SARAJI EAST MINING LEASE PROJECT

Environmental Impact Statement

Chapter 6
Terrestrial Ecology

BHP

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Saraji East Mining Lease Project

6 Terrestrial Ecology

6.1 Introduction

This chapter provides an assessment of the terrestrial ecological values within and surrounding the Saraji East Mining Lease Project (the Project) Site, potential impacts and proposed management measures.

6.2 Legislation and policy

6.2.1 Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is administered by the Department of Agriculture, Water and Environment (DAWE). Amongst other matters, the EPBC Act provides the legal framework to protect and manage Matters of National Environmental Significance (MNES). Nine MNES are currently prescribed and include:

- declared World Heritage properties
- National Heritage places
- declared RAMSAR wetland
- listed threatened species and ecological communities
- listed migratory species
- Commonwealth marine areas
- The Great Barrier Reef Marine Park (GBRMP)
- nuclear actions
- a water resource, in relation to coal seam gas development or large coal mining development.

Under the EPBC Act, a project or activity that may have an impact on an MNES is deemed to be an 'action'. Actions that have or are likely to have a significant impact on an MNES require approval from the Minister for the Environment. Whether or not an action is likely to have a significant impact depends on the sensitivity, value, and quality of the environment that is impacted, and the intensity, duration, magnitude and geographic extent of the impact. If the action consists of a series of activities or related activities, the impacts of each activity must be considered as well as the combined (cumulative) impacts of the series of activities. Consideration is also to be given to all impacts that could reasonably be predicted to follow or be facilitated by the action. Impacts may also be directly or indirectly associated with the action.

On 5 October 2016, BMA referred the Project to the Department of the Environment and Energy (DoEE, now DAWE) for a decision as to whether the Project constitutes a 'controlled action' under the EPBC Act (Referral No. 2016/7791). On 18 October 2016, the Project was determined to be a controlled action under the EPBC Act due to the potential impacts on MNES.

The relevant controlling provisions under the EPBC Act were determined as being:

- nationally listed threatened species and communities (Section 18 and 18A)
- a water resource, in relation to coal seam gas development and a large coal mining development (Section 24D and 24E).

The Project therefore requires assessment and approval under the EPBC Act. The Minister determined that the assessment be conducted in accordance with the bilateral agreement to which both the Australian and Queensland Governments are signatories which accredits the EIS assessment process under the *Environmental Protection Act 1994* (EP Act). This has been acknowledged with ToR issued by the Queensland Department of Environment and Heritage Protection (DEHP) (now the Department of Environment and Science (DES)) on 2 June 2017.

When deciding whether or not a proposed action is likely to have a significant impact on an MNES, the precautionary principle is required to be applied. A lack of scientific evidence as to whether an impact will occur, or to what extent, cannot be used to support or approve an application under the EPBC Act. In addition, beneficial impacts cannot be considered or used to justify other adverse impacts or an approval under the EPBC Act. Through the Matters of National Environmental Significance Significant Impact Guidelines, this principle has been used to determine whether the Project will significantly impact an MNES.

Chapter 21 Matters of National Environmental Significance provides the detailed MNES assessment for the Project.

Commonwealth Offsets Policy

In October 2012, the EPBC Act Environmental Offsets Policy 2012 was published (DSEWPC, 2012). The Environmental Offsets Policy will be applicable to the Project.

There are five key aims of the policy:

- 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
- provide guidance on acceptable delivery mechanisms for offsets.

An Environmental Offset Strategy has been developed for the Project and is provided in **Appendix C-2 Offsets Strategy**. All final offset requirements are subject to the final clearing footprint and assessment and approval from the DAWE.

6.2.2 Queensland legislation

Planning Act 2016

The *Planning Act 2016* regulates development in Queensland that is made assessable under the Planning Regulation 2017 or the local government planning scheme and is administered by the Department of State Development, Tourism and Innovation. Development within a mining lease (or other resource tenure as stated in the Planning Regulation 2017) is exempt from provisions of the *Planning Act 2016*. As the Project is within the resource tenure and is associated with mining activity, this exemption applies to the Project.

Nature Conservation Act 1992

The *Nature Conservation Act 1992* (NC Act) prohibits the taking or destruction (without authorisation) of protected flora and fauna species in the wild. All native plants and animals in Queensland are protected under Section 71 of the NC Act. The NC Act also provides for an integrated and comprehensive approach to conserving nature.

The Nature Conservation (Animals) Regulation 2020 (NC (Animals) Regulation) and the Nature Conservation (Plants) Regulation 2020 (NC (Plants) Regulation) lists the plants and animals considered presumed extinct in the wild, endangered, critically endangered, vulnerable, near threatened, least concern, international and prohibited. The NC Regulation discusses their significance and states the declared management intent and the principles to be observed in any taking and use for each group.

Appropriate authorisations or permits under the NC Act are required prior to clearing of listed conservation significant plant species, interfering with an animal breeding place, or removing protected animals unless the activity is exempt. Fauna and flora species identified during field surveys were assessed against threatened species listed in the NC Regulations. This ensured any impacts from the construction and operation of the Project could be quantified in relation to significant species requirements.

Vegetation Management Act 1999

The *Vegetation Management Act 1999* (VM Act) regulates the clearing of native vegetation, including remnant (termed Regional Ecosystems (REs)), high-value regrowth (HVR), reef regrowth watercourse vegetation and non-remnant on certain tenures. In Queensland, the VM Act does not apply to mining leases. Although mining is exempt development, the VM Act provides useful guidelines on management including mapping.

Amendments to the VM Act in May 2018 under the *Vegetation Management and Other Legislation Amendment Act 2018* (VMOLA) reinstated the regulation of HVR and reef regrowth watercourse vegetation. HVR areas are those which have not been cleared for over 15 years if the area is an endangered, of concern or least concern regional ecosystem. Reef regrowth watercourse vegetation is native regrowth vegetation on watercourse areas within the Great Barrier Reef Catchments. The clearing of this vegetation has been regulated to increase wetland and watercourse bank stability, and maintain water quality, habitat and landscape stability.

The status of REs and HVRs is based on their pre-clearing and remnant extent, as gazetted under the VM Act and listed in the Regional Ecosystem Description Database (REDD) maintained by the Queensland Department of Natural Resources and Mines and Energy (DNRME). A RE considered to have “Vegetation Management Status” is described as either:

- **Endangered** regional ecosystem:
  - less than ten per cent of its pre-clearing extent remaining, or
  - ten per cent to 30 per cent of its pre-clearing extent remaining and the remnant vegetation remaining is less than 10,000 hectares (ha).
- **Of Concern** regional ecosystem:
  - ten per cent to 30 per cent of its pre-clearing extent remaining, or
  - more than 30 per cent of its pre-clearing extent remaining and the remnant vegetation remaining is less than 10,000 ha.
- **Least Concern** regional ecosystem:
  - more than 30 per cent of its pre-clearing extent remaining and the remnant vegetation remaining is more than 10,000 ha.

Environmental Protection Act 1994

Under the *Environmental Protection Act 1994* (EP Act) and the Environmental Protection Regulation 2019 (EP Regulation), certain environmental features are protected within mining leases. These are termed 'Environmentally Sensitive Areas' (ESAs) and include such features as national parks, conservation reserves, wetlands of international importance, heritage places and endangered regional ecosystems (EREs).

All mining and exploration activities in Queensland are conducted under an Environmental Authority (EA) as set out under Section 183 of the EP Act. The EA lists conditions with which the activity must comply in order to mitigate impacts to the environment.

Biosecurity Act 2014

The *Biosecurity Act 2014* commenced on 1 July 2016. It ensures a consistent, risk-based approach to biosecurity in Queensland.

The Act provides biosecurity measures to safeguard Queensland's economy, agricultural and tourism industries and environment from:

- pests (e.g. wild dogs and weeds)
- diseases (e.g. foot-and-mouth disease)
- contaminants (e.g. lead on grazing land).

Under the Act, all persons have a general biosecurity obligation to take all reasonable and practical measures to prevent or minimise the biosecurity risk. This includes:

- preventing or minimising adverse effects of a biosecurity risk
- minimising the likelihood of causing a biosecurity event and deal with a biosecurity matter by limiting the consequences of a biosecurity event should one arise
- not exacerbating the effects of a biosecurity matter.

Nature Conservation (Koala) Conservation Plan 2017

The *Nature Conservation (Koala) Conservation Plan 2017* provides for the conservation of the Koala (*Phascolarctos cinereus*) in Queensland and includes provisions for the assessment and management of Koalas (*Phascolarctos cinereus*) during the development approval processes and implementation of projects. Different levels of provisions apply to the three Koala (*Phascolarctos cinereus*) districts that have been mapped across Queensland. The Project is located with Koala (*Phascolarctos cinereus*) District C. This district includes areas where Koalas (*Phascolarctos cinereus*) are found; however, provisions for clearing in Koala (*Phascolarctos cinereus*) District C are less stringent than those in Koala (*Phascolarctos cinereus*) Districts A and B (for example, Districts A and B are subject to sequential clearing conditions).

Environmental Offsets Act 2014 and Environmental Offsets Regulation 2014

The *Environmental Offsets Act 2014* (EO Act) coordinates the delivery of environmental offsets across jurisdictions and provides a single point-of-truth for offsets in Queensland.

The Environmental Offsets Regulation 2014 (EO Reg) provides details of the prescribed activities regulated under existing legislation and prescribed environmental matters to which the EO Act applies. These matters are:

- Matters of National Environmental Significance (MNES)
- Matters of State Environmental Significance (MSES)
- Matters of Local Environmental Significance (MLES).

Environmental Offsets Policy 2020

The Environmental Offsets Policy 2020 Version 1.9 (EO Policy) provides a single, consistent, whole-of-government policy for the assessment of offset proposals to satisfy offset conditions.

The EO Policy outlines seven principles that environmental offsets must meet:

- offsets will not replace or undermine existing environmental standards or regulatory requirements or be used to allow development in areas otherwise prohibited through legislation or policy
- environmental impacts must first be avoided, then minimised, before considering the use of offsets for any remaining impact
- offsets must achieve a conservation outcome that achieves an equivalent environmental outcome
- offsets must provide environmental values as similar as possible to those being lost
- offset provision must minimise the time-lag between the impact and delivery of the offset
- offsets must provide additional protection to environmental values at risk, or additional management actions to improve environmental values
- where legal security is required, offsets must be legally secured for the duration of the impact on the prescribed environmental matter.

For land-based offsets, the suitability of the offset site relative to the impact site and the prescribed environmental matters is measured through undertaking a habitat quality analysis. The Guide to Determining Terrestrial Habitat Quality (Department of Environment and Heritage Protection, 2017) must be used for REs and species offsets (including advanced offsets) to undertake this analysis, unless an alternative approach is approved by DES as being able to measure a conservation outcome.

An Environmental Offset Strategy has been developed for the Project and is provided in **Appendix C-2 Offsets Strategy**. All final offset requirements are subject to the final clearing footprint and assessment and approval from the DES.

6.2.3 Isaac Regional Council Biosecurity Plan 2020-2023

The Isaac Regional Council Biosecurity Plan 2020-2023 aims to minimise biosecurity risk within the local government area by providing a framework to mitigate the impacts of pest animal and weeds on local biosecurity considerations. The Biosecurity Plan identifies five desired outcomes including:

1. strategic Planning and Management - Pest management planning is collaborative, co-ordinated, and risk-based.
2. stakeholder Awareness and Commitment - All stakeholders have an improved working knowledge of regional pest species, understand their biosecurity responsibilities, and hold agency in management goals.

3. effective and Integrated Management Systems - Pest management is based on best practice information and is integrated.
4. proactivity for Prevention and Early Intervention - Timely and collaborative responses diminish pest spread and promotes cost-effective, long-term asset protection.
5. monitoring and Assessment - Review processes strive to better understand and improve biosecurity management.

The Operational Guide within the Isaac Regional Council Biosecurity Plan 2020-2023 determines management goals for priority pest animal and weed species within the local government area. Controls will be established in line with the Biosecurity Plan.

6.3 Methodology

6.3.1 Desktop assessment

A desktop review of ecological data and literature was undertaken to characterise ecological values and identify the potential presence of conservation significant species, habitats and vegetation communities within the Project Site.

6.3.2 Field surveys

Both flora and fauna surveys were undertaken to supplement and confirm findings of the desktop assessment. The sampling of vertebrate fauna species including threatened species was undertaken using standard methodologies for the systematic survey of terrestrial fauna in eastern Australia (Eyre et al., 2018) and relevant Commonwealth and species-specific survey guidelines including:

- survey guidelines for Australia's threatened reptiles (Department of Sustainability, Environment, Water, Population and Communities 2011)
- survey guidelines for Australia's threatened birds (Department of the Environment, Water Heritage and the Arts, 2010)
- draft referral guidelines for the nationally listed Brigalow Belt reptiles (Department of Sustainability Environment Water Population and Communities, 2011a)
- survey guidelines for Australia's threatened mammals (Department of Sustainability, Environment, Water, Population and Communities, 2011b)
- survey guidelines for Australia's threatened bats (Department of the Environment, Water, Heritage and the Arts, 2010a)
- industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (Department of the Environment and Energy, 2017)
- species-specific survey guidelines, such as the survey guidelines for the Koala (*Phascolarctos cinereus*) (Department of the Environment, 2014), Painted Honeyeater (*Grantiella picta*) (Rowland, 2012b), Ghost Bat (*Macroderma gigas*) (Hourigan, 2011), and Yakka Skink (*Egernia rugosa*) (Ferguson and Mathieson, 2014).

A summary of these surveys is provided in Table 6.1

Table 6.1 Summary of flora and fauna surveys undertaken

Year	Company	Target
Flora		
2007	SKM	• mapping the extent of threatened ecological communities (TECs) • targeted survey for the vulnerable King Bluegrass (*Dichanthium queenslandicum*) (protected under the NC Act and EPBC Act) • field checking of RE mapping of the mining lease (ML) (Version 5.0, 2003) • compilation of a flora inventory for the mining lease, based on secondary and quaternary level sampling.
2008	SKM	• survey the extent of remnant brigalow vegetation communities across Mining Lease Application (MLA) 70383. All patches of brigalow within MLA 70383 were ground-truthed, and the boundaries mapped.
2010	SKM	• collation of secondary-level sampling data for each vegetation type in the Project Site • opportunistic traverses of natural grasslands.
2016-2017	AECOM	• ground truthing of REs
2020	AECOM	• TEC assessment (Brigalow (*Acacia harpophylla* dominant and codominant) only)
Fauna		
2007 and 2010	SKM	• systematic fauna survey at primary and secondary sites designed to census terrestrial fauna assemblages and to identify conservation significant species that may occur within the Project Site.
2010	SKM	• targeted survey for the Commonwealth protected Ornamental Snake (*Denisonia maculata*).
2011	SKM	• winter fauna survey including morning bird surveys at wetland habitats, diurnal herpetofauna searches in Brigalow and Bat call detection (Anabat).
2016 and 2017	AECOM	• targeted the entire Project Site and included observations of terrestrial vertebrate fauna assemblages (birds, mammals, reptiles and amphibians), habitat assessments and Anabat deployment.
2020	AECOM	• targeted survey for the Commonwealth protected species Dunmall's Snake (*Furina dunmalli),* Yakka Skink (*Egernia rugosa*), Ornamental Snake (*Denisonia maculata),* Adorned Delma (*Delma torquata*), Koala (*Phascolarctos cinereus*), Greater Glider (*Petauroides volans*), Latham's Snipe (*Gallinago hardwickii*), Australian Painted Snipe (*Rostratula australis*), Painted Honeyeater (*Grantiella picta*), Red Goshawk (*Erythrotriorchis radiatus*) and Squatter Pigeon (Southern) (*Geophaps scripta scripta*).

This assessment also drew on previous studies undertaken by EcoServe between 2005 and 2009 at the existing Saraji Mine. Details on these previous studies is provided in **Appendix C-1 Terrestrial Ecology Technical Report.**

Data acquisition during flora surveys generally has inherent limitations associated with variability of vegetation communities across a site, and changes to the detectability and presence of species with time. A high level of confidence in comprehensiveness is implicit in this study as survey sites were strategically located to capture representative samples of all communities. Further, the seasonal conditions during which this survey was undertaken were conducive to a relatively high degree of

detectable floral diversity. However, given the above, it is recognised that field studies with a temporal limitation cannot always account for 100 per cent of potential floral diversity present within a site.

The introduction of HVR mapping by the Queensland Government occurred in May 2018. Therefore, the field survey program (completed in February 2017) did not include mapping of HVR. All reference to extent of HVR within this report is based on Queensland Government mapping and was not ground-truthed. Flora survey sites are shown in Figure 6-1 and fauna survey sites are illustrated in Figure 6-2

6.3.3 Likelihood of occurrence assessment

A likelihood of occurrence assessment for threatened and migratory species and TECs identified during the desktop review was undertaken. Targeted searches were undertaken in the field for species identified as either being likely to occur, or having potential to occur, within the Project Site, based on the desktop sources. The methodology was applied again after field surveys to determine the likelihood of occurrence once site-based information became available.

Each species was assessed against the categories defined below.

- **Known**: Species was positively identified and recorded in the Project Site during the field surveys; or previous, reliable records occur within the Project Site.
- **Likely**: Species was not recorded during the field surveys or previously, however there are known records within the nearby surrounding area (i.e. 15 km) and suitable habitat exists in the Project Site.
- **Potential**: Species was not recorded during the field surveys or previously, however known records occur in the surrounding area (i.e. 15 km) and habitat in the Project Site is marginal or degraded.
- **Unlikely**: Habitat in the Project Site might be suitable or marginal; however, species was not recorded during the field surveys, and no known records of the species exist within the surrounding area (i.e. 15 km).
- **No**: This is usually applied to marine species or seabirds for terrestrial sites.

6.3.4 Conservation significant species mapping

Following the completion of field surveys and the likelihood of occurrence assessment, habitat mapping for the MNES values and additional MSES species known or likely to occur within the Project Site was undertaken.

Potential habitat mapping of the Project Site was undertaken to:

- estimate the extent of potential habitat present within the Project Site
- determine the potential impact to MNES and MSES values
- aid the development of specific mitigation measures.

MNES potential habitat mapping was undertaken in accordance with Central Queensland Threatened Species Habitat Descriptions (Kerswell A, Kaveney T, Evans C and Appleby L, 2020). This covers some of the key threatened fauna species of the Central Queensland region and defines habitat based on three categories – preferred, suitable and marginal habitat. The definitions of each category are provided in Table 6.2 below. Preferred habitat definitions have been provided for all species but not all species have been allocated both a suitable and marginal habitat category. Allocation of these categories was based on the known ecological requirements of the species and the most applicable category that best describes the species habitat.

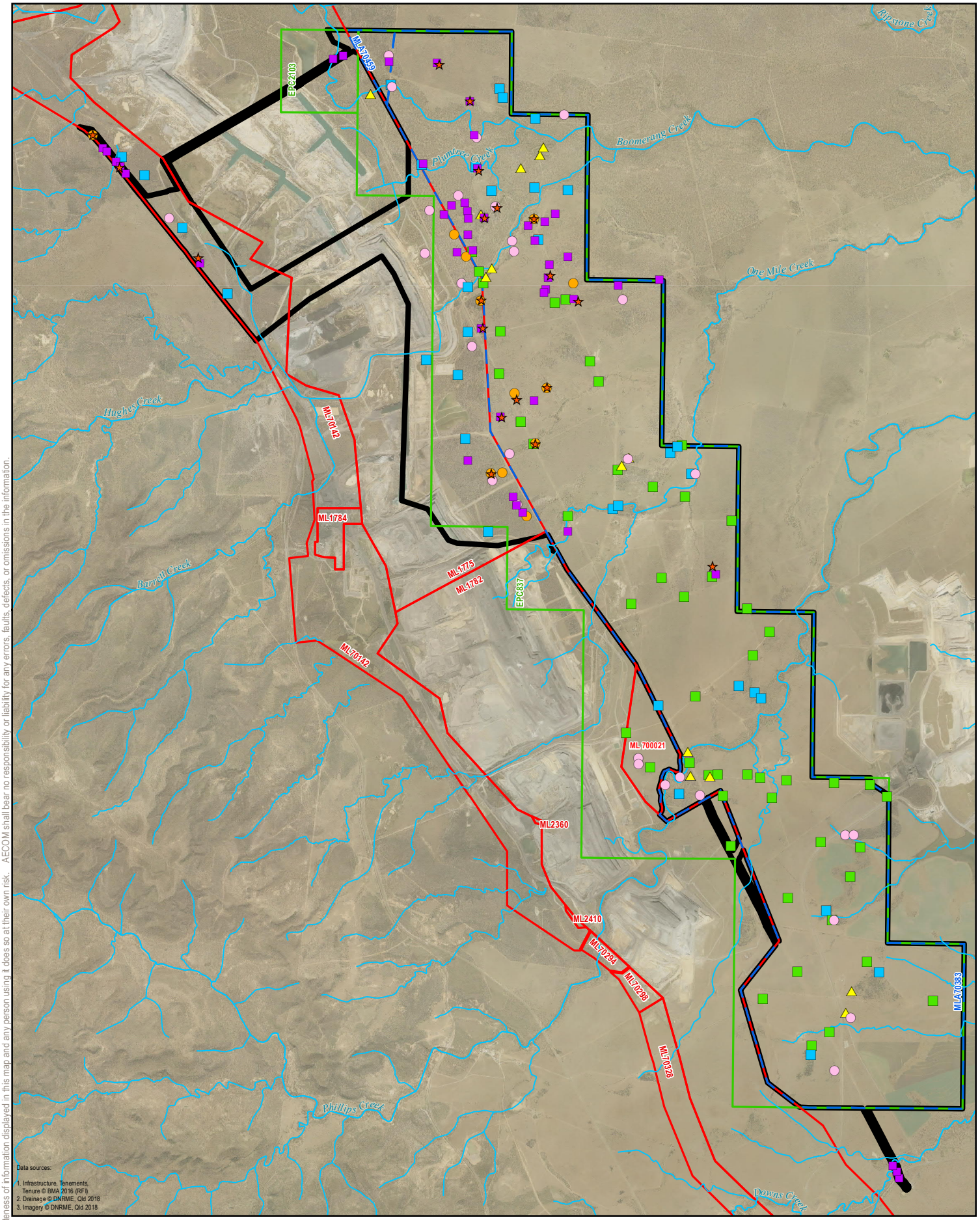
For species not covered by Central Queensland Threatened Species Habitat Descriptions (Kerswell A, Kaveney T, Evans C and Appleby L, 2020), habitat definitions were developed from information sourced from publicly available databases, including relevant species recovery plans (where available), referral guidelines, approved conservation advice, the Species Profile and Threats database (SPRAT), management plans and peer-reviewed journal articles.

Habitat assessment information collected during the field surveys, species records (previous and survey records), and Project vegetation mapping was used to map the potential habitat according to the habitat definitions.

The habitat definitions are provided in **Appendix C-1 Terrestrial Ecology Technical Report.**

Table 6.2 Habitat category definition

Habitat Category	Definition
Preferred	Habitats that are most important to the species and contain the features that are crucial for the species' persistence in an area. It includes habitats in which key activities are undertaken e.g. breeding, roosting and/or where high quality/species limiting foraging resources are found. If the species is present in a region, individuals will usually be found in preferred habitat.
Suitable	Habitats that provide resources for the species but is not crucial for its persistence in an area. Individuals may be found in suitable habitat but are not likely to be undertaking key activities such as breeding or roosting. Foraging resources may be lower quality or used opportunistically (rather than being depended upon). If the species is present in a region, individuals may be found in suitable habitat but this habitat type may also remain unoccupied.
Marginal	Habitats that provides limited resources for the species and is not crucial for its persistence in an area. Individuals may be occasionally found in marginal habitat but will not be undertaking key activities such as breeding, roosting or extensive foraging. If the species present in a region, individuals would be found in marginal habitat only rarely and this habitat type is likely to be unoccupied most of the time.



LEGEND

- Project Site
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Watercourse

Flora survey sites

- TEC assessment - Brigalow (AECOM 2020)
- Quaternary site (AECOM 2020)
- Tertiary site (AECOM 2020)
- Quaternary site (AECOM 2017)
- Tertiary site (AECOM 2017)
- Quaternary site (SKM)
- Secondary site (SKM)

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Figure 6-1
Flora survey sites

Environmental Impact Statement
Saraji East Mining Lease Project

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Kilometres

Scale: 1:110,000 (when printed at A4)

Projection: Map Grid of Australia - Zone 55 (GDA94)

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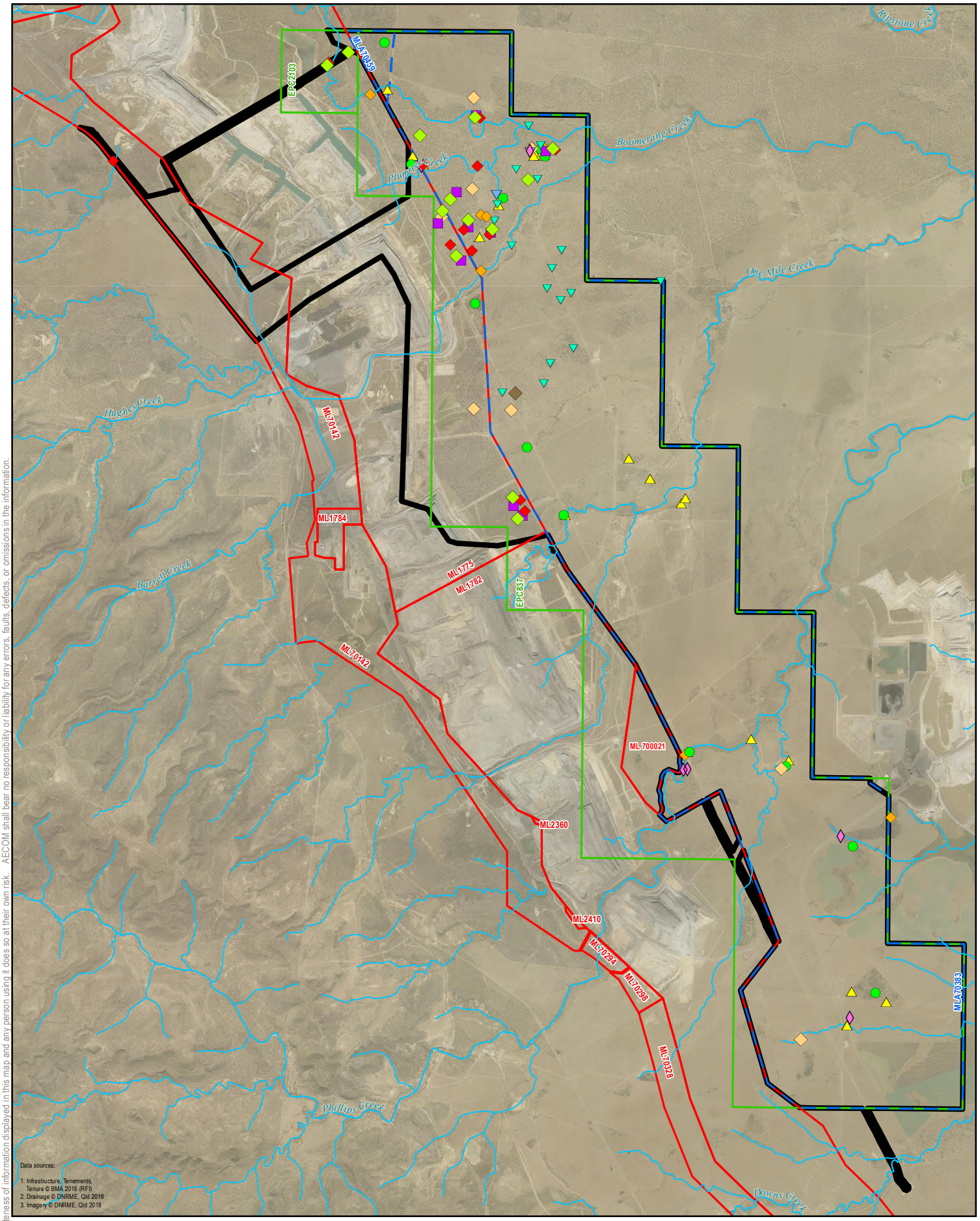

Legend

- Project Site
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Watercourse

Fauna survey sites

- Yakka Skink habitat site (AECOM 2020)
- Squatter Pigeon habitat site (AECOM 2020)
- Greater Glider habitat site (AECOM 2020)
- Active fauna search (AECOM 2020)
- Spotlight location (AECOM 2020)
- Fauna habitat site (AECOM 2017)
- Anabat location (AECOM 2017)
- Spotlight location (AECOM 2017)
- Winter site (SKM)
- Primary site (SKM)
- Secondary site (SKM)

N

Figure 6-2
Fauna survey sites

Environmental Impact Statement
Saraji East Mining Lease Project

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Kilometres

Scale: 1:110,000 (when printed at A4)

Projection: Map Grid of Australia - Zone 55 (GDA94)

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6.4 Terrestrial flora results

6.4.1 Desktop assessment

Regional context

The Project Site is situated within the northern Brigalow Belt bioregion. Queensland's bioregions are based on landscape patterns that reflect changes in geology and climate, as well as major changes in floral and faunal assemblages at a broad scale and are used as the fundamental framework for the planning and conservation of biodiversity.

Nature conservation of the northern Brigalow Belt bioregion has received increasing attention due to the rapid and extensive loss of habitat that has occurred. Major impacts upon vegetation of the Brigalow Belt include tree clearing, high grazing pressure and the proliferation of exotic species such as the Prickly Pear (*Opuntia spp*.). As a consequence of habitat modification, many flora and fauna species have undergone severe range reductions and localised extinctions have occurred for several fauna species (Sattler and Williams, 1999).

Vegetation clearing has occurred on most of the lowland landscapes and those formed on shales. The more rugged topography associated with the sandstone and metamorphic ranges remain relatively undisturbed (Sattler and Williams, 1999).

Regional ecosystems and high value regrowth

DNRME RE mapping (Version 10.1) was reviewed to determine the extent of REs across the Project Site. Ten REs are mapped as occurring within the Project Site. The REs are predominantly associated with the creeks that drain across the properties as remaining areas have largely been cleared. Based on the Biodiversity Status classifications, three REs are listed as endangered, four as of concern and three as no concern at present. The EPBC Act status refers to the status of the threatened ecological community which contains the RE. Three of the REs are also component REs of endangered ecological communities listed under the EPBC Act.

DNRME mapping was also consulted to determine the extent of HVR within the Project Site. HVR occurs in several small patches which have not been cleared for greater than 15 years. HVR is mapped for four REs all of which are also mapped as remnant within the Project Site.
No Essential Habitat for conservation significant flora species is mapped within the Project Site (DNRM, 2016a).

Threatened ecological communities

Four endangered TECs were identified from desktop sources as potentially occurring within the Project Site:

- Brigalow (*Acacia harpophylla* dominant and codominant)
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions
- Weeping Myall Woodlands.

The literature review identified that two of the above are likely to be present in the Project Site: Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin, and Brigalow (*Acacia harpophylla* dominant and codominant).

Flora of conservation significance

A review of the existing databases and literature on terrestrial flora for the region identified seven conservation significant flora species as being potentially present within the Project Site. These are identified in **Appendix C-1 Terrestrial Ecology Technical Report**.

6.4.2 Field survey results

Ground-truthed regional ecosystems

Table 6.3 provides a summary of the classification of vegetation communities and REs identified during the flora surveys. Vegetation communities for the survey areas were delineated on the basis of mapped REs. Figure 6-3 presents the observed REs across the Project Site.

Table 6.3 Ground-truthed regional ecosystems within the Project Site

RE	Community description	Biodiversity status	VM Act class	EPBC Act	Project Site Extent (ha)	Project Footprint (ha)
11.3.1	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains.	Endangered	Endangered	Endangered (when condition thresholds and diagnostic criteria are met)	15.76	6.58
11.3.2	*Eucalyptus populnea* woodland on alluvial plains.	Of Concern	Of Concern	Listed as endangered after submission[1]	151.15	73.33
11.3.4	*Eucalyptus tereticornis* and/or *Eucalyptus spp.* woodland on alluvial plains.	Of Concern	Of Concern	Not listed	23.05	0.01
11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines.	Of Concern	Least Concern	Not listed	192.08	79.60
11.3.27b	Lacustrine wetland (e.g. lake). Vegetation ranges from open water +/- aquatics and emergents such as *Potamogeton crispus, Myriophyllum verrucosum,*	Of Concern	Least Concern	Not listed	16.64	11.17

[1] RE 11.3.2 has not been assessed as a potential MNES as the analogous TEC was not listed at the time of referral and referral decision for the Project.

RE	Community description	Biodiversity status	VM Act class	EPBC Act	Project Site Extent (ha)	Project Footprint (ha)
	Chara spp., *Nitella* spp, *Nymphaea violacea, Ottelia ovalifolia, Nymphoides indica, N. crenata, Potamogeton tricarinatus, Cyperus difformis, Vallisneria caulescens and Hydrilla verticillata*.					
11.4.4	*Dichanthium* spp., *Astrebla* spp. grassland on Cainozoic clay plains.	Of Concern	Least Concern	Endangered (when condition thresholds and diagnostic criteria are met)	1.73	0.075
11.4.8	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains.	Endangered	Endangered	Endangered (when condition thresholds and diagnostic criteria are met)	322.16	236.02
11.4.9	*Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains.	Endangered	Endangered	Endangered (when condition thresholds and diagnostic criteria are met)	188.57	32.57
11.4.13	*Eucalyptus orgadophila* open woodland on Cainozoic clay plains.	Of Concern	Least Concern	Not listed	222.06	37.94

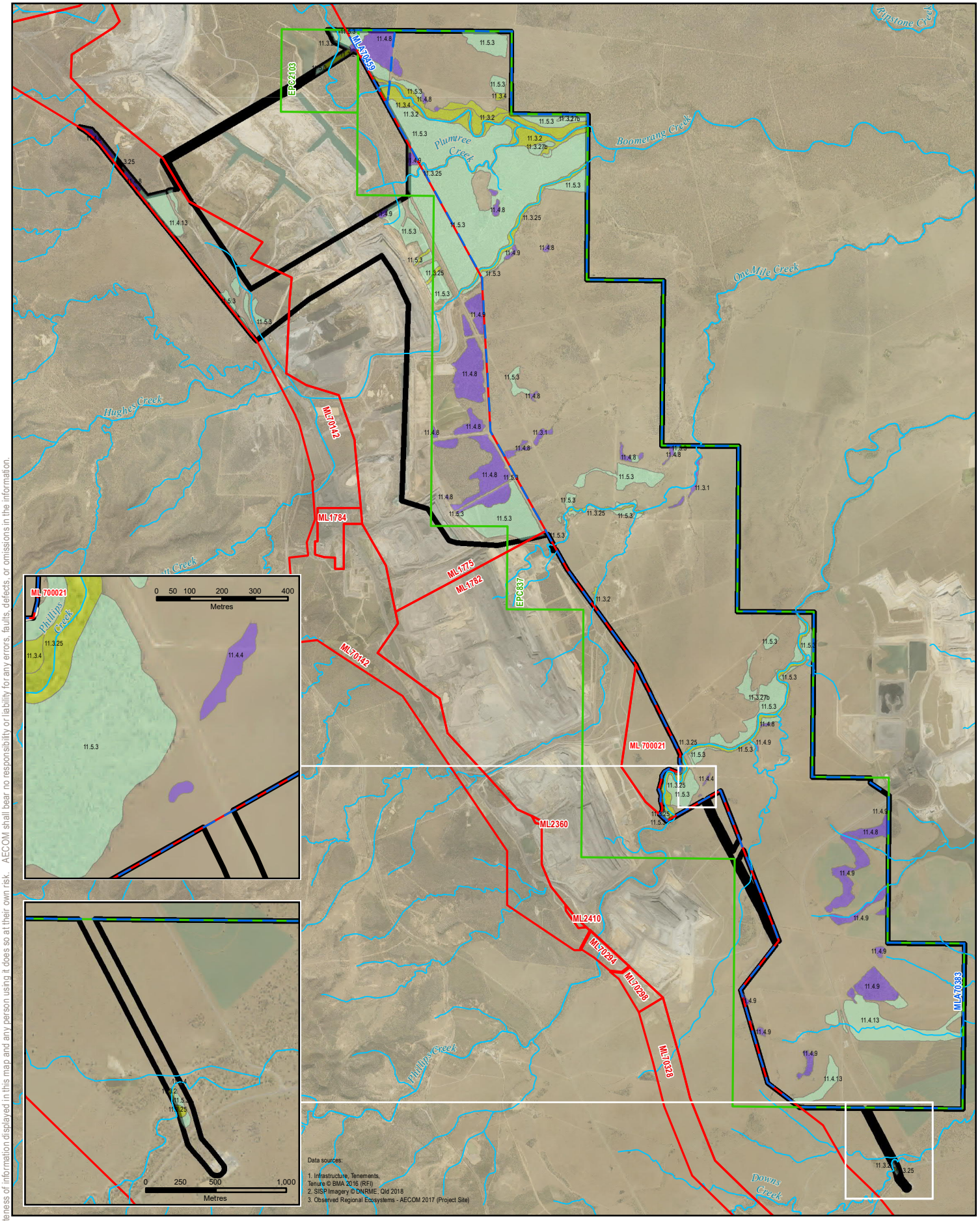
RE	Community description	Biodiversity status	VM Act class	EPBC Act	Project Site Extent (ha)	Project Footprint (ha)
11.5.3	*Eucalyptus populnea* ± *E. melanophloia* ± *Corymbia clarksoniana* on Cainozoic sand plains/remnant surfaces.	No Concern At Present	Least Concern	Not listed	1,480.04	813.63

At the time of the vegetation surveys, HVR was not mapped as it was not regulated under the VM Act.

Legislative amendments in 2018 have reverted to regulating HVR as Category C under VMOLA. As such, HVR within the Project Site has been quantified, despite the Project not requiring assessment against the VMOLA or VM Act. The DNRME RE mapping version 10.1 was used to calculate impacts to HVR, with no field verification undertaken. Refer to Table 6.4 for further detail.

Table 6.4 HVR regional ecosystems mapped by DNRME within the Project Site

HVR RE	Community description	Biodiversity status	VM Act class	EPBC Act	Area (ha) within Project Site	Area (ha) within Project Footprint
11.4.4	*Dichanthium* spp., *Astrebla* spp. grassland on Cainozoic clay plains.	Of Concern	Least Concern	Endangered	2.1	0.0
11.4.8	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains.	Endangered	Endangered	Endangered	38.4	2.0
11.4.9	*Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains.	Endangered	Endangered	Endangered	47.8	4.3
11.5.3	*Eucalyptus populnea* ± *E. melanophloia* ± *Corymbia clarksoniana* on Cainozoic sand plains/remnant surfaces.	No concern at present	Least Concern	-	23.8	1.92



LEGEND

- Project Site
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Watercourse

Regional Ecosystems biodiversity status

- Endangered
- Of Concern
- No Concern at Present

N

Figure 6-3

Ground-truthed regional ecosystems

Environmental Impact Statement
Saraji East Mining Lease Project

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Kilometres

Scale: 1:110,000 (when printed at A4)

Projection: Map Grid of Australia - Zone 55 (GDA94)

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Threatened ecological communities

Field surveys confirmed the presence of two EPBC Act TECs within the Project Site: Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin and Brigalow (*Acacia harpophylla* dominant and co-dominant). Table 6.5 outlines the EPBC Act TECs and analogous REs. Figure 6-4 presents the observed TECs within Project Site.

Table 6.5 EPBC Listed Threatened Ecological Communities and related regional ecosystems

EPBC TEC	Analogous REs	EPBC Act status	VM Act status	Extent (ha) in Project	Extent (ha) in Project Footprint
Brigalow (*Acacia harpophylla* dominant and co-dominant)	RE 11.3.1 RE 11.4.8 RE 11.4.9 (only polygons which met the criteria for this TEC)	Endangered	Endangered	417.85	246.07
Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin	RE 11.4.4	Endangered	Of Concern	1.73	0.075

Further details on the specifications of these TECs are provided in **Appendix C-1 Terrestrial Ecology Technical Report**.

Conservation significant flora species

The literature review and desktop searches identified seven flora species of conservation significance as potentially occurring in the Project Site. Of those seven species, previous field surveys undertaken by SKM confirmed the presence of *Dichanthium setosum* (Bluegrass), which is listed as vulnerable under the EPBC Act.

No threatened flora species within the Project Site were identified during the AECOM field surveys. However, suitable habitat within the Project Site was confirmed for *Dichanthium setosum* (Bluegrass). The likely occurrence *Dichanthium queenslandicum* (King Bluegrass) was also reported as this species is known to inhabit similar areas to *Dichanthium setosum* (Bluegrass). The extent of potential habitat for each of these species totalled 1.73 ha in Project Site of which 0.075 ha fell within the Project Footprint.

Based on ground-truthed habitat conditions the remaining five flora species were not considered to be likely occurrences.

Flora diversity

The field surveys identified the presence of 315 taxa representing 70 families and 190 genera. These are discussed in further detail in **Appendix C-1 Terrestrial Ecology Technical Report.**

Weeds

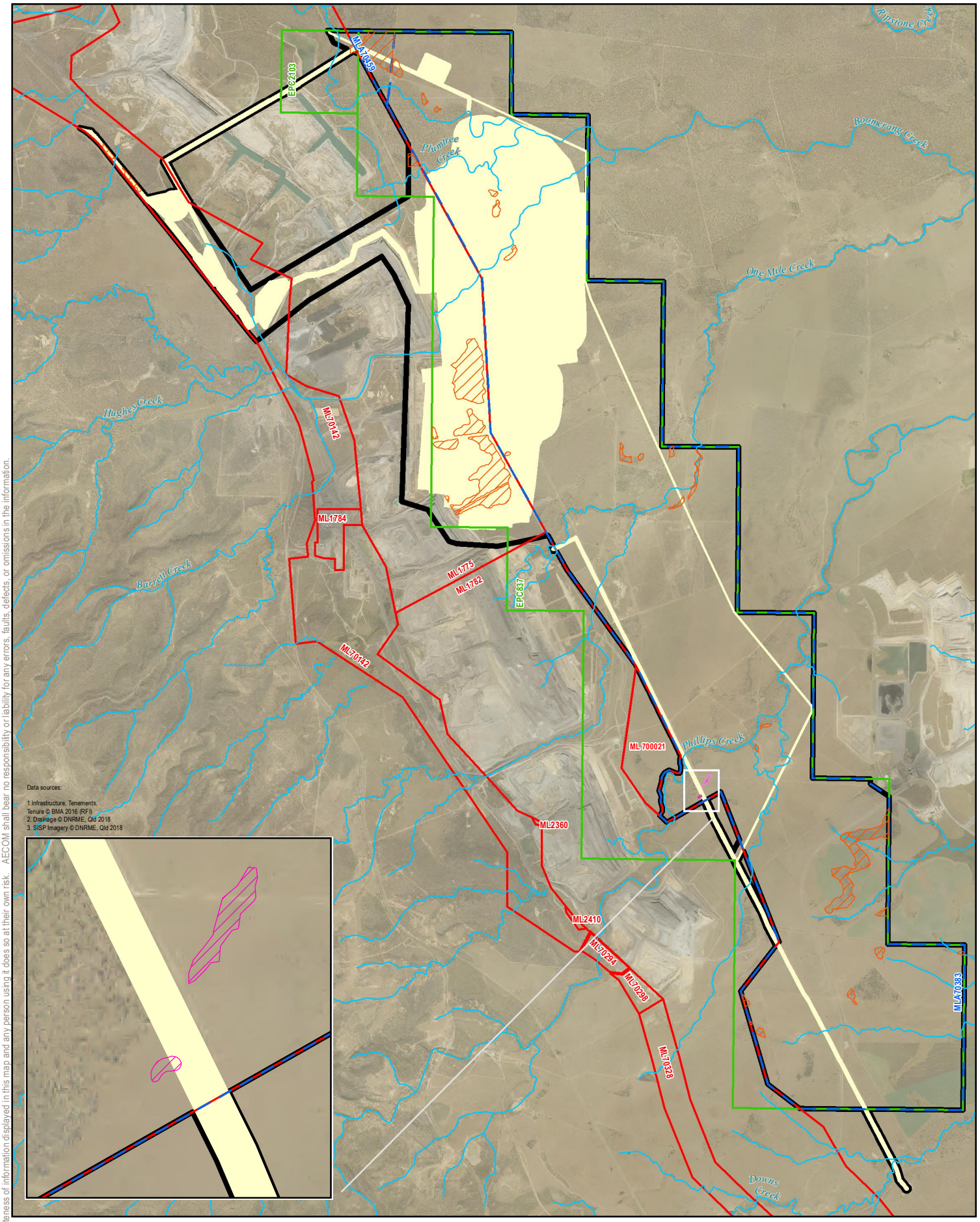
A total of 40 exotic species were recorded from the Project Site during the field surveys, including 11 species which are a ‘Restricted Matter’ under the *Biosecurity Act 2014.* Eight of these species are Weeds of National Significance (WoNS). ‘Restricted Matter’ refer to biosecurity matter found in Queensland which have a significant impact on social, economic, health or environment.

Under the Isaac Regional Biosecurity Plan 2020-2023, a weed is known as a plant identified in Schedule 1 Part 2 of the *Biosecurity Act 2014* that are having, or with potential to have, adverse environmental, economic, or social impact in the Isaac region, Nine of the species recorded during survey were identified within the Isaac Regional Biosecurity Plan.

A list of these significant weed species is provided in Table 6.6.

Table 6.6 Declared weed species recorded in the Project Site

Species	Common name	Biosecurity matter	Weeds of National Significance	Isaac Regional Council Biosecurity Plan - Priority Weeds	Source
Bryophyllum daigremontianum x *delagoense*	Mother of Millions Hybrid	Restricted Matter	-	Yes	EcoServe
Cryptostegia grandiflora	Rubber Vine	Restricted Matter	Yes	Yes	EcoServe
Harrisia martinii	Harrisia Cactus	Restricted Matter	-	Yes	AECOM, EcoServe
Hymenachne amplexicaulis	Hymenachne	Restricted Matter	Yes	Yes	EcoServe
Jatropha gossypifolia	Bellyache Bush	Restricted Matter	Yes	Yes	EcoServe
Lantana camara	Lantana	Restricted Matter	Yes	Yes	AECOM, SKM, EcoServe, Wildlife Online
Lantana montevidensis	Creeping Lantana	Restricted Matter	-	-	EcoServe
Opuntia tomentosa	Velvety Prickly Pear	Restricted Matter	Yes	-	SKM, EcoServe, Wildlife Online
Opuntia stricta	Prickly Pear	Restricted Matter	Yes	Yes	SKM, EcoServe, Wildlife Online
Parthenium hysterophorus	Parthenium Weed	Restricted Matter	Yes	Yes	AECOM, SKM, EcoServe, Wildlife Online
Vachellia nilotica	Prickly Acacia	Restricted Matter	Yes	Yes	AECOM



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LEGEND

- Project Site
- Project Footprint
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Watercourse

Threatened ecological community

- Brigalow (Acacia harpophylla dominant and co-dominant)
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin

N

Figure 6-4
Threatened ecological communities ground-truthed within the Project Site

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Kilometres

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6.5 Terrestrial fauna results

6.5.1 Literature review and previous survey results

Essential habitat mapping

The Essential Habitat mapping shows vegetation known to support Essential Habitat values for conservation significant species, or habitat which surrounds records of conservation significant species.

Essential Habitat has been mapped for two species within the Project Site (Ornamental Snake (*Denisonia maculata*) and Squatter Pigeon (Southern) (*Geophaps scripta scripta*)) Figure 6-7. In the north east corner of the Project Site, Essential Habitat for Squatter Pigeon (Southern) (*Geophaps scripta scripta*) has been mapped based on suitable habitat detailed in a previous record for this species (77.62 ha in Project Site and 24.79 ha in Project Footprint). Essential Habitat has also been mapped for Ornamental Snake (*Denisonia maculata*) in *Acacia harpophylla* (Brigalow) with *Casuarina cristata* or *Eucalyptus cambageana* (Dawson Gum) Open Woodlands, regrowth *Acacia harpophylla* (Brigalow) woodland and woodland communities on alluvium (1,985.44 ha in Project Site and 811.01 ha in Project Footprint).

Biodiversity values

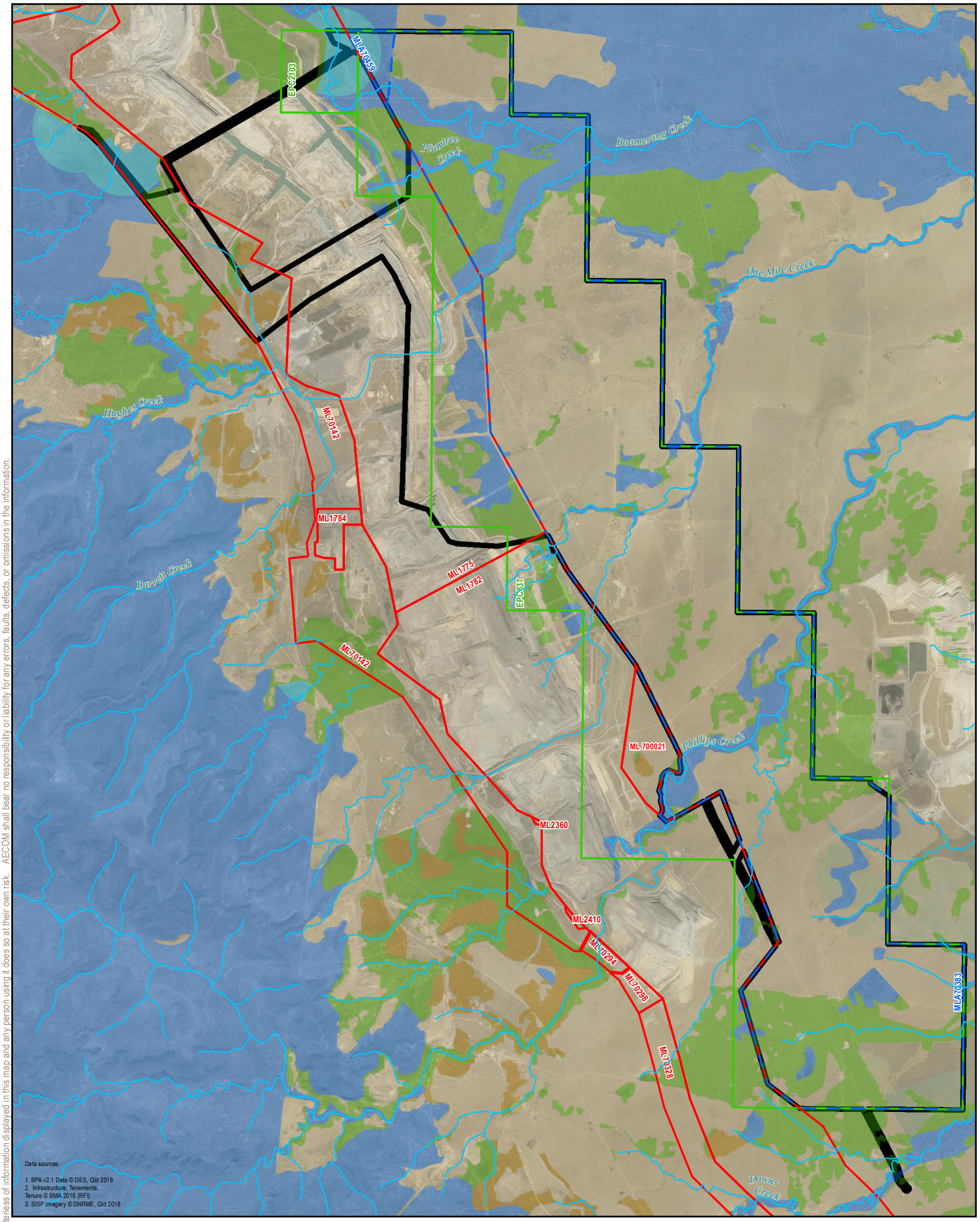
An analysis of the Biodiversity Planning Assessment (BPA) for the Brigalow Belt shows that 692 ha of state significant habitat and 863 ha of regionally significant habitat is present within the Project Footprint. No locally significant habitat is mapped within the Project Footprint (DERM, 2008; DEHP, 2014).

Regional connectivity and biodiversity corridors identified from the BPA within the Project Site are displayed in Figure 6-5.

The Brigalow Belt BPA mapping indicates that the major creek systems within the Project Site (Phillips Creek, Plumtree Creek, Boomerang Creek, Hughes Creek and One Mile Creek) and their associated riparian vegetation contribute to habitat connectivity from west to east on a state level. North east of the Project Site is largely mapped as significant for biodiversity at a state level and several disjunct patches of regional significance for biodiversity are mapped throughout the southern half of the Project Site.

Fauna of conservation significance

Conservation significant fauna species (including migratory species) protected under both State and Commonwealth legislation were identified from the database searches and subsequently targeted during the field surveys. These are provided in **Appendix C-1 Terrestrial Ecology Technical Report**.



LEGEND

- Project Site
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Watercourse

Biodiversity significance

- State Habitat for Endangered, Vulnerable and Near Threatened taxa
- State
- Regional
- Local or Other Values

N

Figure 6-5
Biodiversity planning assessment mapping within the project site

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Kilometres

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6.5.2 Field survey results

Fauna habitats

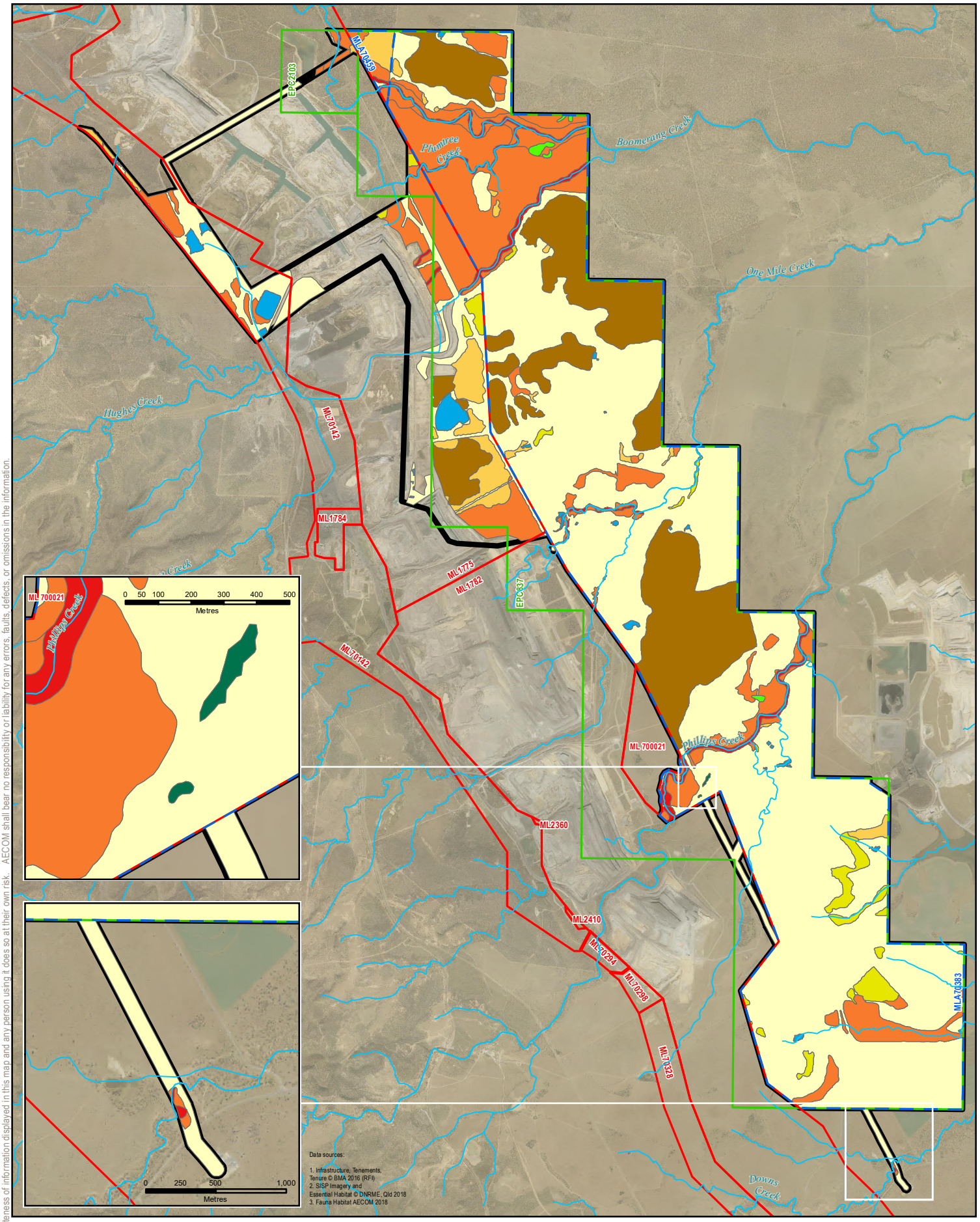
The habitat landscape within the Project Site has been significantly altered from its original state; the majority of the area has been cleared for grazing land and improved pasture. The current habitat landscape comprises cleared grazing land dominated by the exotic grass species *Cenchrus ciliaris* (Buffel Grass) traversed by narrow remnants of riparian woodlands. There are larger patches of remnant woodlands in the northern section of the Project Site, connected to more extensive areas of habitat to the north. Fauna habitat that does persist has been subjected to disturbance from cattle grazing, selective clearing, weeds and pests. This has led to a general lack of native understorey growth in the remnant woodlands. However, thinning has resulted in an accumulation of ground habitats in the form of logs and large branches. Despite signs of habitat degradation, several fauna habitat values exist.

Nine distinct habitat types were recorded within the Project Site (Table 6.7). **Appendix C-1 Terrestrial Ecology Technical Report** provides further details on these communities.

Table 6.7 Fauna habitat types within the Project Site

Habitat type	Habitat summary	Analogous REs	Project Site (ha)	Project Footprint (ha)
1	River Red Gum Riparian Woodland	11.3.25	192.08	79.60
2	Eucalyptus and/or Corymbia Open Woodland	11.3.2, 11.3.4, 11.4.13; 11.5.3	1,876.30	924.91
3	Dawson Gum and Brigalow Woodland	11.4.8	322.16	236.02
4	Brigalow or Belah Woodland	11.3.1, 11.4.9	204.33	39.15
5	Oxbow Wetland	11.3.27b	16.64	11.17
6	Natural Grasslands	11.4.4	1.73	0.075
7	Modified Grasslands	Non-remnant	6,252.43	1,229.62
8	Shrubby Brigalow Regrowth with gilgai	Non-remnant	1,776.14	652.63
9	Dams	Non-remnant	107.66	70.72

Figure 6-6 presents the distribution of the fauna habitat types across the Project Site.



LEGEND

- Project Site
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Watercourse

Fauna habitat types

- River red gum riparian woodland
- Eucalyptus and Corymbia open woodland
- Dawson gum and brigalow woodland
- Brigalow and belah woodland
- Oxbow wetland
- Natural grasslands
- Modified Grasslands
- Shrubby Brigalow Regrowth with Gilgai
- Dams

N

Figure 6-6
Fauna habitat types within the project site

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Kilometres

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Fauna corridors

Riparian corridors associated with Boomerang Creek, Plumtree Creek, Hughes Creek, One Mile Creek, Phillips Creek and Downs Creek provide east–west fauna movement opportunities through the landscape. The functional habitat connectivity in an east to west direction in a regional context is interrupted by the Saraji mine complex directly west of the Project Site. However, to the east and west of the Saraji mine complex, there are opportunities for fauna movement despite the historical clearing of woodland for grazing.

The northern portion of the Project Site also forms part of a large contiguous area of remnant vegetation which provides significant faunal dispersal opportunities to the north and east. The Project Site is bisected by the Lake Vermont Mine Road and railway corridor as well as Golden Mile Road in the southern extent, and movement opportunities for fauna through the landscape north–south are limited. Fauna species richness.

A total of 188 vertebrate fauna species were recorded during the 2007, 2010, 2011, 2016, 2017 and 2020 field surveys, comprising 14 amphibians (including one exotic species), 24 reptiles, 117 birds and 33 mammals (including seven exotic species). These are discussed in detail in **Appendix C-1 Terrestrial Ecology Technical Report.**

Threatened fauna

Seven species listed as threatened under the EPBC Act and/or the NC Act were recorded in the Project Site. These species are listed in Table 6.8. Based on the Likelihood of Occurrence assessment, no additional species were considered as likely to occur within the Project Site.

Essential habitat and conservation significant fauna and flora observed within Project Site are presented in Figure 6-7).

Table 6.8 Listed threatened species recorded within and adjacent to the Project Site

Common name	Scientific name	EPBC Act	NC Act
Ornamental Snake	*Denisonia maculata*	Vulnerable	Vulnerable
Australian Painted Snipe	*Rostratula australis*	Endangered	-
Squatter Pigeon (Southern)	*Geophaps scripta scripta*	Vulnerable	Vulnerable
Grey Falcon	*Falco hypoleucos*	-	Vulnerable
Greater Glider	*Petauroides volans*	Vulnerable	-
Koala	*Phascolarctos cinereus*	Vulnerable	Vulnerable
Short-beaked Echidna	*Tachyglossus aculeatus*	-	Special Least Concern

Ornamental Snake (Denisonia maculata)

The Ornamental Snake (Denisonia maculata) has been recorded in the Project Site on multiple occasions (see records on Figure 6-7):

- in two locations during surveys by AECOM (2020)
- in three locations during surveys by SKM (2012)
- essential Habitat for the species is also mapped in the west of the Project Site which relates to 11 previous records associated with studies conducted for the existing Saraji Mine.

The distribution and number of records available within the Project Site suggests that a viable population of this species is present. The gilgai within the Project Site provides suitable habitat for this species.

Australian Painted Snipe (Rostratula australis)

This species was observed from an area of flooded *Acacia harpophylla* (Brigalow) woodland within the Project Site during SKM surveys in 2007 (Figure 6-7). Potential habitat within the Project Site lacks the required microhabitat features to provide breeding habitat for this species. The species is likely to be a vagrant visitor only and may use wetlands in the Project Site on passage to more suitable breeding or foraging grounds..

Squatter Pigeon (Southern) (Geophaps scripta scripta)

The Squatter Pigeon (Southern) (*Geophaps scripta scripta*) was recorded in the Project Site by SKM (2012) and AECOM (2017) and Essential Habitat for the species has been mapped in the north of Project Site surrounding an existing record (Figure 6-7). This species is expected to occur throughout the Project Site, with preferred, suitable and marginal habitat identified.

Greater Glider (Petauroides volans)

One Greater Glider (*Petauroides volans*) was located in mature *Eucalyptus camaldulensis* (River Red Gum) woodlands fringing Phillips Creek in the south of the Project Site by SKM (2012). Within similar habitat associated with Boomerang Creek and Hughes Creek in the north of the Project Site, another 18 Greater Gliders (*Petauroides volans*) were observed by AECOM in 2020 and one additional individual was also found in *Eucalyptus* and/or *Corymbia* open woodland (RE 11.5.3) (Figure 6-7).

Koala (Phascolarctos cinereus)

A solitary Koala (*Phascolarctos cinereus*) was observed to the north-west of the Project Site within the riparian zone associated with Plumtree Creek by AECOM (2020) and one Koala (*Phascolarctos cinereus*) was recorded from Downs Creek adjacent to the Project Site during previous ecological surveys. An additional record exists from Atlas of Living Australia approximately 4 km west of the Project Site and the species was recorded at Peak Downs Mine East, directly north of the Project Site by AECOM in 2018.

Grey Falcon (Falco hypoleucos)

This species was not confirmed within the Project Site during any of the field surveys. However, in 2005 EcoServe recorded the species on the adjacent Saraji Mine and as such this species is considered likely to occur. Due to the broad definition of suitable habitat for this species, all vegetation within the Project Site is considered to provide some value for the lifecycle requirements of the Grey Falcon (*Falco hypoleucos*).

Short-beaked Echidna (Tachyglossus aculeatus)

The Short-beaked Echidna (*Tachyglossus aculeatus*) has been confirmed within the Project Site. Given the very broad utilisation of habitat by this species, all vegetation within the Project Site is considered to provide potential habitat.

Migratory fauna

The literature review and desktop searches identified fourteen migratory species as potentially occurring in the Project Site. No migratory fauna species listed under the EPBC Act were recorded from the Project Site during AECOM or SKM surveys. However, four species were recorded by EcoServe in 2005 during surveys of the adjacent Saraji Mine. These species are assessed as known occurrences and are listed in Table 6.9.

Table 6.9 Migratory fauna species occurring within or adjacent to the Project Site

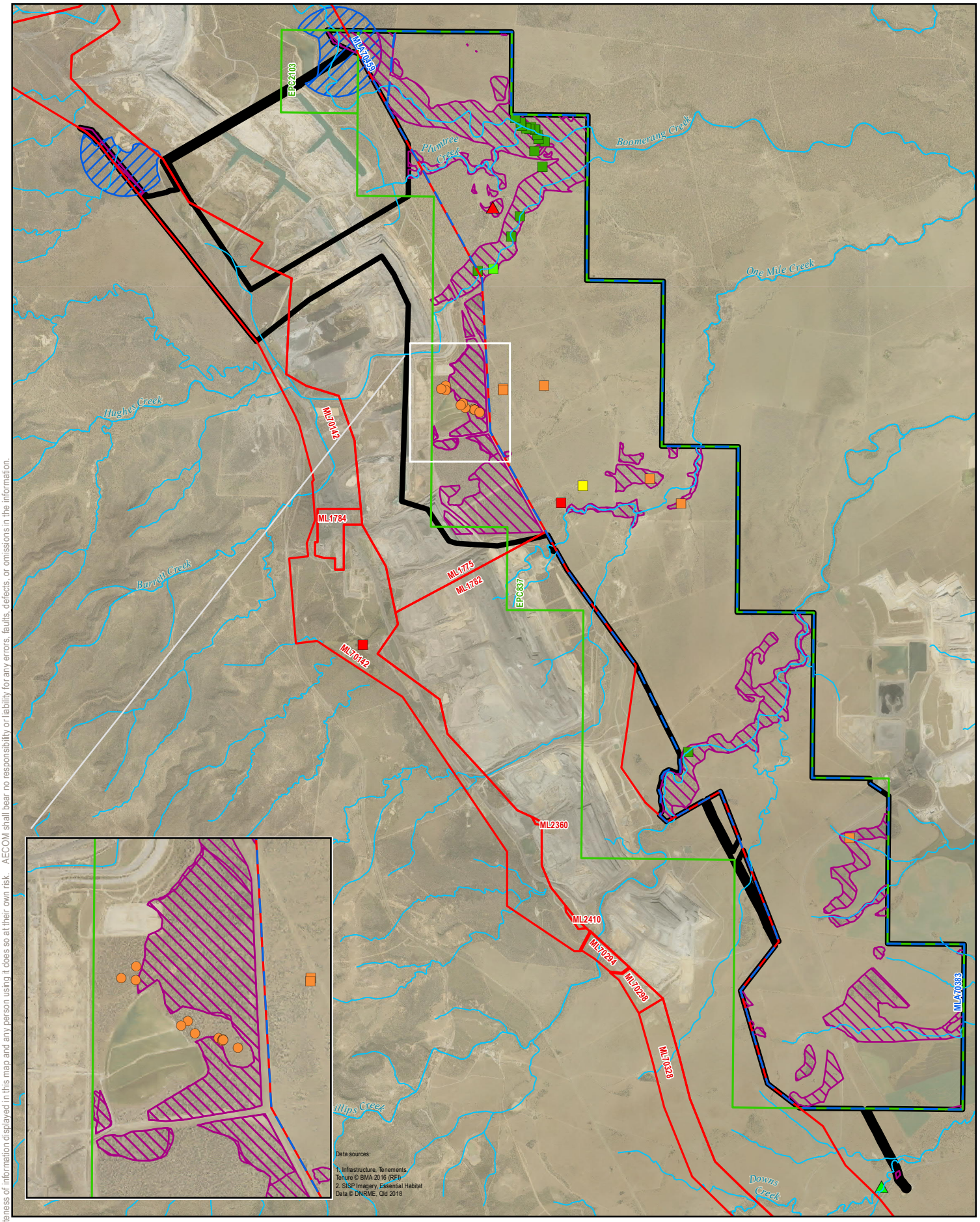
Scientific name	Common name	EPBC Act status	NC Act status	International agreements
Apus pacificus	Fork-tailed Swift	Migratory	Special Least Concern	CAMBA, JAMBA, ROKAMBA
Gallinago hardwickii	Latham's Snipe	Migratory	Special Least Concern	Bonn, JAMBA, ROKAMBA
Hirundapus caudacutus	White-throated Needletail	Migratory	Special Least Concern	CAMBA, JAMBA, ROKAMBA
Hydroprogne caspia	Caspian Tern	Migratory	Special Least Concern	JAMBA

Fork-tailed Swift (Apus pacificus) primarily occurs over inland plains but is known to utilise diverse habitat from coastal foothills, cliffs, beaches, urban areas, riparian woodland, heathland, treeless grassland, spinifex covered sandplains, open farmland, dunes, low scrub, heathland, saltmarsh and tea-tree swamps (DoEE, 2016). The species is found across northern Australia and may use the airspace above wooded areas and open plains within Project Site. They are almost exclusively aerial and do not breed in Australia.

Latham's Snipe (Gallinago hardwickii) uses a variety of freshwater or brackish wetlands, preferring to be close to protective vegetation cover. Small patches of suitable habitat are available within the Project Site in wetlands in the northeast of the Project Site and ponds to the east of Saraji mine.

The White-throated Needletail (Hirundapus caudacutus) is almost exclusively aerial and is known to occur over a variety of habitats. Foraging habitat is at heights of up to cloud level over a variety of habitats. The species may be found in the airspace above all areas within the Project Site.

A pair of Caspian Terns (Hydroprogne caspia) were observed foraging over the evaporation dam on the eastern side of Saraji Mine during SKM surveys in 2007. Suitable habitat for this species within the Project Site includes dams and wetlands.



LEGEND

- Project Site
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Watercourse

Essential Habitat

- Squatter Pigeon
- Ornamental Snake

Threatened Fauna Location

- Squatter Pigeon (SKM 2012)
- Greater Glider (SKM 2012)
- Ornamental Snake (SKM 2012)
- Painted Snipe (SKM 2012)
- Koala (URS 2014)
- Squatter Pigeon (AECOM 2017)
- Greater Glider (AECOM 2020)
- Ornamental snake (AECOM 2020)
- Koala (AECOM 2020)

Threatened Fauna Location (Australian Living Atlas)

- Ornamental Snake

Figure 6-7
Essential Habitat and Observed Conservation Significant Fauna Observed within the Project Site

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Kilometres

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Pest animals

Nine introduced vertebrate fauna species were recorded within the survey area. This included five species considered to be a 'Restricted Matter' under the *Biosecurity Act 2014* and three species noted within Isaac Regional Biosecurity Plan. These species are commonly encountered in central Queensland. These are presented in Table 6.10.

Table 6.10 Pest animals identified within the Project Site

Scientific name	Common name	Biosecurity matter	Isaac Regional Council Biosecurity Plan - Priority Weeds	Source
Bos taurus	Cattle	-	-	AECOM, SKM, EcoServe, Wildlife Online
Canis lupus dingo/ familiaris	Wild Dog	Restricted Matter	Yes	EcoServe
Felis catus	Feral Cat	Restricted Matter	Yes	EcoServe
Lepus europaeus	European Hare	-	-	EcoServe
Mus musculus	House Mouse	-	-	EcoServe
Oryctolagus cuniculus	European Rabbit	Restricted Matter	-	AECOM, EcoServe
Bufo marinus	Cane Toad	-	-	AECOM, SKM, EcoServe, Wildlife Online
Sus scrofa	Pig	Restricted Matter	Yes	AECOM, EcoServe
Vulpes vulpes	Fox	Restricted Matter	-	AECOM

6.6 MNES

A detailed review of MNES occurring within the Project Site is provided as a standalone chapter in this EIS (**Chapter 21 – MNES**).

6.7 MSES

Matters of State Environmental Significance (MSES) include certain environmental values that are protected under Queensland legislation including:

- NC Act
- *Marine Parks Act 2004*
- *Fisheries Act 1994*
- EP Act
- *Regional Interests Planning Act 2014*
- VM Act
- EO Act.

MSES values affected by the Project are presented below in Table 6.11.

Table 6.11 MSES values within the Project Footprint

MSES	Description	Present in the Project Footprint
Regulated vegetation (Endangered / Of Concern REs)	Regional ecosystems which: • are listed in schedule 1 of the Vegetation Management Regulation 2012 • are listed in schedule 1 of the Vegetation Management Regulation 2012 • occur within a Category B area on the regulated vegetation management map • fit the description for the regional ecosystem contained in the Regional Ecosystem Description Database	**Yes** Regulated vegetation (Endangered and Of Concern REs) as per the MSES description occurs within the Project Site (313.29 ha)
Regulated vegetation (within the defined distance of a watercourse)	Regional ecosystems which: • occur within a Category B area on the regulated vegetation management map; and • intersect or occur within a wetland area as identified on the vegetation management wetlands map. • are located within the defined distance from the defining banks of a relevant watercourse or relevant drainage feature (being those that are identified on the vegetation management watercourse and drainage feature map).	**Yes** Regulated vegetation (intersecting a watercourse) as per the MSES description occurs within the Project Site (88.69 ha)
Regulated Vegetation (within a Vegetation Management Wetland Area)	Regional ecosystems which: • are mapped as a Category B area on the regulated vegetation management map; and • identified as a wetland on the vegetation management wetlands map	**Yes** Wetlands as per the MSES description are mapped in the north of the Project Site, associated with RE 11.3.27b, RE 11.3.2 and RE 11.5.3
Wetland and Watercourses	Means an area shown as a wetland: • in a wetland protection area; or • of high ecological significance on the Map of Referrable Wetlands • or watercourse in high ecological value waters (as defined under the Environmental Protection (Water and Wetland Biodiversity) Policy 2019, schedule 2	**No** No wetland or watercourse protection areas occur within the Project Site
Connectivity areas	Areas which consist of vegetation mapped as prescribed regional ecosystem that: are of sufficient size or configured in a way that maintains ecosystem functioning; and will remain despite a threatening process within the meaning of the Nature Conservation Act 1999.	**Yes** Connectivity areas occur within the Project Site as per the MSES description

MSES	Description	Present in the Project Footprint
Protected wildlife habitat	Protected wildlife habitat includes: • an area of essential habitat on the essential habitat map for an animal or plant that is endangered or vulnerable wildlife • a high-risk area on the flora survey trigger map which also contains endangered, vulnerable or near threatened (EVNT) plant species • an area which contains EVNT plants and is not shown on the flora survey trigger map • an area of habitat (e.g. foraging, roosting, nesting or breeding habitat) for an animal that is endangered, vulnerable or a special least concern animal	**Yes** Habitat for state listed species occurs within the Project Site, including: • Koala (*Phascolarctos cinereus*) (1,218.99 ha potential habitat) • Ornamental Snake (*Denisonia maculata*) (including Essential Habitat) (925.73 ha potential habitat) • Greater Glider (*Petauroides volans*) (806.67 ha) • Squatter Pigeon (*Geophaps scripta scripta*) (including Essential Habitat) (1,951.12 ha potential habitat) • Australian Painted Snipe (*Rostratula australis*) (750.14 ha potential habitat) • Grey Falcon (*Falco hypoleucos*) (2,132.17 ha potential habitat) • Short-beaked Echidna (*Tachyglossus aculeata*) (2,132.17 ha potential habitat) Estimated areas for protected fauna have been undertaken through habitat mapping where applicable.
Protected areas	This relates to protected areas as declared under the NC Act, including: • National parks • National parks (Aboriginal land) • National parks (Torres Strait Islander land) • National parks (Cape York Peninsula Aboriginal land) • Regional parks • Nature refuges	**No.** No protected areas as per the MSES definition are present within the Project Site.
Fish Habitat Areas and Highly Protected Zones of State marine parks	An area declared under the *Fisheries Act 1994* to be a fish habitat area.	**No** No state marine parks or fish habitat areas occur within the Project Site.
Waterway providing for fish passage	Any part of a waterway providing for passage of fish if the construction, installation or modification of waterway barrier works carried out under an authority will limit the passage of fish along the waterway.	**Yes** Waterways which provide for fish passage are present within the Project Site. The detailed design of the Project will determine if construction, installation or modification of waterway barrier works within these waterways will limit the passage of fish.

MSES	Description	Present in the Project Footprint
Marine plants	A marine plant within the meaning of the *Fisheries Act 1994.*	**No** Marine plants do not occur within the Project Site.
Legally secured offset area under State legislation	An offset area approved by the administering authority associated with a legislative or policy requirement for the provision of an offset.	**No** No legally secured offset areas are present within the Project Site.

6.8 Environmentally Sensitive Areas

This section of the chapter describes the ESAs present within the Project Site and surrounding region. ESAs include national parks, state forests, world heritage areas, Ramsar wetlands and nationally important wetlands. In addition, they feature areas of elevated natural and cultural value such as habitat for conservation significant flora and fauna and places of Aboriginal and European cultural heritage.

6.8.1 Category A ESAs

Category A ESAs, as defined by the EP Regulation, are displayed in Table 6.12. The occurrence of these areas in relation to the Project Site is described below. In Queensland, mining activities may not be undertaken in land comprising Category A ESAs.

Geographic information system (GIS) interpretation was undertaken to determine if Category A ESAs exist within or in proximity to the Project Site. Results determined no Category A ESAs occur in the Project Site. Refer to Figure 6-8 for ESAs mapped within the vicinity of the Project Site.

Table 6.12 Category A ESAs

ESA Category A	Description and legislative context	Occurrence relative to Project Site
National park	National parks are declared under the NC Act.	Four national parks within 100 km of the Project Site: • Homevale National Park • Junee National Park • Mazeppa National Park • Peak Range National Park
Forest reserves and conservation parks	Conservation parks, as listed under the Nature Conservation (Protected Areas) Regulation 1994 and forest reserves are protected areas under the NC Act.	The Homevale Conservation Park is situated approximately 95 km north east of the Project Site.
Wet Tropics World Heritage Area	The Wet Tropics World Heritage Area is declared under the *Wet Tropics World Heritage P*rotection and Management Act 1993 and is administered by the Wet Tropics Management Authority.	The Wet Tropics World Heritage Area is located approximately 400 km north-east of the Project Site.
Great Barrier Reef Marine Park and other marine parks (other than general use zones)	The Great Barrier Reef Marine Park (GBRMP) is declared under the *Great Barrier Reef Marine Park Act 1975*.	The Project is situated approximately 130 km directly west of the GBRMP. However, the Project is situated within the Fitzroy Catchment which discharges into the GBRMP, approximately 490 km downstream of the Project Site.

6.8.2 Category B ESAs

Category B ESAs are defined in the EP Regulation and are presented in Table 6.13. The occurrence of these areas in relation to the Project Site is described below. GIS interpretation was undertaken to determine if the above ESAs are situated within or in proximity to the Project Site. The results of this interpretation are provided in Table 6.13. In Queensland, mining activities can be undertaken in Category B ESAs. Refer to Figure 6-8 for Category B ESAs located within and in the vicinity of the Project Site.

Table 6.13 Category B ESAs

ESA Category B	Description and legislative context	Occurrence relative to Project Site
Endangered regional ecosystem	Regional ecosystems are protected under the VM Act.	Three endangered regional ecosystems (EREs) are mapped by the Department of Environment and Science (DES) as occurring within the Project Site. AECOM field surveys identified these three EREs during field surveys of the Project Site (total of 526.49 ha). The locality of these EREs is depicted in Figure 6-3 and Figure 6-8.
Coordinated conservation areas and wilderness areas	Coordinated conservation areas and wilderness areas as declared under the NC Act are Category B protected areas.	There are no coordinated conservation areas or wilderness areas within the Project Site or the greater region.
Ramsar wetlands	The Convention on Wetlands, signed in Ramsar, Iran, in 1971, is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. Ramsar wetlands are those that are representative, rare or unique wetlands, or are important for conserving biological diversity (DotE, 2016).	There are no wetlands declared under the Ramsar Convention within the Project Site. The nearest Ramsar wetland (Shoalwater and Corio bays) is approximately 220 km south east of the Project Site. The Shoalwater and Corio bays occur within a separate catchment (Shoalwater and Waterpark Basin) to the Project.
World heritage and international agreement areas	World heritage is the designation for places on earth that are of outstanding universal value to humanity and, as such, have been inscribed on the World Heritage List (UNESCO 2011). International agreement areas include areas such as internationally significant sites for migratory shorebirds.	As detailed above, the Project occurs within the Fitzroy Basin which discharges into the Great Barrier Reef World Heritage Area (GBRWHA), approximately 490 km adopted middle thread distance downstream of the Project Site.
General use zones of a marine park	General use zones of a marine park are declared under the *Marine Parks Act 2004*.	The Project occurs within the Fitzroy Basin which discharges into the GBRWHA. The GBRWHA borders a general use zone of the GBRMP.
Places of cultural heritage significance	Places of cultural heritage significance are protected by the *Queensland Heritage Act 1992* and listed on the heritage register. Aboriginal and Torres Strait Islander cultural heritage is protected under the *Aboriginal Cultural Heritage Act 2003* (ACH Act) and the *Torres Strait Islander Cultural Heritage Act 2003*.	Refer to **Chapter 16 Cultural Heritage** for a discussion on cultural heritage values within and surrounding the Project Site.

ESA Category B	Description and legislative context	Occurrence relative to Project Site
Special forestry areas	Special forestry areas, including state plantation forests, state forests (scientific) and state parks, are declared under the *Forestry Act 1959*, and are administered by DES.	There are no special forestry areas within the Project Site or the surrounding area.
Fish habitat area and marine plants	A declared fish habitat area (FHA) is an area protected against physical disturbance from coastal development (DAFF, 2012). All marine plants are protected under Queensland law through provisions of the *Fisheries Act 1994*.	No declared FHAs are situated within 100 km of the Project Site. The Fitzroy River FHA extends along the Fitzroy River from the Fitzroy Barrage at Rockhampton to the coast; however, this FHA is considered sufficiently far enough downstream to not be affected by the proposed project. There are no marine plants within a 100 km radius of the Project Site.
Critical habitat	Critical habitat is habitat that is essential for the conservation of a viable population of protected wildlife or community of native wildlife, whether or not special management considerations and protection are required. Critical habitat may include an area of land that is considered essential for the conservation of protected wildlife, even though the area is not presently occupied by the wildlife (NC Act)	There are no declared critical habitats within or surrounding the Project Site.
An area to the seaward side of the highest astronomical tide	Areas that face the seaward side of the highest astronomical tide are a Category B protected area.	No areas within the Project Site meet this criterion.

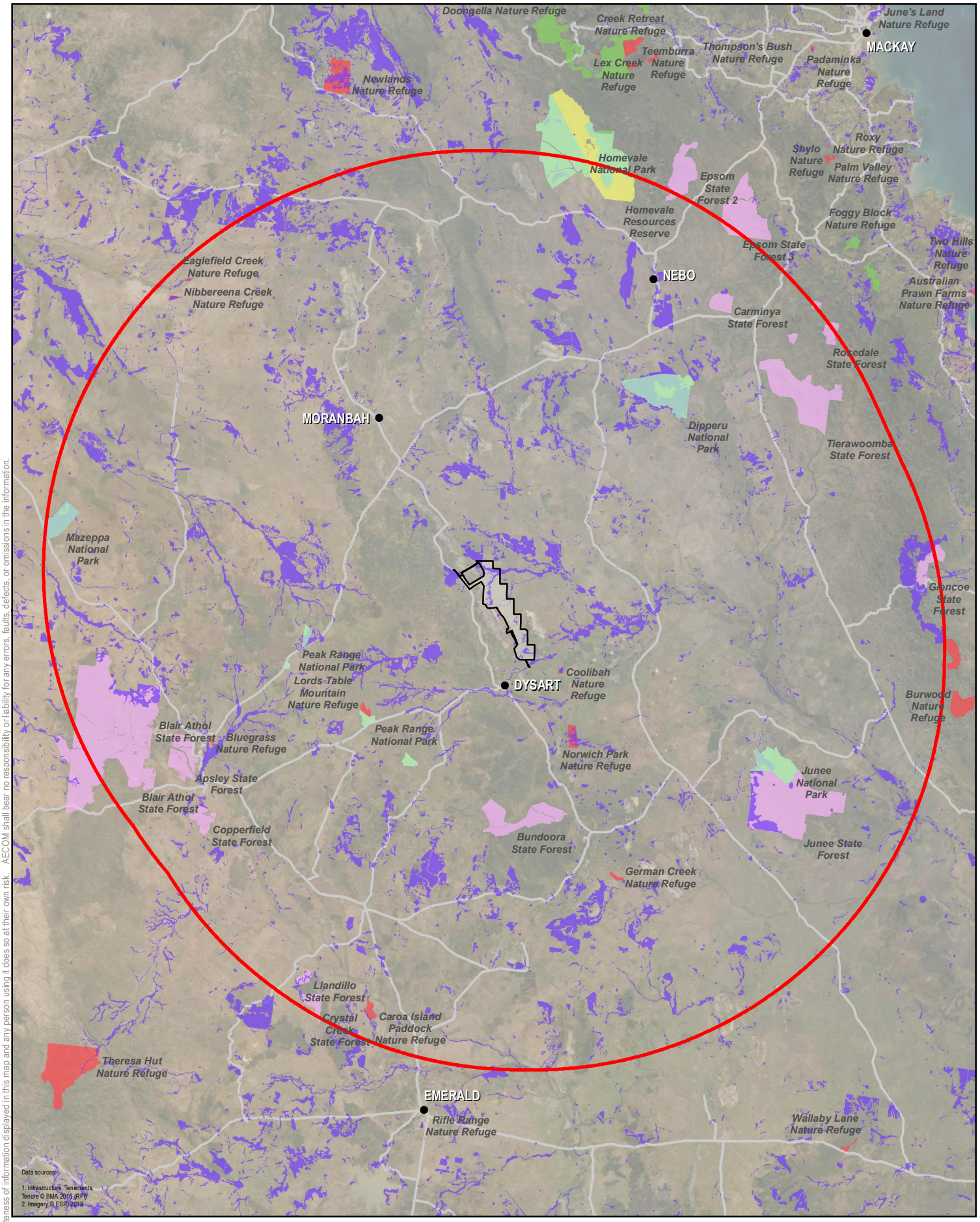
6.8.3 Category C ESAs

Category C ESAs are defined in the DEHP (now DES) document Eligibility criteria and standard conditions for exploration and mineral development projects– Version 2 (DEHP, 2016a) (Table 6.14). No Category C ESAs were identified within the Project Site. In Queensland, mining activities can be undertaken in Category C ESAs.

Table 6.14 Category C ESAs

ESA Category C	Description and legislative context	Occurrence relative to Project Site
Nature refuges and resource reserves	A nature refuge is a voluntary agreement between a landholder and the Queensland Government that acknowledges a commitment to manage and preserve land with significant conservation values while allowing compatible and sustainable land uses to continue (DEHP, 2017c). A resource reserve is an area of land dedicated under the NC Act, and is administered by DES.	There are no nature refuges or resource reserves within the Project Site. Nine nature refuges and one resource reserve exist within 100 km of the Project Site. The Homevale Resource Reserve is situated approximately 95 km from the Project Site.
State forests	State forests are declared under the *Forestry Act 1959* and administered by DES	There are no state forests within the Project Site. Thirteen state forests are situated within 100 km of the Project Site.

ESA Category C	Description and legislative context	Occurrence relative to Project Site
Declared catchment and irrigation areas	Areas of land that immediately surround water storage areas are termed 'declared catchments. Certain types of development proposed within declared catchment areas are referred to DES during the integrated development assessment system (IDAS) process to ensure the quality of water entering the storage facility is not degraded by proposed development	Within Queensland there are 20 declared catchment areas administered by DES, none of which are situated within 100 km of the Project Site. There are no declared irrigation areas within the Project Site or downstream of the Project. There are no declared drainage areas within the Project Site.
River improvement areas	River improvement areas (RIA) are areas protected under the *River Improvement Trust Act 1940*.	There are no RIAs within the Project Site.
Designated landscape area – Stanbroke Pastoral Holding	Under the repealed *Cultural Record (Landscapes Queensland and Queensland Estate) Act 1987*, an area was declared a 'designated landscape area' (DLA) if it was deemed necessary or desirable for it to be preserved or to regulate access. DLAs are recorded in accordance with the ACH Act.	The Stanbroke Pastoral Holding designated landscape area does not occur within the Project Site. It is located approximately 60 km to the south of Mount Isa.
Timber reserves	A timber reserve is land set apart and declared or deemed to be set apart and declared under the *Forestry Act 1959* as a timber reserve.	There are no timber reserves in or within 100 km of the Project Site.
Critical areas and public purpose reserves	Critical areas and public purpose reserves are legislated under the *Land Act 1994* and administered by the DNRME.	No critical areas and public purpose reserves were mapped within the Project Site or surrounding region.
Coastal management districts	Coastal management districts occur over all tidal waters and on most land adjacent to tidal waters in Queensland. Coastal management districts are declared under the *Coastal Protection and Management Act 1995*.	There are no coastal management districts within 100 km of the Project Site.
Erosion prone areas	Erosion prone areas are declared under the *Beach Protection Act 1968*.	There are no erosion prone areas within 100 km of the Project Site.
Dams and weirs	Dams and weirs owned and controlled by the Queensland Government are considered Category C ESAs.	There are no dams or weirs controlled by the Queensland Government within the Project Site or the surrounding region.



LEGEND

- Locality
- Major Road
- Project Site
- 100km Project Area

Category A
- National Park
- Conservation Park
- Forest Reserve

Category B ESA
- Endangered Regional Ecosystem (Biodiversity Status)
- Queensland Heritage Register Place

Category C ESA
- Nature Refuge
- Resource Reserve
- State Forest

N

Figure 6-8
Environmentally Sensitive Areas

Environmental Impact Statement
Saraji East Mining Lease Project

0 5 10 20
Kilometres

Scale: 1:1,200,000 (when printed at A4)

Projection: Map Grid of Australia - Zone 55 (GDA94)

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6.9 Potential impacts on terrestrial ecology

6.9.1 Construction phase

Facilities and infrastructure associated with the Project includes the MIA, CHPP, water management infrastructure, roads, the IMG drainage network, as well as water and power supply to the Project Site. The construction of this infrastructure will occur in three stages:

- site preparation
- civil works including water storage and transport network and powerlines/connections
- MIA building and CHPP construction.

To manage and facilitate the construction of Project infrastructure, temporary facilities, including offices, will be constructed close to the work centres such as the MIA. The facilities will be located within the Project Footprint which may include previously disturbed areas.

The Project Site covers approximately 11,427 ha, within which 2,613 ha of remnant and 8,136 ha non-remnant vegetation exists. Of this, 1,291 ha of remnant and 1,953 ha of non-remnant vegetation falls within the Project Footprint and may be disturbed. Eight of the nine fauna habitat types which were identified in Section 6.5, and nine of the ten REs identified in Section 6.4.2, may be impacted by the Project. The potential impacts on terrestrial biodiversity are quantified in Table 6.16 and delineated in Figure 6-10. This includes disturbances from all Project components, including:

- surface facilities and ancillary infrastructure (construction village, Coal Handling and Preparation Plant (CHPP), ROM pad, MIA, process water dam, raw water dam, proposed product stockpiles, conveyor, 66 kV powerline connection, transport and infrastructure corridor)
- incidental mine gas (IMG) drainage network.

6.9.1.1 Potential direct impacts (construction phase)

Flora and vegetation communities

The total worst-case disturbance area from surface facilities, ancillary infrastructure and IMG drainage is 1,071.37 ha. This area comprises 179.98 ha of remnant vegetation. Table 6.15 below presents the breakdown of the potential direct impacts to vegetation communities and habitat types. Disturbance to each vegetation community is indicated as a percentage of the community found within the Isaac Comet Downs sub-region of the Brigalow Belt Bioregion. It should be noted that the disturbance calculations incorporate an additional buffer of between 50-100 m around the Project Footprint; therefore, the calculations provide a conservative estimate of proposed disturbance. The areas provided in Table 6.15 are considered a worst-case scenario.

Impacts on vegetation and habitat will occur throughout the life of the Project. On commencement of construction, areas required for the proposed infrastructure will be cleared. The IMG drainage infrastructure will be installed as early as possible to allow adequate time to drain gas prior to mining. This is discussed further in **Chapter 3 Project Description** of this EIS. As the footprints of these facilities will be fully developed, 100% of vegetation will be cleared from these areas except the powerline connection where clearing will only be required for towers and a narrow easement.

Surface facilities and ancillary infrastructure

The Project Footprint intersects seven REs, three of which are listed as least concern, two of concern and three endangered under the VM Act. These endangered REs, RE 11.3.1 and RE 11.4.8, are also analogous with the *Acacia harpophylla* (dominant and co-dominant) TEC. The proposed construction village has been located in non-remnant vegetation to reduce impact on REs. Vegetation communities in these areas are low (approximately 1 m in height) *Acacia harpophylla* (Brigalow) regrowth.

The CHPP, conveyors, product stockpiles are located within the existing Saraji Mine area and, while vegetation clearing is required, this vegetation is partly disturbed and fragmented. The future MIA and the raw water dam are in a highly disturbed area within the Saraji Mine area and will not require removal of remnant vegetation.

It is likely that clearing impacts associated with the powerline connection and the transport and infrastructure corridor will be lower than estimated for the maximised footprint. Clearing for the powerline connection will only be required for footings and a narrow easement and as such high value biodiversity values within the powerline connection footprint will be avoided or impacts minimised. The width of the infrastructure corridor is also expected to reduce during the detailed design process.

IMG drainage network

The IMG drainage network will disturb remnant vegetation across seven REs, three with endangered status and one of concern status under the VM Act. The endangered RE 11.4.8 and analogous TEC will experience some clearing for the network, however, most of the infrastructure is situated within modified grassland, shrubby brigalow and *Eucalyptus populnea* (Poplar Box) woodland.

Of the endangered REs, also listed as endangered under the EPBC Act as their analogous TEC, *Brigalow (Acacia harpophylla dominant and co-dominant)*, approximately 43.14 ha will be cleared. In terms of total area of remnant Brigalow (*Acacia harpophylla*) vegetation cleared, the largest affected area is of RE 11.4.8, of which 41.02 ha will be cleared. In a regional context, approximately 1.2% of the subregional extent of RE 11.4.8 will be cleared for the Project (Table 6.15).

In addition to reduction in extent of TECs, disturbance to the riparian communities which border Boomerang Creek, Hughes Creek and Plumtree Creek must also be considered. Vegetation communities associated with these creeks include *Eucalyptus* and/or *Corymbia* woodlands on alluvial plains (RE 11.3.2, RE 11.3.25, RE 11.3.4 and RE 11.3.27b). These REs form a west-east corridor within the Project Site. This corridor is recognised as significant at the State level under the Biodiversity Planning Assessment for the Brigalow Belt.

While design of the layout of the IMG drainage infrastructure has not yet been finalised, it is intended to restrict the number of times that the infrastructure crosses these creeks to minimise direct disturbance to this corridor. Some pipeline crossings will be required, and these will be trenched crossings, with disturbed areas reinstated to stabilise the river bed and banks. Wherever possible, the wells required for IMG drainage will be installed outside of the riparian zone. With these design measures in place, riparian vegetation connectivity will largely be retained along these creek systems during this phase of the Project.

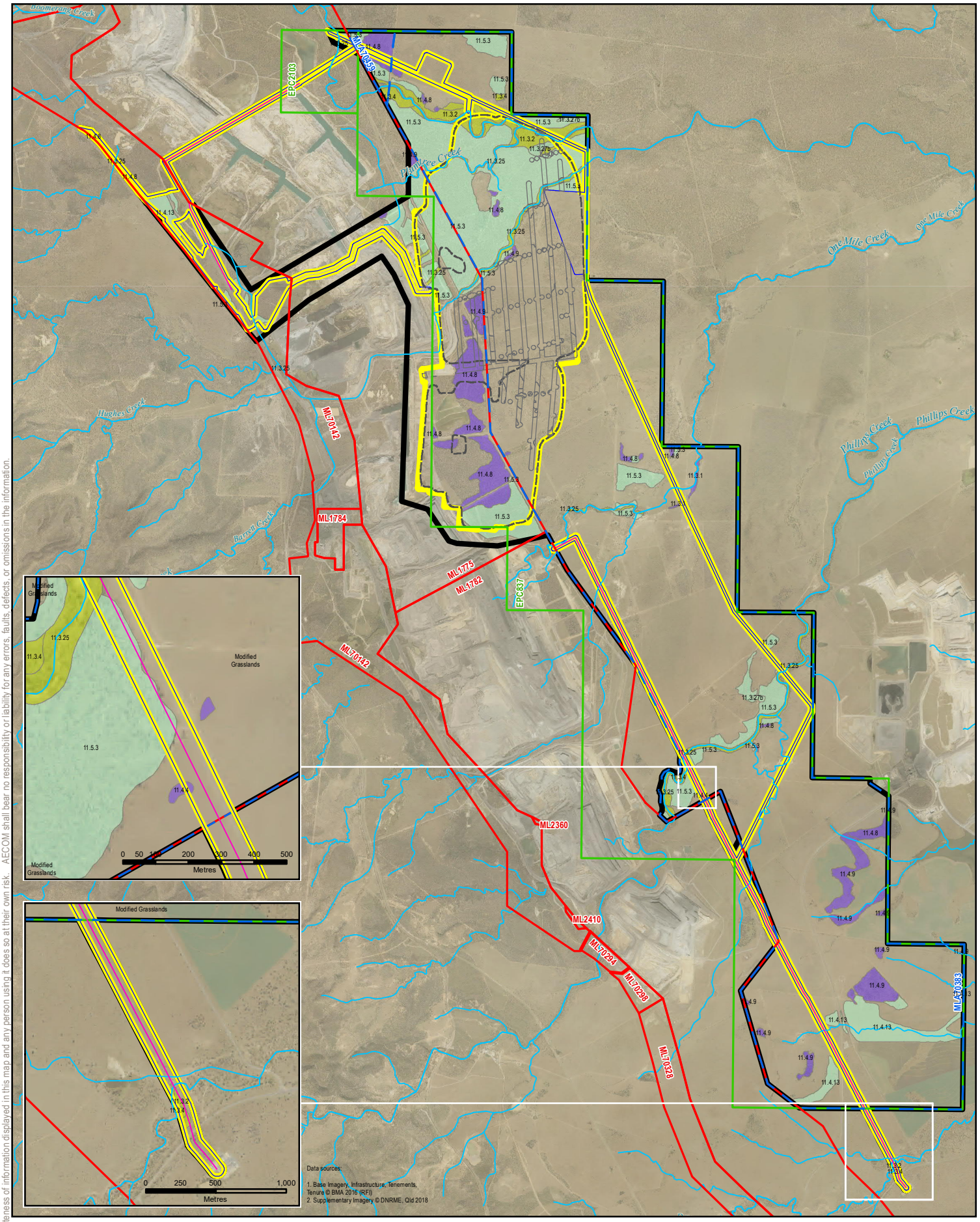
The gas drainage network will be constructed in a grid like pattern. As a result, vegetation will still occur in patches between the gas drainage infrastructure. While patches of vegetation communities including TECs and REs will be retained within the grid formed by the IMG management infrastructure, these patches will be isolated and fragmented and may not contribute significantly to the conservation of these vegetation communities at a local or regional level.

Indirect impacts such as dust from gas management infrastructure construction activities may result in the degradation of vegetation adjacent to works. These impacts are also discussed below.

Table 6.15 Potential disturbance to REs

RE	Status			Project areas (ha)				Total extent within subregion	Total direct impacts	
	EPBC	Biodiv	VMA	Project Site	Project Footprint	Surface facilities	IMG drainage network		Total impact Area (ha)	% of subregion
RE 11.3.1	E	E	E	15.76	6.58	0.45	1.51	22,355	1.96	0.0
RE 11.3.2	-	OC	OC	151.15	73.33	16.43	2.70	37,797	19.13	0.2
RE 11.3.4	-	OC	OC	23.05	0.01	0.01	-	9,062	0.01	0.0
RE 11.3.25	-	OC	LC	192.08	79.60	6.50	5.41	47,044	11.91	0.2
RE 11.3.27b	-	OC	LC	16.64	11.17	-	3.05	976	3.05	1.1
RE 11.4.4	E	OC	LC	1.73	0.08	0.08	-	1,931	0.08	0.0
RE 11.4.8	E	E	E	322.16	236.02	24.13	16.89	20,023	41.02	1.4
RE 11.4.9	E	E	E	188.57	32.57	-	6.66	23,782	6.66	0.1
RE 11.4.13	-	OC	LC	222.06	37.94	37.94	-	4,863	37.94	0.8
RE 11.5.3	-	NCP	LC	1,480.04	813.63	34.72	23.50	71,713	58.22	1.1
Non – remnant	-	-	-	8,136.23	1,952.97	602.23	289.16	NA	891.39	NA
Total				**10,749.47**	**3,244.0**	**722.49**	**348.88**	**NA**	**1,071.37**	**348.88**

Note: E: Endangered; OC: Of Concern; LC: Least Concern; NCP: No Concern at Present



LEGEND

- Project Site
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Limit Of Subsidence
- IMG Drainage Network
- Surface Facilities and Ancilliary Infrastructure
- 66kV Powerline
- Watercourse

Biodiversity Status Regional Ecosystems

- Endangered
- Of Concern
- Not of Concern

N

Figure 6-9
Potential Impacts on Vegetation Communities and Flora

Environmental Impact Statement
Saraji East Mining Lease Project

0 0.5 1 2
Kilometres

Scale: 1:110,000 (when printed at A4)

Projection: Map Grid of Australia - Zone 55 (GDA94)

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Fauna

Surface facilities and ancillary infrastructure

Clearing for the proposed infrastructure will have direct impacts on fauna and fauna habitat during vegetation clearing activities. Habitat types will be impacted include *Eucalyptus* and/or *Corymbia* Open Woodland, Brigalow or Belah Woodland, River Red Gum Riparian Woodland, Dawson Gum and Brigalow Woodland, modified grasslands and shrubby Brigalow regrowth with gilgai (see Figure 6-10). The locations for the proposed construction village and proposed operations village have been situated where no remnant vegetation is mapped. However, the area does provide suitable habitat for Ornamental Snake (*Denisonia maculata*) with gilgai and cracking clay present in both areas. Ground timber, another microhabitat feature which is associated with the occurrence of this species, was absent from these locations. The species is less likely to occur in the proposed operations village area as it is fragmented from remnant vegetation.

The proposed transport and infrastructure corridor may cause some severance of fauna dispersal opportunities. The road alignment passes largely through modified grassland habitat however the alignment will bisect a large patch of *Eucalyptus populnea* (Poplar Box) woodland and will require crossings over Boomerang Creek, Hughes Creek, Plumtree Creek, Spring Creek and Phillips Creek. The riparian communities surrounding these creek crossings have a comparatively high faunal diversity. Clearing of these areas will reduce fauna dispersal as well as food and roosting/nesting resources associated with this corridor. Given the width of the proposed clearing, the impact on fauna from the construction of the transport and infrastructure corridor is likely to be minimal.

The proposed infrastructure to the west of the Saraji Mine including the CHPP, MIA, conveyor, ROM pad, stock piles and dams are located close to existing mining areas and while there is some remnant vegetation in the footprints of these facilities, this vegetation has limited connectivity and habitat value. Clearing associated with these facilities is not likely to have significant impacts on fauna species utilising the Project Site.

Essential Habitat for Squatter Pigeon (Southern) (*Geophaps scripta scripta*) exists in the north of the Project Site which will be intersected by the proposed rail loading balloon loop and the transport and infrastructure corridor. This is discussed further below.

The potential disturbance (worst case scenario) to fauna habitat types is provided in Table 6.16 and Figure 6-10.

IMG drainage network

Impacts on fauna from the installation and operation of the IMG drainage infrastructure have the potential to occur from:

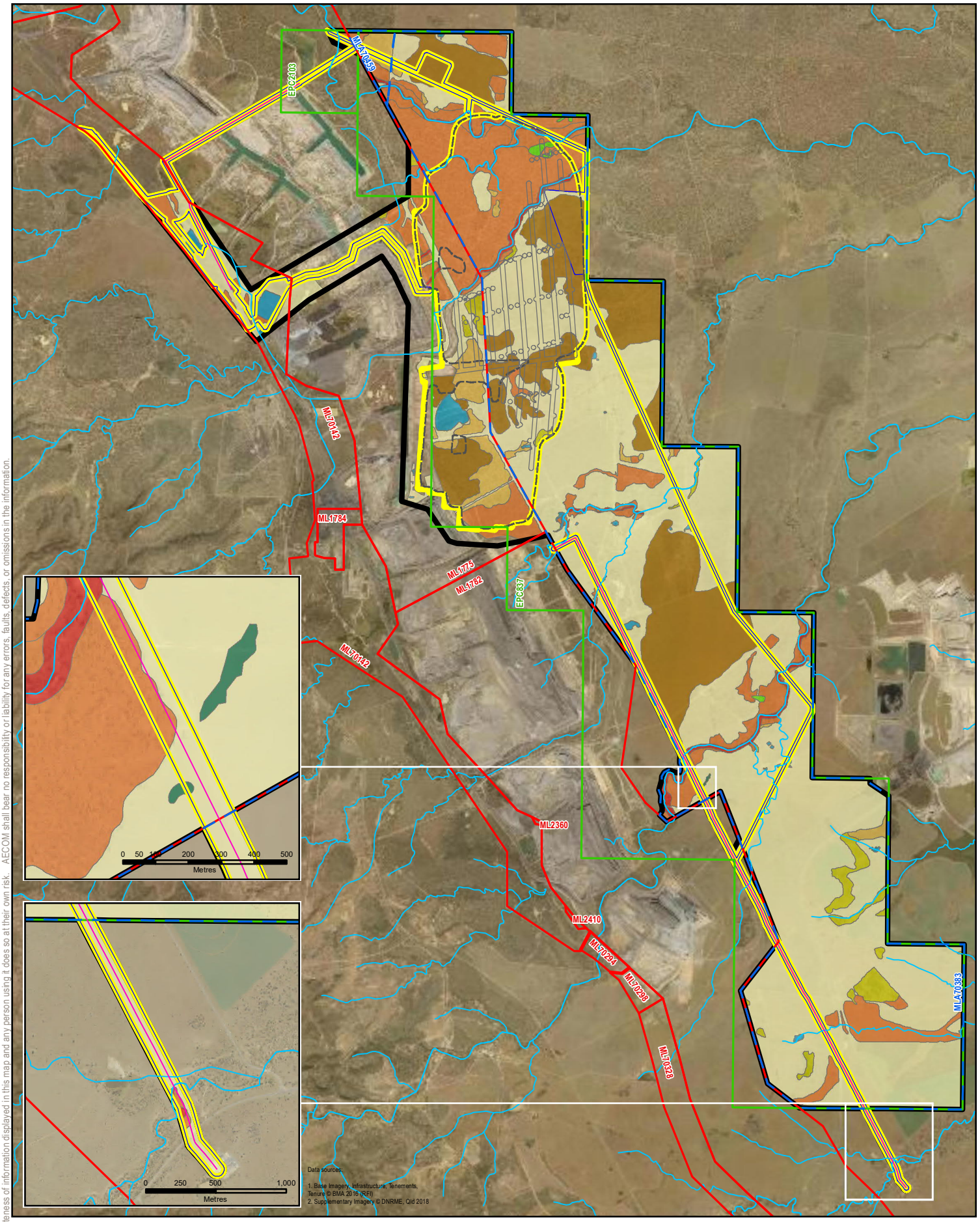
- loss of habitat from direct clearing of vegetation, including habitat trees, which will restrict the ability of fauna to move across the Project Site
- injury or mortality to fauna present during vegetation clearing activities.

The impacts on fauna are based on the area of vegetation cleared once the construction of the IMG drainage network is completed. However, construction of the gas drainage network will be undertaken progressively, such that loss of habitat values will be gradual and there will be opportunities for fauna to move into adjacent habitat or into areas that will have already undergone partial rehabilitation. Suitable habitat is available to the north and east of the proposed mining footprint. Competition for resources and territory within these new areas may affect some species; however, most species present on site are relatively resilient and do not have highly specific habitat preferences. Additionally, an increase in predation may occur as a result of dispersing. Many of the fauna species observed within the Project Site are relatively tolerant to disturbed habitats and may continue to utilise remaining habitat with fragmentation and noise, light and activity disturbance. As installation of the IMG infrastructure progresses, food and shelter resources will be diminished and density of fauna in the area may also diminish.

Potential impacts on each habitat type across the Project Site are detailed in **Appendix C-1 Terrestrial Ecology Technical Report**.

Table 6.16 Potential disturbance to fauna habitat types

Fauna Habitat Type	RE associations	Project Site (ha)	Project Footprint (ha)	Surface Facilities (ha)	IMG drainage network (ha)	TOTAL disturbance surface facility and IMG drainage network (ha)
River Red Gum Riparian Woodland	RE11.3.25	192.08	79.60	6.50	5.41	11.91
Eucalypts and/or *Corymbia* Open Woodland	RE11.3.2, RE11.3.4, RE11.4.13, RE11.5.3	1,876.30	924.91	89.10	26.20	115.30
Dawson Gum and Brigalow Woodland	RE11.4.8	322.16	236.02	24.13	16.89	41.02
Brigalow or Belah Woodland	RE11.3.1, RE11.4.9	204.33	39.15	0.45	8.17	8.62
Oxbow Wetland	RE11.3.27b	16.64	11.17	0	3.05	3.05
Natural Grasslands	RE11.4.4	1.73	0.08	0.08	0	0.08
Modified Grasslands	NA	6,252.43	1,229.62	383.25	193.75	577.0
Shrubby Brigalow regrowth with gilgai	NA	1,776.14	652.63	188.82	95.21	234.03
Dams	NA	107.66	70.72	30.16	0.20	30.36
Total		**10,749.6**	**3,243.90**	**722.49**	**348.88**	**1,071.37**



LEGEND

- Project Site
- Project Footprint
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Limit Of Subsidence
- IMG Drainage Network
- Surface Facilities and Ancilliary Infrastructure
- 66kV Powerline
- Watercourse

Fauna Habitat Type

- River red gum riparian woodland
- Eucalyptus and Corymbia open woodland
- Dawson gum and brigalow woodland
- Brigalow and belah woodland
- Oxbow wetland
- Natural grasslands
- Modified Grasslands
- Shrubby Brigalow Regrowth with Gilgai
- Dams

N

Figure 6-10
Potential Impacts on Fauna Habitat Types

Environmental Impact Statement
Saraji East Mining Lease Project

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Kilometres

Scale: 1:110,000 (when printed at A4)

Projection: Map Grid of Australia - Zone 55 (GDA94)

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6.9.1.2 Potential indirect impacts (construction phase)

Potential indirect impacts associated with disturbance during the construction phase include:

- erosion and soil loss
- dust impacts
- edge effects
- noise and light impacts
- mortality or injury of fauna from traffic
- pests and feral fauna
- weeds.

Erosion and soil loss

Soil erosion may occur in areas disturbed by activities associated with the Project. Where these activities occur on dispersive soils and/or on slopes, mobilisation of sediment into watercourses can occur. Impacts to aquatic ecosystems can include build-up of sediment in waterholes with a resultant reduction in available microhabitat and smothering of aquatic plants and substrate (refer to **Chapter 7 Aquatic Ecology** for further details).

Erosion can remove the most productive part of the soil profile, the topsoil, resulting in a greatly reduced opportunity for natural regeneration of vegetation communities (unless stockpiled). Impacted areas most susceptible to erosion include floodplain areas and riparian vegetation associated with Boomerang Creek, Plumtree Creek, Hughes Creek, One Mile Creek, Spring Creek and Phillips Creek, as well as those vegetation communities associated with erosive sand or silt land zones.

Topsoil resources can be protected by removing topsoil altogether from areas of high disturbance and setting the topsoil aside for reuse in rehabilitation programs. Where topsoil is left in situ in disturbed areas, erosion and sediment control measures are required to minimise loss of topsoil. These control measures are discussed in more detail in **Chapter 5 Land Resources**.

Dust

Dust impacts generated during the construction of the Project may negatively affect vegetation.

Deposition of airborne dust, sand and soil may have potential impacts on vegetation if excessive levels are sustained over extended periods. When dust settles on plant foliage, it can reduce the amount of light penetration on the leaf surface, block and damage stomata, and slow rates of gas exchange and water loss. Diminished ability to photosynthesise may result in reduced growth rates of vegetation and decreases in floral vigour and overall community health.

Vegetation situated in proximity to construction activities may become coated with dust and suffer some of the impacts discussed above; however, this will be short term and unlikely to cause any significant damage. Vegetation immediately adjacent to the transport and infrastructure corridor, and access tracks may also encounter some dust deposition from vehicle movements.

Use of water sprays to control dust in exposed areas is likely to be sufficient to prevent any long-term impacts. An Air Management Plan will be developed prior to construction which will consider potential dust related impacts.

Edge effects

Fragmented vegetation communities will be subjected to increased edge effects, which when considered in combination, can reduce the effective size of habitat fragments. The proposed IMG infrastructure will, in particular, lead to creation of a large number of habitat patches which may be

subject to edge effects. To a lesser extent, construction of other surface facilities and infrastructure will also create edges adjacent to remnant vegetation patches.

Edge effects can include:

- increased risk of weed invasion from disturbed areas
- increased exposure of fauna to predation due to increased visibility
- microclimatic changes associated with increased sunlight
- increased weed proliferation.

Weeds are already prevalent and distributed across the Project Site. However, there is a risk that disturbance to native vegetation, changes to microhabitat and mobilisation of earthmoving equipment and materials may introduce or exacerbate weeds within the Project Site.

Ground dwelling fauna are most at risk from increased predation around the edges of remnant habitat as fauna are more visible and accessible. Although there is limited ground dwelling fauna present in the Project Site, this may further reduce populations.

As most of the vegetation within the Project Footprint is open woodland to grassland, significant vegetation changes are not likely to occur as a result of increased exposure to sunlight along the edges of remnant vegetation.

Noise and light

Secondary impacts to fauna include disturbance from noise and light during construction of surface infrastructure and IMG management infrastructure. Fauna will generally move away from noise and light sources as these may be perceived as a threat. Acclimatisation by some species is likely to occur over the medium to long term and many of the species identified in the Project Site are known to occur in areas subject to noise, light and general activity.

Some disturbance to fauna is expected from light and noise across the Project Footprint and this may have short term impacts on feeding and resting behaviour which in turn can affect animal health. It is also possible that fauna particularly sensitive to noise and light will become locally extinct within the Project Footprint. Long term effects are not anticipated for most fauna species identified as these species are expected to habituate to higher noise and brighter light levels.

Mortality or injury

Conflict between site traffic and fauna is likely to occur, particularly within the gas drainage footprint, at the construction accommodation village and within the transport and infrastructure corridor.

Development of the IMG network will require the construction of access roads for installation and future maintenance of infrastructure. Construction and maintenance activities will be undertaken predominantly during daylight hours. Given this, reptiles are the fauna group most likely to be affected, as they utilise roads to gather warmth and seek prey.

Pests and feral fauna

The Project Site supports populations of rabbits, foxes, pigs, feral cats, wild dogs, and cane toads. Ponds are likely to be created from subsidence impacts and may vary from areas of intermittent inundation to semi-permanent ponds. Ponds will potentially create new habitat opportunities for some of the pest fauna species recorded including Cane Toad (*Bufo marinus*) and pig (*Sus scrofa*). It is unlikely that the proposed works will significantly result in the further proliferation of the remainder of these species or the introduction of further feral vertebrate species.

The introduction of exotic ant fauna is a risk due to import of construction materials. Yellow Crazy Ants (*Anoplolepis gracilipes*) and Fire Ants (*Solenopsis invicta*) are exotic ants that have the potential to affect native flora, fauna and ecological communities. These ants are capable of being transported from infested sites to new construction sites on equipment or within materials. While efforts to control

spread of these ant species have been quite effective, the spread of ants to new areas is a potential issue and needs to be monitored. No exotic ants are known to occur within the Project Site.

The construction of water storages and dams has the potential to create conditions suitable for a build-up of biting insects. Biting pests such as mosquitoes can rapidly increase populations when appropriate breeding conditions are provided.

Weeds

A diversity of weeds are already prevalent and distributed across the Project Site, including 40 exotic species, 11 of which are considered to be 'Restricted Matter' under the *Biosecurity Act 2014* and eight of which are WoNS and nine considered weed species under the Isaac Regional Biosecurity Plan. There is a risk that disturbance to native vegetation and mobilisation of earthmoving equipment and materials may introduce or exacerbate weeds within the Project Site.

The most likely causes of weed dispersal will be through the movement of soil and attachment of seed (and other propagules) to construction vehicles and machinery involved with clearing of vegetation and stockpiling mulch and topsoil during earthworks.

6.9.2 Operation Phase

The proposed underground longwall mining operations will result in a varying degree of ground surface subsidence. Current modelling indicates the potential of ground subsidence between 0 m and 3.5 m. More information is provided in **Appendix B-2 Subsidence Modelling**. Subsidence will be progressive as mining advances. Subsidence does not require actual clearing of vegetation, but changes to local topography soils and hydrology as a result of subsidence can potentially affect vegetation. The impacts described below assume full extent of subsidence and that all impacts will result in a negative impact to habitats. As such they are considered worst case scenario.

6.9.2.1 Potential subsidence impacts (operational phase)

Flora and vegetation communities

Prior to subsidence, vegetation will already have been disturbed by installation of IMG management infrastructure, leaving a mosaic of remnant and modified vegetation across the proposed underground mine footprint.

Trees and other plants will be subject to localised changes in topography and tension cracking may occur at the surface, which could affect individual plant health. Additionally, localised changes in topography will alter drainage characteristics across the Project Site and could lead to water ponding within surface water drainage lines.

The vegetation communities within the predicted subsidence footprint include seven REs as well as the Brigalow (*Acacia harpophylla* dominant and codominant) TEC. These REs occur in several patches within the subsidence area. Of this TEC, approximately 202.92 ha may potentially be subjected to subsidence-related changes. It should be noted that this area does overlap with the impacts area from the IMG drainage network.

Soil movement and tension cracking

Tension cracks may develop adjacent to the pillars where slopes are greatest. These tension cracks form as the panel area subsides and the areas supported by the pillars remain in place. Movement in soil profiles and the formation of cracks and fissures can lead to stress on the roots of trees and shrubs and localised root shearing. In turn, these effects can lead to the decline and death of trees and shrubs. Where cracking occurs in grassland, minimal impact is expected as root systems are small and restricted to the surface soil layers. This will be the case for the modified grasslands and much of the low shrubby Brigalow regrowth with gilgai within the subsidence footprint.

Changes in drainage characteristics

Depression of the surface due to subsidence can lead to water ponding after heavy rain or in areas traversed by creeks or ephemeral streams. Vegetation in ponded areas will be inundated periodically or, in some areas, for longer periods of time. Where ponding is temporary, species (such as *Eucalyptus tereticornis*) that can tolerate periodic inundation will remain (Jackson, 2005). Where vegetation is intolerant to this inundation (such as *Eucalyptus populnea*), it will die back and, in areas subject to temporary inundation, may be replaced by more tolerant vegetation.

Subsidence will also affect the riparian corridors of Boomerang Creek, Plumtree Creek and Hughes Creek. In the short to medium term, these watercourses will become more pond-like in nature, with flows potentially restricted and changes in inundation levels along riparian zones.

Through a combination of erosion of pillars and the main heading, and infilling due to sediment transport, these creek channels are expected to re-establish over time. During this time, changes in riparian vegetation are expected as vegetation that is not tolerant to ponding will tend to die back in the subsided areas, potentially being replaced by vegetation more tolerant to inundation. Along the pillars and main heading, water availability to riparian vegetation may be reduced and erosion may also destabilise large trees along these sections of the creeks. A Subsidence Management Plan has been developed and is detailed in **Appendix K-2 Subsidence Management Plan.**

Drawdown from water extraction

As discussed in **Appendix C-1 Terrestrial Ecology Technical Report**, vegetation within the Project Site is not considered groundwater dependent and no known aquatic, terrestrial or subterranean groundwater dependent ecosystems have been mapped within the Project Site as per the National Atlas of groundwater dependent ecosystems.. Most floral assemblages within the area are characterised by drought tolerant species with low physiological sensitivity to water availability.

The Tertiary and Permian sediments within the Project Site have groundwater levels at depths of greater than 20 m (refer to **Chapter 9 Groundwater**), which is deeper than the known root zone of any local vegetation communities. The proposed underground mining and gas drainage operations will necessitate dewatering and depressurisation; however, underground mining will take place at depths of up to 780 m. This is unlikely to have significant effects on the shallow perched groundwater resources.

Fauna

As subsidence occurs, further changes to vegetation and habitats on the underground mine footprint may occur. These include:

- the loss of habitat trees that provide roosting and nesting habitat as well as food resources
- the conversion of some areas from grassland or woodland to ponds
- modification of riparian zones along Boomerang Creek, Plumtree Creek and Hughes Creek.

These changes are gradual, and this may provide opportunity for fauna to move to adjacent areas to the north and east as food and nesting resources in the Project Site are diminished.

As detailed above, in areas of maximum subsidence, significant alteration to vegetation can occur. Surface cracking is likely to result in root failure and premature death of individual trees.

It is likely that the nature of the wildlife corridor provided by the Boomerang Creek, Plumtree Creek and Hughes Creek complex will change significantly during mining. In particular, a number of fauna habitat trees may be lost. This will affect the ability of arboreal mammals to disperse through the landscape. Generally, bird species are highly mobile and will be able to fly over or through disturbed areas in order to access alternative habitat. Microchiropteran bats will be able to continue to forage over disturbed areas if their roosts remain unaffected.

Ground dwelling fauna will be less affected by subsidence impacts as ground cover is not likely to be significantly affected and may in fact be increased if dead trees fall to the ground. Loss of shade trees may increase ground temperatures which may be problematic for some ground dwelling fauna, although reptiles are not likely to be particularly sensitive to this. Any exposed areas caused by vegetation clearing or die back will expose ground dwelling fauna to predation by native and non-native predators. Progressive rehabilitation of mined areas will offer alternative habitat to many fauna species and thus impacts may be reduced. However, re-colonisation of rehabilitated areas by ground fauna may be slow where feeder sources (such as remnant woodland) are isolated from the rehabilitated areas.

A number of ponds are likely to be created from subsidence impacts and may vary from areas of intermittent inundation to semi-permanent ponds. Ponds will potentially create new habitat opportunities for some fauna groups. A relatively high diversity of amphibians was recorded in the Project Site and an increase in aquatic habitats will potentially benefit this fauna group in turn increasing food resources for their predators such as the conservation significant species, Ornamental Snake (*Denisonia maculata*). Cane toads (*Bufo marinus*) are present, and availability of aquatic habitat may also increase their numbers. The availability of permanent water will also benefit larger fauna using the site, including Eastern Grey Kangaroo (*Macropus giganteus*) and pest species such as Feral Pigs (*Sus scrofa*).

The maximum extent these impacts will affect fauna habitat and vegetation communities is outline in Table 6.17 and described in the following sections.

Table 6.17 Subsidence impacts to vegetation and fauna habitat during operation

Fauna habitat type	RE associations	Project Site (ha)	Project Footprint (ha)	Subsidence impact area (ha)
River Red Gum Riparian Woodland	RE11.3.25	192.08	79.60	67.69
Eucalypts and/or Corymbia Open Woodland	RE11.3.2, RE11.3.4, RE11.4.13, RE11.5.3	1,876.30	924.91	809.61
Dawson Gum and Brigalow Woodland	RE11.4.8	322.16	236.02	195.00
Brigalow or Belah Woodland	RE11.3.1, RE11.4.9	204.33	39.15	30.53
Oxbow Wetland	RE11.3.27b	16.64	11.17	8.12
Natural Grasslands	RE11.4.4	1.73	0.08	0
Modified Grasslands	NA	6,252.43	1,229.62	652.62
Shrubby Brigalow regrowth with gilgai	NA	1,776.14	652.63	368.60
Dams	NA	107.66	70.72	40.36
Total		**10,749.47**	**3,243.90**	**2,172.53**

6.9.2.2 Potential indirect impacts (operational phase)

Potential indirect impacts during the operational phase are similar to those described during the construction phase but will primarily relate to activities, maintenance and subsequent vehicle associated with the surface facilities and IMG management infrastructure.

Surface facilities such as the future MIA, CHPP, ROM pad and conveyors are in areas that are already highly modified. Noise and light from these areas is unlikely to increase impacts on fauna due to lower densities of fauna utilising these areas and due to noise and light impacts from existing operations.

During operation of the IMG management infrastructure there will be some low-level noise from the gas wells. However, fauna are expected to habituate to this noise. There will also be some activity and noise from maintenance activities but, as with construction works this will be relatively low impact in terms of noise levels and duration. Fauna present within the mine footprint area are expected to either habituate to the disturbance or temporarily move away.

Once operational, traffic to and from the Project will increase, occurring both day and night. As a result, it is anticipated that mortality or injury to fauna will occur. As above, reptiles and macropods are the fauna groups most likely affected. Some birds, such as the Squatter Pigeon (Southern) (*Geophaps scripta scripta*), the cumbersome Pheasant Coucal (*Centropus phasianinus*) and raptors feeding on carrion on the roadside may also be involved in vehicle collisions.

Elsewhere on the Project Site, internal roads are already formed and occur within disturbed areas. It is anticipated that fauna mortality from vehicle strikes will not significantly increase in these areas.

6.9.3 Decommissioning and rehabilitation phase

The decommissioning phase will involve the removal of mine infrastructure and rehabilitation of the landform. As such further direct disturbance is not anticipated during this stage or if required, will be temporary in nature.

There is the potential for indirect impacts to occur if the decommissioning process in not managed appropriately. These indirect impacts can include contaminate release from soil or water into the surrounding environment, dust, noise, light, erosion weed and pest proliferation. However, all proposed decommissioning works will be undertaken in accordance with detailed plans and as such these impacts are considered to be low risk.

As rehabilitation of the post mining land surface is closely connected with subsidence effects, management of ecological impacts from IMG drainage requirements will be closely linked to the overall management approach to subsidence impacts. In particular, it is expected that remnant vegetation that is not directly affected by the IMG management network will become important in terms of ongoing management of subsidence impacts and rehabilitation. The Rehabilitation and Subsidence Management Plans can be found in **Appendix K-1 and K-2 of this EIS**.

6.10 Potential Impacts on conservation significant species

6.10.1 Regional ecosystems

The following impact assessment provides worst case scenario disturbance calculations and it is likely that the following disturbance areas will be reduced.

Conservation significant REs are those that have a biodiversity status of, of concern or endangered and those that are analogous with EPBC Act listed TECs. Nine conservation significant REs were confirmed within the Project Site during field surveys. Six of these REs will experience impacts from the proposed activities. Impacts to endangered REs (11.3.1, 11.4.8 and 11.4.9) include disturbance to 275.17 ha. Impacts to of concern REs (11.3.2, 11.3.4, 11.3.25, 11.3.27b, 11.4.4 and 11.4.13) include disturbance to 202.13 ha.

Potential direct and indirect impacts to the endangered RE 11.4.8 of approximately 236.02 ha (49.64 ha direct impacts and 195.0 ha indirect impacts) constitutes approximately 1.2% of this vegetation community within the Isaac-Comet Downs subregion. Of concern RE 11.3.25, subject to second largest area of impact of approximately 79.60 ha (11.91 ha direct impacts and 67.69 ha indirect impacts) constitutes 0.2% of this vegetation community found within the Isaac-Comet Downs subregion.

Disturbance to RE 11.3.27b is minimal (11.17 ha); however, the occurrence of this RE within the sub-region is similarly sparse and as such this disturbance equates to approximately 1.1 per cent of this

community in the Isaac-Comet Downs subregion. The least concern RE 11.5.3 experiences much larger impacts across the site (813.63 ha) however this is much more widely available in the region and as such the impact only constitutes 1.1% of this community in the subregion.

The area of potential impacts on all remaining conservation significant REs in context to the extent in which they occur across the subregion is less than 1 per cent.

HVR which is regulated under the VM Act may also be impacted by the Project. A total of 6 ha of HVR endangered RE 11.4.8 and RE 11.4.9 is mapped within the Project Footprint.

6.10.2 EPBC threatened ecological communities

Within the Project Site, two EPBC TECs have been identified. These communities are:

- EPBC TEC Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin (of concern RE 11.4.4)
- EPBC TEC Brigalow (*Acacia harpophylla* dominant and co-dominant) (endangered REs 11.3.1, 11.4.8 and 11.4.9).

Potential impacts to both these TECs often associated with the construction and operational phase of mining projects are associated with both direct disturbances and indirect effects, including:

- vegetation clearing and loss
- fragmentation and edge effects
- weed incursion
- dust
- alterations to hydrological regime, including water quality
- erosion and sedimentation.

Development of mining operations within the Project Footprint will involve direct clearing for surface facilities and ancillary infrastructure as well as direct clearing and fragmentation for the incidental mine gas (IMG) drainage network. Ongoing operational impacts may include subsidence due to the development of the Project.

Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin

Vegetation reflecting the Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin TEC is located in the Project Footprint, within and adjacent to the transport infrastructure corridor. Some impact is mapped within the Project Footprint based on overlapping infrastructure (approximately 0.075 ha), however the proposed overhead power line is expected to span overhead with limited to no clearing required for its construction. As there is unlikely to be above ground disturbance, indirect impacts associated with vegetation clearing such as fragmentation and edge effects, erosion and sedimentation will not occur. In this area, there is low likelihood that vehicle traverses during construction will lead to increased or new weed incursions, excessive dust or the contamination of soils and water. As underground works are occurring to the north of this TEC, subsidence impacts are unlikely to affect vegetation conforming to this TEC.

Brigalow (Acacia harpophylla dominant and co-dominant)

A total of 246.07 ha of the *Brigalow (Acacia harpophylla dominant and co-dominant)* TEC falls within the Project Footprint.

The proposed construction village has been located in non-remnant vegetation with vegetation in these areas predominantly low (approximately 1 to 2 m in height) *Acacia harpophylla* (Brigalow) regrowth. The transport and infrastructure corridor dissect several REs, including *Brigalow (Acacia*

harpophylla dominant and codominant) TEC conforming areas of RE 11.3.1 and RE 11.4.8. The location of the rail loading balloon loop will also require clearing of RE 11.4.8.

Installation of the IMG drainage network will require clearing of vegetation for the construction of gas wells and corresponding infrastructure including gas pipelines, water pipelines and service roads. The nature of the clearing required will mean that the area will be divided into a grid like pattern. Vegetation conforming to *Brigalow (Acacia harpophylla dominant and codominant)* TEC in the form of RE 11.4.8 will experience some clearing for the network, which may facilitate additional fragmentation of small areas of *Brigalow (Acacia harpophylla dominant and codominant)* TEC. Fragmentation will also likely have an impact through the potential for weed incursion. *Cenchrus ciliaris* (Buffel Grass) is widespread through the Project Footprint and may more readily infiltrate Brigalow (*Acacia harpophylla* dominant and codominant) TEC areas fragmented from construction of the mining project.

Dust impacts generated during the construction and operation of the Project may negatively affect vegetation, particularly if excessive levels are sustained over extended periods. Excessive dust on plant foliage can reduce the amount of light penetration on the leaf surface, block and damage stomata, and slow rates of gas exchange and water loss. Diminished ability to photosynthesise due to physical effects may result in reduced growth rates of Brigalow (*Acacia harpophylla* dominant and codominant) TEC vegetation and decrease floral vigour and overall community health.

Subsidence may cause a range of additional changes in remaining flora and vegetation communities as well as direct site rehabilitation. Areas of RE11.4.8 and RE11.4.9 analogous to *Brigalow (Acacia harpophylla dominant and codominant)* TEC occur with the subsidence area and may potentially be subject to subsidence related changes. These changes may include localised changes in topography, tension cracking and altered drainage characteristics. As subsidence occurs, some further changes may affect the viability of this TEC, although brigalow is generally relatively tolerant of periodic inundation. Refer to **Chapter 21 Matters of National Environmental Significance** for further detail.

6.10.3 Flora species of conservation significance

One significant flora species was recorded within the Project Site - *Dichanthium setosum* (Bluegrass). One additional conservation significant species, *Dichanthium queenslandicum* (King Bluegrass) is considered likely to be present within the Project Site, although it was not identified in field surveys.

Potential impacts to *Dichanthium setosum* (Bluegrass) and *Dichanthium queenslandicum* (King Bluegrass) often associated with the construction and operational phase of mining projects are associated with both direct disturbances and indirect effects, including:

- vegetation clearing and loss
- fragmentation and edge effects
- weed incursion
- dust
- alterations to hydrological regime, including water quality
- erosion and sedimentation.

Habitat for these species is located in the Project Footprint, within and adjacent to the transport infrastructure corridor where an overhead powerline will be constructed. Approximately 0.075 ha of potential habitat is mapped within the Project Footprint based on overlapping infrastructure, however the proposed overhead powerline is expected to span overhead with limited to no clearing required for its construction. With limited to no ground disturbance required, indirect impacts associated with vegetation clearing such as fragmentation and edge effects, erosion and sedimentation will also be limited. In this area, there is low likelihood that vehicle traverses during construction will lead to increased or new weed incursions, excessive dust or the contamination of soils and water. As underground works are occurring to the north of this TEC, subsidence impacts are unlikely to affect *Dichanthium setosum* and *Dichanthium queenslandicum*.

Refer to **Chapter 21 Matters of National Environmental Significance** for further detail.

6.10.4 Fauna species of conservation significance

A number of fauna species of conservation significance were identified from the literature review and field surveys as occurring or likely to occur within the Project Site (Section 6.4 and 6.5). Comments on potential impacts to these species are provided below. Potential significant residual impacts have been assessed in **Appendix C-1 Terrestrial Ecology**.

Squatter Pigeon

A total of 1,9521.12 ha of potential habitat for this species is mapped within the Project Footprint. This includes 699.10 ha of preferred habitat, 285.25 ha of suitable habitat and 967.77 ha of marginal habitat. The potential impacts on the Squatter Pigeon (Southern) (*Geophaps scripta scripta*) include habitat loss and/or fragmentation and direct mortality from vehicle strike or destruction of nests.

Ornamental Snake

A total of 925.73 ha of suitable habitat for this species is mapped within the Project Footprint. Negative project related impacts on the Ornamental Snake (*Denisonia maculata*) may arise from habitat loss due to clearing, mortality or injury during vegetation clearing, subsidence and from vehicle traffic. Although subsidence is likely to alter habitat for this species, it is expected that much of this habitat will still retain habitat functionality for this species. This habitat alteration may result in the creation of subsidence ponds which may benefit prey populations (frogs) within the area. However, increased pooling would also support other pest species such as Feral Pigs and Cane Toads. Destruction of wetland habitat by Feral Pigs and lethal toxic ingestion of cane toads have been identified as threats to Ornamental Snake (*Denisonia maculata*).

Australian Painted Snipe

A total of 750.14 ha of suitable habitat is mapped for Australian Painted Snipe (*Rostratula australis*) within the Project Footprint. This habitat lacks the required microhabitat features to provide breeding habitat for this species. The species is likely to be a vagrant visitor only and may use wetlands in the Project Site on passage to more suitable breeding or foraging grounds Based on the lack of preferred habitat for this species within the Project Footprint, it's highly mobile nature and the availability of suitable habitat within the region, Project related impacted are expected to be minimal.

Koala

A total of 1,218.99 ha of potential habitat for Koala (*Phascolarctos cinereus*) is mapped within the Project Footprint. Koalas (*Phascolarctos cinereus*) are likely to be present in low densities and may experience the following impacts:

- loss and fragmentation of habitat
- mortality or injury during vegetation clearing and vehicle strikes
- increased predation risk by domesticated and wild dogs.

A fragmented landscape will result in Koalas (*Phascolarctos cinereus*) being required to travel on the ground in order to traverse between habitats. This will increase their risk from predators such as wild dogs and increase the potential for mortality from vehicle strikes. Mortality during vegetation clearing may also occur. However, the use of mitigation measures such as fauna spotter-catchers will assist in reducing impacts during clearing of potential Koala (*Phascolarctos cinereus*) habitat. While Koalas (*Phascolarctos cinereus*) will be able to move away from the progressive disturbance arising from the IMG management infrastructure, the overall fragmentation, loss of habitat and disturbance may make their continued presence untenable across much of the Project Footprint.

Greater Glider

A total of 203.81 ha of potential habitat for Koala (*Phascolarctos cinereus*) is mapped within the Project Footprint. Potential impacts to Greater Glider (*Petauroides volans*) include the loss and/or fragmentation of habitat. Fragmentation will occur at creek crossings for the transport and infrastructure corridor and powerline connection and within the IMG drainage network and subsidence areas in the north. This may locally restrict movement of the species, particularly where the clearing impact width exceeds the volplane distance of the species (greater than 100 m). Given the availability of similar habitat in the region, the expected clearing impact will not typically exceed 100 m.

Indirect impacts as a result of subsidence may include localised dieback of denning trees or canopy trees that provide connectivity and alteration of stream flows, which overall may impact on the health of riparian vegetation and Greater Glider (*Petauroides volans*) habitat. Increased noise and light, particularly during construction, may have impact on breeding, foraging and dispersal behaviours.

Grey Falcon

A total of 2,132.17 ha of potential habitat for Grey Falcon (*Falco hypoleucos*) is mapped within the Project Footprint. This species inhabits woodland, shrubland and grassland in arid and semi-arid zones with a preference for wooded riparian habitats. Habitat is widely available for this species throughout the Project Site and the wider region.

Short-beaked Echidna

A total of 2,132.17 ha of potential habitat for this species is mapped within the Project Footprint. This includes 1,479.55 ha of suitable habitat and 652.62 ha of marginal habitat. This species has a wide distribution in Australia and can tolerate a broad range of habitats. Habitat for this species includes remnant vegetation throughout the Project Site and can also persist in natural or modified grasslands and regrowth, provided that a suitable food source is available. This species is widespread in the area and is a habitat generalist.

Latham's Snipe

The preferred habitat for Latham's Snipe (*Gallinago hardwickii*) is permanent and ephemeral wetlands of which small areas are available associated with RE 11.3.27b. Watercourses such as Phillips Creek and Boomerang Creek, ephemeral wetlands following heavy rain and artificial dams may provide temporary stopover opportunities during dispersal to preferred habitat. It is possible that disturbance adjacent to wetlands within the Project Site may deter the species from utilising the habitat. However, impacts from the Project to this species in a regional context are considered minimal.

White-throated Needletail

This species breeds in northern Asia and migrates to Australia during early October (DoEE, 2017d)). The White-throated Needletail (*Hirundapus caudacutus*) occupies open spaces of sky over almost any habitat. This species is not expected to suffer from habitat loss impacts.

Fork-tailed Swift

The Fork-tailed Swift (*Apus pacificus*) is a non-breeding migrant to Australia and exclusively aerial, spending day and night on the wing. This species flies above a wide range of habitats and may potentially occur in the airspace across the Project Site but is not associated with particular habitat types. Similarly, to the white-throated needletail (*Hirundapus caudacutus*), this species is not expected to suffer from habitat loss impacts.

Caspian Tern

Suitable habitat for this species within the Project Site includes dams and wetlands. This species has a widespread occurrence in both coastal and inland habitats. The Project is not expected to cause significant habitat loss for the species.

Refer to **Chapter 21 Matters of National Environmental Significance** for further detail on impacts to MNES.

6.11 Potential impacts on ESAs

Section 6.6 details the ESAs within the Project Site and surrounding region. ESAs more than 100 km from the Project Site (not including ESAs downstream) have been excluded from further consideration. Table 6.18 details the ESAs relevant to the Project, and the likelihood that the Project may potentially impact them.

Table 6.18 Likelihood of impact to ESAs

ESA	Classification	Likelihood of impact	Potential impact
National Parks	Category A	Nil. Impacts on national parks are considered unlikely due to distance from the Project Site and lack of connective vegetation.	Nil
Conservation Park	Category A	Nil. Impacts on conservation parks are considered unlikely due to distance from the Project Site and lack of connective vegetation.	Nil
Great Barrier Reef Marine Park	Category A	Unlikely. The Fitzroy River discharges to the GBRMP 490 km downstream of the Project Site. Water quality impacts are not likely to be detectable.	Nil
World Heritage Areas	Category B	Unlikely. The Fitzroy River discharges to the GBRWHA 490 km downstream of the Project Site. Water quality impacts are not likely to be detectable	Nil
Endangered Regional Ecosystems	Category B	Confirmed. Three endangered RE with total area of 275 ha exists within the Project Footprint with potential for 24.5 ha to be directly impacted by surface infrastructure.	Direct
Places of Cultural or Aboriginal Heritage Significance	Category B	Unlikely. There are known Aboriginal cultural heritage sites within the Project Site which includes a combination of recorded places and sites identified during exploration works. This EIS assumed that any Project impacts to Aboriginal cultural heritage will be identified and managed under the existing Cultural Heritage Management Plan (CHMP) between BMA and the Aboriginal Party (CLH012020).	Nil
Nature Refuges	Category C	Unlikely due to distance from the Project Site and lack of connective vegetation.	Nil
Resource Reserves	Category C	Unlikely due to distance from the Project Site and lack of connective vegetation.	Nil
State Forests	Category C	Unlikely due to distance from the Project Site and lack of connective vegetation.	Nil
General Use Zones of a Marine Park	Category C	Unlikely. The Fitzroy River discharges to the GBRWMP 490 km downstream of the Project Site. Water quality impacts are not likely to be detectable Further discussion is provided in **Appendix E-1 Surface Water Quality Technical Report.**	Nil

As noted in above, three ESAs that occur within the Project Site will potentially be impacted by the Project. Figure 6-8 depicts the proposed expansion footprint and the location of each ESA situated within the Project Site. The potential impacts on these ESAs are discussed in **Appendix C-1 Terrestrial Ecology Technical Report**.

6.12 Mitigation measures

The application of mitigation measures will minimise impacts from the Project on flora, fauna and ESAs. Where impacts are unable to be avoided or mitigated (e.g. clearing of vegetation) offsets may be required. Mitigation measures associated with the potential impacts from each activity are presented below.

6.12.1 Avoidance

The implementation of avoidance strategies is limited by the location of the coal resource; however, the placement of associated infrastructure required to support the project does have greater flexibility. Infrastructure such as the construction accommodation village, powerlines, roads, etc have been located to avoid to the greatest extent possible, areas of ecological value.

6.12.2 Minimise

The project has been designed to utilise previously disturbed land at Saraji Mine as well as existing mine infrastructure in order to minimise further disturbance and therefore further impact to the environment. Where disturbance to areas is required, this will be restricted to the minimum that is needed.

The CHPP, conveyors and product stockpiles are located within the existing Saraji Mine ML and, while vegetation clearing is required, this vegetation is disturbed and fragmented. The proposed MIA and the raw water dam are to be located in a disturbed area within Saraji Mine and are not anticipated to require removal of remnant vegetation.

Clearing for the powerline connection will only be required for footings and a narrow easement. As such, impacts to high biodiversity values within the powerline connection footprint will be minimised. The width of the corridor is also expected to reduce during the detailed design process.

While design of the layout of the IMG drainage infrastructure has not yet been finalised, it is intended to restrict the number of times that the infrastructure crosses these creeks to minimise direct disturbance to this corridor. Wherever possible, the wells required for IMG drainage will be installed outside of the riparian zone. Required crossings will be selected where natural breaks in vegetation occur where practical. Some pipeline crossings will be required, and these will be trenched crossings, with disturbed areas reinstated to stabilise the riverbed and banks. The required crossings will be reduced to the minimal width required.

6.13 Mitigation measures specific to surface facilities and infrastructure

Flora and vegetation communities

When clearing vegetation for any of the surface facilities, the following mitigation measures will be implemented:

- areas for clearing will be clearly delineated to avoid inadvertent clearing
- if habitat trees can be retained without compromising safety, these will be identified and clearly marked

- habitat features such as felled trees and logs will be considered for relocation to other areas where practical to provide microhabitat
- vehicles and equipment will be cleaned to remove weed seeds before being brought to the site
- workers will be made aware of mitigation management requirements in induction training.

Throughout construction, the following mitigation measures will be utilised to manage impacts from construction activities:

- vehicles and equipment will be cleaned to remove weed seeds before being brought to the site
- topsoil will be removed and used to rehabilitate existing disturbed areas
- erosion and sediment control measures will be installed and maintained as described in **Chapter 5 Land Resources** of the EIS
- dust suppression measures will be utilised to minimise deposition of dust on adjacent vegetation
- weed monitoring and management will be ongoing throughout construction and operation.

As it will not be possible to avoid impacts on vegetation communities of conservation significance, offsets may be required to mitigate residual impacts.

Fauna

Measures set out above to minimise impacts on flora and vegetation communities will also assist to some extent in minimising impacts on fauna. Other measures which will be implemented include:

- the workforce will be provided with contact details of suitably qualified spotter catchers in the event that fauna is present and needs to be removed, or fauna are accidentally injured. This will be covered in induction training and work instructions
- heavy vehicles (and where practical, light vehicles) will not traverse vegetated areas outside designated construction zones and will be required to remain on existing tracks
- during detailed design, lighting will be designed so that light spill into adjacent habitat areas is minimised.

Suitably qualified spotter catchers will be required during vegetation clearing (all spotter catchers will hold appropriate permits under the NC Act). If fauna are injured by vehicles during operations, the RSPCA or local wildlife carers will be contacted for assistance.

6.14 Mitigation measures specific to the gas drainage network

Flora and vegetation communities

While the extent of infrastructure required for IMG drainage will mean that impacts on significant vegetation communities and plants are unavoidable, there are a range of measures that will be taken to potentially reduce the level of impact of clearing and manage associated impacts. These include the following:

- avoiding placement of IMG extraction wells and infrastructure within Endangered REs 11.3.1, RE 11.4.8 and RE 11.4.9 where practical. Where unavoidable, offsets will be sourced
- designing and constructing IMG management infrastructure to minimise disturbance to riparian zones along the Boomerang Creek, Plumtree Creek, Hughes Creek and oxbow wetlands and avoiding placement of wells within 50 m of these waterways wherever possible
- wherever practical, locating infrastructure alignments and gas drainage wells to avoid remnant vegetation
- minimise creek crossings
- selecting river and creek crossings where natural breaks in vegetation occur where practical

- areas where clearing is planned should be distinctly delineating, so that inadvertent clearing of additional areas does not occur
- before being brought onsite, all vehicles and equipment should be cleaned to remove weed seeds
- dust suppression measures will be undertaken to minimise dust deposition on vegetation adjacent to tracks and construction areas
- utilising erosion and sediment control measures as set out in **Chapter 5 Land Resources** for all ground disturbance activities and stream crossings.

Fauna

The primary impacts on fauna during construction of the IMG drainage network are the loss of habitat and potential risk of mortality associated with the works.

Measures to reduce habitat impacts will include:

- selecting already disturbed areas for crossings of creeks and drainage lines where practical
- minimising the width of clearing required for crossing, and particularly retaining tall trees on either side of crossing locations wherever this is safe to do so
- minimising placement of gas wells in riparian and woodland areas wherever possible.

Suitably qualified spotter catchers will be required during all clearing activities. Spotter catchers will hold appropriate permits under the NC Act. When working remote to the spotter catchers, workers will be provided with contact details for the spotter/catchers in the event that fauna is present and needs to be removed or are accidentally injured. This will be covered in the induction training and work instructions.

Vehicles will not be allowed to traverse vegetated areas but will be required to remain on existing tracks. Speed limits will be placed on all roads and tracks associated with the IMG drainage network.

As potential animal breeding places are present within the Project Site, a Species Management Program (SMP) will be obtained for the Project for approval to tamper with animal breeding places (e.g. nests and hollow bearing trees), as required under Section 335 of the NC (Animal) Regulation. As breeding places for least concern species, least concern colonial breeders and wildlife prescribed as threatened under the NC (Animal) Regulation (i.e. Greater Glider (*Petauroides volans*)) are likely to be present within the Project Footprint, a High Risk SMP will be required.

Where lighting is required, lighting will be directed away from vegetated areas where practical.

6.15 Mitigation measures specific to subsidence

Management strategies which will include lessons learnt from subsidence monitoring results from other BMA owned underground operations in the region (e.g. Broadmeadow Mine).

Where works are required to repair surface cracks from subsidence, this will be in accordance with the measures within the Subsidence Management Plan. Clearing of vegetation will be minimised through the use of smaller machinery where practical. Grasses and other groundcover will be slashed rather than cleared to allow access.

Where machinery is required to repair cracks or construct subsidence pond drainage channels, vehicles and equipment will be cleaned of all weed seeds and other potential contaminants before entering the site.

Progressive rehabilitation will be undertaken as detailed in the Rehabilitation Management Plan.

6.16 Management and monitoring

A number of specific management plans will be prepared to address specific impacts and outline mitigation measures to be implemented during the construction and operational phase of the project. This includes:

- Weed and Pest Management Plan (construction phase only)
- Rehabilitation Plan (construction and operational phase)
- Topsoil Management Plan (construction and operational phase)
- High Risk Species Management Plan (construction phase only)
- Subsidence Management Plan, including vegetation health monitoring (operational phase)
- Offset Management Plan (operational phase).

An overarching Construction Environmental Management Plan (CEMP) will also be prepared to mitigation and manage impacts. This plan will be developed to outline and describe the following:

- objectives
- risk assessment
- environmental management activities and mitigation measures
- the timing of actions
- a monitoring program, which will include:
  - performance indicators (clear and concise criteria against which achievement of outcomes are to the measured), which are capable of accurate and reliable measurement
  - outcomes (time bound outcomes as measured by performance indicators), which might include milestones (interim outcomes)
  - monitoring requirements (timing and frequency of monitoring to detect changes in the performance indicators, to determine if outcomes are being achieved, and to inform adaptive management)
  - trigger values for corrective actions.
- Potential corrective actions to be implemented if trigger values are reached, and how environmental incidents and emergencies will be managed
- Roles and responsibilities (clearly stating who is responsible for activities)
- Auditing and review mechanisms.

Monitoring of retained vegetation areas will be undertaken throughout the life of the Project. As the subsidence ultimately changes the hydrology of the area, a floristic change will naturally occur over time in areas of retained vegetation. Monitoring will need to focus on whether this change can occur naturally through regrowth of native vegetation from seed stock, or whether intervention is required to replace plants that die at a greater rate than natural reestablishment.

Remnant vegetation will be monitored for foliar discolouration, partial defoliation, increased pathogenic attack, or tree death as signs of vegetation impacts from subsidence. Tree deaths and regrowth in areas affected by subsidence will be monitored to assess whether rehabilitation is required. In areas where natural regrowth is not sufficient to replace dead trees, replanting will be undertaken.

Further details on weed management measures that will be implemented to reduce impacts is detailed below.

6.16.1 Weed and pest management

Weed and pest management strategies will be implemented for controlling the spread of weeds and potential proliferation of pest fauna. Weed and pest management measures will be based around the following principles:

- eradication measures to remove localised populations where feasible
- containment and treatment measures including:
  - managing pests and weeds through documented procedures on new infestations, consultation with stakeholders prior to implementation and removal in accordance with Local Government measures
  - prioritising control programs based on risk levels
  - containing the spread through best practise controls
  - monitoring for response to controls or future control methods.

A Weed and Pest Management Plan will be developed prior to construction and will include:

- all staff will undergo a site-specific induction including the identification, prevention, minimisation and management requirements of weed and pest species on-site
- management methods to control spread of weed species (in particular *Parthenium hysterophorus*), in keeping with regional management practice or Queensland Department of Agriculture and Fisheries pest control prescriptions
- ongoing inspection of the Project Site to identify any new incidence of weed infestation
- provision of information for staff on the identification of WONS, Restricted Matter weed species and their dispersal methods
- wash down protocols for any vehicles or machinery entering and leaving the Project Site
- methods for weed eradication from the site in accordance with local management practice from the IRC and/or the Queensland Government pest fact sheets
- promotion of awareness of weed management, by inclusion of weed issues, pictures and procedures into the Project's site induction program.

Details of weed and pest monitoring will be outlined in the Weed and Pest Management Plan. Monitoring will occur throughout the life of the Project to ensure their ongoing effectiveness. Any significant findings, such as new pest or weeds species, new outbreaks or any actions resulting from Project activities will be incorporated into a review of the Weed and Pest Management Plan. This will allow the Weed and Pest Management Plan to be adapted if performance criteria are not met.

The monitoring program will include:

- pre-clearance surveys within and directly adjacent to the Project Footprint to record presence and abundance of invasive weeds and pests and to identify weed hot spots
- a schedule and details of methods and data collected during construction audits and ecological condition monitoring in retained vegetation adjacent to the Project Footprint
- details of how results from these monitoring activities may trigger a corrective action
- details of the corrective actions which will be triggered when predetermined weed/pest thresholds are exceeded. These will include but not be limited to:
  - treatment of new weed incursions
  - monitoring of success and treatment
  - review of site procedures for weed management

  - rehabilitate and stabilise disturbed non-operational areas
  - re-educate / train site personnel on management requirements, practices and site rules
  - develop a species-specific control program for pest fauna where require and review as necessary to ensure it remains effective and applicable.
- monitoring for pest plants and fauna within subsided areas where ponding occurs will be undertaken to determine the need for specific management measures
- the monitoring will be undertaken in accordance with QLD state and federal survey guidelines for monitoring weed and pest species.

6.17 Rehabilitation

BMA has prepared a Rehabilitation Management Plan (**Appendix K-1**) in line with the Mined Land Rehabilitation Policy (DES, 2018c). In accordance with the policy, land will be progressively rehabilitated to achieve the following rehabilitation goals:

- safe to humans and wildlife
- non-polluting and does not cause environmental harm
- stable
- able to sustain an agreed post mining land use.

BHP's Queensland Coal Rehabilitation Completion Criteria (BHP, 2018a) outlines the completion criteria for meeting satisfactory rehabilitation for post mining land uses. Post mining land uses may include:

- cattle grazing
- dryland cropping
- woodlands habitat
- watercourses
- water storage.

The completion criteria set out objectives, indicators and quantitative criteria for achieving acceptable rehabilitation in the post mining land uses. The completion criteria consider goals of safety, stability, minimal pollution and the ability to sustain an agreed post mining land use. **Chapter 5 Land Resources** presents these completion criteria and rehabilitation goals in further detail.

The proposed post mining land use will be an undulating landscape that could be used as grazing land, consistent with the surrounding pastoral land use that dominates the region. Native vegetation outside of the surface infrastructure footprint will be retained in a way that is compatible with the pre-existing land use for biodiversity values. However, where vegetation mortality occurs as result of persistent ponding, associated with subsidence, it will be revegetated with species that are tolerant of inundation. There may be instances in which a mix of native and non-native species will be implemented.

Post mining land uses for the Project will be confirmed prior to construction.

6.18 Significant Residual Impacts and Offsets

For MNES with the potential to be impacted by the Project, the significance of these potential impacts has been assessed against the *EPBC Act Significant Impact Guidelines 1.1* (DotE, 2013). A detailed review of MNES including the outcome of impact assessment is provided as a standalone chapter in this EIS (**Chapter 21 – Matters of National Environmental Significance**).

As detailed in Section 6.7, a number of MSES that relate to terrestrial ecology are found within the Project Site and Project Footprint. After all reasonable avoidance and on-site mitigation measures for the Project have been or will be undertaken (Section 6.10), the Project may still impact on MSES. Therefore, the Significant Residual Impact Guideline prepared by the Department of the Environment and Heritage Protection (2014) was used to determine the significance of the residual impact. To avoid duplication of offset conditions between jurisdictions, state and local governments can only impose an offset condition in relation to a prescribed activity if the same or substantially the same impact and the same or substantially the same matter has not been subject to assessment under the EPBC Act. As such, SRI assessments for protected wildlife habitat were only completed for the known or likely conservation significant species that have not already been assessed under the EPBC Act policy statement 'Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (refer to **Appendix C-1 Terrestrial Ecology).**

A significant residual impact was considered likely for impacts to the following MSES values:

- regulated vegetation – Endangered and of concern prescribed REs
- regulated vegetation – Prescribed REs within the defined distance of a watercourse
- connectivity areas.

The full assessment against the Department of the Environment and Heritage Protection (2014) Significant Residual Impact Guideline is detailed in **Appendix C-1 Terrestrial Ecology**.

While mitigation and management measures for impacts on terrestrial ecology focus on maximising retention of vegetation across the underground mine footprint, offsets may be required for those areas where vegetation clearing is unavoidable, and in relation to fragmentation due to IMG management infrastructure and potentially from subsidence effects. On this basis, initial identification of offset requirements is based on offsetting of significant remnant vegetation within the Project Footprint.

The Project will be subject to the EPBC Act Environmental Offsets Policy and the Queensland Environmental Offsets Framework. BMA proposes to provide land-based offsets through a staged offset strategy which will be finalised at issue of the environmental authority (mining) for the Project and will be based on determination of actual clearing areas as mining and associated IMG management and subsidence progress. This staged offset strategy will be aligned to BMA's mine planning cycle to allow accurate identification of actual offsets required in each stage of mining. BMA currently conducts mine planning on a five-year cycle.

It is expected that the offsets may be staged as set out in **Appendix C-2 Offset Strategy** of this EIS.

A vegetation condition monitoring program with baseline performance targets will be conducted to support and inform this approach. This program will allow BMA to establish significant biodiversity values prior to clearing and subsidence and then, post subsidence; identify the net loss of values. This will be done on a five yearly cycle as set out in **Appendix C-2 Offset Strategy**. As part of this program, BMA will establish the ecological equivalence of state significant biodiversity values prior to any disturbance to inform replacement of these values either through rehabilitation or land-based offsets.

6.19 Summary and conclusions

The desktop and ecological field surveys conducted for the Project have documented a range of flora and fauna. Several flora communities of conservation significance exist within the Project Site, including listed TECs and endangered REs. Although some areas of remnant vegetation remain intact, most have been modified to some extent by historical and current land management practices. The most common modification is the removal of the shrub and ground layers and replacement with pasture grass species to support grazing.

The majority of the fauna habitat within the Project Site is generally of low conservation value.

Some habitats such as the riparian zones and alluvial woodland act as a wildlife corridor and the oxbow wetland and the *Acacia harpophylla* (Brigalow) woodland with gilgai possess greater potential for supporting conservation significant fauna.

Flora

Systematic flora surveys were carried out for the Project Site during 2007, 2008, 2010 by SKM, and in 2016, 2017 and 2020 by AECOM. Flora surveys were undertaken using guidelines established by the Queensland Government. The aim of the flora study was to document the flora values with particular reference to the occurrence of conservation significant vegetation communities and species.

The ecological values of the Project Site are considered typical for the northern Bowen Basin with large areas of land historically cleared for grazing.

The literature review identified four EPBC Act TECs as potentially present within the Project Site. The presence of two of these communities was confirmed on site: Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin and Brigalow (*Acacia harpophylla* dominant and co-dominant). Field surveys were conducted to determine whether the RE areas met the criteria for classification as a TEC. The natural grasslands community met the condition threshold of 'good quality' for the EPBC Act listed community, and the brigalow community met the condition thresholds for the TEC within most patches of analogous REs. **Chapter 21 Matters of National Environmental Significance** outlines the detailed assessment of impacts and management of MNES, including a significant impact assessment.

Where analogous REs existed but did not meet the condition thresholds, the TEC was not mapped or considered in area calculations. The flora survey identified a total of ten REs, including three listed as endangered, six listed as of concern and one listed as 'no concern at present' as per the Biodiversity Status.

The literature review identified five flora species of conservation significance as potentially occurring in the survey area. Of the five species, field surveys confirmed the presence of one - *Dichanthium setosum* (Bluegrass) which is listed as vulnerable under the EPBC Act. Additional species of conservation significance - *Aristida annua, Cerbera dumicola* and *Dichanthium queenslandicum* (King Bluegrass) were identified as possibly being present given the habitat available.

Of the 40 exotic species recorded during the vegetation surveys, 11 species were identified as being of management concern.

Approximately 1,952.75 ha of remnant vegetation communities may be impacted by the proposed underground mining, surface facilities and infrastructure associated with the Project. This includes the indirect disturbance of remnant vegetation associated with subsidence from underground mining operations.

Clearing will cause direct loss of some remnant native vegetation as well as fragmentation of some vegetation communities. A total of 246.07 ha of the *Brigalow (Acacia harpophylla dominant and co-dominant)* TEC will be impacted by the Project. Less than one hectare of natural grassland TEC, also endangered RE, occurs within and adjacent to the transport infrastructure corridor and may not require direct clearing as powerlines may span above this vegetation.

Subsidence and gas drainage infrastructure may also impact on remnant native vegetation, particularly taller trees where ground movements and tension cracking may affect root zones. Grasses (native and introduced) and smaller shrubs are expected to survive subsidence without intervention; however, taller trees may be affected and will need to be managed and potentially replaced to maintain riparian zones. Following subsidence, some areas may become ponded and this will change the nature of vegetation in these areas.

Disturbance to key biodiversity values including TECs and endangered and of concern REs will be avoided and managed wherever possible. However, it is inevitable that some remnant native vegetation will be lost, and offsets are proposed in accordance with the Queensland Environmental Offsets Framework and the EPBC Act Environmental Offsets Policy.

A significant residual impact was considered likely for impacts to the following MSES values:

- regulated vegetation – Endangered and of concern prescribed REs
- regulated vegetation – Prescribed REs within the defined distance of a watercourse
- connectivity areas.

Fauna

Fauna surveys were conducted by SKM in 2007, 2009, 2010 and 2011. Supplementary fauna assessments were undertaken by AECOM in 2016, 2017 and 2020. The aim of the fauna surveys was to document the terrestrial vertebrate fauna and habitat, with particular reference to the occurrence of conservation significant fauna and to undertake an assessment of potential impacts.

A comprehensive literature review was undertaken prior to field survey to assist in targeting survey effort. Systematic fauna surveys were then conducted using methods including trapping, systematic searches, animal call recording and incidental sighting.

The studies identified a total (including exotic fauna) of 188 fauna species as occurring within the Project Site. This includes 117 bird, 33 mammal, 14 amphibian and 24 reptile species. Eleven conservation significant species were identified during ecological surveys including six conservation significant species, one special least concern species and four migratory species (also listed as special least concern). The literature review identified a further four species listed as threatened or migratory under the EPBC Act and or the NC Act as potentially occurring within the Project Site due to the availability of suitable habitat.

Essential Habitat has been mapped for two species within the Project Site. In the north-east corner of the Project Site, Essential Habitat for Squatter Pigeon (Southern) (*Geophaps scripta scripta*) has been mapped based on suitable habitat surrounding a previous record for this species (77.62 ha in Project Site and 24.79 ha in Project Footprint). Essential Habitat has also been mapped for Ornamental Snake (*Denisonia maculata*) in *Acacia harpophylla* (Brigalow) with *Casuarina cristata* or *Eucalyptus cambageana* (Dawson Gum) open woodlands, regrowth *Acacia harpophylla* (Brigalow) woodland and woodland communities on alluvium (1,985.44 ha in Project Site and 811.01 ha in Project Footprint). Ground-truthing confirmed habitat for both species within the Project Site and identified similar extents of habitat to the Essential Habitat mapping.

Impacts on native animals using the site will include habitat loss and fragmentation from direct impacts of vegetation clearing, as well as disturbance to animals using remnant habitat from noise, light and general activity and possible mortality during vegetation clearing or from vehicle strike. Mitigation measures are proposed to address these impacts and these measures are expected to be effective in avoiding or minimising impacts.

In the longer term, some habitat modification will also occur due to subsidence in some areas. The majority of fauna species using the site are generally resilient to disturbance and do not have highly specialised habitat requirements, and so it is envisaged that these animals will be able to adapt reasonably well to the habitat changes and also be able to utilise adjacent similar habitat. However, it is possible the Project will have a significant impact on four conservation significant species, due to loss and degradation of habitat. These are:

- Ornamental Snake (*Denisonia maculata*)
- Greater Glider (*Petauroides volans*)
- Koala (*Phascolarctos cinereus*)
- Squatter Pigeon (*Geophaps scripta scripta*).

Species specific mitigation measures and offsets will be required to reduce impacts on these species.

Offsets proposed to address loss of flora biodiversity will also provide habitat for native species, including threatened species present on or around the proposed mine. Subsidence management and

rehabilitation will include a focus on retaining riparian corridors so that they can continue to provide opportunities for fauna dispersal.

Conclusion

This chapter has assessed potential impacts on terrestrial flora and fauna protected under the relevant state and Commonwealth legislation. Outcomes of the assessment of MNES in accordance with the *Significant Impact Assessment Guidelines 1.1* (DotE, 2013a) are provided in **Chapter 21 Matters of National Environmental Significance**.

Desktop analyses and field surveys carried out by AECOM determined that three EREs (also protected under the EP Act) are present within the Project Site as well as EPBC Act listed species, TECs and flora and fauna species declared under the NC Act. Category B ESA (i.e. EREs) are present within the Project Site.

As it will not be possible to avoid impacts on vegetation communities of conservation significance, offsets are proposed to mitigate residual impacts. Most conservation significant fauna will not experience significant impacts. This is due to the availability of suitable habitat elsewhere in the Project Site or surrounding region and the highly mobile nature of many of these species. The Project has the potential to cause significant impacts to four conservation significant species. These are:

- Ornamental Snake (*Denisonia maculata*)
- Greater Glider (*Petauroides volans*)
- Koala (*Phascolarctos cinereus*)
- Squatter Pigeon (*Geophaps scripta scripta*).

In addition, a significant residual impact was considered likely for impacts to the following MSES values:

- Regulated vegetation – Endangered and of concern prescribed REs
- Regulated vegetation – Prescribed REs within the defined distance of a watercourse
- Connectivity areas.

Offsets are proposed in accordance with **Appendix C-2 Offsets Strategy**.