorhina tibicen*), striated pardalote (*Pardalotus striatus*), blue-faced honeyeater (*Entomyzon cyanotis*), pale-headed rosella (*Platycerus adscitus*) and red-winged parrot (*Aprosmictus erythropterus*).

Fringing riparian vegetation generally had a greater structural and floristic complexity, and so supported a broad array of bird species, including a number of bird species not recorded in other habitat types. In addition to the common eucalypt woodland species described above, birds that were recorded predominantly or exclusively from riparian habitats included Pacific baza (*Aviceda subcristata*), fantail cuckoo (*Cacomantis flabelliformis*), shining bronze cuckoo

(*Chrysococcyx lucidus*), varied sittella (*Daphoenositta chrysoptera*) and broad-billed flycatcher (*Myiagra ruficollis*).

In addition to the different shrub and tree species present (as compared with adjacent floodplain habitats), the denser foliage cover and vertical structural complexity in these fringing riparian vegetation habitats combined to promote a different and more diverseavian community. While weedy undergrowth often occurred in riparian habitats in the preliminary investigation corridor, it provided habitat for more cryptic bird species. The presence of water (typically ephemeral, although pools last through much of the year) further contributed to the value of fringing woodland/forest habitats for birds by providing a drinking resource and a potential foraging resource (e.g. fish, tadpoles and insects).

Acacia woodlands/shrubland habitats varied between open, structurally simple habitats, to more densely wooded habitats featuring greater structural complexity (shrub layer, sub-canopy and emergent eucalypts). The characteristic bird species of eucalypt woodlands were also associated with acacia habitats. Other bird species recorded from these habitat types included yellow-rumped thornbill (*Acanthiza chrysorrhoa*), white-browed scrubwren (*Sericornis frontalis*), white-naped honeyeater (*Melithreptus lunatus*), striped honeyeater (*Plectorhyncha lanceolata*), spotted bowerbird (*Ptilonorhynchus maculatus*) and rufous fantail (*Rhipidura rufifrons*).

The eastern fringe of the Caley Valley Wetland provided habitat for large and diverse bird community (Plate 4-25). The wetland areas comprised both open and closed brackish palustrine habitats dominated by open water and stands of marsh vegetation, respectively. The open water and stands of vegetation provided high value habitat (including breeding habitat) for a variety of waterbirds. These habitats were dominated by the Threskiornithidae family (particularly royal spoonbill (*Platalea regia*) (in breeding plumage) and glossy ibis (*Plegadis falcinellus*)) and the Anatidae family (particularly Pacific black ducks (*Anas superciliosa*), whistling ducks (*Dendrocygna* spp.) and grey teal (*Anas gracilis*)).

Plate 4-25 Australian pelican (*Pelecanus conspicillatus*) and black swan (*Cygnus atratus*) with cygnets (left); large and diverse waterbird community (right)

Surveys of the Caley Valley Wetland and adjacent coastal areas through February and March 2012 (BAAM 2012) identified 60 species of waterbird (including records from desktop searches), numbering up to an estimated 24,000 individuals. This study added several other generally abundant bird species, but also a number of more notable species. These were: 12 EPBC Act listed migratory shorebird species (mostly notably Australian painted snipe (*Rostratula australis*), listed as ‘endangered’ under the EPBC Act and vulnerable’ under the NC Act), seven other EPBC Act migratory bird species (including the State-listed little tern (*Sternula albifrons*)) and three other State-listed bird species (black-necked stork (*Ephippiorhynchus asiaticus*),

radjah shelduck (*Tadorna radjah*) and Lewin's rail (*Lewinia pectoralis*)) (BAMM 2012). Field surveys at the edge of the Caley Valley Wetland within the preliminary investigation corridor identified 59 bird species including six migratory species listed under the EPBC Act and the NC Act listed (near threatened) black-necked stork (*Ephippiorhynchus asiaticus*).

Non-remnant cleared land supported more diverse bird communities due to the presence of flocking birds (budgerigars (*Melopsittacus undulates*), white-browed woodswallow (*Artamus superciliosus*), apostlebirds (*Struthidea cinerea*), brolgas (*Grus rubicunda*) etc.) often being recorded in this habitat type. Several smaller birds were found to preferentially occur in these habitats. Such species included the golden-headed cisticola (*Cisticola exilis*), Australasian pipit (*Anthus novaeseelandiae*), restless flycatcher (*Myiagra inquieta*) and little grassbird (*Megalurus gramineus*). Non-remnant cleared land habitats provided foraging habitat for birds of prey such as the Australian kestrel (*Falco cenchroides*), wedge-tailed eagle (*Aquila audax*), black kite (*Milvus migrans*) and brown falcon (*Falco berigora*). Natural and artificial waterbody habitats, often either within eucalypt woodlands or non-remnant cleared areas, also provided habitat for common water birds including a range of duck species, herons and egrets. Bird diversity in other habitat types was generally lower than those habitats discussed above. Semi-evergreen vine thicket and grassland habitats supported the fewest species.

4.3.2 Survey effort

Results obtained during this field program revealed an assortment of cryptic and infrequently recorded species (most notably, a number of ground-dwelling reptiles). Table 4-10 summarises the fauna survey methodology and results from a number of recent EIS studies in the region, as well as a summary of effort and results for the NGBR Project.

Table 4-10 Comparison of fauna survey results – the NGBR Project and other recent studies*

	The NGBR Project	Alpha Coal Rail	Galilee Coal Rail	Multi-cargo Facility (Abbot Point)	Surat Basin Rail
Survey methodology	50 habitat assessments Additional sites for diurnal searches, dam watches and nocturnal surveys	16 trap sites 43 habitat assessments	No trap sites 57 habitat assessments	6 trap sites Additional habitat assessment (number of sites not stated)	5 trap sites 32 habitat assessments
Species recorded					
Amphibians	9	13	Unknown	7	21
Reptiles	23	36	Unknown	26	37
Mammals	40	41	Unknown	25	23
Birds	180	131	Unknown	152	90
Total	252	221	133	210	171

* Note that these recent studies encompass seasonal surveys from October 2008 through to August 2012 (Table 2-1).

The results presented in Table 4-10 indicate that the number of species detected through the survey techniques were comparable to or greater than those of equivalent projects in the region. The integrated suite of fauna detection methods used in the May/June 2013 surveys yielded the highest number of bird species. In relation to trapping, the surveys yielded broadly comparable numbers of mammal, reptile and amphibian species.

4.3.3 Threatened terrestrial fauna species likelihood of occurence

A combined total of 33 threatened fauna species (listed under the EPBC Act or NC Act) are previously recorded or predicted to occur within the preliminary investigation corridor. This includes 6 mammals, 10 reptiles and 17 birds. Seven birds protected under the JAMBA, CAMBA and/or Bonn conventions, listed as 'migratory' under the EPBC Act and 'special least concern' under the NC Act were confirmed from field surveys (Appendix C). Thirty-six birds listed as 'marine' under the EPBC Act were also observed. Platypus (*Ornithorhynchus anatinus*) ('special least concern' wildlife under section 34(3) of the Queensland Nature Conservation (Wildlife) Regulation 2006) may also occur in the preliminary investigation corridor. A likelihood of occurrence assessment for threatened terrestrial fauna species (refer to Table 4-11) was undertaken in accordance with the methodology outlined in Section 2.6.

Eleven listed threatened fauna species were considered likely to occur in habitats within and near the preliminary investigation corridor, based on distribution, previous records and habitat suitability from the likelihood of occurrence assessment (Table 4-11). Predictive habitat mapping for these species, based on the methodology outlined in Section 2.7, is presented in Appendix F. Observations from field surveys, in combination with desktop information on these 11 species, indicated that eucalypt woodland, acacia dominated woodland and shrubland and fringing riparian vegetation may provide habitat for the black-chinned honeyeater (*Melithreptus gularis*), square-tailed kite (*Lophoictinia isura*), common death adder (*Acanthophis antarcticus*) and little pied bat (*Chalinolobus picatus*). Eucalypt woodlands and fringing riparian vegetation were considered likely to provide habitat for the koala; these habitats were present throughout the preliminary investigation corridor. Potential habitat for the black-throated finch (southern) was observed in and near the northern and central sections of the preliminary investigation corridor. Suitable habitat was within fringing riparian vegetation and eucalypt woodlands featuring an understorey of suitable native grasses, where water is locally available. Coastal wetlands within and near the preliminary investigation corridor (especially the Caley Valley Wetland) is likely to provide habitat for the Australian painted snipe, little tern and eastern curlew.

The estuarine crocodile is likely to occur within the preliminary investigation corridor where large permanent pools of water are present within the major rivers of the Burdekin Basin. This species may also occur within deeper tidal creeks associated with the Caley Valley Wetland. The ornamental snake is a cryptic species with relatively specific habitat associations with brigalow woodlands, riparian areas and, in particular, gilgais. Therefore the distribution of potential habitat for ornamental snake is likely to be patchy within the preliminary investigation corridor. The brigalow scaly foot occurs in a range of remnant to non-remnant open forest to woodland areas generally coinciding with land zones 3, 4, 5, 7, 8, 9 and 10 (SEWPaC 2013b). Potentially suitable habitat for this species can be associated with eucalypt woodland and acacia dominated woodland/shrubland. These habitats occur within and near the preliminary investigation corridor, particularly south of Collinsville.

Threatened marine and migratory species (listed under the EPBC Act) are addressed in Volume 1 Chapter 7 Matters of National Environmental Significance.

Table 4-11 Threatened terrestrial fauna species – likelihood of occurrence

Species	EPBC Act/ NC Act status	Prediction of occurrence and previous records*	Habitat preferences and known distributions	Likelihood of occurrence
Birds – confirmed present				
Squatter pigeon ***Geophaps scripta scripta***	Vulnerable/ vulnerable	Predicted to occur by PMST# - yes Previously recorded* - WO Recorded from field surveys^ - yes	This species is classified as a Matter of National Environmental Significance (MNES). Please refer to Volume 1 Chapter 7 Matters of National Environmental Significance for description.	**Confirmed present** Historically recorded in the desktop search extent. Suitable habitat occurs in parts of preliminary investigation corridor. This species was recorded during surveys for the Alpha Coal Project (Rail) EIS (Hancock Prospecting Pty Ltd 2010) and the Water for Bowen EIS (SunWater 2009). *Squatter pigeons (southern) were observed on four separate occasions during field studies.*
Black-necked stork ***Ephippiorhynchus asiaticus***	Not listed/ near threatened	Predicted to occur by PMST# - no Previously recorded* - WO, BA Recorded from field surveys^ - yes	The black necked-stork occurs throughout eastern and central Queensland, and across much of northern Australia. It favours habitats featuring wetlands, swamps and riverine areas (Marchant & Higgins 1990). It occasionally occurs in woodland and grassland habitats. (Marchant & Higgins 1990). Nesting usually occurs at the top of tall trees (Marchant & Higgins 1990).	**Confirmed present** Historically recorded in the desktop search extent. Potentially suitable habitat occurs at the Caley Valley Wetland, larger water courses and dams in the natural and artificial waterbodies habitat type within the preliminary investigation corridor. This species was detected at the Caley Valley Wetland during surveys undertaken by BAAM (2012). This species was also recorded during surveys for the Water for Bowen EIS (SunWater 2009). *This species was observed in the coastal wetland habitat type at the Caley Valley Wetland.*

Species	EPBC Act/ NC Act status	Prediction of occurrence and previous records*	Habitat preferences and known distributions	Likelihood of occurrence
Cotton pygmy-goose ***Nettapus coromandelianus***	Not listed/ near threatened	Predicted to occur by PMST# - no Previously recorded* - WO, BA Recorded from field surveys^ - no	The cotton pygmy-goose occurs in eastern and central Queensland. It is an almost entirely aquatic species, with a preference for deep, permanent fresh waterbodies (Marchant & Higgins 1990). Habitats featuring floating and submerged vegetation interspersed with open water are favoured (Marchant & Higgins 1990).	**Confirmed present** Historically recorded in the desktop search extent. Potentially suitable habitat is located within natural and artificial waterbodies and coastal wetland habitats within and near the preliminary investigation corridor. *This species was observed at one large dam within the preliminary investigation corridor.*
Freckled duck ***Stictonetta naevosa***	Not listed/ near threatened	Predicted to occur by PMST# - no Previously recorded* - WO, BA Recorded from field surveys^ - yes	This species inhabits larger fresh waterbodies including lakes and vegetated swamps (Pizzey & Knight 2010). The freckled duck is a rare visitor to northern Queensland.	**Confirmed present** Historically recorded in the desktop search extent. Potentially suitable habitat occurs in and near large freshwater bodies. This species generally occurs in southern Australia and is a vagrant visitor to northern Queensland. *This species was observed from two farm dam locations within natural and artificial waterbody habitat within or adjacent to the preliminary investigation corridor.*
Birds – like to occur				
Australian painted snipe ***Rostratula australis***	Endangered, migratory, marine/ vulnerable	Predicted to occur by PMST# - yes Previously recorded* - no Recorded from field surveys^ - no	This species is classified as a MNES. Please refer to Volume 1 Chapter 7 Matters of National Environmental Significance for description.	**Likely to occur** Not recorded in the desktop search extent. Potentially suitable habitat occurs near and possibly within preliminary investigation corridor, associated with vegetated margins of the Caley Valley Wetland. This species was detected at Caley Valley Wetland during surveys undertaken by BAAM (2012).

Species	EPBC Act/ NC Act status	Prediction of occurrence and previous records*	Habitat preferences and known distributions	Likelihood of occurrence
Black-chinned honeyeater ***Melithreptus gularis***	Not listed/ near threatened	Predicted to occur by PMST# - no Previously recorded* - WO, BA Recorded from field surveys^ - no	The black-chinned honeyeater occurs through much of eastern, northern and central Australia. It inhabits eucalypt woodlands and open forests, especially where box and ironbark species are present (Higgins *et al* 2001). In arid and semi-arid areas the black-chinned honeyeater is often associated with riparian and littoral areas (Higgins *et al* 2001).	**Likely to occur** Historically recorded in the desktop search extent. Potentially suitable habitat occurs in areas of remnant vegetation, particularly in eucalypt woodland and fringing riparian vegetation habitats.
Black-throated finch ***Poephila cincta cincta***	Endangered/ endangered	Predicted to occur by PMST# - yes Previously recorded* - BA Recorded from field surveys^ - no	This species is classified as a MNES. Please refer to Volume 1 Chapter 7 Matters of National Environmental Significance for description.	**Likely to occur** Historically recorded in the desktop search extent. Suitable habitat occurs in open woodland habitat featuring an understorey of native grasses, where water is locally available. This species was recorded at Splitter's Creek (northern part of preliminary investigation corridor) during surveys for the Water for Bowen EIS (SunWater 2009). Another record (Birds Australia database, dated April 2012) is located on the Bowen Developmental Road near the intersection of the Cerito-Elphinstone Road near the Leichardt Range near the centre of the preliminary investigation corridor.
Eastern curlew ***Numenius madagascariensis***	Migratory/ near threatened	Predicted to occur by PMST# - yes Previously recorded* - WO, BA Recorded from field surveys^ - no	This species is classified as a MNES. Please refer to Volume 1 Chapter 7 Matters of National Environmental Significance for description.	**Likely to occur** Historically recorded in the desktop search extent. Potentially suitable habitat occurs within and near preliminary investigation corridor at the Caley Valley Wetland.

Species	EPBC Act/ NC Act status	Prediction of occurrence and previous records*	Habitat preferences and known distributions	Likelihood of occurrence
Little tern ***Sternula albifrons***	Marine Migratory/ endangered	Predicted to occur by PMST# - yes Previously recorded* - WO, BA Recorded from field surveys^ - no	This species is classified as a MNES. Please refer to Volume 1 Chapter 7 Matters of National Environmental Significance for description.	**Likely to occur** Historically recorded in the desktop search extent. Potentially suitable habitat occurs within and near preliminary investigation corridor at the Caley Valley Wetland. This species was detected at the Caley Valley Wetland during surveys undertaken for the Abbot Point Multi Cargo Facility EIS (NQBP 2009).
Square-tailed kite ***Lophoictinia isura***	not listed/ near threatened	Predicted to occur by PMST# - no Previously recorded* - WO Recorded from field surveys^ - no	This species is patchily distributed through much of coastal Australia, extending inland through central Queensland (Marchant & Higgins 1993). In inland areas the square-tailed kite generally occurs along timbered watercourses. This species occasionally forages in open habitats, but is more generally restricted to woodland and forest habitats supporting high numbers of passerines (a key food source) (Marchant & Higgins 1993).	**Likely to occur** Historically recorded in the desktop search extent. Potentially suitable habitat occurs in areas featuring remnant vegetation – especially in eucalypt woodlands and fringing riparian vegetation.
Birds – may occur				
Painted honeyeater ***Grantiella picta***	Not listed/ vulnerable	Predicted to occur by PMST# - no Previously recorded* - WO Recorded from field surveys^ - no	The painted honeyeater occurs in Queensland and New South Wales west of the Great Dividing Range. It is rare throughout its range. It favours habitat containing mistletoes within box woodlands and forests along watercourses, and box, ironbark and yellow gum woodlands (Pizzey & Knight 2010).	**May occur** Historically recorded in the desktop search extent. Distribution for this species generally does not encompass the preliminary investigation corridor. Potentially suitable habitat may occur within the southern extent of the preliminary investigation corridor within large tracts of eucalypt woodlands containing mistletoes

Species	EPBC Act/ NC Act status	Prediction of occurrence and previous records*	Habitat preferences and known distributions	Likelihood of occurrence
Red goshawk ***Erythrotriorchis radiatus***	Vulnerable/ endangered	Predicted to occur by PMST# - yes Previously recorded* - no Recorded from field surveys^ - no	This species is classified as a MNES. Please refer to Volume 1 Chapter 7 Matters of National Environmental Significance for description.	**May occur** Not recorded in the desktop search extent. The preliminary investigation corridor is within the species known distribution. Potentially suitable habitat occurs in preliminary investigation corridor, particularly where tall riparian vegetation occurs along larger watercourses (possible nesting habitat).
Birds – unlikely to occur				
Beach stone-curlew ***Esacus magnirostris***	Marine/ vulnerable	Predicted to occur by PMST# - no Previously recorded* - WO, BA Recorded from field surveys^ - no	Open, undisturbed beaches, islands, reefs, estuarine intertidal sand and mudflats. The beach stone-curlew is a coastal species occurring from Exmouth Gulf in Western Australia to Nambucca Heads, New South Wales (Pizzey & Knight 2010). Habitat for this species includes open, undisturbed beaches, islands, reefs, estuarine intertidal sand and mudflats. This species has also been known to frequent river mouths, sandbars and coastal lagoons.	**Unlikely to occur** Historically recorded in the desktop search extent. Potentially suitable habitat does not occur within the preliminary investigation corridor; habitat does occur to the north of the corridor at beaches near Abbot Point. This species was detected at beaches near Abbot Point during surveys undertaken by BAAM (2012).

Species	EPBC Act/ NC Act status	Prediction of occurrence and previous records*	Habitat preferences and known distributions	Likelihood of occurrence
Pictorella manikin ***Heteromunia pectoralis***	Not listed/ near threatened	Predicted to occur by PMST# - no Previously recorded* - BA Recorded from field surveys^ - no	The historical distribution of the pictorella manikin is from Derby in Western Australia, across northern Australia and north Queensland to the upper Burdekin River basin. However, there are no recent records from north-east Queensland. Pictorella mannikins are found near water in acacia shrublands that have a grassy understorey, and in spinifex hummock grassland, where they feed on seeds on the ground, as well as insects (Pizzey & Knight 2010).	**Unlikely to occur** Historically recorded in the desktop search extent. Distribution for this species generally does not encompass the preliminary investigation corridor.
Sooty oystercatcher ***Haematopus fuliginosus***	Not listed/ near threatened	Predicted to occur by PMST# - no Previously recorded* - WO Recorded from field surveys^ - no	The sooty oystercatcher is found around the entire Australian coastline as well as islands off mainland Australia and Tasmania (Pizzey & Knight 2010). Habitat for this species includes intertidal rocky and coral reefs, sand spits and tidal mudflats (Pizzey & Knight 2010).	**Unlikely to occur** Historically recorded in the desktop search extent. Potentially suitable habitat does not occur within the preliminary investigation corridor, but does occur to the north of the corridor at beaches near Abbot Point.
Star finch (eastern sub species) ***Neochima ruficauda ruficauda***	Endangered/ endangered	Predicted to occur by PMST# - yes Previously recorded* - no Recorded from field surveys^ - no	This species is classified as a MNES. Please refer to Volume 1 Chapter 7 Matters of National Environmental Significance for description.	**Unlikely to occur** Not recorded in the desktop search extent. This subspecies has disappeared from much of its former eastern and central Queensland range, with a lack of recent records (Higgins *et al* 2006).

Species	EPBC Act/ NC Act status	Prediction of occurrence and previous records*	Habitat preferences and known distributions	Likelihood of occurrence
White-bellied storm petrel ***Fregetta grallaria grallaria***	Vulnerable/ not listed	Predicted to occur by PMST# - yes Previously recorded* - no Recorded from field surveys^ - no	This species is classified as a MNES. Please refer to Volume 1 Chapter 7 Matters of National Environmental Significance for description.	**Unlikely to occur** Not recorded in the desktop search extent. Species distribution does not include the preliminary investigation corridor.
Reptiles – likely to occur				
Brigalow scaly-foot ***Paradelma orientalis***	Not listed/ vulnerable	Predicted to occur by PMST# - yes Previously recorded* - WO Recorded from field surveys^ - no	The brigalow scaly-foot inhabits a variety of open forest habitats in central and south-east Queensland. Acacia and eucalypt woodlands are known habitat for this species. The species has been recorded from habitats featuring substrates including cracking clays and sandy alluvium (SEWPaC 2013b).	**Likely to occur** Historically recorded in the desktop search extent. Potentially suitable habitat associated with eucalypt woodland and acacia dominated woodland/shrubland occurs within and near the preliminary investigation corridor, particularly south of Collinsville.
Common death adder ***Acanthophis antarcticus***	Not listed/ near threatened	Predicted to occur by PMST# - no Previously recorded* - WO Recorded from field surveys^ - no	The common death adder occurs throughout central and eastern Queensland, the Northern Territory and New South Wales (DEHP 2013d). The species prefers habitat associated with a deep leaf litter layer, such as those found in forests, woodlands and grasslands (DEHP 2013d).	**Likely to occur** Historically recorded in the desktop search extent from the Bowen River adjacent to the preliminary investigation corridor. Potentially suitable habitat occurs in areas featuring dense remnant vegetation with leaf litter present. These features limit potential habitat within the preliminary investigation corridor to small areas within the northern half of the preliminary investigation corridor.

Species	EPBC Act/ NC Act status	Prediction of occurrence and previous records*	Habitat preferences and known distributions	Likelihood of occurrence
Estuarine crocodile ***Crocodylus porosus***	Migratory (Bonn); Marine/ vulnerable	Predicted to occur by PMST# - yes Previously recorded* - no Recorded from field surveys^ - no	The estuarine crocodile is classified as an aquatic reptile species within this report. Please refer to Section 4.3.4 for habitat preferences for this species.	**Likely to occur** (refer to Section 4.3.4)
Ornamental snake ***Denisonia maculata***	Vulnerable/ vulnerable	Predicted to occur by PMST# - yes Previously recorded* - WO, QM Recorded from field surveys^ - no	This species is classified as a MNES. Please refer to Volume 1 Chapter 7 Matters of National Environmental Significance for description.	**Likely to occur** Historically recorded in the desktop search extent. The preliminary investigation corridor is within the SEWPaC modelled 'known/likely to occur' and 'may occur' distribution for this species. Suitable habitat is likely to exist within the preliminary investigation corridor within vegetation approximately north and south of the Bowen River, and south of the Suttor Developmental Road.
Reptiles – may occur				
Dunmall's snake ***Furina dunmalli***	Vulnerable/ vulnerable	Predicted to occur by PMST# - yes Previously recorded* - no Recorded from field surveys^ - no	This species is classified as a MNES. Please refer to Volume 1 Chapter 7 Matters of National Environmental Significance for description.	**May occur** Not recorded in the desktop search extent. The very south of the preliminary investigation corridor abuts the northern distributional limit of the SEWPaC modelled 'may occur' distribution for this species. Limited potentially suitable habitat may occur around where the preliminary investigation corridor intersects the Gregory Developmental Road.

Species	EPBC Act/ NC Act status	Prediction of occurrence and previous records*	Habitat preferences and known distributions	Likelihood of occurrence
Retro slider ***Lerista allanae***	Endangered/ endangered	Predicted to occur by PMST# - yes Previously recorded* - no Recorded from field surveys^ - no	This species is classified as a MNES. Please refer to Volume 1 Chapter 7 Matters of National Environmental Significance for description.	**May occur** Not recorded in the desktop search extent. The very south of the preliminary investigation corridor abuts the northern distributional limit of the SEWPaC modelled 'may occur' distribution for this species. Limited potentially suitable habitat may occur south of the Suttor Developmental Road.
Striped-tailed delma ***Delma labialis***	Not listed/ vulnerable	Predicted to occur by PMST# - yes Previously recorded* - WO, QM Recorded from field surveys^ - no	The striped-tailed delma occurs from Paluma north of Townsville to Keswick Island near Mackay in central Queensland (SEWPaC 2013g). The distribution of this species is restricted to areas below 800 m altitude, typically within 150 km of the coast (SEWPaC 2013g). Modelled distribution mapping for this species indicates that it may occur within or near the preliminary investigation corridor north of the Bowen River (SEWPaC 2013g). Habitats from which the striped-tailed delma has been recorded include low and tall open woodland with grass understorey, wet sclerophyll forest, coastal vine forest, open rocky hillsides and seasonally dry paperbark swamps (SEWPaC 2013g).	**May occur** Previously recorded in the desktop search extent. The preliminary investigation corridor is within the SEWPaC modelled 'may occur' distribution for this species. Potentially suitable habitat associated with eucalypt woodlands (hilly terrain and on coastal plain) occurs within and near the preliminary investigation corridor, north of the Bowen River.

Species	EPBC Act/ NC Act status	Prediction of occurrence and previous records*	Habitat preferences and known distributions	Likelihood of occurrence
Yakka skink ***Egernia rugosa***	Vulnerable/ vulnerable	Predicted to occur by PMST# - yes Previously recorded* - no Recorded from field surveys^ - no	This species is classified as a MNES. Please refer to Volume 1 Chapter 7 Matters of National Environmental Significance for description.	**May occur** Not recorded in the desktop search extent. The preliminary investigation corridor is within the SEWPaC modelled 'may occur' distribution for this species. Suitable habitat may occur within the preliminary investigation corridor in rocky outcrop areas or where eucalypt woodland with suitable timber microhabitats are present.
Reptiles – may occur				
Lemon-barred forest skink ***Eulamprus amplus***	Not listed/ near threatened	Predicted to occur by PMST# - no Previously recorded* - QM Recorded from field surveys^ - no	The lemon-barred forest skink is an endemic species, confined to the central Queensland coast in the areas of Eungella National Park, Finch Hatton, Mount Blackwood and the Conway State Forest (Wilson 2005). Habitat preferences for this rainforest species include boulders beside streams, or among root structures of large trees, particularly figs (Wilson & Swan 2008).	**Unlikely to occur** Historically recorded in the desktop search extent. Potentially suitable habitat is unlikely to exist within the preliminary investigation corridor.
Mount Cooper striped Lerista ***Lerista vittata***	Vulnerable/ vulnerable	Predicted to occur by PMST# - yes Previously recorded* - no Recorded from field surveys^ - no	This species is classified as a MNES. Please refer to Volume 1 Chapter 7 Matters of National Environmental Significance for description.	**Unlikely to occur** Not recorded in the desktop search extent. Potentially suitable habitat is unlikely to exist within the preliminary investigation corridor.
Mammals – confirmed present				

Species	EPBC Act/ NC Act status	Prediction of occurrence and previous records*	Habitat preferences and known distributions	Likelihood of occurrence
Little pied bat ***Chalinolobus picatus***	Not listed/ near threatened	Predicted to occur by PMST# - no Previously recorded* - WO Recorded from field surveys^ - yes	The little pied bat is located through central Queensland and into north-west New South Wales (Thompson *et al* 2011). In central western Queensland, this species reaches its greatest relative abundance in riverine open forest communities (Churchill 2008). A variety of woodland and open forest habitats are utilised by this species (Churchill 2008). Roosting habitat includes tree hollows, caves and abandoned buildings and mines (Churchill 2008).	**Confirmed present** Historically recorded in the desktop search extent. This species was recorded during surveys for the Alpha Coal Project (Rail) EIS (Hancock Prospecting Pty Ltd 2010) and the Water for Bowen EIS (SunWater 2009). Potentially suitable habitat occurs in areas featuring remnant vegetation with tree hollows – particularly eucalypt woodlands, acacia dominated woodland/shrubland and fringing riparian vegetation. Foraging habitat is also present at natural and artificial waterbodies. *This species' echolocation calls were positively identified on anabat devices at five locations within the preliminary investigation corridor.*
Mammals – likely to occur				
Koala ***Phascolarctos cinereus***	Vulnerable/ special least concern	Predicted to occur by PMST# - yes Previously recorded* - WO, QM Recorded from field surveys^ - no	This species is classified as a MNES. Please refer to Volume 1 Chapter 7 Matters of National Environmental Significance for description.	**Likely to occur** Historically recorded in the desktop search extent. The preliminary investigation corridor is within the species known distribution. Suitable habitat occurs within the preliminary investigation corridor within eucalypt woodland and fringing riparian vegetation, based on species known habitat requirements and targeted field habitat assessments.
Mammals – may occur				

Species	EPBC Act/ NC Act status	Prediction of occurrence and previous records*	Habitat preferences and known distributions	Likelihood of occurrence
Coastal sheathtail bat ***Taphozous australis***	Not listed/ vulnerable	Predicted to occur by PMST# - no Previously recorded* - WO Recorded from field surveys^ - no	The coastal sheathtail bat roosts within coastal caves, rock fissures and mines along a thin coastal band in northeast Queensland from Shoalwater Bay to Cape York (DEHP 2013e). The species forages within 1 km of the ocean within sand dune scrub, mangroves, melaleuca swamp, coastal heath and open eucalypt forests (DEHP 2013e).	**May occur** Historically recorded in the desktop search extent. The northern part of the preliminary investigation corridor at the Caley Valley Wetland is within the species known distribution. Potentially suitable forage habitat is limited to the coastal semi-evergreen vine thicket habitat adjacent to the Caley Valley Wetland.
Northern quoll ***Dasyurus hallucatus***	Endangered /not listed	Predicted to occur by PMST# - yes Previously recorded* - no Recorded from field surveys^ - no	This species is classified as a MNES. Please refer to Volume 1 Chapter 7 Matters of National Environmental Significance for description.	**May occur** Not previously recorded in the desktop search extent. The preliminary investigation corridor is within the SEWPaC modelled 'may occur' distribution for this species. Suitable habitat may occur within the preliminary investigation corridor where areas of rocky eucalypt woodland are present.
Mammals – unlikely to occur				
Greater large-eared horseshoe bat ***Rhinolophus philippinensis***	Endangered/ endangered	Predicted to occur by PMST# - yes Previously recorded* - no Recorded from field surveys^ - no	This species is classified as a MNES. Please refer to Volume 1 Chapter 7 Matters of National Environmental Significance for description.	**Unlikely to occur** Not previously recorded in the desktop search extent. Potentially suitable habitat may occur within the preliminary investigation corridor in association with densely vegetated fringing riparian vegetation.

Species	EPBC Act/ NC Act status	Prediction of occurrence and previous records*	Habitat preferences and known distributions	Likelihood of occurrence
Water mouse ***Xermomys myoides***	Vulnerable/ vulnerable	Predicted to occur by PMST# - yes Previously recorded* - no Recorded from field surveys^ - no	This species is classified as a MNES. Please refer to Volume 1 Chapter 7 Matters of National Environmental Significance for description.	**Unlikely to occur** Not previously recorded in the desktop search extent. Potentially suitable habitat is lacking for this species within the preliminary investigation corridor. Tidal areas with mangrove vegetation around Caley Valley Wetland may provide habitat north of the preliminary investigation corridor.

Predicted to occur within approximately a 10 km area around the Study Area: SEWPAC Protected Matters Search Tool
* Previously recorded within desktop search extent from sources including Wildlife Online (WO), HERBRECS, Queensland Museum (QM), Birds Australia (BA) and essential habitat mapping (EH). Note that these desktop results are based on historical records (of either a known or unknown date). Dated specimen collections range in age from 1974 through to 2005, and encompass a range of seasons.
^ Recorded during field surveys of the preliminary investigation corridor undertaken May/June 2013

Five threatened terrestrial fauna species (EPBC Act and NC Act listed) were confirmed present during field surveys within and near the preliminary investigation corridor (Table 4-11):

- Squatter pigeon (southern) (*Geophaps scripta scripta*) – 'vulnerable' (EPBC Act); 'vulnerable' (NC Act)
- Black-necked stork (*Ephippiorhynchus asiaticus*) – 'near threatened' (NC Act)
- Cotton pygmy-goose (*Nettapus coromandelianus*) – 'near threatened' (NC Act)
- Freckled duck (*Stictonetta naevosa*) – 'near threatened' (NC Act)
- Little pied bat (*Chalinolobus pictatus*) – 'near threatened' (NC Act) – this species' echolocation call was positively identified on anabat devices at five locations within the preliminary investigation corridor during field surveys. Potential calls for this species (not reliably identified from anabat data) were also recorded at a further three locations.

Squatter pigeon (southern)

A total of eight individual squatter pigeons were recorded during field surveys at four locations within the preliminary investigation corridor (refer to Figure 4-1). All records of this species from field surveys were from the Suttor River flood plain in the southern half of the preliminary investigation corridor. Squatter pigeons were typically encountered from eucalypt woodland with a grassy understorey, and non-remnant cleared land habitat types. Squatter pigeons were recorded in pairs at each location.

Details of the squatter pigeon (southern) field survey records are presented in Appendix C. Potential habitat for this species occurs throughout the preliminary investigation corridor. Squatter pigeons are associated with eucalypt woodland, fringing riparian vegetation and non-remnant cleared lands/regrowth areas (occurring on land zones 3, 4, 5, 7 and 10) close to water (within 3 km (SEWPaC 2013a)). Predictive habitat mapping for this species is presented in Appendix F.

Black-necked stork

An individual black-necked stork was observed during the field survey within the Caley Valley Wetland at the northern end of the preliminary investigation corridor. Historical and recent records of black necked stork across the Caley Valley Wetland are frequent, with numbers of 10 or more adult and immature birds recorded during BAAM (2012) surveys across a variety of wetland habitats in the area. No breeding sites have been located in the area.

This species is also likely to occur in larger water courses and dams in the natural and artificial waterbodies habitat type within and near the preliminary investigation corridor. Potential habitat for this species occurs throughout the preliminary investigation corridor. Details of the black-necked stork field survey record are depicted on Figure 4-1 and are presented in Appendix C. Predictive habitat mapping for the black-necked stork is presented in Appendix F.

Cotton pygmy goose

The cotton pygmy-goose was recorded from one location during field surveys. Six individuals of this species were observed at one large dam/waterbody located on the Suttor River flood plain within the preliminary investigation corridor. No recent population size data is available for this species. The Burdekin River Basin is considered a major centre for cotton pygmy goose populations. Potentially suitable habitat for this species is patchily distributed throughout the preliminary corridor within natural and artificial waterbodies and coastal wetland habitat types.

The cotton pygmy-goose field survey records are depicted on Figure 4-1 and are also presented in Appendix C. Predictive habitat mapping for the cotton pygmy-goose is presented in Appendix F.

Freckled duck

The freckled duck was recorded at farm dam locations within or near the preliminary investigation corridor on two separate occasions. A total of 60 individuals (15 and 45 individuals respectively) were observed from two farm dam locations within the natural and artificial waterbodies habitat type in the southern half of the preliminary investigation corridor. This species generally occurs in southern Australia and is a vagrant visitor to northern Queensland. The species typically breeds in large temporary floodwater filled swamps in the Bulloo and Lake Eyre Basins and the Murray Darling Basin. It is known to disperse during times of inland drought (Marchant & Higgins 1990). As a result, habitats within and near the preliminary investigation corridor are unlikely to support large breeding populations of this species. The freckled duck field survey records are depicted on Figure 4-1 and are presented in Appendix C. Predictive habitat mapping for the freckled duck is presented in Appendix F.

Little pied bat

The little pied bat was positively identified in fringing riparian vegetation (two locations), natural and artificial waterbodies (two locations) and acacia dominated woodland/shrubland (one location). Potential calls for this species (identified as probably this species, but not able to be reliably identified from anabat data) were also recorded within fringing riparian vegetation and natural and artificial waterbodies. Recorded calls of the little pied bat were not limited to one specific habitat type or area within the preliminary investigation corridor (Figure 4-1). This indicates that the species is likely to be present through much of the landscape in which the preliminary investigation corridor occurs. The microbat call identification report is contained within Appendix C. Predictive habitat mapping for the little pied bat is presented in Appendix F.

4.3.4 Aquatic fauna

A total of 55 fish species are expected to occur within the Burdekin and Don River Basins, based on known presence and distributions described in Pusey *et al* (2004) and Carter and Tait (2008). The full fish species list is presented in Appendix E, which also includes a summary of the biology and habitat requirements of each species. The fish community within the study area is likely to consist of a diverse range of species, given the broad range (i.e. lacustrine, palustrine, riverine and estuarine) of habitats. Each of these species has different movement requirements for breeding or non-breeding purposes. The movement biology of these potentially occurring species can be categorised as being:

- **Sedentary:** species that do not actively or directionally migrate – can fulfil their entire life cycle within a single wetland, pool or river reach
- **Potamodromous:** species which undertake breeding or dispersal migrations wholly within freshwater.
- **Catadromous:** species that may spend much of their lives in freshwater before migrating as adults to the sea or brackish/estuarine areas to spawn.
- **Amphidromous:** species that migrate between freshwater and the sea at some stage in their life cycle but not for the purposes of reproduction.

- **Marine vagrant/facultative freshwater:** marine or estuarine breeding species that are not dependent on access to freshwater though may spend limited to substantial time in freshwater, usually lower reaches (Carter & Tait 2008).

Consequently, the movement biology of fish can determine the extent of their distribution within a catchment. A marine vagrant is unlikely to occur in fresh headwater streams; alternatively, an amphidromous species is unlikely to occur upstream of barriers to their dispersal. For the Burdekin River Basin, most (if not all) diadromous species are thought to be restricted to the lower Burdekin River catchment as a result of both natural and artificial barriers to fish passage (Pusey *et al* 1998; Cater & Tait 2008).

The only threatened fish species known to occur in the Burdekin and Don River Basins are the freshwater sawfish (*Pristis microdon*) and the green sawfish (*Pristis zijsron*), which are both listed as 'vulnerable' under the EPBC Act. There are historical records of the freshwater sawfish (*Pristis microdon*) in the Burdekin River Basin (Inglis & Howell 2009a; Inglis & Howell 2009b). While freshwater sawfish (*Pristis microdon*) are known to inhabit upstream waterways (sometimes penetrating some 400 km inland), this species is not likely to occur due to the artificial barriers (dams and weirs) that prevent dispersal for freshwater sawfish. Likewise, the green sawfish (*Pristis zijsron*) is unlikely to occur upstream of barriers. The freshwater sawfish (*Pristis microdon*) is also listed a 'priority' conservation species in the *Burdekin Natural Resource Management Region Back on Track Actions for Biodiversity* (medium rank for the North Queensland Dry Tropics region, and high rank for DERM). There are an additional 11 fish species of AquaBAMM conservation 'priority' (Table 4-12) (Inglis & Howell 2009a; Inglis & Howell 2009b).

A number of fish species were observed within the study area (see Table 4-12 and Plate 4-26). Targeted fish surveys were not conducted during field surveys, and so the following list should not be considered as a true representation of the potential fish community within the preliminary investigation corridor. The following fish were observed:

- Sooty grunter (*Hephaestus fuliginosus*)
- Spangled perch (*Leiopotherapon unicolor*) (Plate 4-26)
- Eastern rainbowfish (*Melanotaenia splendida splendida*) (Plate 4-26)
- Flyspecked hardyhead (*Craterocephalus stercusmuscarum*)
- Sailfin glassfish (*Ambassis agrammus*)
- Barramundi (*Lates calcarifer*)
- Seven-spot archerfish (*Toxotes chatareus*)
- Pacific blue-eye (*Psuedomugil signifer*)
- Unidentified gudgeons (*Hypseleotris spp.*)
- Unidentified gudgeons (unknown genera)
- Unidentified gobies (unknown genera).

A comprehensive list of the potential and confirmed fish community of the Burdekin and Don River Basin is provided in Appendix E.

Plate 4-26 Eastern rainbowfish (*Melanotaenia splendida splendida*) sheltering in a small refugial pool (left); spangled perch (*Leiopotherapon unicolor*) at Tabletop Creek (right)

The Burdekin and Don River Basins are known habitat for up to five freshwater turtle species (Cann's long-necked turtle (*Chelodina canni*); eastern snake-necked turtle (*Chelodina longicollis*); Irwin's turtle (*Elseya irwini*); Krefft's river turtle (*Emydura macquarii krefftii*); saw-shelled turtle (*Wollumbinia latisternum*)) and one crocodile species (*Crocodylus porosus*) (Inglis & Howell 2009a; Inglis & Howell 2009b). Of the six potentially occurring aquatic reptile species, only Krefft's river turtle (*Emydura macquarii krefftii*) was observed in the preliminary investigation corridor (Plate 4-27). In previous field surveys, freshwater turtles were not observed within the Burdekin River catchment; however, the Bogie River was identified as potential habitat for Irwin's turtle (*Elseya irwini*) (GHD 2012). Additionally, the gilgais were considered to provide habitat suitable for Cann's long-necked turtle (*Chelodina canni*).

These five turtle species inhabit a diverse range of habitats, from ephemeral or refugial waterholes through to structurally complex riverine environments. While none of the turtle species are listed as threatened under the NC Act or EPBC Act, Irwin's turtle (*Elseya irwini*) is a 'priority' species in the Burdekin region *Back on Track Actions for Biodiversity* (North Queensland Dry Tropics rank 'high' and DERM rank 'high'). Irwin's turtle (*Elseya irwini*) is considered to be a generalist species that can be found in most freshwater habitats, including riverine, lacustrine and palustrine environments (Wilson 2005). However, it is thought to prefer sandy creeks and rivers with structure provided by macrophytes and woody debris (Cann 1998; Cann 2008). Suitable habitat for this species exists in a number of riverine habitats that are crossed by the preliminary investigation corridor, and so this species is considered as being likely to occur in the preliminary investigation corridor.

The habitat preferences for the Chelonid turtles (Cann's long-necked turtle (*Chelodina canni*) and eastern snake-necked turtle (*Chelodina longicollis*) are mostly lentic off channel surface waters (e.g. waterholes, billabongs, dams or wetlands) or low flow watercourses (Cann 2008). Suitable habitat exists for these species throughout the preliminary investigation corridor. The most commonly available habitat in the preliminary investigation corridor for Chelonid turtles is in isolated billabongs and farm dams. Gilgais in the preliminary investigation corridor may also provide ephemeral (and so, seasonally available) habitat for these species. The saw-shelled turtle (*Wollumbinia latisternum*) can also be found in waterholes and billabongs. However, it prefers riverine environments with structural diversity (Cann 2008). Habitat for the saw-shelled turtle (*Wollumbinia latisternum*) exists throughout the preliminary investigation corridor, and it is likely that this species will occur.

Plate 4-27 Adult Krefft's river turtle (*Emydura macquarii krefftii*) from the Suttor River

The estuarine crocodile (*Crocodylus porosus*) is listed as 'migratory' and 'marine' under the EPBC Act, and 'vulnerable' under the NC Act. This species inhabits coastal and estuarine waters, but can also be found in a range of riverine, palustrine and lacustrine freshwater habitats. It is typically confined to larger perennial rivers, coastal waterways and estuaries. Potential habitat for this species does occur throughout the preliminary investigation corridor. The most likely habitats for the estuarine crocodile are in the Bowen and Bogie Rivers, Pelican Creek and the Caley Valley Wetland. It is considered that the estuarine crocodile is likely to occur in the preliminary investigation corridor as it has been recorded from the Burdekin River Basin (SEWPaC 2013c).

Two species of aquatic macroinvertebrates (the freshwater crab (*Austrothelphusa transversa*) and the freshwater mussel (*Alathyria* sp.)) were observed within the preliminary investigation corridor and wider study area. The most commonly observed species was the freshwater crab (*Austrothelphusa transversa*), which can be found in a range of aquatic habitats, including gilgais (see Plate 4-28 and Plate 4-29). Freshwater mussels and mussel shells (see Plate 4-29 were also frequently observed along the banks of waterways. The waterways of the preliminary investigation corridor provided habitat for a range of additional aquatic macroinvertebrate species. A number of coastal and estuarine crab species were observed during previous surveys of the Caley Valley Wetland, and included mud crabs (*Scylla serrata*), semaphore crabs (*Heloecius cordiformis*), fiddler crabs (*Uca* sp.) and shore crabs (family Grapsidae) (E3 Consulting 2010).

Plate 4-28 Freshwater crab (*Austrothelphusa transversa*) burrows in gilgai

Plate 4-29 Freshwater mussel (*Alathyria sp.*) shells (left); the exoskeleton of a freshwater crab (*Austrothelphusa transversa*) (right)

Table 4-12 provides a summary of the aquatic fauna species previously observed, and the the aquatic fauna species observed during May/June 2013 in preliminary investigation corridor and wider study area.

Table 4-12 Aquatic fauna species previously observed+, and the the aquatic fauna species observed during May/June 2013

Species	Status	Burdekin and Don River Basins*	Previously recorded*					Recorded during current survey				
			S	B	LB	D	CVW	S	B	LB	D	CVW
Freshwater sawfish (*Pristis microdon*)	vulnerable under the EPBC Act	✓										
Green sawfish (*Pristis zijsron*)	vulnerable under the EPBC Act	✓										
Flathead gudgeon (*Philypnodon grandiceps*)	priority species #	✓										
Freshwater longtom (*Strongylura krefftii*)	priority species	✓										
Hyrtl's tandan (*Neosilurus hyrtlii*)	priority species	✓	✓	✓								
Jungle perch (*Kuhlia rupestris*)	priority species	✓										
Marbled eel (*Anguilla reinhardtii*)	priority species	✓		✓	✓	✓	✓					
Pacific short-finned eel (*Anguilla obscura*)	priority species	✓										
Purple-spotted gudgeon (*Mogurnda adspersa*)	priority species	✓	✓	✓	✓							
Sailfin glassfish (*Ambassis agrammus*)	priority species	✓									✓	
Small-headed grunter (*Scortum parviceps*)	priority species	✓	✓									

Species	Status	Burdekin and Don River Basins*	Previously recorded*					Recorded during current survey				
			S	B	LB	D	CVW	S	B	LB	D	CVW
Snakehead gudgeon (*Giurus margaritacea*)	priority species	✓										
Soft-spined catfish (*Neosilurus mollespiculum*)	priority species	✓										
Agassiz's glassfish (*Ambassis agassizii)*				✓	✓	✓	✓					
Banded scat (*Selenotoca multifasciata*)							✓					
Barramundi (*Lates calcarifer*)				✓			✓					✓
Barred grunter (*Amniataba percoides*)				✓			✓					
Black catfish (*Neosilurus ater*)			✓	✓								
Blue catfish (*Arius graeffei*)				✓								
Bony bream (*Nematalosa erebi*)			✓	✓			✓					
Carp gudgeons (*Hypseleotris* sp.)				✓					✓			
Crescent perch (*Terapon jarbua*)							✓					
Eastern rainbowfish (*Melanotaenia splendida splendida*				✓	✓	✓	✓		✓	✓	✓	✓
Empire gudgeon						✓	✓					

Species	Status	Burdekin and Don River Basins*	Previously recorded*					Recorded during current survey				
			S	B	LB	D	CVW	S	B	LB	D	CVW
(*Hypseleotris compressa*												
Flyspecked hardyhead (*Craterocephalus stercusmuscarum*)				✓						✓	✓	✓
Milkfish (*Chanos chanos*)							✓					
Moses perch (*Lutjanus russelli*)							✓					
Oxeye herring (*Megalops cyprinoides*)				✓			✓					
Pacific blue-eye (*Pseudomugil signifer*				✓								✓
Rendahl's catfish (*Porochilus rendahli*)			✓									
Sea mullet (*Mugil cephalus)*							✓					
Seven-spot archerfish (*Toxotes chatareus*)				✓								✓
Sleepy cod (*Oxyeleotris lineolata*)			✓	✓								
Sooty grunter (*Hephaestus fuliginosus*)				✓					✓		✓	
Spangled perch (*Leiopotherapon unicolor*)				✓	✓	✓	✓	✓	✓	✓	✓	✓

Species	Status	Burdekin and Don River Basins*	Previously recorded*					Recorded during current survey				
			S	B	LB	D	CVW	S	B	LB	D	CVW
Speckled goby (*Redigobius bikolanus*)				✓								
Spotted scat (*Scatophagus argus*)							✓					
Tadpole goby (*Chlamydogobius ranunculus*)							✓					
Western carp gudgeon (*Hypseleotris klunzingeri*)				✓		✓	✓					
Cann's long-necked turtle (*Chelodina cann)i*	LC	✓					✓					
Eastern snake-necked turtle (*Chelodina longicollis)*	LC	✓										
Irwin's turtle (*Elseya irwini)*	LC, priority species	✓		✓			✓					
Krefft's river turtle (*Emydura macquarii krefftii)*	LC	✓	✓	✓				✓				
Saw-shelled turtle (*Wollumbinia latisternum)*	LC	✓		✓		✓						
Estuarine crocodile (*Crocodylus porosus)*	V	✓										
Freshwater shrimp (*Caridina* sp.)			✓	✓	✓	✓						

Species	Status	Burdekin and Don River Basins*	Previously recorded*					Recorded during current survey				
			S	B	LB	D	CVW	S	B	LB	D	CVW
Australian river prawn (*Macrobrachium australiense*)			✓	✓	✓	✓						
Riffle shrimp (*Australatya striolata*						✓						
East Australian river prawn (*Macrobrachium tolmerum)*						✓						
Orange-fingered yabby (*Cherax drepressus*)			✓									
Red claw (*Cherax quadricarinatus*)			✓	✓								
Freshwater crab (*Austrothelphusa transversa*)			✓					✓	✓			
Freshwater mussels (*Alathyria* sp.)								✓	✓			

* *Burdekin Natural Resource Management Region Back on Track Actions for Biodiversity*; # ACA conservation 'priority'; S – Suttor River catchment; B – Bowen River catchment; LB – Lower Burdekin catchment; D – Don River Basin; CVW – Caley Valley Wetland

[+] Previously recorded within desktop search extent from sources including Wildlife Online (WO), Queensland Museum (QM), previous EIS ecological surveys and from Pusey *et al.* (2004). Note that these desktop results are based on historical records (of either a known or unknown date). Dated specimen collections range in age from 1974 through to 2005, and encompass a range of seasons.

4.4 Wetland protection areas and nationally important wetlands

Wetlands considered being of high ecological significance in GBR catchments are identified as wetland protection areas (WPAs). These WPAs are surrounded by a 500 m trigger area (taken from the outside margin of the WPA) for assessable developments. The 'State Planning Policy 4/11: protecting wetlands of high ecological significance in GBR catchments' outlines a code for assessing prospective developments that are planned in wetlands of high ecological significance. Referrable wetland mapping is developed using AquaBAMM identified wetlands of high ecological significance (Clayton *et al* 2006). A set list of criteria, conditions and indicators are applied to each wetland to determine its ecological values. The preliminary investigation corridor intersects only one WPA at the northern end of the corridor (Caley Valley Wetland) (Figure 4-3). This WPA is described in Inglis and Howell (2009b) under the AquaBAMM criteria as:

- Wetland class: palustrine
- Salinity: hypo-saline
- Priority ecosystems and special features:
  - Flora: seasonal palustrine/swamps of the floodplain with native macrophyte communities (regional ecosystem 11.3.27)
  - Fauna: Caley Valley Wetland special feature – large coastal wetland with a saline influence and old marine sediments, wetlands provide important habitat for waterbirds including migratory species, wetlands contain significant limestone formations
  - Wetland ecosystems: Splitter's Creek special feature – contains good diversity of flora species in an intact riparian zone, good connectivity with estuarine areas providing good habitat for crocodiles and various species of bird and fish
- AquaBAMM conservation value (or AquaScore): rated as very high.

A total of eight DIWA listed nationally important wetlands occur within, or in close proximity to the preliminary investigation corridor. These eight wetlands are the:

- Abbot Point – Caley Valley Wetland (within the Don River Basin, within the preliminary investigation corridor))
- Southern Upstart Bay Wetland (within the Don River Basin, downstream of the preliminary investigation corridor)
- Bowen River: Birralee – Pelican Creek Wetland (within the Bowen River catchment, downstream of the preliminary investigation corridor)
- Burdekin delta – Lower Burdekin (within the Lower Burdekin River catchment) (downstream of the preliminary investigation corridor)
- Junction of the Bogie River and Kirknie Creek aggregation (within the Lower Burdekin River catchment, downstream of the preliminary investigation corridor)
- Lake Dalrymple (within the Suttor River catchment, downstream of the preliminary investigation corridor)
- Scartwater aggregation (within the Suttor River catchment) (
- Burdekin-Bowen junction and Blue Valley Weir aggregation (within the Lower Burdekin and Bowen River catchments) (downstream of the preliminary investigation corridor).

The preliminary investigation corridor, due to its 1,000 m width, crosses the western part of the DIWA listed Abbot Point – Caley Valley Wetland (Figure 4-4), however the proposed final rail corridor is not expected to enter any part of this wetland. No other DIWA listed wetlands occur within the preliminary investigation corridor; however, the Southern Upstart Bay Wetland and Bowen River: Birralee – Pelican Creek Wetland are within 4.5 km and 2.6 km respectively (Figure 4-4). All other DIWA listed wetlands are greater than 20 km from the preliminary investigation corridor.

LEGEND

- Population Centres
- Major Port
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- Wetland Protection Area
- Wetland Protection Area Trigger
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

Based on or contains data provided by the State of QLD (DNRM) [2013]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:1,100,000 Paper Size A4

0 7.5 15 30

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

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North Galilee Basin Rail Project

Wetland Protection Areas in or of Relevance to the Preliminary Investigation Corridor

Job Number	41-26457
Revision	A
Date	07 Aug 2013

Figure 4-3

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Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010, Wetland Protection Area/2011. Created by:MS

LEGEND

- Population Centres
- Major Port
- Highway
- Main Road
- Carmichael Project (Rail)
- Railway
- Watercourses (Major)
- Directory of Important Wetlands
- North Galilee Basin Rail 1000m Corridor
- North Galilee Basin Rail 100m Corridor

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1:1,100,000 Paper Size A4

0 7.5 15 30

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Adani Mining Pty Ltd

North Galilee Basin Rail Project

Nationally Important Wetlands in or of Relevance to the Investigation Corridor

Job Number	41-26457
Revision	A
Date	07 Aug 2013

Figure 4-4

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Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013 NGBR Corridor 06/06/2013, Camichael Rail Project/2012; DNRM: Roads/2010, DOIW/2012. Created by:MS

5. Existing threatening processes

5.1 Overview

The landscape in which the preliminary investigation corridor occurs has been historically, and continues to be, exposed to a diverse array of threatening processes. Sattler and Williams (1999) identified continued tree clearing, high total grazing pressure and exotic species, as the major threats to biodiversity in the Brigalow Belt bioregion. The Burdekin NRM Region *Back on Track Actions for Biodiversity report* (DERM 2010) details a variety of threatening processes impacting upon priority terrestrial and aquatic taxa in the region. These include:

- Clearing of vegetation
- Feral animals (terrestrial and aquatic)
- Baiting
- Disease
- Vehicle collisions with wildlife
- Inappropriate fire regimes
- Inappropriate grazing regimes
- Linear infrastructure development and maintenance
- Mining
- Urban development
- Weeds (terrestrial and aquatic)
- Flow regime disruption (including disruptions to surface water flow regimes, and groundwater extraction)
- Water quality alteration (DERM 2010).

These threatening processes are mostly related to the land use in the Brigalow Belt bioregion. Historical vegetation clearing has occurred in parts of the landscape to facilitate agricultural and mining industries, and associated infrastructure (such as roads and railways). Vegetation clearing has resulted in direct mortality of flora and fauna, habitat loss, habitat fragmentation and the erosion and sedimentation of watercourses. The introduction of non-indigenous grazing animals (mainly cattle) has resulted in terrestrial and aquatic habitat degradation throughout the preliminary investigation corridor. The presence and abundance of feral animals and exotic plants was reflected in the management practices of properties throughout the preliminary investigation corridor. In general, riparian areas throughout the landscape appeared to be particularly susceptible to weed invasion, with a number of weed infestations noted. Introduced fauna or evidence of introduced fauna was common, particularly in riparian areas surrounding watercourses.

Five priority reptiles, five priority birds and three priority mammals were identified in the Burdekin NRM *Back on Track Actions for Biodiversity* report (DERM 2010). Table 5-1 identifies 'Back on Track' priority species relevant to the preliminary investigation corridor, including their regional-specific threats (sourced from the *Back on Track Actions for Biodiversity* report (DERM 2010)).

Table 5-1 Burdekin NRM region 'Back on Track' 'priority' species relevant to preliminary investigation corridor

Species	Threats and impact (sourced from DERM 2010)
Reptiles	
common death adder *Acanthophis antarcticus*	• Feral animals (cane toads) – loss and/or removal of individuals • Inappropriate fire regimes – habitat degradation • Inappropriate grazing regimes – loss of habitat • Clearing of vegetation – loss of habitat
striped-tailed delma *Delma labialis*	• Inappropriate fire regimes – habitat degradation • Urban development – loss of habitat
ornamental snake *Denisonia maculata*	• Clearing of vegetation – loss of habitat • Feral animals (cane toads) – loss and/or removal of individuals • Feral animals (pigs) – competition
brigalow scaly-foot *Paradelma orientalis*	• Clearing of vegetation – loss of habitat • Inappropriate fire regimes – loss of habitat • Inappropriate grazing regimes – loss of habitat • Feral animals (cats) – loss and/or removal of individuals
Yakka skink *Egernia rugosa*	• Inappropriate fire regimes - loss of habitat • Inappropriate grazing regimes - loss of habitat • Site maintenance - habitat degradation • Feral animals (cats and foxes)- loss and/or removal of individuals • Road maintenance – loss of habitat
Birds	
Red goshawk *Erythrotriorchis radiatus*	• Inappropriate fire regimes – habitat degradation • Clearing of vegetation – loss of habitat • Inappropriate grazing regimes – habitat degradation • Drainage of habitat – loss of food resources • Weeds – habitat degradation
beach stone-curlew *Esacus magnirostris*	• Recreation/tourism – habitat degradation • Feral animals (wild dogs/dogs) – loss and/or removal of individuals • Feral animals (cats, foxes, pigs) – loss and/or removal of individuals • Urban development – loss of habitat
black-throated finch (southern) *Poephila cincta cincta*	• Inappropriate grazing regimes – habitat degradation • Urban development – loss of habitat • Inappropriate fire regimes – habitat degradation • Mining – habitat degradation • Collectors – loss and/or removal of individuals • Feral animals (cats) – loss and/or removal of individuals • Weeds – habitat degradation
Australian painted snipe *Rostratula australis*	• Weeds (exotic ponded pasture species) – loss of habitat • Inappropriate grazing regimes - habitat degradation • Feral animals (pigs) – habitat degradation • Drainage of habitat – habitat degradation • Flow regime – loss of habitat
little tern *Sternula albifrons*	• Recreation/tourism – disruption of breeding and/or resting • Feral animals (wild dogs/dogs, rodents, foxes and pigs) – loss and/or removal of individuals

Species	Threats and impact (sourced from DERM 2010)
Mammals	
northern quoll *Dasyurus hallucatus*	• Feral animals (cane toad and wild dogs/dogs) – loss and/or removal of individuals • Urban development – loss of habitat • Baiting – loss and/or removal of individuals • Feral animals (cats) – competition and loss and/or removal of individuals • Inappropriate fire regimes – habitat degradation • Road kill – loss and/or removal of individuals
Greater large-eared horseshoe bat *Rhinolophus philippinensis*	• Mining – loss of habitat • Inappropriate fire regimes – loss of habitat • Barbed-wire – loss and/or removal of individuals
Coastal sheathtail bat *Taphozous australis*	• Clearing of vegetation – loss of habitat • Urban development – loss of habitat • Barbed-wire – loss and/or removal of individuals • Recreation/tourism – disruption of breeding and/or resting

5.2 Introduced flora

The information gathered from desktop sources included predictive weed mapping information (based on climate suitability) over the region and historical confirmed records of weed species in the preliminary investigation corridor. The desktop review for weed species identified 38 species of 'declared plants' under the LP Act (including 4 aquatic, semi-aquatic or aquatic dependant Weeds of National Significance) that have been recorded within the preliminary investigation corridor. These are species are listed in Appendix H.

A total of 35 introduced plant species were recorded during field surveys, including 9 declared weeds (under the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act)) weeds (Table 5-2). In addition, two introduced aquatic plants were identified at two sites – the umbrella sedge (*Cyperus involucratus*) at Pelican Creek, and curled dock (*Rumex crispus*) at a farm dam (see Section 4.2.10).

Table 5-2 Queensland declared weeds recorded in preliminary investigation corridor

Scientific name	Common name	Location in corridor
Class 2		
Cryptostegia grandiflora	Rubber vine	Prevalent in creeks and waterways primarily north of Bowen River.
Harrisia martini	Harrisia cactus	Commonly encountered in semi-evergreen vine thicket and brigalow throughout the corridor, less frequently present in sclerophyll vegetation.
Opuntia stricta and *O. tomentosa*	Prickly pear	Encountered across the entire corridor but always with a very sparse distribution (only ever seen as isolated individuals) in most habitat types.
Parkinsonia aculeata	Parkinsonia	Abundant at Caley Valley on dune scrub, but rare elsewhere within preliminary investigation corridor – generally restricted to river banks and riparian areas.

Scientific name	Common name	Location in corridor
Parthenium hysterophorus	Parthenium	This species was frequently noted along roadsides and scattered throughout paddocks in the entire preliminary investigation corridor, particularly on clay and clay loams.
Sporobolus pyramidalis	Giant rat's tail grass	Isolated occurrence within preliminary investigation corridor; recorded only from Bakara Station in Oaky Creek, but also known to occur in Sandy Creek.
Acacia nilotica (now *Vachellia nilotica*)	Prickly acacia	Abundant at Caley Valley on dune scrub, but not recorded elsewhere.
Class 3		
Lantana camara	Lantana	Primarily located in the Collinsville area, with a particular infestation known from the northern bank of the Bowen River.

5.3 Introduced fauna

The Queensland Department of Agriculture, Fisheries and Forestry (DAFF) has produced maps illustrating the density and distribution of various pest species. An assessment of these maps was undertaken to provide additional information on the likelihood of occurrence (and potential of abundance) of pest fauna species in the landscape in which the preliminary investigation corridor occurs. The maps relevant to the potentially occurring pest species within the preliminary investigation corridor indicated that:

- Wild dogs, feral cats (both LP Act Class 2 declared animals) and cane toads are considered to be widespread and common (DAFF 2011a; DAFF 2007a; DAFF 2011c)
- European rabbits (LP Act Class 2 declared animals) are considered to be widespread and occasional (DAFF 2011b)
- Feral pigs (LP Act Class 2 declared animals) are considered to be widespread and common in the middle part of the preliminary investigation corridor, and common to occasional abundance with a localised distribution throughout the rest of the preliminary investigation corridor (DAFF 2008a)
- Feral horses are considered to be occasional and localised in the southernmost part of the preliminary investigation corridor (DAFF 2007b)
- The chital deer (*Axis axis*) (LP Act Class 2 declared animal) is considered to be localised and occasional in a small area to the north and west of Collinsville (DAFF 2008c)
- European fox (*Vulpes vulpes*) (LP Act Class 2 declared animal) is considered to be widespread and occasional throughout the landscape in the northern half of the preliminary investigation corridor and widespread and common throughout the landscape in the southern half (DAFF 2011d)
- The feral water buffalo (*Bubalis bubalis*) is mapped as being of localised distribution and occasional density in one small area west of Collinsville (DAFF 2008b).

Under the LP Act, a Class 2 declared animal is one that is established in Queensland and has, or could have, a substantial adverse economic, environmental or social impact. Management of these species is the responsibility of landowners, local governments and communities.

Other introduced mammals that occur in the landscape include the house mouse (*Mus musculus*), black rat (*Rattus rattus*) and brown hare (*Lepus europeaus*). Tilapia (*Oreochromis mossambicus*), three spot gourami (*Trichogaster trichopterus*) and mosquitofish (*Gambusia holbrooki*) currently occur within the Burdekin River Basin (Pusey *et al* 2004; Carter and Tait 2008). Tilapia (*Oreochromis mossambica*) has been observed in previous surveys of the Suttor River, Bowen River and Pelican Creek, and the mosquito fish (*Gambusia holbrooki*) has been observed in the Caley Valley Wetland catchment (E3 Consulting 2010; GHD 2010).

Ten introduced terrestrial vertebrates were recorded in habitats within and near the preliminary investigation corridor:

- One amphibian – cane toad
- Eight mammals – wild dog, dingo, feral cat, European rabbit, feral pig, wild horse, chital deer and feral cattle
- One bird – rock dove.

Cattle, pigs, and their pugging and wallowing areas were frequently noted within a range of habitats throughout the preliminary investigation corridor. Cattle and feral pigs are particularly detrimental to aquatic habitats as they defecate and urinate in and around surface waters, which can result in heavy nutrient loads, eutrophic conditions, algal blooms and subsequent anoxic conditions (Hooda *et al* 2000; Bilotta *et al* 2007). Habitat quality was also influenced by cattle and pig pugging and disturbance of the littoral zone in watercourses.

6. Key findings

The desktop assessment and field investigation confirmed that a number of species, regional ecosystems and ecological communities of conservation significance are actually present in the preliminary investigation corridor. In addition, as a result of the field investigation, and research conducted during the desktop assessment, it is predicted that similar ecological values are either likely to be present, or may occur, within the corridor. These values persist despite the modified nature of the landscape in which the preliminary investigation corridor occurs, and the presence of ongoing disturbances including existing infrastructure, historic land clearing (habitat fragmentation and simplification), weeds and pests. These values will require consideration and management at all stages of the NGBR Project.

In summary, terrestrial ecological habitats and species within the preliminary investigation corridor that are conservation significant (i.e. protected or identified by Commonwealth, State and/or regional bodies) include:

- Seven ‘endangered’ REs and 18 ‘of concern’ REs
- Constituent REs of three ‘endangered’ TECs – natural grassland, brigalow and semi-evergreen vine thicket (only the latter two were actually confirmed as present)
- One vulnerable plant species under the NC Act was confirmed present, black ironbox (*Eucalyptus raveretiana*), with several other threatened plant species predicted as potentially occurring
- Five threatened terrestrial fauna species (listed under the NC Act) were confirmed present, with potential for a further 11 threatened fauna species to likely occur. Those confirmed are
  - squatter pigeon (southern) (*Geophaps scripta scripta*) – vulnerable
  - black-necked stork (Ephippiorhynchus australis) – near threatened
  - cotton pygmy-goose (*Nettapus coramandelianus*) – near threatened
  - freckled duck (*Stictonetta naevosa*) – near threatened
  - little pied bat (*Chalinolobus picatus*) – near threatened.
- A number of EPBC Act listed ‘migratory’ and ‘marine’ birds confirmed present in a variety of habitats, but in particular the Caley Valley Wetland
- Essential habitat mapped as occurring for the NC Act listed plant species *Bonamia dietrichiana.*

Other terrestrial ecological values recorded in the preliminary investigation corridor include:

- A wide diversity of native plant species occurring in eight vegetation communities, despite communities often being impacted to varying extents by degradation including from introduced weed species
- Habitat for a wide diversity of common fauna species
- Potential conduits for regional movement of wildlife associated with connected tracts of remnant vegetation at the landscape scale

Existing disturbance across terrestrial and aquatic habitats in the preliminary investigation corridor was mainly due to the direct and indirect impacts of land use (cattle grazing), exotic

flora and fauna (mostly pigs) and existing infrastructure (particularly roads and waterbody crossings).

Aquatic habitats within the preliminary investigation corridor include riverine (drainage lines, creeks and rivers), palustrine (vegetated wetlands), lacustrine (farm dams and billabongs) and estuarine environments. A number of these aquatic waterways were ephemeral and contained no surface water at the time of the assessment. Habitats with perennial surface waters supported the most diverse and abundant aquatic communities. Ephemeral aquatic habitats provided periodically available habitat, and acted as pathways for dispersal when hydrological connectivity was established. High value perennial habitats were identified at a number of locations:

- Suttor River
- Pelican Creek
- Strathmore Creek
- Oaky Creek
- Bogie River
- Bowen River
- Splitter's Creek
- Caley Valley Wetland
- Saltwater Creek.

These sites are of particular importance as refuges for aquatic communities during dry periods.

A total of 179 aquatic dependent flora species (of which 24 are introduced, and 10 are listed as 'threatened' under the NC Act and/or EPBC Act) are known to occur in riverine and/or non-riverine wetlands within Burdekin River Basin. Field surveys in the study area identified only 15 aquatic flora species; however, it is emphasised that macrophyte presence and abundance is highly seasonal and dependant on the presence of surface water.

No threatened fish or turtle species known to occur in the Burdekin River Basin is expected to occur within the preliminary investigation corridor. However, the estuarine crocodile (*Crocodylus porosus*), listed as 'migratory' and 'marine' under the EPBC Act, and 'vulnerable' under the NC Act, is considered likely to occur. Potential habitat for this species occurs throughout the northern end of the preliminary investigation corridor. None of the aquatic macroinvertebrates that are known to occur within the preliminary investigation corridor are listed as being of conservation significance.

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Appendices

Appendix A – Survey site details

Flora survey sites

Fauna habitat assessment sites

Diurnal active search sites

Nocturnal survey sites

Threatened species survey effort

Aquatic habitat assessment sites

Flora Assessment Sites

Flora site	Preliminary investigation corridor section	Easting	Northing
Quaternary assessment	Northern	573561	7742751
Quaternary assessment	Northern	575628	7749203
Quaternary assessment	Northern	575824	7749204
Quaternary assessment	Southern	503986	7582611
Quaternary assessment	Southern	500258	7584547
Quaternary assessment	Southern	502182	7584279
Quaternary assessment	Southern	502570	7584236
Quaternary assessment	Southern	502700	7585104
Quaternary assessment	Southern	501666	7585541
Quaternary assessment	Southern	501250	7586531
Quaternary assessment	Southern	500174	7587680
Quaternary assessment	Southern	501903	7596293
Quaternary assessment	Southern	503996	7597579
Quaternary assessment	Southern	504890	7599728
Quaternary assessment	Southern	504992	7600021
Quaternary assessment	Southern	505366	7600919
Quaternary assessment	Southern	505479	7600900
Quaternary assessment	Southern	505324	7600996
Quaternary assessment	Southern	505318	7600591
Quaternary assessment	Southern	505494	7600548
Quaternary assessment	Southern	505845	7600265
Quaternary assessment	Southern	505982	7599468
Quaternary assessment	Southern	505651	7599188
Quaternary assessment	Southern	505538	7597829
Quaternary assessment	Southern	505336	7597365
Quaternary assessment	Southern	505268	7596971
Quaternary assessment	Southern	505267	7596730
Quaternary assessment	Southern	504937	7596824
Quaternary assessment	Southern	505117	7596782
Quaternary assessment	Southern	504897	7596032
Quaternary assessment	Southern	505118	7596110
Quaternary assessment	Southern	504429	7594749
Quaternary assessment	Southern	505378	7593545
Quaternary assessment	Southern	505246	7593497
Quaternary assessment	Southern	504129	7594045
Quaternary assessment	Southern	504165	7593924
Quaternary assessment	Northern	564461	7725650
Quaternary assessment	Northern	574100	7732689
Quaternary assessment	Northern	574621	7732327
Quaternary assessment	Northern	575044	7732234
Quaternary assessment	Northern	577992	7735570

Flora site	Preliminary investigation corridor section	Easting	Northing
Quaternary assessment	Northern	578046	7736093
Quaternary assessment	Northern	578710	7742073
Quaternary assessment	Northern	575383	7739359
Quaternary assessment	Northern	574045	7740335
Quaternary assessment	Northern	573455	7740943
Quaternary assessment	Northern	573442	7741331
Quaternary assessment	Northern	573426	7741199
Quaternary assessment	Northern	573613	7740674
Quaternary assessment	Northern	575159	7739373
Quaternary assessment	Northern	577947	7735661
Quaternary assessment	Southern	578788	7667240
Quaternary assessment	Southern	577732	7666394
Quaternary assessment	Southern	576263	7665959
Quaternary assessment	Southern	575732	7665569
Quaternary assessment	Southern	575429	7665074
Quaternary assessment	Southern	575139	7664598
Quaternary assessment	Southern	574621	7663754
Quaternary assessment	Southern	574531	7663254
Quaternary assessment	Southern	574445	7662874
Quaternary assessment	Southern	573187	7661240
Quaternary assessment	Southern	572963	7660820
Quaternary assessment	Southern	571862	7659274
Quaternary assessment	Southern	572521	7659398
Quaternary assessment	Southern	573044	7659348
Quaternary assessment	Southern	573589	7659302
Quaternary assessment	Southern	574372	7659058
Quaternary assessment	Southern	574816	7658858
Quaternary assessment	Southern	576249	7659068
Quaternary assessment	Southern	577879	7657913
Quaternary assessment	Southern	580283	7652613
Quaternary assessment	Southern	580708	7651699
Quaternary assessment	Southern	579263	7649203
Quaternary assessment	Southern	578361	7649471
Quaternary assessment	Southern	576030	7650078
Quaternary assessment	Southern	575896	7650189
Quaternary assessment	Southern	574618	7650559
Quaternary assessment	Southern	574903	7650532
Quaternary assessment	Southern	575343	7650358
Quaternary assessment	Southern	575735	7650259
Quaternary assessment	Southern	575602	7650074
Quaternary assessment	Southern	575753	7650400
Quaternary assessment	Southern	576371	7649990
Quaternary assessment	Southern	576574	7650222

Flora site	Preliminary investigation corridor section	Easting	Northing
Quaternary assessment	Southern	576600	7650031
Quaternary assessment	Southern	577290	7649786
Quaternary assessment	Southern	577486	7649724
Quaternary assessment	Southern	577788	7649542
Quaternary assessment	Southern	577919	7649431
Quaternary assessment	Southern	578614	7649403
Quaternary assessment	Southern	579568	7649116
Quaternary assessment	Southern	580173	7648941
Quaternary assessment	Southern	580491	7648849
Quaternary assessment	Southern	580795	7648799
Quaternary assessment	Southern	581030	7649412
Quaternary assessment	Southern	580897	7650163
Quaternary assessment	Southern	580917	7650966
Quaternary assessment	Southern	580811	7651331
Quaternary assessment	Southern	580497	7652059
Quaternary assessment	Southern	580377	7652430
Quaternary assessment	Southern	580220	7652891
Quaternary assessment	Southern	579970	7653419
Quaternary assessment	Southern	579466	7653885
Quaternary assessment	Southern	579296	7654490
Quaternary assessment	Southern	579132	7654761
Quaternary assessment	Southern	579107	7655528
Quaternary assessment	Southern	578547	7656426
Quaternary assessment	Southern	578456	7656945
Quaternary assessment	Southern	578357	7657381
Quaternary assessment	Southern	577613	7658202
Quaternary assessment	Southern	577056	7658671
Quaternary assessment	Southern	576270	7659188
Quaternary assessment	Southern	575763	7658944
Quaternary assessment	Southern	573808	7662231
Quaternary assessment	Southern	576564	7666183
Quaternary assessment	Southern	577381	7666240
Quaternary assessment	Southern	541127	7608597
Quaternary assessment	Southern	540889	7608900
Quaternary assessment	Southern	541592	7611247
Quaternary assessment	Southern	541770	7611592
Quaternary assessment	Southern	542303	7612289
Quaternary assessment	Southern	542506	7612557
Quaternary assessment	Southern	542961	7613256
Quaternary assessment	Southern	542971	7613921
Quaternary assessment	Southern	543027	7614625
Quaternary assessment	Southern	543159	7615622

Flora site	Preliminary investigation corridor section	Easting	Northing
Quaternary assessment	Southern	543348	7616399
Quaternary assessment	Southern	543632	7617589
Quaternary assessment	Southern	543598	7618715
Quaternary assessment	Southern	535322	7626480
Quaternary assessment	Southern	534965	7614516
Quaternary assessment	Southern	536072	7614796
Quaternary assessment	Southern	535273	7614753
Quaternary assessment	Southern	535121	7614777
Quaternary assessment	Southern	534784	7614804
Quaternary assessment	Southern	532007	7615299
Quaternary assessment	Southern	529751	7615728
Quaternary assessment	Southern	531007	7615080
Quaternary assessment	Southern	520024	7613198
Quaternary assessment	Southern	519288	7612833
Quaternary assessment	Southern	518849	7612535
Quaternary assessment	Southern	518523	7611658
Quaternary assessment	Southern	517384	7611783
Quaternary assessment	Southern	517048	7611953
Quaternary assessment	Southern	516783	7611841
Quaternary assessment	Southern	516539	7611874
Quaternary assessment	Southern	515448	7611995
Quaternary assessment	Southern	514694	7612342
Quaternary assessment	Southern	516373	7611885
Quaternary assessment	Southern	525182	7613004
Quaternary assessment	Southern	603171	7541557
Quaternary assessment	Southern	601043	7540989
Quaternary assessment	Southern	518487	7607703
Quaternary assessment	Southern	518052	7608361
Quaternary assessment	Southern	516882	7609281
Quaternary assessment	Southern	516456	7609763
Quaternary assessment	Southern	515977	7610308
Quaternary assessment	Southern	515593	7610743
Quaternary assessment	Southern	515326	7611045
Quaternary assessment	Southern	515143	7611256
Quaternary assessment	Southern	515041	7611373
Quaternary assessment	Southern	513062	7612211
Quaternary assessment	Southern	508675	7610083
Quaternary assessment	Southern	508617	7609944
Quaternary assessment	Southern	508607	7609814
Quaternary assessment	Southern	508644	7609452
Quaternary assessment	Southern	508531	7609167
Quaternary assessment	Southern	508458	7608418
Quaternary assessment	Southern	508444	7608245

Flora site	Preliminary investigation corridor section	Easting	Northing
Quaternary assessment	Southern	508413	7607816
Quaternary assessment	Southern	508379	7607513
Quaternary assessment	Southern	508344	7607191
Quaternary assessment	Southern	508336	7607101
Quaternary assessment	Southern	508309	7606874
Quaternary assessment	Southern	508300	7606341
Quaternary assessment	Southern	508223	7606096
Quaternary assessment	Southern	508159	7605466
Quaternary assessment	Southern	509225	7604745
Quaternary assessment	Southern	508908	7604906
Quaternary assessment	Southern	508686	7604810
Quaternary assessment	Southern	508111	7604721
Quaternary assessment	Southern	508129	7605086
Quaternary assessment	Southern	508132	7605243
Quaternary assessment	Southern	508189	7605714
Quaternary assessment	Southern	508242	7606218
Quaternary assessment	Southern	551900	7622847
Quaternary assessment	Southern	552495	7622704
Quaternary assessment	Southern	552922	7622519
Quaternary assessment	Southern	553115	7622536
Quaternary assessment	Southern	553292	7622399
Quaternary assessment	Southern	553570	7622127
Quaternary assessment	Southern	553538	7621741
Quaternary assessment	Southern	553780	7621418
Quaternary assessment	Southern	554217	7621032
Quaternary assessment	Southern	554596	7620931
Quaternary assessment	Southern	555657	7620427
Quaternary assessment	Southern	555996	7620255
Quaternary assessment	Southern	556704	7620109
Quaternary assessment	Southern	557309	7620240
Quaternary assessment	Southern	558109	7620158
Quaternary assessment	Southern	559302	7620204
Quaternary assessment	Southern	560072	7620404
Quaternary assessment	Southern	600600	7620269
Quaternary assessment	Southern	578599	7645685
Quaternary assessment	Southern	578534	7645986
Quaternary assessment	Southern	578483	7646383
Quaternary assessment	Southern	578518	7646709
Quaternary assessment	Southern	578575	7647038
Quaternary assessment	Southern	578533	7647219
Quaternary assessment	Southern	578614	7647493
Quaternary assessment	Southern	578698	7647959
Quaternary assessment	Southern	578779	7648227

Flora site	Preliminary investigation corridor section	Easting	Northing
Quaternary assessment	Southern	578801	7648279
Quaternary assessment	Southern	578892	7648379
Quaternary assessment	Southern	579116	7648615
Quaternary assessment	Southern	574110	7650712
Quaternary assessment	Southern	572422	7651219
Quaternary assessment	Southern	571863	7651241
Quaternary assessment	Southern	570703	7651091
Quaternary assessment	Southern	569576	7652543
Quaternary assessment	Southern	569995	7652866
Quaternary assessment	Southern	570228	7653004
Quaternary assessment	Southern	570454	7653329
Quaternary assessment	Southern	570625	7653365
Quaternary assessment	Southern	570767	7653444
Quaternary assessment	Southern	571695	7654846
Quaternary assessment	Southern	571910	7655005
Quaternary assessment	Southern	571788	7655081
Quaternary assessment	Southern	571993	7655099
Quaternary assessment	Southern	571967	7655211
Quaternary assessment	Southern	572059	7655343
Quaternary assessment	Southern	572125	7655448
Quaternary assessment	Southern	572229	7655532
Quaternary assessment	Southern	572306	7655657
Quaternary assessment	Southern	572871	7656007
Quaternary assessment	Southern	573188	7656064
Quaternary assessment	Southern	573659	7655304
Quaternary assessment	Southern	574316	7654406
Quaternary assessment	Southern	574413	7654111
Quaternary assessment	Southern	574851	7653028
Quaternary assessment	Southern	574488	7653686
Quaternary assessment	Southern	574385	7654242
Quaternary assessment	Southern	573924	7654771
Quaternary assessment	Southern	573521	7655792
Quaternary assessment	Southern	573309	7656095
Quaternary assessment	Southern	573435	7656417
Quaternary assessment	Southern	573573	7656711
Quaternary assessment	Southern	574001	7656878
Quaternary assessment	Southern	573832	7656947
Quaternary assessment	Southern	574121	7656892
Quaternary assessment	Southern	574396	7657192
Quaternary assessment	Southern	574520	7657581
Quaternary assessment	Southern	574753	7658187
Quaternary assessment	Southern	584751	7672360

Flora site	Preliminary investigation corridor section	Easting	Northing
Quaternary assessment	Southern	583961	7672209
Quaternary assessment	Southern	583626	7672062
Quaternary assessment	Southern	583083	7671730
Quaternary assessment	Southern	582531	7671252
Quaternary assessment	Southern	582068	7671018
Quaternary assessment	Southern	576313	7672145
Quaternary assessment	Southern	577617	7672613
Quaternary assessment	Southern	579041	7674972
Quaternary assessment	Southern	578966	7675268
Quaternary assessment	Southern	579093	7675407
Quaternary assessment	Southern	579162	7675541
Quaternary assessment	Southern	579564	7675564
Quaternary assessment	Southern	580365	7677019
Quaternary assessment	Southern	580292	7676729
Quaternary assessment	Southern	580133	7675159
Quaternary assessment	Southern	580260	7675094
Quaternary assessment	Southern	580331	7675115
Quaternary assessment	Southern	580479	7675103
Quaternary assessment	Southern	580419	7675032
Quaternary assessment	Southern	579724	7675421
Quaternary assessment	Southern	579730	7675555
Quaternary assessment	Southern	579510	7675622
Quaternary assessment	Southern	579011	7675355
Quaternary assessment	Southern	578962	7674701
Quaternary assessment	Southern	578940	7674600
Quaternary assessment	Southern	578985	7674204
Quaternary assessment	Southern	578828	7674191
Quaternary assessment	Southern	578433	7673496
Quaternary assessment	Southern	577683	7672890
Quaternary assessment	Southern	576793	7672285
Quaternary assessment	Southern	576716	7672119
Quaternary assessment	Southern	576566	7671907
Quaternary assessment	Southern	577135	7671191
Quaternary assessment	Southern	577346	7670950
Quaternary assessment	Southern	577579	7671115
Quaternary assessment	Southern	577680	7670505
Quaternary assessment	Southern	578020	7670734
Quaternary assessment	Southern	578500	7669870
Quaternary assessment	Southern	578653	7669133
Quaternary assessment	Southern	578376	7669097
Quaternary assessment	Southern	578525	7668516
Quaternary assessment	Southern	578812	7668395
Quaternary assessment	Northern	578085	7716114

Flora site	Preliminary investigation corridor section	Easting	Northing
Quaternary assessment	Northern	578150	7715506
Quaternary assessment	Northern	577494	7714299
Quaternary assessment	Northern	576116	7712971
Quaternary assessment	Northern	574861	7712544
Quaternary assessment	Northern	568079	7722162
Quaternary assessment	Northern	569429	7721333
Quaternary assessment	Northern	570163	7720994
Quaternary assessment	Northern	570371	7721020
Quaternary assessment	Northern	570688	7720381
Quaternary assessment	Northern	570429	7719835
Quaternary assessment	Northern	570198	7719660
Quaternary assessment	Northern	571588	7719350
Quaternary assessment	Northern	572866	7718990
Quaternary assessment	Northern	572441	7719300
Quaternary assessment	Northern	571974	7719522
Quaternary assessment	Northern	571886	7719591
Quaternary assessment	Northern	571729	7719707
Quaternary assessment	Northern	571101	7719737
Quaternary assessment	Northern	571083	7719862
Quaternary assessment	Northern	570792	7720193
Quaternary assessment	Northern	570097	7721273
Quaternary assessment	Northern	569949	7721147
Quaternary assessment	Northern	568313	7721614
Quaternary assessment	Northern	574878	7732188
Quaternary assessment	Northern	569360	7731752
Quaternary assessment	Northern	572695	7731812
Quaternary assessment	Northern	573906	7732561
Quaternary assessment	Northern	577610	7734259
Quaternary assessment	Northern	577956	7735630
Quaternary assessment	Northern	578443	7742958
Quaternary assessment	Northern	577739	7743171
Quaternary assessment	Northern	577048	7743256
Quaternary assessment	Northern	576673	7743930
Quaternary assessment	Northern	576261	7745825
Quaternary assessment	Northern	576140	7746616
Quaternary assessment	Northern	576472	7747128
Quaternary assessment	Northern	576153	7747389
Quaternary assessment	Northern	576091	7746372
Quaternary assessment	Northern	576203	7746086
Quaternary assessment	Northern	576350	7745939
Quaternary assessment	Northern	576175	7745415
Quaternary assessment	Northern	576100	7745141
Quaternary assessment	Northern	576129	7745023

Flora site	Preliminary investigation corridor section	Easting	Northing
Quaternary assessment	Northern	576429	7743138
Quaternary assessment	Northern	613956	7790770
Quaternary assessment	Northern	615293	7794768
Quaternary assessment	Northern	615265	7794723
Quaternary assessment	Northern	615405	7794578
Quaternary assessment	Northern	612552	7792650
Quaternary assessment	Northern	612544	7792568
Quaternary assessment	Northern	612426	7792415
Quaternary assessment	Northern	611801	7792049
Quaternary assessment	Northern	611443	7791860

Fauna habitat assessment sites and diurnal active search locations

Site number	Easting	Northing	Date
Terrestrial fauna habitat assessment sites			
TH1	508138	7605093	10/05/2013
TH2	508262	7606337	10/05/2013
TH3	518510	7608530	10/05/2013
TH4	515770	7611953	09/05/2013
TH5	517040	7611974	09/05/2013
TH6	528190	7613575	09/05/2013
TH7	518167	7614431	09/05/2013
TH8	536120	7614659	09/05/2013
TH9	531394	7615119	09/05/2013
TH10	574271	7634434	11/052013
TH11	578559	7645705	11/052013
TH12	578482	7646820	11/052013
TH13	578738	7648179	11/052013
TH14	576650	7650045	08/05/2013
TH15	575000	7650522	08/05/2013
TH16	575078	7652639	11/052013
TH17	570555	7653408	11/052013
TH18	573148	7656084	11/052013
TH19	574487	7657536	11/052013
TH20	573620	7662333	07/05/2013
TH21	574601	7662528	07/05/2013
TH22	575695	7665599	07/05/2013
TH23	577619	7666173	07/05/2013
TH24	578615	7667409	07/05/2013
TH25	578916	7667562	07/05/2013
TH26	578412	7673483	13/05/2013
TH27	580436	7675053	13/05/2013
TH28	574674	7712460	15/05/2013

Site number	Easting	Northing	Date
TH29	571868	7719511	14/05/2013
TH30	570181	7719637	14/05/2013
TH31	569498	7721370	14/05/2013
TH32	574710	7732230	14/05/2013
TH33	574092	7732620	15/05/2013
TH34	576442	7743137	14/05/2013
TH35	576179	7745196	13/05/2013
TH36	611482	7791858	16/05/2013
TH37	612459	7792653	16/05/2013
TH38	615322	7794773	16/05/2013
TH39	583200	7685454	13/05/2013
TH40	583279.8	7684708	13/05/2013
TH41	584581.7	7681840	13/05/2013
TH42	576305.9	7745239	14/05/2013
TH43	576283.5	7745816	14/05/2013
TH44	615692.5	7793913	16/05/2013
TH45	575740	7749019	13/06/2013
TH46	575748	7748975	13/06/2013
TH47	504264	7593989	14/06/2013
TH48	505169	7596679	14/06/2013
TH49	505351	7600417	14/06/2013
TH50	500267	7584499	14/06/2013
Diurnal active search sites			
AS1	508138	7605093	10/05/2013
AS2	508262	7606337	10/05/2013
AS3	518510	7608530	10/05/2013
AS4	515770	7611953	09/05/2013
AS5	517040	7611974	09/05/2013
AS6	518167	7614431	09/05/2013
AS7	536120	7614659	09/05/2013
AS8	578559	7645705	11/052013
AS9	576650	7650045	08/05/2013
AS10	575000	7650522	08/05/2013
AS11	575078	7652639	11/052013
AS12	570555	7653408	11/052013
AS13	573148	7656084	11/052013
AS14	574487	7657536	11/052013
AS15	573620	7662333	07/05/2013
AS16	574601	7662528	07/05/2013
AS17	575695	7665599	07/05/2013
AS18	577619	7666173	07/05/2013
AS19	578615	7667409	07/05/2013

Site number	Easting	Northing	Date
AS20	578412	7673483	13/05/2013
AS21	571868	7719511	14/05/2013
AS22	574092	7732620	15/05/2013
AS23	583200	7685454	13/05/2013
AS24	583280	7684708	13/05/2013
AS25	584582	7681840	13/05/2013
AS26	576306	7745239	14/05/2013
AS27	576284	7745816	14/05/2013
AS28	615692	7793913	16/05/2013
AS29	575740	7749019	13/06/2013
AS30	575748	7748975	13/06/2013
AS31	504264	7593989	14/06/2013
AS32	505169	7596679	14/06/2013
AS33	505351	7600417	14/06/2013
AS34	500267	7584499	14/06/2013

Nocturnal survey locations

Site number	Easting	Northing	Date
Nocturnal survey sites			
NS1	615303	7794769	16/05/2013
NS2	576284	7745816	14/05/2013
NS3	576306	7745239	14/05/2013
NS4	576306	7745239	14/05/2013
NS5	576306	7745239	14/05/2013
NS6	577495	7744278	14/05/2013
NS7	583200	7685454	13/05/2013
NS8	583280	7684708	13/05/2013
NS9	583449	7684954	13/05/2013
NS10	583956	7684059	13/05/2013
NS11	518559	7608511	10/05/2013
NS12	518504	7608681	10/05/2013
NS13	518546	7613880	09/05/2013
NS14	517955	7614155	09/05/2013
NS15	518111	7614398	09/05/2013
NS16	517985	7614598	09/05/2013
NS17	575516	7650055	08/05/2013
NS18	576483	7650179	08/05/2013
NS19	576483	7650179	08/05/2013
NS20	575698	7650235	08/05/2013
NS21	573148	7656084	11/052013
NS22	573535	7656644	11/052013
NS23	573535	7656644	11/052013

Site number	Easting	Northing	Date
NS24	573191	7661419	07/05/2013
NS25	577550	7666143	07/05/2013
NS26	578912	7667564	07/05/2013
Anabat survey location			
AB1	576306	7745239	14/05/2013
AB2	577495	7744278	14/05/2013
AB3	518433	7608511	10/05/2013
AB4	518111	7614398	09/05/2013
AB5	518198	7614435	09/05/2013
AB6	580929	7648967	08/05/2013
AB7	573148	7656084	11/052013
AB8	573535	7656644	11/052013
AB9	574676	7659006	11/052013
AB10	573248	7661498	07/05/2013
AB11	578912	7667564	07/05/2013
AB12	615692	7793913	16/05/2013
AB13	575516	7650055	08/05/2013
Nocturnal call playback locations			
CP1	573191	7661419	07/05/2013
CP2	575516	7650055	08/05/2013
CP3	518111	7614398	09/05/2013
CP4	518433	7608511	10/05/2013
CP5	573148	7656084	11/052013
CP6	576306	7745239	14/05/2013

Threatened species survey effort

Species Name	Easting	Northing	Date
Black-throated finch	575740	7749019	13/06/2013
Black-throated finch	504264	7593989	14/06/2013
Black-throated finch	577619	7666173	07/05/2013
Black-throated finch	578916	7667562	07/05/2013
Black-throated finch	531394	7615119	09/05/2013
Black-throated finch	575078	7652639	11/05/2013
Black-throated finch	578482	7646820	11/05/2013
Black-throated finch	574271	7634434	11/05/2013
Black-throated finch	518167	7614431	09/05/2013
Black-throated finch	573148	7656084	11/05/2013
Black-throated finch	611482	7791858	16/05/2013
Black-throated finch	612459	7792653	16/05/2013
Black-throated finch	574710	7732230	14/05/2013
Black-throated finch	576179	7745196	13/05/2013
Black-throated finch	580436	7675053	13/05/2013

Species Name	Easting	Northing	Date
Black-throated finch	576305	7745239	14/05/2013
Black-throated finch	615692	7793913	16/05/2013
Black-throated finch	615354	7794580	16/05/2013
Black-throated finch	615437	7794591	16/05/2013
Ornamental snake	577619	7666173	07/05/2013
Ornamental snake	517040	7611974	09/05/2013
Ornamental snake	536120	7614659	09/05/2013
Ornamental snake	508138	7605093	10/05/2013
Ornamental snake	575078	7652639	11/05/2013
Ornamental snake	518510	7608530	10/05/2013
Ornamental snake	573148	7656084	11/05/2013
Ornamental snake	580436	7675053	13/05/2013
Ornamental snake	505169	7596679	14/06/2013
Ornamental snake	505351	7600417	14/06/2013
Ornamental snake	573191	7661419	07/05/2013
Ornamental snake	577550	7666143	07/05/2013
Ornamental snake	578912	7667564	07/05/2013
Ornamental snake	518111	7614398	09/05/2013
Ornamental snake	517985	7614598	09/05/2013
Ornamental snake	517955	7614155	09/05/2013
Ornamental snake	518546	7613880	09/05/2013
Ornamental snake	518504	7608681	10/05/2013
Ornamental snake	518559	7608511	10/05/2013
Ornamental snake	573148	7656084	11/05/2013
Brigalow scaly-foot	577619	7666173	07/05/2013
Brigalow scaly-foot	574601	7662528	07/05/2013
Brigalow scaly-foot	578615	7667409	07/05/2013
Brigalow scaly-foot	576650	7650045	08/05/2013
Brigalow scaly-foot	515770	7611953	09/05/2013
Brigalow scaly-foot	517040	7611974	09/05/2013
Brigalow scaly-foot	536120	7614659	09/05/2013
Brigalow scaly-foot	508138	7605093	10/05/2013
Brigalow scaly-foot	508262	7606337	10/05/2013
Brigalow scaly-foot	575078	7652639	11/05/2013
Brigalow scaly-foot	570555	7653408	11/05/2013
Brigalow scaly-foot	578559	7645705	11/05/2013
Brigalow scaly-foot	575695	7665599	07/05/2013
Brigalow scaly-foot	573620	7662333	07/05/2013
Brigalow scaly-foot	575000	7650522	08/05/2013
Brigalow scaly-foot	518510	7608530	10/05/2013
Brigalow scaly-foot	574487	7657536	11/05/2013
Brigalow scaly-foot	573148	7656084	11/05/2013

Species Name	Easting	Northing	Date
Brigalow scaly-foot	580436	7675053	13/05/2013
Brigalow scaly-foot	578412	7673483	13/05/2013
Brigalow scaly-foot	583200	7685454	13/05/2013
Brigalow scaly-foot	583279	7684708	13/05/2013
Brigalow scaly-foot	584581	7681840	13/05/2013
Brigalow scaly-foot	505169	7596679	14/06/2013
Brigalow scaly-foot	505351	7600417	14/06/2013
Stripe-tailed delma	576442	7743137	14/05/2013
Koala	577442	7666322	07/05/2013
Koala	574601	7662528	07/05/2013
Koala	516467	7611875	09/05/2013
Koala	575024	7652604	11/05/2013
Koala	518510	7608530	10/05/2013
Koala	574674	7712460	15/05/2013
Koala	576560	7745830	14/05/2013
Koala	584581	7681840	13/05/2013
Koala	576305	7745239	14/05/2013
Koala	576283	7745815	14/05/2013

Aquatic habitat assessment sites

Site number	Easting	Northing	Date
AQ1	500271	7584500	14/06/2013
AQ2	501211	7586541	14/06/2013
AQ3	504266	7593988	14/06/2013
AQ4	505552	7600280	14/06/2013
AQ5	505310	7600963	14/06/2013
AQ6	508115	7605072	10/05/2013
AQ7	515009	7611720	08/05/2013
AQ8	516458	7611930	08/05/2013
AQ9	536122	7614669	09/05/2013
AQ10	553502	7621886	09/05/2013
AQ11	578482	7646820	11/05/2013
AQ12	580928	7648963	08/05/2013
AQ13	576636	7649998	08/05/2013
AQ14	575552	7650023	08/05/2013
AQ15	574876	7650539	08/05/2013
AQ16	574167	7650692	11/05/2013
AQ17	575077	7652636	11/05/2013
AQ18	574217	7654444	11/05/2013

Site number	Easting	Northing	Date
AQ19	574595	7662411	07/05/2013
AQ20	577459	7666338	07/05/2013
AQ21	580436	7675053	13/05/2013
AQ22	579889	7675808	13/05/2013
AQ23	588250	7704643	09/05/2013
AQ24	568997	7724587	08/05/2013
AQ25	574713	7732231	14/05/2013
AQ26	576193	7745191	14/05/2013
AQ27	575727	7749014	13/06/2013
AQ28	581694	7760967	08/05/2013
AQ29	582998	7763723	08/05/2013
AQ30	588056	7784120	07/05/2013
AQ31	603686	7789626	07/05/2013
AQ32	605670	7789870	07/05/2013
AQ33	611223	7791486	07/05/2013
AQ34	609337	7791846	07/05/2013
AQ35	611491	7791858	16/05/2013
AQ36	615598	7793765	07/05/2013
AQ37	615330	7794597	16/05/2013

Appendix B – Regional ecosystem, essential habitat and regrowth vegetation information

RE descriptions within preliminary investigation corridor

Figure B-1 RE mapping (version 6.1)

Figure B-2 Regrowth vegetation and essential habitat mapping

Figure B-3 Broad vegetation community and fauna habitat types mapping

Regional Ecosystems within the preliminary investigation corridor

RE code	VM Act status/ biodiversity status	Description	Land form	Protected area representation[1]	Comments
Land zone 12					
11.12.1	Least concern/no concern at present	*Eucalyptus crebra* +/- *Corymbia erythrophloia* shrubby woodland. *E. melanophloia* is often present and may be locally dominant. Also includes localised areas dominated by *E. persistens*.	Occurs on ranges on igneous rocks.	Low	One of the most common REs in the preliminary investigation corridor, particularly prevalent north of the Bowen River.
11.12.2	Least concern/no concern at present	*Eucalyptus melanophloia* and *Corymbia erythrophloia* +/- *E. populnea* grassy woodland. *Eucalyptus moluccana* sometimes present on colluvial lower slopes.	Occurs on undulating rises and low hills formed from Mesozoic to Proterozoic igneous rocks.	Low	Most commonly recorded from Mt Lookout north to the Bowen River.
11.12.4	Least concern/no concern at present	*Araucaria cunninghamii* is a common emergent from the general canopy layer with is 15-28 metres high. Canopy species include *Paraserianthes toona*, *Ficus virens*, *Canarium australianum*, *Alstonia scholaris*, *Planchonella pohlmaniana*, *Cleistanthus dallachyanus* and *Backhousia citriodora*. *Eucalyptus moluccana* often associated with lower slopes on sandy sites.	Occurs on low hills, ranges and boulder strewn slopes formed from Mesozoic to Proterozoic igneous rocks including granite.	High	Not observed during surveys – may be present in the northern section of the preliminary investigation corridor. A minor RE within the preliminary investigation corridor.
11.12.7	Least concern/no concern at present	*Eucalyptus crebra* woodland with patches of semi-evergreen vine thicket.	Occurs on boulder strewn hills formed on Mesozoic to Proterozoic igneous rocks.	Low	Believed present near the centre of the preliminary investigation corridor on Fig Tree property, and may be present on Tabletop property.

RE code	VM Act status/ biodiversity status	Description	Land form	Protected area representation[1]	Comments
11.12.9	Least concern/no concern at present	*Eucalyptus platyphylla*, *Corymbia dallachiana*, *C. tessellaris* and *E. drepanophylla* woodland. *Corymbia clarksoniana*, *Eucalyptus drepanophylla* and *E. platyphylla* dominate the woodland canopy. Other species sometimes present are *Corymbia erythrophloia*, *C. dallachiana*, *Eucalyptus tereticornis*, *E. exserta* and *C. tessellaris*.	Occurs on lower slopes of Mesozoic to Proterozoic igneous rocks.	Medium	Most prevalent in the preliminary investigation corridor north of the Bowen River.
11.12.10	Of concern/of concern	*Corymbia clarksoniana* woodland.	Occurs on Mesozoic to Proterozoic igneous rocks on lower slopes.	None	Not observed during the field surveys. A minor RE within the preliminary investigation corridor.
11.12.13	Least concern/no concern at present	*Eucalyptus crebra*, *Corymbia erythrophloia*, *C. dallachiana* and *C. tessellaris* +/- *C. intermedia* +/- *E. acmenoides* +/- *Canarium australianum* mixed open-forest or woodland.	Occurs on coastal hills formed on Mesozoic to Proterozoic igneous rocks.	High	Believed present in the northern half of the preliminary investigation corridor (north of the Bowen River).
11.12.14	Of concern/of concern	*Lophostemon* spp. shrubby woodland. Associated shrubs include *Acacia* spp., *Alphitonia excelsa* and *Xanthorrhoea johnsonii*. *Lophostemon confertus* is the most common species in the top canopy layer. *Eucalyptus exserta* is consistently present, while *Acacia simsii* is often found.	Occurs on Mesozoic to Proterozoic igneous rocks on Coastal ranges.	High	Not observed during the field surveys and believed to be restricted (in the preliminary investigation corridor) to the slopes and summit of coastal ranges (Mt Abbot and Mt Roundback). A minor RE within the preliminary investigation corridor.

RE code	VM Act status/ biodiversity status	Description	Land form	Protected area representation[1]	Comments
11.12.15	Of concern/of concern	*Allocasuarina torulosa* +/- *Livistona decora* with *Xanthorrhoea johnsonii* understorey +/- areas of low open-forest with *Corymbia intermedia* and *Eucalyptus acmenoides*.	Occurs on coastal ranges formed on Mesozoic to Proterozoic igneous rocks.	High	Not observed during the field surveys and believed to be restricted (in the preliminary investigation corridor) to the slopes and summit of Mt Abbot. A minor RE within the preliminary investigation corridor.
11.12.16	Of concern/of concern	Mixed low woodland to shrubland. Canopy species include *Lophostemon grandiflorus*, *Canarium australianum, Pleiogynium timorense*, *Acacia leptostachya*, *A spirorbis* subsp. *solandri*, *Cochlospermum gillivraei* +/- *Eucalyptus drepanophylla* +/- *Eucalyptus portuensis* +/- *Corymbia tessellaris* +/- *C. dallachiana* and semi-evergreen vine thicket species.	Occurs on coastal ranges formed on Mesozoic to Proterozoic igneous rocks.	High	Not observed during the field surveys and believed to be restricted (in the preliminary investigation corridor) to the slopes and summit of Mt Abbot. A minor RE within the preliminary investigation corridor.
11.12.18	Of concern/of concern	Montane shrub/heathland. Dominant species include *Leptospermum amboinense*, *L. neglectum*, *Phebalium glandulosum*, *Acacia aulacocarpa*, *Leucopogon cuspidatus*, *Sannantha collina* and *Acacia humifusa*. Sometimes emergent *Eucalyptus exserta* tree layer is present which may form a low woodland over localised areas.	Occurs on mountain tops formed from Mesozoic to Proterozoic igneous rocks.	High	Not observed during the field surveys and believed to be restricted (in the preliminary investigation corridor) to the slopes and summit of Mt Abbot. A minor RE within the corridor.
11.12.21	Endangered/ endangered	Open-forest dominated by *Acacia harpophylla* with or without semi-evergreen vine thicket species. A moderately tall dense shrub layer of *Geijera parviflora* and *Eremophila mitchellii* may	Occurs on Mesozoic to Proterozoic igneous rocks on colluvial lower slopes of volcanic hills and strongly	Low	Mapped in two small polygons just north of the Bowen River, but not confirmed during field surveys. A minor RE within the

RE code	VM Act status/ biodiversity status	Description	Land form	Protected area representation[1]	Comments
		occur where semi-evergreen vine thicket species are absent.	undulating plains. Soils range from moderately deep cracking clays to clay loams and deep texture contrast soils.		corridor.
Land zone 11					
11.11.1	Least concern/of concern	*Eucalyptus crebra* woodland or tall woodland, often with *Acacia rhodoxylon*. Other species that may be present include *Corymbia citriodora*, *C. leichhardtii*, *E. melanophloia*, *C. erythrophloia*, *C. clarksoniana*, *E. fibrosa* subsp. *fibrosa* and *E. moluccana* on lower slopes.	Occurs mainly on sub-coastal hills and ranges formed on moderately to strongly deformed and metamorphosed sediments and interbedded volcanics.	Medium	May be present in small areas near the centre of the corridor in the vicinity of Fig Tree south to the Suttor Development Road. A minor RE within the preliminary investigation corridor.
11.11.9	Least concern/of concern	*Eucalyptus populnea* or *E. brownii* woodland to open-woodland.	Occurs on undulating rises and lower slopes of hills formed on moderately to strongly deformed and metamorphosed sediments and interbedded volcanics.	Low	Primarily located in the south and central sections of the preliminary investigation corridor on rocky rises.
11.11.13	Of concern/of concern	*Acacia harpophylla* shrubby open-forest or *A. argyrodendron* shrubby low open-forest or woodland. *Terminalia oblongata*, *Eremophila mitchellii* are common components in the understorey. Emergent *Eucalyptus* spp. may be present, especially *E. populnea*.	Occurs on undulating rises and low hills often with distinct strike pattern formed on moderately to strongly deformed and metamorphosed sediments and interbedded volcanics.	Low	Mapped in two small areas at both ends of the preliminary investigation corridor. A minor RE within the preliminary investigation corridor.

RE code	VM Act status/ biodiversity status	Description	Land form	Protected area representation[1]	Comments
11.11.18	Endangered/ endangered	Semi-evergreen vine thicket.	Occurs on undulating plains, rises and gentle slopes of ranges formed on moderately to strongly deformed and metamorphosed sediments and interbedded volcanics.	Low	Mapped in one small polygon that was not ground truthed. A minor RE within the preliminary investigation corridor.
11.11.19	Least concern/of concern	*Eucalyptus thozetiana*, *Acacia harpophylla* woodland.	Occurs on moderately to strongly deformed and metamorphosed sediments and interbedded volcanics located on lowlands and footslopes.	Low	Relatively common in the south of the preliminary investigation corridor, particularly on Disney.
Land zone 10					
11.10.7	Least concern/of concern	*Eucalyptus crebra* and/or *E. melanophloia* +/- *E. populnea* shrubby woodland. *Eucalyptus melanophloia* and/or *E. crebra* predominate and form a distinct but open canopy. *E. populnea* is commonly present and may be locally dominant particularly on lower slopes.	Occurs on the lower slopes of scarp retreats, associated with dissected tablelands. Associated soils are generally moderately deep, acidic, sandy, yellow earths and sandy-surfaced texture contrast soils formed from medium to coarse-grained sediments.	Low	Primarily located on Cerito in the vicinity of the Bowen Development Road. A minor RE within the preliminary investigation corridor.

RE code	VM Act status/ biodiversity status	Description	Land form	Protected area representation[1]	Comments
Land zone 9					
11.9.1	Endangered/ endangered	Open-forest to woodland of *Eucalyptus cambageana* or *E. thozetiana* and *Acacia harpophylla*. *Eucalyptus cambageana* is commonly codominant with *Acacia harpophylla* in the open-forest, or the open-forest may be dominated by *A. harpophylla* and have scattered emergent *Eucalyptus cambageana* or *E. thozetiana* trees. The *A. harpophylla* trees range from about 12 m to 14 m in height and the eucalypts 15-18 m high. In central western areas the *Acacia harpophylla* may form tall shrubland c. 4 m high with emergent *Eucalyptus cambageana* trees 10-12 m high. The community has a moderately dense to dense lower tree/tall shrub layer dominated by species such as *Eremophila mitchellii, Carissa ovata* and *Geijera parviflora*, with *Terminalia oblongata* often present in the north. The ground layer is frequently sparse.	Associated with slopes and crests of undulating plains and below low ridges and escarpments formed from Cainozoic to Proterozoic consolidated, fine-grained sediments. Texture contrast soils predominate, often with surface stone or gravel in sub-surface horizons, but other soils such as clays, sandy clay loams and cracking clays may also be present.	Low	Present in small areas across the length of the preliminary investigation corridor.
11.9.2	Least concern/of concern	*Eucalyptus melanophloia* and/or *E. orgadophila* grassy woodland to open-woodland. Other tree species occasionally present as subdominants include *Corymbia erythrophloia*, *Eucalyptus populnea* or *Corymbia dallachiana*.	Occurs on rises on undulating plains with cracking clay or texture contrast soils	Medium	Mapped in a number of small polygons, mostly near the centre of the preliminary investigation corridor.

RE code	VM Act status/ biodiversity status	Description	Land form	Protected area representation[1]	Comments
11.9.3	Least concern/of concern	Grassland dominated by *Dichanthium sericeum* and/or *Astrebla* spp. (*A. lappacea*, *A. elymoides* and *A. squarrosa*) but contains large numbers of short-lived perennial grasses, annual grasses and annual forbs, which may dominant depending on seasonal conditions and management regime. Isolated low shrubs and trees and open-woodland occur in some areas, including *Eucalyptus melanophloia*, *E. orgadophila*, *Corymbia erythrophloia*, *Lysiphyllum carronii*, *Atalaya hemiglauca*, *Acacia pendula*, *A. omalophylla* and *Geijera parviflora*.	Occurs on gently undulating to undulating plains and rises with cracking clay soils derived from fine-grained sediments.	Low	Mapped over one polygon near the Bowen River – presence was not confirmed during surveys. A minor RE within the preliminary investigation corridor.
11.9.9	Least concern/of concern	*Eucalyptus crebra* grassy woodland. *Eucalyptus moluccana* sometimes conspicuous on lower slopes.	Occurs on Cainozoic to Proterozoic consolidated, fine-grained sediments.	Low	A relatively common RE across the preliminary investigation corridor, more prevalent in the northern half.
11.9.10	Of concern/ endangered	*Eucalyptus populnea* predominates forming a distinct but discontinuous canopy (15-18 m tall). *Acacia harpophylla* and sometimes *Casuarina cristata* usually forms a lower tree layer (8-14 m tall) which occasionally becomes the dominant layer. An open to moderately dense layer of tall shrubs is usually present and dominated by *Eremophila mitchellii* and *Geijera parviflora* with *Acacia excelsa*, *Atalaya hemiglauca*, *Psydrax oleifolia*, *Alectryon oleifolius* frequent. Scattered low shrubs such as *Carissa ovata* and	Occurs on Cainozoic to Proterozoic consolidated, fine-grained sediments, lower parts of undulating plains often with deep texture-contrast soils, or on sodic and saline soils which may act as a discharge area if adjacent to alluvium.	Low	Mapped in three polygons, generally as a sub-component. A minor RE within the preliminary investigation corridor.

RE code	VM Act status/ biodiversity status	Description	Land form	Protected area representation[1]	Comments
		Eremophila deserti are frequently present. The ground cover is usually sparse, and dominated by the grasses *Aristida ramosa*, *Enteropogon acicularis*, *Bothriochloa decipiens* and *Paspalidium* spp.			
11.9.12	Endangered/ endangered	Grassland dominated by *Dichanthium sericeum* and forms a mosaic with clumps of *Acacia harpophylla*, *Lysiphyllum hookeri* and *L. carronii* (usually 8+/-3 m high). A range of other grass and forb species are usually present and may dominant depending on seasonal conditions and management regime.	Occurs on undulating plains and rises, on Cainozoic to Proterozoic consolidated, fine-grained sediments. Associated soils are shallow to deep cracking clays that may be self-mulching, with linear gilgai present in places.	Low	Mapped on alluvial plains associated with the Bowen River. A minor RE within the preliminary investigation corridor.
Land zone 7					
11.7.1	Least concern/of concern	*Eucalyptus thozetiana* predominates forming a distinct but discontinuous canopy (13-21 m high) although localised areas may be dominated by a wide range of species. Occasionally scattered *E. microcarpa* or *Casuarina cristata* or *Acacia harpophylla* and sometimes *E. cambageana* (12-13 m emergents) are present in the canopy or locally dominant.	Occurs on the slopes and scarps of rocky residual ranges with Cainozoic lateritic duricrust. The soils are shallow, gravelly, acidic loams and clays on the upper slopes, with deep (70-105 cm deep), uniform, brown clays with surface gravel on the lower slopes.	Low	This RE is scattered over the southern half of the preliminary investigation corridor in small patches.

RE code	VM Act status/ biodiversity status	Description	Land form	Protected area representation[1]	Comments
11.7.2	Least concern/no concern at present	Monospecific stands of *Acacia* spp. forest/woodland on Cainozoic lateritic duricrusts. *Acacia shirleyi* and or *Acacia catenulata* usually predominate the woodland to low woodland to low open-forest tree canopy (7-12 m high). Emergent eucalypt species such as *Eucalyptus thozetiana*, *E. crebra*, *E. decorticans* and *E. exserta* may be present.	Occurs on scarps and adjacent tops and slopes of dissected tablelands, mesas and buttes formed from chemically altered sediments and duricrusts. The soils are shallow to very shallow lithosols with surface stone and boulders.	Low	This RE is scattered over the southern half of the preliminary investigation corridor in small patches.
11.7.3	Least concern/no concern at present	*Eucalyptus persistens* low open-woodland often with a *Triodia mitchellii* ground layer. Other scattered eucalypts such as *Corymbia leichhardtii* or *Eucalyptus melanophloia* may also occur.	Occurs on the stripped margins of ranges and plateaus. Soils are usually shallow loamy red earths overlying a hard pan.	Low	This RE is scattered over the southern half of the preliminary investigation corridor in small patches.
Land zone 5					
11.5.2	Least concern/no concern at present	*Eucalyptus crebra* +/- *Corymbia clarksoniana* +/- *C. citriodora* +/- *E. moluccana* woodland. Sparse ground layer and sparse to mid-dense shrub/low tree layer. On duplex soils, *Allocasuarina luehmannii* low tree layer is often present and can be the dominant layer in some areas.	Occurs on Cainozoic sandplains which are often below hills and ranges.	Low	A relatively common RE located in the southern half of the preliminary investigation corridor.
11.5.3	Least concern/no concern at present	*Eucalyptus populnea* +/- *E. melanophloia* +/- *Corymbia clarksoniana* +/- *C. dallachiana* and occasionally *E. cambageana* or *E. brownii* dominate the tree layer (14 m median height and	Occurs on flat to gently undulating plains formed from Cainozoic sediments. Associated soils are	Low	A relatively common RE located in the southern and central sections of the preliminary investigation corridor.

RE code	VM Act status/ biodiversity status	Description	Land form	Protected area representation[1]	Comments
		11-15 m range) woodland. Localised areas may be dominated by *E. melanophloia*, occasionally *E. crebra* and other canopy species.	generally deep texture contrast with thick sandy surface horizons with some deep red earths.		
11.5.9	Least concern/no concern at present	*Eucalyptus crebra* and/or *Eucalyptus melanophloia* woodland. Other tree species that may be present and locally dominant include *Corymbia citriodora* or *C. clarksoniana* sometimes in association with *C. intermedia, C. dallachiana, C. lamprophylla, E. tenuipes, E. exserta, E. cloeziana, E. acmenoides*. The mid layer ranges from absent to a sparse to dense shrubland typically dominated by *Acacia* spp. (such as *A. excelsa, A. leiocalyx*), *Petalostigma pubescens, Lysicarpus angustifolius, Alphitonia excelsa* and occasionally *Melaleuca nervosa* (on texture contrast soils).	Occurs on plateaus and broad crests of hills and ranges which are formed by Cainozoic sandplains. Soils are generally deep red earths.	Low	A relatively common RE located in the southern and central sections of the preliminary investigation corridor.
11.5.12	Least concern/no concern at present	*Corymbia clarksoniana* and *C. dallachiana* +/- *C. lamprophylla* +/- +/- *Callitris glaucophylla* +/- *Corymbia tessellaris* woodland. A low tree layer comprising species such as *Lysicarpus angustifolius*, *Acacia leiocalyx* and sometimes *Melaleuca nervosa* is often present.	Occurs on colluvial lower slopes of Cainozoic sandplains.	Low	A relatively commonly mapped RE, often in a mixed polygon with the RE 11.5.3.
11.4.2	Of concern/of concern	*Eucalyptus populnea/brownii* or *E. melanophloia* +/- *Corymbia dallachiana* +/- *C. tessellaris* +/- *E. crebra* +/- *E. platyphylla* woodland.	Occurs on Cainozoic clay plains, often on rises or patches of coarser textured material. Cracking clay and	Low	Mapped in two small polygons in the southern half of the preliminary investigation corridor. A minor RE within the preliminary

RE code	VM Act status/ biodiversity status	Description	Land form	Protected area representation[1]	Comments
			texture contrast soils.		investigation corridor.
Land zone 4					
11.4.4	Least concern/of concern	Tussock grassland dominated by *Dichanthium* spp. +/- *Astrebla* spp. (mainly *A. lappacea* and *A. pectinata* occurs on flat to gently undulating clay plains formed from Cainozoic or weathered basalt unconsolidated sediments.	Soils are generally moderately to deep to very deep dark grey self-mulching cracking clays with linear gilgai. Gravel or stone may be present in some areas.	None	Mapped within a small number of polygons in the southern half of the preliminary investigation corridor, but not observed during field surveys. A minor RE within the preliminary investigation corridor.
11.4.5	Of concern/ endangered	*Acacia argyrodendron* dominates the very sparse canopy (12-16 m high). There are usually scattered small trees (6-10 m high) including *A. argyrodendron*, *Terminalia oblongata*, *Owenia acidula*, *Lysiphyllum carronii* and *Eremophila mitchellii*.	Occurs on flat to gently undulating plains formed from unconsolidated Cainozoic deposits.	Low	Mapped within a small number of polygons in the southern half of the preliminary investigation corridor, but not observed during field surveys. A minor RE within the preliminary investigation corridor.
11.4.6	Of concern/ endangered	*Acacia cambagei* dominates the tree canopy (10-13 m high). There is a sparse to open low tree layer (7-9 m high) dominated by *Lysiphyllum carronii*, *Geijera parviflora*, *Acacia harpophylla*, and sometimes *A. argyrodendron*, *Terminalia oblongata*, and *Eremophila mitchellii*.	Occurs on gently undulating plains formed from Cainozoic sediments. Associated soils are texture contrast with thin sandy or loamy surface horizons and strongly alkaline clay subsoils.	Low	A relatively common RE within the southern third of the preliminary investigation corridor (south of the Suttor Development. Road).

RE code	VM Act status/ biodiversity status	Description	Land form	Protected area representation[1]	Comments
11.4.8	Endangered/ endangered	Woodland to open-forest dominated by *Eucalyptus cambageana* and *Acacia harpophylla* or, sometimes in the north, *A. argyrodendron*. *E. thozetiana* is sometimes present on shallower soils.	Occurs on level to gently undulating plains formed from Cainozoic deposits. Associated soils are usually deep texture contrast with thin loamy or sandy surface horizons overlying strongly alkaline clay subsoils.	Low	A relatively common RE within the southern half of the preliminary investigation corridor (north to the Bowen river).
11.4.9	Endangered/ endangered	Open-forest, occasionally woodland, dominated by *Acacia harpophylla* usually with a low tree mid-storey of *Terminalia oblongata* and *Eremophila mitchellii*. *Casuarina cristata* sometimes replaces *Acacia harpophylla* in the overstorey and *Lysiphyllum cunninghamii* sometimes co-dominates.	Occurs on level to gently undulating Cainozoic plains, including weathered basalt. Associated soils are predominantly moderately deep to deep cracking clays that may be brown, red-brown or grey-brown, and with much surface gravel in some areas.	Low	A relatively common RE within the southern half of the preliminary investigation corridor (north to the Bowen river).
11.4.11	Of concern/of concern	*Dichanthium sericeum* and *Astrebla* spp. grassland with patches of low *Acacia harpophylla* or *Eucalyptus coolabah*. Grassland dominated by *Dichanthium sericeum* and forms a mosaic with clumps of *Acacia harpophylla*, *Lysiphyllum hookeri* and *L. carronii* (usually 8+/- 3 m high). A wide range of other grass and forb species are usually present and may dominant	Occurs in shallow open valleys and poorly drained Cainozoic clay plains with deep cracking clay soils.	Low	Mapped over a small number of polygons within the southern half of the preliminary investigation corridor, but not recorded during field surveys – commonly these mapped areas are oversown with exotic buffel grass.