Central Queensland Coal Project

Chapter 14 – Terrestrial Ecology

Environmental Impact Statement

CDM Smith

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Central Queensland Coal Project

Chapter 14 – Terrestrial Ecology

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14 Terrestrial Ecology

This chapter of the Environmental Impact Statement (EIS) describes the existing terrestrial flora and fauna values within and surrounding the Central Queensland Coal Project (the Project), as defined by the boundary of the Central Queensland Coal Project area defined by Mine Lease (ML) 80187 and the adjacent ML 700022 on which the haul road and trail load out facility (TLF) is located (herein referred to as 'the Project area'). The assessment is based on desktop literature reviews of existing background information and site-specific field assessments.

The investigation focuses on habitats within the Project area and wider surrounds, considers seasonal variation, and targets threatened species. Field surveys have been carried out over a number of years and were designed to encapsulate seasonal variation in species' detectability. Survey sites were selected in representative locations of the key vegetation communities and habitat types present. The Project area together with additional sites visited surrounding the Project area represent the ecological Study area, as referred to in this chapter.

The following chapter assesses the likely impacts of the Project on terrestrial flora and fauna Environmental Values (EVs). This chapter collates the results of several fauna and flora technical reports (refer Appendix A9a – Terrestrial Fauna Reports and A9b – Terrestrial Flora Reports respectively) and provides the results of an updated desktop review and additional targeted fauna surveys (refer Appendix A9c – Ecological Desktop Search Results and A9d – Ecological Field Survey Results respectively).

Specific objectives of the terrestrial ecology assessment were to:

- Review the relevant background information including databases, mapping and literature;
- Describe the main vegetation communities within the Study area and confirm Regional Ecosystem (RE) mapping, known Environmentally Sensitive Areas (ESA) (as listed under the *Environmental Protection Act 1994* (EP Act)) and vegetation mapped as Essential Habitat for conservation significant species under the *Vegetation Management Act 1999* (VM Act);
- Confirm the likely presence / absence of flora and fauna (and associated habitats) listed under Queensland's *Nature Conservation Act 1992* (NC Act) and the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- Record the presence of introduced pest flora and fauna;
- Discuss potential direct and indirect impacts to terrestrial ecological values because of the Project; and
- Propose mitigation measures to protect or enhance terrestrial ecological values within the Project area.

The Draft Project Terms of Reference (ToR) were published for public review and comment by the Queensland Department of Environment and Heritage Protection (EHP) on 10 April 2017. The ToR were finalised by EHP 4 August 2017. As per the ToR the Project's impacts on Matters of National Environmental Significance (MNES) as listed under the EPBC Act are addressed in detail in Chapter 16 - MNES.

14.1 Project Overview

The Project is located 130 km northwest of Rockhampton in the Styx Coal Basin in Central Queensland. The Project will be located within Mining Lease (ML) 80187 and ML 700022, which are adjacent to Mineral Development Licence (MDL) 468 and Exploration Permit for Coal (EPC) 1029, both of which are held by the Proponent.

The Project will involve mining a maximum combined tonnage of up to 10 million tonnes per annum (Mtpa) of semi-soft coking coal (SSCC) and high grade thermal coal (HGTC). Development of the Project is expected to commence in 2018 and extend for approximately 20 years until the current reserve is depleted.

The Project consists of three open cut operations that will be mined using a truck and shovel methodology. The run-of-mine (ROM) coal will ramp up to approximately 2 Mtpa during Stage 1 (Year 1-4), where coal will be crushed, screened and washed to SSCC grade with an estimate 80% yield. Stage 2 of the Project (Year 4-20) will include further processing of up to an additional 4 Mtpa ROM coal within another coal handling and preparation plant (CHPP) to SSCC and up to 4 Mtpa of HGTC with an estimated 95% yield. At full production two CHPPs, one servicing Open Cut 1 and the other servicing Open Cut 2 and 4, will be in operation.

A new train loadout facility (TLF) will be developed to connect into the existing Queensland Rail North Coast Rail Line. This connection will allow the product coal to be transported to the established coal loading infrastructure at the Dalrymple Bay Coal Terminal (DBCT).

The Project is located within the Livingstone Shire Council (LSC) Local Government Area (LGA). The Project is generally located on the "Mamelon" property, described as real property Lot 11 on MC23, Lot 10 on MC493 and Lot 9 on MC496. The TLF is located on the "Strathmuir" property, described as real property Lot 9 on MC230. A small section of the haul road to the TLF is located on the "Brussels" property described as real property Lot 85 on SP164785.

14.2 Relevant Legislation and Policies

Environmental protection of existing terrestrial wildlife and habitats is governed by several legislative Acts, policies and guidelines which are described in Chapter 1 - Introduction. Those with relevance to terrestrial and aquatic values are outlined below.

14.2.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act regulates activities that may have an impact upon MNES. The Project has the potential to impact upon MNES including listed threatened species, communities and migratory birds and, therefore has been designated as a Controlled Action under the Act. This chapter does not assess the potential impacts on MNES as prescribed under the EPBC Act. As per the Project ToR impacts to MNES are described separately within Chapter 16 – MNES.

14.2.2 Nature Conservation Act 1992

The *Nature Conservation Act 1992* (NC Act) provides for the protection and management of native wildlife and habitat that supports native species with regard to:

- The clearing of plants protected under the NC Act;
- A clearing permit or an exemption under the NC Act;
- Activities that may cause disturbance (that is tamper, damage, destroy, mark, move or dig up) to animal breeding places; and
- The taking of fauna.

Subordinate legislation lists protected species and areas to which the regulatory provisions of the NC Act apply including:

- Nature Conservation (Wildlife) Regulation 2006: this Regulation lists terrestrial and aquatic plant and animal species presumed extinct, endangered, vulnerable, rare, common, international or prohibited. It recommends management objectives for the protection and maintenance of these species in Queensland, as appropriate; and
- Nature Conservation (Protected Plants) Conservation Plan 2000: this Plan provides protection and management of native flora.

14.2.3 Environmental Protection Act 1994

The EP Act and subordinate legislation provide regulatory provisions for the protection and management of EVs in relation to mining activities. The Act defines Category A, B and C ESAs and specifies limitations of mining activities on those areas.

14.2.4 Environmental Offsets Act 2014

The *Environmental Offsets Act 2014* (EO Act), *Environmental Offsets Regulation 2014* and the Queensland Government Environmental Offsets Policy provide a streamlined framework for environmental offset requirements. Offsets are required where there is an unavoidable impact on significant EVs. In addition, an environmental offset can only be required if impacts from a prescribed activity constitute a significant residual impact as identified through the following guidelines:

- The State guideline that provides guidance on what constitutes a significant residual impact for Matters of State Environmental Significance (MSES);
- The Commonwealth Significant Impact Guidelines for what constitutes a significant residual impact on MNES; and
- Any relevant local government significant impact guideline for Matters of Local Environmental Significance (MLES).

To avoid duplication with offsets required under the EPBC Act, the policy provides that the administering agency must consider other relevant offset conditions for the same or substantially the same prescribed impact. If duplicating conditions are imposed it allows the proponent to remove the duplication.

14.2.5 Vegetation Management Act 1999

The VM Act regulates the conservation and management of vegetation communities and provides protection for regional ecosystems (REs) classified as 'endangered', 'of concern' or 'least concern' under the VM Act. The clearing of native vegetation for the Project will be exempt from the provisions of the VM Act under Schedule 21 Part 1, Item 1 (6) of the Planning Regulation 2017 where clearing occurs within the Project's ML for a mining activity.

Off-lease development and activities that require the clearing of remnant vegetation will require approval under the VM Act before clearing can commence.

14.2.6 Biosecurity Act 2014

The *Biosecurity Act 2014* (Biosecurity Act) provides legislative measures to manage pests and weeds, diseases and environmental contaminants, to address the impacts they have on the economy, environment, agriculture, tourism and society. The Act commenced on 1 July 2016 and supersedes a range of separate legislative implements previously used to manage biosecurity. This includes the *Land Protection (Pest and Stock Route Management) Act 2002* which previously provided legislative measures to manage damaging pests and weed species.

The Act provides statutory powers to prohibit or restrict the introduction and spread of declared plant and animal pests within Queensland. Weeds and pests pose one of the most significant threats to flora and fauna and agriculture within the study area. Accordingly, a range of management measures will be implemented to restrict the introduction and / or spread of pest species as a means of protecting the viability of local cattle grazing activity.

14.2.7 Planning Act 2017

As of 3 July 2017, the *Planning Act 2017* (Planning Act) replaced the *Sustainable Planning Act 2009* (Sustainable Planning Act). The new Act is Queensland's principal planning legislation and comprises three main elements: plan making, development assessment and dispute resolution. The aim of the recent reform was to deliver a better planning system that enables responsible development and delivers proseperity, sustainability and liveability. The reform consolidated similar matters and rearranged provisions to create a more streamline legislative framework for development in Queensland. In comparison to the Sustainable Planning Act, the Planning Act is very similar in that:

- There are still state planning instruments (including the State Planning Polices (SPP)) and local planning intruments;
- There is still a development assessment system of which the State Assessment and Referral Agency will continue to be the assessment manager or referral agency for development applications where the state has jurisdiction;
- There are still dispute resolution processes; and
- There is still a hierarchy of regulatory instruments.

The SPP is a statutory instrument prepared under the Planning Act that relates to matters of Queensland interest. The SPP applies to a range of circumstances under the SP Act, including for development assessment and when proposed new planning schemes are made or amended. The SPP is applicable to assessable development within Queensland. The provisions of the SPP may also

be considered under the standard criteria of the EP Act which includes ecological matters of State interest including:

- Biodiversity - MSES - Regulated vegetation and MSES - Regulated vegetation (intersecting a watercourse) and waterway barriers; and
- Water Quality - Climatic regions - stormwater management design objectives.

In relation to additional ecologically related approvals, Section 4A of the *Mineral Resources Act 1989* precludes the application of the Planning Act to activities undertaken for purposes of the mining tenure where those activities occur within the ML.

14.3 Environmental Objectives and Performance Outcomes

In accordance with the EP Act (Section 125), generally there are three key areas to be identified and addressed through the Environmentally Relevant Activity (ERA) application process regarding land and the associated ecological values:

- Identify the EVs of the site, including any significant flora and fauna associated with the land;
- Identify the possible impacts due to the proposed activity and all associated risks to the EVs; and
- Identify the strategies to mitigate the identified risks to the EVs.

Performance outcomes for the related EVs identified within the Project area include:

- Activities that disturb land, soils, subsoils, landforms and associated flora and fauna will be managed in a way that prevents or minimises adverse effects on the EVs of land;
- Areas disturbed by Project activities will be rehabilitated to achieve sites that are stable, safe to wildlife and able to sustain an appropriate land use for EVs; and
- The activity will be managed to prevent or minimise adverse effects on the EVs of land due to unplanned releases or discharges.

Any Environmental Authority (EA) applications that have the potential to impact land must describe how environmental objective and performance outcomes for the ERA will be achieved.

14.4 Nomenclature

Flora nomenclature within this chapter follows taxonomy accepted by the Queensland Herbarium and Queensland Museum. Fauna nomenclature follows the Birdlife Australia Rarities Committee checklist (for birds) and EHP's WildNet database taxonomy (for all other fauna), unless otherwise noted. All flora and fauna in this chapter will be referred to initially by both their common and scientific names and then for ease of reading only by the common name.

14.5 Study Methodology

The methodology for the terrestrial and aquatic ecology assessment and stygofauna assessment involved a combination of desktop and field based assessment methods, including:

- A desktop review of relevant literature, published ecological studies and Commonwealth and State databases. The desktop review specifically identified vegetation communities, and flora

and fauna species which are known to exist, are likely to occur, or which have the potential to occur within the Project area;

- Review of field data and recent aerial imagery to refine existing mapping at the property scale; and
- Field surveys to assess and confirm the presence of listed species and vegetation communities identified during the desktop review.

14.5.1 Desktop Review

14.5.1.1 Terrestrial Ecology Desktop Review

Desktop studies were undertaken prior to field assessments. The desktop review was used to obtain background information relating to the potential presence and distribution of species and ecological communities (including connectivity across the regional landscape), particularly those listed under the VM Act and NC Act. Desktop studies involved database searches and review of:

- Current publicly available RE mapping (V8.0 - Queensland Herbarium 2017) and sensitive area mapping (DNRM);
- Commonwealth EPBC Act Protected Matters Search Tool (Department of the Environment and Energy (DotEE)) (to confirm current legislative status of listed species);
- EHP's WildNet (Wildlife Online) database and Species Profile Search results;
- Atlas of Living Australia species database;
- Mapping for the Protected Plants Trigger Survey Map, MSES, and Biodiversity Planning Assessment (BPA) (EHP, 2015);
- Styx Coal: Flora and Vegetation Assessment (Yeats Consulting Engineers (YCE), 2011); and
- Reporting of three seasonal fauna assessments for Central Queensland Coal:
    - A preliminary assessment of faunal values within and adjacent to EPC 1029, Styx Basin, central-east Queensland (Meyer 2011a)
    - September 2011 fauna survey results for EPC 1029, Styx Basin, central-east Queensland (Meyer 2011b) and
    - February 2012 fauna survey results for EPC 1029, Styx Basin, central-east Queensland (Meyer 2012).

Database searches were undertaken over a 50 km radius for State databases and 25 km radius for Commonwealth databases using the central portion of the Project area as a reference point. The EPBC protected matters search tool, whilst based on some species records, primarily relies on modelling of suitable habitats (with mapped boundary constraints accounted for) and is largely a predictive tool. As such, given the site's location (close to the coast) a smaller search radius was used for the search tool in order to avoid the inclusion of marine / coastal species not applicable to the Project area.

Wildlife Online database records are based on records of species from a wide variety of observers and although the records are generally accurate in terms of spatial location, not all records have been verified. Records from EHP's Species Profile Search are generally restricted to sightings from

Queensland Government department activities and are considered spatially accurate. Atlas of Living Australia records are largely verified and include specimen records from museum collections across Australia. The database search results for fauna and flora species are provided in Appendix 9c – Ecological Desktop Search Results.

14.5.1.2 Protected Plants Flora Trigger Survey Map

EHP maintains mapping showing high risk areas for the occurrence of protected plants. The mapping is for guidance on determining the necessity for detailed flora surveys and clearing permit requirements for a particular location. Areas mapped as 'high risk' are subject to specific requirements under the *Nature Conservation (Wildlife Management) Regulation 2006*.

14.5.1.3 Matters of State Environmental Significance

EHP maintains a mapping database of MSES as a guide to assist the planning and development decision-making process. Queensland's SPP includes a biodiversity interest that states 'Significant impacts on matters of National or State environmental significance are avoided, or where this cannot be reasonably achieved; impacts are minimised and residual impacts offset'.

The SPP defines matters of state environmental significance as:

- Protected areas under the NC Act;
- 'Marine national park', 'conservation park', 'scientific research', 'preservation' or 'buffer' zones under the *Marine Parks Act 2004*;
- Areas within declared fish habitat areas that are management A areas or management B areas under the Fisheries Regulation 2008;
- A designated precinct, in a strategic environmental area under the Regional Planning Interests Regulation 2014, schedule 2, part 5, s15(s);
- Wetlands in a wetland protection area or wetlands of high ecological significance shown on the map of refereable wetlands under the Environmental Protection Regulation 2008;
- Wetlands and watercourses in high ecological value waters identified in the Environmental Protection (Water) Policy 2009, Schedule 1;
- Legally secured offset areas as defined under the EO Act;
- Threatened wildlife under the NC Act and special least concern animlas under the Nature Conservation (Wildlife) Regulation 2006;
- Marine plants under the *Fisheries Act 1994* (excluding marine plants in an urban area);
- Waterways that provide for fish passage under the *Fisheries Act 1994* (exluding waterways provided for fish passage in an urban area);
- High risk area on the flora survey trigger as described by the Environmental offsets Regulation 2014, schedule 2, part 6(1);
- Regulated vegetation under the VM Act that is:

    a) category B areas on the regulated vegetation management map, that are 'endangered' and 'of concern' regional ecosystems

b) category C areas on the regulated vegetation management map that are 'endangered' and 'of concern' regional ecosystems

c) category R areas on the regulated vegetation management map

d) areas of essential habitat on the essential habitat map for an animal that is 'endangered wildlife' or 'vulnerable wildlife' or a plant that is 'endangered wildlife' or 'vulnerable wildlife' wildlife prescribed as 'endangered wildlife' or 'vulnerable wildlife' under the NC Act

e) category A, B, C, R areas that are located within a defined distance from the defining banks of a relevant watercourse identified on the vegetation management watercourse and drainage feature map

f) category A, B, C, R areas that are located within 100 metres from the defining bank of a wetland identified on the vegetation management wetlands map.

14.5.1.4 Matters of Local Environmental Significance

The Livingstone Shire Council was re-established in 2014 following a successful referendum on de-amalgamation from Rockhampton Regional Council (formed in 2008). Public comments on the draft *Livingstone Planning Scheme* (the 'Draft plan') are currently being evaluated by Council. The Draft plan identifies MLES and associated assessment provisions under Part 8.2.3 of the Draft plan – 'Biodiversity overlay code.' Biodiversity overlay mapping identifies both MSES and MLES. Within the Project area all vegetation listed as 'Least Concern' under the VM Act is mapped as a MLES – habitat and vegetation.

However, the Project area remains covered under the *Planning Scheme 2005 – Reprint 6* (the Scheme) and does not refer to MLES. 'Locally significant vegetation' is identified in small patches of Endangered vegetation (under the VM Act) to the north of the Bruce Highway within the Project area. Much of the continuous habitat that intersects the southern portion of the ML is also considered as 'locally significant vegetation.' The scheme identifies Tooloombah Creek Conservation Park as a 'protected area.' The eastern boundary of this area lies less than 1 km west of the Project. The Scheme outlines management outcomes related to development on or adjacent to a 'protected area' ensuring no significant adverse effects occur including: fire risk management; changes to natural drainage; disposal of waste and sources of pollution; managing public access and pest and weeds; and impacts to fauna activity such as through the use of fencing or lighting.

14.5.1.5 Biodiversity Planning Assessment

EHP has prepared a Biodiversity Planning Assessment (BPA) for a number of Queensland bioregions in order to provide broad scale ecological data to advise a range of planning and decision-making processes. The BPA process employs the Biodiversity Assessment and Mapping Methodology (BAMM) (Environmental Protection Agency (EPA) 2002) to determine the relative biodiversity significance of habitats and landscapes in relation to:

- Threatened ecosystems or taxa;
- Tract size of habitats;
- Ecosystem diversity;
- Landscape context and connection; and

- Buffers to wetland or other types of habitat important for the maintenance of biodiversity or ecological processes.

This is based largely on remnant vegetation mapping data generated under the VM Act, significant flora and fauna records, and expert panel determinations. The BAMM assigns three levels of Biodiversity Significance:

- State Significance – areas assessed as being significant for biodiversity at the Bioregional or State scales. They also include areas assessed by other studies / processes as being significant at national or international scales;
- Regional Significance – areas assessed as being significant for biodiversity at the sub-bioregional scale. These areas have lower significance for biodiversity than areas assessed as being of State significance; and
- Local Significance and Other Values – areas assessed as not being significant for biodiversity at State or Regional scales. Local values are of significance at the local government scale.

The BPA methodology uses seven diagnostic criteria: habitat for significant taxa, ecosystem value, tract size, relative size of RE, condition, ecosystem diversity, and context and connection to determine the relative biodiversity significance of habitats and landscapes. The BPA methodology also uses the advice of convened 'expert panels' to refine the mapping-based results and identify specific areas of value.

14.5.2 Field Surveys

A number of ecological field surveys have been undertaken for this Project to ground-truth desktop information and identify any additional flora and fauna values not identified through the desktop study. These include studies carried out for the former incarnation of the Central Queensland Coal Project which encompassed a much larger area (EPC 1029). Field surveys comprised:

- Detailed summer (wet season) fauna survey of EPC 1029 (five days) 21 to 25 March 2011 by Ed Meyer (ecological consultant);
- Summer (wet season) flora survey of EPC 1029 (five days) 21 to 25 March 2011 by Oberonia Botanical Services;
- Detailed winter (dry season) aquatic ecology survey of EPC 1029 (six days) 1 to 6 June 2011 by ALS Water Sciences;
- Detailed spring (dry season) fauna survey of EPC 1029 (five days) 25 to 29 September 2011 by Ed Meyer (ecological consultant);
- Targeted threatened fauna survey of EPC 1029 (four days) 7 to 10 February 2012 by Ed Meyer (ecological consultant);
- Stygofauna pilot survey (four days) 21 to 24 November 2011, by ALS Water Sciences;
- Summer (wet season) flora survey of ML 80187 and immediate surrounds (three days) 8 to 10 February 2017 by Terrestria (led by Dr Andrew Daniel – Terrestria);
- Detailed summer (wet season) fauna survey of ML 80187 and immediate surrounds (six days) 8 to 13 February 2017 by CDM Smith (led by Brett Taylor); and

- Supplementary fauna data obtained during water quality sampling events on ML 80187 and the wider surrounds in May 2017. Activities included bird surveys, herpetrofauna searches and spotlighting.

Surveys were designed to encapsulate seasonal variation in species' detectability, and survey sites were selected in locations representing the key threatened vegetation communities and dominant habitat types present on the Project area and surrounds. All surveyed areas within the Project area were visited at least once during the site studies. Weather conditions for each survey period as recorded at Saint Lawrence (located 37 km north of the Project) are presented in Table 14-1.

Table 14-1 Weather conditions during Central Queensland Coal Project surveys

Survey	Temperatures during study	Rainfall and comments
March 2011	Minimum: 21.9°C Maximum: 34.6°C (source: Meyer 2011a)	23 mm rain recorded during survey. Heavy falls recorded in area in week prior to survey (145 mm). Survey undertaken following an exceptionally wet summer with well-above-average rainfall over most of coastal eastern Queensland. December 2010 rainfall totals were especially high with Marlborough recording over 560 mm of rain.
September 2011	Minimum: 10.8°C Maximum: 26.8°C (source: Meyer 2011b)	Except for August 2011 monthly rainfall totals for Marlborough (to the near south of EPC 1029) were close to average in the six months prior to surveys. Little rain was recorded at Marlborough in the month preceding surveys and no rain was recorded during the survey period.
February 2012	Minimum: 21.8°C Maximum: 33.2°C (source: Meyer 2012)	Rainfall in the months preceding surveys was generally at or below average. With significant rainfall in late January and storms on the 7th and 8th of February surface water was plentiful in low-lying parts of the Study area.
February 2017	Minimum: 21.9°C Maximum: 35.6°C (source: BoM 2017)	Conditions during the February 2017 survey were very hot and dry. Excepting a single day in January on which 212 mm was recorded at St Lawrence (located 74 km north of the Project area), mean rainfall in the area was below average in the months preceding the survey and across the entirety of February. How the January rain event affected the Project site is uncertain as no rain was recorded in Rockhampton on the same day.
May 2017	Minimum: 15.6°C Maximum: 29.1°C (source: BoM 2017)	The region received high rainfall in March 2017 (680 mm) mostly associated with cyclone Debbie. Localised flooding was recorded in Deep Creek and Tooloombah Creek. As a result, the area was much less dry on subsequent site visits with many waterholes / dams much higher and flow in the creeks observed in May 2017.

With exceptional rainfall in the months and weeks leading up to the March 2011 survey, site access was greatly restricted. With conditions already wet and the prospect of further significant rainfall, pitfall trapping was not undertaken during the baseline fauna assessment. Site conditions during subsequent surveys were more favourable and did not restrict the assessment methods used.

14.5.2.1 Terrestrial Vegetation Assessment

Terrestrial vegetation surveys were undertaken to assess the vegetation communities present within the Study area, to assess the quality of vegetation communities, and to assess whether vegetation communities mapped in the latest RE mapping (V9.0; Queensland Herbarium 2015) were represented by communities which were actually present within the Project area. Initial surveys of the ML were undertaken to broadly characterise vegetation communities within the Study area and confirm the accuracy of existing RE mapping for remnant and regrowth vegetation.

Further information was required where RE mapping was found to be inconsistent with the onsite vegetation. These sites were marked by waypoints on a hand held Global Positioning System (GPS) and accompanied by photographic evidence and site proformas / observations. Tertiary level information gathered at these sites was complemented by Quaternary level sites taken throughout

the site traverse. Quaternary sites were used to confirm vegetation community types, vegetation community boundaries, land zones, and occurrence of creek lines.

The vegetation surveys also focussed toward confirming the presence / absence of listed flora species through a series of observational assessments and targeted searches within key habitat types identified through desktop searches.

The 2017 field assessment was conducted in accordance with the Queensland Herbariums' Methodology for Survey and Mapping of REs and Vegetation Communities in Queensland, Version 3.1 (Neldner *et al.,* 2012). Where discrepancies were identified in the field between existing RE mapping and field observations, areas were traversed by foot to confirm the extent of the change. Field surveys used standard floristic survey methods to describe vegetation type, structure and composition are outlined below. The locations of flora assessment survey sites are shown in Figure 14-1.

Secondary Assessments

Secondary assessments involve sampling plots of at least 50 m by 10 m in size, within each defined vegetation community. This methodology was; however; subject to the size of the vegetation community, with additional sites surveyed in vegetation communities covering large areas, and a reduction in the number of sites surveyed in small communities.

Tertiary Assessments

Tertiary site assessments were used for classification and detailed descriptions of REs and vegetation communities. Data collected included location, environmental and overall structural information as well as a full species list, estimates of stem density, estimates of basal area (of woody stems using the Bitterlich stick method) and a measure of percentage cover.

Quaternary Assessments

Quaternary site assessments were used to rapidly assess REs and vegetation communities, using linear transects. Data were collected at regular intervals along each transect and where REs and vegetation communities change in structure and composition.

Regional Ecosystem Code Sites

Regional Ecosystem Code Sites were used during the February 2017 survey and are used to aid in classification and detailed descriptions of regional ecosystems and vegetation communities and provide 'enhanced' Tertiary level information. Data collected include location, and environmental information such land zone. Structural information such as height and covers are estimated for all structural layers. Generally, only the dominant or conspicuous species that characterise each layer are recorded. Plots are not laid out using a tape, site dimensions are restricted to a commonly occurring vegetation type and condition.

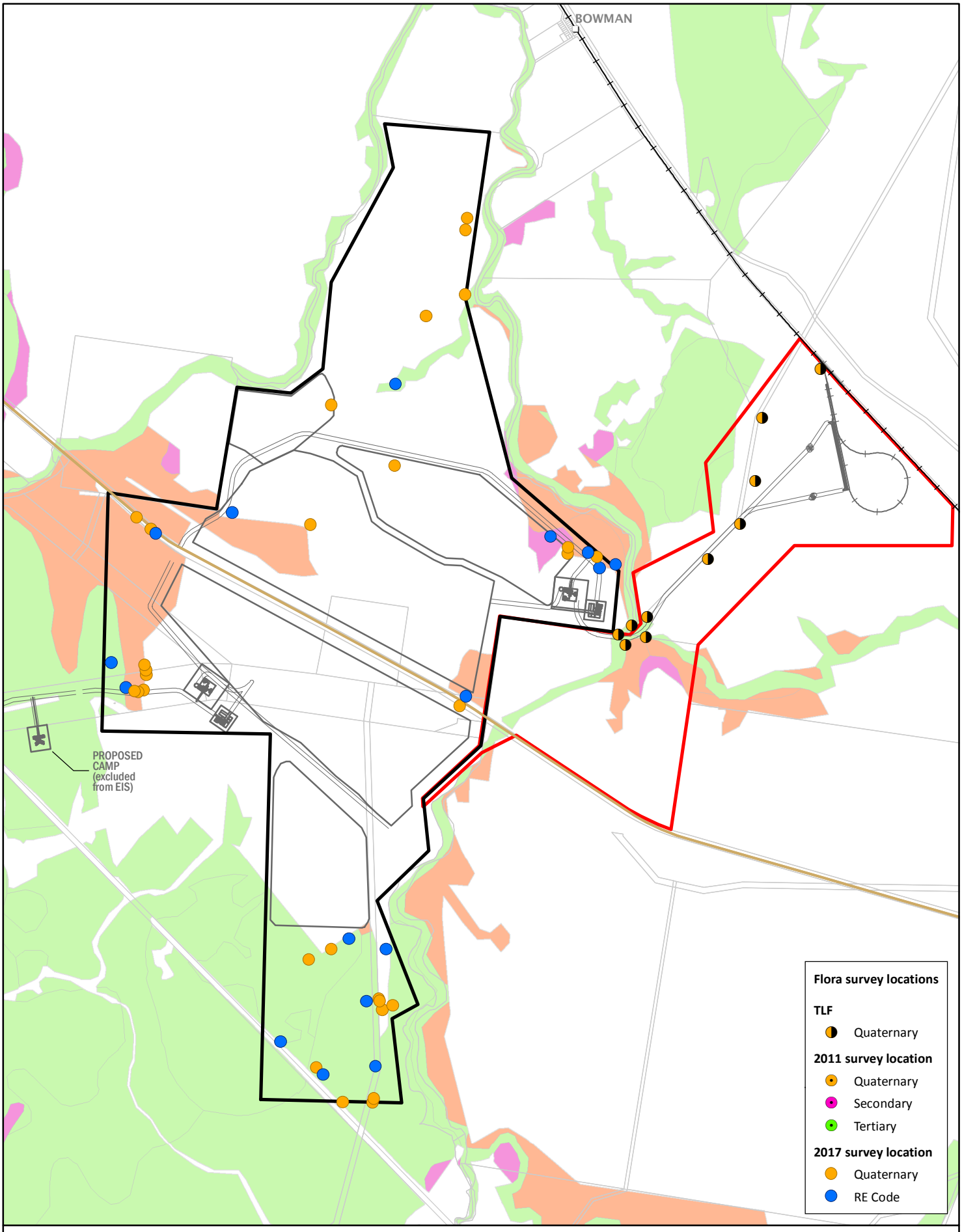
Opportunistic Observations

In addition to the detailed survey plots, opportunistic flora data were collected while traversing roads and tracks and whilst travelling between the more detailed survey sites. These data were used to assist in confirmation of RE mapping and to check relationships between classificatory units (such as vegetation associations, REs, photo-patterns) and landscape features.

Field Data Analysis

Ground-truthed data along with contemporary aerial imagery were used to determine:

- Potential presence / absence of Threatened Ecological Communities (TEC);
- Known or potential habitat for listed species (NC Act and EPBC Act);
- Accuracy of RE mapping (VM Act); and
- Potential presence of pest flora species (Biosecurity Act).



N

0 0.5 1 km

Scale @ A4 1:50,000
Date: 12/07/17
Drawn: Gayle B.

Legend

- ML 80187
- ML 700022
- Proposed mine infrastructure
- North Coast Rail Line
- Main road

Remnant Vegetation (DNRM)

- Endangered - Dominant
- Least Concern
- Of Concern - Dominant
- Non-remnant

Figure 14-1
Flora survey locations ML 80187 on current DNRM vegetation mapping

DATA SOURCE
QLD Spatial Catalogue (QSpatial), 2017

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14.5.2.2 Terrestrial Fauna Assessment

A detailed summer fauna assessment of the wider area (EPC 1029) was carried out over five days from 21 to 25 March 2011 inclusive. A second early spring, or dry season assessment, was carried out over five days from 19 to 23 September 2011. A total of four detailed survey sites were established for both survey periods with eight separate survey sites established overall. A third detailed assessment was carried out in February 2017 establishing an additional four sites.

Survey sites were selected based on RE mapping, land access and the integrity of the habitat to support local fauna species. Although the 2011 surveys covered a much wider study area than the present Project area, five of the detailed survey sites were located on or within 500 m of the boundary of ML 80187, two further sites were located within 2.5 km of the ML boundary, and the final site was located 5 km north of the ML. Locations of detailed survey sites are depicted in Figure 14-2 and descriptions of the trapping sites are provided in Table 14-2.

The 2011 and 2017 fauna surveys used generalised methods to sample all fauna groups potentially present. Each systematic survey site was subject to a fauna trapping regime carried out over five days and four nights. Supplementary assessments were also carried out across the entirety of the study area and included bird surveys, herpetofauna searches, microbat call recording and spotlighting searches. Locations of the 2011 supplementary sites are detailed in the fauna assessment technical reports (Appendix A9a – Terrestrial Fauna Reports). Further details of survey methodology techniques are provided in Table 14-3.

Opportunistic fauna data was also collected in subsequent site visits for water quality sampling in May 2017 covering the study area and wider surrounds.

The fauna surveys carried out in February 2012 and February 2017 used survey methods designed to target conservation significant fauna species (listed under NC Act and the EPBC Act). Surveys were undertaken at an intensity considered sufficient to maximise detection of the main target species (with regard to EPBC Act threatened fauna survey guidelines) potentially present.

Although the fauna assessment program is considered robust, CDM Smith have adopted a conservative approach when considering conservation significant fauna species within the impact assessment for this Project. As such, all species with the potential to occur in the Project area have been assumed to be present unless evidence exists to suggest absence. Further details of survey methods used to target conservation significant fauna identified from the desktop review are provided in Table 14-3.

Four categories were used to classify the likelihood of a threatened flora and fauna species being present within the Project area based on the desktop research and onsite observations. Categories were defined as:

- Known (confirmed during field assessments);
- Likely (known distribution, records within or around the Project area, and suitable habitat observed during field assessments);
- Potential (known distribution, limited records of the species occurring in the wider area and possibility of suitable habitat occurring); and
- Unlikely (no suitable habitat or not known to occur within the local region).

The presence or potential presence of a species, and species habitat was used to inform assessment of the potential risk of impacts from the Project on identified ecological values.

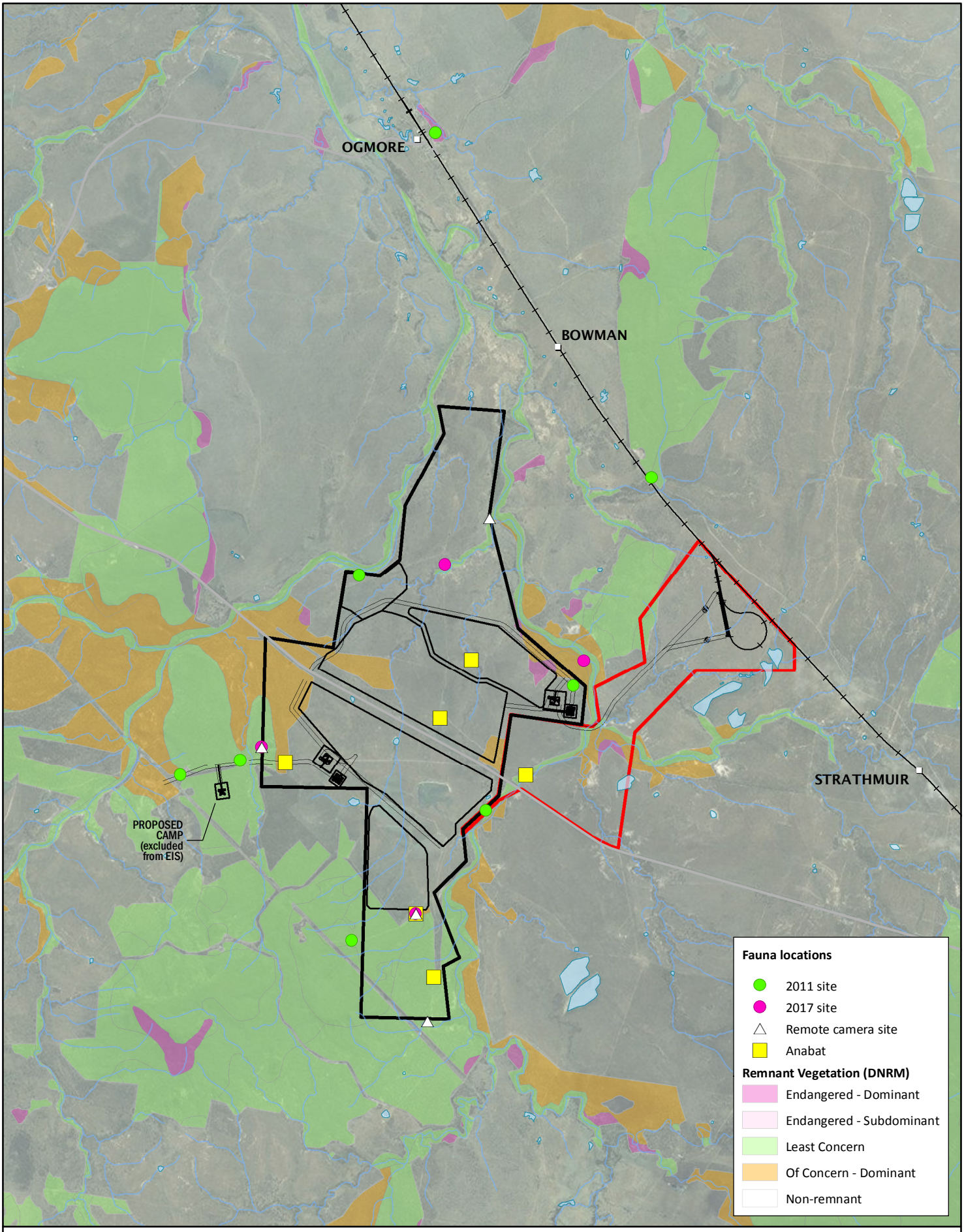

Figure 14-2
Fauna survey locations – 2011/12 and 2017

DATA SOURCE
QLD Department of Environment and Heritage Protection, 2016;
QLD Spatial Catalogue (QSpatial), 2017

CDM Smith

Table 14-2 Description of fauna trapping sites – 2011 and 2017 surveys

Trap site	Location and coordinates	Habitat description
March 2011		
Site 1	-22.66886 149.69475	Remnant Narrow-leaved Ironbark (*Eucalyptus crebra*) woodland with sparse shrub layer and dense cover of native grasses. Located approximately 2.5 km east of northern extent of Project area
Site 2	-22.61894 149.65978	Remnant gilgaied Brigalow (*Acacia harpophylla*) woodland, near Ogmore. Located approximately 4.5 km north of Project area.
Site 3	-22.718 149.66964	Remnant riparian open forest / woodland along Deep Creek, south of the Bruce Highway. Located on eastern boundary of Project area.
Site 4	-22.71356 149.62136	Remnant Narrow-leaved Ironbark / Queensland Peppermint (*E. exserta)* woodland / open forest with a mid-dense shrubby understory of Spear Wattle (*Acacia rhodoxylon*), adjacent to Mt Bison Road, south of the Bruce Highway. Located approximately 1.3 km west of Project area.
September 2011		
Site 5	-22.66886 149.69475	Narrow-leaved Ironbark woodland with dense grassy understory, upslope from watercourse. Located approximately 300 m west of Project area.
Site 6	-22.61894 149.65978	Mixed eucalypt woodland / open forest on hill slope with sparse shrub layer and sparse grass cover, on sandy soil with small areas of exposed rock. Located approximately 200 m west of southern extent of Project area.
Site 7	-22.718 149.66964	Semi-evergreen vine thicket with emergent Forest Red Gum (*Eucalyptus tereticornis*) and Moreton Bay Ash (*Corymbia tesselaris*) fringing Tooloombah Creek. Located within northwest extent of Project area.
Site 8	-22.71356 149.62136	Remnant gilgiaed Brigalow woodland with dense to mid-dense shrub layer dominated by Currant Bush (*Carissa ovata)*, to the near east of Deep Creek. Located within eastern extent of Project area.
February 2017		
Site 1	-22.7093 149.63409	Remnant Poplar Gum (*E. platyphylla*) woodland with very sparse shrub layer (RE11.5.8a). Native grasses sparse at time of survey due to very dry conditions and ongoing cattle presence. Located uphill from large ephemeral wetland area on western edge of Project area.
Site 2	-22.73334 149.65887	On edge of remnant Narrow-leaved Ironbark / Poplar Box (*E. populnea)* dominated woodland (RE11.10.7). Dense understorey dominated by the introduced Lantana (*Lantana camara*) and Red Ash (*Alphitonia exselsa*). Located within southern portion of Project area.
Site 3	-22.68213 149.6625	Thin riparian Forest Red Gum open forest strip adjacent to dense regrowth Brigalow (RE11.3.25). Dense but patchy lower shrub layer. Small pools of water present in creek. Located within northern portion of Project area.
Site 4	-22.69589 149.68464	Remnant mixed gum woodland (RE11.3.4) with patchy shrub layer dominated by the introduced Lantana. Ground layer also patchy with some dense areas of sedges in low drainage channel bisecting site. On eastern edge of Project area.

Table 14-3 Fauna trapping methods

Survey method	Description	Target listed species (as identified in desktop surveys)
Trap sites (all)		
Elliott trapping	20 baited Elliott A and B traps located 10 m apart along a single transect at each site. Trapping carried out at 12 sites comprising 940 trap nights.	▪ Northern Quoll; and ▪ Yakka Skink (around potential colonies).
Pitfall / funnel trapping	A pitfall line at each site comprising 4 x 20 L pitfall buckets, 30 m fence and 4 x funnel traps paired at each end of fence line. Positioned where suitable habitat structure occurs (woody debris, shrubby vegetation). No pitfall trapping was possible in March 2011. Trapping carried out at eight sites comprising 32 trap nights.	▪ Ornamental Snake; ▪ Dunmall's Snake; and ▪ Collared Delma.
Infrared camera traps	Infrared camera set at each trap site (5 per site in March 2011 and 2 per site in September 2011). Cameras set at four sites in 2017 in front of bait station. Trapping carried out at 12 sites comprising a total of 130 camera trap nights.	▪ Northern Quoll.
General methods (across Project area including trap sites)		
Diurnal bird census	Two 20 minute bird surveys across a 2 ha area at each trap site and opportunistically throughout Study area. Birds identified by direct observation and / or by call. 54 surveys over approximately 18 hrs across Project area.	▪ All bird species.
Diurnal searches for herpetofauna	Searches for frogs and reptiles under leaf litter, debris, logs and rocks. Carried out at each trap site and throughout Study area where appropriate habitat factors occurred. Approximately 42 hr of searches over 42 ha were conducted across Project area.	▪ Ornamental Snake; ▪ Dunmall's Snake; ▪ Collared Delma; and ▪ Yakka Skink.
Anabat microbat call recording	Passive recording of microbat calls overnight (6 pm to 6 am) using Anabat recording system. Carried out at each trap site and throughout Study area where appropriate habitat factors occurred. Anabat surveys carried out over 17 nights at sites across Project area.	▪ Large-eared Pied Bat (*Chalinolobus dwyeri*); and ▪ South-eastern Long-eared Bat (*Nyctophilus corbeni*).
Spotlighting surveys	Minimum ½ hour (hr) spotlighting in early evening (2 people) at each trap site for nocturnal mammals and herpetofauna. Also surveying tracks at night and throughout Study area where appropriate habitat factors occurred. Call playback surveys for nocturnal bird species also carried out where considered suitable. Approximately 25 person hours conducted over survey periods.	▪ Koala; ▪ Ornamental Snake; ▪ Grey-headed Flying-fox; and ▪ Greater Glider
Terrestrial habitat assessment	Habitat assessed for suitability to provide resources for terrestrial fauna. Habitat characters assessed include: tree hollow abundance, evidence of nesting, leaf litter, large woody debris and weed invasion.	Assessments included searches for Koala and signs of habitat use (tree scratches and scats).

Survey method	Description	Target listed species (as identified in desktop surveys)
Incidental records	Fauna observations were ongoing throughout the site and survey period.	N/A

14.6 Existing Environmental Values

The Project is largely located within the Marlborough Plains subregion, one of the 13 subregions of the Brigalow Belt North bioregion. The southern portion of the ML occurs in the adjacent Nebo-Connors Ranges subregion. The Project area is located close to the boundary of the Brigalow Belt South bioregion located to the south. Vegetation within the Marlborough Plains subregion is dominated by alluvial plains and colluvial slopes, usually supporting woodlands characterised by Poplar Gum, Ghost Gum (*Corymbia dallachiana*), Forest Red Gum and paperbarks (*Melaleuca* spp.) with low rises supporting Narrow-leaved Ironbark.

Large sections of the Brigalow Belt North bioregion have been cleared of remnant native vegetation for grazing, agriculture and mining. Remaining vegetation is generally confined to rockier hilly areas, linear strips of roadside vegetation, riparian vegetation and relatively small isolated remnants. Thus, clearing over the past 150 years has resulted in a highly fragmented landscape with remnant vegetation patches separated by large expanses of cleared land.

Areas to the north and east of the Project area have been substantially impacted by vegetation clearing associated with cattle grazing activity. Connectivity between remaining tracts of vegetation is tenuously maintained by thin strips of riparian vegetation along creek lines such as Tooloombah Creek and Deep Creek which border the Project. Nevertheless, woodland and open forest habitat remaining in the south and east of the site remains contiguous with an extensive tract of remnant vegetation, which includes Tooloombah Creek Conservation Park. To the west of the Project remains extensive tracts of remnant forest associated with the nearby Broadsound Range.

Vegetation within the Project area and immediate surrounds comprises:

- Heavily disturbed habitats that have previously undergone significant clearing for cattle production. Where this habitat occurs north of the Bruce Highway it is often dominated by patches of regrowth Brigalow;
- Substantial areas of less disturbed eucalypt woodland; and
- Smaller pockets of relatively closed canopy (open forest) vegetation generally with a dense weedy shrub layer. These are largely associated with the creek systems adjacent to the Project (mine ML) boundary.

The mine area and TLF is situated within the lower catchments of Tooloombah Creek and Deep Creek, which are sub-catchments within the Styx River catchment. Both creeks feed directly into the Styx River (2 km north of the Project area) which discharges into the Broad Sound area approximately 8 km north of the Project. The haul road to the TLF crosses Deep Creek and Barrack Creek. Tooloombah Creek and Deep Creek are non-perennial or ephemeral, and only flow following rainfall events.

14.6.1 Terrestrial Flora – Desktop Results

14.6.1.1 Threatened Ecological Communities

The Protected Matters Search Tool identified five listed TECs as having potential to occur in the Project area:

- Brigalow – Endangered;
- Broad leaf tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland – Endangered;
- Coolibah (*Eucalyptus coolabah*) - Black Box (*Eucalyptus largiflorens*) Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions – Endangered;
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin – Endangered; and
- Semi-evergreen vine thickets (SEVT) of the Brigalow Belt (north and south) and Nandewar Bioregions – Endangered.

Current RE mapping indicates there is one RE present within the overall Project area that may be considered a Brigalow TEC (RE11.4.9).

14.6.1.2 Regional Ecosystems

Assessment of current DNRM RE mapping (Version 10.0) identified nine REs occurring on six land zones within the Project area: alluvial river and creek flats (land zone 3); Cainozoic clay plains (land zone 4); Cainozoic sand plains (land zone 5); Cainozoic lateritic duricrust (land zone 7); coarse-grained sedimentary rocks (land zone 10); and deformed and metamorphosed sediments and interbedded volcanics (land zone 11) (Neldner *et al*., 2014). The proposed mine area incorporates land holdings currently used for cattle grazing. Due to historical and current farming practice, the ML has been substantially cleared with 80 percent of the Project area mapped as non-remnant. The TLF is also located on lands currently used for cattle grazing.

Table 14-4 provides a brief description of all REs considered to occur within the Project area and Table 14-5 describes the extent of REs within each section, within a 10 km radius of the Project area, and within the Marlborough Plains and Nebo-Connors Range subregions.

Table 14-4 Project area – Regional Ecosystem descriptions

RE	VM Act status	EP Act status	Description*
11.3.4	Of Concern	Of Concern	*Eucalyptus tereticornis* and / or *Eucalyptus* spp. woodland on alluvial plains
11.3.25	Least Concern	Of Concern	*E. camaldulensis* or *E. tereticornis* open forest to woodland. Occurs on fringing levees and banks of major rivers and drainage lines of alluvial plains throughout the region. Soils are very deep, alluvial, grey and brown cracking clays
11.4.2	Of Concern	Of Concern	*Eucalyptus* spp. and / or *Corymbia* spp. grassy or shrubby woodland on Cainozoic clay plains
11.4.9	Endangered	Endangered	*Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains
11.5.8a	Least Concern	No Concern	*Melaleuca* spp., *Eucalyptus crebra*, *Corymbia intermedia* woodland on Cainozoic sand plains / remnant surfaces
11.7.2	Least Concern	No Concern	*Acacia* species woodland on Cainozoic lateritic duricrust

RE	VM Act status	EP Act status	Description*
11.10.1	Least concern	No Concern	*Corymbia citriodora* woodland on coarse-grained sedimentary rocks
11.10.7	Least concern	No Concern	*Eucalyptus crebra* woodland on coarse-grained sedimentary rocks
11.11.15a	Least Concern	No Concern	*Eucalyptus crebra* woodland on deformed and metamorphosed sediments and interbedded volcanics

*Source: QLD Herbarium, 2015

Table 14-5 Currently mapped Regional Ecosystems within the Project area

RE code	VM Act status	EP Act biodiversity status	Total within Project area (ha)	Total within a 10 km radius of Project (ha)	Total within Marlborough Plains subregion (ha)	Total within Nebo-Connors Ranges subregion (ha)
ML80187						
Non-remnant	-	-	1,801.6	37,232.3	543,487.3	176,257.7
11.3.4	Of Concern	Of Concern	9.78	925.5	10,042.1	4,287.6
11.3.25	Least Concern	Of Concern	16.03	1,332.4	2,955.8	8,981
11.4.2	Of Concern	Of Concern	174.92	2,058.6	6,121.3	1,822.1
11.4.9	Endangered	Endangered	12.7	182.7	517.2	129.1
11.5.8a / 11.7.2	Least Concern	No Concern at present	25.38	362.6	1,840	362.6
11.10.7	Least Concern	No Concern at present	29.11	513.5	88.4	513.5
11.10.7 / 11.10.1	Least Concern	No concern at present	80.58	1,484.2	772.7	711.5
11.11.15a	Least Concern	No concern at present	125.52	1,090.6	20,698.4	1,949.1
ML700022						
Non-remnant	-	-	675.66	37,232.3	543,487.3	176,257.7
11.3.4	Of Concern	Of Concern	9.64	925.5	100,42.1	4,287.6
11.3.25	Least Concern	Of Concern	26.04	1,332.4	2,955.8	8,981
11.4.2	Of Concern	Of Concern	19.74	2,058.6	6121.3	1,822.1
11.4.9	Endangered	Endangered	7.14	182.7	517.2	129.1
11.11.1	Least Concern	No concern at present	4.18	2619.5	3,270.6	576.7
11.11.15	Least Concern	No concern at present	9.72	1,090.6	20,698.4	1,949.1

Data source: DNRM, 2017

14.6.1.3 Protected Plants Flora Survey Trigger Map

The Project area does not intersect any area considered to be 'high risk' under the flora survey trigger mapping. An area mapped as 'high risk' occurs approximately 1 km directly north of the Project boundary.

14.6.1.4 Matters of State Environmental Significance

Current mapping of MSES for the ML (EHP 2016) indicates the presence of the following features:

- 3.4 ha of lands considered to be MSES under 'Criteria 2.1: High Ecological Significance wetlands on the map of Referable Wetlands';
- 196.5 ha of lands considered to be MSES under 'Criteria 4.1: remnant vegetation considered to be Endangered or Of Concern under the VM Act';
- 4.4 ha of lands considered to be MSES under 'Criteria 4.1: Vegetation Management Wetland Map'; and
- There are also 25.5 km of watercourse vegetation considered to be a MSES under 'Criteria 4.3: watercourses shown on the Vegetation Management Watercourse and Drainage Feature Map.' This is considered very likely to be an overestimate as both banks (rather than the centreline) of larger watercourses where present are mapped by the State, increasing the extent of linear features.

There are no other features considered to be MSES within the ML.

14.6.1.5 Biodiversity Planning Assessment

EHP has prepared a BPA for the Brigalow Belt North bioregion in order to provide broad scale ecological data and advise a range of planning and decision-making processes. The results of the online search results are summarised in the following subsections.

Biodiversity Significance

BPA analyses identified the majority of remnant vegetation within the ML as being of Regional significance. Two small patches of vegetation communities (12.4 ha total) identified as Endangered under the VM Act are considered of State significance. A small area of vegetation in the south of the ML is considered as Locally significant (Figure 14-3).

Wildlife Corridors

Wildlife corridors are a key component to regional biodiversity as they have the potential to facilitate the movement and dispersal of both flora and fauna from one area to another, maintain genetic diversity and population numbers. Current BPA mapping identifies no corridor of any significance within or surrounding the ML.

14.6.1.6 Environmentally Sensitive Areas

Environmentally Sensitive Area (ESA) mapping identified a Category B ESA within the ML (Figure 14-4). This Category B ESA is associated with remnant vegetation listed as Endangered under the VM Act. A number of Category A, B and C ESAs are located within the wider locality (within 25 km of the Project area), including various protected areas and nature refuges (Table 14-6). Tooloombah Creek Conservation Park (Category A) is located less than 1 km west of the ML boundary. The Great Barrier Reef World Heritage Area and Marine Park boundaries and Broad Sound Fish Habitat Area overlap (all Category B) and are located 8 km north of the Project. Waters associated with the Styx River are also designated as a 'coastal management district' which is also a Category C ESA.

Table 14-6 Environmentally Sensitive Areas within 25 km of the Project area

Environmentally Sensitive Area	Category	Approximate distance to Project area (km)
		Mine area
Tooloombah Creek Conservation Park	Category A	0.8
Great Barrier Reef World Heritage Area	Category B	8.0
Bukkula Conservation Park	Category A	16.9
Marlborough State Forest	Category C	16.5
Eugene State Forest	Category C	19.0
Mt Buffalo State Forest	Category C	25.0
Develin Nature Refuge	Category C	19.0
Burwood Nature Refuge	Category C	19.3
Great Barrier Reef Marine Park – general use area	Category B	8.0
Fish Habitat Area – Broad Sound	Category B	8.0
Endangered remnant vegetation	Category B	Within 25 km radius
Marine Plants	Category B	7.5 (north – associated with Styx River estuarine plain)
Coastal Management District	Category C	2.0 (north – associated with Styx River)

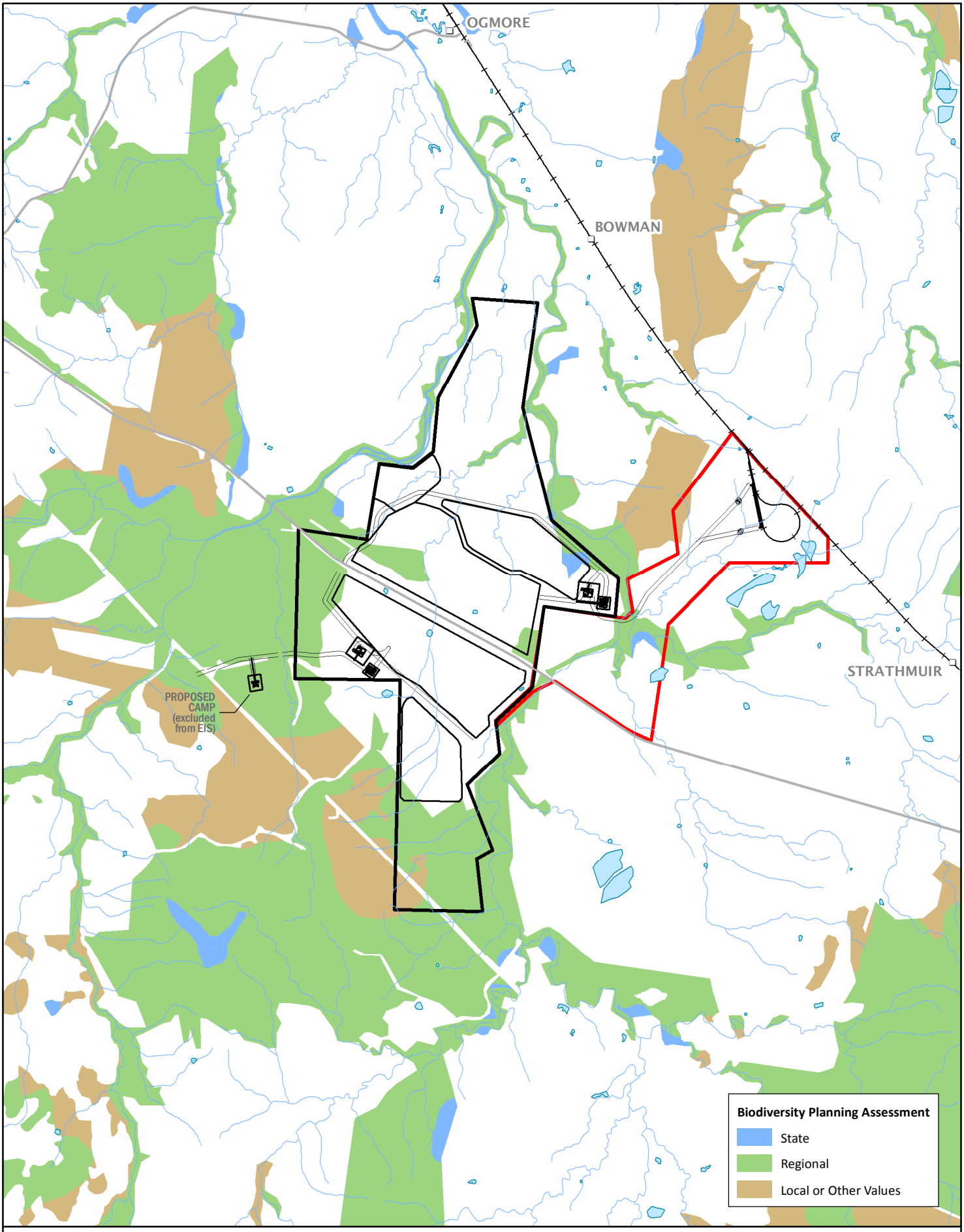

Figure 14-3
Biodiversity Planning Assessment mapping – biodiversity significance

N

0 1 2 km

Scale @ A4 1:80,000
Date: 12/07/17
Drawn: Gayle B.

Legend

- ML 80187
- ML 700022
- Proposed mine infrastructure
- North Coast Rail Line
- Main road
- Major watercourse
- Minor watercourse
- Reservoir

DATA SOURCE
QLD Department of Environment and Heritage Protection, 2016;
QLD Spatial Catalogue (QSpatial), 2017

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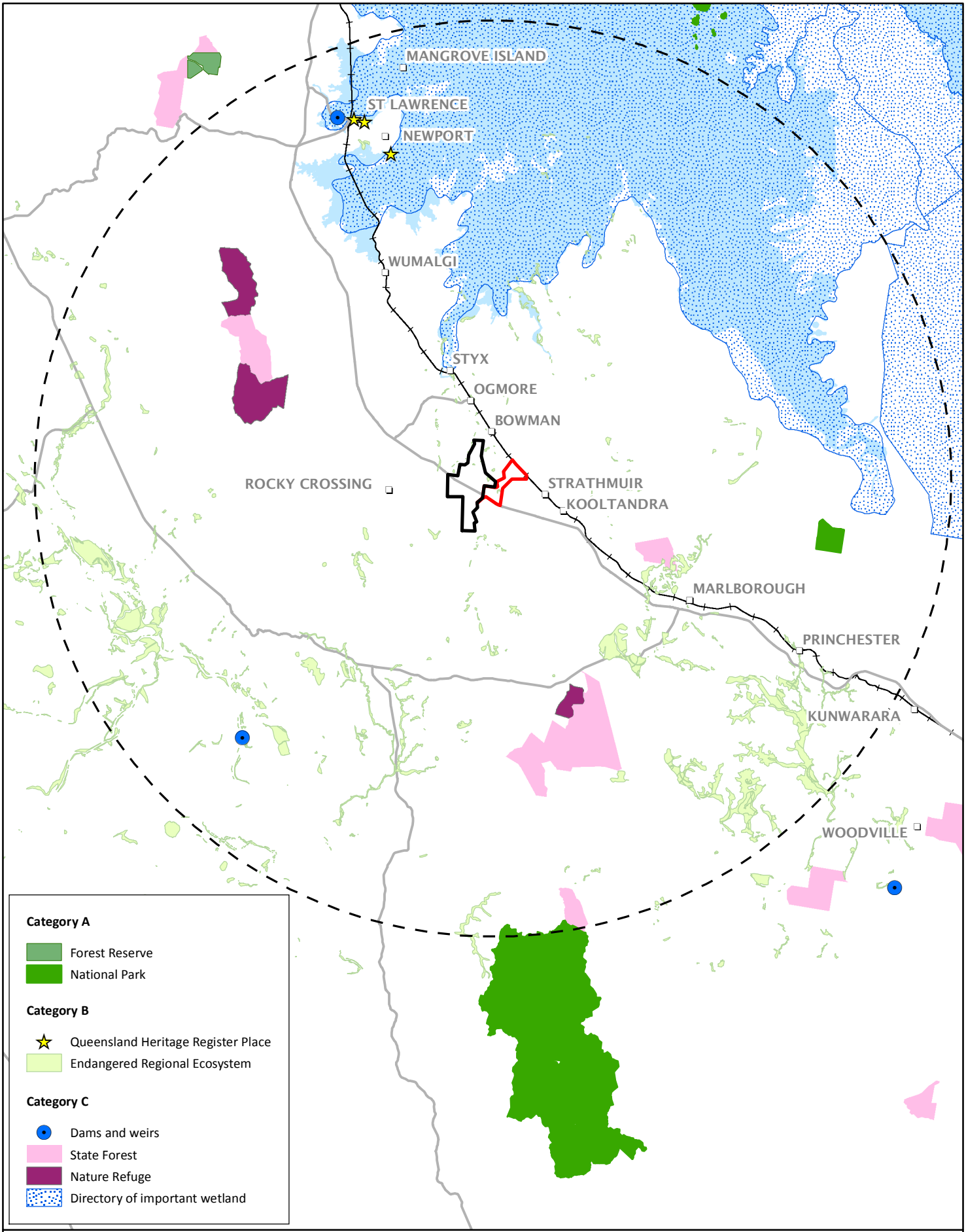


Figure 14-4
Location of Environmentally Sensitive Areas within 50 km of the Project Area

N

0 5 10 km

Scale @ A4 1:540,000
Date: 19/07/17
Drawn: Gayle B.

Legend

- ML 80187
- ML 700022
- Project Area 50 km buffer
- North Coast Rail Line
- Main road
- Estuary

DATA SOURCE
QLD Department of Environment and Heritage Protection, 2016;
QLD Spatial Catalogue (QSpatial), 2017

CDM Smith

BRUGGEMANNGD B:\BES150160 Styx Coal\GIS\DATA\MXD\Chapter 14 Terrestrial Ecology\BES150160.01 R2 env sens area-figure 14-4.mxd 7/19/2017

14.6.1.7 Declared Weed Species

According to the EPBC protected matters search tool, the following eight Weeds of National Significance (WoNS) have the potential to occur in the Project area:

- Rubber Vine (*Cryptostegia grandiflora*);
- Olive Hymenachne (*Hymenachne amplexicaulis*);
- Bellyache Bush (*Jatropha gossypifolia*);
- Lantana;
- Prickly Pears (*Opuntia* spp.);
- Parkinsonia (*Parkinsonia aculeata*);
- Parthenium (*Parthenium hysterophorus*); and
- Prickly Acacia (*Vachellia nilotica,* form. *Acacia nilotica*).

All of the above species are also listed as Restricted Matters under the Biosecurity Act. Database searches of the wider area encountered records of 153 introduced species, including all eight species listed as WoNS above, and seven other species listed as Restricted Matters under the Biosecurity Act:

- Mother-of Millions (*Bryophyllum delagoense* and *Bryophyllum* x *houghtonii*);
- Heart Seed Vine (*Cardiospermum grandiflorum*);
- Cat's Claw Creeper (*Dolichandra unguis-cati*);
- Harrisia cactus (*Harrisia martini*);
- Rat's Tail grasses (*Sporobolus jacquemontii*); and
- Indian Jujube (*Ziziphus mauritania*).

14.6.2 Terrestrial Flora – Field Survey Results

Ten vegetation communities were identified within the Project area during field surveys. Detailed descriptions of these communities are provided in the following table based on flora data collected in February 2017. The Flora Technical Report for the 2011 site works including a full list of site species encountered is provided in Appendix A9b – Terrestrial Flora Report. Note that Appendix A9b – Terrestrial Flora Report references the original proponent; Styx Coal Pty Ltd, and the original Project name, Styx Coal Mine Project; however, the Central Queensland Coal Pty Ltd is the new Proponent for the Project and the Project has been renamed as Central Queensland Coal Project to better reflect the change of Proponent. This proponent and title change does not affect the technical studies.

Table 14-7 Project vegetation community descriptions

RE 11.3.4	
Forest Red Gum (*Eucalyptus tereticornis*) woodland on alluvial plains	
VM Act status: Of Concern	**EP Act Biodiversity status: Of Concern**
Description of community onsite	**Site cover: 33.2 ha**
This community occurs in patches across the eastern portion of the ML where it is associated with the alluvial plains adjacent to Deep Creek. This community occurs on shallow black self-mulching clays. This vegetation community is characterised by a canopy of Forest Red Gum, Poplar Gum with Carbeen (*Corymbia tessellaris*). An understorey is often present and comprised of species such as Swamp Mahogany (*Lophostemon suaveolens*) and Red Ash. The lower shrub layer tends to be dominated by Lantana, although native species present include Coffee Bush (*Breynia oblongifolia*) and Boonaree (*Alectryon diversifolius*). The ground layer tends to be dense and dominated by grasses such as *Bothriochloa* spp., Kangaroo Grass (*Themeda triandra*) and Black Spear Grass (*Heteropogon contortus*). This community is in a variable condition with evidence of past tree clearing or thinning for cattle grazing purposes particularly in the southern portion of the ML. An understorey of Lantana is common throughout. No Endangered, Vulnerable and Near Threatened (EVNT) flora species were observed or expected.	
RE 11.3.11	
Semi-evergreen vine thicket on alluvial plains	
VM Act status: Endangered	**EP Act Biodiversity status: Endangered**
Description of community onsite	**Site cover: 0.4 ha**
This community occurs on the edge of the eastern boundary of the ML (north of the highway) and is associated with alluvial terraces along Tooloomba Creek where several patches occur in the localised area. This vegetation community is characterised by a relatively low canopy (7 – 10 m) comprising a variety of species including Python Tree (*Gossia bidwillii*), Red Kamala (*Mallotus philippensis*), Peanut Tree (*Sterculia quadrifida*), White Cedar (*Melia azedarach*), Tuckeroo (*Cupaniopsis anacardioides*) among other taxa. Forest Red Gum and Carbeen occur as occasional emergents. A varied understorey with abundant vines is present and comprised of species such as Chain Fruit (*Alyxia ruscifolia*), Queensland Ebony (*Diospyros geminata*), Sandpaper Fig (*Ficus opposita*), Broad-leaved Cherry (*Exocarpos latifolius*), and Velvet Mock-orange (*Notelaea microcarpa*) and Currant Bush. This community is in a reasonable condition given evidence of past tree clearing for cattle grazing purposes. Rubber Vine is commonly present on the edge of this community. No EVNT flora species were observed or expected.	

RE 11.3.25	
Forest Red Gum (*Eucalyptus tereticornis*) woodland fringing drainage lines	
VM Act status: Least Concern	**EP Act Biodiversity status: Of Concern**
Description of community onsite	**Site cover: 32.9 ha**
Occurs along riparian areas of drainage lines. including a tributary of Deep Creek which crosses the ML north of the Bruce Highway. Restricted to the immediate bed and banks of watercourses this woodland community is dominated by Forest Red Gum and Weeping Tea Tree (*Melaleuca leucadendra*). Along Deep and Tooloombah Creeks a mid-dense lower tree and upper shrub layer is characterised by River She-oak (*Casuarina cunninghamiana*), Weeping Bottlebrush (*Melaleuca viminalis*) as well as White Cedar (*Melia azedarach*) and Red Ash. Tooloombah Creek and sections of Deep Creek feature a range of dry rainforest species along the banks. Lantana is a common and often dense understorey species. Within the ML the sub-canopy of this community includes Carbeen, Brigalow and Northern Swamp Mahogany (*L. grandiflorus*). The lower shrub layer includes *Hibiscus heterophyllus, Capparis loranthifolia,* Wilga (*Geijera parviflora*)*,* Sandpaper Fig*,* Currant Bush and Lantana. Within the ML this habitat is restricted to a narrow strip in poor condition heavily impacted by past clearing of adjacent communities. Cattle are largely excluded from Deep and Tooloombah Creeks and this community is in good condition (although suffering extensive weed invasion). No EVNT flora species observed or expected.	 **Community along Barrack Creek**  **Community along drainage line in north of ML**

RE 11.4.2	
***Eucalyptus* spp. and / or *Corymbia* spp. grassy or shrubby woodland on Cainozoic clay plains**	
VM Act status: Of Concern	**EP Act Biodiversity status: Of Concern**
Description of community onsite	**Site cover: 171.2**
Dominant remnant community remaining on the clay plains within the ML, mainly north of the Bruce Highway. Dominated by Polar Box and Narrow-leaved Ironbark as well as Poplar Gum and Pink Bloodwood (*Corymbia intermedia*). The relatively open canopy of this community is evident over the sparse shrub layer and grassy understorey. Shrub species include Currant Bush, Wilga, Boonaree and Turkey Bush (*Grewia retusifolia*). Where it borders regrowing Brigalow communities species such as Brigalow and Belah (*Casuarina cristata*) occur. Ground layer tends to be characterised by grasses such Kangaroo grass, Black Spear Grass, *Eragrostis* spp. and *Bothriochloa* spp. This community is in fair condition. The open structure and good grass cover mean that impacts from tree clearing or thinning to promote grazing efficiency have been lessened. No EVNT flora species were observed and none are expected.	

RE 11.4.9	
Brigalow (*Acacia harpophylla*) shrubby woodland on Cainozoic clay plains	
VM Act status: Endangered	**EP Act Biodiversity status: Endangered**
Description of community onsite	**Site cover: 0.61 ha**
This community occurs as an isolated remnant patch within the eastern portion of the ML. Much of the ML north of the Bruce Highway comprises dark cracking clays with extensive low regrowth of this community. This community is characterised by an open forest canopy of Brigalow with occasional Poplar Box. Upper and lower shrub layers are mid-dense comprising False Sandalwood (*Eremophila mitchellii*), Currant Bush, Boonaree and Queensland Ebony (*Disospyros humilis*). The ground layer tends to be dominated by introduced pasture grasses. This community is heavily impacted by cattle grazing. No EVNT flora species observed. May provide low quality habitat for *Solanum elachophyllum* (Endangered - NC Act).	

RE 11.5.3b	
***Eucalyptus populnea* on closed depressions - palustrine wetland (e.g. vegetated swamp)**	
VM Act status: Least Concern	**EP Act Biodiversity status: No Concern at Present**
Description of community onsite	**Site cover: 4.1 ha**
Occurs as an isolated area in a natural depression in the western portion of the site north of Mt Bison Road. Water present during 2011 surveys. No water present in February 2017 (depicted) but filled in April 2017. This community is characterised by a central patch of Broad-leaved Paperbark with a variety of sedges and a sparse cover of hydrophytes (including *Ottelia ovalifolia*) present in 2011. Dry margins of wetland with sparse to dense cover of low sedges and forbs. Surrounded by mixed eucalypt woodland (RE11.5.8a). Impacted by cattle grazing. Cattle observed to be present in community throughout 2017 survey. No EVNT flora species were observed or are expected.	

RE 11.5.8a	
***Eucalyptus platyphylla*, *Corymbia intermedia* woodland on Cainozoic sand plains / remnant surfaces**	
VM Act status: Least Concern	**EP Act Biodiversity status: No Concern at Present**
Description of community onsite	**Site cover: 56.3 ha**
This community occurs as extensive remnants along the western boundary of the ML (south of the Bruce Highway) on colluvial and residual deposits. Characterised by emergent eucalypts such as Pink Bloodwood and Queensland Peppermint, as well as Poplar Gum and Ghost Gum. The sparse to mid-dense lower tree layer is a mix of co-dominant species including: Red Ash, Quinine Bush (*Petalostigma pubescens*) and a variety of *Acacia* spp. Shrubs include *Canthium buxifolium*, Orange Box Thorn (*Denhamia celastroides*) and scattered Lantana. Species common in the ground layer include Black Spear Grass, *Aristida* spp., *Bothriochloa* spp. and Kangaroo grass. Cattle present in this habitat during February 2017 survey. Some limited impacts from tree thinning evident. No EVNT flora species were observed or expected.	

RE 11.10.3	
***Acacia shirleyi* open forest on coarse-grained sedimentary rocks - crests and scarps**	
VM Act status: Least Concern	**EP Act Biodiversity status: No Concern at Present**
Description of community onsite	**Site cover: 36.6 ha**
Restricted to rocky elevated habitat in the southeast corner of the ML. The mid-dense canopy layer is dominated by Lancewood (*Acacia shirleyi*) with emergent Pink Bloodwood. There is a lower tree layer including Quinine Bush, *Canthium buxifolium* and *Melaleuca nervosa.* Lower shrub and ground layers are often sparse on the rocky substrate. Shrubs include Medicine Bush (*Pogonolobus reticulatus*) and Bitterbark (*Alstonia constricta*). Grasses present include perennial species such as Wiry Panic (*Entolasia stricta*), *Eragrostis elongatus* and *Bothriochloa pertusa*. This community is in good condition and is likely less attractive to cattle for browsing, impacts due to grazing are limited. No EVNT flora species were observed. May provide habitat for *Cycas ophiolitica* (EPBC Act and NC Act – Endangered) and *Lissanthe brevistyla* (NC Act – Vulnerable).	

RE 11.10.7	
***Eucalyptus crebra* woodland on coarse-grained sedimentary rocks**	
VM Act status: Least Concern	**EP Act Biodiversity status: No Concern at Present**
Description of community onsite	**Site cover: 77.2 ha**
Restricted to lower slopes of elevated habitat in the southeast of the ML. The canopy is dominated by Poplar Gum and Clarkson's Bloodwood (*Corymbia clarksonia*). A shrub layer ranges from mid-dense to sparse and is characterised by the presence of Red Ash, Quinine Bush, *Acacia longispicata* and Red Kamala (*Mallotus philippensis*). Lantana is dominant in the lower shrub layer and often in high density. This community has been variably impacted by cattle grazing with some evidence of previous tree clearing (few mature trees present). No EVNT flora species were observed and none are expected.	
RE 11.11.15a	
***Eucalyptus crebra* woodland on deformed and metamorphosed sediments and interbedded volcanics**	
VM Act status: Least Concern	**EP Act Biodiversity status: No Concern at Present**
Description of community onsite	**Site cover: 109.4 ha**
This community occurs in the southern extent of the ML. This woodland community is dominated by a mixture of Poplar Gum and Narrow-leaved Ironbark with a range of less dominant eucalypts including Carbeen and Ghost Gum. The lower tree and shrub layers tend to be sparse including Red Ash, Broad-leaved Paperbark, Beefwood (*Grevillea striata*) and Quinine Bush. Lantana is also present in scattered and sparse patches. Ground cover comprises a mix of native grass species including Black Spear Grass, *Bothriochloa* spp., Kangaroo Grass and *Panicum* spp. This community appears in fair condition although is subject to cattle grazing. Canopy tree cover remains high. No EVNT flora species were observed and none are expected.	

14.6.2.1 Discrepancy in Regional Ecosystem Mapping

The 2017 field surveys within the Project area identified several inconsistencies between the current RE mapping and onsite vegetation communities. The amount of listed Of Concern vegetation communities increased by approximately 20 ha and Endangered vegetation communities decreased substantially down to a single hectare. The majority of the Project area (approximately 78.3%) remains cleared of remnant vegetation. Ground-truthing identified the Project area is dominated by remnant eucalypt woodland communities on dark clay soils (RE 11.4.2) mainly north of the Bruce Highway, and rocky or coarse volcanic soils in the south of the ML (RE11.11.15a, 11.10.3 and 11.10.7). The TLF is located in cleared lands. The proposed haul road will cross Deep Creek and will thereby impact riparian (RE11.3.25) and adjacent communities (Figure 14-5).

Table 14-8 Discrepancies with DNRM RE mapping

RE	VM Act status	Extent of current RE mapping (ha)	Extent of proposed ground-truthed mapping (ha)	Total within a 10 km radius of Project (ha)	Total within Marlborough Plains subregion (ha)
Non-remnant	-		-	-	-
11.3.4	Of Concern	9.78	33.15	925.5	10,042.1
11.3.11	Endangered	Not mapped	0.4	5.22	112.9
11.3.25	Least Concern	16.03	32.5	1,332.4	2,955.8
11.4.2	Of Concern	174.92	171.2	2,058.6	6,121.3
11.4.9	Endangered	12.7	0.61	182.7	517.2
11.5.3b	Least Concern	Not mapped	4.16	-	-
11.5.8a	Least Concern	Mapped as mixed polygon with RE 11.7.2	56.3	636	4783.9
11.10.3	Least Concern	Not mapped	36.6	-	-
11.10.7	Least Concern	29.11	77.24	513.5	88.4
11.11.15a	Least Concern	125.52	109.42	1,090.6	20,698.4

14.6.2.2 Threatened Flora Species

Habitat requirements for flora species listed under the NC Act and / or EPBC Act were considered during the flora surveys. Table 14-10 lists species that were identified through desktop searches and their potential to occur within the Project area based on mapped vegetation types and field surveys.

A total of 245 native plant species were identified within the Project area (Appendix A9b – Terrestrial Flora Report). No flora species listed as Endangered, Vulnerable or Near Threatened (EVNT) under the NC Act were observed within the Study area during field assessments. Surveys recorded *Eleocharis blakeana* which was listed as Near Threatened in 2011. This species is no longer listed under the NC Act.

A number of listed species (seven) were identified as having some potential to occur, based on the onsite observations including six species listed as threatened under the NC Act (Table 14-10). None are considered likely to occur. Three of the species may have potential to occur in the rocky, elevated habitat in the southern portion of the ML (RE11.10.3 and RE11.10.7). No cycads were observed growing in this area during site traverses in the vicinity of tracks. It is noted the southern vegetated portion mostly lies outside the Project footprint.

The remaining three species have a low potential to occur on the cracking clay soils that dominate the ML to the north of the Bruce Highway. Much of this area has been heavily impacted by clearing, weed invasion and cattle grazing.

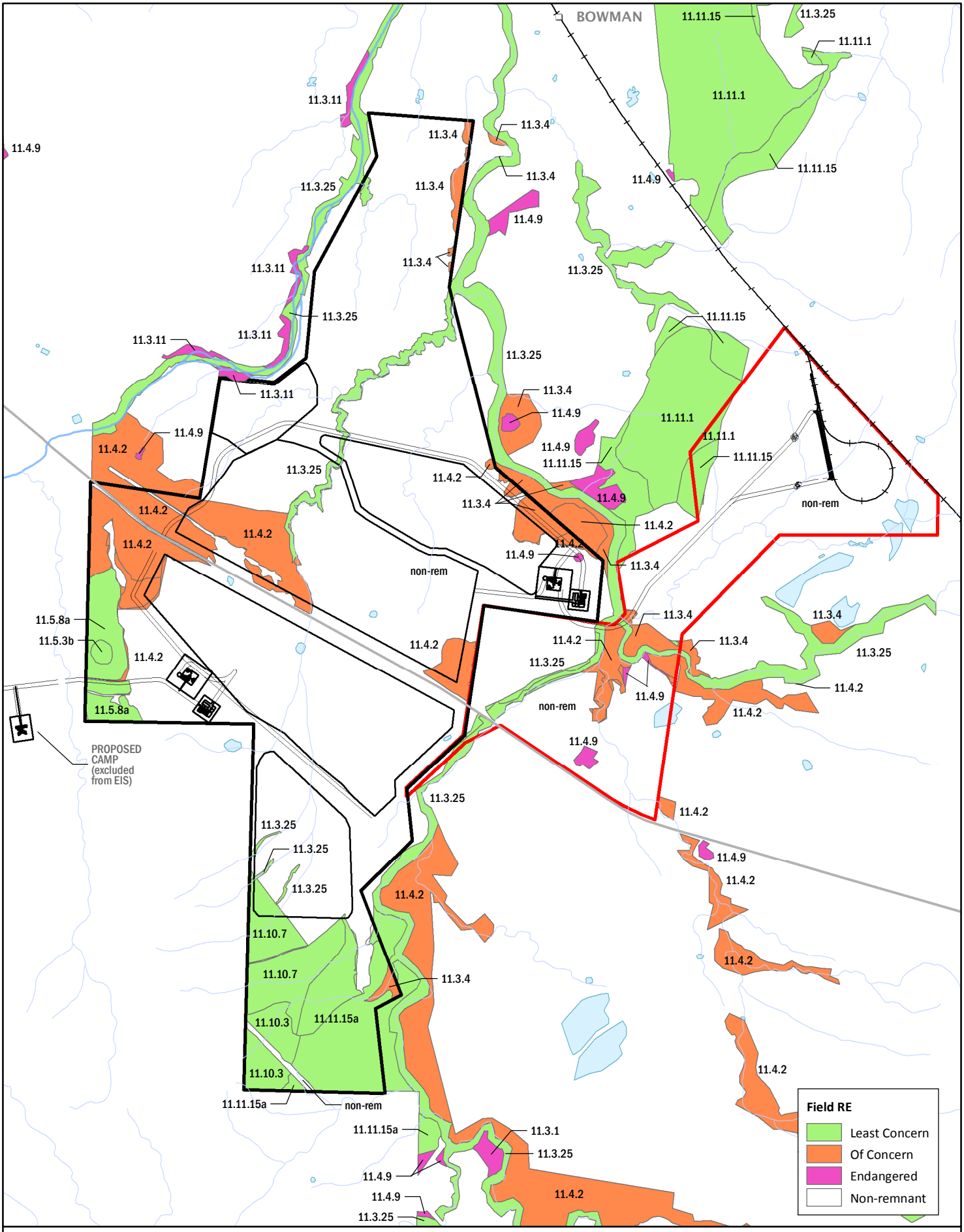


Figure 14-5
Revised RE mapping within ML following site surveys

0 0.5 1 km

Scale @ A4 1:50,000
Date: 15/09/17
Drawn: Gayle B.

Legend

- ML 80187
- ML 700022
- Proposed mine infrastructure
- North Coast Rail Line
- Main road
- Major watercourse
- Minor watercourse
- Reservoir

DATA SOURCE
QLD Department of Environment and Heritage Protection, 2016;
QLD Spatial Catalogue (QSpatial), 2017

CDM Smith

14.6.2.3 Declared Weed Species

Fifty-three introduced weed species were identified within the Project area during the onsite surveys (refer to Appendix A9b –Terrestrial Flora Report). Of the 53 weed species identified, ten are classified as Category 3 'Restricted Matters under the Biosecurity Act, and six are also declared as Weeds of National Significance (Table 14-9). The site surveys in February 2017 identified seven species including an additional species of Prickly Pear (*Opuntia tomentosa*) not identified previously.

According to the Act, under a Category 3 restriction 'a person who has, or has a thing infested with, the 'Restricted Matter' in the person's possession or under the person's control must not distribute or dispose of the restricted matter unless the distribution or disposal is carried out via the methods set out in the Biosecurity Act.'

The occurrence of the listed weed species is consistent with distributions shown in the latest Biosecurity Queensland Annual Pest Distribution Survey data.

Table 14-9 Declared weed species identified within Project area

Species name	Common name	Biosecurity Act category	Weeds of National Significance	2011 surveys	2017 surveys
Aristolochia elegans	Dutchman's Pipe	Category 3	No	X	
Bryophyllum delagoense	Mother-of millions	Category 3	No	X	X
Cryptostegia grandiflora	Rubber-vine	Category 3	Yes	X	X
Harrisia martinii	Harrisia Cactus	Category 3	No	X	
Hymenachne amplexicaulis	Olive Hymenachne	Category 3	Yes	X	X
Jatropha gossypifolia	Bellyache Bush	Category 3	Yes	X	X
Lantana camara	Lantana	Category 3	Yes	X	X
Opuntia stricta *Opuntia tomentosa*	Prickly Pear species	Category 3	Yes	X	X X
Parthenium hysterophorus	Parthenium	Category 3	Yes	X	X
Sporobolus fertilis	Giant Paramatta Grass	Category 3	No	X	

In general, weed species were abundant within the ML and particularly along drainage lines such as Deep Creek and Tooloombah Creek (Figure 14-6). The ground layer of cleared areas within the northern section of the ML is dominated by the introduced Buffel Grass (*Cenchrus ciliaris*) where cracking clays occur. Bellyache Bush occurs patchily along the margins of both creeks. Rubber Vine is common along both creeks (sometimes forming dense infestations) and also occurs along the minor drainage located within the ML to the north of the Bruce Highway. Lantana occurs in varying density throughout much of the remnant vegetation in the area, and in non-remnant areas located in the vicinity of creek lines. High densities were noted in the south of the ML around fauna trap site 2, in the floodplain vegetation adjacent to Deep Creek such as fauna trap site 4 (refer Figure 14-2) and along the creek lines themselves.

Olive Hymenachne is a semi-aquatic species and was recorded in the northern extent of the ML at a farm dam (February 2017) and in a water-filled gilgai (May 2017). Parthenium was only observed along Tooloombah Creek and not within the ML itself. Prickly Pear is sparsely distributed throughout the ML although mainly occurs on the heavy clay soils north of the Bruce Highway within the regrowth Brigalow communities.

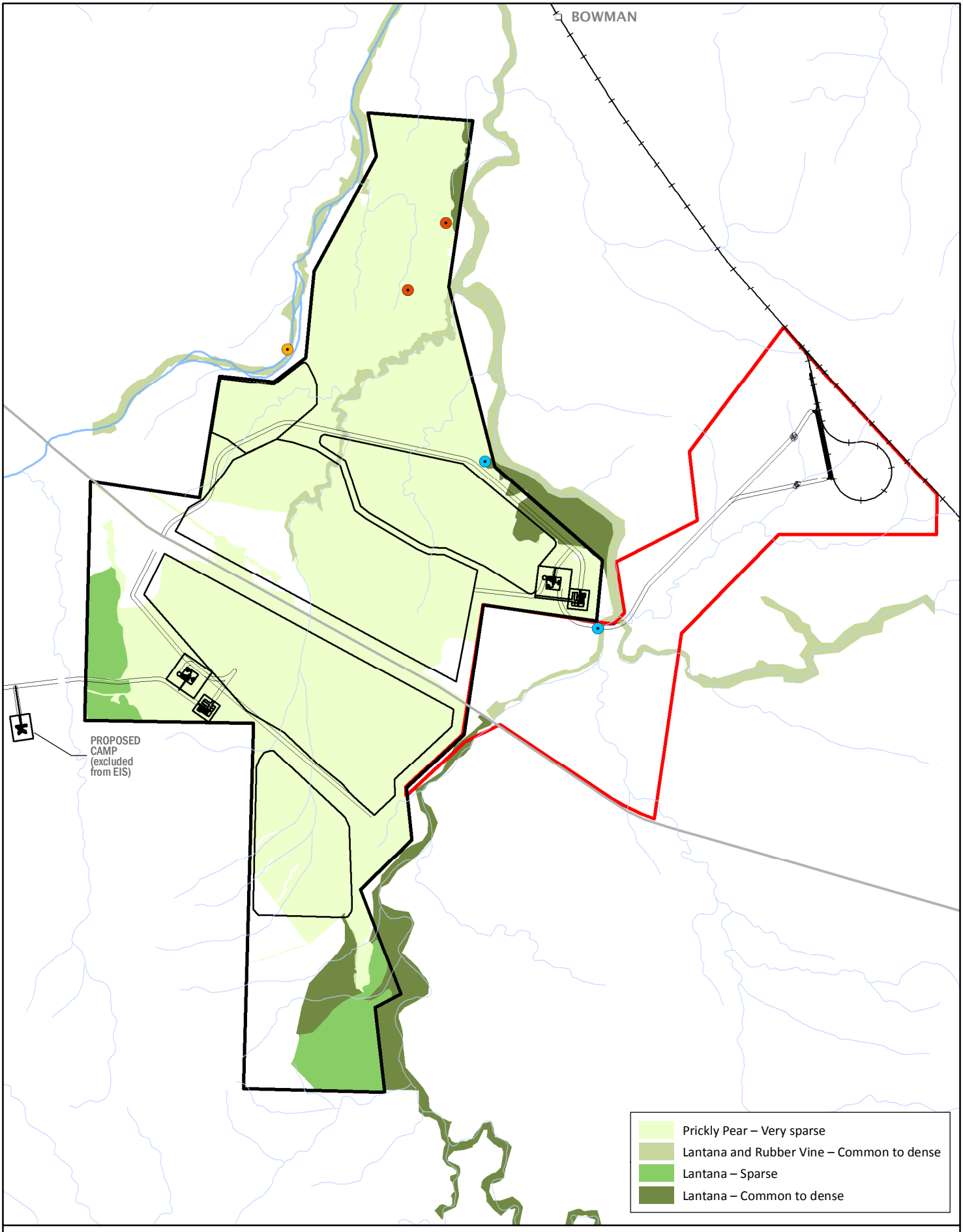


Figure 14-6
Listed (Biosecurity Act) weed species distribution across the Project Area

Legend

- *Parthenium*
- *Olive Hymenachne*
- *Bellyache Bush*
- ML 80187
- ML 700022
- Proposed mine infrastructure
- North Coast Rail Line
- Main road
- Major watercourse
- Minor watercourse

N

0 0.5 1 km

Scale @ A4 1:50,000
Date: 12/07/17
Drawn: Gayle B.

DATA SOURCE
QLD Department of Environment and Heritage Protection, 2016;
QLD Spatial Catalogue (QSpatial), 2017

CDM Smith

Table 14-10 Potential for listed flora species to occur within the Project area and surrounds

Scientific name	Common name	Status		Description and preferred habitat	Potential to occur in Project area
		NC Act	EPBC Act		
Bursaria reevesii		V		A multi-stemmed shrub to 3 m tall. Grows along drainage lines and creek beds in silty loams derived from serpentine rocks. Associated species and vegetation include Red Ironbark (*Eucalyptus fibrosa) /* Glen Geddes Bloodwood *(Corymbia xanthope)* open woodlands.	**Unlikely.** No suitable habitat (serpentine landscapes) observed within the Project area. 11 Wildlife online database records from wider area.
Capparis humistrata		E		A spreading shrub to 1.5m tall. Grows in eucalypt woodland with a shrubby understorey, on stony hard ridges and serpentinite soil. It also occurs on the margins of Brigalow forest on sandy soil.	**Potential.** Suitable habitat may occur within the Project area as stony ridges occur in the south of the ML. Regrowth Brigalow forest may occur adjacent to sandy soils in several areas north of the Bruce Highway. Seven Wildlife online database records from wider area.
Capparis thozetiana		V	V	Spiny shrub endemic to central Queensland in the Marlborough–Rockhampton region where it is confined to serpentinite hills and adjacent undulating colluvial aprons. The species grows on mostly shallow skeletal serpentinitic soils in woodland communities dominated by Red Ironbark and Glen Geddes Bloodwood.	**Unlikely.** No suitable habitat (serpentine landscapes) observed within the Project area. 20 Wildlife online database records from wider area.
Cerbera dumicola		NT		Shrub or small tree growing to 4 m high. Occurs across a range of habitats in central and southern Queensland. Associated vegetation and species include: sandstone hills; on plateaus, in woodland of Lancewood with Long-fruited Bloodwood (*Corymbia dolichocarpa*); semi-deciduous notophyll-microphyll vine forest on rhyolite hillslopes; open-woodland of Silver-leaved Ironbark (*E. melanophloia*) with occasional Lancewood, Poplar Box and Brown's Box (*E. brownie*); and in Carbeen.	**Potential.** Suitable habitat occurs in southern portion of site. Two Wildlife online database records from wider area.
Corymbia xanthope	Glen Geddes Bloodwood	V	V	Occurs in woodlands with Red Ironbark on ridges or hill slopes on serpentinite geology with sandy soils. This community is recognised as a distinct regional ecosystem (RE 11.11.7 *E. fibrosa* subsp. *fibrosa*, Glen Geddes Bloodwood woodland on serpentinite).	**Unlikely.** No suitable habitat (serpentine landscapes) observed within the Project area. 16 Wildlife online database records from wider area.
Cycas megacarpa	Trunked Cycad	E	E	Trunked Cycad grows to 5m tall. Is endemic to southeast Queensland from Bouldercombe in the north, to near Woolooga in the south, in woodland or open woodland dominated by eucalypts, usually on rocky substrate.	**Unlikely.** Two Wildlife online database records from wider area to the south. Species is not known to occur this far north.

Scientific name	Common name	Status		Description and preferred habitat	Potential to occur in Project area
		NC Act	EPBC Act		
Cycas ophiolitica	Marlborough blue	E	E	Occurs from Marlborough in the north, to the Fitzroy River near Rockhampton in the south, in woodland or open woodland dominated by eucalypts, often on serpentinite substrates. Plants occur along hilly outcrops and in lower regions near creek systems.	**Unlikely.** No suitable habitat occurs and no cycads recorded. 23 Wildlife online database records from wider area.
Dichanthium setosum	Bluegrass	V	V	Associated with heavy basaltic black soils and stony red-brown hard setting loams with clay subsoil. Found in moderately disturbed areas such as cleared woodlands, grassy roadside remnants, grazed land and highly disturbed pastures.	**Unlikely.** No suitable habitat in Project area. No database records. EPBC Online search only.
Eucalyptus raveretiana	Black Ironbox	C	V	Grows along watercourses on alluvial flats or open woodland. Associated with RE 11.3.25a and occasionally 11.3.11.	**Unlikely**. Single Wildlife online database record from wider area (25 km to south of ML). Suitable habitat within ML (RE11.3.25) is heavily degraded. Better habitat occurs along Deep Creek, however no individuals have been recorded for this species within the region and not recorded during site surveys.
Hakea trineura		V	V	Occurs on serpentinite-derived soil mostly on gravelly ridges and slopes, often with Red Ironbark and Glen Geddes Bloodwood woodland over hummock grassland on hills.	**Unlikely.** No suitable habitat (serpentine landscapes) observed within the Project area. 13 Wildlife online database records from wider area.
Lissanthe brevistyla		V		A spreading shrub growing to 1.5m tall. Confined to steep hillsides in eucalypt woodlands, on red gravely soil or on loose stony slopes.	**Potential.** Low quality habitat for this species occurs in the southern part of the ML where rocky elevated habitat occurs. 14 Wildlife online database records from wider area.
Macrozamia serpentina		E		Occurs from Marlborough in the north, to the Fitzroy River near Rockhampton in the south. Grows at altitudes between 80 – 160m in low woodland with a mixed grassy and shrubby understory in red clay loams over serpentinites. Associated canopy species include Glen Geddes Bloodwood and Red Ironbark.	**Unlikely.** No suitable habitat (serpentine landscapes) observed within the Project area. 24 Wildlife online database records from wider area.
Marsdenia brevifolia		V	V	Erect or loosely scrambling sub-shrub up to 1 m tall. Plants occurring north of Rockhampton grow on serpentine rock outcrops or on black crumbly soils derived from serpentine in woodland dominated by Glen Geddes Bloodwood and Red Ironbark. Despite this close association with serpentine, the species is not a serpentine endemic. Also grows in woodland on granite soils dominated by Granite Ironbark (*Eucalyptus granitica)*, Yellow Jacket (*Corymbia leichhardtii*) and White Mahogany (*E. acmenoides*).	**Unlikely.** No suitable habitat (serpentine landscapes) observed within the Project area. 17 Wildlife online database records from wider area.

Scientific name	Common name	Status		Description and preferred habitat	Potential to occur in Project area
		NC Act	EPBC Act		
Myrsine serpenticola		E		Shrub to small tree dark green glossy sub-opposite leaves. Known from gallery rainforest on serpentinic soils. Often associated with low woodlands of Glen Geddes Bloodwood and Red Ironbark.	**Unlikely.** No suitable habitat (serpentine landscapes) observed within the Project area. 12 Wildlife online database records from wider area.
Neoroepera buxifolia		V	V	Shrub or small tree growing to 6 m high. Known from two small areas between Marlborough and Yaamba, and between Rockhampton and Yeppoon, in Queensland. This species occurs along creek banks or in creek beds on serpentitite soils (Henderson, 1992; Batianoff et al., 2000) in riparian vine thicket, vine forest, melaleuca or eucalypt woodland or open forest with rainforest species in the understorey.	**Unlikely.** No suitable habitat (serpentine landscapes) observed within the Project area. 26 Wildlife online database records from wider area.
Olearia macdonnellensis		E	V	Viscid aromatic shrub to 1.2 m high. Occurs in eucalypt open forest in the Marlborough region of central Queensland, all records are from rocky serpentinite hills and ridges. Associated vegetation / species includes open forests of Glen Geddes Bloodwood and Red Ironbark.	**Unlikely.** No suitable habitat (serpentine landscapes) observed within the Project area. Six Wildlife online database records from wider area.
Omphalea celata		V	V	Known from three rocky sites in central east Queensland occurring in SEVT. Locations are Hazlewood Gorge, near Eungella; Gloucester Island, near Bowen; and Cooper Creek in the Homevale Station area, north-west of Nebo (TSSC, 2008).	**Unlikely.** Well outside of known range of species. No database records. EPBC Online search only.
Phaius australis	Lesser Swamp Orchid	E	E	Commonly associated with coastal wet heath / sedgeland wetlands swampy grassland or swampy forest and often where Broad-leaved Paperbark (*M. quinquinervia*) or Swamp Mahogany (*E. robusta*) is found (Sparshott and Bostock, 1993). It is restricted to the swamp-forest margins, where it occurs in swamp sclerophyll forest, swampy rainforest, or fringing open forest. Mostly found in southeast Queensland and further south. Isolated population in Byfield National Park.	**Unlikely.** No suitable habitat in Project area. No database records. EPBC Online search only.
Pimelea leptospermoides		NT	V	A shrub growing to 1 m high. Occurs from near Marlborough to Rockhampton in Queensland. Found in most serpentine soil vegetation communities, but not in riverine forest. Notably on black clays on stony hillsides and sandy clay in Red Ironbark and Glen Geddes Bloodwood open woodland. Also tall open forest, open forest and low open forest, all with a grassy and / or heathy understorey, and in woodland with a Black Tea-tree (*Melaleuca bracteate)* subcanopy layer where prolonged flooding occurs.	**Unlikely.** No suitable habitat (serpentine landscapes) observed within the Project area. 44 Wildlife online database records from wider area.
Pultenaea setulosa		V	V	An erect shrub growing on serpentine substrates in Red Ironbark and / or Glen Geddes Bloodwood woodlands or open forests on ridges, hills and slopes.	**Unlikely.** No suitable habitat (serpentine landscapes) observed within the Project area. 11 Wildlife online database records from wider area.

Scientific name	Common name	Status		Description and preferred habitat	Potential to occur in Project area
		NC Act	EPBC Act		
Samadera bidwillii	Quassia	V	V	Occurs in lowland rainforests or rainforest margins. Also found in other forest types, such as open forest and woodland. Usually found in areas adjacent to both temporary and permanent watercourses up to 510 m altitude. Commonly associated trees in open forest and woodlands include Lemon-scented Gum (*Corymbia citriodora*), Grey Gum (*Eucalyptus propinqua*), White Mahogany, Forest Red Gum, Pink Bloodwood, Northern Grey Ironbark *(E. siderophloia*), Gum-topped Box (*E. moluccana*), Gympie Messmate (*E. cloeziana*) and Red Ironbark.	**Unlikely.** No suitable species associations observed within the Project area. Two Wildlife online database records from wider area.
Sannantha brachypoda		V		There is little information available on this species. It has been recorded at Apis Creek west of Marlborough although the majority of the records are to the south of the Capricorn Highway (i.e. Precipice and Humboldt National Parks). Records suggest SEVT and riparian corridors within eucalypt woodlands as the preferred habitat.	**Potential.** Degraded and marginal habitat (drainage line north of the Bruce Highway) occurs within the ML for this species. Better habitat occurs along Tooloombah Creek. Two Wildlife online database records from wider area.
Solanum adenophorum		E		Perennial herb growing to 40cm high. Occurs mostly in brigalow woodland and on very gently inclined slopes. It also occurs in Gidgee (*Acacia cambagei*) scrub on deep cracking clay soils.	**Potential.** Highly degraded and marginal habitat (north of the Bruce Highway) occurs within the ML for this species. Single Wildlife online database records from wider area.
Solanum elachophyllum		E		Known only from limited collections in the Leichhardt pastoral district, occurring on fertile cracking clay soils associated with Brigalow, Belah, *Eucalyptus thozetiana*, or woodland of Narrow-leaved Ironbark and Narrow-leafed White Mahogany (*E. tenuipes*).	**Potential.** Suitable habitat may occur on cracking clay soil north of the Bruce Highway. Single Wildlife online database records from wider area.
Stackhousia tryonii		NT		Annual or perennial herb, stems striate and often woody near the base. Serpentine landscape often associated with low woodlands of Glen Geddes Bloodwood and Red Ironbark.	**Unlikely.** No suitable habitat (serpentine landscapes) observed within the Project area. 12 Wildlife online database records from wider area.

*Status abbreviations: NC Act - NT = Near Threatened, V = Vulnerable, and E = Endangered; EPBC Act - V = Vulnerable, and E = Endangered.

14.6.3 Terrestrial Fauna – Desktop Results

Altogether, 342 species of terrestrial vertebrate are known or predicted to occur within a 50 km radius of the Study area, comprising 15 frogs, 42 reptiles, 254 birds and 31 mammal species (see Appendix A9c - Ecological Desktop Search Results).

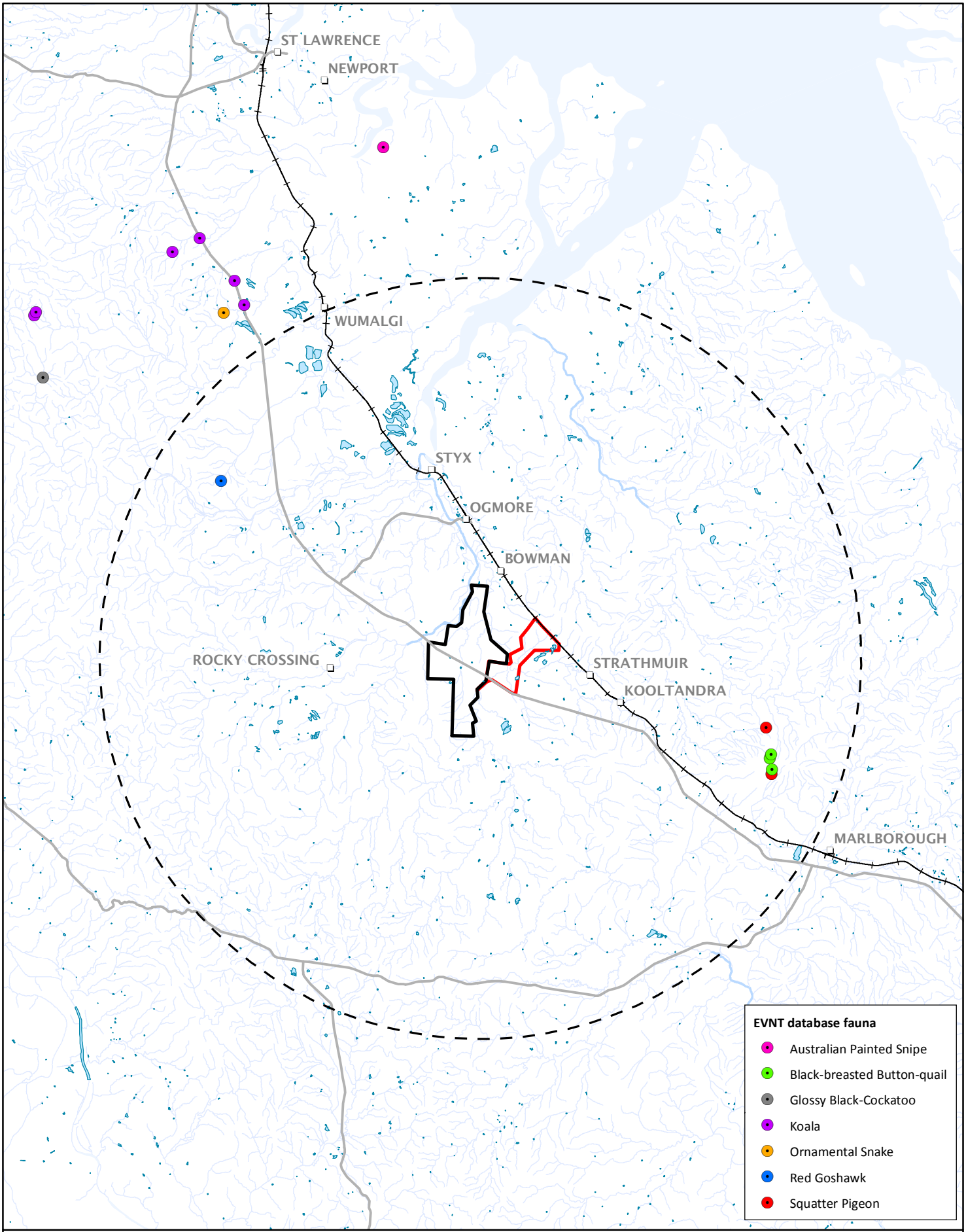
Fifty-seven conservation significant terrestrial vertebrate species are known or predicted to occur within a 50 km radius of the Study area based on the database searches. This includes 32 species listed as Endangered, Vulnerable or Near Threatened under the NC Act and / or EPBC Act. The remaining species include one reptile and 24 birds listed as Migratory species under the EPBC Act. The full list of conservation significant species is provided in Table 14-12.

One further significant species (but not listed as EVNT) predicted to occur is the Short-beaked Echidna (*Tachyglossus aculeatus*) which is listed as Special Least Concern (culturally significant) under the NC Act.

The EPBC Act Protected Matters Online Search also identified a further 17 threatened and / or migratory marine fauna species and five pelagic bird species as potentially occurring in the or near the Project area (refer Apendix A9c). As the Project is located inland and as no impacts are predicted to downstream marine ecosystems these species have not been considered further in this assessment.

There are several records of threatened fauna species in the wider area surrounding the Project area. Five fauna species listed as EVNT were recorded on the EHP or ALA database within a 25 km buffered radius of the Project area including:

- One old record (1905) of Red Goshawk (*Erythrotriorchis radiatus*) located 17 km northwest of the MLs;
- Two records of Squatter Pigeon (southern) (*Geophaps scripta scripta*) located approximately 18 km east of the Project area;
- Three 1996 records of Black-breasted Button-quail (*Turnix melanogaster*) located 18 km east of the Project area located on the edge of hilly country;
- A single record of Ornamental Snake 24 km northwest of the ML; and
- A single record of Koala (*Phascolarctos cinereus*) 24 km northwest of the ML. There are five additional records of Koala between 25 and 33 km to the northwest in the same general area (Figure 14-7). There is also a single record of Australian Painted Snipe (*Rostratula australis*) 30 km to the north and a single record of Glossy Black-cockatoo (*Calyptorhynchus lathami*) over 30 km north-west of ML 80187



N

0 2.5 5 km

Scale @ A4 1:325,000
Date: 19/07/17
Drawn: Gayle B.

Legend

- ML 80187
- ML 700022
- Project Area 25 km buffer
- North Coast Rail Line
- Main road
- Major watercourse
- Minor watercourse
- Reservoir

Figure 14-7
Database records of EVNT fauna within 25 km of Project Area

DATA SOURCE
Geofabric v2.x, Bureau of Meteorology (BoM), 2017
QLD Spatial Catalogue (QSpatial), 2017

CDM Smith

14.6.3.1 Declared Pest Fauna Species

Database searches of the wider area encountered records of eight introduced fauna species. Four of these species are also listed as Restricted Matters under the Biosecurity Act (Table 14-9). Under the Act a person who has control over a 'Restricted Matter' must not do the following:

- Category 3 – A person who has, or has a thing infested with, the 'Restricted Matter' in the person's possession or under the person's control must not distribute or dispose of the restricted matter unless the distribution or disposal is carried out via the methods set out in the Biosecurity Act;
- Category 4 – move the 'Restricted Matter', or cause or allow to be moved;
- Category 5 – keep in the person's possession or under the person' control; and
- Category 6 – give food to the 'Restricted Matter.'

Table 14-11 Introduced fauna species known from the Project area and surrounds

Species name	Common name	Biosecurity Act category
Rhinella marina	Cane Toad	
Streptopelia chinensis	Spotted Turtle-dove	
Passer Domesticus	House Sparrow	
Bos sp.	Cattle	
Canis lupus familiaris	Dog	Category 3, 4, 6
Felis catus	Cat	Category 3, 4, 6
Oryctolagus cuniculus	Rabbit	Category 3, 4, 5, 6
Sus scrofa	Pig	Category 3, 4, 6

14.6.4 Terrestrial Fauna – Field Survey Results

A total of 252 terrestrial vertebrate species were recorded during the 2011 and 2012 field surveys across EPC 1029, including 17 frog, 40 reptile, 159 bird and 36 mammal species as well as two microbats that could only be identified to the level of genus. The February 2017 survey (focused on ML 80187) and subsequent site visits (May and August 2017) recorded 170 species including 20 species not recorded in the earlier surveys. A full list of species recorded during all surveys is provided in Appendix A9c – Ecological Desktop Search Results. The faunal community observed appears typical for a woodland landscape subject to cattle grazing. The total number of species recorded is likely to be an overestimation of that existing within the ML due to the wider ranging extent of the earlier studies.

14.6.4.1 Herpetofauna

Twelve frog species have been recorded within or near the ML across all site surveys. All are relatively widespread and common. The suite of frog species (nine in total) recorded in February 2017 was likely restricted in number and abundance due to the very dry conditions observed during the survey, where frog activity was largely restricted to wetlands / farm dams. The only species encountered at trap sites were Cane Toad (*Rhinella marina*) and Scarlet Pobblebonk (*Limnodynastes terraereginae*) (Plate 14-1).

A total of 29 reptile species were recorded within or near the ML over the surveys, with a further 11 species recorded across the wider region indicating the presence of a relatively diverse fauna, largely of common species. The community included three gecko species, 13 snakes, 13 skinks, four dragons, one pygopodid (legless lizard) (Plate 14-2), one blind snake and five freshwater turtles

(also refer to Chapter 15 – Aquatic Ecology). Eucalypt woodlands dominate the remnant vegetation within the Project area overall and most reptiles were observed or trapped in this habitat type. Sixteen species were recorded during the February 2017 survey of the ML. Most species were recorded on one or two occasions only. Bynoe's Gecko (*Heteronotia binoei*) was the only species commonly recorded throughout the area during habitat searches. Keelback or Freshwater Snake (*Tropidonophis mairii*) was commonly observed hunting around waterholes during spotlighting and during the day.

Plate 14-1: Scarlet Pobblebonk - trap site 2 (February 2017)

Plate 14-2: Brigalow Scaly-foot (*Paradelma orientalis*) - trap site TH3 (February 2012)

14.6.4.2 Birds

In general, the bird fauna assemblage observed during the surveys is typical of drier habitats, along with a range of wetland species that periodically use the abundant wetlands available across the wider area following wet periods. The bird fauna across the Project area is dominated by common and widespread species. The artificial grasslands dominating the MLs were relatively species poor during the February 2017 survey, but nevertheless supported species attracted to grasslands including Brolga (*Grus rubicunda*) and Australian Pipit (*Anthus australis*). The tall canopy and heavy understorey provided by creek line vegetation along Deep Creek and Tooloombah Creek provided a higher localised bird diversity within the landscape with a number of species not recorded elsewhere including Varied Triller (*Lalage lesuerii*), Little Bronze-cuckoo (*Chalcites minutilis*) and Lewin's Honeyeater (*Meliphaga* lewinii).

The site visit in early May 2017 followed heavy rainfall in March. This resulted in increased numbers of waterbirds in the area and more abundant bird life in general, with an additional 17 species recorded in the area that were not present in February including Great Egret (*Ardea modesta*), Australian Pelican (*Pelecanus conspicillatus*) and Eurasian Coot (*Fulica atra*). This also included species using the area during winter migration including Australian Reed-warbler (*Acrocephalus australis*) and Grey Fantail (*Rhipidura albiscapa*).

14.6.4.3 Mammals

Thirty-six mammal species were recorded on or near the MLs across all the site surveys. Macropods were generally abundant, particularly in the vicinity of remnant vegetation close to Deep Creek. Where Agile Wallaby (*Macropus agilis*) and Swamp Wallaby (*Wallabia bicolor*) (Plate 14-3) were commonly encountered due to the shrubby cover provided. Eastern Grey Kangaroo (*Macropus giganteus*) were common in the cleared habitat within the ML. No small ground mammals were trapped during the February 2017 survey although species such as Eastern Chestnut Mouse (*Pseudomys gracilicaudatus*) and Common Planigale (*Planigale maculata*) were recorded during the September 2011 survey. Echidna scats were commonly recorded at several sites during the 2011

surveys. Spotlighting surveys in February 2017 recorded a range of species including Rufous Bettong (*Aepyprymnus rufescens*) and Water Rat (*Hydromys chrysogaster*) at farm dams, and two conservation significant arboreal species were encountered: Central Greater Glider (*Petauroides armillatus*) and Koala.

The microbat fauna was relatively diverse with 15 species recorded during microbat call recording. No flying-fox species were recorded during the February 2017 survey likely due to the lack of flowering gums at the time. Both Little Red Flying-fox (*Pteropus scapulatus*) and Black Flying-fox (*Pterops alecto*) were recorded during the 2011 site surveys. No flying-fox species were recorded onsite.

Plate 14-3: Swamp Wallaby captured on remote camera (Feb 2017)

14.6.4.4 Conservation Significant Species Observed

From the 252 fauna species encountered across all surveys, 10 species are listed as conservation significant under the NC Act and / or EPBC Act, as outlined in Table 14-12:

- Southern Snapping Turtle (*Elseya albagula*) (Endangered NC Act, Critically Endangered EPBC Act);
- Ornamental Snake (*Denisonia maculata*) (Vulnerable NC Act and EPBC Act);
- Latham's Snipe (*gallinago hardwickii*) (Special Least Concern NC Act, Migratory EPBC Act);
- Squatter Pigeon (southern) (Vulnerable NC Act and EPBC Act);
- Oriental Cuckoo (*Cuculus orientalis*) (Special Least Concern NC Act, Migratory EPBC Act);
- Fork-tailed Swift (*Apus pacificus*) (Special Least Concern NC Act, Migratory EPBC Act);
- Rufous Fantail (*Rhipidura rufifrons*) (Special Least Concern NC Act, Migratory EPBC Act);
- Koala (Vulnerable NC Act and EPBC Act);
- Greater Glider (*Petauroides volans*) (Vulnerable NC Act); and
- Short-beaked Echidna (*Tachglossus aculeatus*) (Special Least Concern NC Act).

Of these, five species are known to have been recorded within or close to the Project area: Southern Snapping Turtle, Squatter Pigeon, Koala, Greater Glider, Latham's Snipe and Short-beaked Echidna. Locations of observations are provided in Figure 14-8. Southern Snapping Turtle is covered in further detail in Chapter 15 – Aquatic Ecology.

Ornamental Snake was recorded 3 km west of the Project area in remnant Brigalow open forest during the 2011 survey. It has not been recorded within the ML despite targeted surveys in the 2012 fauna survey and again in 2017 although suitable habitat occurs. As such, this species is treated as 'likely to occur' in the Project area rather than 'known' to occur.

Glossy Ibis (*Plegadis facinellus*) is listed as Migratory (under the EPBC Act) and was recorded in estuarine / wetland habitat north of the current Project area during the 2011 / 2012 surveys. This species is considered as 'likely to occur' within the ML given the suitable wetland / dam habitat occurring in the Project area and local surrounds.

One additional species listed as Migratory is predicted as 'likely to occur' in the area:

- White-throated Needletail (*Hirundapus caudacutus*) (Special Least Concern NC Act, Migratory EPBC Act).

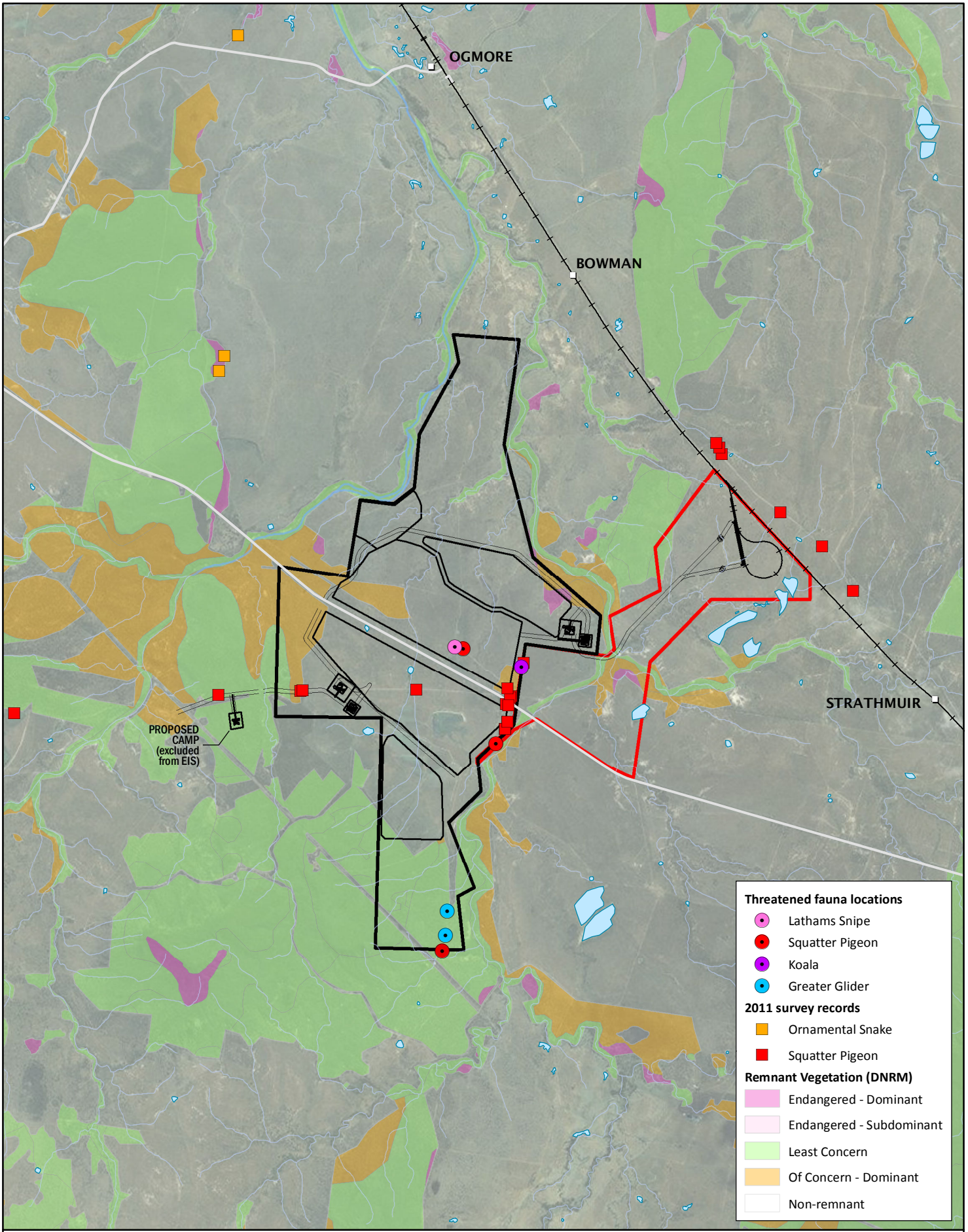
A further five species listed as conservation significant were recorded during the 2011 / 2012 site surveys in estuarine wetland habitat associated with the Styx River / Broad Sound area 14 km to the north of the ML:

- Eastern Curlew (*Numenius madagascariensis*) (Vulnerable NC Act, Critically Endangered and Migratory EPBC Act);
- Whimbrel (*Numenius phaeopus*) (Special Least Concern NC Act, Migratory EPBC Act);
- Bar-tailed Godwit (baueri) (*Limosa lapponica baueri*) (Special Least Concern NC Act, Vulnerable and Migratory EPBC Act);
- Gull-billed Tern (*Gelochelidon nilotica*) (Special Least Concern NC Act, Migratory EPBC Act); and
- Caspian Tern (*Hydroprogne caspia*) (Special Least Concern NC Act, Migratory EPBC Act).

There is no suitable estuarine habitat (mangroves or salt pans) for these species within or near the Project. The tern species may also occur over larger inland wetlands / dams but suitable sites do not occur within either ML as observed in February and May 2017. As such these species are not treated as 'known' or 'likely to occur' in the Project area and therefore there will be no impacts on these species and they are not considered further in this document.

Descriptions of the above species are provided in the following sections where considered applicable.

CDM Smith has approached the predicted occurrence of conservation significant fauna species using a conservative approach. As such, analysis of impact has been based on the assumption that significant fauna species which have good quality habitat within the Project area and localised sighting records are present unless evidence to the contrary exists. An additional 18 conservation significant species listed under the NC Act and / or EPBC Act are considered to have some potential to occur sporadically within the study area (Figure 14-8). These species are; however, not considered to have core habitat in the Project area and as such are not expected to be impacted by the Project and are therefore not considered further.



N

0 1 2 km

Scale @ A4 1:80,000
Date: 24/07/17
Drawn: Gayle B.

Legend

- ML 80187
- ML 700022
- Proposed mine infrastructure
- North Coast Rail Line
- Main road
- Major watercourse
- Minor watercourse
- Reservoir

Figure 14-8
Threatened fauna records – Project area survey results

DATA SOURCE
Geofabric v2.x, Bureau of Meteorology (BoM), 2017
QLD Spatial Catalogue (QSpatial), 2017

CDM Smith

Table 14-12 Likelihood of occurrence of conservation significant and migratory fauna

Species	Status*		Habitat preference	Likelihood of occurrence
	NC Act	EPBC Act		
Known				
Southern Snapping Turtle (*Elseya albagula*)	E	CE	Occurs in Fitzroy, Mary and Burnett Rivers and associated drainages in southern coastal Queensland. Prefers flowing, clear well-oxygenated waters. Occurs in lower densities in rivers with intermittent flows (TSSC, 2014).	**Known.** Styx River catchment is separated from the Fitzroy Basin, however was identified in Deep Creek during 2011 aquatic ecology surveys. Two Wildife Online records from wider area. Nearest records are located over 60 km south on Marlborough Creek and the Mackenzie River both of which are part of the Fitzroy Basin (refer Chapter 15 - Aquatic Ecology).
Latham's Snipe (*Gallinago hardwickii*)	S	M	Occurs on swamp and marsh margins and in wet pasture (Pringle 1987).	**Known.** Up to 15 individuals observed at farm dam within the proposed mine area in February 2017. Single Wildlife Online record.
Oriental Cuckoo (*Cuculus optatus*)	S	M	Rainforest, vine thickets, wet sclerophyll forest and open forest and woodland (Higgins 1999).	**Known**. Recorded on March 2011 survey although sighting location unknown. May be occasional visitor to denser woodlands (such as riverine and adjacent woodland) in the Project area.
Squatter Pigeon - southern subspecies (*Geophaps scripta scripta*)	V	V	Dry grassy eucalypt woodlands and open forests, also Callitris and Acacia woodlands. Most birds live in sandy sites near permanent water (Frith 1982; Blakers et al. 1984; and Crome and Shields 1992). Often around cattle yards and other disturbed areas.	**Known.** Species observed on all surveys including within the ML. Species is relatively common in the wider area and there are 23 Wildlife Online database records.
Fork-tailed Swift (*Apus pacificus*)	S	M	An aerial non-breeding summer visitor, may occur over any habitat type, including cleared land and infrastructure.	**Known.** Recorded during the September 2011 survey although well to the northwest of the ML. Wide ranging aerial species which migrates from the northern hemisphere to Australia. May be occasional aerial visitor to the Project area in the summer months. Single Wildlife Online record from wider area.
Rufous Fantail (*Rhipidura rufifrons*)	S	M	Generally occur in dense vegetation, mainly in rainforests, but also in wet sclerophyll forests and other dense vegetation such as mangroves, drier sclerophyll forests, woodlands, parks and gardens (Higgins et al. 2006).	**Known.** Recorded on March 2011 survey although sighting location unknown. May occur throughout the Project area including regrowth Brigalow. Six database records from wider area. More likely in denser woodlands such as riverine and adjacent woodland.
Greater Glider	C	V	May occur in a range of eucalypt dominated habitats from coastal areas to ranges. Needs large hollow-bearing trees for daytime roosting. Favours habitats with a diversity of eucalypt species (Kavanagh 1984).	**Known.** Two individuals recorded in woodland habitat (RE11.11.15a) in south of ML in February 2017. Also noted in Feb 2012 survey but no location provided. No database records from wider area. EPBC Online search only. Nearest records from mainland adjacent to Shoalwater Bay. Suitable habitat in southern and eastern extent of ML where continuous forest with large hollows remain.

Species	Status*		Habitat preference	Likelihood of occurrence
	NC Act	EPBC Act		
Koala (*Phascolarctos cinereus*)	V	V	Feed almost entirely on eucalypts (Martin et al. 2008); most likely in riverine and riparian habitats.	**Known.** Scats recorded in both 2011 surveys. Species recorded in Poplar Box woodland remnant (RE11.4.2) within ML in February 2017 survey. Forest Red Gum along creeks likely the most favoured habitat for this species. Eleven Wildlife Online record from wider area.
Short-beaked Echidna (*Tachyglossus aculeatus*)	S		Occurs throughout Australia in almost all terrestrial habitats except for intensively managed farms. It shelters in logs, crevices, burrows and leaf litter (Menkhorst and Knight 2004; Augee 2008).	**Known.** Scats of this species observed at several sites within ML during 2011 surveys. Common and widespread species. Five Wildlife Online database records from wider area.
Likely				
Ornamental Snake (*Denisonia maculata*)	V	V	Occurs in low-lying areas with deep-cracking clay soils that are subject to seasonal flooding, and adjacent areas of clay and sandy loams. The species is found in woodlands and shrublands, such as Brigalow, and in riverine habitats, and lives in soil cracks and under fallen timber (Ehmann 1992; and Wilson 2015). Potential habitat is associated with REs 11.3.3, 11.4.3, 11.4.6, 11.4.8, 11.4.9 and 11.5.16 or where they occurred before clearing. (DSEWPaC 2011).	**Likely.** Recorded on three occasions during the 2011 / 2012 fauna surveys. All recorded in areas associated with remnant RE 11.4.9 outside of the current Project area: two records 3.5 km west and one record 5.8 km north-west of the ML. No Wildlife Online records from the wider area. A single ALA record located approximately 24 km north of the Project area. Soils in the Project area are generally suitable and gilgai habitat is widespread in the ML north of the Bruce Highway.
Glossy Ibis (*Plegadis falcinellus*)	S	M	Terrestrial wetlands, preferring inland freshwater wetlands with abundant aquatic flora (Pringle 1985; and Marchant and Higgins 1990).	**Likely.** Recorded in 2011 north-west of the ML on estuarine sedge swamp. Seasonal wetlands and shallow dams in the Project area provide ephemeral habitat for this species. Single Wildlife online database record.
White-throated Needletail (*Hirundapus caudacutus*)	S	M	An aerial non-breeding summer visitor may occur over any habitat type, including cleared land and infrastructure.	**Likely**. Wide ranging aerial species which migrates from the northern hemisphere to eastern Australia. May occur over the Study area in the summer months. No database records from wider area. EPBC Online search only.
Potential				
Yakka Skink (*Egernia rugosa*)	V	V	Occurs in dry forests, woodlands and rocky areas (Wilson 2015). Variety of drier forests and woodlands (usually on well drained, coarse gritty soils) including Poplar Box on alluvial soils, low ridges, Callitris on sands, Belah (Ehmann 1992; Cogger 2000; and Wilson 2015). Also occur in highly degraded sites and where there are log piles and rabbit warrens (EPA 2003).	**Potential.** Only sparse large woody debris is present in wooded habitat in the south of the ML and in habitat adjacent to Deep Creek in the vicinity of Site 4 (2017). No database records in near vicinity. Nearest record in Blackwater region approximately 100 km southwest of Project. EPBC online search only.

Species	Status*		Habitat preference	Likelihood of occurrence
	NC Act	EPBC Act		
Dunmall's Snake (*Furina dunmalli*)	V	V	Rarely encountered. Occurs in a variety of habitats including forests to woodlands on sandy soils, cracking soils with Brigalow scrub, and dry vine scrub. Occurs in the Brigalow Belt in southeast inland Queensland.	**Potential.** No database records from wider area. EPBC Online search only. Species is on the northern edge of its range in this area. Nearest record to Project is from Mt Archer, Rockhampton and species previously recorded from Yeppoon (DotEE 2017). Most northerly record is from Clermont area over 400 km west of the Project. Suitable cracking clay substrate occurs in Project area although vegetation mostly cleared in this habitat.
Red Goshawk (*Erythrotriorchis radiatus*)	E	V	Endemic to northern and eastern Australia in coastal and subcoastal areas with large home ranges of up to 200km^2. Occurs in woodlands and forests and prefers mosaic habitats that hold a large population of birds and permanent water. Riparian areas are heavily favoured (Marchant and Higgins 1993).	**Potential.** One old Wildlife Online database record (1905) from wider search area. Preferred riverine nesting habitat adjacent to Project area although local landscape is heavily cleared so generally unsuitable. Southern extent of ML remains well vegetated. Species may utilise Project area for foraging should it occur in the area.
Eastern Osprey (*Pandion cristatus*)	S	M	Mainly coastal habitats but can occur on inland rivers and lakes (Debus 2012).	**Potential.** Suitable habitat adjacent to Project area along Tooloombah Creek and Deep Creek. No database records. EPBC Online search only.
Australian Painted Snipe (*Rostratula australis*)	V	E	Terrestrial shallow wetlands, ephemeral and permanent, usually freshwater but occasionally brackish. They also use inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains (Marchant and Higgins 1993). Most likely in alluvial areas but could also occur in gilgaied areas.	**Potential.** May be occasional visitor to dams in the Project area. Prefers shallow wetlands with adjacent vegetative cover for shelter. Very uncommon species that occurs erratically over eastern and northern Australia. Three database records from wider region recorded on wetlands to the north of Project area associated with the Broad Sound region (including St Lawrence wetlands) where the species is known to occur.
Curlew Sandpiper (*Calidris ferruginea*) Sharp-tailed Sandpiper (*Calidris acuminata*) Common Greenshank (*Tringa nebularia*) Marsh Sandpiper (*Tringa stagnatilis*) Red-necked Stint (*Calidris ruficollis*)	S S S S S	CE M M M M	All of these species are generally found on wetland habitat along the coast including tidal flats, salt pans and sewage ponds. They also occur on nearby coastal freshwater / brackish wetlands and less commonly on inland wetlands (Pizzey and Knight 2012).	**Potential.** There are limited database records from the wider area for all of these species. Preferred estuarine habitat does not occur on or near the Project area, however these species occasionally occur on inland freshwater wetlands close to the coast, particularly during migration periods.

Species	Status*		Habitat preference	Likelihood of occurrence
	NC Act	EPBC Act		
Gull-billed Tern (*Gelochelidon nilotica*)	S	M	Similar to the above species. Generally coastal habitats but may occur well inland. As well as wetlands can be found on grasslands, crops and ploughed fields where it forages for insects.	**Potential.** Recorded on September 2011 survey although sighting location unknown. Dams / wetlands within the Project area are generally small. More likely to occur downstream of the Project foraging along the Styx River and associated extensive wetland areas.
Caspian Tern (*Hydroprogne caspia*)	S	M	Mostly coastal habitats but also inland terrestrial wetlands including lakes, reservoirs and large rivers (Higgins and Davies 1996).	**Potential.** Recorded on 2012 survey to the north of the Project area associated with estuarine habitat. Dams / wetlands within the Project area are generally small. More likely to occur downstream of the Project foraging along the Styx River and associated extensive wetland areas.
Satin Flycatcher (*Myiagra cyanoleuca*)	S	M	Satin Flycatchers are mostly found in coastal forest, favouring wet forests, moist gullies and watercourses (Higgins et al. 2006).	**Potential.** This species may occasionally utilise the Study area during autumn / spring migrations. No database records. EPBC online search only.
Spectacled Monarch (*Symposiachrus trivirgatus*) Black-faced Monarch (*Monarcha melanopsis*)	S	M	Both species generally occur mostly in dense vegetation, mainly in rainforests, but also in wet sclerophyll forests and other dense vegetation such as mangroves, drier sclerophyll forests, woodlands, parks and gardens (Higgins et al. 2006).	**Potential.** There are limited WildNet database records for these species from the wider area. In general, the habitat in the Project area is open, dry and unsuitable. More suitable (dense) habitat occurs along the adjacent creek lines. Species may utilise the Project area during autumn / spring migrations.
Northern Quoll (*Dasyurus hallucatus*)	C	V	Formerly occurred in a variety of habitats across northern Australia and Queensland. Now most common in rocky eucalypt woodland and open forest within 200 km of the coast (Menkhorst and Knight 2004).	**Potential.** No Wildlife Online or ALA database records from the search area (EPBC Online Search only). Nearest records are 65 km west in the Middlemount area (1969 record) and in Stanage Bay 110 km and 130 km to the northeast (1929 record and 1990 record). The nearest recent records are in Homevale National Park (2011 records) 170 km to the northwest and the Mt Morgan area (2000 record) 120 km to the southeast. The south-west corner of the ML may provide suitable habitat where a rocky jump-up occurs providing potential den habitat in the form of rock crevices on crest of jump-up. Species requires access to permanent freshwater and none is nearby (nearest waterhole approximately 1.5 km). This area occupies approximately 25 ha within the ML boundary and adjoins a large area of contiguous woodlands that remain tenuously connected to more suitable habitat to the west (rocky ranges).

Species	Status*		Habitat preference	Likelihood of occurrence
	NC Act	EPBC Act		
Grey-headed Flying-fox (*Petropus poliocephalus*)	C	V	Nomadic species that generally roosts at sites near water and within 50 km of the coast generally with rainforest, paperbark or casuarina species. Generally occurs further south but regular roost site found near Finch Hatton (Eungella area) in recent years (Roberts et al. 2008).	**Potential.** No database records from the wider area. Little Red and Black Flying-fox have been recorded during the 2011 / 2012 surveys. Black Flying-fox was observed roosting at a large colony site in the township of Marlborough 50 km southeast of the Project. A survey of the colony found no other species resident at the time. There are no roost sites where the species is known to occur in the region surrounding the Project. Current DotEE (2017) data on monitored flying-fox roosts indicates that Finch Hatton (200 km north of the Project) is the nearest roost regularly utilised by the species. They have been recorded using a roost at Middlemount (96 km west of the Project) in 2014 but not during subsequent surveys. To the south the species has been recorded at roost sites in the Bundaberg area (approximately 350 km south of the Project). There is a low potential for the species to forage in the Project area during eucalypt flowering periods given the Project area lies in the northern extent of its accepted range. There is potential roost habitat adjacent to the Project area along Tooloombah Creek and Deep Creek although no camp sites were observed or are known from the wider area.
Ghost Bat (*Macroderma gigas*)	V	V	One of the largest microbat species in the world. Roosts in shallow caves, abandoned mines and rock piles. Australia's only carnivorous bat (Churchill 2008).	**Potential.** No database records from wider area. EPBC Online search only. Well known maternity colony known to occur at Mt Etna caves approximately 90 km southeast of Project area. No suitable habitat observed within mine disturbance area but jump-up at southern extent of ML may provide suitable rocky crevices for roosting.
Large-eared Pied Bat (*Chalinolobus dwyeri*)	V	V	Species has been recorded roosting in disused mine tunnels, rock overhangs, caves and Fairy Martin (*Petrochelidon ariel*) nests (Eyre et al. 1997; Thompson 2002). Appears to be closely associated with the presence of sandstone escarpment country for roost sites.	**Potential.** No database records from search area. EPBC Online search only. Records from the 1990s to the east of the Project area associated with the mainland adjacent to Shoalwater Bay. No suitable habitat observed within mine disturbance area but jump-up at southern extent of ML may provide suitable rocky crevices for roosting.
Unlikely				
Pale Imperial Hairstreak (*Jalmenus eubulus*)	V		Species is confined to vegetation communities containing mature Brigalow which the larvae feed on (Valentine and Johnson 2012).	**Unlikely.** Suitable habitat for this species restricted to single small patch (0.61 ha) of mature Brigalow in mine area. Two database records from the wider area.

Species	Status*		Habitat preference	Likelihood of occurrence
	NC Act	EPBC Act		
Fitzroy Turtle (*Rheodytes leukops*)	V	V	Known only from the Fitzroy Basin. The species prefers large pools and connecting flowing riffle habitats with clear water. It generally does not move far within its home range. It is known to feed on aquatic insect larvae, freshwater sponges and Ribbonweed (*Valisneria* spp.) (Tucker et al. 2001).	**Unlikely.** Uncertain whether species occurs in Styx catchment which is separated from the Fitzroy Basin. Five Wildife Online records from wider area, all located in the Fitzroy Basin. Nearest records are located over 70 km south of the Project and associated with Marlborough Creek (part of the Fitzroy Basin).
Collared Delma (*Delma torquata*)	V	V	Occurs in soil cracks on heavy stoney soils west of Brisbane. Also recorded from Blackdown Tablelands west of Rockhampton. Known from REs on land zones 3, 9 and 10 including 11.3.2, 11.9.10, 11.10.1 and 11.10.4 (DotEE 2017).	**Unlikely.** No database records from wider area. Nearest record from south of Rockhampton. No suitable habitat within Project area. EPBC Online search only.
Grey Falcon (*Falco hypoleucos*)	V		Occurs sparsely in the interior and the north of the Australian mainland found in semi-arid and arid woodlands, grasslands and wooded watercourses (Debus 1998).	**Unlikely.** Single database record from wider area. Very likely to be vagrant record. Habitat is unsuitable and species does not occur in region.
Beach Stone-curlew (*Esacus magnirostris*)	V		Species inhabits sandy beaches, especially where sandflats, mudflats or reefs are exposed at low tide, and are often around river mouths (Marchant and Higgins 1993).	**Unlikely.** Four database records from wider area. However, there is no suitable habitat for this species on or near the Project area.
Eastern Curlew (*Numenius madagascariensis*)	V	CE, M	Mainly forage on intertidal mudflats and sandflats and occasionally ocean beaches, and roost on sandy spits and islets, in mangroves and saltmarsh, and along high water mark on beaches (Higgins and Davies 1996).	**Unlikely.** All three species recorded in Broad Sound area well to north of the current Project during the 2011 / 2012 fauna surveys. Several Wildlife Online records from the wider area for all three species. There is no suitable estuarine / marine habitat for these species located within or near the current Project area.
Whimbrel (*Numenius phaeopus*)	S	M	Occurs on coastal mudflats, coral cays, estuaries, sewage ponds and sometimes flooded grasslands or paddocks. Roosts in mangroves (Pizzey and Knight 2007).	
Bar-tailed Godwit (baueri) (*Limosa lapponica baueri*)	S	V, M	Mainly occurs in coastal habitats such as tidal flats, estuaries, lagoons, bays and harbours. Sometimes occurs on brackish wetlands, saline flats or sewage farms located near coast (Higgins and Davies 1996). May occur on larger waterbodies in inland areas.	
Western Alaskan Bar-tailed Godwit (*Limosa lapponica menzbieri*)	S	CE, M	Subspecies migrates from breeding grounds in North America. Same habitat as Bar-tailed Godwit (baueri) (which migrates from Siberian region). In Australia this subspecies occurs in north-western Australia.	**Unlikely.** No database records. EPBC Online search only. Species does not occur in this region of Australia.

Species	Status*		Habitat preference	Likelihood of occurrence
	NC Act	EPBC Act		
Greater Sand Plover (*Charadrius leschenaultia*)	S	V	These are shorebird species that occur on intertidal habitats in sheltered coastal areas. Species such as Great Knot and Curlew Sandpiper may occasionally occur on inland wetlands. The extensive Broad Sound wetland area is known to support nationally important populations of several migratory shorebird species including Great Knot and Terek Sandpiper (Bamford et al. 2008).	**Unlikely.** There are database records for these species in the wider area. The boundary of Broad Sound occurs approximately 8 km upstream of the northern boundary of the Project area. Preferred habitat does not occur on or near the Project area.
Lesser Sand Plover (*Charadrius mongolus*)	S	E		
Red Knot (*Calidris canutus*)	S	E		
Great Knot (*Calidris ferruginea*)	S	CE		
Grey Plover (*Pluvialis squatorola*)	S	M		**Unlikely.** There are no database records for these species from the wider area. EPBC online search only. Preferred habitat does not occur on or near the Project area.
Terek Sandpiper (*Xenus cinereus*)	S	M		
Grey-tailed Tattler (*Tringa brevipes*)	S	M		
Crested Tern (*Thalasseus bergii*)	S	M	Largely coastal species that may also occur on tidal rivers and larger inland rivers (Pizzey and Knight 2012).	**Unlikely.** No database records. EPBC online search only. No suitable habitat present for this species.
Little Tern (*Sternula albifrons*)	S	M	Coastal species that also occurs on coastal waterbodies such as brackish lakes, salt fields and sewage ponds (Pizzey and Knight 2012).	**Unlikely.** No database records. EPBC online search only. No suitable habitat present for this species.
Black-breasted Button-quail (*Turnix melanogaster*)	V	V	Cryptic species that occurs in dry rainforest and vine-thickets with abundant leaf-litter. They have also been recorded in Brigalow, Belah and Bottle-tree scrubs, and in eucalypt forests with a dense understorey including Lantana (Marchant and Higgins 1993).	**Unlikely.** Three database records located 18 km east of Project area. No potential habitat within ML. Very marginal habitat along Tooloombah Creek where understorey of vine thicket occurs in a narrow band along steep creek bank. No evidence of presence (i.e. platelets) was observed during surveys.
Glossy Black-cockatoo (*Calyptorhynchus lathami*)	V		Feeds exclusively on the cones of she-oaks. In the Brigalow Belt the species feeds on Belah. Needs large hollows for nesting (Higgins 1996).	**Unlikely.** Preferred forage tree species occur along Deep Creek and Tooloombah Creek (River She-oak) but suitable habitat within the Project area is heavily disturbed and unsuitable. Single Wildlife Online record from wider area.

Species	Status*		Habitat preference	Likelihood of occurrence
	NC Act	EPBC Act		
Yellow Chat (Dawson) (*Epthianura crocea macgregori*)	E	CE	Occurs on marine plain wetlands in the Fitzroy River Delta, Torilla Plains and Curtis Island in central Queensland (Houston et al. 2004; Jaensch et al. 2004). Requires grassland, dense beds of rush or sedge, bare mud and / or shallow water, and patches of Samphire (Houston et al. 2004).	**Unlikely.** 50 Wildlife Online database records from wider area. These records are likely to be associated with the extensive Torilla Plains located approximately 40 km east of the Project area. There is no suitable marine habitat in or near the Project area.
Black-throated Finch (southern) (*Poephila cincta cincta*)	E	E	Occurs in grassy open woodlands near water. Prefers areas of intact woodlands with a variety of native grasses for year round feeding. Nests in large trees, sometimes in tree hollows and arboreal termite nests.	**Unlikely.** Suitable grassy woodland habitat exists however, Project area is southeast of the species current known range. No database records. EPBC online search only.
Star Finch (*Neochmia ruficaunda ruficauda*)	E	E	Occurs mainly in dense, damp grasslands bordering wetlands and watercourses, as well as open grassy woodlands near permanent water. Forages for seeds in tall native grasses (Higgins et al. 2006).	**Unlikely.** Although once widespread this species is now very rare. Project area is south of the species current known range. No database records. EPBC online search only.
Yellow Wagtail (*Motacilla flava*)	S	M	Occurs on sort grass and bare ground on swamp margins, salt marshes and sewage ponds near coast (Pizzey and Knight 2012).	**Unlikely.** No database records. EPBC online search only. May occur on the edge of dams in Project area. Very occasional visitor to Queensland.
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	V	V	Occurs in a variety of dry forest habitats including River Red Gum, open woodland, mallee, brigalow and other arid and semi-arid habitats. The preferred habitat is Mallee and Callitris woodlands (Pennay et al 2011), and habitats that have a distinct canopy with a dense, cluttered understorey (Turbill and Ellis 2006). It roosts in tree hollows or under bark (NSW NPWS 2003). Surveys suggest the species requires large tracts of forest to occur (Turbill et al. 2008).	**Unlikely.** The Project area is located substantially north of its current known distribution. The nearest available records for this species (either EHP or ALA records) are three records (in 2002 and 2014) located over 280 km to the south within open forest in Expedition Range NP and near the Dawson River. Churchill (2008) notes the distribution of the species is largely restricted to the Murray Darling Basin and western slopes of the GDR from south central Queensland. DotEE (2016) note the species is largely recorded in the Brigalow Belt South Bioregion in Queensland which lies well south of the Project area. No database records. EPBC Online search only.
Water Mouse (*Xeromys myoides*)	V	V	Occurs in mangroves, saltmarsh, sedged lakes near foredunes and coastal freshwater swamps. Requires relatively large areas of intertidal flats over which to forage (Gynther and Janetzki 2008).	**Unlikely.** No database records from wider area. No suitable habitat within or near Project area. EPBC Online search only.

*Status abbreviations: NC Act - C = Least Concern, S = Special Least Concern, NT = Near Threatened, V = Vulnerable, and E = Endangered; EPBC Act - Ex = Extinct, M = Migratory , V = Vulnerable, and E = Endangered.

14.6.4.5 Conservation Significant Fauna Species Profiles – Threatened Species

Squatter Pigeon (southern) (*Geophaps scripta scripta*)

Plate 14-4: Squatter Pigeon recorded during Project surveys (March 2011)

Status: Vulnerable – NC Act and EPBC Act

Occurrence in the study area: Recorded during every site survey and throughout ML 80187, although mostly south of Bruce Highway (Figure 14-8, Plate 14-4). The species was mainly observed in pairs or as individuals but groups of up to six individuals recorded. The species is not associated with particular REs and was often recorded in cleared habitat.

Ecology and habitat: The Squatter Pigeon is largely terrestrial, foraging and breeding on the ground. The southern subspecies occurs mainly in dry grassy eucalypt woodlands and open forests (Frith, 1982; Crome and Shields, 1992). It also inhabits *Callitris* and *Acacia* woodlands and was reported from open plains in its historical southern range (Frith, 1982). Most birds live in sandy sites near permanent water (Blakers et al., 1984). Squatter Pigeons dust-bathe and are often encountered on dirt tracks and in areas of bare soil denuded of ground cover by livestock (Frith, 1982; Higgins and Davies, 1996). Although they remain common in heavily grazed country in tropical Queensland (Reis 2012) they are typically more common in ungrazed land compared to grazed land (Woinarski and Ash, 2002; Reis 2012). This species is largely granivorous although insects are seasonally important in the diet and some insects (Reis 2012).

Distribution and breeding: This subspecies was historically found from the Dubbo region in New South Wales north to the Burdekin River area in in Queensland. There have been no official records in New South Wales since the 1970s. Although the species has declined greatly in southern Queensland in the past it appears this decline has slowed and the species now persists over a wide area and can be locally abundant in central Queensland (Garnett et al. 2011) where groups of up to 30 individuals can still be seen (Reis 2012).

Breeding is poorly known but does appear to be greatly influenced by rainfall. The nest is a shallow depression on the ground usually sheltered by a bush or log (Reis 2012). The total population size is estimated at 40,000 breeding birds and is thought to occur as a single continuous interbreeding population. This estimate is considered to be of low reliability. Numerous recent records from the Injune / Canarvon Range region suggest that individuals from this area are part of this population.

South of this area and Tin Can Bay on the coast the subspecies has become fragmented (DotEE 2015). No populations have been identified as being especially important to the long-term survival or recovery of the Squatter Pigeon (southern).

Threats: Much of the original habitat in Queensland has been replaced with pasture for livestock (Higgins and Davies 1996). Threats to existing populations include clearing and fragmentation of habitat, overgrazing by livestock and feral herbivores, trampling of nests by livestock and feral animals, predation by cats and foxes, and illegal shooting (NSW NPWS 2003).

Greater Glider (*Petauroides volans*)

Status: Vulnerable – EPBC Act only.

Occurrence in the study area: Two individuals were recorded during spotlighting surveys of the site in February 2017. The individuals were recorded in the continuous tracts of eucalypt woodland that characterise the southern portion of ML 80187 and well to the south of the closest disturbance area (see Figure 14-8). There are no database records of the species occurrence from the wider area surrounding the Project. Suitable habitat within or near the Project is likely to be restricted to this area due to the extensive clearing carried out elsewhere.

Ecology and habitat: Greater Gliders are typically found in mature eucalypt forests and woodlands with a variety of eucalypt species and a high density of large tree hollows (van der Ree et al. 2004). Its diet is largely composed of eucalypt leaves and sometimes flowers. Large hollows in old trees are favoured as shelter sites during the daytime (Goldingay 2012). Sites with a high abundance of suitable hollows appear to support higher populations. The species uses relatively small home ranges of 1 ha – 4 ha in more productive forests (Gibbon and Lindenmayer 2002), but up to 16 ha in more open and dry habitats (Smith et al. 2007).

Distribution and breeding: The species occurs across eastern Australia in a broad swathe of territory associated with the Great Dividing Range. It is known to occur from north Queensland (Atherton Tablelands) to central Victoria.

Females breed in their second year giving birth to a single young each year (March to June). Their low birth rate may cause isolated populations in small forest fragments to be vulnerable to extinction (van der Ree et al. 2004).

Threats: Greater Glider is thought to be particularly sensitive to forest clearing / logging and forest fragmentation. They appear to have a poor dispersal ability being relatively restricted to intact forests / woodlands. They are thought to be susceptible to major disturbances such as frequent or intense fires (TSSC, 2016). Climate modelling suggests the species may be threatened by potentially increased temperatures associated with climate change, particularly populations in north Queensland (Kearney *et al*., 2010).

Koala (*Phascolarctos cinereus*)

Status: Vulnerable – NC Act and EPBC Act.

Occurrence in the study area: The species was observed in Poplar Box remnant woodland within ML 80187 during spotlighting for the February 2017 site survey. Scats / scratches attributed to this species identified near the south eastern boundary of the ML in September 2011. No other observations of presence (such as tree scratches) within the Project area or surrounds recorded.

The central eastern and western portion of the ML is dominated by tracts of Poplar Box (RE 11.4.2) which is considered a secondary forage tree. Forest Red Gums are considered primary feed trees

(Australian Koala Foundation 2015) and occur in narrow bands along creek lines including the drainage line that crosses the ML north of the Bruce Highway. The Forest Red Gum habitat in the local area (RE 11.3.4 and 11.3.25) is likely to be the most favoured habitat for this species.

Ecology and habitat: Koalas have a distinct association with eucalypt woodland and forest habitat types containing suitable food trees (Hume and Esson, 1993; Moore and Foley, 2000; and Martin et al. 2008). Koala's are not necessarily restricted to bushland or remnant areas and are known to exist and breed within farmland and the urban environment (Dique et al. 2004). Similarly, movement is not confined to vegetated corridors, as they also move across cleared rural land and through suburbs (Martin et al. 2008). They use a variety of trees, including many non-eucalypts, for feeding, shelter and breeding purposes (Dique et al. 2004; and Martin et al. 2008).

They are known to have localised preferences throughout their range, selecting some tree species over others (Pahl and Hume 1990). They are also known to favour individual trees and this has been suggested to be a response to a variety of factors including high leaf moisture content, high leaf nitrogen content (which is often related to low fibre content making leaves more palatable) and low levels of chemical compounds which are expressed by eucalypts to resist herbivory (Pahl and Hume 1990; Hume and Esson 1993; and Moore and Foley 2000).

Distribution and breeding: Koalas occur throughout northeast, central and southeast Queensland, extending south through Victoria into South Australia and Kangaroo Island. Breeding occurs in spring / summer when males become territorial, attacking and fighting rivals and using loud bellows to advertise their presence (Martin et al. 2008). Young permanently leave the females pouch after seven months, but continue to ride on the mothers back until 12 months and the beginning of a new breeding season. After this time adolescent females may remain in the natal habitat, but males generally disperse to new territories between one to three years of age (Dique et al. 2003; and Martin et al. 2008).

Threats: Current threats to Koalas include habitat destruction and fragmentation, bushfire and disease. Populations around urban / populated areas are also at increased risk of mortality due to dog attack and road strike (Maxwell et al. 1996).

Ornamental Snake (*Denisonia maculata*)

Plate 14-5: Ornamental Snake recorded during Project surveys (March 2011)

Status: Vulnerable – NC Act and EPBC Act.

Occurrence in the study area: There are suitable cracking clay soils within the Project area north of the Bruce Highway (Figure 14-8, Plate 14-5) where regrowth Brigalow occurs including extensive gilgai formations. No individuals were observed during the Project surveys despite targeted surveys (trapping, habitat searches and spotlighting) within the Project area in both February 2012 and February 2017.

Two individuals were recorded in remnant Brigalow habitat (RE 11.4.9) 3 km west of the northern boundary of ML 80187 in September 2011. One individual was recorded in Brigalow habitat (RE 11.4.9) along a minor drainage line approximately 5.8 km north-west of the northern boundary of ML 80187 in March 2011.

Ecology and habitat: Ornamental snake occurs in low-lying areas with deep-cracking clay soils that are subject to seasonal flooding, and adjacent areas of clay and sandy loams. The species is found in woodlands and shrublands in Brigalow, Gidgee (*Acacia cambagei*), Blackwood (*A. argyrodendron*) or Coolabah (*Eucalyptus coolabah*) dominated vegetation communities associated with moist areas, particularly gilgaied landscapes. It also occurs in modified grassland associated with gilgais, and lake margins and wetlands (Melzer 2012). The species has been recorded in the following REs, none of which occur in the Project area: 11.4.6, 11.4.8, 11.4.9, 11.3.3 and 11.5.16 (DotEE 2015).

Ornamental snake requires microbhabitat shelter sites such as soil cracks, rocks, human debris (e.g. corrugated iron sheeting) and under fallen timber. It is a nocturnal species and feeds almost entirely on frogs, though lizards may very occasionally be eaten (Ehmann 1992; Wilson 2015). They are known to congregate around waterholes and temporary pools where frogs are abundant. They are most likely to be encountered following heavy summer rains (Melzer 2012). Gilgais are a known important habitat for the species and the presence of remnant vegetation is not required for the species to occur (DSEWPaC 2011).

Distribution and breeding: The species occurs in the eastern half of the central and northern Brigalow Belt, mainly in the Fitzroy and Burdekin Basins. High population densities are known from the Isaac River (Dysart, Moranbah and Nebo) and Dawson River catchments (Melzer 2012).

Threats: Threats to ornamental snake include: habitat clearing and fragmentation; altered water quality and hydrology affecting gilgai and wetland habitat; habitat degradation by cattle and exotic weed species; predation by feral species; and consuming cane toads. The species is generally not found in areas with high numbers of cane toads (Melzer 2012).

14.6.4.6 Conservation Significant Fauna Species Profiles – Other Species

Glossy Ibis (*Plegadis falcinellus*)

Status: Special Least Concern – NC Act; Migratory – EPBC Act.

Recorded in the wider area to the north of the Project on a brackish swamp associated with the Styx River marine plains during the September 2011 survey. The Project area is likely to provide suitable habitat, particularly following heavy rainfall.

The Glossy Ibis is a widespread species, occurring throughout the northern hemisphere and over much of Australia. This species breeds in dense colonies, often with other species of ibis and waterbirds (Marchant and Higgins 1990). Outside of the breeding season, the species is nomadic, seeking suitable foraging areas. It feeds on aquatic invertebrates and occurs in terrestrial wetlands, preferring inland freshwater wetlands with abundant aquatic flora (Pringle 1985; and Marchant

and Higgins 1990). Core breeding habitat for the species is within the Murray-Darling Basin (New South Wales and Victoria), the Macquarie Marshes in NSW and in southern Queensland.

Latham's Snipe (*Gallinago hardwickii*)

Status: Special Least Concern – NC Act; Migratory – EPBC Act.

This species was recorded at a single farm dam on Mamelon Station in February 2017. Several visits to the site were made to ascertain the number of individuals present. Up to 15 individuals were recorded.

Latham's Snipe is a secretive species that occurs in swamp and marsh margins and in wet pasture, feeding mainly on earthworms and insect larvae (Pringle 1987). Latham's Snipe breeds mainly in Japan, arriving in northeast Queensland during the northern winter and then moving south through the coastal / sub-coastal areas of southeast Queensland into much of eastern Australia during spring / summer (Pringle 1987; and Pizzey and Knight 2007). The species does not breed in Australia. It has been recorded in Australia from the Cape York Peninsula through South Australia. The species may occur around shallow wetlands and farm dams in the Project area.

Fifteen individuals is an unusually high number for this species on a relatively small site (approximately 0.6 ha in extent). The species was not recorded elsewhere within the Project area during the February 2017 survey (or other Project related surveys) and no other migratory shorebird / wader species was recorded within the ML. The Commonwealth's *Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species* (DotEE 2015) treats Latham's Snipe differently to the other migratory shorebirds listed under the EPBC Act due to the different habitats and behaviour of the species. The Guideline states that important habitat for the species may be identified where:

- Areas that have previously been identified as internationally important for the species; and
- Areas that support at least 18 individuals of the species (DotEE 2015).

Six important sites have been identified in Australia located in Victoria (five sites) and Tasmania (one site) (DotEE, 2017). The Project is not considered as 'important habitat' for Latham's Snipe.

Oriental Cuckoo (*Cuculus optatus*)

Status: Special Least Concern – NC Act; Migratory – EPBC Act.

A single record of this species 1.3 km east of the ML during the March 2011 survey.

Oriental Cuckoo breeds in China, Japan and Mongolia in the northern summer. It migrates south to the Australasian region. It is widespread but sparsely recorded across eastern Queensland in the summer months (September to May). The species may occur in a wide range of habitats including relatively cleared areas such as leafy trees in paddocks (Pizzey and Knight 2012).

White-throated Needletail (*Hirundapus caudacutus*) and Fork-tailed Swift (*Apus pacificus*)

Status: Special Least Concern – NC Act; Migratory – EPBC Act.

White-throated Needletail has not been recorded in the area but is common and widespread and considered likely to occur. Fork-tailed Swift was recorded during 2011 and 2012 surveys of the wider area.

The White-throated Needletails and Fork-tailed Swift are widespread over eastern and south eastern Australia during the warmer months. Both species breed in eastern Asia and spend the non-breeding season mainly in Australia, and occasionally in New Guinea and New Zealand (Blakers et al. 1984; and Higgins 1999). White-throated Needletail arrives in eastern Australia in late October moving south along both sides of the Great Dividing Range as far south as Tasmania. Fork-tailed Swift also arrives in October but may occur throughout Australia (Higgins 1999). Both are aerial foraging species and can occur over most habitats including heavily disturbed areas. They are commonly associated with storm fronts. White-throated Needletail is likely to be more common in the Project area; however, both species may occur.

Rufous Fantail (Rhipidura rufifrons)

Status: Special Least Concern – NC Act; Migratory – EPBC Act.

A single record of this species during March 2011 survey. Most suitable habitat for this occurs along Deep Creek and Tooloombah Creek.

Rufous Fantails occur in moist habitats, including closed forests, coastal scrubs, mangroves and along watercourses and gullies, and urban / rural areas during mid-year migration (Pizzey and Knight 2007; Higgins et al. 2006). They predominantly feed on small insects within the understorey (Higgins et al. 2006). The species occurs across Northern Australia from the Kimberley to Cape York and down the entire eastern coast (Pizzey and Knight 2007). The eastern races migrate to the north in early Autumn and return in early Spring to breed (Pizzey and Knight 2007; Higgins et al. 2006).

Short-beaked Echidna (*Tachyglossus aculeatus*)

Status: Special Least Concern (culturally significant) – NC Act.

Scats and diggings attributable to this species were encountered on all surveys of the area. The species is likely to occur within eucalypt and acacia woodlands throughout the wider area.

The Short-beaked Echidna is, with the Platypus and the Long-beaked Echidna (*Zaglossus bruijni*) of New Guinea, the only three extant species of monotreme, a group of mammals believed to have diverged early in the evolution of mammals, possibly about 200 million years ago (Augee 2008). The Short-beaked Echidna is specialised for feeding on ants, termites and beetle larvae. It occurs in almost all terrestrial habitats except for intensively managed farms. The species is active both by day and night and shelters in logs, crevices, burrows and leaf litter (Menkhorst and Knight 2004; and Augee 2008). This species occurs throughout Australia and can be expected in all well forested areas. Mating takes place in July and August with juveniles seen from September (Augee 2008). Short-beaked Echidnas are killed by dingoes / dogs and motor vehicles.

14.6.4.7 Exotic Fauna Species Observed

Five introduced terrestrial vertebrate species were recorded within the Project area and surrounds including: Cane Toad (*Rhinella marina*); Cat (*Felis catus*); Rabbit (*Oryctolagus cuniculus*); Dingo (*Canis lupus dingo*) and Pig (*Sus scrofa*). Four of these species (Rabbit, Feral Cat Dingo and Pig) are declared Class 2 pest species under the *Land Protection (Pest and Stock Route Management) Act 2002.*

14.6.5 Habitat Values for Terrestrial Fauna

Habitat type is a significant factor in the composition of the fauna species assemblage of a given area. Two habitat components are especially important: physical structure and resource availability.

Structure refers to the abundance and complexity of the vegetation, debris and substrate. Habitats with thick ground cover, abundant shrubs and many large trees are complex in vertical structure and provide abundant sheltering sites in dense leaf litter, dense foliage, under loose bark and in tree hollows. Horizontal habitat complexity refers to characteristics such as the presence of ground plant species, open areas, fallen timber and rock crevices that provide sheltering opportunity for terrestrial species. Habitats with higher vertical and horizontal complexity (generally with a diverse plant species assemblage) tend to be more structurally complex due to the different growth forms of different species. In addition, the availability and variety of resources (food, water and mates) affect the number and type of vertebrate species inhabiting an area. Habitats with abundant and variable resources tend to support more species, while the presence of preferred dietary items will facilitate the presence of particular taxa. However, habitat usage will be variable with certain species utilising habitats dependent upon seasonal conditions or in response to a specific event such as recent rainfall or mass flowering events.

Four principal fauna habitat types were present within the Project area and surrounds:

- Eucalypt open woodland to open forest;
- Brigalow open forest (remnant / regrowth);
- Farm dams / wetlands; and
- Non-remnant grassland with scattered trees and shrubs on previously cleared areas.

14.6.5.1 Eucalypt Open Forest to Woodland

Eucalypt woodlands dominate the remnant vegetation remaining within the Project area and surrounds. Eucalypts provide seasonal food resources for nectar-feeding birds and flying-fox and abundant nest / roost sites in the form of tree hollows for birds (such as parrots), microbats, possums, gliders and other small mammals. In general, the bird fauna recorded during the site surveys were restricted to widespread and commonly occurring species. Woodland habitat provides suitable values for Squatter Pigeon, particularly where sandy soils and permanent water occurs (such as farm dams).

Poplar Box woodland (RE 11.4.2) dominates the middle of the lease both north and south of the highway (Plate 14-6). Although Poplar Box dominates, a number of other species also occur including Narrow-leaved Ironbark and Ghost Gum. Where larger trees occur, this habitat will provide abundant tree hollows although mature trees appear scarce. This habitat generally appears impacted by cattle access. Generally, there is very little to no understorey in this habitat and large fallen timber is relatively sparse providing little cover for ground fauna. The grass layer is a mixture of native species and Buffel Grass. Koala was recorded in this habitat in February 2017. In the western portion of the ML (in the vicinity of fauna trap site 4) a more varied woodland dominated by Poplar Gum occurs on sandy soils. This habitat provides a scattered shrub layer dominated by Lantana and Red Ash and abundant large woody debris providing potential shelter for a variety of ground fauna including reptiles and native rodents.

Narrow–leaf Ironbark dominates the relatively continuous tracts of woodland in the southern portion of ML 80187, although the steeper, rocky section in the far southern corner of the ML becomes dominated by Lancewood (Plate 14-7). Other tree species commonly present include Ghost Gum and Clarkson's Bloodwood (*C. clarksonia*). Greater Glider was recorded in this area, well to the south of the nearest disturbance area, indicating mature trees with large hollows occur. The shrub

layer is generally sparse, although Lantana becomes more common (sometimes dense) in the vicinity of drainage lines and in more disturbed areas adjacent to clearing. Large fallen timber is sparse throughout providing limited potential shelter opportunities. The ground layer is made up of largely native grass species providing a relatively continuous cover suitable for species such as Eastern Chestnut Mouse (*Pseudomys gracilicaudatus*).

Plate 14-6: Poplar Box woodland where Koala was recorded (February 2017)

Plate 14-7: Rocky ridgeline with Lancewood in southeast corner of ML

Riparian open forest featuring Forest Red Gum (RE 11.3.25) occurs along Deep Creek and Tooloombah Creek (largely outside of the ML). It also occurs within ML 80187 along a tributary of Deep Creek north of the highway, although this is a very narrow and degraded strip of vegetation. Adjacent floodplain woodland (RE 11.3.4) occurs in the east of the ML and is continuous with riparian vegetation associated with Deep Creek (Plate 14-8). These forests provide the most varied habitat values in the area. The canopy is multi-storeyed and relatively diverse including Moreton Bay Ash, Swamp Mahogany, large *Melaleuca* species and River She-oak (along the creeks). There is a patchily dense shrub layer which tends to be dominated by the introduced Lantana and Rubber Vine. Similarly, the ground layer is also dense in areas where the shrub layer is less developed. Large woody debris is generally abundant in these habitats.

The multilayered nature of these forests provides abundant foraging and sheltering values for a wider range of bird species than is found elsewhere on the site. The banks of Tooloombah Creek (Plate 14-9) and patchy sections along Deep Creek are often dominated by a patchy understorey of dry rainforest tree / shrub species providing additional seasonal fruiting resources. A range of smaller bird species (such as fantails and scrubwrens) will utilise the dense shrub layer despite the dominant weed species often present. The dense shrub and grass layer may provide shelter for a range of ground fauna including frogs and reptiles, small and medium-sized mammals such as Planigale (*Planigale maculata*), and Northern Brown Bandicoot (*Isoodon macrourus*) and Fawn-footed Melomys (*Melomys cervinipes*), both of which were only recorded in this habitat on Tooloombah Creek. Macropods including Agile Wallaby (*Macropus agilis*) and Swamp Wallaby (*Wallabia bicolor*) were commonly disturbed in this habitat adjacent to Deep Creek in the eastern portion of ML 80187. Particularly along the creek lines this habitat features abundant large tree hollows for glider species and possums where mature trees remain, and is favoured foraging habitat for Koala.

Plate 14-8: Red Gum open forest adjacent to Deep Creek

Plate 14-9: Western bank of Tooloombah Creek with dry rainforest understorey

14.6.5.2 Brigalow Open-forest (remnant / regrowth)

Only a single small patch of remnant Brigalow open-forest habitat (RE 11.4.9) occurs in the western portion of ML 80187. This is a small patch at 0.61 ha and is unlikely to provide substantial habitat value for fauna. However, much of the ML located north of the Bruce Highway occurs on cracking clay soils with extensive but patchy areas of regrowth generally 3 m to 5 m in height (Plate 14-10). Brigalow is the dominant species in the very patchy canopy with a scattered lower shrub layer of vine thicket species. Much of the regrowth areas occurs on cracking clay soils with gilgai formations of varying depth. Following heavy rains these areas may provide habitat for a variety of wetland birds, frog species as well as Ornamental Snake.

This habitat may provide suitable foraging values for a variety of smaller forest bird species that prefer a closed canopy and dense low vegetation such as fantails and fairywrens. There is abundant shelter for ground fauna (particularly reptiles) in the form of low shrubs, although large fallen timber is very sparse.

14.6.5.3 Farm Dams / Wetlands

There are a number of wetlands of varying size across the ML. The majority of these have been artificially created ('turkey nest' dams and dammed creek lines). A large seasonal wetland occurs in the western portion of the site (Plate 14-11). Analysis of aerial imagery indicates large portions of the ML are likely to retain water for substantial periods following heavy rains. Conditions were very dry at the time of the February 2017 survey, but water was still present throughout ML 80187. Many of these waterbodies appear relatively shallow, providing suitable habitat for a range of wetland bird species and amphibians. During the survey periods, these wetlands supported a diversity of waterbirds, including Plumed Whistling-duck (*Dendrocygna eytoni*), Wandering Whistling Duck (*D. arcuata*), a range of other duck and heron species, Little Black Cormorant (*Phalacrocorax melanoleucos*), Brolga (*Grus rubicunda*), Purple Swamphen (*Porphyrio porphyrio*) and Eurasian Coot (*Fulica atra*) as well as less common species such as Cotton Pygmy-goose (*Nettapus coromandelianus*). The February 2017 survey recorded several Latham's Snipe (Migratory – EPBC Act) congregated around a vegetated farm dam. Waterbodies with abundant vegetative cover may provide habitat for shy species such as rails and Australian Painted Snipe. These areas will also provide resources for birds reliant on the presence of permanent water such as pigeon and parrot species.

Plate 14-10: Regrowth Brigalow north of highway

Plate 14-11: Large seasonal wetland in eastern ML (May 2017)

14.6.5.4 Non-Remnant Vegetation

Non-remnant grassland areas dominate large portions of the proposed mine impact area, much of the haul road and the TLF. Within the ML these areas are generally dominated by introduced pasture grasses, including Buffel Grass. South of the highway there are few and scattered taller shade trees within this habitat, which remains largely clear of trees (Plate 14-12). Habitat to the north of the highway remains patchily vegetated with regrowth composed largely of Brigalow and Poplar Box. The haul road and TLF are located mainly to the east of Deep Creek. This area remains mostly cleared but is vegetated in patches with sparse stands of taller Narrow-leaved Ironbark (Plate 14-13) or Forest Red Gum which have been subject to tree-thinning (and are thereby non-remnant).

With limited structural and floristic diversity, non-remnant grassland habitats supported limited fauna diversity in comparison to remnant habitats, but provided habitat for certain grassland dependent fauna species such as Eastern Grey Kangaroo (*Macropus giganteus*), Australian Bustard (*Ardeotis australis*), Horsfield's Bushlark (*Mirafra javanica*) and Australasian Pipit (*Anthus novaeseelandiae*). Sparsely treed habitat to the east of Deep Creek will provide additional habitat, largely to a range of widespread bird species that occur in open woodland habitats.

Plate 14-12: Typical cleared habitat south of highway

Plate 14-13: Sparsely treed habitat within haul road

14.7 Potential Impacts on Environmental Values

The Project has the potential to impact terrestrial EVs and MSES, including threatened flora and fauna, vegetation communities and other ecological values within the Study area. These include:

- Remnant vegetation (including Of Concern and Endangered communities);
- Populations of threatened flora and fauna;
- Habitat for threatened flora and fauna; and
- Ecological functioning (e.g. habitat connectivity).

Throughout the construction, operation and decommissioning phases, the Project has the potential to impact on these ecological values through the following activities:

- Removal of remnant vegetation for the Mine Infrastructure Area (MIA), spoil dump areas, dams, open cut pits, TLF and haul road;
- Topsoil stripping;
- Construction of above ground buildings and facilities;
- Day and night time operation of coal mining activities;
- Stockpiling and transportation of the coal resource; and
- General transportation movements.

14.7.1 Vegetation Clearing

The Project will require the clearing of remnant vegetation for construction of the MIA, open cut pits, spoil dump areas, dams, haul and access roads, coal conveyor and TLF. Remnant vegetation may also provide habitat for fauna and flora listed as threatened under the NC Act and / or EPBC Act. Vegetation communities listed as Of Concern, Endangered or considered as watercourse vegetation (under the VM Act) are listed as MSES. Habitat for threatened species listed under the NC Act is also listed as MSES. Endangered remnant vegetation is also considered as a Category B ESA.

The layout of the proposed mine, associated infrastructure and the ground-truthed remnant vegetation on the site is depicted in Figure 14-9. Table 14-13 details the projected extent of vegetation clearing for the Project including potential impacts to habitat for threatened fauna and flora species. Only those species considered 'likely' or 'known' to occur are considered (refer to Table 14-10).

Based on ground-truthed vegetation mapping, clearing activities within the mine area are predicted to impact 32.05 ha of Least Concern, 102.76 ha of Of Concern vegetation and 0.6 ha of Endangered vegetation. Vegetation clearing for the haul road is predicted to impact 2.6 ha of Least Concern vegetation where the haul road crosses Deep Creek and Barrack Creek. The TLF is located in heavily cleared lands and will not impact any remnant vegetation.

Table 14-13 Proposed vegetation clearing of ground-truthed remnant and non-remnant vegetation

RE	VM Act Status	Threatened species habitat	Impact area (ha)	Total within a 10 km radius of Project (ha)	Total within Marlborough Plains subregion (ha)
11.3.4	Of Concern	Koala – core foraging habitat Greater Glider – may provide hollow-bearing habitat where it occurs next to continuous woodlands in the south of the mine ML	7.92	925.5	10,042.1
11.3.11	Endangered	None	0.4	5.22	112.9
11.3.25	Least Concern	Koala – core foraging habitat Greater Glider – may provide hollow-bearing habitat where it occurs next to continuous woodlands in the south of the mine ML Ornamental Snake – may provide habitat where it occurs within the ML adjacent to cleared / regrowth Brigalow habitat	28.1	1,332.4	2,955.8
11.4.2	Of Concern	Koala – secondary foraging habitat Squatter Pigeon – species may forage in this habitat.	94.84	2,058.6	6,121.3
11.4.9	Endangered	Ornamental Snake - species may forage in this habitat.	0.2	182.7	517.2
11.10.7	Least Concern	Koala – supplementary feeding habitat Greater Glider - species known to occur nearby Squatter Pigeon – species may forage in this habitat.	6.84	362.6	1,840
11.11.15a	Least Concern	Koala – supplementary feeding habitat Greater Glider - species known to occur nearby Squatter Pigeon – species may forage in this habitat.	0.11	513.5	88.4
Non-remnant vegetation			1,093.4	37,232.3	543,487.3

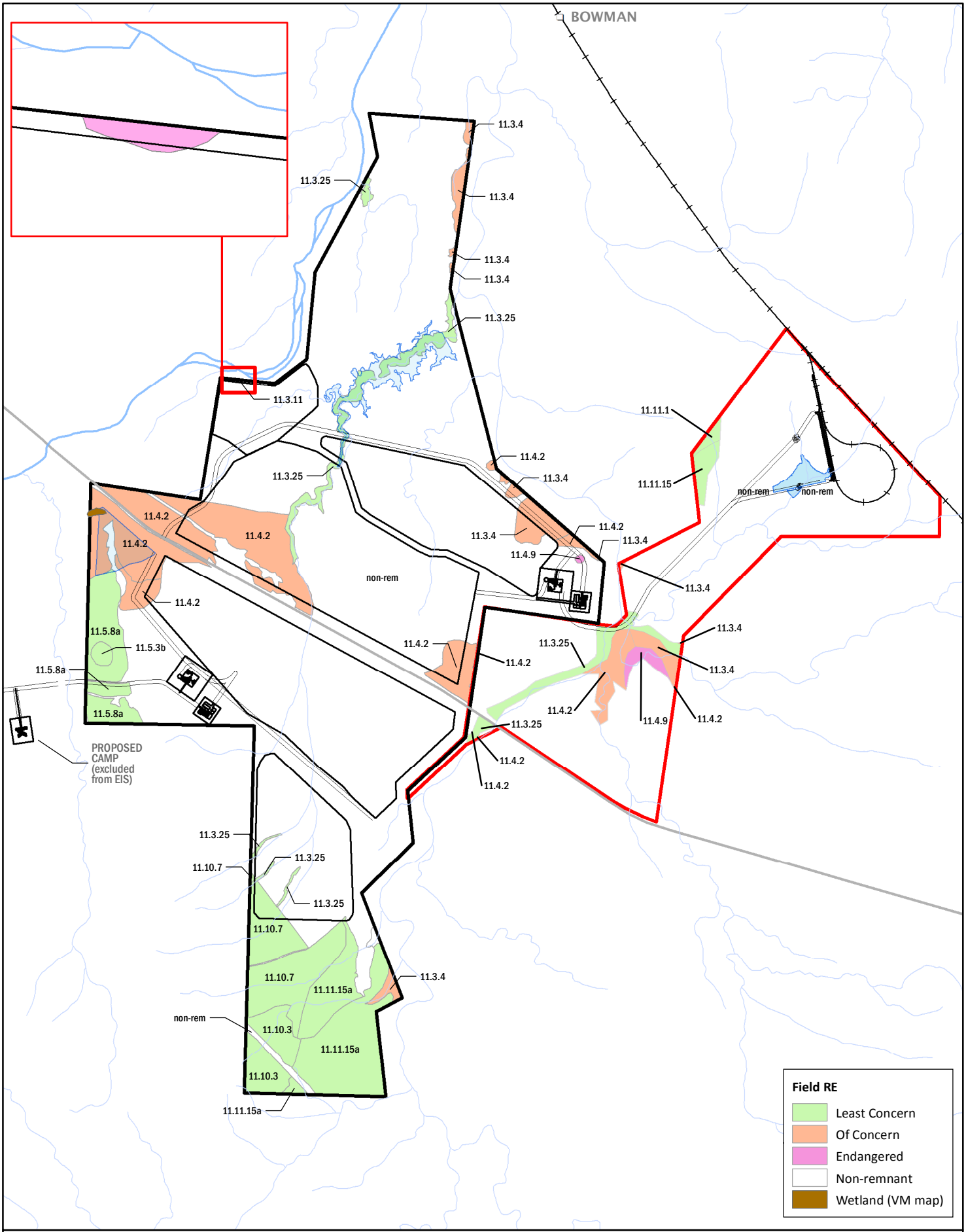


Figure 14-9
Mine infrastructure layout and existing remnant vegetation

14.7.2 Habitat Connectivity

Terrestrial habitat connectivity may be disturbed as a result of the Project by obstructing movement of fauna across the open cut pits, spoil areas and dams. The mine area largely occupies already cleared lands and does not sever any existing connections between tracts of continuous remnant vegetation. Lands to the immediate east of the ML are largely cleared. A relatively continuous tract of vegetation extending in a north-south orientation located to the immediate west of the ML is not impacted by the Project. The mine area presently consists of a mosaic of cleared grazing land and some woodland and is unlikely to be used as a corridor by fauna, except for some large, highly mobile species that utilise open grassland such as kangaroos.

The haul road has the potential to reduce north-south remnant habitat connectivity along Deep Creek connecting patchy eucalypt woodlands in the northeast of the ML to large habitat patches to the south and east. However, it is noted that riparian habitat along both Deep Creek (and a tributary that enters the main creek upstream of the proposed crossing point) is already intersected by the Bruce Highway to the south of the haul road maintaining an existing vegetation gap of approximately 25 m. The remainder of the haul road, TLF and rail loop is located in cleared or sparsely treed non-remnant lands which is unlikely to be used as a corridor for the majority of fauna. Impacts to landscape connectivity because of the Project activities are considered minor at worst.

The layout of the Project and its potential impact on landscape habitat connectivity was assessed using EHP's 'Lanscape Fragmentation and Connectivity' tool. The results of the assessment indicate no significant impact is expected (for output refer Appendix A9g – Results for Landscape Fragmentation and Connectivity).

14.7.3 Direct Fauna Mortality

Direct mortality of native fauna may occur because of the Project during habitat clearing and through vehicle collisions. Mortality during habitat clearing will be managed through the presence of a qualified fauna spotter. It is anticipated that vehicle collisions caused by an increase in local traffic may pose a longer-term risk to native fauna.

14.7.4 Dust

Increased dust resulting from excavations, topsoil stripping, vehicle movement, open cut mining activities, construction of infrastructure and from coal stockpiles has the potential to impact flora and fauna values within the Project area throughout construction and operation. Increased dust can result in respiratory issues in fauna, adverse impacts on plant photosynthesis and productivity (Chaston and Doley 2006), changes in soil properties ultimately impacting plant species assemblages' (Farmer 1993), and mortality and / or decrease in aquatic health on aquatic communities from the toxicity of poor water quality. Evidence of potential impacts on entire vegetation communities is scarce. Many studies focus on specific impacts to single species. Recent research on threatened flora in a semi-arid environment in Western Australia found no significant impact on plant health as a result of a range of dust accumulation loads caused by vehicle movements (Matsuki et al. 2016).

The predominant wind directions from the region are as follows: from the north and northeast during spring; north, northeast and southeast during summer; in autumn, the winds are primarily from the south-east; and southerly and southeast winds are more frequent during the winter season (refer Chapter 4 – Climate for more information). Vegetation in the vicinity of Project activities has potential to be impacted during construction works for infrastructure such as access roads and the raw water dam. This includes Tooloombah Creek and Deep Creek and the adjacent Tooloombah

Creek Conservation Park (considered a Category A ESA under the EP Act). Dust impacts during operation may result from activities such as open cut mining, haul and access road use, coal conveyor activity, and from the spoil dump areas. The Open Cut 4 mine area is located adjacent to Tooloombah Creek. The larger mine areas (Open Cut 1 and 2) and southern spoil dump are between 1.2 km and 1.5 km southeast of Tooloombah Creek. The northern spoil dump is located approximately 200 m east of the creek.

There may be some potential for dust impacts on Deep Creek due to its proximity to the mine infrastructure. Deep Creek is located approximately 250 m from the eastern edge of Open Cut 1 mine area and the southern spoil dump. The south eastern corner of the Open Cut 2 is located 500 m away from Deep Creek and the adjacent spoil dump is located between 300 m and 400 m from the creek. The MIA located on the eastern side of the Bruce Highway is approximately 250 m from Deep Creek. The coal conveyor runs adjacent to Deep Creek including utilising the existing highway bridge. Coal dust spillover from the conveyor may impact the adjacent waterway and riparian vegetation.

The haul road also crosses Deep Creek, although there are no large, permanent pools on Deep Creek at, or near, the proposed haul road crossing point. Dust emitted during coal transport may have a minor potential to impact riparian vegetation associated with Deep Creek where it occurs adjacent to the haul road. Refer to Chapter 12 – Air Quality for further information.

The Styx River and coastal wetland areas wiassociated with Broad Sound are located to the north of the township of Styx which is approximately 10 km north of the Project. The closest modelled sensitive receptor to this location is Ogmore township, which is approximately 5 km closer to the Project. The maximum predicted daily dust deposition generated by the Project activities at this sensitive receptor is 0.02 mg/m^2/day which is much lower than the threshold criteria of 120 mg/m^2/day. Therefore, dust deposition impacts from the Project on the wetlands and waters of Broad Sound are considered negligible at worst.

Significant fauna habitat and threatened remnant vegetation is largely well removed from potential sources of dust. However, vegetation associated with Deep Creek is located directly east of the MIA and is intersected by the haul road. These areas may provide habitat for Koala (see Chapter 12 – Air Quality for further information).

14.7.5 Noise

Understanding of the impacts of noise on fauna is limited. There are no current government policies or guidelines that recommend thresholds or limits in relation to fauna. Noise may adversely affect wildlife by interfering with communication, masking the sound of predators and prey, causing stress or avoidance reactions, and in some cases, may lead to changes in reproductive or nesting behaviour. Excessive noise may lead some species to avoid noisy areas, potentially resulting in the fragmentation of species habitat. Radle (2007) states the consensus that terrestrial fauna will avoid any industrial plant or construction area where noise or vibration presents an annoyance to them. Additionally, many animals react to new noise initially as a potential threat, but quickly 'learn' that the noise is not associated with a threat (Radle 2007).

Noise will be generated by the Project through the use of machinery, plant, vehicles, and blasting. The generation of construction and operational noise will largely be in cleared areas adjacent to intact riparian communities (RE 11.3.25) along Deep Creek and adjacent floodplain vegetation (RE 11.3.4) which may provide habitat for Koala. Potential operational noise sources include the northern waste rock dump and infrastructure including the CHPP / MIA, site access road and the haul road which are adjacent to this habitat.

Squatter Pigeon may also occur in woodland habitat in the south and west of the Project which lie adjacent to the open cut operations, dewatering dam and the southern waste rock dump. Individuals that occur on the site are expected to leave the area of impact. During operation, the species may become habituated to adjacent habitat following completion of construction disturbance.

14.7.6 Lighting

Artificial lighting from infrastructure and machinery may impact fauna within the Project area during construction and operation. Artificial lighting may have a range of impacts across different groups of taxa and between species within these groups. Rodents may avoid brightly lit areas at night. Frogs and nocturnal reptiles may congregate at artificial lights to feed on insects attracted to light (Perry et al. 2008). Similarly, many microbat species may congregate at artificial lighting (Rich and Longcore, 2006), although other species may avoid well-lit areas (Threlfall et al., 2013). Species such as Sugar Glider (*Petaurus breviceps*) have been experimentally shown to reduce foraging time under artificial lighting (Barber-Meyer, 2007), although whether this effect occurs in natural situations is unknown. Known impacts on birds include disruption of migratory patterns and choice of nest sites (Longcore and Rich, 2004).

There are few if any studies to suggest the fauna inhabiting the woodland around the Project area will be impacted to more than a minor extent. As suggested by the evidence above there will be differing responses between species or taxa groups with some responses considered quite benign (e.g. microbats and other taxa attracted to night lighting). Habitat around the Project area is largely cleared or woodland with a limited suite of species present. Significant fauna habitat nearest to the CHPP / MIA 2 area is likely to be Forest Red Gum habitat which may support Koala. This species was also observed onsite in Poplar Box woodland which will remain adjacent to the open cut operations. Non-remnant areas containing regrowth Brigalow and gilgaied habitat surrounding the CHPP / MIA 2, Open Cut 2 and the adjacent waste rock dump may provide habitat for Ornamental Snake. Squatter Pigeon occurs in woodland as well as cleared grassy habitat in the area but it is uncertain what impact lighting will have on this species. Koala may occur, although given the species occurs in suburban habitats Project lighting is not expected to impact this species. With informed lighting design, this habitat will be at a distance where light levels would have attenuated to levels where they are unlikely to be causing a significant impact to fauna.

14.7.7 Fire

Due to the combustibility of coal, mining operations are at risk of fire. The Project is located within a mosaic of cleared grasslands and remnant woodlands which have the potential to be impacted by fire. Threatened communities such as Brigalow and Semi-evergreen Vine Thicket are sensitive to fire impact. However, the open and grazed nature of much of the habitat is considered likely to reduce the potential for catastrophic fires resulting in large scale tree mortality. Nevertheless, the site is located within the vicinity of continuous vegetation to the west (including Tooloombah Creek Conservation Park) and site-specific fire management measures will be developed and implemented to manage these risks.

14.7.8 Pests and Weeds

Pests and particularly weeds may pose a significant threat to flora and fauna within the Project area. Much of the habitat already contains a high proportion of introduced grass species and woody weeds (Lantana and Rubber Vine) because of the long farming history within the Project area. Olive Hymenachne, which has the potential to infest wetland areas, was observed at two wetland sites. Other problem weed species such as Parthenium, also toxic to cattle, is presently limited in extent, having only been recorded on Tooloombah Creek. Any potential unmitigated weed introductions,

or spread of existing weeds and pests as a result of Project activities may therefore pose a significant risk to the productive capacity of the adjacent land-use, to less developed vegetated areas of the site, and surrounding areas which include Tooloombah Creek Conservation Park. The transportation and operation of construction vehicles and equipment has the potential to introduce pests and weeds into the Project area.

Waste has the potential to impact flora and fauna because of attracting pests and vermin through the supply of artificial food sources. This may impact on natural behaviour and natural species assemblages. Waste will be managed to the highest standards, and a range of waste minimisation strategies will be in place to reduce waste streams generated. As such, it is not anticipated that waste generated as part of the Project will have a significant impact on flora and fauna communities within the Project area.

14.7.9 Accidental Release of Pollutants

The release of pollutants into the surrounding environment and waterways has the potential to degrade stream habitat quality near the site, degrade stream water quality and thereby impact vegetation communities and terrestrial fauna utilising these areas. Without mitigation, potential exists for contaminants to enter waterways including: contaminated mine dewatering runoff; contaminated runoff from waste rock stockpiles; aqueous waste streams including oily waste water (from heavy equipment cleaning); contaminated runoff from chemical storage areas; potentially contaminated drainage from fuel oil storage areas; and general washdown water.

During operations, the creeks are not anticipated to be directly impacted by surface water runoff from Project facilities (such as the CHPP / MIA areas) as runoff will be captured in a number of environmental dams for re-use or treatment.

The majority of the Project lies within the catchment of Deep Creek which is located approximately 250 m from the eastern edge of the Open Cut 1 and 500 m from the south eastern corner of Open Cut 2. Other potential sources of pollutants include the CHPP / MIA areas which are located approximately 250 m and 500 m from Deep Creek respectively. The southern spoil dump is located approximately 250 m west of Deep Creek and thereby has potential to release contaminated run-off in the creek (refer Figure 14-9).

A mine dewatering dam that will be used throughout the life of the Project will be located in the Tooloombah Creek catchment (approximately 800 m east of the creek) (Figure 14-9). The dewatering dam will store ground and surface waters pumped from the mine pits. The dam water will be subject to controlled releases into Tooloombah Creek under the strict conditions of the Project EA. Dam water is also proposed to be used for coal processing and for general services at the MIA and CHPP areas and for dust suppression onsite.

14.7.10 Groundwater Drawdown

Initial modelling of the potential drawdown effect of the open cut mine operations has been carried out (refer Chapter 10 – Groundwater). At this stage, there is a 'low confidence' in the groundwater modelling results due to a lack of any long-term (time series) groundwater data that would provide insight into the temporal nature of groundwater and surface water connections. Further works are ongoing, including sampling of existing groundwater bores and installation of ten more Project-associated bores (refer Figure 14-10) to expand the knowledge of local groundwater conditions and assess the potential for future impacts. For the purposes of the EIS we have assessed the impact based on the results of the initial modelling.

The Project area is dominated by shallow alluvial aquifers. A review of groundwater bore information and groundwater dependent ecosystems in the Project area indicates the water table reaches the rooting depth of riparian vegetation along Tooloombah Creek and Deep Creek (RE 11.3.25) and the alluvial community adjacent to Deep Creek (RE 11.3.4) although there is a lack of understanding around the hydrological relationship between these communities and groundwater. Elsewhere it is unlikely that groundwater interacts with terrestrial vegetation.

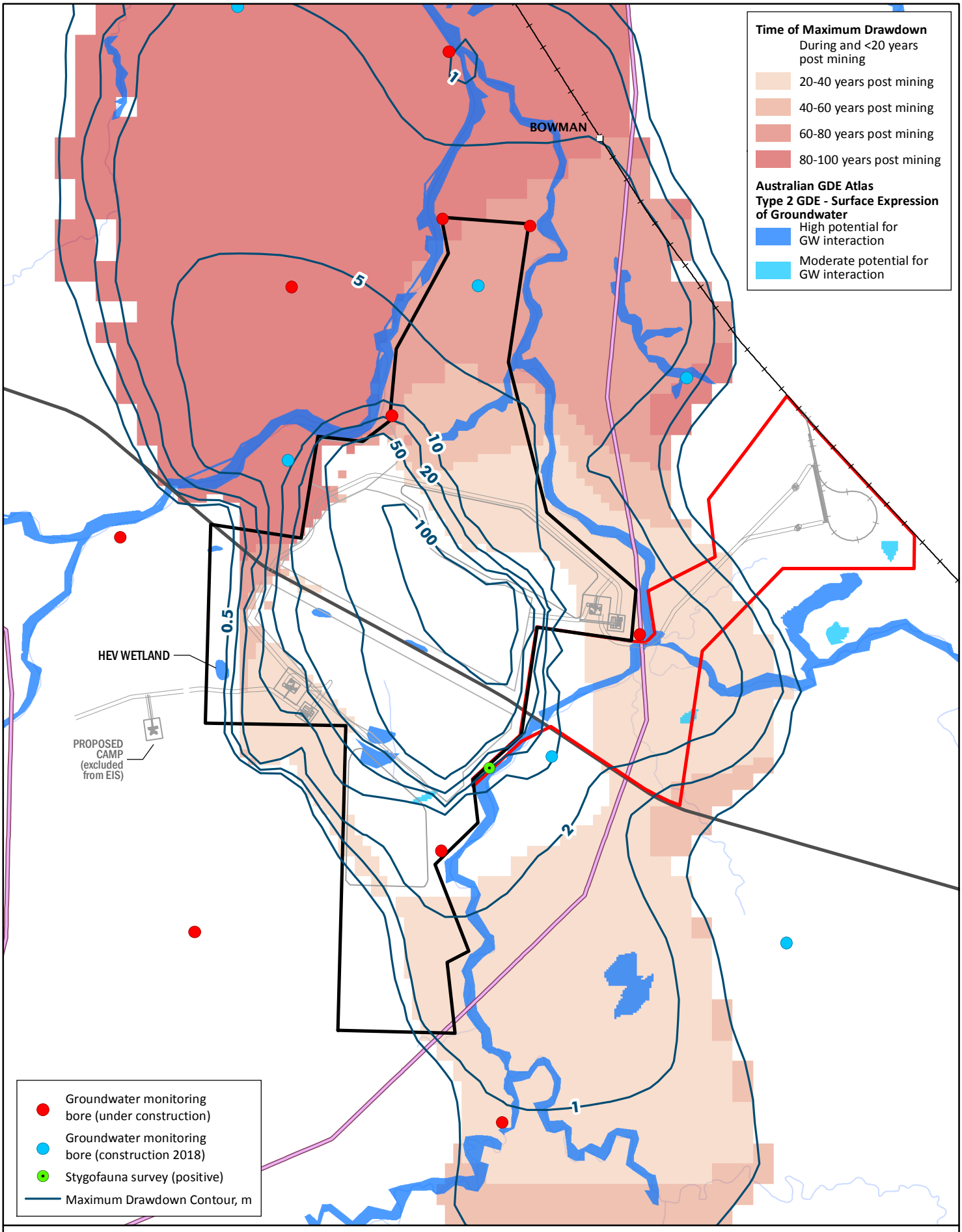
Potential impacts on these communities will depend on the magnitude of the alteration to groundwater connection as well as the positive or negative influences additional drivers have on their condition. The magnitude of dewater ranges up to 100 metres below ground level (mbgl) and may persist for 100 years. The greatest dewatering (5 to 100 metres) occurs within the first 20 years of mine operation, and is centred around the immediate mine area between Toowoomba and Deep Creek (Figure 14-10). The cone of depression is initially steep, reflecting the change in geology from Quaternary sediments to the outcropping Bowen basin units. Further decline in the groundwater levels propagates to the north and south for the following 80 years creating an oval shaped region of impact that is affectively confined to the Quaternary sediments.

This may result in long-term impacts to the riparian Forest Red Gum communities along sections of Tooloombah Creek and Deep Creek located close to open cut mining operations which may suffer adverse impacts in the long-term if groundwater levels decline below the necessary rooting depth required for tree species within these communities. This has potential to reduce the extent of habitat for fauna species in the area including that suitable for Koala, and at its worst, may impact riparian connectivity along these sections of the creeks.

The area of most concern is related to areas of greater than 5 m drawdown. This may result in long-term impacts to the riparian Forest Red Gum communities, and semi-evergreen vine thicket along sections of Tooloombah Creek and Deep Creek located close to open cut mining operations. It is likely these vegetation communities will to some degree suffer adverse impacts in the long-term if groundwater levels decline below the necessary rooting depth required for tree species within these communities. It is uncertain what impact this may have on this community as most species are expected to obtain water requirements from multiple sources.

Semi-evergreen vine thicket occurs in several discrete patches along Tooloombah Creek adjacent to Open Cut 4 (refer Figure 14-9) and may also be subject to the area of substantial groundwater drawdown. It is uncertain what impact this may have on this community as most species are expected to obtain their water needs from rainfall and soil water and are unlikely to be reliant on the water table. Emergent gums, including Forest Red Gum are more likely to suffer impacts.

Based on characterisation of Groundwater Dependent Ecosystems in the area (refer Chapter 10 – Groundwater for detailed information) it is considered likely that permanent waterholes in Tooloombah Creek are connected to the water table. This is less certain for the waterholes in Deep Creek which may only be connected to the water table in very wet conditions and is therefore potentially more resilient to a reduction in the level of groundwater. As a result, groundwater drawdown may also have a localised impact on water levels in permanent waterholes on Tooloombah Creek and Deep Creek potentially reducing fauna access to watering points. Figure 14-10 indicates the large waterhole observed on Tooloombah Creek to the south of the highway is unlikely to be impacted by groundwater drawdown.



N

0 0.5 1 km

Scale @ A4 1:60,000
Date: 15/09/17
Drawn: Gayle B.

Legend

- ML 80187
- ML 700022
- Proposed mine infrastructure
- Styx Basin
- North Coast Rail Line
- Main road
- Watercourse

Figure 14-10
Maximum predicted groundwater drawdown impacts on Groundwater Dependent Ecosystems

DATA SOURCE
QLD Spatial Catalogue (QSpatial), 2017

CDM Smith

14.8 Mitigation and Management Measures

Mitigation measures have been developed to minimise impacts associated with construction and operation of the Project. Mitigation strategies have been developed based on the following criteria:

- Avoid potential impacts where possible;
- Minimise the severity and / or duration of the impact; and
- Offset unavoidable impacts.

The potential impacts to terrestrial EVs, including impacts to MSES, and threatened fauna and flora because of the activities, and suggested mitigation measures associated with the Project are outlined in the following sections.

14.8.1 Vegetation Clearing

Vegetation clearing will be subject to the Project Offsets Delivery Plan (ODP). Under current ground-truthed vegetation mapping the majority of impacted remnant vegetation is listed as Of Concern (RE 11.4.2 and RE 11.3.4). Two very small areas of Endangered vegetation will also be impacted (RE 11.4.9 and RE 11.3.11). A number of Least Concern vegetation communities will also be impacted by tree clearing largely associated with riparian habitat (RE 11.3.25) and woodland communities in the southern portion of the ML which may also provide habitat for threatened fauna.

To ensure the Project does not result in additional unforeseen direct impacts to remnant vegetation, the following mitigation measures will be implemented:

- Prior to construction, Project design may be further altered to avoid unnecessary clearing of remnant vegetation communities and potential habitat for threatened fauna species where possible;
- Vegetation located adjacent to the Project construction works will be appropriately marked to avoid unnecessary clearing / vegetation damage;
- Riparian vegetation and creek banks adjacent to culverts that are damaged during construction will be rehabilitated / stabilised;
- The open cut pit areas will be backfilled and rehabilitated as the mine progresses; and
- Monitoring of vegetation health in remnant vegetation potentially impacted mining activities (such as riparian vegetation along Deep Creek) to identify whether indirect impacts are occurring as a result of dust and mine run-off contamination.

The Project is located on the Mamelon property. Mamelon encompasses a total area of 6,478 ha of which the Project footprint covers approximately 1,070 ha. CQC have proposed destocking the majority of the property and restricting cattle access to already cleared habitat in the south-west and south of the property. This area encompasses approximately 1,000 ha. The remaining area, including the creek lines which lie adjacent to the mine area, will be managed and allowed to regenerate. This measure will in the long-term increase the area of remnant vegetation on the property as well as contributing to improving the water quality entering Broad Sound by reducing nutrient inputs from cattle, reducing soil erosion and increasing vegetation on the site.

14.8.2 Habitat Connectivity

The Project clearing impacts have been assessed as 'not significant' using EHP's Landscape Fragmentation and Connectivity tool (refer Appendix A9g – Results for Landscape Fragmentation and Connectivity for output). At worst only minor impacts to habitat connectivity are expected as a result of the Project. Impacts along the haul road crossing of Deep Creek / Barrow Creek will be mitigated through the construction and installation of fauna fencing and bridge construction design that allows for the passage of terrestrial fauna (such as box culvert design).

Potential impacts to stream connectivity and fish passage are considered in Chapter 15 – Aquatic Ecology.

14.8.3 Direct Fauna Mortality

The Project requires the clearing of vegetation and therefore fauna habitat. As such direct fauna mortality during construction has the potential to occur. In addition, vehicle collisions during construction and operation pose a threat to a number of species, including listed species such as the Koala and Short-beaked Echidna. General fauna management measures will be implemented as part of the Project Land Use Management Plan (LUMP) and will establish protocols for pre-clearing surveys, data collection regarding fauna incidents.

Measures to mitigate impacts include:

- Prior to any vegetation disturbance a trained ecologist or other qualified environmental specialist will be onsite to remove fauna (if required). Hollow-bearing trees will be marked and hollows inspected for the presence of arboreal fauna prior to tree-felling. All fauna recorded during pre-clearing surveys will be recorded on a dedicated fauna register. Construction areas that pose a risk to fauna will be fenced off where practical;
- Where clearing hollow-bearing trees is required and arboreal fauna (such as gliders or microbats) are detected, appropriate nest boxes will be installed adjacent to those areas in order to minimise impacts to species utilising tree hollows. Nest box use will be regularly monitored to ensure effectiveness of next box design and placement;
- The LUMP will include measures for monitoring and recording wildlife road collision incidents throughout construction and operation to help remediate 'high risk' collision areas and set conditions for attending to injured native wildlife;
- Appropriate speed limits will also be in place throughout the site and all contractors will be educated on the risks to local fauna to minimise impacts when driving; and
- To reduce the risk of mortality to native wildlife, no domestic animals will be allowed onsite.

Significant Species Management Plans will be developed and implemented for those threatened species known or likely to occur on the site (under the NC Act and EPBC Act). The plan will identify potential impacts on these species (including identified habitat) as a result of Project activities from throughout the life of the Project (construction, operation and decommissioning). The Plan will detail specific management measures to mitigate the potential impacts and will incorporate adaptive management principles to allow for the adoption of new measures where necessary as the Project progresses.

14.8.4 Dust

Dust is not anticipated to significantly impact aquatic habitat in the area surrounding the Project. However, a vegetation monitoring program will be implemented as part of the Project's Air Quality Management Plan and will include measures to monitor the health of vegetation communities considered to be at risk from dust deposition issues such as riparian vegetation along Deep Creek and Tooloombah Creek. These areas may be potentially subjected to dust accumulation impacts. Results of the vegetation monitoring will be used to inform adaptive management of mitigation measures where impacts are found to be occurring.

The following measures have been developed to ensure dust levels resulting from the Project are kept to a minimum:

- The coal conveyor will be covered (although not fully enclosed) and will incorporate 'spill protectors' along the sides for the entire length of operation in order to minimise fugitive coal dust emission;
- All areas which have the potential to give rise to airborne dust such as unsealed roads, tracks, spoil areas and coal stockpiles will be wetted down regularly using water from environmental dams;
- Speed limits will be implemented throughout the site to minimise dust generated;
- Areas stripped of topsoil for Project construction will be rehabilitated as soon as practicable where not required during operations;
- Regular cleaning of machinery and vehicle tyres to prevent wheel entrained dust emissions;
- Design haul roads to have a less erodible surface, particularly where adjacent threatened fauna habitat occurs, such as using materials with a lower silt content and / or applying chemical dust suppressants or paving used for haul roads; and
- Further dust suppression mitigation measures are discussed in Chapter 12 - Air Quality.

14.8.5 Noise

Noise is not expected to have a significant effect on local fauna population. However, the following measures will be implemented to reduce any impacts which may result from construction and operational noise:

- Noise will be mitigated by properly maintaining all equipment used onsite in accordance with manufacturers specifications;
- Enforcing speed limits to ensure that all mining operations are operating at the lowest possible noise level to minimise the impacts of noise and vibration upon wildlife;
- Ensuring mine vehicles and traffic are strictly controlled and do not operate in areas (such as threatened species habitat) outside of the needs of the mine operations; and
- Further details of mitigation measures for noise control within the Project area are provided in Chapter 13 - Noise and Vibration.

14.8.6 Lighting

Project lighting is not considered to be a significant issue for fauna. Lighting required during the construction period is expected to be minor as construction is expected to be carried out largely in daylight hours.

Night lighting will mainly be limited to lights required for safety and security. During operations Project lighting will be minimised (i.e. low luminance) as far as possible, and directed towards the CHPP / MIA areas and open cut areas and thereby away from fauna habitat to reduce any minor localised impacts even further. Further investigations will be carried out during the detailed design phase of the Project into low-light spill lighting options.

Construction and Operation Environmental Management Plans (CEMP and OEMP) will be produced prior to construction commencing. These will detail and illustrate the potential impacts from lighting during both the construction and operation phases of the Project and inform the Project lighting design to minimise these impacts. Further investigations will be carried out during the development of the CEMP / OEMP into low-light intensity spill lighting options.

14.8.7 Fire

Fire management is an essential component to all coal mining operations and as such, the following measures have been developed to reduce the potential impacts of a site fire:

- Fire management measures for the Project will be developed and implemented within the LUMP;
- Specific onsite smoking areas should be designated;
- Onsite burning of any material should not be undertaken;
- Ensure onsite fire-fighting equipment is regularly maintained and adequate staff training is implemented;
- Vegetation surrounding the site will be managed for fuel load with appropriate fire management regimes in place to maintain present ecological values; and
- Weed management to prevent habitat degradation and potential increased fire risk.

In the unlikely event that a fire should escape from the area of Project activities, fire-fighting equipment and appropriately trained personnel will be on stand-by to fight potential wildfires, as will be detailed in the LUMP.

14.8.8 Pests and Weeds

Weed and pest management will be an important and integral part of proposed site management activities, and will be detailed in the Project LUMP. This Plan will include measures and monitoring to be developed and managed in accordance with the requirements of the Biosecurity Act, and will include the following measures:

- Implementation of sediment control mechanisms to minimise the risk of weed seed washing into waterways;

- Implement control strategies outlined in the Department of Agriculture and Fisheries (DAF) weed and pest animal fact sheets and other relevant government biosecurity management strategies;
- Pre-construction weed mapping should be undertaken to accurately determine the extent of weeds and pests;
- Vehicle wash down procedures;
- Minimise the use of off-road vehicle movements;
- Onsite waste disposal strategies (particularly for food wastes) to be employed that will not encourage the presence of pest fauna;
- Strategies for the storage of construction and operation materials / equipment to be employed that will not encourage the presence of resident pest fauna;
- Regular onsite inspections of site infrastructure / equipment for resident pest fauna and establishment of register for pest sightings; and
- Monitoring and weed and pest inspections particularly in response to reported outbreaks or from complaints or adjacent property owners.

Waste storages are not likely to have significant impacts on native flora and fauna within the Study area, as all waste produced as a result of the Project will be stored and disposed of appropriately, as per the relevant legislation.

14.8.9 Accidental Release of Pollutants

The Project design has incorporated the following components as part of the wider Project Water Management Plan. With these design elements, it is considered the potential impacts from the Project to water quality and hence local aquatic EVs in the vicinity of the site and downstream, are appropriately minimised to the greatest possible extent.

A large mine dewatering dam (833 ML) that will be used throughout the life of the Project will be located in the Tooloombah Creek catchment (approximately 800 m east of Tooloombah Creek). The dewatering dam will store ground and surface waters pumped from the mine pits. It will be built to a 1:1,000 Annual Exceedance Probability (AEP) standard flood spillway capacity. The dam water will be subject to controlled releases into Tooloombah Creek under the strict conditions of the Project EA. Dam water is also proposed to be used for coal processing and for general services at the CHPP / MIA areas and for dust suppression onsite.

Several environment dams are proposed to capture rainfall runoff from the CHPP / MIA areas, TLF facility and waste rock dump areas. The primary function of the environmental dams is to capture sediment laden runoff for sediment removal.

Deep Creek, which is located approximately 250 m from the eastern edge of the Open Cut 1 area and 500 m from the south eastern corner of Open Cut 2. Other potential sources of pollutants include the MIA 2 and the CHPP areas which are located approximately 250 m and 500 m from Deep Creek respectively. The southern waste rock dump and the waste rock dump adjacent to Open Cut 2 are located relatively close to Deep Creek and thereby have potential to release contaminated run-off in the creek. Surface water run-off from the TLF facility will be diverted into a large environmental dam for remediation before discharge into Barrack Creek. The waste rock dams and the TLF environmental dam will be built to a 1:100 AEP standard flood level capacity.

A water release strategy has been developed for the Project. Water quality release limits are set for mine affected water across several parameters as conditioned under the Project EA conditions. Release contaminant trigger investigation levels also apply. Ongoing water monitoring will be undertaken at the environmental dams, mine-affected water dams, discharge locations and locations both upstream and downstream of the Project area. Discharge of mine-affected water will be restricted to flow trigger events in the relevant creek catchments and will also be limited by the quality of water to be released.

Surface waters will be managed and monitored according to the Project-specific Receiving Environment Monitoring Plan and Water Management Plan. Surface water contaminants from industrial pollutants have the potential to impact the local catchment and vegetation communities throughout the Project area.

These impacts will be mitigated through:

- Bunding of chemical storage facilities and appropriate storage of chemicals according to AS 1940-2004 'The storage and handling of flammable and combustible liquids";
- Spill containment kits located onsite and near likely impacted ecological values;
- Locate and design roads and other built infrastructure so that minimal run-off to waterways occurs;
- Retention Basins to allow a pre-treatment of water and wastewater prior to discharge into the terrestrial environment. The discharge of wastewater and stormwater will be similar to water quality of receiving waters and in accordance with Project water quality objectives; and
- Discharge (if any) of treated wastewaters to receiving water will occur during wet periods where possible.

The Project LUMP will include monitoring of remnant vegetation considered at risk from contaminated run-off / wastewater releases from Project construction and operation to identify whether impacts are occurring.

Further details relating to surface water management and water infrastructure design are discussed in Chapter 3 – Description of the Project and Chapter 9 – Surface Water. With the proposed design features in place, significant impacts to terrestrial EVs from the release of pollutants are not considered likely to occur.

14.8.10 Rehabilitation Plan

Rehabilitation will be carried out progressively throughout the life of the Project. As outlined in the previous sections, impacts resulting from the Project development are likely to eventuate largely because of vegetation clearing for Project activities. As such, measures to rehabilitate impacted areas will occur progressively. Clearing for open cut mining will occur progressively over the life of the mine and will be predictable with respect to both the extent and location.

A Rehabilitation Framework will be developed and evolve over time to reflect changing regulatory requirements, community values, and lessons learned onsite or at other mines. This will include the following:

- The appropriate stockpiling and placement of removed topsoil in designated rehabilitation areas. Topsoil stockpiles will be seeded to minimise the risk of soil erosion;

- Open cut mining will occur in a staged manner during the Project. Pit areas will be backfilled and, in consultation with the adjacent landowners, be revegetated as mining progresses. Revegetation will comprise those communities / flora species existing on the site prior to mining disturbance; and

- In the event that vegetation is impacted by other mining activities (such as groundwater drawdown or dust settlement), a revegetation program will be initiated using species representative of the RE impacted. Revegetated land will be surveyed periodically to quantify success of rehabilitation works.

The proposed approach to rehabilitation onsite is discussed in detail in Chapter 11 – Rehabilitation and Decommissioning.

14.8.11 Groundwater Drawdown

Although there is uncertainty in the modelling of groundwater drawdown outputs, it remains likely that access to groundwater for Groundwater Dependent Ecosystems (GDEs) will be compromised due to drawdown. This is most of concern within the riverine and riparian environments of Tooloombah and Deep Creeks. Central Queensland Coal is currently installing ten more Project-associated bores to expand the knowledge of local groundwater conditions and monitor the potential for future impacts (refer Figure 14-10). Additional Project bores are planned for installation in 2018. The location / configuration of monitoring bores together with the landholder bores, has been designed to provide sufficient coverage for the Project and surrounding area to detect and monitor groundwater effects from the Project. Based on the information collected during the first few years of mining, a need for expansion or rationalisation of the monitoring network may be identified.

The data collected from the bores (refer Chapter 15 – Aquatic Ecology) will be used to refine the groundwater model for the area and thereby allow for a more accurate depiction of the local groundwater conditions and potential effects of groundwater drawdown due to Project activities. This is of most concern within the riverine environments of Tooloombah and Deep Creeks where impacts on permanent waterholes and riparian vegetation have been predicted.

The current model of groundwater drawdown is based on limited groundwater data and its results are therefore of 'low confidence.' Of note is the lack of time series groundwater level monitoring data and aquifer testing data for the different hydrostratigraphic units that are critical in the development of aquifer properties during the calibration of the groundwater model and to the understanding of groundwater and surface water interactions. While groundwater monitoring of landholder bores has been ongoing, these bores are not located in optimum positions, therefore a further ten Project-related bores are being installed to further inform the modelling that will be done to inform the SEIS and to form part of the ongoing groundwater monitoring regime to be described in the Projects WMP. These bores are strategically located to improve the spatial distribution of groundwater monitoring, with eight of these adjacent water ways.

In the long term monitoring of these bores will allow for a better understanding of local groundwater conditions and observations regarding actual drawdown caused by mining activity. Data collected from the WMP in the first years of mining will be used to verify the groundwater drawdown model predictions and, if necessary, provide a basis for recalibration of the groundwater model. As mining progresses, a need for further model updates will be assessed every twelve months based on quarterly reviews of groundwater monitoring data and findings of impact verification. It is expected the confidence level of model predictions will increase over time as the model is updated to reflect the observed effects on groundwater from the monitoring program.

In the first instance however, data from the bores will provide a critical dataset to assess key assumptions regarding groundwater connection with surface water systems. The assessment of the presence of GDEs is largely based upon existing desktop evaluations of the landscape setting, ecosystem type and hydrology (near permanent pools) and currently suggests there is a groundwater contribution. At this stage, this assumption has not been validated with field based groundwater data.

Groundwater level data from the bores will be used to evaluate the:

1) Hydraulic gradient between the shallow groundwater adjacent to the creeks and the surface water level within the creeks. The impact that dewatering may have on the groundwater supply to the GDEs, depends largely on the understanding the nature of groundwater and surface water connection. This process will involve installing gauges within the pools of Tooloombah and Deep Creeks.

For the permanent pools to be connected to the groundwater a positive gradient from the groundwater to the creek is required. If a negative gradient exists (the elevation of the groundwater is lower than the elevation of the water within the creek) then groundwater inflow is less likely (and this needs to be evaluated both intra- and inter-annually. If a positive gradient exists then groundwater inflow is likely. There are several possible groundwater and surface water connection relationship, they are:

- The creeks are disconnected from groundwaters in the area of investigation – where groundwater levels remain lower than the creeks, such that there is no connection between the groundwater and the creek bed and an unsaturated zone exists

- The creeks are connected to the groundwater but receive no groundwater inflow - where groundwater levels are equal to or lower than the creek, such that the movement of water is from the creek into the groundwater and

- The creeks are connected to the groundwater and groundwater inflow occurs – in this case the creeks may be a) permanently connected such that there always exists a positive hydraulic gradient to the water level in the creek and permanent inflow of groundwater, or b) the gradient may alternate (+ to -) such that the nature of groundwater connection has a temporal element, switching from gaining to losing depending on climate conditions.

2) The rate of groundwater inflow into the creeks. It is important to note, that determining the nature of groundwater connection (point 1) does not provide actual groundwater inflow volumes, additional information pertaining to aquifer hydraulic properties is required. The rate and volume of groundwater inflow into the creeks is the combination of the existing hydraulic gradient, effective porosity and the hydraulic conductivity of the surrounding aquifer. Testing of aquifer properties of the newly installed bores will enable groundwater inflow calculations to be made.

3) Additional water chemistry sampling and analyses from the groundwater and surface water can assist in identifying the timing of groundwater inflows and the volume of groundwater inflow. It is likely the chemistry of the groundwater and surface water is different. End member analyses, and isotopic signatures (stable and non-stable) can be used to identify groundwater inflow as it mixes with surface waters.

The practice of supplementary surface water flows to maintain riparian vegetation health is widely used as a management tool in providing environmental flow requirements to waterways and wetlands across Australia. In most cases, environmental flow programs are established where the

'natural flow' of a system has been altered by water diversion, reservoir or dam constructions. The implementation of a supplementary water program for the Project will need to consider the nature of connection between groundwater and the creeks and terrestrial GDEs. This relationship will become more apparent after information has been gathered from the newly installed groundwater bores. Supplementary surface water flows should aim to simulate the natural pattern of environmental flows or offset drawdown of the water table by providing additional recharge to the root zone of riparian vegetation to replenish the shallow groundwater stores at times when groundwater is intermittently accessed by the vegetation. This process would require an evaluation of the frequency and size of flows that would generate sufficient inflow to maintain the depth of the pools within the creek that persisted during low flow periods and infiltration and recharge to the water table, as to maintain appropriate groundwater levels necessary to maintain the riparian condition.

Further understanding of the hydrological function of the identified GDEs in the area is required to develop mitigation measures including the following:

- Environmental water requirements of the GDEs such as minimum water depth and pool size to maintain a healthy aquatic environment, and the likely water demand to riparian vegetation provided by surface flows compared with deeper groundwater;
- Knowledge of the conductance properties of stream bed material will help determine the rate at which pools receive groundwater (during the wet phase) and the rate at which the pools lose water due to leakage to the groundwater (during dry phases) as this depends on the hydraulic properties of the stream beds; and
- The water budget of the pools. Understanding the relationships between the frequency of surface flow events and persistence of in-stream pools is important, as it may indicate that pools can be maintained (irrespective of groundwater inflows) through managed environmental flows. It will also be important to understand if the presence of shallow groundwater provides a volume of water required and / or provides a buffer to stream leakage.

The success of providing supplementary flows can be measured by monitoring the condition of the target 'end point' of the system, in this case the riparian vegetation communities. The hypothesis proposed is that a portion of the water requirements of the riparian vegetation is provided by shallow groundwater, predominantly during dry periods when stream flows are absent. Wetland and stream health and vegetation monitoring will be implemented as part of the LUMP and REMP. This will include at a minimum the following measures:

- Ongoing assessment and monitoring to address the knowledge gaps identified above and allow a greater understanding of GDE function in the area including a baseline water source study of the riparian vegetation to determine the nature of groundwater uptake. This would require a combination of soil, water and tree analyses to assess water use patterns, and the seasonal source of water;
- Monitoring of water levels and water chemistry in permanent waterholes on Deep Creek and Tooloombah Creek, particularly those identified as potentially impacted by severe groundwater drawdown near mining operations;
- Monitoring of local groundwater levels and chemistry in areas associated with Deep Creek and Tooloombah Creek; and
- Monitoring of riparian vegetation health along Deep Creek and Tooloombah Creek in those areas identified as potentially impacted by severe groundwater drawdown.

As drawdown depends on a range of factors, its impacts will need to be managed adaptively. Adaptive management will involve monitoring groundwater impacts and, based on the severity of impacts, implementing appropriate mitigation measures to minimise impacts on existing groundwater environmental values as mining takes place.

With an understanding of the hydrological function of the waterholes in the area and environmental water requirements of the instream ecosystems, as well as ongoing surface and groundwater monitoring, trigger levels will be established for the depth of waterholes that are required to maintain a healthy instream environment. These levels will incorporate the combination of stream flow inundation and groundwater inputs. It is likely that theses triggers will represent the low flow period of the creeks, when groundwater inputs represent a larger % of the waterholes water budget. Where water levels decline below the trigger it is assumed that this is occurring because of groundwater extraction and dewatering. At this point a Project supplementary water program will be initiated to maintain waterhole depth at a level that will sustain ecological function. Supplementary water is likely to be derived from treated mine water and will be within the water quality objectives set for the lowland waters of the Styx River.

As a last resort, where vegetation communities are found to be unavoidably impacted by groundwater drawdown these areas will be subject to the Project Biodiversity ODP.

14.9 Cumulative Impacts

The nature of the Styx River catchment is rural with approximately 78% of lands occupied by agriculture dominated by cattle grazing. A review of the latest publicly available information regarding proposed developments in Queensland found no large-scale industrial or mining developments proposed for the catchment other than the Central Queensland Coal Project and there are no such Projects within a minimum of 100 km radius of the Project area.

The nearest mining operation to the Project is the Kunwarara magnesite mine located 60 km to the south-east. The mine began operation in 1991 and is currently owned by Sibelco. Magnesite resides close to the surface layers and is mined using open cut pits generally between 15 m to 18 m deep. The mine is mainly divided into three sections - KG1, KG2 and KG3 pit areas. The KG1 pits are located in predominantly cleared lands. The KG2 and KG3 pit areas are located adjacent to patches of Endangered vegetation. There is no information available regarding any current or proposed expansion plans for the project and the Project is not considered further.

The only major development known from the surrounding area is the proposed expansion of the Shoalwater Bay Training Area by the Department of Defence. This area lies largely within the adjacent Shoalwater catchment which also drains into Broad Sound to the northeast of the Project area. The original proposal identified a 'likely expansion area' stretching west from the existing training area to the approximate east bank of the Styx River located to the north of the Project. Based on opposition from local communities it has been recently assessed that a reduced expansion area is 'achievable' (Department of Defence, 2017). As such, the extent of the proposed expansion and the potential changes to land use are unknown at this stage.

The next closest proposed development is the Capricorn Integrated Resort proposed by Iwasaki Sangyo and located 110 km due east of the Project at Corio Bay. Although a final Terms of Reference was issued for the Project in May 2014 no further documentation regarding this Project is available. The Project draft EIS is said to be still in preparation.

Given there are no other large projects currently known to have identified lands within the Styx River catchment, the Project impacts to terrestrial ecology will only add to those impacts that are a result of current land use in the catchment. These background land use impacts have already been characterised within this chapter. There are no other projects in the catchment or surrounds which the potential Project impacts to terrestrial ecology subject to this assessment could conceivably add to.

14.10 Qualitative Risk Assessment

Potential impacts resulting from the current Project on ecological values have been assessed utilising the risk assessment framework outlined in Chapter 1 – Introduction.

For the purposes of this risk assessment, risk levels are defined as follows:

- Extreme – Works must not proceed until suitable mitigation measures have been adopted to minimise the risk;
- High – Works should not proceed until suitable mitigation measures have been adopted to minimise the risk;
- Medium – Acceptable with formal review. Documented action plan to manage risk is required; and
- Low - Acceptable with review.

A qualitative risk assessment that outlines the potential impacts, the initial risk, control measures and the residual risk following the implementation of the control measures detailed in the previous sections is shown in Table 14-14 .

Table 14-14 Qualitative risk assessment

Hazard	Potential Impacts	Potential Risk	Control Measures	Residual Risk
Vegetation clearing	▪ Removal of Endangered and Of Concern vegetation communities and other MSES vegetation ▪ Removal of habitat for threatened species (also MSES)	Extreme	▪ Prior to construction, Project design may be further altered to avoid clearing areas of threatened vegetation communities and habitat for threatened species where possible; ▪ Avoid unnecessary clearing; ▪ Vegetation clearing on the site will be subject to an environmental ODP; and ▪ Vegetation adjacent to construction works will be appropriately marked to avoid unnecessary clearing / vegetation damage.	Extreme
	▪ Bank instability and associated follow-on impacts such as further degradation as a result of clearing / construction in riparian habitat ▪ Potential offsite vegetation impacts of dust settlement from clearing activity	High	▪ Rehabilitate riparian habitat adjacent to creek disturbance such as for the haul road; ▪ Vegetation adjacent to construction works will be appropriately marked to avoid unnecessary clearing / vegetation damage; ▪ The open cut areas will be backfilled and rehabilitated as the mine progresses; and ▪ Modification to dust suppression systems to minimise any unforeseen impacts of dust on adjacent vegetation communities.	Low
Habitat connectivity	▪ Road crossing causing loss of connectivity along Deep Creek and Barrow Creek	Medium	▪ Appropriately designed culverts that allows passage of terrestrial fauna species under bridge; and ▪ Fauna fencing to reduce vehicle collisions.	Medium
Direct fauna mortality	▪ Mortality of terrestrial fauna during vegetation clearing activities ▪ Mortality of terrestrial fauna due to vehicle collisions	High	▪ Fauna management measures incorporated within Project LUMP; ▪ Preclearance surveys carried out by qualified fauna spotter to remove resident fauna; ▪ Nest boxes installed in adjacent areas where construction requires the clearing of hollow-bearing trees; ▪ Site speed limits set and contractor education on risks to local fauna; ▪ Fauna register implemented to record fauna encountered during clearing activities and vehicle collisions; ▪ Fauna infrastructure installed along haul road to reduce vehicle collisions at Deep / Barrack Creek crossing; and ▪ No domestic animals allowed onsite.	Medium

Hazard	Potential Impacts	Potential Risk	Control Measures	Residual Risk
Dust	▪ Impacts of coal dust settlement to onsite and offsite vegetation	Medium	▪ Incorporate monitoring program to encompass at risk riparian / wetland vegetation within Project LUMP; ▪ Project mine water to be recycled and used for dust suppression across site; ▪ Vehicle speed limits and regular maintenance enforced to reduce dust emissions; ▪ Coal conveyor designed to minimise fugitive dust emissions (covered and spill collectors featured in design); ▪ Areas stripped of topsoil during construction to be rehabilitated as soon as practical; and ▪ Haul road design to incorporate dust suppression techniques.	Low
Noise	▪ Potential impact of Project noise on local fauna populations	Medium	▪ Construction and operational machinery and vehicles maintained in an appropriate manner to reduce unnecessary noise; ▪ Site speed limits set to reduce operational noise levels to lowest possible levels; and ▪ Ensure mine vehicular activity is controlled and restricted to only those areas required for operations.	Low
Lighting	▪ Potential impacts of Project lighting on local fauna populations	Medium	▪ Operational night lighting limited to that required for site safety and security; ▪ Lighting directed towards required areas (e.g. MIA / CHPP areas) and away from vegetation; ▪ Investigation of low-light spill lighting options for Project; and ▪ Project CEMP to detail lighting design to further minimise impacts.	Low
Fire	▪ Potentially increased risk of fire due to Project activities and impact on vegetation and fauna habitat both on and offsite, including MSES and ESAs (such as Tooloombah Creek Conservation Park)	High	▪ Fire management measures developed and implemented within Project LUMP; ▪ Fire-fighting equipment maintained and regular staff training; ▪ Smoking onsite restricted to designated areas and no onsite burning / incineration practises; and ▪ Vegetation adjacent to site will be managed for fuel load risk through fire management regimes and weed management.	Medium
Pests and weeds	▪ Degradation of vegetation communities and fauna habitat both on and offsite, including MSES and ESAs through weed invasion and proliferation ▪ Predation on local fauna due to increase of introduced predators attracted to site	High	▪ Pest and weed management measures incorporated within LUMP; ▪ Carry out pre-construction weed mapping of Project site and implement control strategies as per DAF fact sheets; ▪ Implement weed wash-down procedures and minimise off-road vehicle movements across site; ▪ Implement appropriate strategies to reduce pest occurrence onsite; ▪ Implement regular weed and pest monitoring regime; and ▪ Establish complaints register to report outbreaks on neighbouring lands.	Medium

Hazard	Potential Impacts	Potential Risk	Control Measures	Residual Risk
Accidental release of pollutants	▪ Degradation of vegetation communities and fauna habitat downstream of pollutant release ▪ Direct impact on fauna using polluted waterholes	High	▪ Design and implement Project REMP and Water Management Plan (WMP); ▪ Controlled release of better quality water in accordance with licensed EA conditions; ▪ Maintenance of Design Storage Allowance on the onset of the wet season to minimise the likelihood of uncontrolled discharges; ▪ Pipeline connectivity between storages to allow water transfer to where there is available capacity; ▪ Establish measures to minimise / control Project-associated chemical spills; ▪ Project design will locate infrastructure to minimise stormwater run-off; and ▪ All waters discharged into adjacent waterways will be treated in retention basins and similar in quality to receiving waters.	Medium
Changes to groundwater table	▪ Drawdown of groundwater impacting long-term habitat persistence in creeks (large waterholes) ▪ Drawdown of groundwater impacting adjacent riparian vegetation communities	High	▪ Design and implement Project REMP and WMP; ▪ Ongoing assessment and monitoring to address knowledge gaps and allow a greater understanding of hydrological function between groundwater and riparian vegetation; ▪ Regular monitoring of water levels and riparian vegetation health at identified areas considered at risk of drawdown impacts; ▪ WMP to include measures to replenish large waterholes in the event of identified impacts; and ▪ Implementation of the Project Biodiversity ODP.	High

14.11 MSES Impact Assessment

The Matters of State Environmental Significance (MSES) that are applicable to terrestrial ecology EVs are compiled in the following Table.

Table 14-15 MSES as they apply to the Project

Category	Description	Project applicability
Protected areas	Includes all classes of protected area (except nature refuges and coordinated conservation areas).	Tooloombah Creek Conservation Park is located 750 m west of the westernmost boundary of the ML. Bukkula Conservation Park and Marlborough State Forest are located 17 km east of the ML boundaries. Mitigation measures will be implemented to prevent potential offsite impacts such as dust settlement. No impacts are expected.
Marine Parks	Includes 'highly protected areas' of State marine park zones. These zones include: Preservation zones Marine National Park zones Scientific research zones Buffer zones Conservation Park zones	The boundary of the Great Barrier Reef Marine Park is located approximately 8 km north of the Project in the lower estuary of the Styx River. The downstream section of the park closest to the Project is identified as a 'general use zone' and therefore not identified as a 'highly protected area.' The Marine National Park zone is located approximately 40 km downstream of the Project by which time the Styx River opens into a broad shallow estuary. The Project is predicted to release treated mine water only during flow events. Other potential impacts resulting from Project activities include increased sedimentation and uncontrolled releases of pollutants. Water quality of released water will be strictly controlled under the Project EA conditions. Mitigation measures to control for such events are described in Chapter 15 – Aquatic Ecology and Chapter 9 – Surface Water. No impacts expected.
Fish habitat areas	Includes areas declared as Fish Habitat Area (FHA) A, or fish habitat area B under the *Fisheries Act 1994.* Also includes protected marine plants.	The Project area is located 8 km south of the boundary of Broad Sound which is listed as declared FHA A. The Project does not require any works within the boundary of the FHA. Not applicable. Marine Couch (*Sporobolus virginicus*) was identified along the edge of the Styx River downstream of the site and is considered a marine plant. There are no marine plants within the Project area.
Waterway Fish Passage	Includes any part of a waterway that provides for passage of fish. Applies to any structure that may create a barrier or otherwise impact fish habitat quality.	The mine haul road will cross Deep Creek and Barrow Creek. Deep Creek is likely to be used for fish passage when flows occur. With appropriate crossing construction including culverts no impacts are anticipated.
Protected wildlife habitat	Includes flora and fauna species listed as Special Least Concern, Vulnerable, or Endangered under the NC Act and includes habitat that supports a listed fauna species (e.g.	There are several terrestrial fauna and flora species listed as Endangered, Vulnerable or Special Least Concern (including bird species listed as Migratory under the EPBC Act) that occur or have potential to occur in the study area. Refer Section 14.12.1.1

Category	Description	Project applicability
	foraging roosting or breeding habitat).	Two threatened aquatic species are known or likely occur in the waters adjacent to the Project area. Refer Chapter 15 – Aquatic Ecology.
Regulated vegetation	Includes: REs classified as 'endangered' or 'of concern', 'High value regrowth' areas containing 'endangered' or 'of concern' REs; and REs classified as 'watercourse'.	Under DNRM mapping there is a single RE classified as Of Concern and a single RE classified as Endangered impacted by the Project, and regulated vegetation intersecting a watercourse that may be impacted by the Project, thereby requiring offsets.
Connectivity	Includes all remnant vegetation.	The landscape Project impacts to the extent of remnant vegetation in the area have been analysed using EHPs 'landscape fragmentation and connectivity' tool. Refer Appendix A9g – Results of Landscape Fragmentation and Connectivity. No impacts expected.
Designated precinct in a strategic environmental area	Includes areas designated under the *Regional Planning Interests Regulation 2014*	No strategic environmental area is designated within or near the Project area.
High conservation value wetlands and watercourses	Includes: Wetlands assessed as 'High Ecological Significance' on the map of referable wetlands; or High Ecological Value (HEV) freshwater and estuarine areas declared under the *Environmental Protection (water) Policy 2009* [EPP (water)].	There is a single HEV wetland considered as a 'Wetland Protection Area' on the map of referable wetlands located in the western portion of the ML. An access road associated with Project works will intersect the 500 m buffer area applied to this wetland. Refer Chapter 15 – Aquatic Ecology. The estuarine section of the middle estuary of the Styx River (located approximately 8 km north of the Project area) is mapped as HEV under the EPP (water). Refer Chapter 15 – Aquatic Ecology.
Legally secured offset areas	Includes offset areas legally secured under a registered covenant, easement, conservation agreement or development approval condition.	There are no secured offset areas on or near the Project area. Not applicable.

14.11.1 Regulated Vegetation

Project impacts to MSES that will require offsetting under the Environmental Offsets Act 2014 are proposed to be based on the ground-truthed vegetation mapping described in this chapter. Under ground-truthed mapping, the Project will require the clearing of remnant vegetation considered to be MSES under Criteria 4.1 i.e. listed as Of Concern or Endangered under the VM Act. Clearing within the mine area and transport corridor will require the removal of 102.76 ha of Of Concern vegetation and 0.61 ha of Endangered vegetation.

The Project will also impact watercourse vegetation (Criteria 4.3) i.e. vegetation along a watercourse mapped as Least Concern. A total of 4.2 km of lands mapped as 'watercourse vegetation' will be impacted by clearing within the mine area and for the haul road.

There is potential in the long-term for watercourse vegetation and remnant vegetation listed as Endangered under the VM Act to be adversely impacted by groundwater drawdown in the vicinity of open cut mining operations. These areas will be subject to vegetation health monitoring as part of the Project LUMP. In the event that impacts have been found to occur these areas will also be subject to environmental offsets.

14.11.2 Habitat for Threatened Fauna

Sections 14.6.2 and 14.6.4 describe the likelihood of occurrence of threatened flora and fauna (listed under the NC Act and / or EPBC Act). Species that are considered unlikely or with potential to occur are not considered further and will not be subject to significant residual impacts from Project activities. There are four terrestrial fauna species listed as Vulnerable under the NC Act (and EPBC Act) which are considered as likely or known to occur in the Project area or immediate surrounds:

- Ornamental Snake;
- Squatter Pigeon;
- Koala; and
- Greater Glider.

Short-beaked Echidna and several migratory bird species are listed as Special Least Concern and considered as likely or known to occur in the Project area. Habitat for migratory species is not considered as a MSES and are not discussed further. These species are considered in more detail in Chapter 16 – MNES.

The most significant impacts for each species and applicable mitigation measures as already detailed in Section 14.10 and Table 14-14 are outlined below.

Ornamental Snake

Suitable habitat for this species (regrowth Brigalow on gilgais and cleared gilgai habitat) occurs to the north of the Bruce Highway. The Project will require clearing of 25 ha of a narrow strip of riparian vegetation within this area which may also provide shelter and foraging habitat (RE 11.3.25). The proposed construction of the northern pit and MIA will clear some of this area although it is not known if the species occurs. Indirect impacts to this species (if it occurs) are restricted to changes to water quality resulting from uncontrolled contaminated runoff entering the minor creek line draining this area and adjacent gilgais / wetlands.

The Project EA will require a site WMP to control contaminated rainfall runoff from mine spoil areas and environmental dams associated with mine pit water extraction as outlined under 'Accidental Release of Pollutants' above.

Squatter Pigeon

Identified onsite within proposed mine area, occurring in individuals, pairs or small groups within vegetated and cleared areas. Substantial amounts of habitat in which this species has been recorded is already cleared of native vegetation. The Project will require clearing of 101.8 ha of potential woodland habitat (RE 11.4.2, 11.10.7 and 11.11.15a) in which the species may forage. Substantial similar habitat occurs across the wider area and region surrounding the Project. Individuals are expected to naturally move away from clearing and construction activities. Vehicle collisions may represent a long-term threat if individuals remain in the area.

The species remains widespread across northern and central Queensland. The majority of vegetation impacted by Project activities will be included under the Project ODP. Mitigation measures outlined under 'Direct Fauna Mortality' above will alleviate the potential impact of vehicle traffic on this species.

Koala

Recorded close to Open Cut 2 in Poplar Box woodland (considered a secondary feed tree species). Primary foraging habitat (where Forest Red Gum occurs) will be intersected by the haul road and conveyor belt along Deep Creek. The Project will require clearing of 36.42 ha of habitat containing primary feed trees (RE 11.3.4 and 11.3.25) and 94.8 ha of habitat containing secondary feed trees (RE 11.4.2). Long-term groundwater drawdown resulting from open cut mining operations may also have adverse impacts on suitable habitat for Koala along sections of Tooloombah Creek and Deep Creek. These areas will be subject to vegetation health monitoring as part of the Project LUMP.

Vehicle collisions along the haul road may represent an ongoing threat to the Koala although the Bruce Highway bisecting the Project is likely to represent a greater ongoing threat.

The preferred habitat for this species will be included under the Project ODP. Mitigation measures outlined under 'Direct Fauna Mortality' above will alleviate the potential impact of Project-associated vehicle traffic on this species.

Greater Glider

Recorded in the southern portion of ML 80187 in tall Narrow-leaved Ironbark (RE 11.11.15a). A small portion of this area (6.95 ha) will require clearing for the southern waste rock dump. Habitat within the remaining footprint of the Project appears less likely to support this species due to a lack of tree diversity and / or lack of the continuous vegetation that is required to support the species.

Short-beaked Echidna

The Project will require clearing of remnant habitat suitable for this species. However, Echidna occurs widely across the landscape including cleared areas. A fauna spotter will be present and required to remove individuals during clearing activities. Vehicle collisions also represent an ongoing threat to the Short-beaked Echidna during construction and operation. Mitigation measures outlined under 'Direct Fauna Mortality' above will alleviate the potential impacts of mortality during vegetation clearing and vehicle traffic on this species.

MSES and MNES Significant Impact Assessment

Under the Queensland Environmental Offsets Policy: Significant Residual Impact Guideline (SoQ, 2014) the residual impact criteria for assessing the potential impact of a project's activities are essentially the same as that for Vulnerable MNES fauna under the EPBC Act Significant Impact Guidelines 1.1 (DotEE, 2013) (refer Chapter 16 – MNES). The significant impact criteria assessment for each of the threatened species listed above is presented in Table 14-16 and Table 14-17.

Table 14-16 Assessment against MSES and MNES significant impact criteria

Assessment criterion	Ornamental Snake	Squatter Pigeon	Koala	Greater Glider
	Assessment against significance criteria			
Lead to a long-term decrease in the size of a local population of the species	Not recorded in the Project area. Known from west of Project area. Suitable gilgai habitat (already cleared of vegetation) occurs patchily north of Bruce Highway and will be impacted by clearing activities. Potential indirect impacts restricted to surface water quality downstream of mine activities. With mitigations applied to surface water flows, erosion and sediment controls and water quality monitoring unlikely to lead to a decrease of a local population.	Recorded in mine area in woodland and cleared habitat. Extensive habitat surrounds the site. Species is widely dispersed across central Queensland and considered a single population. Expected to leave disturbed area during construction. Unlikely to lead to a decrease of a local population.	Species observed once onsite in woodland habitat. Density of population in area likely to be sparse and therefore widely dispersed. Haul road will bisect suitable habitat and may lead to localised road mortality. Fauna infrastructure will be included in corridor construction to reduce mortality events. Unlikely to lead to a long-term decrease of a local population.	Recorded in woodland south of majority of disturbance area. Remaining habitat within the disturbance footprint appears less favourable. Species is widely dispersed across eastern Queensland and considered a single population. Very minor amount of suitable habitat impacted by waste spoil area in south of Project. Unlikely to lead to a decrease of a local population.
Reduce the area of occurrence of the species	Some suitable habitat to be cleared within the Project area although uncertain if species occurs. Habitat has already been cleared of remnant vegetation. Project unlikely to reduce the area of occurrence of this species during clearing for construction.	Project will reduce the localised area of occurrence of this species during clearing for construction but given the widespread occurrence of the species this is considered a very marginal impact.	Project will reduce the localised area of occurrence of this species during clearing for construction. Potential for further reduction in suitable habitat due to impact of groundwater drawdown on favoured habitat.	Species only recorded south of disturbance footprint. Very minor amount of suitable habitat impacted by waste spoil area in south of Project. Project unlikely to reduce the area of occurrence of this species.
Fragment an existing population	Suitable habitat to be cleared for the Project is patchy and occurs in the surrounding region. Unlikely to fragment an existing population.	Species is widely dispersed across central Queensland and considered a single population. Unlikely to fragment an existing population.	Species is widely dispersed across central and southern Queensland. Haul road crossing bisects suitable habitat connection along Deep Creek, however this habitat is already crossed by the Bruce Highway to the south. Fauna infrastructure will be included in corridor construction. Unlikely to fragment an existing population.	Species is widely dispersed across eastern Queensland. Extensive similar habitat occurs to the south and east of the Project. Unlikely to fragment an existing population.
Result in genetically distinct populations forming as a result of habitat isolation	Project design and location within surrounding landscape is unlikely to result in habitat isolation of any species.			

Assessment criterion	Ornamental Snake	Squatter Pigeon	Koala	Greater Glider
	Assessment against significance criteria			
Result in invasive species that are harmful to a vulnerable species becoming established in the species habitat	The Project Environmental Management Plan (EMP) will incorporate a LUMP to control the introduction and spread of weed and pest species across the Project area. The LUMP will be in place for the life of the Project, and will minimise the potential for weed invasion and may in the long-term improve habitat condition within vegetation communities located adjacent to Project infrastructure. The Project is considered very unlikely to result in invasive species becoming established in the Project area to the detriment of any threatened species' habitat.			
Introduce disease that may cause the population to decline	The Project EMP will incorporate the management of invasive species which will assist in the prevention of pest plant introduction and associated diseases resulting from Project activities. Project equipment sourced from overseas will be quarantined as required under State and Commonwealth legislation. The Project is considered unlikely to introduce disease that may cause a population of threatened species to decline.			
Interfere with the recovery of the species	The extent of the Project area is relatively small and no substantial populations of any of the threatened species have been found on the Project site. With mitigation of potential Project impacts through ecological monitoring, subsidence rehabilitation, surface water management, an offset program and measures incorporated within the Project EMP, any potential impact on a threatened species, should it occur in the Project area, will be minor and is considered unlikely to interfere with the recovery of the species.			
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species	Project may cause disruption to existing feeding and resting sites where habitat clearing occurs should the species occur onsite.	Project may cause disruption to existing feeding sites where habitat clearing occurs, however the species is often seen feeding in cleared areas.	Project may disrupt suitable feeding locations during clearing for construction. Species known to occur in urban areas. Unlikely to cause disruption to ecologically significant locations during operation.	Species only recorded south of footprint. Very minor amount of suitable habitat impacted by waste spoil area in south of Project. Unlikely to cause disruption to ecologically significant locations during operation.
Assessment of potential for significant residual impacts	Project may cause disruption to existing feeding and resting sites where habitat clearing occurs should the species occur onsite.	No significant residual impacts expected.	Significant residual impacts considered likely to occur through habitat loss.	No significant residual impacts expected.

Table 14-17 Assessment against MSES significant impact criteria: Echidna (special least concern)

Assessment criterion	Assessment against significance criteria
Lead to a long-term decrease in the size of a local population of the species	Sign of species presence (scats) observed onsite. Species is dispersed across the entire continent. No subpopulations noted on mainland Australia. Unlikely to lead to a long-term decrease of a local population.
Reduce the area of occurrence of the species	Species is dispersed across the entire continent. Project is not likely to reduce the area of occurrence of the species in more than a very minor extent.
Fragment an existing population	Species is dispersed across the entire continent. Project will not fragment an existing population.
Result in genetically distinct populations forming as a result of habitat isolation	Species is dispersed across the entire continent. Project will not cause habitat isolation for this species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species	Species has potential to be encountered at feeding and resting sites during construction clearing. Mitigation measures during construction include presence of qualified fauna spotter / ecologist. Project unlikely disrupt ecologically significant location.
Assessment of potential for significant residual impacts	No significant residual impacts are considered likely to occur for this species.

From the significant impact assessment guidelines for habitat for MSES fauna and flora the following species are considered to have significant residual impacts as a result of Project activities and as a result will be subject to a biodiversity offsets plan:

- Ornamental Snake; and
- Koala.

14.12 Offsets

14.12.1 Introduction

The Queensland Environmental Offsets Policy 2014 identifies an environmental offset as an action taken to counterbalance unavoidable, negative environmental impacts that result from an activity or a development. The policy provides a decision-support tool to enable government agencies assess proposals and ensure the requirements of the EO Act are met.

The EPBC Act Environmental Offsets Policy (2012) defines offsets as measures that compensate for the residual adverse impacts of an action on the environment. In both cases, an offset may be located within or outside the geographic site of the impact, and may be applicable once the impacts from an action have been avoided or minimised, as an additional management tool.

Avoidance and mitigation measures are the primary strategies for managing the potential significant impacts of a project. Offsets are not intended to reduce the likely impacts of a proposed project, but to compensate for any residual significant impact.

It is essential for projects to address and incorporate offsets issues and policies early in the project planning lifecycle to avoid impacts, reduce any likely impacts through mitigation, and accept that any residual impacts associated with the project must be offset. Environmental offsets:

- Are necessary to protect or repair impacts to a protected matter;
- Relate specifically to the matter being impacted; and
- Seek to ensure that the health, diversity and productivity of the environment are maintained or enhanced.

14.12.2 Legislation

Offsets are a legislative requirement, with each specific project (or action) having potential offsetting requirements dependent on the relevant project impacts. The Commonwealth and State Governments have a number of requirements under various acts, regulations and policies which need to be addressed for most projects.

The proponent will ensure that the Project meets all offset obligations under Queensland and Commonwealth legislation. Generally, projects will be conditioned as part of the approvals process to provide specific offset outcomes. The Queensland Environmental Offsets Policy promotes coordination of any Australian Government and Queensland Government offset requirements.

14.12.2.1 Commonwealth Legislation

The Commonwealth Government released the EPBC Act Environmental Offsets Policy in October 2012. The policy outlines the DotEE approach to environmental offsets under the EPBC Act. It applies to new referrals and variations to approval conditions from 2 October 2012 and applies to any projects currently under assessment for which a proposed decision has not yet been made.

The key aims of the Policy are to:

- Ensure the efficient, effective, timely, transparent, proportionate, scientifically robust and reasonable use of offsets under the EPBC Act;
- Provide proponents, the community and other stakeholders with greater certainty and guidance on how offsets are determined and when they may be considered under the EPBC Act;
- Deliver improved environmental outcomes by consistently applying the policy;
- Outline the appropriate nature and scale of offsets and how they are determined; and
- Provide guidance on acceptable delivery mechanisms for offsets.

Ten overarching principles are defined in the EPBC Act Environmental Offsets Policy to be applied in determining the suitability of offsets.

The first eight principles require that suitable offsets must:

- Deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action;
- Be built around direct offsets but may include other compensatory measures;
- Be in proportion to the level of statutory protection that applies to the protected matter;
- Be of a size and scale proportionate to the residual impacts on the protected matter;
- Effectively account for and manage the risks of the offset failing;
- Be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action);
- Be efficient, effective, timely, transparent, scientifically robust and reasonable; and

- Have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.

The last two principles require that in assessing the suitability of an offset, government decision-making will be:

- Informed by scientifically robust information and incorporate the precautionary principle in the absence of scientific certainty; and
- Conducted in a consistent and transparent manner.

For this Project, offsets required under Commonwealth legislation will be addressed under a separate approvals process.

14.12.2.2 State Legislation

The Queensland EHP, Queensland Environmental Offsets Policy provides a single, streamlined framework for environmental offsets which replaces a number of former policies. The framework was introduced in July 2014 and includes:

- *Environmental Offsets Act 2014* – this is the primary legislation that establishes a head of power for the State to impose offset conditions and rules around how offsets will be required and delivered. It outlines offsets will be required to counterbalance a significant residual impact of a prescribed activity on a prescribed environmental matter. Key definitions are established and it also provides for the making of an Environmental Offsets Policy;
- *Environmental Offsets Regulation 2014* – the regulation defines those prescribed environmental matters that may require an offset and are referred to as "Matters of State Environmental Significance" that may be required to provide an offset. It also sets out the requirements of an Offset Delivery Plan and provisions for advance offsets; and
- Environmental Offsets Policy 2014 – the policy is where the operational detail and guidance can be found as to how offsets will be assessed and need to be delivered. The policy includes information on the relationship between Commonwealth and State offsets, criteria that offsets must meet, offset delivery options and staging of offsets.

14.12.2.3 Queensland Environmental Offsets Policy

The aim of the Queensland Environmental Offsets Policy is to increase the long-term viability and protection of Queensland's biodiversity where residual, post-mitigation impacts on Commonwealth MNES, MSES and MLES cannot be avoided. MNES specific to the Project area include impacts to water resources from mining activities, threatened vegetation communities, fauna and flora. Potential impacts to MNES because of the Project are covered in detail in Chapter 16 – MNES.

MSES include designated conservation areas, endangered and of concern REs, high value regrowth and watercourse vegetation, essential habitat for threatened fauna, wetlands and watercourses of high ecological value, and threatened wildlife under the NC Act.

MLES are designated areas or features (not already considered under MSES) by local government under regional planning instruments. Livingstone Shire Regional Council is currently reviewing public comments on the draft *Livingstone Planning Scheme* recently and as such no MLES have been identified. The Project area remains covered under the *2005 Planning – Reprint 6*.

'Locally significant vegetation' is identified in small patches of Endangered vegetation (under the VM Act) to the north of the Bruce Highway within the Project area. Much of the continuous habitat that intersects the southern portion of the ML is also considered as 'locally significant vegetation.' The scheme identifies Tooloombah Creek Conservation Park as a 'protected area.' The eastern boundary of this area lies less than 1 km west of the Project. These matters are already covered under MSES.

Biodiversity offsets are required where residual impacts to ecological matters of interest remain after all reasonable and practical efforts have been taken to avoid and minimise impacts. Thus, biodiversity offsets are not required where impacts can be effectively mitigated such that no residual impacts remain.

14.12.2.4 Offset Delivery Options

Central Queensland Coal proposes to offset or apply mitigation measures to impacted lands in accordance with the Queensland Environmental Offsets Policy and / or EPBC Environmental Offset Policy including:

- The use of ecological equivalence assessment methodologies to quantify potential offset requirements;
- The identification of potential offset areas that occur on lands adjacent to the Project such as neighbouring properties;
- Consultation with State and Commonwealth agencies to secure offsets;
- Identification of the potential for alternative biodiversity offset strategies such as financial settlement offsets or Direct Benefit Management Plan Offsets as described under Section 2.3.1.2 within the Queensland Environmental Offsets Policy; and
    - Where land-based offsets are acquired prepare a ODP that will include:
        - Rehabilitation and planting requirements;
        - Ongoing monitoring and maintenance;
        - Weed and pest management;
        - Fire management; and
        - Flood management.

Further information on the offset delivery options is presented below.

Land-based Offsets

This is referred to as a type of proponent-driven offset. The offset is to deliver a conservation outcome that achieves an equivalent environmental outcome. It must be of a size and scale proportionate to the significant residual impact on MSES. The size of a land based offset can be determined through use of the Land-based Offsets Multiplier Calculator or using a rapid assessment which caps the offset at a ratio of 1:4.

Land-based offsets are to provide EVs as similar as possible to those being lost and may consist of remnant or non-remnant vegetation. Where remnant vegetation is used, management actions are required to demonstrate additional outcomes and enhance the EVs. For example, Endangered and

Of Concern RE offsets must be of the same broad vegetation group as the impacted RE, of the same or higher status and within the same bioregion. For flora and fauna species the offset must contain, or be capable of containing, a self-sustaining population of that same impacted species.

The offset site is preferably located in a strategic offset investment corridor closest to the impacted site, and risks of a conservation outcome not being achieved are identified and mitigated. The offset must be legally secured for at least the duration of the impact. The policy provides a number of options for legal security, specifically:

- Voluntary declaration under the VM Act;
- Nature refuge or other form of protected area under the NC Act; and
- Statutory covenant for environmental purposes under the *Land Act 1994* or *Land Title Act 1994*.

Financial Settlement

A financial settlement payment can be used to meet an offset requirement for MSES impacted by a development. It must be calculated using the Financial Settlement Offset Calculation Methodology set out in the Queensland Environmental Offsets Policy. A financial settlement must be paid to the offset account administered by EHP prior to project commencement. Financial payments are made up of costs associated with on-ground land management, administration and landholder incentive payment. The impact site needs to be divided into distinct matter areas. Each distinct matter area is then multiplied by four to determine the offset area for payment.

Direct Benefit Management Plan

Proponent-driven offsets can also be delivered through priority actions identified in a Direct Benefit Management Plan (DBMP). DBMPs are pre-approved packaged investments that outline priority actions to address threats to, and provide substantial benefits for, MSES. Examples of DBMP actions are:

- Enhancing, restoring and establishing key habitat across multiple tenures or properties;
- Threat mitigation activities such as weed or feral animal control on a landscape or multiple property scale;
- Research programs that are consistent with published recovery plans, conservation advice statements or government and community established programs; and
- Landscape scale fire management activities.

In electing to provide an offset (or part of) through a DBMP, the proponent will need to include the approved DBMP that relates to the MSES, in an Offset Delivery Plan outlining how the actions will be implemented and demonstration of how proposed actions are additional to existing activities, are cost effective, and will provide a conservation outcome.

14.12.3 Method for Developing Offsets Delivery Plan

Central Queensland Coal will develop an ODP in accordance with the relevant State and Commonwealth policies. The Plan will offset the residual impacts detailed in the previous section. The aim of the Plan will be to provide an overall net environmental gain. Central Queensland Coal considers the most effective and efficient way to achieve this is to provide an ODP which includes all aspects of the Project, rather than a piecemeal approach to offsetting. The Plan will incorporate the provision for acquiring future offsets should they be required due to the impacts of subsidence, or other unforeseen impacts resulting from Project activities.

Central Queensland Coal will continue to collaborate with the relevant agencies (such as DNRM, EHP, and DotEE) regarding offset options to ensure optimal environmental net benefit. The Plan will identify solutions that:

- Will protect against or repair residual impacts to matters of Commonwealth and State environmental significance;
- Relate specifically to the matter (for example, species or their habitat) being impacted; and
- Seek to ensure that the health, diversity and productivity of the environment are maintained or enhanced.

14.12.3.1 Development of an Offsets Delivery Plan

It is proposed that the key steps for development and implementation of an ODP will be as follows:

- Step 1: Identifying and quantifying residual Project impacts;
- Step 2: Identification of applicable offset requirements to address residual Project impacts;
- Step 3: Smart consolidated approach to meeting offset requirements – finalisation of Draft Plan;
- Step 4: Relevant agency input and approval of ODP;
- Step 5: Implementation of ODP; and
- Step 6: Ongoing monitoring of ODP.

Throughout each of these steps, consultation will be undertaken with key stakeholders including State and Commonwealth government departments and interested community groups.

Step 1: Identifying and quantifying residual Project impacts

The desired outcome of the first step is a definition and quantification of residual impacts resulting from the Project. Through the EIS process many of the expected impacts identified have been avoided and / or reduced through appropriate mitigation.

Step 2: Identification of applicable offset requirements to address residual Project impacts

The second step in developing the ODP is proposed to involve the quantification of offset requirements based on relevant offset policies, including the EPBC Act Environmental Offsets Policy and any applicable State offset policies and regulations. In collaboration with the relevant government departments, Central Queensland Coal will determine the offset requirements under the relevant policies which are triggered. Recovery plans specific to impacted species will also be

used for guidance. It is anticipated that a Project Approval administered by the State Government will specify the level of offsetting required to meet requirements under the relevant Acts.

As a part of this step, the identification of available and acceptable offset measures will be assessed, including as a preference direct land-based offsets to ensure that the aim is achieved of compensating for any authorised unavoidable impacts confirmed through pre-clearance surveys.

Central Queensland Coal will consider the use of both direct and indirect offsets in the development of the Offsets Plan. Generally, direct offsets require restoration, rehabilitation or enhancement of 'like-for-like' habitat. Indirect offsets include financial contribution toward applied research, education, habitat enhancement, restoration, rehabilitation, or connectivity. Under the EPBC Act, the aim is for direct offsets to account for 90% of the total offsets, however deviation from this requirement may be considered under certain circumstances.

Any required direct offsets will entail the identification of potentially suitable areas that may be secured for long-term conservation outcomes. It will be essential that the offsets may be secured for management (by covenant or other acceptable mechanism) to ensure environmental gain and meet regulatory requirements.

Step 3: Smart consolidated approach to meeting offset requirements – finalisation of Draft Plan

As a part of this step, it is proposed that Central Queensland Coal develop an ODP that acceptably satisfies all approval requirements, in an ecologically strategic manner. This step will involve discussions with relevant State agencies (EHP, DNRM), DotEE and any other identified key interest groups to ensure the best ODP is formed.

Central Queensland Coal Project will aim to provide a smart, strategic approach to meeting the specified offset requirements, as a package, rather than separate offset proposals addressing each policy. This step will also analyse other policies which may be developed regarding carbon credits and *National Greenhouse and Energy Reporting Act 2007* to see if there are offsets required that could be included in the ODP. This step will incorporate an assessment of how any necessary offsets may be developed and coordinated using best practice in planning and implementation, ensuring the best ecological outcomes. This planning step will be critical to ensure that the best outcome is secured from the ODP.

The development of the ODP will include further ground-truth verification and detailed assessment of the following aspects:

- Appropriate location and type of land and vegetation;
- Assessment of healthy vegetation that could be utilised in offsets (using detailed analysis of mapping, aerial imagery, and fieldwork including BioCondition assessment);
- Land use and land management techniques that may improve on methods contributing to historical degradation;
- Maximising connectivity of ecosystems, where possible;
- Maximising relationships to State and National wildlife corridors, providing regional and national context and value;
- Low risk areas – limited edge effects, fragmentation, ecosystem failure, fire;
- Potential for securing strategic land acquisitions, partnerships, and protections / covenants;
- Opportunities to add to relevant research programmes; and
- Ongoing monitoring and management techniques and schedules.

An important approach during this step is to finalise assessment of the existing environment in the region in and around the proposed offset area (to the extent it falls outside of the Project area and therefore outside of assessment already undertaken) to determine the ecological processes already enhancing natural regeneration (such as natural recruitment and regrowth). Incorporating these processes into the offsets strategy will help ensure a successful, reliable and cost efficient approach to offsets.

Step 4: Relevant agency input and approval of ODP

This proposed step will entail the submission of the Draft ODP in order to seek approval from relevant governmental agencies, ready for implementation. The purpose of this step is to provide opportunity for the relevant authorising agencies to comment on the Draft Strategy (which will be incorporated into the draft as necessary). Because of this step it is also proposed that approval will be secured, thereby ensuring confidence that the approach taken in the finalised Strategy will meet all requirements and may be implemented to secure the necessary environmental outcomes. The ODP will be issued to EHP prior to Project construction and no construction will occur until the plan has been approved.

Step 5: Implementation of ODP

The next proposed step is necessarily the conduct of on-ground implementation of the ODP in all offset areas. This step will mark the commencement of the implementation of the approved ODP.

Implementation will include important measures such as the securing of land necessary for offsets in an acceptable manner (e.g. through purchase or use of covenants on title), as the majority of policies require a covenant or change of land title to ensure perpetuity of the offset area.

Step 6: Ongoing Monitoring of Offset Proposal

The final but ongoing step in the proposed delivery of the ODP will be to conduct ongoing monitoring and reporting of all offset areas for the required period in accordance with the ODP and the statutory processes to gain Project approvals.

Approval conditions usually require ongoing monitoring (and associated reporting) of offset areas until a specific time has passed or targets are achieved. This step continues to assess and monitor the implementation of the ODP. It should audit and monitor offset areas against timely targets set out in the Plan (these should utilise BioCondition methodologies) that will ensure overall offset targets are met (that is vegetation offsets remnant status is achieved within the specified timeframe).

Monitoring will require site visits, or if capabilities and technologies allow, remote sensors and analysis. Reporting must meet requirements of government departments. Monitoring will allow for ongoing identification of further appropriate measures that may be undertaken (if required) to ensure the ultimate environmental goals of the Plan.

14.12.4 Potential Residual Impacts

Section 14.12 within this chapter identifies the Project's potential environmental impacts and the mitigation measures required. The current Project footprint and design have been planned to avoid significant environmental impacts, where possible or practicable, however, unavoidable residual environmental impacts have been identified. This section identifies the identified and potential future residual impacts that may require offsets.

Potential impacts of the proposed mining activity have been assessed during detailed ecological investigations that were designed to assess current biodiversity values. The potential for significant impacts on MNES have been assessed under the Significant Impact Guidelines for Matters of National Environmental Significance 1.1 (DotEE 2013) and are detailed in Chapter 16 – MNES. Ground-truthed and proposed MNES and MSES within the overall Project area include:

- Two Endangered REs (which are equivalent to EPBC Act listed TECs);
- Two Of Concern REs;
- A single wetland as featured on the vegetation management wetland map;
- Linear watercourse features as described on the Vegetation Management Watercourse Map; and
- Threatened species habitat for Koala and Ornamental Snake.

Table 14-18 details the areas of predicted impact of vegetation clearing based on ground-truthed vegetation mapping. Several of these matters overlap and the overall extent of impact encompasses an area of 131.46 ha. As such, biodiversity offsets will be required.

There is further potential in the long-term for impacts to MSES and MNES as a result of groundwater drawdown in the vicinity of open cut mining operations. This may impact sections of Deep Creek and Tooloombah Creek including the following:

- Adverse impacts on riparian vegetation (RE 11.3.25) which is a linear watercourse features as described on the Vegetation Management Watercourse Map and provides primary foraging habitat for Koala;
- Adverse impacts on SEVT vegetation patches identified along Tooloombah Creek; and
- Adverse impacts to water levels in permanent waterholes which provide habitat for Southern Snapping Turtle (*Elseya albagula*) (listed as Endangered – NC Act and Critically Endangered – EPBC Act). This species was recorded in Deep Creek within the maximum predicted groundwater drawdown area in June 2011 (refer Chapter 15 – Aquatic Ecology for more information).

An assessment of the entirety of the riparian vegetation community (RE11.3.25) lying within the current extent of 1 m (and more) of maximum groundwater drawdown predicted (80-100 years post-mining) is also presented in Table 14-18 based on DNRM vegetation mapping. This area is based on the current groundwater model based on insufficient data. This will be refined with further bore data in the future. It is important to stress this area is a 'worst-case' scenario contending rainfall and the instigation of supplementary watering are ineffective in maintaining the health of the present community.

These at risk areas will be subject to vegetation monitoring under the Project LUMP and wetland health monitoring and management under the REMP. Where vegetation communities or waterhole

habitats are found to be unavoidably impacted by groundwater drawdown these areas will be subject to the Project Biodiversity ODP.

Table 14-18 Identified residual and potential impacts to MNES and MSES

Matter of concern	Description	Impact area total (ha)
Identified residual impacts		
Endangered RE	RE11.4.9 also listed as a Brigalow TEC and considered suitable habitat for Ornamental Snake	0.2
	RE11.3.11 also listed as SEVT TEC	0.4
Of Concern RE	RE11.4.2 also considered foraging habitat for Koala	94.84
	RE11.3.4 also considered foraging habitat for Koala	7.92
Habitat for threatened fauna	Ornamental Snake: RE 11.4.9 and 11.3.25. Overlaps with Endangered RE and habitat for Koala.	25.5
	Koala (based on presence of 'primary and secondary foraging habitat') – 11.3.4, 11.3.25, and 11.4.2. Overlaps with Of Concern REs.	130.86
Wetlands	Single wetland under the vegetation management map.	1.0
Watercourse vegetation	Mapped watercourses intersecting remnant vegetation (Least Concern only). Project will impact 4.2 km of 1st or 2nd order streams – distance from defining bank 10 m (i.e. 20 m corridor width). Haul road will also intersect 70 m of 4th order stream – distance from defining bank 25 m (i.e. 50 m corridor width) and 160 m of 5th order stream – distance from defining bank 50 m (i.e. 100 m corridor width). Overlaps with habitat for Koala. Mine area RE11.3.25 Haul road RE11.3.25 Total Watercourse vegetation	 8.4 0.69 9.09
	Overall impact area	**132.46 ha**
Potential residual impacts due to future groundwater drawdown (considered at extreme impact area 80-100 years post-mining at ≥1 m drawdown)		
Habitat for threatened fauna	Koala (based on presence of 'primary foraging habitat') – RE11.3.25. Overlaps with watercourse vegetation.	342.4 ha

14.12.5 Potential Offset Activities

Under the EPBC Offsets Policy it is recognised that direct land-based offsets should comprise a minimum of 90% of the offset requirements for any given impact. At this stage, the residual significant impacts due to vegetation clearing for the Project is 132.46 ha of MSES-associated vegetation. Central Queensland Coal Project will continue to liaise with the relevant State governing body (EHP) and DotEE to discuss the preferred approach and outcomes for offsetting these impacts.

Offsets under the State and Commonwealth Offsets Policies require the quality of vegetation to be at least similar to that impacted. The quality of the vegetation requiring offsetting will be assessed using the 'Guide to determining terrestrial habitat quality' (EHP, 2014). The assessment methods are based on the BioCondition Assessment Manual (developed by the Queensland Herbarium), and align with the EPBC Act Offsets Policy measure of 'habitat quality.' This allows for a consistent framework for environmental offsets between the State and Commonwealth approval process.

The BioCondition assessment will aid in determining offset ratios using EHP's 'Land-based Offsets Multiplier Calculator' (based on the EPBC Offsets Calculator). The BioCondition assessment will be used to assess the condition of the impact areas and potential offset areas. The assessment of habitat quality ensures a proposed offset site is of a suitable quality and extent to achieve a gain that is sufficient to compensate for the loss of ecological values (for MSES) at the Project impact site.

When considering direct offsets, Central Queensland Coal considers it important, if possible, to acquire lands local to the area of impact. As such an initial investigation of leasehold lands (i.e. lands not under current protection such as National Parks, State Forests and Nature Refuges) has been undertaken within a 50 km radius of the Project area in order to determine the quantity and spatial extent of potential offset areas. The area of REs available (under current DNRM mapping) within a 50 km radius and a 100 km radius of the Project area, and analogous to the MSES potentially impacted by the Project are provided in Table 14-19.

Table 14-19 Extent of regional mapped REs (ha) associated with potential residual impacts

RE	50 km radius of Project area	100 km radius of Project area	Marlborough Plains subregion	Nebo-Connors Range subregion
11.3.4	3,561	11,326	9,985	4,230
11.3.11	485	689	74	430
11.3.25	7,749	21,007	928	8,902
11.4.2	6,485	9,702	6,121	1812
11.4.9	694	1,541	517	129

The above assessment does not include those composite vegetation polygons that may also include the REs listed as either a dominant or subdominant mixed community. However, for the purposes of offsetting these communities may still be of value where they can be secured and are located to enhance environmental values such as within or adjacent to recognised regional biodiversity corridors and / or adjacent to already existing protected areas.

14.12.5.1 Potential Offset Options

Mamelon Property

Central Queensland Coal is currently investigating options for offsetting purposes for both the initial predicted residual impacts as well as the potential long-term impacts related to subsidence. Where possible, offsets will be preferentially located within the 50 km radius investigation area. CQC will seek to achieve synergistic habitat and conservation benefits. This will be done by integrating potential offset opportunities with the surrounding landscape and landuse on lands / habitat of an equivalent (or better) condition, or suitable for rehabilitation, and located within Mamelon property which is owned by CQC.

Mamelon encompasses a total area of 6,478 ha of which the Project ML covers 2,275 ha. Significant portions of remnant vegetation remain outside of the Project boundary. The major direct impact to MSES as a result of the Project is to habitat for Koala. The Table below summarises the remnant vegetation remaining on the property and outside the Project footprint as mapped under State vegetation mapping. The mapping indicates that up to 686 ha may be available within Mamelon that can be used for environmental offsets for Koala. There is also 45 ha of SEVT vegetation which may be suitable for offsetting impacts to SEVT along Tooloombah Creek (in the event such impacts occur). In addition, there are an additional 370 ha of remnant vegetation that will not be impacted under the Project footprint. Ground-truthing vegetation surveys indicate this includes 161 ha of vegetation suitable for Koala (RE 11.3.4, 11.3.25, 11.4.2 and 11.5.8a) and therefore suitable for potential use as environmental offsets for the property.

Surveys of the property will be required to confirm the vegetation actually present on the site and its suitability for offsetting purposes relevant to the Project impacts. Surveys will be carried out using the methods described in the Queensland *Guide to determining terrestrial habitat quality* (EHP 2017) and will obtain the required information for input into DotEE's 'Offsets Assessment Guide,' as required under the EPBC Act environmental offsets policy. Site offsets assessment surveys will not take place until the extent of impacted vegetation required under the finalised Project footprint is

determined through the EIS and SEIS process. The final Project Offsets Delivery Plan will detail CQCs approach to managing environmental offsets on the property should this approach be taken.

Table 14-20 Mamelon property - remnant vegetation outside of Project footprint

RE	Area outside of Project (ha)	Suitability for MNES
11.3.4	15.8	Variety of eucalypt species present including Forest Red Gum. Suitable for Koala.
11.3.25	58.9	Canopy dominated by Forest Red Gum. Occurs along creek lines. Suitable for Koala and potentially Ornamental Snake.
11.3.29	115	Variety of eucalypt species present over *Melaleuca* understorey. Suitable for Koala.
11.4.2	168.1	Poplar Box dominated woodland. Suitable for koala.
11.4.9	4.6	Brigalow (TEC). Unsuitable for Koala.
11.5.8a/11.7.2	297.3	Variety of eucalypt species present in 11.5.8a (90% dominance in community polygon) including Forest Red Gum. Suitable for Koala. *Acacia* species dominate 11.7.2 which is unsuitable for Koala.
11.10.7	484.4	Narrow-leaved Ironbark dominated woodland. Marginal foraging habitat for Koala.
11.10.7/11.10.1	618.7	Narrow-leaved Ironbark dominated woodland for 11.10.7 (90% dominance in community polygon). Marginal foraging habitat for Koala. 11.10.1 Dominated by Spotted Gum (*Corymbia citriodora*) with other species. Suitable for Koala.
11.11.1	135	Narrow-leaved Ironbark dominated woodland. Marginal foraging habitat for Koala.
11.11.15a	536	Narrow-leaved Ironbark dominated woodland. Marginal foraging habitat for Koala.
11.11.18	45	Semi-evergreen vine thicket (TEC). Unsuitable for Koala.

As part of the Offsets Strategy, Central Queensland Coal may also investigate a management and monitoring approach for vegetation patches to increase the overall coverage and connectivity of such communities in the immediate vicinity of the Project area. This may be applied on the Mamelon property itself. The northern portion of the property has potential to be allowed to regenerate tree cover over approximately 250 ha connecting Tooloombah Creek and Deep Creek, much of which is likely to have comprised Brigalow communities.

Rehabilitation could also be applied to vegetation on and adjacent to sections of Tooloombah Creek and deep Creek which are relatively thin due to past clearing for cattle grazing. The Mamelon property encompasses a total area of 6,478 ha of which the Project footprint covers approximately 1,070 ha. CQC have proposed destocking the majority of the property and restricting cattle access to already cleared habitat in the south-west and south of the property. This area encompasses approximately 1,000 ha. The remaining area, including the creek lines which lie adjacent to the mine area, will be managed and allowed to regenerate. This measure will in the long-term also contribute to localised water quality improvements, and contribute to improving the water quality entering Broad Sound and the GBRWHA.

At least 5 km of riparian vegetation lies within the Mamelon property boundary and close to the mine area which may be rehabilitated and expanded. Significant portions of non-remnant habitat along drainage lines also occur within Mamelon to the south of the ML. Vegetation rehabilitation of these areas will enhance the available foraging habitat for Koala in the area in the future.

Strategic Offset Investment Corridor

Where offsetting investigations indicate that lands on the Mamelon property are not suitable or insufficient then CQC will utilise lands within potential regional biodiversity corridors such as identified in a Strategic Offset Investment Corridor (SOIC) close to the impacted Project area.

The Southern Brigalow Belt and New England Tableland SOIC (the SOIC) has been developed by EHP to identify some of the best places in the landscape for environmental offsets. The SOIC identifies 'conservation hubs' as potential focus areas for providing environmental offsets. Three hubs exist near the Project area: Styx Hub; Marlborough Hub; and the Torilla Plains Hub (see Figure 14-12). As part of the SOIC, EHP has developed a register of landholders who have indicated an interest in allocating lands towards offset proposals.

The SOIC footprint identifies several potential habitat areas considered to be of 'high value' or 'key linkage' within a 50 km radius to the south, east and north of the Project area (Figure 14-12). These areas lie for the most part within the same subregion as most of the Project area (Marlborough Plains) as well as adjacent subregions (Nebo-Connors Range and Boomer Range). Central Queensland Coal will liaise with EHP (including the register of interested landholders under the strategy) during offsetting investigations.

Other options include locating offsets, where possible, adjacent to existing local protected areas including National Parks, State Forests and Nature Refuges. There is an array of protected areas surrounding the Project area. The potential for locating adjacent offset properties and 'value-adding' to existing conservation reserves will also be investigated. For example, the SOIC identifies several properties to the south of the Project area as 'high value' or 'key linkage' areas that abut Eugene State Forest and Goodedulla National Park (see Figure 14-12).

Central Queensland Coal may also achieve habitat and conservation benefits through other strategies such as:

- Nest hollows. There is the potential that artificial nest hollows could be installed in appropriate vegetation and locations to offset any loss of habitat for birds, bats, gliders, and other species which utilise nest hollows. The planning of nest hollow requirements and best location for installations could be incorporated in this ODP to increase the overall ecological value of the Offset areas;

- In the unlikely event the Project is found to impact GBR values (such as through accidental releases of polluted water) CQC will investigate using the Australian Government Reef Trust to deliver biodiversity-related offsets; and

- Offsetting GHG emissions. To add further value to both the ODP and outcomes, and to the GHG emission requirements under legislation, Central Queensland Coal will evaluate the best way in which habitat offsets and revegetation for carbon sequestration can be integrated.

Central Queensland Coal will investigate other programmes being conducted locally, regionally and nationally to determine if they can provide information (such as ongoing monitoring data), research assistance, to get a higher net benefit for the environment through indirect offsets. For example, Greening Australia is known to carry out programmes in the Fitzroy Basin to benefit Fitzroy River Turtle populations and nesting. This programme may be expanded to support Southern Snapping Turtle populations. Other examples may be associated with the Caring for Country initiative (DotEE) and Environmental Stewardship Program (DotEE).

14.12.6 Conclusion and Offsets Delivery Plan

Offsets will be applied to compensate residual environmental impacts remaining after all practical and practicable management and mitigation actions have been applied. Unavoidable residual ecological impacts have been quantified for the above-ground construction and operation activities associated with the Project as described above.

Central Queensland Coal will seek to achieve synergistic benefits where possible on CQC lands thereby providing net environmental benefits close to the area of impacts. Where required CQC may seek additional outcomes with nearby landholders and / or other environmental programs in the region to achieve enhanced conservation outcomes.

Central Queensland Coal proposes to submit a detailed Draft ODP for State and Commonwealth approval within 30 days prior to any impacts occurring on MNES or Matters of State Environment Significance. The ODP will provide a detailed account of the proposed offset settlement including (but not restricted to) the following:

- Identification of proposed offset lands including a description of current land use;
- Ecological condition (through the Biocondition Assessment process) of potentially impacted areas within the Project area and the proposed offset lands;
- Measures to secure the land as an approved offset area; and
- Proposed management and monitoring measures to ensure the required conservation outcome occurs.

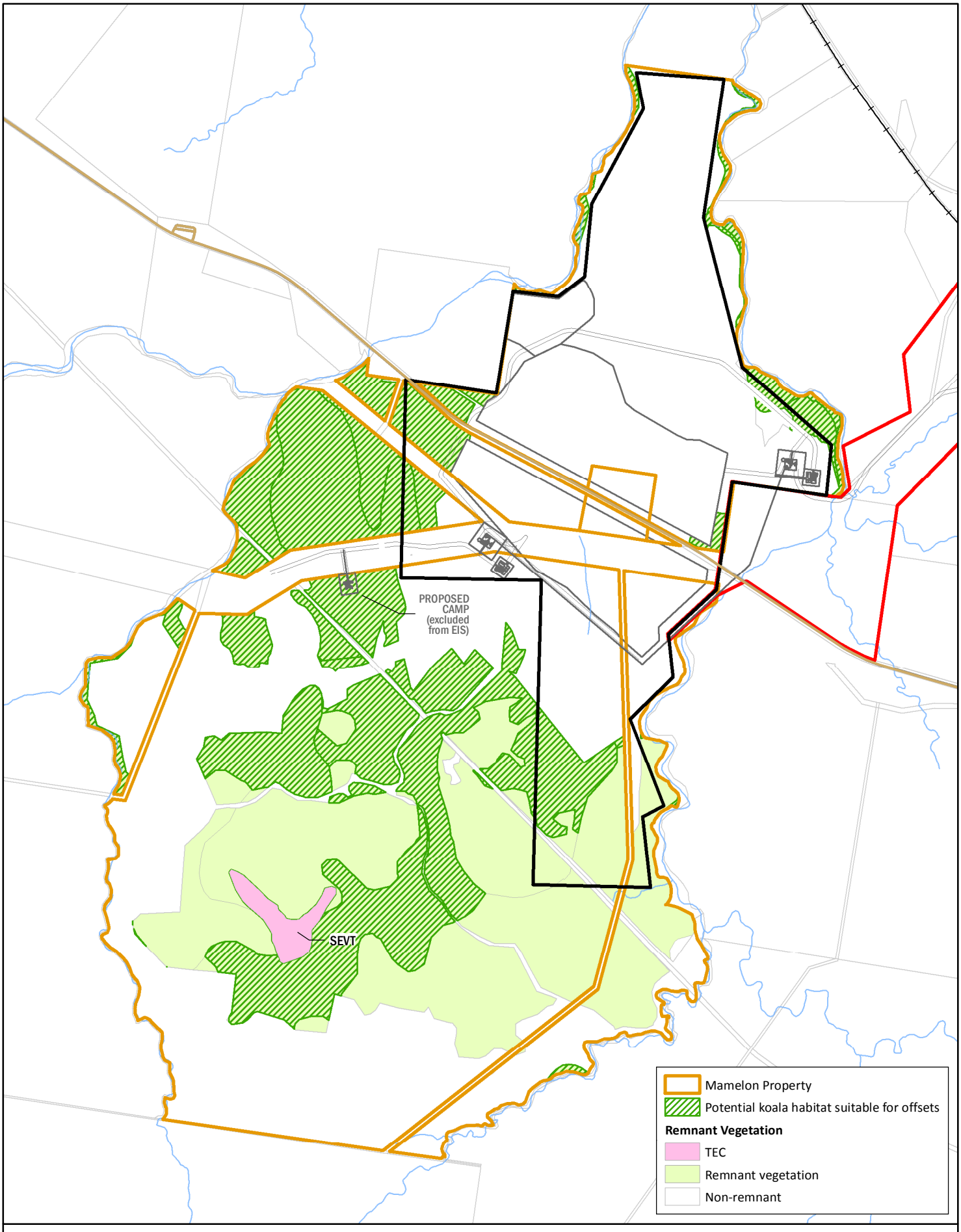


Figure 14-11
Mamelon property – remnant vegetation suitable for MNES habitat offsets

N

0 0.5 1 km

Scale @ A4 1:60,000
Date: 19/09/17
Drawn: Gayle B.

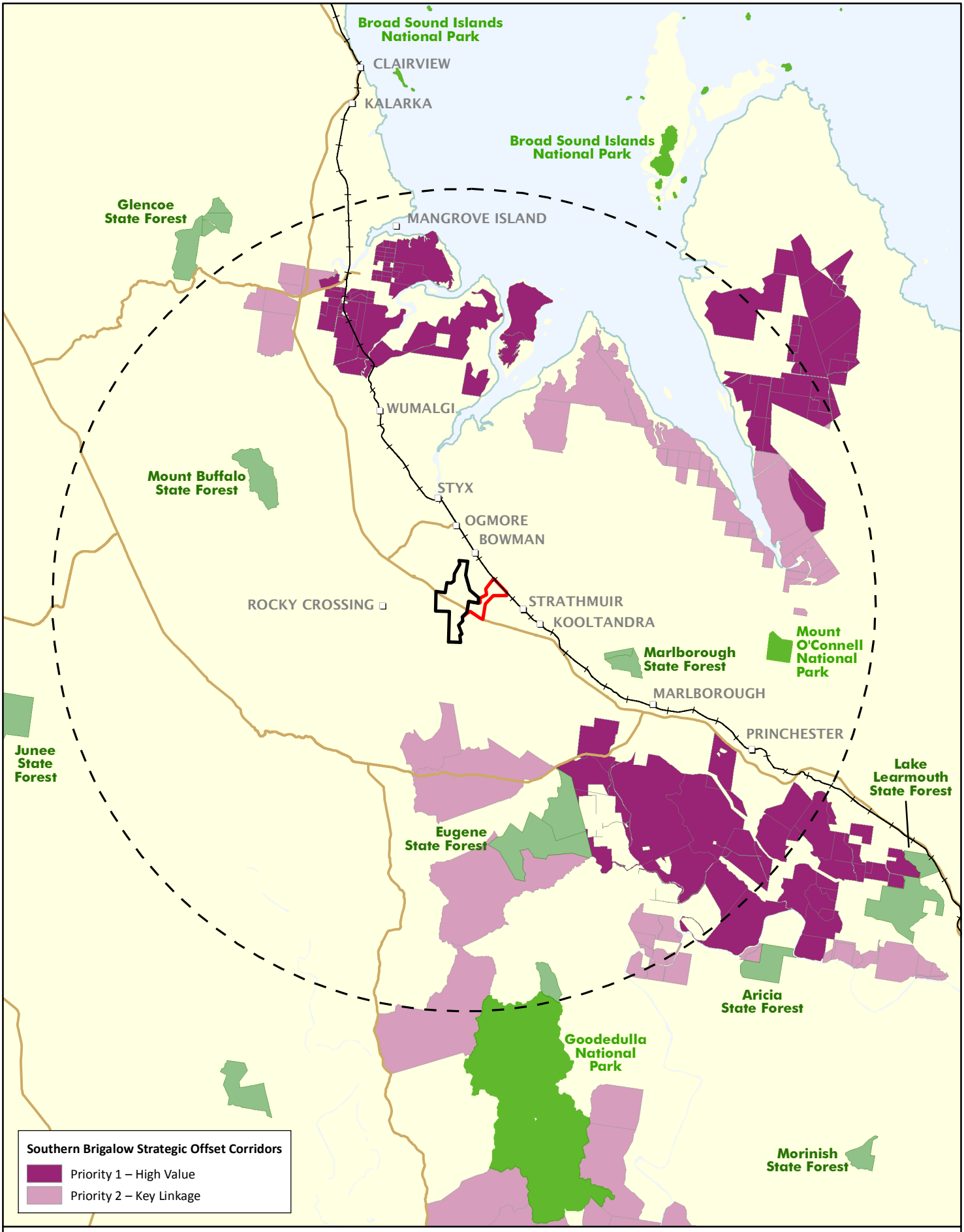
Legend

- ML 80187
- ML 700022
- Proposed mine infrastructure
- North Coast Rail Line
- Main road
- Cadastral boundary
- Watercourse

DATA SOURCE
QLD Spatial Catalogue (QSpatial), 2017

CDM Smith

SINCLAIRA B:\BES150160 Styx Coal\GIS\DATA\MXD\FINAL\.03 EIS Preparation\BES150160.03-098 R1 Mamelon - veg mnes habitat.mxd 9/19/2017



N

0 5 10 km

Scale @ A4 1:600,000
Date: 04/07/17
Drawn: Gayle B.

Legend

- National Park
- State Forest
- Project area 50 km buffer
- ML 80187
- ML 700022
- North Coast Rail Line
- Main road

Figure 14-12
Southern Brigalow Belt and New England Tableland SOIC – Project Area

DATA SOURCE
QLD Spatial Catalogue (QSpatial), 2017

CDM Smith

14.13 Conclusion

The Project is located largely within the Marlborough Plains subregion of the Brigalow Belt South bioregion. A small portion in the south of the mine area lies within the adjacent Nebo-Connors Range subregion. The region has experienced a long history of human disturbance due to agriculture and mining activities. The Project area is representative of the wider region and landscape with over 78% of the Project area cleared and currently mapped as non-remnant. Remnant vegetation within the Project area is largely confined to the south and western portions of the mine area. The TLF and haul road lie entirely in cleared lands excepting a linear riparian strip of vegetation associated with Deep Creek. The ground layer in cleared areas and in remnant open woodland was often observed to be dominated by the exotic Buffel Grass, particularly that portion of the mine ML located north of the Bruce Highway.

Vegetation was composed of 10 RE types situated on five landforms: alluvial river and creek flats; Cainozoic clay plains; Cainozoic sand plains / remnant surfaces; coarse-grained sedimentary rocks; moderately to strongly deformed and metamorphosed sediments and interbedded volcanics; reflecting the underlying geology and position in the landscape. Field verification of REs within the Project area identified a number of inconsistencies in current RE mapping, relating to RE composition and polygon size. Remnant vegetation listed as Endangered under the VM Act, and as a TEC under the EPBC Act, was observed during field assessments as two very small polygons located in the east of the mine area and adjacent to the western boundary of the ML. The polygons were composed of Brigalow and semi-evergreen vine thicket communities. The majority of remnant vegetation within the ML comprises communities listed as Of Concern and Least Concern under the VM Act.

No listed flora species were observed during the field assessments and no species identified as occurring in the wider area during desktop searches was identified as having a high likelihood of occurring within the Project area.

Listed fauna species observed in the Project area include Koala, Greater Glider and Squatter Pigeon (all listed as Vulnerable under the NC and EPBC Act) and several bird species listed as Migratory (EPBC Act) and Special Least Concern (NC Act). Suitable habitat for Koala occurs within the mine area (where the species was identified) and along the haul road and adjacent riparian communities associated with Deep Creek and Tooloombah Creek. Suitable gilgai habitat for Ornamental Snake (listed as Vulnerable under the NC and EPBC Act), identified in remnant Brigalow habitat to the west of the Project area, also occurs in cleared lands north of the Bruce Highway.

The Project will require unavoidable significant impacts to ecological matters of State and Commonwealth significance including: remnant vegetation listed as Of Concern and Endangered under the VM Act and / or considered as a TEC under the EPBC Act; habitat for listed species (Koala and Ornamental Snake); and watercourse remnant vegetation. Significant impacts will be a result of clearing for mining infrastructure, open cut pits and environmental dams. The total extent of these impacts has been calculated to be 132.46 ha and will be the subject of the Project ODP.

Other potential impacts of concern include the drawdown of the groundwater table because of open cut mining. This may have long-term impacts, particularly to the north of the Project and to a lesser degree, to the east and south. This may have impacts on permanent waterholes and riparian vegetation (including habitat for Koala), largely in those areas closest to mining operations where the groundwater drawdown is at its greatest. There is some potential for impacts to patches of semi-evergreen vine thicket vegetation located along Tooloombah Creek although it is uncertain to what extent this community relies on groundwater.

The mitigation measures proposed as part of the Project will minimise additional indirect impacts to terrestrial fauna and flora communities within and surrounding the Project area from construction and operational activities. These measures include fauna crossing infrastructure to minimise fauna traffic collisions along the haul road and a detailed ecological monitoring program to monitor the health of vegetation communities adjacent to the Project for indirect impacts such as dust and surface water contamination. With control measures in place indirect impacts to fauna and flora are not expected to be significant.

14.14 Commitments

In relation to managing terrestrial ecology, Central Queensland Coal's commitments are provided in Table 14-21.

Table 14-21 Commitments – terrestrial ecology

Commitment
Develop and implement a Land Use Management Plan which will establish a vegetation monitoring program, identify pest and weed management controls, fire management measures and principles for managing fauna.
Develop and implement Significant Species Management Plans for managing those threatened species known or likely to occur on the site.
Develop and implement a series of dust mitigation and monitoring measures.
Prepare and implement a Water Management Plan that outlines the monitoring and management measures for surface water and groundwater.
Develop and submit to EHP and DotEE an Offsets Delivery Plan in accordance with the relevant State and Commonwealth policies, prior to construction.
Collaborate with the relevant agencies (such as DNRM, EHP and DotEE) regarding offset options to ensure optimal environmental net benefit.
Seek to achieve a synergistic habitat and conservation benefits by working with nearby landholders and EHP.
Investigate other programs being conducted locally, regionally and nationally to determine if they can provide information (such as ongoing monitoring data), research assistance, in order to get a higher net benefit for the environment through indirect offsets.

14.15 ToR Cross-reference Table

Table 14-22 ToR Cross-reference Table

Terms of Reference	Section of the EIS
8.7 Flora and Fauna	
Describe the potential direct and indirect impacts on the biodiversity and natural environmental values of affected areas arising from the construction, operation and decommissioning of the project.	Section 14.7
Consider any proposed avoidance and/or mitigation measures.	Section 14.8
The EIS should provide information based on relevant guidelines, including but not limited to EHP's EIS information guidelines that cover flora and fauna, aquatic ecology, coastal issues, ground-dependent ecosystems, water, matters of national environmental significance, and biosecurity.	Noted
The assessment should include the following key elements: • identification of all significant ecological species and communities, including MSES and MNES, listed flora and fauna species, and regional ecosystems, on the project's site and in its vicinity	Section 14.6 and Chapters 14 – Aquatic Ecology and 16 - MNES
• terrestrial and aquatic ecosystems (including groundwater-dependent ecosystems) and their interactions	Section 14.7 and Chapters 10 – Groundwater, 14 – Aquatic Ecology, and 16 – MNES
• biological diversity	Chapters 14.5.1.5 and 14.6 and Chapter 16 - MNES
• the integrity of ecological processes, including habitats of listed threatened, near threatened or special least-concern species	Section 14.6 and Chapters 10 – Groundwater, 15 – Aquatic Ecology and 16 - MNES
• connectivity of habitats and ecosystems	Section 14.7.2
• the integrity of landscapes and places, including wilderness and similar natural places	Section 14.8
• chronic, low-level exposure to contaminants or the bio-accumulation of contaminants	Section 14.7.9 and Chapters 9 – Surface Water, 10 – Ground Water, 15 – Aquatic Ecology and 16 - MNES
• impacts (direct or indirect) on terrestrial and aquatic species and ecosystems whether due to: vegetation clearing; hydrological changes; discharges of contaminants to water, air or land; noise; etc.	Section 14.7 and Chapters 9 – Surface Water, 10 – Groundwater, 15 – Aquatic Ecology and 16 - MNES
• impacts of waterway barriers on fish passage in all waterways mapped on the Queensland Waterways for Waterway Barrier Works spatial data layer.	Chapter 15 – Aquatic Ecology

Terms of Reference	Section of the EIS
Describe any actions of the project that require an authority under the *Nature Conservation Act 1992*, and/or would be assessable development for the purposes of the *Vegetation Management Act 1999*[1], the *Regional Planning Interests Act 2014,* the *Fisheries Act 1994* and the *Planning Act 2016.* Features to consider include regional ecosystems, environmentally sensitive areas, wetlands, nature refuges, protected areas and strategic environmental areas.	Section 14.2.5
Propose practical measures to avoid, minimise, mitigate and/or offset direct or indirect impacts on ecological environmental values.	Sections 14.8 and 14.12 and Chapters 10 – Groundwater, 15 – Aquatic Ecology and 16 - MNES
Assess how the nominated quantitative indicators and standards may be achieved for nature conservation management.	Section 14.8
Address measures to protect or preserve any listed threatened, near-threatened or special least concern species.	Section 14.8
Propose measures that would avoid the need for waterway barriers, or propose measures to mitigate the impacts of their construction and operation.	Chapter 15 – Aquatic Ecology
Assess the need for buffer zones and the retention, rehabilitation or planting of movement corridors. The assessment should take account of the role of buffer zones in maintaining and enhancing riparian vegetation to enhance water quality and habitat connectivity.	Chapter 15 – Aquatic Ecology
Propose rehabilitation success criteria, in relation to natural values, that would be used to measure the progressive rehabilitation of disturbed areas. Describe how the achievement of the objectives would be monitored and audited, and how corrective actions would be managed. Proposals for the rehabilitation of disturbed areas should incorporate, in suitable habitat, provision of nest hollows and ground litter.	Chapter 11 - Rehabilitation
Specifically address any obligations imposed by State or Commonwealth legislation or policy or international treaty obligations, such as the China–Australia Migratory Bird Agreement, Japan–Australia Migratory Bird Agreement, or Republic of Korea–Australia Migratory Bird Agreement.	Chapter 16 - MNES
8.7.1 Offsets	
For any significant residual impacts, propose offsets that are consistent with the following requirements as set out in applicable State and Commonwealth legislation or policies: • Where a significant residual impact will occur on a prescribed environmental matter as outlined in the Environmental Offsets Regulation 2014, the offset proposal(s) must be consistent with the requirements of Queensland's *Environmental Offsets Act 2014* and the latest version of the Queensland Environmental Offsets Policy[2].	Section 14.12
• Where the Commonwealth offset policy requires an offset for significant impacts on a MNES, the offset proposal(s) must be consistent with the requirements of the EPBC Act Environmental Offsets Policy (October 2012), the *Offsets Assessment Guide* and relevant guidelines[3] (refer to also Appendix 3 of this TOR).	Chapter 16 - MNES
8.8 Coastal Environment	
Conduct impact assessment in accordance with the EHP's *EIS Information guideline – Coastal.*	Noted

[1] This is notwithstanding that the Vegetation Management Act 1999 does not apply to mining projects. Refer also to https://www.qld.gov.au/environment/land/vegetation/clearing/

[2] https://www.qld.gov.au/environment/pollution/management/offsets/

[3] http://www.environment.gov.au/epbc/publications/epbc-act-environmental-offsets-policy

Terms of Reference	Section of the EIS
Provide illustrated details of the existing coastal zone that is potentially affected by the project, and describe and illustrate any proposed works in the coastal zone, including a schedule of ongoing maintenance requirements. The description should at least address the following matters: • state or Commonwealth marine parks in the region of the project's site	Section 14.11
• separately mention marine plants and any fish habitat areas protected under the *Fisheries Act 1994*	Section 14.11
Assess the potential impacts of the project's activities in the coastal zone.	Section 14.7
Propose measures to avoid or minimise the potential impacts of the project's activities in the coastal zone. If acid sulfate soils would be disturbed, describe measures to avoid oxidation of the sulfides or to treat and neutralise the acid if it forms.	Chapter 5 - Land
Detail any residual impacts that cannot be avoided, and propose measures to offset the residual loss.	Sections 14.11 and 14.12
Develop and describe suitable indicators for measuring coastal resources and values, and set objectives to protect them in accordance with relevant State Planning Policy July 2014, guidelines and legislation. Refer to EHP's guidelines on coastal development.	As no development is proposed within the coastal zone this as pect of the ToR is not considered relevant. Aspects associated with preseving the values of the coastal area are discussed in Chapter 4 Climate, Chapter 5 Land, Chapter 9 Surface Water, Chapter 14 Terrestrial Ecology, Chapter 15 Aquatic Ecology and Chapter 16 MNES.
Detail a monitoring program that would audit the success of mitigation measures, measure whether objectives have been met, and describe corrective actions to be used if monitoring shows that objectives are not being met.	Section 14.8