# 12.0 Flora and fauna

## 12.1 Introduction

This chapter of the Environmental Impact Statement (EIS) provides the flora and fauna assessment for the Project. The Project is located in the Eastern Darling Downs province of the Brigalow Belt Bioregion (Bioregion), and between Bunya Mountains National Park and Diamondy State Forest (Figure 12.1, Volume 2) and is subject to a number of flora and fauna values.

The chapter describes the known ecological values within and adjacent to the Project Site that have been retrieved from desktop resources and a series of on-site investigations. This information has been used through the design refinement process to select the Project Site, including avoidance of threatened ecological values where possible. The potential impacts to flora and fauna from the construction and operational works within the Project Site are discussed and, where relevant, mitigation measures are provided to suitably avoid, minimise and/or mitigate those potential impacts.

## 12.2 Scope of assessment

The aim of this assessment is to identify the ecological values that may exist within the Study Area and Project Site. This assessment seeks to use this information to:

- Identify and map areas that are environmentally sensitive to the proposed construction of operation of the Project
- Describe the terrestrial flora and fauna values within the Study Area and Project Site
- Provide input to the design refinement process, so that
    - impacts to: (i) remnant vegetation; (ii) high value regrowth vegetation; (iii) essential habitat; and (iv) riparian areas are minimised
    - turbines avoid (where possible) remnant vegetation, regrowth vegetation, and habitat identified as important for species of conservation significance, in particular to minimise the occurrence of bird and bat strikes
    - individual paddock trees are avoided, which could provide stepping stones for fauna moving through the Study Area.
- Provide an assessment of the potential impacts to all flora and fauna values within the Study Area
- Outlines measures to mitigate the impacts of the Project on the flora and fauna values, including residual and cumulative impacts
- Consider the relevant legislative requirements to protect ecological values, including where works require permits, approvals and offsets.

## 12.3 Legislation and policy

### 12.3.1 Commonwealth

**Environment Protection and Biodiversity Conservation Act 1999**

The EPBC Act provides the legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places. These are defined under the EPBC Act as ‘matters of national environmental significance’ (MNES). Under the EPBC Act, a referral to the Department of the Environment and Energy (DOTEE) would be required if the Project had the potential to cause a ‘significant impact’ on MNES. The determination is made with reference to the Matters of National Environmental Significance Significant Impact Guidelines 1.1 (DEWHA 2009) and other EPBC Act policy statements including significant impact guidelines for individual threatened species, groups of species and threatened ecological communities (DOTE, 2016).

The Project has been referred to the DOTEE (and its predecessors, the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) and the Department of Environment, Water, Heritage and the Arts (DEWHA)) on three occasions for determination of controlled action status. On each

occasion a decision was returned that the Project was “not a controlled action”. The most recent decision notice (received on 29 July 2011 - Ref. 2011/5976) was based on the Project Site assessed as part of the Initial Assessment Report, published in 2011.

An assessment on MNES was undertaken based on the updated layout for the Project and taking into consideration changes to the EPBC Act Protected Matters database search tool (PMST) since 2011. Based on the likelihood of occurrence and the significance of potential impacts to threatened communities and species, an updated referral to DOTEE is not considered to be required. The EPBC Act MNES assessment is summarised in Chapter 3 Legislative Framework.

### 12.3.2 Queensland

**Nature Conservation Act 1992**

The Object of the *Nature Conservation Act 1992* (NC Act) is “the conservation of nature” (Section 4, NC Act). Section 5 of the NC Act sets out how the object is to be achieved.

In support of the NC Act, the Nature Conservation (Wildlife) Regulation 2006 (NCWR) lists ‘protected wildlife’ (flora and fauna species), which are considered to be ‘extinct in the wild’, ‘Endangered’ (E), ‘Vulnerable’ (V) and ‘Near Threatened’ (NT) (EVNT species) and ‘Least Concern’ (LC) wildlife. Under Sections 88 and 89 of the NC Act, it is an offense to take or use protected wildlife, which is outside a ‘protected area’, unless exemptions apply or an approval (e.g. clearing permit) is obtained from the Department of Environment and Heritage Protection (DEHP).

It is also an offense under Section 332 of the Nature Conservation (Wildlife Management) Regulation 2006 (NCWMR) to interfere with an animal breeding place used by protected wildlife to incubate or rear the animal’s offspring unless an exemption applies or an approval is given by way of a Species Management Plan (SMP) submitted by the applicant.

**Environmental Protection Act 1994**

The object of the EP Act is to protect Queensland’s environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development) (refer Section 3, EP Act). Section 4 of the EP Act sets out how the object of the Act is to be achieved.

The EP Act provides the key legislative framework for the protection of the environment in Queensland. Section 319 of the EP Act imposes a ‘general environmental duty’, which specifies that a person must not undertake any activity that may harm the environment without taking reasonable and practical measures to prevent or minimise the harm.

The Project follows the ‘Avoidance’, ‘Mitigation’ and ‘Offset’ principle, thus taking reasonable and practical measures to prevent or minimise harm. Avoidance has been achieved through the design refinement process detailed in Chapter 2 Project Description which has guided the alignment of the Project Site to avoid ecologically significant areas. In cases where avoidance is not possible, mitigation and management measures have been provided (refer Section 12.7).

**Vegetation Management Act 1999**

The *Vegetation Management Act 1999* (VM Act) regulates the clearing of native vegetation in Queensland. The purpose of the VM Act is to regulate the clearing of vegetation in a way that: (a) conserves remnant vegetation; (b) conserves vegetation in declared areas; (c) ensures that clearing does not cause land degradation; (d) prevents the loss of biodiversity; (e) maintains ecological processes; (f) manages the environmental effects of the clearing to achieve the matters mentioned in paragraphs (a) to (e); and (g) reduces greenhouse gas emissions (refer s3(1) of the VM Act). Section 3(2) of the VM Act outlines how the purpose of the Act is to be achieved.

The VM Act protects and regulates the clearing of native vegetation including ‘remnant’ vegetation (shown as Category B area on the Regulated Vegetation Management Map) on freehold land, Indigenous land and State tenures. The VM Act also protects and regulates the clearing of particular ‘regulated regrowth’ vegetation, and areas designated for offsets or compliance.

Clearing of regulated vegetation is made assessable under the *Sustainable Planning Act 2009* (SP Act). Schedule 3 of the Sustainable Planning Regulation 2009 details that operational work for clearing native vegetation is code assessable, unless the clearing is under a structure plan or is clearing mentioned under schedule 24 of the SP

Act. These exemptions do not apply to the Project and a development approval under the SP Act must be sort for the clearing.

The *Vegetation Management Framework Amendment Act 2013* was passed in May 2013 which significantly reformed the vegetation management framework in Queensland including the removal of regrowth regulations. Prior to May 2013 desktop and field assessments were undertaken to confirm the presence of 'high value regrowth' within the Project. The presence of regrowth vegetation has continued to be used to inform the assessment and siting of the Project Site and its infrastructure.

The *Vegetation Management (Reinstatement) and Other Legislation Amendment Bill 2016* was introduced on 17 March 2016 which if passed will change the vegetation management framework and will be effective from the date the Bill was introduced. These changes include (but are not limited to) regulations around the clearing of high-value regrowth (category C) and regrowth vegetation within 50 m of a watercourse in the Burnett-Mary, Eastern Cape York and Fitzroy Great Barrier Reef catchments (category R). The requirements relating to proposed category C and R (which do occur within the Project Site) do not take effect until the proposed Reinstatement Bill is passed, at which stage they will be addressed.

**Land Protection (Pest and Stock Route Management) Act 2002**

The main purpose of the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act) is to provide for: (a) pest management; and (b) stock route network management (refer Section 3, LP Act). Section 4 sets out how these purposes are to be achieved.

The LP Act provides a legislative framework for managing pest species and addressing their economic, environmental and social impact. The associated Land Protection (Pest and Stock Route) Regulation 2003 (LPR) declares the pest plants and pest animals for control and management in the State.

Under the LP Act, specified plants and animals are listed as 'declared pests', and assigned a Class of threat. Depending upon the Class, a range of statutory restrictions is activated. There are three Class categories, Class 1 pest, Class 2 pest and Class 3 pest. These categories, their description and statutory restrictions are noted in Table 12.1. The Project will need to consider the presence and potential spread of 'declared pests' within the Study Area that may result from Project activities.

**Table 12.1 Categories of declared pests in Queensland listed under the LP Act, their description and legislative requirements.**

| Category | Description | Statutory requirements |
|---|---|---|
| Class 1 | A plant or animal that:<br>- Is not commonly present in Queensland and, if introduced, would cause an adverse economic, environmental or social impact.<br>- Are subject to eradication by the State | Class 1 pests established in Queensland are subject to eradication from the state.<br>Land owners must take reasonable steps to keep land free of Class 1 pests.<br>It is a serious offense to introduce, keep or supply a Class 1 pest without a permit issued by Biosecurity Queensland. |
| Class 2 | A plant or animal that:<br>- Is established in Queensland and have, or could have, an adverse economic, environmental or social impact<br>- Requires coordination and are subject to programs led by local government, community and landowners. | Landowners must take reasonable steps to keep land free of Class 2 pests.<br>It is a serious offense to introduce, keep or supply a Class 2 pest without a permit issued by Biosecurity Queensland. |
| Class 3 | A plant that:<br>- Is established in Queensland and has, or could have, a substantial adverse economic, environmental or social impact. | Landowners may be required to manage Class 3 weeds in or near environmentally significant areas such as protected areas, important habitats for threatened species or areas of interest only. |

**Queensland Environmental Offsets Framework**

The Queensland Environment Offsets Frameworks provides a single approach to environmental offsets and aligns requirements across three levels of government.

The offset framework includes:

- The *Environmental Offsets Act 2014*, which establishes the environmental offset framework with the purpose of counterbalancing significant residual impacts of particular activities on prescribed environmental matters through the use of offsets;
- The Environmental Offsets Regulation 2014, which provides the details of prescribed activities regulated under existing legislation and prescribed environmental matters to which the Act applies; and
- Queensland Environmental Offsets Policy (V1.1), which clarifies how environmental offsets should be delivered. This policy provides a single, streamlined framework for environment-related offsets in Queensland. This policy replaces the following offset policies:
    - Queensland Government Environmental Offsets Policy (2008)
    - Marine Fish Habitat Offsets Policy (version FHMOP005.2)
    - Policy for Vegetation Management Offsets (2011)
    - Queensland Biodiversity Offset Policy (2011)
    - Offsets for Net Gain in Koala Habitat in South East Queensland Policy (2010).

**Environmental Offsets Act 2014 and Environmental Offsets Regulation 2014**

Under Section 14 of the *Environmental Offsets Act 2014*, offsets conditions can only be imposed for prescribed activities if:

- a prescribed activity will, or is likely to have, a significant residual impact on a prescribed environmental matter; and
- all reasonable on-site mitigation measures for the prescribed activity have been, or will be, undertaken.

Prescribed activities are the subject of an authority under another Act for which an offset condition may be imposed and is detailed in Schedule 1 of the Offsets Regulation. The Project is likely to entail a prescribed activity as it will be subject to the application of a development approval for the clearing of regulated vegetation (a prescribed environmental matter) under the SP Act, for which an environmental offset may be required.

The environmental offset required for the Project will be determined following the detailed design (at which stage the extent of clearing will be confirmed) and if necessary an Offset Strategy will be developed to support all relevant approvals and authorities. It is not anticipated at this stage that the Project will require an authority for impacts to other prescribed environmental matters besides clearing of regulated vegetation.

**State Development Assessment Provisions – Module 20 Wind Farm Development**

Under Module 20 of the SDAP, wind farm development is required to ensure that impacts on flora, fauna and associated ecological processes are avoided, or minimised and mitigated, through effective siting, design and operation of the development. This is addressed below, and a compliance assessment is provided in Appendix M State Development Assessment Provisions Compliance Assessment.

## 12.4 Methodology

### 12.4.1 Desktop assessment

A desktop review of information relating to flora and fauna values within and surrounding the Study Area has been undertaken. The review considered the following datasets, government publications, published literature and previous field studies:

- DOTE's EPBC PMST (March 2016) to identify MNES that may occur within the Study Area. A copy of the search data is provided in Appendix D, Volume 3
- DEHPs' Wildlife Online database to identify flora and fauna species, including EVNT species recorded from or surrounding the Study Area. A copy of the search data is provided in Appendix D, Volume 3

- DNRM Regulated Vegetation Management Map (2016) to determine the extent of Category A, Category B and Category R vegetation within and surrounding the Study Area. The occurrence of remnant vegetation (Category B) in the Study Area is provided as the relevant Regional Ecosystems on Figure 12.2, Volume 2
- DNRM's Vegetation Management Supporting Map (2016) including Essential Habitat and Wetland mapping. Note that the Study Area does not contain either of these designations
- DEHP's certified Biodiversity Planning Assessment (BPA) mapping to identify significant wildlife corridors and areas of State, regional and local biodiversity significance. An extract of the BPA mapping is provided on Figure 12.3, Volume 2
- DEHP's Protected plants flora survey trigger map (2016) to identify the high risk areas for protected plants and determine whether a flora survey and a clearing permit is required. There are no high risk areas within the Project Site
- The Queensland Herbarium Regional Ecosystem Description Database (REDD) for current RE descriptions and geological and land zone descriptions
- Atlas of Living Australia database (2016) incorporating Queensland Herbarium HERBRECS specimens and Queensland Museum species database
- Land Zones of Queensland (Wilson & Taylor, 2012) for a description of land zones
- Coopers Gap Wind Farm Flora and Fauna Assessment (ERM, 2008).

The search extent for the Protected matters searches and wildlife online specified a search radius of 20 km from the Study Area centre point (-26.71° South, 151.42° East). The search results are provided in Appendix D, Volume 3.

### 12.4.2 Field assessments

For the purpose of the field assessments the 'Study Area' was defined as the properties of 'involved landholders' (Figure 2.1, Volume 2).

In February 2008, a flora and fauna survey of the Study Area was undertaken over nine days and consisted of:

- Surveying 37 flora sites to describe the structure, composition and condition of the vegetation; and targeting habitats suitable for threatened flora
- Fauna habitat assessment
- Diurnal bird surveys developed and adapted from the AUSWEA Guidelines – Wind Farms and Birds: Interim standards for Risk Assessment (Brett Lane and Associates 2005), including: (i) a regional assessment of threatened and migratory species, and a one day preliminary site assessment to determine broad habitat values; (ii) fourteen dedicated bird utilisation surveys (point area search method with each point being surveyed for 20 minutes); and (iii) roaming/meander bird surveys throughout all habitat types
- Call playback and spotlighting for nocturnal birds
- Call playback for amphibians
- Three nights of ultrasonic bat detection. The habitats sampled were described as: (i) ridgeline in the vicinity of the proposed turbines; (ii) a remnant woodland community; and (iii) wooded stream bank vegetation
- Opportunistic sightings of species and evidence of fauna activity (scratches, scats, etc.).

Documented survey locations are shown on Figure 12.4 and Figure 12.5 in Volume 2.

Further site assessment was carried out between 2010 and 2013 and involved three stages:

- Stage 1: Flora, bird and bat surveys (October 2010)
- Stage 2: Comprehensive terrestrial fauna survey (February and May 2012)
- Stage 3: Comprehensive terrestrial flora survey, fauna habitat assessments and koala surveys (February 2013).

This was undertaken to address the following:

- The addition and removal of a number of threatened flora and fauna species listed under the EPBC Act and NC Act
- Updated desktop search results from databases including the EPBC Act PMST, wildlife online, Queensland Museum and the Queensland Herbarium
- Changes to the status of Regional Ecosystems listed under the VM Act
- Changes to the Regional Ecosystem Maps with the release of Version 6.1
- The introduction of legislation protecting 'High Value Regrowth' (which has subsequently been removed)
- The need to undertake spring survey for two of the threatened orchids known from the locality
- Detailed and targeted fauna surveys
- More detailed microchiropteran bat surveys.

#### 12.4.2.1 Stage 1: Threatened flora, bird and bat surveys (October 2010)

The stage 1 surveys were undertaken by two ecologists between 25 October 2010 and 30 October 2010 (the 2010 Survey). This assessment focussed on surveying suitable habitat for threatened bats, birds and flora (specifically orchids) with the potential to occur within the Study Area. The results of the October 2010 survey are attached as Appendix D in Volume 3.

**Threatened flora survey**

Database searches (undertaken in 2010) identified the potential occurrence of a number of threatened flora species in the Study Area: Mt Berryman Phebalium (*Phebalium distans*), Austral Cornflower (*Rhaponticum australe*), Austral Toadflax (*Thesium australe*), Ooline (*Cadellia pentastylis*), Bailey's Cypress Pine (*Callitris baileyi*), Finger Panic Grass (*Digitaria porrecta*) and Slender purple donkey orchid (*Diuris parvipetala*). The 2008 field assessment had also identified the Cobar greenhood orchid (*Pterosylis cobarensis*) as a possible occurrence.

The 37 flora assessment sites completed in the 2008 field survey provided a reasonable degree of insight into the habitat values of the Study Area for most of the threatened flora species. However, it was acknowledged that the summer survey period was not appropriate for sampling native orchids. Therefore in 2010, a further 18 sites were surveyed in areas of remnant vegetation and regrowth vegetation in close proximity (within 20 m) of potential turbine locations. At each survey site a preliminary qualitative assessment was undertaken to record characteristics such as landform, dominant flora species, disturbance and condition. Regional ecosystem mapping was ground-truthed, and specific searches were conducted for the target threatened species. The spring survey period was suitable for detecting both the Cobar greenhood orchid and the slender purple donkey orchid (TSSC, 2008 and Stanley and Ross, 1983).

**Microchiropteran Bat surveys**

Ultrasonic bat call detectors were placed at nine locations throughout the Study Area and sampled a range of broad habitat types. Survey effort targeted microhabitat of greatest habitat value, and detectors were set at sites where the greatest number and diversity of species were likely to be recorded.

Sampling sites within remnant vegetation was conducted in riparian woodland; Eucalypt woodland and open forest; and vine thicket. A dam was the focus for sampling in the non-remnant open grassland community as water bodies are known to be a common focus for microchiropteran bats in sparsely vegetated areas.

The detectors were secured to trees at approximately 1.5 m above ground level and left in place for three to nine nights. Sampling sites are shown on Figure 12.5 in Volume 2. Table 12.2 identifies the broad habitat type at each sampling site and the number of sampling nights conducted.

**Table 12.2 Number of Bat Detection Nights at each ultrasonic bat detector sites**

| Sampling site | Broad habitat type | Number of sampling nights |
|---|---|---|
| B1, B3, B4, B9 | Fringing riparian woodland | 9, 5, 3, 6 respectively. |
| B2 | Non-remnant open grassland (next to a man-made dam) | 7 |
| B5, B7 | Eucalypt woodland or open forest | 3, 3 respectively |
| B6 | Vine thicket | 7 |
| B8 | Non-remnant open grassland (on an open hill) | 3 |
| | **Total nights** | **46** |

Harp trapping was also used in identifying the presence of microchiropteran bats. Three harp traps were set in wooded riparian areas with suitably enclosed flyways. Sampling sites B2 and B4 were located in riparian woodland adjoining first order watercourses. Sampling site B3 was located in the flyway of a stream order three watercourse. The watercourse contained small pools of water at the time of survey. A fourth sampling site (B1) was located in a small dam in a sparsely vegetated area. All bat calls were identified by a specialist in the analysis of micro-bat echolocation calls in eastern Australia.

**Bird surveys**

A meandering search technique targeting the areas less disturbed habitat (remnant vegetation and regrowth vegetation) was used to survey birds across the Study Area. Surveys commenced at dawn and continued throughout the day. Surveys were conducted for the duration of the survey period. The open grassland areas were subject to opportunistic survey during vehicle traverse. Hilltop vantage points were used to observe aerial hunters, feeders and scavengers such as raptors, wood swallows and bee-eaters. At least 15 minutes was spent at each vantage point in an effort to record these species.

#### 12.4.2.2 Stage 2: Terrestrial fauna surveys and threatened fauna searches

Following the consultation period of the 2011 IAR, the Queensland Department of Environment and Resource management (DERM) (now Department of Environment and Heritage Protection (DEHP)) issued an information request seeking further detail on a range of matters, including vegetation management, biodiversity and protected flora and fauna. To meet this request, additional survey effort was proposed and agreed with DERM that built upon the surveys undertaken over different seasons in earlier years, including a trapping program targeting small terrestrial mammals.

This additional survey was undertaken between 20 February 2012 and 25 February 2012 (the 2012 Summer Survey) which was limited by poor weather. To supplement this, further survey was undertaken between 14 May 2012 and 16 May 2012 (the 2012 Autumn Survey).

During these surveys, four detailed trapping sites were established in habitat types most suitable to the identified threatened fauna species. Figure 12.5 in Volume 2 shows the location of the detailed survey sites; Table 12.3 describes the broad habitat types in which the detailed survey sites were located; and Table 12.4 describes the survey methods completed at the detailed survey sites (it also describes the cumulative effort for the survey program).

Other fauna encountered opportunistically during the survey (e.g. during vehicle traverse) were also recorded. Signs of fauna presence such as tracks, scats, bones, scratches and diggings were analysed and recorded. Scats of unknown origin and hair samples were sent to specialists for identification.

**Table 12.3 Detailed fauna survey sites**

| Detailed trapping site | Broad habitat type | Target species |
|---|---|---|
| DS1 | Vine thicket | - Black-breasted button-quail *(Turnix melanogaster)*<br>- Northern quoll (*Dasyurus hallucatus*)<br>- Spotted-tailed quoll (s. ssp) (*Dasyurus maculatus maculatus*) |
| DS2 | Eucalypt woodland or open forest | - Collared Delma (*Delma torquata*)<br>- Yakka skink (*Egernia rugosa*)<br>- Dunmall's snake (*Furina dunmalli*)<br>- Northern quoll (*Dasyurus hallucatus*)<br>- Spotted-tailed quoll (s. ssp) (*Dasyurus maculatus maculatus*) |
| DS3 | Eucalypt woodland or open forest | - Collared Delma (*Delma torquata*)<br>- Yakka skink (*Egernia rugosa*)<br>- Dunmall's snake (*Furina dunmalli*)<br>- Northern quoll (*Dasyurus hallucatus*)<br>- Spotted-tailed quoll (s. ssp) (*Dasyurus maculatus maculatus*) |
| DS4 | Fringing riparian (non-remnant) | - Collared Delma (*Delma torquata*)<br>- Northern quoll (*Dasyurus hallucatus*)<br>- Spotted-tailed quoll (s. ssp) (*Dasyurus maculatus maculatus*) |

**Table 12.4 Methods and effort used at each detailed survey site, and overall cumulative effort**

| Method | Target species | Daily effort / site | Cumulative (total) effort / site | Cumulative (total) effort / all sites |
|---|---|---|---|---|
| Elliot 'A' | Small mammals | 25 traps (over three nights) | 75 trap nights | 225 trap nights |
| Elliot 'B' | Small to medium sized mammals | 5 traps (over three nights) | 15 trap nights | 45 trap nights |
| Funnels | Amphibians, reptiles, small mammals | 6 traps along three 5 m drift fences (2 per drift fence) (over three days) | 18 trap nights | 54 trap nights |
| Cages | Medium to large mammals | 5 traps (over three nights) | 15 trap nights | 45 trap nights |
| Cameras | All medium to large species | 1 camera (over three nights) | 3 observation nights | 12 observation nights |
| Bat detector | Microchiropteran bats | 1 detector (over two nights) (site DS2 only) | 2 recording nights | 2 recording nights |
| Hair tubes | Small to medium mammals | 10 tubes (over three nights) | 30 trap nights | 120 trap nights |
| Spotlighting and nocturnal active searches | Nocturnal species | 2hr/night for two nights | 4 hours | 16 hours |
| Diurnal active searches | Diurnal reptiles | 2hr/day over three days | 6 hours | 24 hours |
| | Black-breasted button-quail | 50min/day over three days | 2.5 hours | 10 hours |
| Bird surveys | Birds | 2 hours (over three days either in the morning of afternoon) using the random meander technique | 6 hours | 24 hours |

Active survey for the black-breasted button-quail involved a detailed traverse of suitable vine thicket habitat within or in close proximity to the Project Site. Patches greater than 10 ha were subject to traverse along transects. The traverse was undertaken to identify button quail platelets (Distinctive circular feeding depressions 15-25 cm in diameter) and to flush individuals. It was recognised that platelets can be made by the black-breasted button-quail and other button-quail species (e.g. painted button-quail *Turnix varius*), and so the presence of platelets was to be treated as a catalyst for more intensive black-breasted button-quail searches rather than conclusive proof of the species' presence.

Platelet searches were also undertaken during non-targeted site traverses (passive observation) for other purposes (e.g. setting and checking mammal traps and conducting reptile searches). Overall, it is estimated that 10 hours of active and passive observation was achieved over the three day survey period.

Survey conditions were suitable for detecting the northern quoll and spotted-tailed quoll, with the May-August months preferable due to the least amount of disruption to species reproduction periods (DSEWPC, 2011). Habitat assessments were undertaken throughout the Study Area to identify micro-habitat types in which the species was most likely to be detected. Targeted micro-habitat types included rocky outcrops, caves, crevices, hollows bearing trees and fallen logs. Habitat which incorporated these preferred habitat features were then targeted during the detailed trapping survey.

Twelve assessment sites were established for the northern quoll and spotted-tailed quoll (remote camera/hair tube sites are provided in Figure 12.5, Volume 2). Surveys undertaken at these sites included: searches for den and latrine sites; placement of remote infra-red cameras (Reconyx Hyperfire HC600) and hairtube analysis. Remote cameras were positioned at eight of the sites and left in place for 21 nights (168 sample nights). Chicken frames were pegged to the ground and lightly covered with earth to act as an attractant to the camera site. Twenty hairtubes were placed at each of the assessment sites and left in place for 21 nights (5040 sample nights). The hairtubes were baited with a mix of sardines, oats, peanut paste and honey.

Results of the fauna survey are provided in the fauna species list, Appendix D, Volume 3.

#### 12.4.2.3 Stage 3: Comprehensive flora survey and habitat assessments

Further detailed flora and habitat assessment survey across the Study Area was undertaken from 12 – 19 February 2013 (the 2013 Summer Survey).

The survey was undertaken to address limitations identified in previous assessments and provide further detail on values of concern. The scope of this assessment was to provide further detail on flora and vegetation communities; undertake a koala habitat assessment; and additional fauna habitat assessment sites.

**Comprehensive flora and vegetation**

Observations of flora and vegetation were made at 72 sites across the Study Area; primarily in areas of remnant vegetation intersecting the Project Site. In accordance with Neldner *et al*. (2012), tertiary level assessment was undertaken at 30 sites, and quaternary level assessment was undertaken at 42 sites (Figure 12.4, Volume 2, Appendix D, Volume 3).

At each of the tertiary survey sites the following data was collected:

- Site name, location (using hand-held GPS)
- Photos (taken north, east, south, west)
- Landform and soil descriptions
- Observed disturbance factors (weeds, fire, drought, grazing)
- Vegetation condition, using the scale of Kaesehagen (1994) (Table 12.5)
- Vegetation structural description using modified Specht (1970) (Neldner, Wilson, Thompson, & Dilewaard, 2012)
- Full list of vascular flora species recorded within a radius of approximately 20 m from the centre point
- Strata, height and an estimate of Foliage Projective Cover (FPC) percentage for each species.

Quaternary sites were used to confirm vegetation between tertiary sites. At each of the quaternary sites the following data was collected:

- Site name
- Location
- Remnant status
- RE
- Dominant species present
- Estimate of FPC
- Other general condition or vegetation comments.

In addition, opportunistic species, not located at a particular site but observed throughout the course of the survey, were also recorded. A flora species list is provided within Appendix D, Volume 3

Scientific names of plants follow that of the Census of the Queensland Flora (Bostock & Holland, 2010).

Species that could not be identified in the field were collected, tagged, pressed, dried and then sorted into families. Specimens were identified through comparison of named materials at the Queensland Herbarium reference collection and through the use of taxonomic keys. Specimens that could not be identified through this process were submitted to the Queensland Herbarium for identification.

**Table 12.5 The Vegetation Condition Scale of Kaesehagen (1994).**

| Vegetation condition | Description |
|---|---|
| **'Very Good to Excellent'** | - 80% to 100% native flora composition.<br>- Vegetation structure intact or nearly so.<br>- Cover/abundance of weeds <5%.<br>- No or minimal signs of disturbance. |
| **'Fair to Good'** | - 50% to 80% native flora composition.<br>- Vegetation structure modified or nearly so.<br>- Cover/abundance of weeds 5% to 20%, any number of individuals.<br>- Minor signs of disturbance. |
| **'Poor'** | - 20% to 50% native flora composition.<br>- Vegetation structure completely modified or nearly so.<br>- Cover/abundance of weeds 20% to 60%, any number of individuals.<br>- Disturbance incidence high. |
| **'Very Poor'** | - 0% to 20% native flora composition.<br>- Vegetation structure disappeared.<br>- Cover/abundance of weeds 60% to 100%, any number of individuals.<br>- Disturbance incidence very high. |

Plant communities were mapped by overlaying the flora survey locations (tertiary and quaternary sites) onto aerial photography (aerial flown April 2011) and mapped at a scale of 1:20,000. Plant communities were mapped through extrapolation of survey points and interpretation of the vegetation patterns on the aerial imagery. Supplementary information used to map plant communities included the DEHP RE boundaries, topographic contour mapping and geological mapping.

Plant communities and regrowth vegetation were attributed to an RE of the Brigalow Belt South Bioregion. REs were attributed based on land zone and dominant species data, using the Queensland Herbarium regional ecosystem classification (Queensland Herbarium 2012).

Vegetation condition was mapped by extrapolation of condition values recorded at the tertiary and quaternary survey sites and interpretation of the aerial photography. Vegetation condition was also mapped at a scale of 1:20,000.

**Koala Habitat Assessment**

On 2 May 2012, Koala populations in Queensland, New South Wales and the Australian Capital Territory were listed as Vulnerable under the EPBC Act. While the Project's "controlled action" status had already been determined by DOTEE (refer to Section 12.3), it was considered of interest during the ongoing assessment in 2012 to assess the Study Area's koala habitat values against the *Interim Koala Referral Advice for Proponents* (IKRAP) (DSEWPaC 2012) as habitat suitable for koala was known to be present in the Study Area.

The following assessments were undertaken:

- During the 2013 Summer Survey, eight koala scat search sites were established within or in close proximity to the Project Site (Figure 12.5, Volume 2). Sites were established in areas where either koala activity was observed or an appropriate suite of koala habitat trees was present (i.e. remnant or regrowth sclerophyll vegetation). Two of the sites were within areas identified as "essential regrowth habitat" for the koala (refer to Figure 12.5, Volume 2). Scat searches were undertaken in accordance with the 'Spot Assessment Technique' (SAT) (Phillips & Callaghan, 2011). The koala scat search data is provided in Appendix D, Volume 3.
- Quantitative data from the tertiary and quaternary vegetation assessment sites was used to determine if the Study Area contained "*habitat critical to the survival of the koala*". The IKRAP references the work of Callaghan (unpublished) in regard to making this assessment
- Diurnal and nocturnal canopy searches. While the recommended line transect method was not implemented, the studies undertaken since 2008 have included a significant number of hours of passive and active canopy observation during bird survey, spotlighting and general site traverse. Landholders also provided information on koala occurrence.

In 2014, DOTE finalised the EPBC Act referral guidelines for the vulnerable koala (DOTE, 2014) (the guidelines), which replaces the Draft EPBC Act referral guidelines for the vulnerable Koala (draft guidelines) which, in turn, replaced the IKRAP.

The guidelines encourage the assessment of significant impacts on the koala primarily through the assessment of habitat critical to the survival of the koala and actions that interfere substantially with the recovery of the koala. The guidelines provide a koala habitat assessment tool which is applied to the entire impact area of the Project Site. This tool has been applied to the Project (Table 12.10) based on the outcome of the survey and 2016 desktop data.

**Fauna habitat assessment**

Fauna habitat values were assessed at 28 fauna habitat sites within or adjoining the Project Site (Figure 12.5, Volume 2). The Basic Site Information data sheet (Biodiversity and Ecosystem Sciences, 2012) was used as a template for recording field data. Information from the data sheet was summarised and added to photographs showing the fauna habitat assessment site and surrounding landscape (taken to show north, east, south and west perspectives). Fauna habitat assessment sites correspond with flora assessment sites, and therefore are also focused in areas of remnant vegetation and regrowth vegetation. Survey data for fauna habitat sites is provided in Appendix D, Volume 3.

### 12.4.3 Limitations

- Heavy rainfall during Stage 2 of the field surveys forced the comprehensive sites to be shut-down after three nights
- Funnel traps were unable to be installed in Detailed Site 4 (D4) due to the very dense exotic pasture grasses and the abundance of cattle.

## 12.5 Description of environmental values

### 12.5.1 Bioregional context

The Study Area is located in the Eastern Darling Downs province of the Brigalow Belt Bioregion (the Bioregion). The bioregion is dominated by eucalypt woodlands and *Acacia* spp. forests, especially Brigalow (*Acacia harpophylla*). Several of the bioregion's vegetation types have been heavily cleared, and are now listed as Threatened Ecological Communities (TEC's) under the EPBC Act or as endangered regional ecosystems under the VM Act. Extensive past tree clearing, exotic species and high grazing pressure are key issues that threaten conservation in the bioregion (Sattler & William, 1999).

The Eastern Darling Downs province is comprised of tertiary basalts in the extreme east and Jurassic sediments in the south-east. Vegetation occurring on the basalt is predominately narrow-leaved red ironbark (*Eucalyptus crebra*), yellow box (*E. melliodora*), forest red gum (*E. tereticornis*) and white box (*E. albens*) or mountain coolibah (*E. orgadophila*). Vegetation occurring on sandstone hills supports E. crebra, with *E. moluccana/microcarpa* and poplar box (*E. populnea*) on lower slopes and valley. Areas of semi-evergreen vine thicket/araucarian microphyll rainforest are also present, particularly in the south-east (Sattler & William, 1999).

### 12.5.2 General site description

The Study Area is comprised of highly cleared landscapes characteristic of the broader locality. Low intensity grazing on mixed native / exotic pasture is the predominant land use, but there is improved pasture on some lower slopes and cropping on fertile valley floors.

Remnant vegetation comprises less than 10% of the Study Area and includes sclerophyll and vine thicket communities. The Project Site intersects remnant vegetation in only a limited number of areas. The remainder of the Study Area consists of regrowth vegetation, scattered trees and shrubs amongst pasture. Vegetation is described further in Section 12.5.4.

### 12.5.3 Geology and land zones

Geology mapping (Natural Resource Sciences, 2004) shows that three geological units underlie the Study Area.

Land zones are categories that describe the major geologies and associated landforms and geomorphic processes of the State of Queensland. The differences between land zones result in marked differences in the function of ecosystems and their associated biodiversity and this is due in part to the effects that geology (lithology, structure, alteration) has on landform, hydrology and landscape processes (geomorphology and soil formation).

The identity and relationship of the geological units to Land Zones (Wilson & Taylor, 2012) is as follows:

1. Main Range Volcanics (Tertiary Basalt) dominate the eastern portions of the Study Area. This geology is defined as Land Zone 8: Cainozoic igneous rocks (basalt plains and hills) under the regional ecosystem framework
2. Marburg Formation (Sedimentary Rocks) dominates the western portions of the Study Area. This geology includes: (i) Land Zone 9: fine grained sedimentary rocks (undulating country on fine grained sedimentary rocks); and (ii) Land Zone 10: coarse grained sedimentary rocks (sandstone ranges). These geologies are described as landzones 9 and 10 (respectively) under the regional ecosystem framework
3. Quaternary Alluvium occurs along the larger watercourses. This geology is analogous to Land Zone 3: recent Quaternary alluvial system (alluvial river and creek flats) under the regional ecosystem framework.

### 12.5.4 Flora

#### 12.5.4.1 Regional ecosystems

The VM Act conserves vegetation that is endangered, of concern or least concern REs. REs are vegetation communities within a bioregion that consistently occur in association with a particular combination of geology, landform and soil.

REs have been described and mapped by the Queensland Herbarium at a scale of 1:100 000 across the state of Queensland and are identified as Category B areas (remnant vegetation) on the Department of Natural Resource and Mines (DNRM) Regulated Vegetation Management Map and their status is described on the DNRM Vegetation Management Supporting Map.

The DNRM Vegetation Management Supporting Map shows that there are 12 REs (many in 'mixed polygon' REs) mapped within the Study Area, a description of the RE's is provided in Table 12.6.

Seven of these coincide with the Project Site (Figure 12.2, Volume 2), those with the greatest conservation significance are:

- RE 11.8.3: (i) listed as a component of the 'Endangered' TEC, *Semi-evergreen vine thicket of the Brigalow Belt (North and South) and Nandewar Bioregions* (a MNES under the EPBC Act); and (ii) 'Of Concern' VM Act status and Biodiversity status
- RE 11.9.4a: (i) listed as a component of the 'Endangered' TEC *Semi-evergreen vine thicket of the Brigalow Belt (North and South) and Nandewar Bioregions* (a MNES under the EPBC Act); and (ii) 'Of Concern' VM Act status and 'Endangered' Biodiversity status
- RE 12.8.6: (i) can form a small component of the 'Critically Endangered' TEC *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grasslands* (a MNES under the EPBC Act); and 'Of Concern' VM Act status and Biodiversity status
- RE 11.3.25: (i) has an 'Of Concern' Biodiversity status
- To a lesser extent the regrowth examples of these RE's, which may not achieve the condition thresholds to be identified as examples of the TEC or RE.

Other RE's of conservation significance in the broader Study Area are:

- RE 11.9.5: (i) listed as a component of the 'Endangered' TEC *Brigalow (Acacia harpophylla dominant and co-dominant)* (a MNES under the EPBC Act); and (ii) 'Endangered' VM Act status and Biodiversity status
- RE's 11.3.4, 11.9.7 and 12.9-10.7 (i) all have an 'Of Concern' VM Act and Biodiversity status
- To a lesser extent the regrowth examples of these RE's, which may not achieve the condition thresholds to be identified as examples of the TEC or RE.

RE 12.8.16 and 12.9-10.7 are outliers of the Southeast Queensland bioregion. Outliers are REs that are spatially within one bioregion but have the RE code from an adjacent bioregion. They occur when a RE that is found mainly within one bioregion 'extends' slightly into adjacent parts of an adjoining bioregion. An area may be assigned as an outlier RE if:

- it does not match the description (in terms of dominant species and land zone) of an RE from the bioregion it occurs in, but does match the description from an adjacent bioregion; and
- occupies an area in the bioregion of less than 1,000 ha, or if more than 1,000 ha, does not occur more than 50 km from the bioregion boundary.

**Table 12.6 A list and description of the Regional Ecosystems with the Study Area and their conservation status**

| RE | Description | Conservation status | | | REs that coincide with the Project Site |
|---|---|---|---|---|---|
| | | VM Act | Biodiversity Status[1] | EPBC Act | |
| 11.3.4 | *Eucalyptus tereticornis* and / or *Eucalyptus* spp. tall woodland on alluvial plains | OC | OC | - | No |
| 11.3.25 | *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines | LC | OC | - | Yes |
| 11.8.3 | Semi-evergreen vine thicket on Cainozoic igneous rocks. Steep hillsides | OC | OC | E | Yes |
| 11.8.5 | *Eucalyptus orgadophila* open woodland on Cainozoic igneous rocks | LC | NC | - | Yes |
| *11.8.8 | *Eucalyptus albens, E. crebra* woodland on Cainozoic igneous rocks. | LC | NC | *CE | No |
| 11.9.2 | *Eucalyptus melanophloia* +/- *E. orgadophila* woodland on fine-grained sedimentary rocks. | LC | NC | - | Yes |
| 11.9.4a | Semi-evergreen vine thicket on fine grained sedimentary rocks, generally dominated by a low tree layer (5-10m high), which is floristically diverse and variable. Common co-dominant species include *Croton insularis, Denhamia oleaster*. There is also a tall and low shrub layer. | OC | E | E | Yes |
| 11.9.5 | *Acacia harpophylla* and / or *Casuarina cristata* open forest on fine-grained sedimentary rocks. | E | E | E | No |
| 11.9.7 | *Eucalyptus populnea*, *Eremophila mitchellii* shrubby woodland on fine-grained sedimentary rocks. | OC | OC | - | No |
| 11.10.1 | *Corymbia citriodora* open forest on coarse-grained sedimentary rocks | LC | NC | - | Yes |
| 12.9-10.7 | *Eucalyptus crebra* woodland on sedimentary rocks. | OC | OC | - | No |
| **12.8.16 | *Eucalyptus crebra*, *E. tereticornis* woodland on Cainozoic igneous rocks. | OC | OC | **CE | Yes |

[1]The biodiversity status is based on an assessment of the condition of remnant vegetation and is used for a range of planning and management applications including Biodiversity Planning Assessments and to determine environmentally sensitive areas.

*the TEC represents a primary component of this RE

**the TEC can represent a small component of this RE

#### 12.5.4.2 Verified Regional Ecosystems

The field assessment and subsequent mapping verified the occurrence of six remnant REs across the Study Area. These are mapped on Figure 12.4, Volume 2 and are described below, grouped by geology and land zone. Species latin names with an asterisk (*) denotes an introduced species.

**Main Range Volcanics (Tertiary Basalt, Land Zone 8)**

**Plant Community 1 - EcEm:** Woodland to open-forest of narrow-leaved ironbark (*Eucalyptus crebra*), with secondary occurrence of yellow box (*Eucalyptus melliodora*) and Queensland blue gum (*Eucalyptus tereticornis* subsp. *tereticornis*). Occurs over a shrubland of *Xanthorrhoea glauca* and a groundcover of tussock to closed tussock grassland. Occurs on upper slopes and crests of tertiary basalt (Plate 12.1). This community occurs on upper slopes and crests of tertiary basalt across the central and south-eastern parts of the Study Area (Figure 12.4, Volume 2).

RE: 12.8.16

Conservation Status: 'Of Concern' under the VM Act, 'Of Concern' Biodiversity Status.

Canopy: The canopy is dominated by *Eucalyptus crebra,* with secondary occurrence of *Eucalyptus melliodora* and *Eucalyptus tereticornis* subsp. *tereticornis* ranging in height from 6-15 m with a FPC percentage of 25-55%.

Midstorey: The midstorey is generally sparse (although patches of shrubby mid-storey were observed across the range) and dominated by *Xanthorrhoea glauca* ranging in FPC percentage of 15-30 % or absent. Other shrub species recorded included *Leucopogon biflorus, Solanum nemophilum* and **Lantana camara*.

Ground: the ground layer is dominated by grasses, with greater than 50 % FPC. The dominant grasses are *Poa sieberiana* var. *sieberiana* (20-60%), *Cymbopogon refractus* (5-15%), *Sarga leiocladum* (7-10% or absent), *Bothriochloa bladhii* subsp. *bladhii, Dichanthium sericeum* subsp. *sericeum* and *Scleria mackaviensis*. Sparse herbs of *Glycine* sp., *Hybanthus stellarioides* and *Lepidium pseudohyssopifolium* are also present.

Vegetation Condition: The vegetation condition of this community is 'Fair to Good'.

**Plant Community 2 - BaAc:** Open scrub of *Backhousia angustifolia, Alstonia constricta*, *Canthium odoratum* forma *subnitida* and *Geijera salicifolia var. salicifolia* over shrubland of *Carissa ovata, Croton insularis, Breynia oblongifolia* and *Alectryon diversifolius* over spare grasses and forbs on upper slopes and crests of tertiary basalt (Plate 12.2). This community occurs in patches within the southern and western portions of the Study Area (Figure 12.4, Volume 2). Regrowth vine thicket species scattered throughout paddocks across the Study Area indicate that this community was once much more widespread. However due to clearing for agriculture, these vine thicket patches are restricted to the rockier ridgelines and slopes.

RE: 11.8.3

Conservation status: 'Of Concern' VM Act Status, 'Of Concern' Biodiversity Status. This community is a component of the 'Endangered' TEC *Semi-evergreen vine thicket of the Brigalow Belt (North and South) and Nandewar Bioregions.*

Emergent: Emergent canopy species include *Eucalyptus orgadophila*, *Brachychiton rupestris* and/or *Ficus oblique.*

Canopy: The canopy is 5-8 m height with a FPC percentage from 45-75%. Dominant species include *Backhousia angustifolium*, *Alstonia constricta*, *Canthium odoratum* forma *subnitida, Elaeodendron australe* subsp. *integrifolia* and *Geijera salicifolia* var. *salicifolia.* Emergent tree species include *Brachychiton rupestris*, *Ficus obliqua* or *Eucalyptus orgadophila*.

Midstorey: The midstorey ranges in height from 1.5-3 m with a FPC percentage from 5-20%. Dominant species include *Alectryon diversifolius, Pittosporum viscidum, Croton insularis* and *Breynia oblongifolia*.

Ground: The ground layer is generally sparse in the good quality vine thicket. In the poor condition vine thicket, where the canopy is open, the grass species **Megathyrsus maximus* and **Cynodon dactylon* have become dominant ground cover species.

Climbers: Common vine species are *Eustrephus latifolius, Jasminum simplicifolium* subsp. *australiensis* and *Geitonoplesium cymosum*.

Vegetation Condition: Vegetation condition ranges from 'Poor' to 'Very Good to Excellent'.

**Plate 12.1 Plant Community 1 - EcEm: Woodland of *Eucalyptus crebra* and *Eucalyptus melliodora* over shrubland of *Xanthorrhoea glauca* over closed tussock grassland of *Poa sieberiana* and *Cymbopogon refractus*. Vegetation in a 'Very Good' condition**

**Plate 12.2 Plant Community 2 - BaAc: Open scrub of *Backhousia angustifolia, Alstonia constricta* and *Canthium odoratum* over shrubland of *Carissa ovata* and *Croton insularis* over sparse grasses and forbs on upper slopes and crests of tertiary basalt.**

**Marburg Formation (Land Zone 9 and 10)**

**Plant community 3 - CcEc:** Open forest to woodland of spotted gum (*Corymbia citriodora* var. *variegata*) with gum-topped ironbark (*Eucalyptus decorticans*) or narrow-leaved ironbark (*Eucalyptus crebra*) over tall open shrubland of *Acacia leiocalyx* subsp. *leiocalyx* over open tussock grassland of *Ancistrachne uncinulata* and *Aristida personata* on coarse-grained sedimentary rocks (Marburg formation) (Plate 12.3). This spotted gum community occurs on the sedimentary formations in the west and northwest portions of the Study Area (Figure 12.4, Volume 2).

RE: 11.10.1

Conservation significance: 'Least Concern' VM Act status, 'No concern at present' Biodiversity Status.

Canopy: The canopy is dominated by *Corymbia citriodora* var. *variegata* (15-20 m, FPC 15-50%) and either *Eucalyptus decorticans* (15 m, FPC 15-20%) or *Eucalyptus crebra* (10 m, 5-15%).

Midstorey: The midstory ranges in height from 4-6 m, is generally sparse (generally <10% FPC) and consists mostly of *Acacia leiocalyx* subsp. *leiocalyx*. *Exocarpos cupressiformis* was recorded at one site.

Ground: The ground layer cover varies from 20-55% FPC, with areas recently burnt (3-5 yrs) having a greater ground cover (up to 55% cover). This layer is dominated by tussock grasses of the species *Ancistrachne uncinulata, Aristida personata, Aristida caput-medusa* and *Cymbopogon refractus*. Sparse forb species included *Lomandra multiflora* subspecies *multiflora* and *Hybanthus stellarioides*.

Vegetation Condition: Vegetation condition is in a 'Fair to Good' condition.

**Plant Community 4 - FcSa:** Open scrub of leopard ash (*Flindersia collina*), Ivory wood (*Siphonodon australis*), scrub cherry (*Exocarpos latifolius*) *and* shiny leaved canthium (*Canthium odoratum* forma *subnitida*) over shrubland of *Alectryon diversifolius, Breynia oblongifolia* and *Leucopogon biflorus* on sedimentary rocks (Marburg formation) on midslopes surrounding creeklines (Plate 12.4). This community occurs on sedimentary rocks and was located in one location in the central portion of the Study Area occurring on the mid to lower slopes surrounding a creekline (Figure 12.4, Volume 2).

RE: 11.9.4

Conservation status: 'Of Concern' VM Act status, 'Endangered' Biodiversity status. This community is a component of the 'Endangered' TEC *Semi-evergreen vine thicket of the Brigalow Belt (North and South) and Nandewar Bioregions*

Emergent: Emergent canopy species include *Eucalyptus crebra, Brachychiton rupestris* and *Ficus obliqua*

Canopy: The canopy forms an open scrub (5-7 m, 30-70% FPC) with a mixture of species including *Flindersia collina*, *Siphonodon australis, Exocarpos latifolius, Elaeodendron australe* subsp. *integrifolia* and *Canthium odoratum* forma *subnitida*.

Midstorey: The midstorey species make up a FPC percentage of up to 25% and include species *Breynia oblongifolia*, *Leucopogon biflorus, Olearia canescens* and *Alectryon diversifolius.*

Ground: The ground cover is generally sparse (> 25% FPC) and includes a mixture of tussock grasses and forbs including *Austrostipa ramosissima, Enneapogon lindleyanus, Cyperus gracilis*, *Lobelia purpurascens* and *Lomandra multiflora* subsp. *multiflora*.

Climbers: Vine species include *Sarcostemma viminale* subsp. *brunonianus, Jasminum simplicifolium* subsp. australiensis, *Geitonoplesium cymosum* and *Marsdenia* spp.

Vegetation condition: vegetation is in a 'Very Good to Excellent' condition.

**Plate 12.3 Plant Community 3 - CcEc: Open forest of *Corymbia citriodora* and *Eucalyptus decorticans* over a shrub layer of *Exocarpus cupressiformis* over a tussock grassland of *Ancistrachne uncinulata* and *Aristida personata*. Vegetation in a 'Fair to Good' condition.**

**Plate 12.4 Plant Community 4- FcSa Open scrub of leopard ash (*Flindersia collina*), Ivory wood (*Siphonodon australis*), scrub cherry (*Exocarpos latifolius*) *and* shiny leaved canthium (*Canthium odoratum* forma *subnitida*) over shrubland of *Alectryon diversifolius, Breynia oblongifolia* and *Leucopogon biflorus* on sedimentary rocks (Marburg formation) on midslopes surrounding creeklines**

**Plant Community 5 - AhCc:** Open forest of Brigalow *(Acacia harpophylla*) and/or *Casuarina cristata* on fine-grained sedimentary rocks. The ERM (2008) survey mapped this community; however no survey location was placed in this community in the 2013 survey as it occurs away from the Project Site. *Casuarina cristata* dominates patches of previously larger remnants in the south-western sections of the Study Area, while *Acacia harpophylla* dominates several small patches in the north-western sections of the Study Area. The small patches of this community were associated with roadside vegetation.

RE: 11.9.5

Conservation status: 'Endangered' VM Act status, 'Endangered' Biodiversity status. RE 11.9.5 is a component of the 'Endangered' TEC *Brigalow (Acacia harpophylla dominant and co-dominant)*.

Canopy: The height of the canopy ranges from 10-20 m with a FPC of 20-40% generally occurring as an open forest. The canopy is almost exclusively dominated by *Acacia harpophylla* and *Casuarina cristata*.

Midstorey: Generally dominated by juvenile *Acacia harpophylla* and *Casuarina cristata*.

Ground: The ground cover is predominately very sparse and generally dominated by exotic grasses.

Vegetation Condition: The vegetation condition of this community is 'Fair to Good'.

**Alluvium (Land Zone 3)**

**Plant Community 6 - EtAf:** Open forest to woodland to open woodland of Queensland blue-gum (*Eucalyptus tereticornis* subsp. *tereticornis*) over low woodland of rough-barked crab apple (*Angophora floribunda*), Moreton bay ash (*Corymbia tessellaris*) and Sally wattle (*Acacia salicina*) over tussock grassland of *Poa sieberiana* var. *sieberiana*, **Melinis repens*, *Cyperus gracilis* and *Swainsona* sp. on alluvium surrounding creeklines (Plate 12.5).

This community occurs on the alluvium surrounding a number of streamlines in the northern sections of the Study Area (Figure 12.4, Volume 2).

RE: 11.3.25

Conservation status: 'Least Concern' VM Act status, 'Of Concern' Biodiversity status

Canopy: The upper canopy is composed of *Eucalyptus tereticornis* subsp. *tereticornis* (15-25 m, 20% FPC), with a lower tree canopy of *Angophora floribunda*, *Corymbia tessellaris* and *Acacia salicina* (8-10 m, 15-20% FPC).

Midstorey: The midstorey in this community is generally lacking. A few scattered midstorey species include *Alectryon diversifolius, Pimelea neoanglica, *Gomphocarpus fruticosus*, **Opuntia* sp., **Lantana camara.*

Ground: The ground layer in this community has been degraded due to grazing practices, and consists of a tussock grassland including *Poa sieberiana* var. *sieberiana*, **Melinis repens*, *Sporobolus elongatus* and **Eragrostis curvula.* Forbs include **Verbena aristigera*, *Swainsona* sp., and *Lobelia purpurascens*.

**Plate 12.5 Plant Community EtAf: Open forest to woodland of *Eucalyptus tereticornis* over low woodland of *Angophora floribunda*, *Corymbia tessellaris* and *Acacia salicina* on alluvium surrounding creeklines**

### Regrowth and Non-remnant cleared paddocks

Much of the Study Area is comprised of regrowth vegetation and non-remnant cleared paddocks.

Areas of regrowth semi-evergreen vine thicket occur across the Study Area where slopes and crests of basalt have been cleared. Woodland of *Eucalyptus crebra* over closed tussock grassland of *Poaceae* sp., *Cymbopogon refractus and Sporobolus elongates* occurs across the eastern half of the Study Area (Plate 12.6). Scattered *Eucalyptus orgadophila* over scattered shrubs of *Canthium odoratum* forma *subnitida* and *Acacia leiocalyx* subsp. *leiocalyx* and **Opuntia* sp., over **Cynodon dactylon*, **Cyperus rotundus*, **Verbena aristigera* and *Sida hackettiana* occurs throughout the central and western sections of the Study Area (Plate 12.7).

In the cleared paddocks there are scattered native trees present including *Eucalyptus crebra, Eucalyptus orgadophila, Brachychiton rupestris* and *Ficus obliqua*, over scattered shrubs of *Acacia implexa, Elaeodendron australe* subsp. *integrifolia, Alectryon diversifolius, Opuntia* spp., **Lantana camara, Pimelea neoanglica, Sida hackettiana* and *Solanum ellipticum* over grasses and herbs of *Poa sieberiana* var. *sieberiana, Austrostipa scabra, Cymbopogon refractus, *Cynodon dactylon, *Megathyrsus maximus, *Cenchrus ciliaris, *Verbena aristigera* and **Verbena bonariensis* (Plate 12.8).

**Plate 12.6 Example regrowth found in eastern half of Study Area**

**Plate 12.7 Example regrowth found in central and western sections of the Study Area**

**Plate 12.8 Non-remnant cleared paddocks with scattered native tree and shrub species**

#### 12.5.4.3 Threatened Ecological Communities

An ecological community (EC) is a group of native plants, animals and other organisms that naturally occur together and interact in a unique habitat. In Australia, three categories exist for listing TECs under the EPBC Act: Critically Endangered, Endangered and Vulnerable.

The EPBC Act PMST identified the potential occurrence of six TEC's (Appendix D, Volume 3). However, field surveys identified only two:

- Semi-evergreen vine thickets (SEVT) of the Brigalow Belt (North and South) and Nandewar Bioregions; 'Endangered', represented by RE 11.8.3 and RE 11.9.4a
- Brigalow (*Acacia harpophylla* dominant and co-dominant); 'Endangered', represented by RE 11.9.5 and regrowth of 11.9.5.

The extent of these TECs in the Study Area is shown on Figure 12.4, Volume 2. Further analysis is provided below.

**Semi-evergreen vine thickets**

The SEVT of the Brigalow Belt (North and South) and Nandewar Bioregions TEC is listed as 'Endangered' under the EPBC Act. The SEVT TEC is represented by fifteen REs within Queensland, two of which, RE 11.8.3 and RE 11.9.4a, have been identified and field-verified within the Study Area (Figure 12.4, Volume 2).

**Brigalow, (*Acacia harpophylla* dominant and co-dominant)**

The Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC is listed as 'Endangered' under the EPBC Act. Within the Study Area, this TEC is represented by RE 11.9.5. This RE is identified by the DNRM mapping and the 2008 field survey as occurring within the Study Area, but outside of the Project Site. The 2013 field survey did not cover this area of vegetation as it is well removed from the Project Site. An area of regrowth *Acacia harpophylla* was recorded in closer proximity to the Project Site, but again is well-removed from any potential impact (Figure 12.4, Volume 2).

#### 12.5.4.4 Vegetation condition

Vegetation condition across the Study Area ranges from 'Very Poor' to 'Very Good to Excellent'. Most of the Study Area is in a 'Very Poor' vegetative condition, associated with areas of cleared paddocks. High value regrowth vegetation is in a 'Very Poor' to 'Poor' condition, indicating communities where the vegetation structure has been destroyed or completely modified, where native flora composition is between 1 to 50%, where the cover abundance of weed species can be between 20 to <100% and disturbance incidence is high.

Remnant vegetation ranged in condition from 'Fair to Good' to 'Very Good to Excellent'. Plant communities EcEm, CcEc and EtAf were in a 'Fair to Good' condition, indicating a community where the structure has been modified (or nearly so), vegetation composition consists of 50 to 80% native species and a cover abundance of weed species is 5 to 20%, with minor signs of disturbance. These communities are woodland to open forest communities where grazing, weed invasion and fire have been the main disturbance factors.

The SEVT communities (Plant communities BaAc and FcSa) ranged in condition from 'Fair to Good' to 'Very Good to Excellent'. In areas where grazing pressure was reduced or excluded the vegetation condition was 'Very Good' to 'Excellent', indicating a community where the vegetation structure is intact or nearly so, with minimal disturbance, and the native vegetation composition is 80 to 100% and native weed cover is <5%. Areas where grazing pressure has opened up the structure of the community and allowed weeds to invade, the condition is in a 'Fair to Good' condition.

The vegetation condition across the Study Area is illustrated in Figure 12.6, Volume 2.

#### 12.5.4.5 Flora species

The 2013 survey identified 134 plant taxa from 103 genera and 45 families. Of the 134 taxa, 23 were introduced flora, representing 17% of the total flora recorded.

The dominant families were Poaceae (26 taxa), Myrtaceae (12 taxa), Asteraceae (9 taxa) and Mimosaceae (7 taxa). Common native tree species across the site were *Eucalyptus crebra, Eucalyptus tereticornis* subsp. *tereticornis, Canthium odoratum* forma *subnitida* and *Brachychiton* spp. Common native shrubs were *Acacia leiocalyx* subsp*. leiocalyx, Alectryon diversifolius*, *Pimelea neoanglica* and *Xanthorrhoea glauca*. Common native grass species were *Poa sieberi* subsp. *sieberi, Cymbopogon refractus, Panicum* sp., and *Dichanthium sericeum*.

The most common introduced taxa were **Opuntia* spp., **Lantana camara, *Gomphocarpus fruticosus, *Verbena aristigera*, **Cynodon dactylon, *Cyperus rotundus* and **Megathyrsus maximus*.

Appendix D in Volume 3 lists all flora species recorded during the 2008 and 2013 surveys.

#### 12.5.4.6 Threatened flora

Fourteen threatened flora species were identified through database searches as occurring or potentially occurring within, or in close proximity to the Study Area. Of these, ten were considered 'Likely' or 'Possible' to occur within the Study Area based on a 'likelihood of occurrence' assessment. The likelihood of occurrence assessment used the following rating scale:

- *Known* – species positively recorded by this survey or other survey in the Study Area by qualified ecologist during the past 30 years
- *Likely* – based on the presence of suitable habitat and recent database records from the Study Area or proximity
- *Possible* – suitable habitat present for the species, but no recent database record from the Study Area or proximity
- *Unlikely* – based on a lack of suitable habitat and/or lack of proximate records.

The ten species identified as 'likely' or 'possible' occurrences are listed in Table 12.7 with a full likelihood assessment provided in Appendix D, Volume 3. No threatened flora species are known to occur within the Study Area and field surveys have not identified any threatened flora species. The DEHP Protected Plants Trigger Map does not identify the Project Site as being within a High Risk area.

**Table 12.7 Likelihood of occurrence of threatened flora species within the Study Area**

| Family name | Species | Status (NC Act, EPBC Act) | Preferred habitat | Life strategy | Records | Likelihood |
|---|---|---|---|---|---|---|
| Asteraceae | *Rhaponticum australe*<br>Austral cornflower, native thistle | V, V | Grows in open eucalypt forest with a grassy understorey, and along roadsides, growing in association with **Chloris gayana, *Cirsium vulgare, Eucalyptus tereticornis* and *Angophora floribunda*. Occurs on black clay soils (TSSC, 2008). | Perennial | EPBC Act search, Wildlife online | **Possible**<br>Suitable habitat is present within the Study Area; however limited proximal records exist for this species. |
| Celastraceae | *Denhamia parvifolia*<br>Small-leaved Denhamia | V, V | "*Denhamia parvifolia is known from Eidsvold to Chinchilla and east of Kingaroy in Queensland. It occurs in roadside remnants of semi-evergreen microphyll vine thickets on red soil*" (TSSC, 2008). | Perennial | EPBC Act search | **Possible**<br>No proximal records exist for this species, however SEVT (RE 11.8.3) does occur within the Study Area. |
| Poaceae | *Bothriochloa bunyensis*<br>Satin-top grass | V, V | *B. bunyensis* is endemic to south-east Queensland occurring along the Great Dividing Range from Bunya Mountains to Mt Mistake, at altitudes above 600 m. This species grows in woodland or grassland on upper slopes in fertile soils derived from basalt (Halford, 1998). | Perennial | Herbrecs, Wildlife online | **Possible**<br>Recorded at Bunya Mountains, and suitable habitat present. However, the site is used for grazing; therefore the condition of the habitat may not be appropriate. |
| Poaceae | *Dichanthium queenslandicum*<br>King blue-grass | V, V | *Dichanthium queenslandicum* is endemic to central and southern Queensland. It occurs on black cracking clay soils around Emerald and more rarely the Darling Downs (Simon & Alfonso, 2011). | Perennial | EPBC Act search | **Possible**<br>While no proximal records exist, appropriate habitat does exist in the Study Area, if grazing pressure is not too high. |
| Poaceae | *Homopholis belsonii*<br>Belson's panic | E, V | *Homopholis belsonii* occurs within the Brigalow Belt south in Queensland. It is known to occur in dry woodland habitats on poor soils, such as those derived from basalt. Occurs at elevations ranging from 200 to 520 m. Occurs | Perennial | EPBC Act search | **Possible**<br>No proximal records, however, suitable habitat exists within the |

| Family name | Species | Status (NC Act, EPBC Act) | Preferred habitat | Life strategy | Records | Likelihood |
|---|---|---|---|---|---|---|
| | | | on rocky hills supporting White Box (*Eucalyptus albens*) and in Wilga (*Geijera parviflora*) woodland, flat to gently undulating alluvial areas supporting Belah (*Casuarina cristata*) forest, and soils and plant communities of Poplar Box woodlands (TSSC, 2008). | | | Study Area |
| Ranunculaceae | *Clematis fawcettii*<br>Stream clematis | V, V | *Clematis fawcettii* inhabits canopy gaps in dry rainforest, complex notophyll vine forest, semi-evergreen vine thickets, and eucalypt open forest on loam soils derived from basalt and mixed volcanic rocks usually near streams (TSSC, 2008). | Perennial | EPBC Act search, Wildlife online | **Likely**<br><br>Proximal records of this species to the Study Area exist, and suitable habitat (RE 11.8.3) occurs within the Study Area. |
| Rhamnaceae | *Polianthion minutiflorum* | V, V | *Polianthion minutiflorum* is usually found in forest and woodland on sandstone slopes and gullies with skeletal soil, or deeper soils adjacent to deeply weathered laterite. It is known from five locations in Queensland from Redcliffe Vale south to Kingaroy (Kellerman, Rye, & Thiele, 2006). | Perennial | Wildlife online | **Possible**<br><br>Suitable habitat could exist within RE 11.10.1. |
| Rutaceae | *Phebalium distans*<br>Mt Berryman phebalium | E, CE | *Phebalium distans* is endemic to south-east Queensland. It always grows in semi-evergreen vine thicket on red volcanic soils, or in communities adjacent to this vegetation type. Populations are only known from near Mt Berryman and Mt Jones Plateau, near Kingaroy (TSSC, 2008). | Perennial | EPBC Act search | **Possible**<br><br>While suitable habitat occurs within the Study Area, there is a lack of proximal records for this species. |
| Santalaceae | *Thesium australe*<br><br>Austral toadflax, toadflax | V, V | *Thesium australe* is largely confined to moist grasslands, grassy woodlands or sub-alpine grassy heathlands, occurring in association with Kangaroo grass (*Themeda triandra*) and Poa spp. (DSE, 2003). *Thesium australe* is hemi-parasitic and often is parasitic on *Themeda triandra*. | Perennial | EPBC Act search, Wildlife online | **Possible**<br><br>Suitable habitat is present within the Study Area. |

| Family name | Species | Status (NC Act, EPBC Act) | Preferred habitat | Life strategy | Records | Likelihood |
|---|---|---|---|---|---|---|
| Surianaceae | *Cadellia pentastylis*<br>Ooline | V, V | "*Ooline grows in dry rainforest, semi-evergreen vine thickets and sclerophyll ecological communities, often locally dominant or as an emergent*" (TSSC, 2008).It ranges in distribution from Mt Black Jack near Gunnadah to west of Tenterfield in NSW, and extend into Queensland to Carnarvon Range and the Callide Valley, south-west of Rockhampton (TSSC, 2008). | Perennial | EPBC Act search | **Possible**<br><br>Suitable habitat is present within the Study Area, however, there is a lack of proximal records. |

#### 12.5.4.7 Introduced Flora

Three 'Declared' flora species listed under LP Act were recorded by the survey:

- *Opuntia spp. (**Opuntia tomentosa* and **O. stricta*) (Class 2); and
- Lantana (**Lantana camara*) (Class 3).

Non-declared weeds that were recorded across the Study Area include: Buffel Grass (**Cenchrus ciliare*), Couch (**Cynodon dactylon*) and Green Panic (**Megathyrsus maximus*). While these species are not declared plants, they still pose a significant risk to biodiversity through altering the structure and composition of native vegetation communities. Weed invasion is one of the dominant threats to the SEVT TEC.

### 12.5.5 Fauna

#### 12.5.5.1 Fauna Habitat

The Study Area contains five broad habitat types:

1. Fringing riparian woodlands
2. Vine thickets
3. Eucalypt woodland or open forest
4. Non-eucalypt open forest
5. Non-remnant open grassland pasture.

A broad description of their characters is provided in Table 12.8, and their extent is shown on Figure 12.5, Volume 2. Further detail is provided in Appendix D, Volume 3.

**Table 12.8 Broad habitat types identified within the Study Area**

| Habitat type | Field verified RE | Habitat description | Habitat values and condition | Vegetation condition | Area of habitat within the Study Area (ha) | Threatened fauna that could occur within the habitat type |
|---|---|---|---|---|---|---|
| Eucalypt woodland or open forest | 12.8.16 (including regrowth)<br>11.8.5 (including regrowth)<br>11.10.1 (including regrowth) | Sparse to mid-dense woodland dominated by *Eucalyptus* or *Corymbia* species (*E. crebra*, *E. orgadophila*, *E. melanophloia*, *E. propinqua*, *C. citriodora*) although occasionally other species may be present (e.g. *Angophora woodsiana*).<br>Shrub layer is generally absent or sparse consisting of *Xanthorrhoea glauca, Acacia* spp. or juvenile canopy species.<br>Ground layer density varies from open to closed tussock grassland and is comprised of a mixture of native and exotic grasses (*Bothriochloa ewartiana*, *Dichanthium sericeum*, *Poa sieberi* subsp. *sieberi, Aristida caput-medusa, Sarga leiocladum* and **Chloris gayana*). Pasture weeds may also be present and include **Zinnia peruviana* and **Verbena bonariensis*. | Likely to provide habitat for a wide of range of woodland-dependent and generalist fauna. Flowering *Eucalyptus* and *Corymbia* species provide significant seasonal nectar resources. Stags and hollows in eucalypts provide habitat for bats, hollow nesting birds such as owls, and arboreal mammals.<br>Grassy understorey, litter, logs and large rocks provide shelter and foraging resources for small vertebrate species, especially skinks, geckos, snakes and small-medium sized terrestrial/ semi-arboreal mammals. | Remnant vegetation in a 'Fair to Good' condition.<br>Regrowth in a 'Very Poor' to 'Poor' condition. | 2,443.88 | - Squatter pigeon (southern)<br>- Regent honeyeater<br>- Painted honeyeater<br>- Large-eared pied bat<br>- Northern quoll<br>- Spotted-tailed quoll (s. ssp.)<br>- Greater glider<br>- Eastern long eared bat<br>- Koala<br>- Grey-headed flying-fox<br>- Collared delma<br>- Yakka skink<br>- Dunmall's snake |
| Fringing riparian woodlands | 11.3.25 (including regrowth) | Open woodland to open forest associated with stream channels and ephemeral tributaries. Upper canopy dominated by eucalypt species (*Eucalyptus tereticornis* subsp. *tereticornis* and *E. camaldulensis*). Lower tree stratum species include *Angophora floribunda*, *Corymbia tessellaris, Acacia salicina*, *Melaleuca bracteata*, and *Casuarina* | Provides habitat to a range of forest and woodland-dependent and generalist species as well as species specialising in riparian habitats or requiring access to water. Dense ground layer can provide cover for reptiles and ground-dwelling mammals. Numerous hollow-bearing trees | Remnant vegetation is in a 'Fair to Good' condition.<br>Regrowth is in a 'Very Poor' to 'Poor' condition. | 72.34 | - Regent honeyeater<br>- Painted honeyeater<br>- Eastern long eared bat<br>- Greater glider<br>- Koala<br>- Grey-headed flying-fox<br>- Northern quoll |

| Habitat type | Field verified RE | Habitat description | Habitat values and condition | Vegetation condition | Area of habitat within the Study Area (ha) | Threatened fauna that could occur within the habitat type |
|---|---|---|---|---|---|---|
| | | *cunninghamiana*.<br><br>The shrub layer is generally is sparse, with a dense ground layer of grass species, including *Dichanthium sericeum*, *Sporobolus elongatus*, *Panicum* spp. and on the more disturbed sites **Megathyrsus maximus* and **Chloris gayana.* | were present in this habitat providing nesting and denning sites for arboreal fauna.<br><br>Fringing riparian woodlands also provides wildlife corridors for fauna species. | | | - Spotted-tailed quoll (s. ssp)<br>- Collared delma |
| Vine thickets | 11.8.3 (including regrowth)<br><br>11.9.4 (including regrowth)<br><br>*'Unknown' regrowth | Occurs primarily on steeper hillsides. The canopy has emergent *Brachychiton rupestris*, *Ficus obliqua* and eucalypt species (*E. crebra* and *E. orgadophila*).<br><br>The shrub layer is approximately 5-8 m tall and dense (up to 70% cover where not disturbed), consisting of wide variety dry rainforest species including *Backhousia angustifolium*, *Canthium odoratum* forma *subnitida, Alphitonia excelsa* and Alectryon diversifolius. The ground layer is sparse due to the dense shrub layer, and consists of scattered grasses and herbs. | Provides habitat for rainforest and closed forest species. High structural complexity and species diversity can provide foraging and shelter resources across a range of strata. The habitat differs from the other open Eucalypt communities which occur more commonly in the broader landscape.<br><br>Small hollow bearing trees are rare, but where available provide habitat for smaller hollow-nesting species. Occasional dead stags, peeling bark suitable for roosting microchiropteran bats and skinks. Rocky debris provides cover for reptiles (although generally shaded) and ground-dwelling mammals. Rocky outcrops provide roosting, nesting and shelter sites for bats, ground-dwelling | Remnant vegetation in a 'Fair to Good' to 'Very Good to Excellent' condition.<br><br>Regrowth in a 'Poor' condition. | 276.69 | - Black-breasted Button-quail<br>- Eastern long eared bat<br>- Grey-headed flying-fox<br>- Coxen's fig-parrot<br>- Northern quoll<br>- Spotted-tailed quoll (s. ssp) |

| Habitat type | Field verified RE | Habitat description | Habitat values and condition | Vegetation condition | Area of habitat within the Study Area (ha) | Threatened fauna that could occur within the habitat type |
|---|---|---|---|---|---|---|
| | | | mammals and reptiles.<br><br>Habitat suitable for birds of dense shrublands, shade-tolerant reptiles, small mammals, macropods, microchiropteran bats and possibly woodland frogs. | | | |
| Non-eucalypt open forest | 11.9.5 (including regrowth) | Patches of this habitat are heavily dominated by *Casuarina cristata* or *Acacia harpophylla* (generally in small patches along roadsides).<br><br>The shrub layer consists of juvenile canopy species. The ground layer is dominated by exotic grasses and is generally sparse. | Likely to provide limited habitat for a range of woodland-dependent species. Seeds of she-oaks (Casuarinaceae) can provide a food source for many seed eating species such as the glossy black-cockatoo (*Calyptorhynchus lathami*). Litter provides shelter and foraging resources for ground dwelling species such as reptiles at sites in good condition. | Condition not known[1]. | 33.97 | - Eastern long eared bat<br>- Koala<br>- Dunmall's snake<br>- Yakka skink<br>- |
| Non-remnant pasture (closed tussock grassland) | N/A | This is the dominant habitat type in the Study Area. It consists of closed tussock grassland of native and exotic pasture grasses (*Chloris gayana*, *Poa sieberi* subsp. *sieberi*, *Dichanthium sericeum, Cenchrus ciliaris*, *Eragrostis curvula* and *Panicum* spp.)<br><br>There is a low density of scattered native | Reduced habitat values for most species. Paddock trees and small habitat patches may be used by species capable of crossing large open spaces. Extensive grasslands suitable for open grassland species.<br><br>This broad habitat is most suitable | 'Very Poor' | 7,376.35 | - Squatter pigeon (southern subspecies) |

[1] This broad habitat type is well-removed from the Project Site and was not subject to detailed assessment.

| Habitat type | Field verified RE | Habitat description | Habitat values and condition | Vegetation condition | Area of habitat within the Study Area (ha) | Threatened fauna that could occur within the habitat type |
|---|---|---|---|---|---|---|
| | | trees including *Eucalyptus crebra, E. orgadophila, E. tereticornis*, *Brachychiton rupestris* and *Angophora floribunda* and a low density of scattered native regrowth shrubs include *Acacia leiocalyx, A. implexa, A. salicina, Canthium odoratum* forma *subnitida, Elaeodendron australe* and *Alectryon diversifolius*. | for disturbance-tolerant species. It may be occasionally crossed by forest-dependent species moving between more intact forest remnant. | | | |

* Three patches of mapped 'unknown' regrowth vegetation have been included in this habitat type, as they occur in proximity to remnant vine thicket vegetation

### 12.5.5.2 Fauna Species

Surveys conducted between 2008 and 2013 have recorded 146 fauna species, including: six species of amphibian; 10 species of reptile; 95 species of bird; and 35 species of mammal. Survey results are provided in Appendix D, Volume 3. The suite of species recorded is characteristic of the highly fragmented landscape in which the Study Area occurs. Two species of conservation significance have been recorded by the surveys: koala (*Phascolarctos cinereus*) ('Vulnerable' EPBC Act), and the Eastern long-eared bat (*Nyctophilus corbeni)* ('Vulnerable' EPBC). The Eastern long-eared bat was recorded as Nyctophilus spp. during the survey and treated as *Nyctophilus corbeni* as a precautionary approach. A further 13 conservation significant fauna species have been identified through the desktop searches as 'possible' or 'likely' occurrences. These assessments are discussed in detail as follows.

**Koala**

DOTE is primarily focused upon protecting habitat that is critical to the survival and recovery of the koala. To inform koala occurrence within the Study Area, targeted koala surveys were conducted during the 2013 Summer Survey. Locations for the SATs were determined by an assessment of the likely koala habitat within the Study Area, including utilising the 'essential regrowth habitat' mapping for the koala (Figure 12.5, Volume 2). During the survey one koala was observed at SAT site K1. Broad canopy survey efforts conducted between 2008 and 2013 did not identify any additional individuals in the Study Area.

During the 2013 Summer Survey, koala scats were recorded from three SAT survey sites: K1, K2 and K5 (Figure 12.5, Volume 2). Table 12.9 shows koala utilisation for each SAT site. At sites K2 and K5, the scat results returned both koala and possum scats, therefore the utilisation recorded for these sites represent the upper limits of koala utilisation.

**Table 12.9 Koala utilisation**

| Koala site | Verified RE | Koala utilisation | Commentary | Utilisation category* |
|---|---|---|---|---|
| K1 | RE 12.8.16 | 16.67% | - | High |
| K2 | RE 12.8.16 | 20% | Scat analysis results for these sites returned both koala and possum scats, therefore the utilisation recorded at these sites is considered the upper limits of koala utilisation | High |
| K3 | Regrowth of 12.8.16 | 0% | - | No utilisation |
| K4 | Regrowth of 12.8.16 | 0% | - | No utilisation |
| K5 | Regrowth of 12.8.16 | 30% | Scat analysis results for these sites returned both koala and possum scats, therefore the utilisation recorded at these sites is considered the upper limits of koala utilisation | High |
| K6 | RE 11.10.1 | 0% | - | No utilisation |
| K7 | RE 11.10.1 | 0% | - | No utilisation |
| K8 | Regrowth of 11.3.25 | 0% | - | No utilisation |

* The utilisation category is based on the koala activity table in The Spot Assessment Technique: a tool for determining localised levels of habitat use by Koalas (Phillips and Callaghan 2011). Scat strike rates of greater than 12.59% in low density habitat represents 'high' utilisation.

The SAT identified koala utilisation only within RE 12.8.16 and regrowth of 12.8.16 (a subset of Broad Habitat Type 3 – Eucalypt woodland and open forest). This RE contains Queensland blue gum (*E. tereticornis*), a species which is widely recognised as being of significance for koalas. Queensland blue gum is also common in the Broad Habitat Type 1 – Fringing Riparian Woodlands, and despite a lack of direct or indirect observation, it is considered likely that koalas will also preferentially use these parts of the Study Area.

Koala habitat is defined as any forest or woodland containing species that are known koala food trees, or shrubland with emergent food trees. This can include remnant and non- remnant vegetation in natural, agricultural, urban and peri-urban environments. Koala habitat is defined by the vegetation community present and the vegetation structure; the koala does not necessarily have to be present (DOTE, 2014).

Koala food trees are species of tree whose leaves are consumed by koalas. Koala food trees can generally be considered to be those of the following genus: Angophora, Corymbia, Eucalyptus, Lophostemon and Melaleuca. It should be noted that food tree species may vary spatially and temporally and information specific to the local area is likely to be most accurate. Also note that 'primary' and 'secondary' food trees (as defined by some resources) are all considered to be 'food trees' for the purposes of assessment using these guidelines.

The areas of RE 12.8.16 and regrowth of 12.8.16 contain koala food trees and are capable of supporting viable medium to low density koala populations. Despite a lack of direct or indirect koala observation, it is considered possible that the Study Area's Fringing Riparian Woodland Broad Habitat Type may also provide suitable food trees and habitat. The Study Area's remaining Eucalypt woodlands and Open Forest communities are capable of supporting low-density koala populations.

A habitat assessment tool is provided within the DOTE referral guidelines to assist in identifying whether an impact area contains habitat that is critical to the survival of the koala (DOTE, 2014), which has been applied to the Project in Table 12.10.

**Table 12.10 Koala habitat assessment tool**

| Attribute | Score | Description/Commentary |
|---|---|---|
| Koala occurrence | +1 (medium) | - The 2013 Summer Survey identified that there is evidence of one or more koalas occurring outside the Impact Area, but within 2 km in the last ten years.<br>- The SAT survey sites indicated high utilisation in three areas of the Study Area – outside of the impact area.<br>- The EPBC PMST, Wildlife Online and Living Atlas of Australia also indicate koala records in the Study Area. |
| Vegetation composition | +2 (high) | - The Project Site has remnant vegetation and regrowth vegetation with two or more known koala food tree species. |
| Habitat connectivity | 0 (low) | - The vegetation within the Project Site is highly fragmented and not part of a contiguous landscape*. It forms small pockets of habitat within a predominantly rural/agricultural landscape.<br>- There are limited forested riparian zones and other corridors connecting the larger patches.<br>- There a small number of barriers to connectivity, including steep cliffs, cattle and roads. |
| Key existing threats | +1 (medium) | - There are no known data on koala mortality from vehicle strike or dog attack. However, field survey has confirmed the presence of feral dogs (predator scats) within the Study Area. This presence is considered an existing threat to the koalas within the Study Area. |
| Recovery value | 0 (low) | - The habitat within the Project Site is unlikely to be important for achieving the interim recovery objectives as its connectivity to other areas of koala habitat and surrounding habitat refuges is limited by the use of the land (for predominantly grazing purposes).<br>- The Project Site does not form part of the South East Queensland Koala Conservation Area |

* Defined in the guidelines as an area of koala habitat that is greater than 500 ha in the inland context, which encompasses no barriers but is bounded by barriers.

The koala habitat assessment tool provides a total habitat score of +4 for the Project. This indicates that the impact area does not contain habitat critical to the survival of the koala; that the Project will not adversely affect habitat critical to the survival of the koala; and the Project will not interfere substantially with the recovery of the koala (through the introduction or exacerbation of key threats).

**Bats**

During the 2010 Survey, calls from Microchiropteran bats in the *Nyctophilus* genera were recorded at seven of the nine Anabat locations (Appendix D, Volume 3). *Nyctophilus* species cannot be separated on calls alone. However, as the Study Area is within the range of south-eastern long-eared bat (*Nyctophilus corbeni)* and contains suitable habitat, the *Nyctophilus* spp. is treated as *Nyctophilus corbeni* as a precautionary approach, which is listed as Vulnerable under the EPBC Act.

Based on the broad number of sites (and diversity of habitats) in which *Nyctophilus* spp. was encountered, the south-eastern long-eared bat is considered likely to be common and widespread in the Study Area and surrounding landscape. Within these areas it will preferentially occupy Eucalypt and vine thicket communities. Records from the farm dam (within the non-remnant grassland broad habitat) need to be interpreted with care. While dams of this nature will be frequently used as watering points by Microchiropteran bats, the broader open grassland habitats in which they occur will be of low habitat value.

**Threatened Fauna**

In addition to the two confirmed threatened species identified through the field surveys (koala and Eastern long-eared bat), a further 13 species were identified through the desktop assessment as “likely” or “possible” occurrences. based on a “likelihood of Occurrence” assessment (refer to 12.5.4.6 for criteria). The species considered ‘likely’, ‘possible’ or ‘confirmed’ are presented and discussed further in Table 12.11.

The full likelihood of assessment analysis is provided in Appendix D, Volume 3.

**Table 12.11 The likelihood of occurrence of threatened fauna species within the Study Area**

| Species | Status (NC Act, EPBC Act) | Preferred habitat | Available habitat | Likelihood of occurrence in or adjacent to the Project Site |
|---|---|---|---|---|
| **Birds** | | | | |
| Coxen's fig-parrot<br>*Cyclopsitta diophthalma coxeni* | E, E | The accepted core range of Coxen's fig parrot is from Gympie in South-east Queensland to the Richmond River in NSW, and as far west as the Bunya Mountains and the Koreelah Range (Coxen's fig parrot recovery team 2001).<br>Recent records of Coxen's fig-parrots are from subtropical rainforest, dry rainforest, littoral and developing littoral rainforest, sub-littoral mixed scrub, riparian corridors in woodland, open woodland and otherwise cleared land, and urbanised and agricultural areas with fig trees. These sightings span a range of altitudes from sea level to about 900m above sea level. Areas with a high fig diversity, where fruiting is staggered along moisture and altitudinal gradients, may be favoured (ibid.). | Vine thickets | **Possible**<br>The Study Area is located slightly beyond the western limit of the species' current known range. It supports dry rainforest (an identified habitat for this species), but lacks areas with a high diversity of figs, where fruiting is staggered along moisture and altitudinal gradients (refer Coxen's fig parrot recovery team 2001). Coxen's fig parrot cannot be discounted as a **possible** occurrence, but use of the Study Area's dry rainforest habitats appears likely to be very uncommon.<br>Suitable vine thicket habitat occurs within and adjacent to the Project Site, but its use appears likely to be very uncommon. |
| Regent honeyeater<br>*Anthochaera phrygia* | E, CE | In Queensland, the regent honeyeater has been primarily recorded from the south-east corner, south of a line between Chinchilla and the Sunshine Coast. There are records from several State Forests, including breeding activity in suitable habitat, particularly in the Warwick-Stanthorpe districts (Qld EPA, 2008).<br>Regent honeyeaters are strongly associated with box-ironbark eucalypt associations, and appear to prefer wetter more fertile areas, such as broad river valleys, creek flats and lower slopes, within this vegetation community (Menkhorst & Hynes, 2010). River she-oak (*Casuarina cunninghamiana*), and the associated mistletoe, also appears to be important, particularly in years when flowering is poor in the surrounding eucalypt woodlands (Oliver, 1998). | Fringing riparian woodlands<br>Eucalypt woodland or open forest | **Possible**<br>The Study Area is located near the northern extent of the species' accepted range. The Project Site is primarily associated with upper slopes and ridge crests; areas removed from the preferred lower slopes and fertile river valleys. The regent honeyeater cannot be discounted as a **possible** occurrence, but use of the Study Area appears likely to be very uncommon.<br>Suitable habitat occurs within and adjacent to the Project Site, but its use appears likely to be very uncommon. |

| Species | Status (NC Act, EPBC Act) | Preferred habitat | Available habitat | Likelihood of occurrence in or adjacent to the Project Site |
|---|---|---|---|---|
| Black-breasted Button-quail<br>*Turnix melanogaster* | V, V | The black-breasted button quail occurs as scattered populations in eastern Queensland and NSW. Populations generally occur to the east of the Great Dividing Range, but there are records from Palm Grove National Park and Barakula State Forest, 300km inland. (Mathieson & Smith, 2009; Garnett, Szabo, & Dutson, 2011).<br>The black-breasted button-quail occurs in semi-evergreen vine thicket, low microphyll vine forest, Araucarian microphylll forest, Aruacarian notophyll vine forest, Brachychiton spp. scrubs, low thickets or woodlands with a dense understorey but with little ground cover, littoral situations, acacia thickets and areas densely covered in shrubs (Curtis, Dennis, McDonald, & Kyne, 2012) | Vine thickets | **Possible**<br>Not recorded during targeted survey and passive observation over 5 year survey period, but suitable habitat is present. Considered to be a **possible** occurrence.<br>Suitable vine thicket habitat occurs within and adjacent to the Project Site. |
| Squatter pigeon (southern subspecies)<br>*Geophaps scripta scripta* | V, V | The squatter pigeon is now largely (if not wholly) restricted to Queensland. Its range extends from the NSW border, north to Burdekin River, west to Charleville and Longreach, and east to the coast to Townsville and Proserpine (DSEWPAC, 2013m; Curtis, Dennis, McDonald, & Kyne, 2012).<br>The squatter pigeon occurs in dry grassy woodland and open forest, mostly in sandy sites close to water (Curtis, Dennis, McDonald, & Kyne, 2012). | Eucalypt woodland or open forest<br>Non-remnant (open grassland-pasture) | **Possible**<br>The squatter pigeon occurs in open grassy habitat, and is readily observed during site traverse. This species has not been observed during the 5 years survey period, but it cannot be discounted as a **possible** occurrence.<br>Suitable open grassland and grassy woodland habitat occurs within and adjacent to the Project Site. |
| Painted Honeyeater<br>*Grantiella picta* | V, V | "The species inhabits mistletoes in eucalypt forests/woodlands, riparian woodlands of black box and river red gum, box-ironbark-yellow gum woodlands, acacia-dominated woodlands, paperbarks, casuarinas, callitris, and trees on farmland or gardens. The species prefers woodlands which contain a higher number of mature trees, as these host more mistletoes. It is more common in wider blocks of remnant woodland than in narrower strips (Garnett et al., 2011)" (TSSC 2015).<br>"The species is sparsely distributed from south-eastern Australia to north-western Queensland and eastern Northern Territory. The greatest concentrations and almost all records of breeding come from south of | Fringing riparian woodlands<br>Eucalypt woodland or open forest | **Possible**<br>The study area is located near the northern extent of the species main range, and contains suitable eucalypt habitat. |

| Species | Status (NC Act, EPBC Act) | Preferred habitat | Available habitat | Likelihood of occurrence in or adjacent to the Project Site |
|---|---|---|---|---|
| | | 26ºS, on inland slopes of the Great Dividing Range between the Grampians, Victoria and Roma, Queensland (Higgins et al., 2001)." (TSSC 2015). | | |
| **Mammals** | | | | |
| Large-eared pied bat<br>(*Chalinolobus dwyeri*) | V, V | The large-eared pied bat has a poorly known distribution. It is most commonly known from NSW where it occurs in association with the sandstone escarpments of the Sydney basin and north-west slopes. In Queensland the species is found in areas with extensive cliffs and caves, primarily in the central Queensland sandstone belt associated with the Carnarvon Ranges, Blackdown Tableland and Cania Gorge. Records from south-east Queensland suggest that high elevation areas of rhyolite, trachyte and basalt may be similarly important (Curtis, Dennis, McDonald, & Kyne, 2012; Churchill, 2008; DSEWPAC, 2013d).<br><br>The large-eared pied bat is dependent on the presence of diurnal roosts for shelter. Roosts are utilised during the day and also at night when not feeding, as well as for the raising of young. This bat has been known to roost in disused mine shafts, caves, overhangs and abandoned fairy martin Hirundo ariel nests (Schulz 1998). The value of mine shafts and disused fairy martin nests as roost sites has not been evaluated to date. From the type locality it would appear that mines may offer important roost sites, particularly in areas where natural roosts are uncommon or absent. Fairy martin nests may also provide roosting resources in these areas, allowing the large-eared pied bat to penetrate otherwise unsuitable areas and enabling individuals to disperse across areas lacking cave roosts (DERM 2011c).<br><br>Sandstone cliffs and fertile wooded valley habitat within close proximity of each other should be considered habitat critical to the survival of the large-eared pied bat (DECC 2007). Records from south-east Queensland suggest that rainforest and moist eucalypt forest habitats on other geological substrates (viz. rhyolite, trachyte and basalt) at high elevation are of similar importance for the species (DERM 2011c). | Eucalypt woodland or open forest | **Possible**<br><br>The Study Area is within the range of this species and contains habitat which is broadly suitable. However, the specific micro-habitat requirements identified as critical to the survival of this species (refer DERM 2011c) are absent. The large-eared pied bat cannot be discounted as a **possible** occurrence, but the Study Area does not provide critical habitat for this species. This may be reflected in the absence of survey records from the comprehensive Anabat survey.<br><br>Suitable forage habitat occurs within and adjoining the Project Site. |

| Species | Status (NC Act, EPBC Act) | Preferred habitat | Available habitat | Likelihood of occurrence in or adjacent to the Project Site |
|---|---|---|---|---|
| Northern quoll<br><br>(*Dasyurus hallucatus*) | -, E | The current distribution of the northern quoll is discontinuous across northern Australia, with core populations in rocky and/or high rainfall areas. In Queensland, some populations of northern quolls have persisted following colonisation by cane toads. These areas include, but are not restricted to, upland rocky areas (Cape Cleveland/Mt Elliott, Mareeba, Crediton, Eungella, Clarke Range) and several coastal sites (Cleveland, Cape Upstart, Cape Gloucester, Condor Range) in north and central Queensland (Hill and Ward 2010). The Study Area is at the southern extent of the species' former known range, but there has been a range contraction to the north, and the northern quoll has not been recorded in the southern Queensland since 1999 (Ibid.).<br><br>Northern quolls do not have highly specific habitat requirements. They occur in a variety of habitats across their range. They are opportunistic foragers that feed on a broad range of items switching dietary resources according to season and availability. Daytime den sites provide important shelter and protection for northern quolls from predators and weather. However, shelter sites are also non-specific; rocky outcrops, tree hollows, hollow logs, termite mounds, goanna burrows and human dwellings have all been recorded. Therefore habitat critical to survival is that where northern quolls are least exposed to threats or least likely to be in the future.<br><br>Rocky areas provide prime habitat for northern quolls and many other declining animal species. Recent modelling of island populations in the Northern Territory established that occurrence of northern quolls was related to ruggedness or topographic complexity. Analyses show that northern quoll declines in Queensland have mainly been in lowland and flatter (less rugged) areas and a recent survey found the most abundant remnant populations on the Queensland coast were at sites with large boulders. Rocky areas retain water and have a diversity of microhabitats, so support higher floristic diversity and productivity and thus greater prey density and/or diversity compared to non-rocky | Eucalypt woodland or open forest<br><br>Vine thickets<br><br>Fringing riparian | **Possible**<br><br>Historically the Study Area was close to the southern limit of the species' range. However, a significant range contraction has occurred and the northern quoll may no longer occur in southern Queensland. Further, the Study does not support the rugged rocky habitat preferred by this species. While it is not possible to completely discount the occurrence of the northern quoll, the factors discussed above indicate that it is a **possible** (but probably very unlikely) occurrence.<br><br>If present, suitable forage and denning habitat occurs within and adjacent to the Project Site. |

| Species | Status (NC Act, EPBC Act) | Preferred habitat | Available habitat | Likelihood of occurrence in or adjacent to the Project Site |
|---|---|---|---|---|
| | | adjacent country. In addition, cats forage less effectively in rocky areas. Their topographic complexity may also serve to ameliorate fire impacts, and they are typically not used for livestock production (Hill and Ward 2010). | | |
| Spotted-tailed quoll (s. ssp)<br>(*Dasyurus maculatus maculatus*) | V, E | The Spotted-tailed quoll occurs in south-east Queensland: coastally from Bundaberg to the border and inland to Monto and Stanthorpe. Occurrences from five broad geographic areas are known: four from coastal ranges and the Great Dividing Range from the NSW border to Gladstone. The fifth is centred on the Eastern Darling Downs-Inglewood Sandstone provinces of the Brigalow Belt South Bioregion. Unconfirmed reports suggest the subspecies may occur in the Clarke and Conway Range areas, eastern Queensland (DSEWPaC 2013a).<br>The spotted-tailed quoll is a forest dependent species. It has been recorded in rainforest, wet and dry sclerophyll forest and woodland habitats. The spotted-tailed quoll has been found on the margins of farmland and its preferred habitat includes escarpments, gullies, saddles and riparian habitat as well as rocky areas where it finds den sites. Highly disturbed forests and exotic plantations are unlikely to be important habitat. Individual spotted-tailed quolls can range over significant areas (up to 4km, and males can range more than 10 km in the winter mating season). The species is likely to occur across all land tenures (NSW NPWS 1999). | Vine thickets<br>Eucalypt woodland or open forest<br>Fringing riparian | **Likely**<br>ERM (2008) notes that landholders had recorded spotted-tailed quolls within the Study Area. The Study Area is within the range of a reported population (Eastern Darling Downs-Inglewood Sandstone provinces of the Brigalow Belt South Bioregion – refer DSEWPaC 2013a) and contains suitable habitat. In this regard it is considered appropriate to record the landholder observations as a **likely** (and possibly **confirmed**) occurrence of the species.<br>The Project Site intersects suitable forage and denning habitat for this species. |
| South-eastern long eared bat<br>(*Nyctophilus corbeni formerly Nyctophilus timoriensis)* | V, V | In Queensland, the South-eastern Long-eared Bat is mainly recorded in the Brigalow Belt South Bioregion, extending eastwards to the Bunya Mountains National Park. It has been recorded as far north as the Expedition Range and Dawson River areas. Its westerly range extends into the Mulgalands Bioregion and west of Bollon (DSEWPaC 2013b).<br>The South-eastern Long-eared Bat occurs in a range of inland woodland vegetation types, including box, ironbark and cypress pine woodlands. The species also occurs in Buloke woodland, Brigalow woodland, Belah woodland, Smooth-barked Apple, *Angophora leiocarpa,* woodland; River | Eucalypt woodland or open forest<br>Fringing riparian woodlands<br>Vine thickets<br>Non-eucalypt | **Confirmed**<br>During the 2010 Survey, calls from Microchiropteran bats in the *Nyctophilus* genera were recorded at seven of the nine Anabat locations (Appendix D, Volume 3). *Nyctophilus* species cannot be separated on calls alone, so consideration needs to be given to the potential occurrence of the south-eastern long-eared bat (*Nyctophilus corbeni)* in the Study Area. Noting that the Study Area is within the |

| Species | Status (NC Act, EPBC Act) | Preferred habitat | Available habitat | Likelihood of occurrence in or adjacent to the Project Site |
|---|---|---|---|---|
| | | Red Gum, *Eucalyptus camaldulensis,* forests lining watercourses and lakes, Black Box, *Eucalyptus largiflorens,* woodland, dry sclerophyll forest. Throughout inland Queensland, the species habitat is dominated by various eucalypt and bloodwood species, and various types of tree mallee with it being most abundant in vegetation with a distinct canopy and a dense cluttered shrub layer (DSEWPaC 2013b). | open forest | range of this species and contains suitable habitat, the *Nyctophilus* spp. record should[2] be treated as a **confirmed** record of *Nyctophilus corbeni*.<br><br>The Project Site intersects suitable forage and roost habitat for this species. |
| Koala<br><br>(*Phascolarctos cinereus*) | V, V | Koala populations occur in moist forests along the coast, sub humid woodlands in southern and central Queensland, and in some eucalypt woodlands along watercourses in the semiarid environments of the western part of the State. Koalas have also been found to occur in non-riverine communities in semiarid areas.<br><br>Biogeographic regions of Queensland where koalas have been recorded include the Einasleigh Uplands, Wet Tropics, Desert Uplands, Central Mackay Coast, Mitchell Grass Downs, Mulga Lands, Brigalow Belt, South Eastern Queensland and Channel Country.<br><br>The greatest density of koalas in the State occurs in south-east Queensland, and lower densities occur through central and eastern areas. For example, population densities range from moderately high in south-east Queensland and some parts of central Queensland (e.g. 1-3 koalas per hectare) to low in other parts of central Queensland (0.01 koalas per hectare) (TSSC 2012).<br><br>Koalas inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by species from the genus Eucalyptus. The distribution of koalas is also affected by altitude (limited to <800 m ASL), temperature and, at the western and northern ends of the range, leaf moisture. | Eucalypt woodland or open forest<br><br>Fringing riparian woodlands<br><br>Non-eucalypt open forest | **Confirmed**<br><br>During the 2013 Summer Survey the koala was recorded from Eucalypt woodland and regrowth characteristic of RE 12.8.16. As such it is a **confirmed** occurrence in the Study Area.<br><br>The Project Site intersects suitable forage and roost habitat for this species. |

[2] Adopting the precautionary approach.

| Species | Status (NC Act, EPBC Act) | Preferred habitat | Available habitat | Likelihood of occurrence in or adjacent to the Project Site |
|---|---|---|---|---|
| | | The koala is a leaf-eating specialist. Its diet is restricted mainly to foliage of Eucalyptus species. It may also consume foliage of related genera, including Corymbia, Angophora and Lophostemon and at times supplement its diet with other species, including species from the genera Leptospermum and Melaleuca. While koalas have been observed sitting in or eating up to 120 species of eucalypt, the diet of individual koalas is usually limited to obtaining most of their nutrition from one or a few species present at a site. Species-level preferences may also vary between regions or seasons. Consequently, assessment of habitat quality for koalas is usually based on the identification of local preferences for species and quantification of the availability of those species (TSSC 2012). | | |
| Grey-headed flying-fox (*Pteropus poliocephalus*) | -, V | Grey-headed Flying-foxes occupy the coastal lowlands and slopes of southeastern Australia from Bundaberg to Geelong and are usually found at altitudes < 200 m. Areas of repeated occupation extend inland to the tablelands and western slopes in northern New South Wales and the tablelands in southern Queensland (DSEWPaC 2013c). The Study Area is approaching the western limit of the species' range.<br><br>Grey-headed Flying-foxes require a continuous sequence of productive foraging habitats, the migration corridors or stopover habitats that link them, and suitable roosting habitat within nightly commuting distance of foraging areas. Areas supporting these characters are considered to be habitat critical to the survival of the grey-headed flying fox (DECCW 2009).<br><br>On the basis of current knowledge, foraging habitat that meets at least one of the following criteria can be explicitly identified as habitat critical to survival, or essential habitat, for Grey headed Flying-foxes. Natural foraging habitat that is:<br>- productive during winter and spring, when food bottlenecks have been identified;<br>- known to support populations of > 30 000 individuals within an | Fringing riparian woodlands Eucalypt woodland or open forest Vine thickets | **Likely**<br>The Study Area is approaching the western limit of range for the Grey-headed flying fox, but camps occupied by this species are known from Dalby, Kingaroy and the Bunya Mountains. The Study Area is within the forage range of these camps.<br><br>Flying fox roosts are readily detected by the raucous activity of resident animals. Significant survey effort since 2008 has failed to detect any roosts, providing conclusive evidence that no roost sites occur in the Study Area at this time.<br>The Study Area is at the outer forage limit of the known Dalby, Kingaroy and Bunya Mountains roost sites, and despite a lack of survey records it is considered **likely** that the grey-headed flying fox uses the Study Area.<br>Forage habitat occurs within and adjacent to the Project Site. |

| Species | Status (NC Act, EPBC Act) | Preferred habitat | Available habitat | Likelihood of occurrence in or adjacent to the Project Site |
|---|---|---|---|---|
| | | area of 50 km radius (the maximum foraging distance of an adult);<br>- productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to May);<br>- productive during the final stages of fruit development and ripening in commercial crops affected by Grey-headed Flying-foxes (months vary between regions);<br>- known to support a continuously occupied camp.<br><br>Grey-headed Flying-foxes roost in large aggregations in the exposed branches of canopy trees. The locations of camps are generally stable through time, and several sites have documented histories that exceed 100 years. Camps provide resting habitat, sites of social interactions and refuge for animals during significant phases of their annual cycle, such as birth, lactation and conception. On the basis of current knowledge, roosting habitat that meets at least one of the following criteria can be explicitly identified as habitat critical to survival, or essential habitat, for Grey headed Flying-foxes. Roosting habitat that:<br><br>1. is used as a camp either continuously or seasonally in > 50% of years<br>2. has been used as a camp at least once in 10 years (beginning in 1995) and is known to have contained > 10 000 individuals, unless such habitat has been used only as a temporary refuge, and the use has been of limited duration (i.e. in the order of days rather than weeks or months)<br>3. has been used as a camp at least once in 10 years (beginning in 1995) and is known to have contained > 2 500 individuals, including reproductive females during the final stages of pregnancy, during lactation, or during the period of conception (i.e. September to May) (DSEWPaC 2013c ). | | |

| Species | Status (NC Act, EPBC Act) | Preferred habitat | Available habitat | Likelihood of occurrence in or adjacent to the Project Site |
|---|---|---|---|---|
| Greater glider<br>*Petauroides volans* | -, V | "The greater glider is restricted to eastern Australia, occurring from the Windsor Tableland in north Queensland through to central Victoria (Wombat State Forest), with an elevational range from sea level to 1200 m above sea level. An isolated inland subpopulation occurs in the Gregory Range west of Townsville (Winter et al., 2004), and another in the Einasleigh Uplands (Vanderduys et al., 2012)." (TSSC 2016).<br>The greater glider is largely restricted to eucalypt forests. "It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows (Andrews et al., 1994; Smith et al., 1994, 1995; Kavanagh 2000; Eyre 2004; van der Ree et al., 2004; Vanderduys et al., 2012)." (TSSC 2016). | Eucalypt woodland or open forest<br>Fringing riparian woodlands | **Possible**<br>The greater glider is sensitive to forest clearance, and thus unlikely to occur in the smaller patches of eucalypt woodland within the study area. The larger patches could possibly support the greater glider. |
| **Reptiles** | | | | |
| Collared delma (*Delma torquata*) | V, V | The Collared Delma is known from the western suburbs of Brisbane, Queensland, and the following sites: Bunya Mountains, Blackdown Tableland National Park (NP), Bullyard Conservation Park, D'Aguilar Range NP, Expedition NP, Naumgna and Lockyer Forest Reserves, Western Creek near Millmerran and the Toowoomba Range.<br>The Collared Delma normally inhabits eucalypt dominated woodland and open forest where it is associated with suitable micro-habitats (exposed rocky outcrops). The ground cover is predominantly native grasses, such as Kangaroo Grass (*Themeda triandra*), Barbed-wire Grass (*Cymbopogon refractus*), Wiregrass (*Aristida* sp.) and Lomandra (*Lomandra* sp.) (DSEWPaC 2013d) | Eucalypt woodland or open forest Fringing riparian | **Likely**<br>The Study Area is within the known range of the collared delma, and the Eucalypt woodland or open forest broad habitat type is considered **likely** to provide potential habitat for this species, particularly in the east where rocky slopes are common. |

| Species | Status (NC Act, EPBC Act) | Preferred habitat | Available habitat | Likelihood of occurrence in or adjacent to the Project Site |
|---|---|---|---|---|
| Yakka skink<br>(*Egernia rugosa*) | V, V | Yakka skink occurs in dry eucalypt and acacia woodland and open woodlands (Curtis, Dennis, McDonald, & Kyne, 2012). Distribution extends from the coast to the hinterland of sub-humid to semi-arid eastern Queensland. Within this area the species distribution is highly fragmented (DSEWPAC, 2013h; DSEWPAC, 2011a) | Eucalypt woodland or open forest<br>Non-eucalypt open forest | **Possible**<br>The Study Area is within the known range of the yakka skink and contains suitable habitat. Since 2008, active searches in suitable habitat have failed to detect this species but this species is still considered a **possible** occurrence. Potential habitat occurs within the Project Site. |
| Dunmall's snake (*Furina dunmalli*) | V, V | Dunmall's Snake has been found in a broad range of habitats, including: forests and woodlands on black alluvial cracking clay and clay loams dominated by Brigalow (*Acacia harpophylla*), other Wattles (A. burrowii, A. deanei, A. leiocalyx), native Cypress (Callitris spp.) or Bull-oak (Allocasuarina luehmannii). Various Spotted Gum (Corymbia citriodora), Ironbark (Eucalyptus crebra and E. melanophloia), White Cypress Pine (Callitris glaucophylla) and Bulloak open forest and woodland associations on sandstone derived soils. In other environments, one specimen was found on the edge of dry vine scrub near Tarong Power Station, Queensland, whilst another was found in hard ironstone country (Queensland Regional Ecosystem Land Zone 7) at Lake Broadwater near Dalby, Queensland.<br>Little is known about the ecological requirements of Dunmall's Snake, however, the species has been found sheltering under fallen timber and ground litter. Records indicate the species prefers habitats between 200 to 500 m above sea level (DSEWPaC 2013e). | Eucalypt woodland or open forest<br>Non-eucalypt open forest<br>Vine thickets | **Possible**<br>The Study Area is within the known range of Dunmall's snake and contains suitable habitat. Since 2008, active searches in suitable habitat have failed to detect this species but it is known to be a very elusive species and seldom encountered. Dunmall's snake is considered a **possible** occurrence. Potential habitat occurs within the Project Site. |

#### 12.5.5.3 Migratory species

Australia has signed agreements to protect migratory species and their habitat, including the Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA) and Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

The EPBC Act PMST identified 10 migratory species as potentially occurring within the Study Area, including:

- Fork-tailed Swift (*Apus pacificus*)
- Oriental Cuckoo (*Cuculus optatus*)
- White-throated Needletail (*Hirundapus caudacutus*)
- Black-faced Monarch (*Monarcha melanopsis*)
- Spectacled Monarch (*Monarcha trivirgatus*)
- Yellow Wagtail (*Motacilla flava*)
- Satin Flycatcher (*Myiagra cynoleuca*)
- Rufous Fantail (*Rhipidura rufifrons*)
- Latham's Snipe (*Gallinago hardwickii*)
- Osprey (*Pandion haliaetus*).

None of these migratory species were identified during the field assessment (Appendix D, Volume 3).

#### 12.5.5.4 Introduced pest fauna

Four fauna species recorded within the Study Area are Declared 'Class 2' pest species under LP Act:

- Feral dog (*Canis familiaris*)
- Feral cat (*Felis catus*)
- European rabbit (*Oryctolagus cuniculus*)
- European fox (*Vulpes vulpes*).

Five introduced species (but not declared under state legislation) were identified within the Study Area:

- Cane Toad (*Bufo marinus*)
- domestic cow (*Bos taurus*)
- brown hare (*Lepus capensis*)
- house mouse (*Mus musculus*)
- black rat (*Rattus rattus*).

### 12.5.6 Essential habitat

Essential habitat is defined as habitat mapped by the State where threatened flora and/or fauna species are known to occur. Specifically it pertains to an area of vegetation that:

- Has at least three essential habitat factors for the protected wildlife that must include any essential factors stated as mandatory for the protected wildlife in the essential habitat database; or
- In which the protected wildlife, at any stage of its life cycle, is located.

No essential habitat has been mapped within the Study Area by DNRM. Essential regrowth habitat for the koala has been identified (refer to Figure 12.5, Volume 2) as part of the koala assessment (refer to Section 12.5.5.2).

### 12.5.7 State biodiversity corridor

The Brigalow Belt Biodiversity Planning Assessment (BPA) has defined a 'State' biodiversity corridor between Diamondy State Forest to the northwest of the Study Area and Bunya Mountains to the southeast (Figure 12.3, Volume 2).

### 12.5.8 Wetlands and watercourses

No RAMSAR wetlands occur within the Study area or surrounding area. No nationally important wetlands occur within the Study area or surrounding area. No referable or significant wetlands occur within the Study Area or surrounding area. No wetlands on the vegetation management wetland map occur within the Study Area or surrounding area. Many small to medium sized watercourses (stream order 1, 2 and 3) occur within the Study Area and intersect the Project Site (Figure 12.4, Volume 2).

### 12.5.9 Groundwater dependent ecosystems

Groundwater dependant ecosystems (GDEs) are defined as: '*ecosystems which require access to groundwater to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services'* (Richardson E. I., 2011). GDEs include aquifers, caves, lakes, palustrine wetlands, lacustrine wetlands, rivers and vegetation (Queensland Government, 2014).

No aquifer, cave, lake, palustrine or lacustrine GDEs occur within the Study area. Wetland vegetation associated with riverine systems has been mapped within the Study area (Queensland Government, 2014) associated with the stream order 3 watercourse in the northern eastern section of the Study Area (Appendix D, Volume 3). This mapping has likely been based on the alluvial RE, 11.3.25.

## 12.6 Potential impacts

Potential impacts to flora and fauna values may occur in the following phases of the Project:

1. Construction Phase
2. Operation and Maintenance Phase
3. Decommissioning Phase.

The construction footprint of the Project will be approximately 360 ha. The operational footprint will occupy approximately 100 ha. Land not occupied by infrastructure following the construction and rehabilitation period will continue to be used for rural and agricultural purposes.

### 12.6.1 Construction phase

The construction phase of the Project will involve construction of the wind turbines and associated wind farm infrastructure, as described within Chapter 2 Project Description.

The most significant impacts on flora and fauna will occur during the Project's construction phase, when vegetation and habitat removal will occur. Impacts associated with the construction phase of the Project will be from the following activities:

- Removal of native flora species and vegetation comprised of both remnant and regrowth elements
- Noise and vibration impacts from construction activities to fauna species
- Sedimentation and erosion from exposed and excavated areas
- Groundwater drawdown from sourced aquifers
- The introduction of additional pests and weeds.

Specific impacts to flora and fauna values are discussed in the following sections.

#### 12.6.1.1 Potential impacts to flora

**Removal of remnant vegetation**

The Project Site intersects approximately 50 ha of remnant vegetation. However, the Project Site represents a broadly defined area and is taken as a worst case scenario in terms of potential impact. The actual disturbance footprint (and required vegetation clearing) is likely to be a much smaller impact area (refer to Chapter 2 Project Description).

The Project will cause only a very minor impact on the local and sub-regional extent of the affected RE's, as demonstrated within Table 12.12.

**Table 12.12 Area of remnant vegetation within the Project Site**

| RE | Status[#] | | Area (ha) in Study Area | Area (ha) within Project Site | Area (ha) remaining in the Eastern Darling Downs Subregion | % to be removed from the Eastern Darling Downs Subregion |
|---|---|---|---|---|---|---|
| | VM Status | Biodiversity Status | | | | |
| 11.10.1 | LC | NC | 375.18 | 21.42 | 34,949.63 | 0.06% |
| 11.3.25 | LC | OC | 20.24 | 2.50 | 10,432.90 | 0.02% |
| 11.8.3 | OC | OC | 170.24 | 12.42 | 7,617.51 | 0.16% |
| 11.9.4a | OC | E | 22.59 | 2.79 | 1,106.31 | 0.25% |
| 11.9.5 | E | E | 14.85 | N/A | 1,800.60 | N/A |
| 12.8.16 | OC | OC | 271.45 | 11.33 | 4,857.02 | 0.23% |

[#]Status: OC= Of Concern, LC=Least Concern, NC=No Concern

**Removal of Threatened Ecological Communities**

Field surveys have confirmed the occurrence of two TEC's within the Study Area:

1. SEVT TEC (Represented by RE's 11.8.3, 11.9.4a)
2. Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC (Represented by RE 11.9.5)

The Project Site is well-removed from the Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC, and will not cause any direct or indirect impacts on this community.

The Project Site intersects 15.21 ha of SEVT TEC however, as discussed above, the actual disturbance footprint will likely result in a much smaller impact.

**Removal of non-remnant and cleared paddocks**

The Project Site intersects 1,912 ha of non-remnant vegetation and cleared paddocks. As the Project is designed to avoid areas of ecological significance, the greatest land take and disturbance will be in this category.

**Loss of threatened flora**

Desktop assessment indicates that ten threatened flora species could occur in the Study Area (Table 12.7). However, systematic survey over a number of years and seasons within the Project Site (encompassing a broad range of conditions) has failed to record any of these species. The NC Act Protected Plant Trigger Map does not identify the Project Site as being within a High Risk area. While the occurrence of some cryptic species cannot be wholly discounted, the survey results provided a high degree of surety that the Project is unlikely to have a significant impact on a threatened flora species.

**Vegetation fragmentation/edge effects**

The Study Area is within a highly fragmented landscape that retains areas of remnant vegetation. The Study Area is itself characteristic of this broader fragmented landscape. To the greatest extent possible the design process has sought to minimise further fragmentation of remnant vegetation by positioning the Project in the more highly disturbed components of the Study Area. While it has not been possible to avoid remnant vegetation in all areas, it is important to understand that the Project Site represents a broadly defined footprint into which the much smaller disturbance footprint will be placed. Where the Project Site intersects areas of remnant vegetation, micro-siting will be used to minimise further fragmentation. For example, infrastructure could be moved outside of a remnant boundary or an infrastructure pathway (e.g. access track) could be aligned to minimise impact on significant ecological features (e.g. hollow bearing trees).

There is the potential for project-generated (new) edge effects. However, this occurs in an already highly fragmented landscape in which the Project will be located. It is considered unlikely that the Project will cause significant additional light penetration in what are already open forest – woodland communities or areas with fragmented regrowth. Increased light penetration is considered to be of greater significance in the closed SEVT communities.

**Groundwater drawdown from sourced aquifers**

A groundwater bore network will be developed for the construction phase of the project, which will require extraction of water for construction purposes (Chapter 15 – Groundwater). As GDEs require access to groundwater to meet some or all of their water requirements, extraction of groundwater may impact on these communities. Within the Study Area, the only GDEs identified are the alluvial plant communities of the RE 11.3.25, associated with watercourses.

To manage any impacts on GDEs, groundwater monitoring program will be developed for all Project stages, which identifies suitable drawdown levels, which fall below identified thresholds.

**Weed establishment and spread**

During field surveys it was noted that most of the declared and more common pest plants occurred in non-remnant, regrowth vegetation and the more disturbed areas of remnant vegetation. They were generally uncommon or absent from the high integrity remnant areas. The potential for weed establishment in new areas (and a management response) is therefore most pervasive in these later high integrity areas. Mitigation and management is discussed in Section 12.7.

During the construction phase, machinery movement and earthworks has the potential to introduce new weeds to the Project Site and increase the spread of those species which already occur, although this potential impact is readily managed by routine weed hygiene protocols as discussed in Section 12.7:

**Erosion and sedimentation**

There is potential for erosion and sedimentation to occur during both the construction and operational phases of the Project, but contemporary management practices will ensure that impacts are localised and of minimal duration. Nonetheless, it is considered important to ensure that earthworks are minimised as far as practicable and appropriate erosion and sediment control requirements are contained in the management plans for the Project. Further discussion is provided in Section 12.7.

#### 12.6.1.2 Potential impacts to fauna

Impacts on fauna associated with the construction phase of the Project include the direct clearing of fauna habitat, such as removal of remnant or high value regrowth vegetation and habitat trees. Other indirect short-term impacts associated with the construction phase are likely to be construction activity and noise disturbance.

**Loss of fauna habitat**

Clearing of native vegetation can adversely affect native fauna species. Impacts resulting from clearing native vegetation (DECC 2005) can include:

- Destruction of habitat causing a reduction of biological diversity or loss of local populations and genotypes
- Fragmentation of populations, which can reduce gene flow between small isolated populations, reduced the potential for species to adapt to environmental change and loss or severe modification of the interactions between species
- Disturbance which can permit the establishment and spread of exotic species that may displace native species
- Loss of leaf litter, removing habitat for a wide variety of vertebrates and invertebrates
- Loss of food resources such as foliage, flowers, nectar, fruit and seeds.

The fauna habitat occurring within the Project Site and the Study Area likely to be affected by the Project is provided in Table 12.13, along with the threatened species that are ‘possible’, ‘likely’ or ‘confirmed’ to occur within the Study Area.

The Project’s impact on fauna (including threatened species) through the mechanism of habitat loss is unlikely to be significant due to:

- The area of each habitat type to be affected is small in comparison to that which remains in the broader landscape
- Habitat fragmentation will be only very minor and will occur within a landscape already subject to significant fragmentation

- There are no species highly or solely dependent on the habitats within the Study Area.

**Table 12.13 Fauna habitat that coincides with the Project Site and potential threatened species that can occur within the broad habitat type**

| Broad habitat | Threatened species 'possible', 'likely' or 'confirmed' to occur within each habitat | Area (ha) of habitat within the Study Area | Area (ha) of habitat within the Project Site |
|---|---|---|---|
| Eucalypt woodland or open forest | - Squatter pigeon (southern)<br>- Regent honeyeater<br>- Painted honeyeater<br>- Large-eared pied bat<br>- Northern quoll<br>- Spotted-tailed quoll (s. ssp.)<br>- Greater glider<br>- Eastern long eared bat (confirmed)<br>- Koala (confirmed)<br>- Grey-headed flying-fox<br>- Collared delma<br>- Yakka skink<br>- Dunmall's snake | 2,443.88 | 342.37 |
| Fringing riparian woodlands | - Regent honeyeater<br>- Painted honeyeater<br>- Eastern long eared bat (confirmed)<br>- Greater glider<br>- Koala (confirmed)<br>- Grey-headed flying-fox<br>- Northern quoll<br>- Spotted-tailed quoll (s. ssp)<br>- Collared delma | 72.34 | 8.31 |
| Non-eucalypt open forest | - Eastern long eared bat (confirmed)<br>- Koala (confirmed)<br>- Dunmall's snake<br>- Yakka skink | 33.97 | 2.89 |
| Vine thickets | - Black-breasted Button-quail<br>- Eastern long eared bat (confirmed)<br>- Grey-headed flying-fox<br>- Coxen's fig-parrot<br>- Northern quoll<br>- Spotted-tailed quoll (s. ssp) | 276.69 | 28.39 |
| Non-remnant open grassland pasture | - Squatter pigeon (southern subspecies) | 7,376.35 | 1667.59 |

**Construction activity and noise**

During the construction phase (short term) there will be an increase in noise and activity in the Study Area as machinery establishes access routes and infrastructure is installed. It is important to note that these impacts will not affect all of the Study Area simultaneously nor will they persist in any one area for a considerable period of time (months). However, when activity and noise is occurring in areas adjoining conserved habitat, potential impacts may include:

- Reduced foraging ability by auditory predators due to increased background noise
- Increased risk of predation by visual predators due to increased background noise
- Reduction in breeding of species which use auditory calls for attracting mates (e.g. frogs, birds)
- Inhibitions to using a home range of dispersing
- Increased potential for collisions with vehicles
- Human visitation causing disturbance to foraging or breeding behaviours.

While these potential impacts are acknowledged it is considered unlikely that they will cause a significant impact on any of the species detected or likely to occur in the Study Area.

### 12.6.2 Operation and maintenance

#### 12.6.2.1 Potential impacts to flora

Potential for impacts on flora during the operation and maintenance phase of the Project are considered to be limited to:

- Erosion and sedimentation of soils
- Dispersal and spread of weeds.

The significance of this impact is considered to be low as operation and maintenance activities are infrequent and can be adequately controlled by standard management and hygiene practices. Groundwater extractions are expected to primarily occur for the construction phase, limited extraction is anticipated for the operations phase.

#### 12.6.2.2 Potential impacts to fauna

**Fauna connectivity**

In a fragmented landscape, biodiversity corridors can be very important to help maintain viable populations of biota by increasing connectivity. A biodiversity linkage or corridor can be described as a linear landscape element that connects two or more patches of natural habitat and functions to facilitate movement (including birds, bats and other fauna).

At the landscape scale, the Brigalow Belt BPA is identified as a State significant fauna corridor approximately 10 km wide between Bunya Mountains to the southeast of the Study Area and Diamondy State Forest to the northwest (Figure 12.3, Volume 2).

The Project Site extends up to 6 km into the corridor, but the degree of encroachment is less than 3 km in most areas. The Study Area does not contain significant forested areas, and so while the BPA corridor may represent the shortest distance between Bunya Mountains National Park and Diamondy State Forest it may not provide the most important link between these areas and/or there is the potential for other connectivity paths within the wider area. For example, Figure 12.3, Volume 2 shows that a number of remnant parcels occur to the south of the Study Area, including Mahen and Jandowae State Forests. While this link between Bunya Mountains and Diamondy State Forest is more circuitous than the BPA corridor, it is also significantly less fragmented and would provide a significant secondary pathway. Similarly, there is also habitat to the north of the Project Site that would continue to provide a movement pathway. The Project is therefore considered unlikely to have a significant impact on the BPA.

**Terrestrial fauna**

Fauna species that may be present within the Project Site during operation include native threatened and common native fauna, livestock and feral fauna. The majority of research on the relationship between wind farms and fauna is focused on the impacts to birds and bats (discussed in detail in the sections below).

Potential impacts to terrestrial fauna within the available studies include; destruction and modification of the habitat, including the impacts of roads, habitat fragmentation and barriers to gene flow; noise and vibration effects; visual effects; shadow flicker; macro- and microclimate change; predator attraction and an increase in fire risks. There is limited peer reviewed research on these impacts and the small number of studies that do exist all acknowledge there are large gaps in the field.

One study concluded that wind farms affect large mammals mainly through an increase in human activity at the wind farm area. During the construction phase, large animals may temporarily avoid wind farms, but when construction and human presence is removed, animals acclimate to wind energy infrastructure (Helldin, 2012). The presence of humans during the operation phase will be limited to maintenance works and inspections. The Project will be otherwise operated remotely.

For fenced animals with little opportunity to move or for fauna species with limited home ranges; it is possible that noise and visual effects from turbines may increase stress levels. It may affect aspects of their lifecycle involving auditory cues (reduced auditory detectability of predators; reduced auditory detectability of prey; reduced detectability of mating calls etc.).

The Project does not provide fencing around the turbines and tracks, therefore cattle will continue to be able to move within the boundaries of their existing paddocks. It is recognised that there may be some slight negative impact to movement to native fauna from the proposed tracks, through avoidance.

Minor quantities of hazardous substances will be stored on the Project Site during the construction and operation of the Project. With the proposed methods for handling and storage of these contaminants, it is not anticipated that there will be exposure of contaminants to fauna, or bioaccumulation in the system. It is considered likely that in the long term there will be a certain degree of habituation to the background noise, and that significant long term reduction in habitat values is unlikely to occur.

**Birds**

Potential impacts to birds include displacement from suitable habitat due to wind farm avoidance; increased energy expenditure due to increased flight distances as a result of wind farm avoidance; and fatalities due to collisions with turbines and associated power lines.

Appropriate siting of a wind farm is the most effective measure to avoid bird fatalities. However, there is no universal formula or method that can accurately determine where impacts to birds will occur. A qualitative review of the known and likely birds within the Study Area has been undertaken to determine the potential impact to least concern and threatened bird species.

*Avoidance behaviour*

There is potential for the abundance of birds within the Study Area to marginally decline. During operation, avoidance of areas in which turbines are located has the potential to result in the loss of access to habitat areas and displacement of birds. This impact may not be long term, as some birds may habituate and begin to utilise the Project Site again.

The Project is located in a highly cleared landscape in which species typical of fragmented rural environments are common. Avoidance of the Project Site by these species is considered unlikely to affect their broader populations. The issue of avoidance is more significant for forest dependent birds, but in this regard it is noted that the turbines are located on largely cleared ridgelines and that forested areas generally occur at a lower topographic position on adjoining slopes. The height of the turbine towers together with the steepness of slopes combines to create a significant topographic and visual separation between the towers and forested areas within a short distance. This factor is considered likely to attenuate the avoidance behaviour.

*Collision mortality and injury*

Bird collision rates with turbines depend on a range of factors related to bird species characteristics, numbers and behaviour, weather conditions, habitat type, topography and the operation of the wind farm itself.

Birds can become visually aware of turbines from substantial distances and demonstrate considerable caution. However, although fatalities at wind firms are highly variable they tend to be associated with particular behaviours, with the species most susceptible to wind turbine collision being those that exhibit direct foraging behaviours within the wind farm area, causing them to lose track of turbines while focused on prey. Such behaviours include diving on prey items, fly-catching and hovering. These behaviours are most common among raptor species.

Increased collision-related fatalities are also associated with increased interactions with other birds, either of the same or another species, which serves as a distraction leading to increased collision risk. Bird strike is also most likely to be experienced at turbines located at the head of gullies and at turbines adjoining vegetated slopes. These locations are more likely to have larger raptors, attempting to benefit from topographic lift and pursing prey and fail to recall the hazard that turbines pose.

Raptors have been identified within the Study Area including wedge-tailed eagle, brown falcon and nankeen kestrel (refer to Appendix D, Volume 3). The quantitative impact to populations within the Study Area is not possible to fully determine. However, it is likely that whilst individuals within the Study Area may be impacted through collision, this is unlikely to have a significant impact on the populations with the local region.

The area is not known to contain an important population of threatened or migratory birds. The only threatened forest-dependent birds (which may fly at a higher elevation) which may be found within the Study Area is the glossy black cockatoo (refer to Table 12.11). However, suitable habitat does not occur within or adjacent to the Project Site. The collision risk potential to this species is considered to be low.

Other threatened birds that may possibly be found within the Study Area are likely to be utilising the ground and are less likely to fly above canopy height. The potential impact to these species is considered to be low.

### Bats

Wind farms also pose a potential collision fatality and injury risk to bats, with the greatest risk being to migratory or tree roosting bats. There are a number of potential reasons and behaviours that may cause the risk of impact, including pre-migration flocking behaviour and possibly mating activity.

Low wind conditions are associated with increased insect activity, which may attract bats, and encourage the use of turbines from which to hawk, and is also associated with conditions under which bat migration activity peaks.

Barotrauma (tissue damage in the lungs caused by rapid changes in air pressure) around turbines is also a cause of microchiropteran bat deaths.

Fourteen species of microchiropteran bat have been recorded from the Study Area, including the Eastern long-eared bat. The Project is located in a highly cleared landscape, and in this regard is considered to be appropriately positioned to avoid impacts on important forage habitat for this group. Most microchiropteran bat activity will be associated with the vegetated slopes, which occur at a lower topographic position than the turbines. The height of the turbine towers together with the steepness of slopes combines to create a significant topographic and visual separation between the towers and forested areas within a short distance. This factor is considered likely to attenuate avoidance behaviour, i.e. reduce the potential for direct strike with the turbines and barotrauma. Surveys of the Study Area did not record caves or areas supporting a large collective of microchiropteran bats, which may concentrate a large proportion of a local population into a particular narrow flyway susceptible to turbine strike.

Three species of megachiropteran bat are known from the broader locality including the threatened grey-headed flying-fox. While none were recorded during surveys within the Study Area, all are considered possible occurrences and may use the area due to its biodiversity connectivity. The vegetated slopes and valleys will provide the most important habitat for these species.

Less is known about the risk of turbines to flying-foxes. However, the significant topographic and visual separation between the turbines and the most important forage habitat for this group will attenuate avoidance behaviour and the potential for direct strike with the turbines. The likely impact from the addition of the overhead transmission lines is also likely to be low and will not impact a local population. Barotrauma is not known to be a concern for megachiropteran bats and surveys of the Study Area did not record flying fox roosts, which may concentrate a large proportion of a local population into a particular narrow flyway susceptible to turbine strike.

## 12.7 Mitigation measures

Table 12.14 describes mitigation measures that will be implemented during the design, construction and operation phases of the Project. Further detail will be developed through the Project CEMP in consultation with relevant stakeholders.

**Table 12.14 Mitigation and management measures**

| Design |
|---|
| - Micro-siting will be undertaken during detailed design to further minimise impact on the areas of remnant vegetation and SEVT where possible.<br>- A vegetation and fauna management plan will be prepared to provide clear guidance on areas to be cleared and retained; methods for clearing; role of the spotter catcher; and other relevant environmental protection measures.<br>- A fauna construction management plan will be submitted to DEHP to obtain an approved Species Management Plan (SMP) for Least Concern fauna.<br>- A Weed and Pest Control Plan will be developed and implemented, detailing procedures for cleaning and checking construction vehicles entering the construction site<br>- Groundwater drawdown thresholds for the maintenance of GDEs will be considered as part of the groundwater extraction program.<br>- A fauna welfare plan will be prepared to address issues arising from bird and bat strike at turbines and overhead powerlines.<br>- An adaptive management monitoring program will be developed to document bird and bat mortalities, remove carcasses and assess the effectiveness of controls.<br>- An erosion and sediment control plan will be developed to control practices along roads and around infrastructure, which will minimise potential for sedimentation within adjoining conserved habitats.<br>- Any turbine lighting is to be minimised, and red lights used to prevent the attraction of insects. |

| Construction |
|---|
| - The recommendations of the micro-siting study will be implemented and include:<br>• Pre-clearing surveys<br>• Avoidance of features of localised conservation significance (e.g. hollow bearing trees; bottle trees; and rock outcrops). This will include reviewing turbine locations, road alignments, works areas, electricity infrastructure.<br>- Legislative requirements for clearing vegetation will be complied with.<br>- Requirements of the vegetation and fauna management plan/SMP will be complied with.<br>- Requirements of the Weed and Pest Control Plan will be complied with.<br>- Remove overabundant or notifiable pest species in accordance with advice from the Department of Agriculture and Fisheries<br>- Weekly visual inspection of construction areas for new infestations of weeds or pests<br>- Weekly inspections of weed or pest treatment areas to determine efficacy of measures<br>- Comply with groundwater drawdown thresholds identified in the design phase for the maintenance of GDEs<br>- The sediment and erosion management strategy will be implemented as part of the CEMP. Sediment and erosion control measures would be particularly important where roads and turbine footprints occur on steep slopes and within or adjacent to waterways, remnant vegetation or high value regrowth. The following measures will be included as a minimum:<br>• minimise earthworks as much as possible;<br>• install sediment and erosion control structures prior to commencement of construction;<br>• ensure sediment traps and other appropriate controls are maintained until all construction surfaces have stabilised;<br>• monitor regularly to ensure functioning of sediment and erosion control measures is maintained;<br>• stabilise and revegetate disturbed surfaces as soon as practicable; and<br>• construct batters to a gradient that allows adequate soil stability and ease of plant colonisation.<br>- If threatened flora species are located during pre-clearing surveys, efforts will be made to avoid or minimise impacts through the micro-siting process. |
| **Operation and Maintenance** |
| - The requirements of the Weed and Pest Control Plan will be complied with.<br>- The fauna welfare plan will be implemented which will include establishing a relationship with a veterinarian suitably experienced in the management of native wildlife, and a wildlife carers group experienced in the rehabilitation of injured birds.<br>- An adaptive management monitoring program will be implemented. If the results of assessment demonstrate that further mitigation is required, further assessment will be undertaken to determine appropriate mitigation or management measures.<br>- The erosion and sediment control plan (operation phase) will be implemented.<br>- Comply with groundwater drawdown thresholds identified in the design phase for the maintenance of GDEs<br>- Vehicle movements will be restricted to formed tracks to minimise the potential for collection and dispersal of weed seed on vehicles.<br>- Noxious weeds will be regularly controlled in areas adjoining tracks and infrastructure to further minimise risk of seed collection and dispersal. Areas downslope of tracks and infrastructure (in particular, gullies and areas of SEVT) will be inspected for sedimentation and signs of new weed establishment (measured against the baseline of the weed management plan). |

## 12.8 Residual impacts

Residual impacts are impacts that are considered likely to occur following the application of suitable mitigation measures.

Despite the design refinement process and micro-siting during detailed design and construction, there will be some loss of remnant vegetation and fauna habitat for the footprint of the turbines and supporting infrastructure. This loss of habitat forms a very small percentage of the available vegetation within the Study Area and is not likely to have a significant adverse impact on species or vegetation communities.

Following decommissioning of the Project, the land will be rehabilitated in a manner that promotes the reestablishment of the land use and vegetation that was removed.

Residual impacts to flora related values are therefore considered to be low and not significant.

In terms of fauna, it is likely that some degree of bird and bat mortality and injury will occur as a result of the Project, however there will be many factors involved in the actual severity of impact experienced. It is considered that positioning the Project in a largely cleared landscape (principally occupied by regionally common species) is the most significant measure to avoid any significant impacts occurring to bird and bat species. Ongoing monitoring during operation of the Project will indicate whether any further mitigation is required.

## 12.9 Cumulative impacts

Cumulative impacts occur where there is the potential for a combination of impacts from other projects or developments in the area. As there are no wind farms currently planned within 150 km of the Project, or other planned projects that are likely to have a significant impact to bats and birds (e.g. airfields, high-rise buildings), no cumulative impacts with the Project are expected to occur.

The Warrego Highway Upgrade is the closest project that may result in a cumulative loss of vegetation. However, this project is over 60 km from the Project Site and is unlikely to result in significant impacts to regional flora values being an upgrade to an existing road network. The Project's relatively small impact on flora values would result in a minor cumulative impact but is not considered to be significant in a local or regional context.

## 12.10 Summary and conclusions

The Project Site and Study Area has been assessed through desktop and on-site surveys to determine the likely impacts to flora and fauna, and the required mitigation measures to manage those impacts.

The Project is located in a highly cleared landscape where much of the original vegetation and habitat has been removed for grazing and cropping. The Project Site largely avoids areas of ecological significance, which has been achieved through a process of site verification and design refinement.

Decisions on the final location of infrastructure (micro-siting) during detailed design and construction will potentially allow for the further protection of species, habitat and features of localised conservation significance.

Impacts on threatened bat species and bird populations are not considered to be significant. However, there is the potential for occasional mortalities to occur. Ongoing monitoring during operation of the Project will help to determine whether further mitigation is required.

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