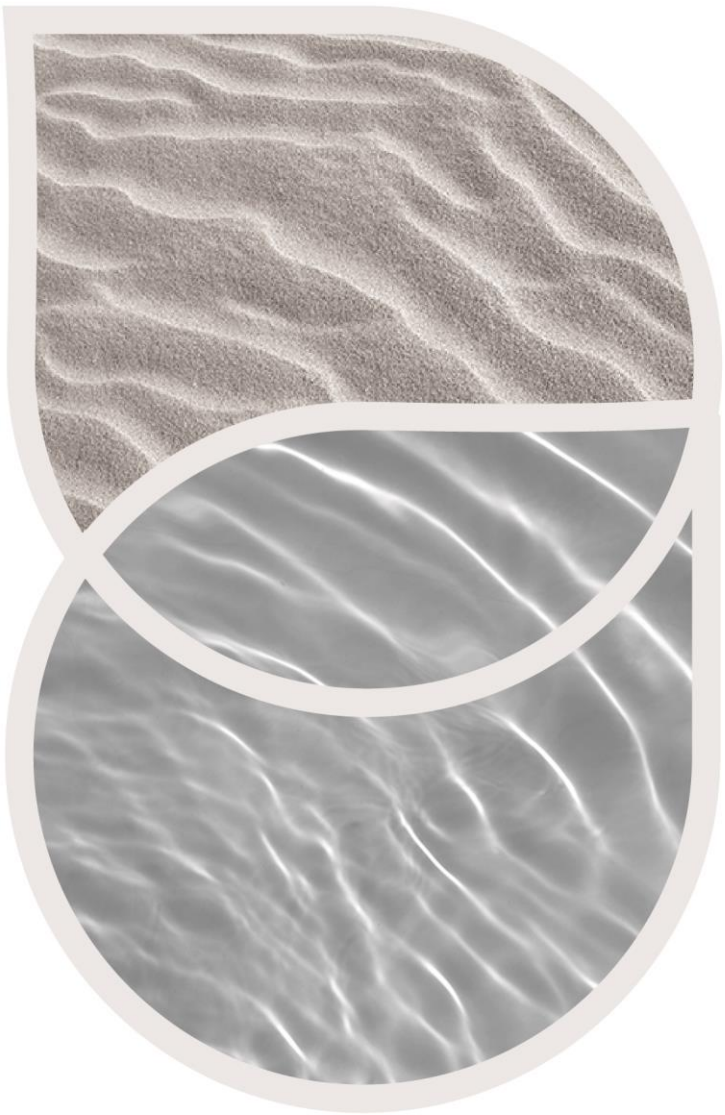
Volume 2

A20 - Terrestrial Ecology Technical Report

MULTICOM RESOURCES

epic ENVIRONMENTAL

Page Intentionally Left Blank



Saint Elmo Vanadium Project – Terrestrial Ecology Technical Report

Multicom Resources Limited

Saint Elmo Vanadium Project – Terrestrial Ecology Technical Report

Multicom Resources Ltd

3 June 2020

Epic Environmental Pty Ltd

Level 6, 193 North Quay,
Brisbane, QLD 4000
Email: enquiries@epicenvironmental.com.au
www.epicenvironmental.com.au

ABN: 54 169 579 275
ACN: 169 579 275

Contents

List of Figures

List of Tables

List of Appendices

Document History and Status

Revision	Date Issued	Reviewed By	Approved By	Date Approved	Revision Type
A	08/06/17	Andrew Daniel Terry Reis Mark Breitfuss	Mark Breitfuss	08/06/17	Draft
B	23/06/17	Mark Breitfuss	Mark Breitfuss	23/06/17	Draft
C	09/08/17	Mark Breitfuss	Mark Breitfuss	09/08/17	Draft
D	30/11/18	Terry Reis Allison Siddaway	Mark Breitfuss	30/11/18	Draft
E	29/08/19	Allison Siddaway	Terry Reis	29/08/2019	Final
1	19/05/20	Mark Breitfuss	Mark Breitfuss	19/05/20	Final

Printed:	3 June 2020
Last saved:	3 June 2020 11:57 AM
File name:	BE180133.01-RPT-Terrestrial Ecology-Rev2_270520
Author:	Terry Reis
Project manager:	Allison Siddaway
Client:	Saint Elmo Vanadium Project – Terrestrial Ecology Technical Report
Document Title:	Multicom Resources Ltd
Document version:	Final
Project number:	BE180133.01

Executive Summary

Multicom Resources Limited (Multicom) is an exploration and mining company seeking to develop the Saint Elmo Vanadium Project (the Project), approximately 25 km by road from Julia Creek, Queensland.

The Project site (Mining Lease Application (MLA) 100162) is currently used for grazing and is covered by tussock grassland and forbland, characteristic of the Mitchell Grass Downs bioregion. Several ephemeral watercourses run through the Project, with several rural water storages (dams) located throughout.

Epic Environmental Pty Ltd (Epic) was engaged to undertake a terrestrial ecology assessment of the Project. The scope of this assessment was based on desktop research as well as a March 2017 baseline survey (late wet season), July 2017 (dry season) targeted field survey, April 2018 targeted field survey for the Endangered nominate subspecies of Star Finch *Neochmia ruficauda ruficauda* and November 2018 survey focused on spotlighting and seasonal variation. The overall aims of this report are to:

- document existing ecological values, including habitat quality, and conservation status of regional ecosystems present;
- develop an inventory of all terrestrial flora and vertebrate fauna known from the Project and immediate environs;
- identify and summarise the ecology of species confirmed to be or potentially found onsite that are listed under Commonwealth and/or State legislation;
- identify potential impacts that the proposed mining activities may have on species and/or ecological communities; and
- make recommendations to mitigate potential impacts.

The ecological survey confirmed five species of National and/or State Significance. Fork-tailed Swift *Apus pacificus*, Glossy Ibis *Plegadis falcinellus*, Oriental Plover *Charadrius veredus*, Marsh Sandpiper *Tringa stagnatilis* and Sharp-tailed Sandpiper *Calidris acuminata* are listed as Migratory under the *Environment Protection and Biodiversity Conservation Act 1999*. None of these species uses the site for breeding and three of these species were recorded only at artificial waterbodies. Impacts are likely to be minimal and short-term.

There is a potential for direct and indirect impacts on the conservation significant Julia Creek Dunnart *Sminthopsis douglasi* as a result of the Project. No Julia Creek Dunnart was recorded at the Project, however this does not prove absence. Direct threats comprise the loss of habitat or direct mortality of individuals through clearing and excavation works. Indirect threats refer to secondary threats that may occur because of the Project.

Star Finch *N. r. ruficauda* is not known to be present on, or in the immediate surrounds of, the Project site. Two fauna surveys were conducted onsite during 2017 and one during 2018, including a targeted

Star Finch survey, and no evidence of Star Finch was found. There is no known record for the Julia Creek area, including historical records (e.g. Barrett et al. 2003; ALA 2018a), despite the Julia Creek area being reasonably well documented with regards to bird species. More broadly, there has been no definite record of the nominate subspecies since 1995, despite targeted surveys, and the nominate subspecies is considered possibly extinct (Payne 2010; Garnett et al. 2011; Maute & Legge 2012b; Birdlife International 2016b; DEHP 2017; Menkhorst et al. 2017). Furthermore, the Project site does not support habitat features (such as large native trees adjacent to waterbodies) relevant for the nominate subspecies.

Recommendations to mitigate potential environmental impacts as a result of the construction and operation of the Project have been made in line with the mining plan.

1 Introduction

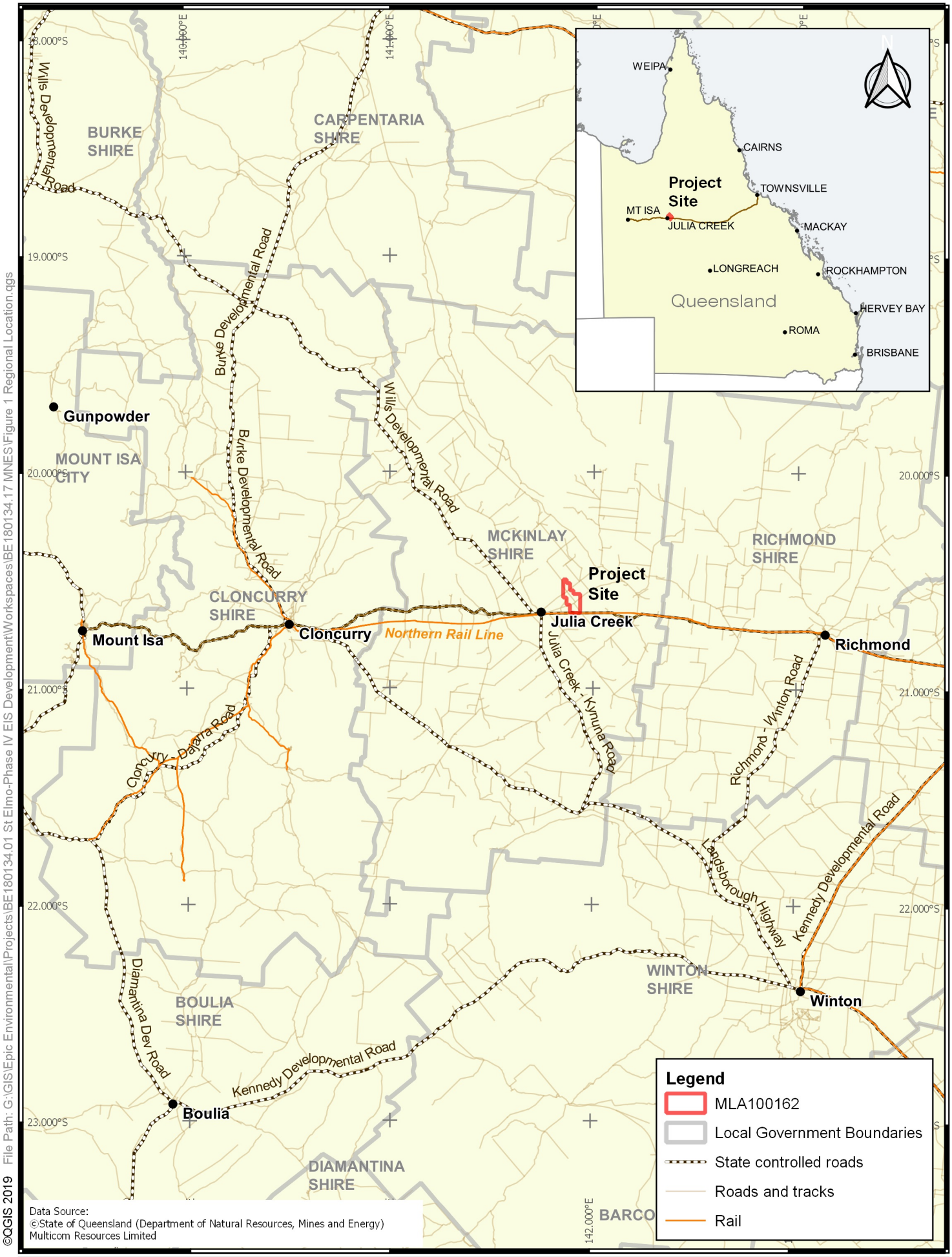
Multicom Resources Limited (Multicom) is an exploration and mining company seeking to develop the Saint Elmo Vanadium Project (the Project), east of Julia Creek, Queensland (**Figure 1**). The Project site is located approximately 25 kilometres (km) east of Julia Creek.

The Project, located within Mining Lease Application (MLA) 100162, covers an area of approximately 8,882 ha (**Figure 2**). Reference to the 'Project area' means the Project (site) and its immediate surrounds, most typically regarding records of fauna of conservation significance. Cloncurry lies approximately 140 km to the west of the Project, with Richmond approximately 125 km to the east. The indicative mine footprint is not finalised at the time of this report, but will be sited wholly within the boundaries of MLA100162. Extensive test drilling and metallurgical test work has been completed, identifying significant vanadium deposits close to the soil surface.

Operational production is scalable and based on market demand, with an initial target of 5,000-10,000 tonnes per annum (tpa) and a maximum tonnage of 20,000 tpa Vanadium Pentoxide (V_2O_5) product over at least a 30 year mine life. Run of Mine (ROM) operations to produce the maximum 20,000 tpa will be up to 15 million tpa. Mine processing will occur onsite, with overburden and process tailings that are unsuitable to go directly into the mined pit, managed in a Tailings Storage Facility (TSF). The assessment of impacts within this Environmental Impact Statement (EIS) is based on the conservative maximum tonnage of 20,000 tpa.

Prior to government approval for the Project, the ecological values of the site, and the potential environmental impacts of the proposed activities, must be assessed. The Project area has not previously been the subject of detailed ecological assessments. Epic was engaged to carry out ecological assessments of the site which involved desktop surveys of potential matters of environmental significance, in conjunction with multiple field surveys. The assessment of the ecological values of the site is presented in this report. The overall aims of this report are to:

- document existing ecological values, including habitat quality, and conservation status of Regional Ecosystems (REs) present;
- develop an inventory of all terrestrial flora and vertebrate fauna known from the Project;
- identify and summarise the ecology of species confirmed to be or potentially found onsite that are listed under Commonwealth and/or State regulations;
- identify potential impacts that the proposed mining activities may have on species and/or ecological communities; and
- make recommendations to mitigate potential impacts.



©QGIS 2019 File Path: G:\GIS\Epic Environmental\Projects\BE180134.01 St Elmo-Phase IV EIS Development\Workspaces\BE180134.17 MNES\Figure 1 Regional Location.qgs

MULTICOM RESOURCES

epic ENVIRONMENTAL

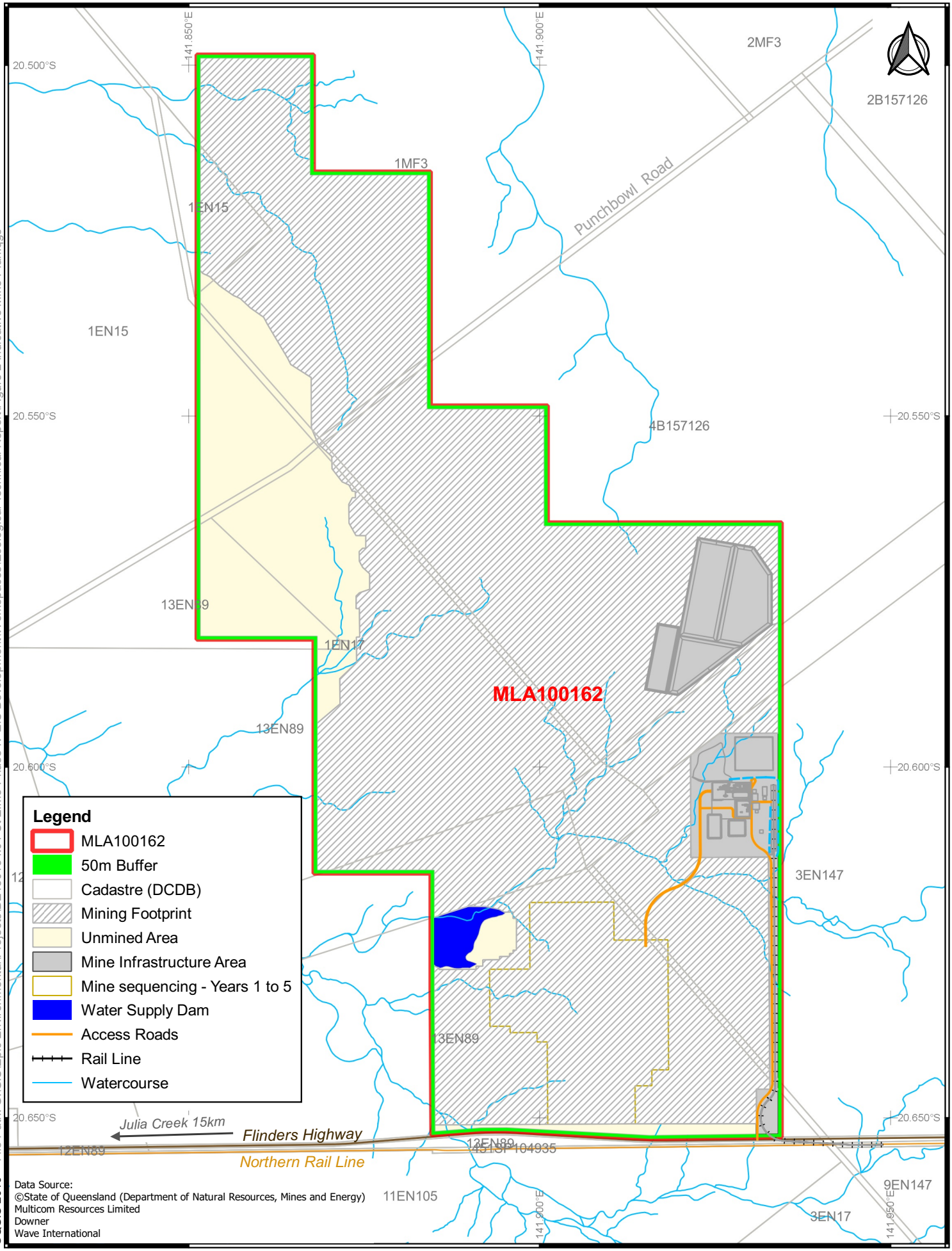
0 25 50 75 100 km

Scale: 2,500,000 @ A4

Datum: GDA94

Multicom Resources Limited
Saint Elmo Vanadium Project

Figure 1
Regional Location



MULTICOM RESOURCES

epic ENVIRONMENTAL

0 1 2 3 km

Scale: 1:60,000 @ A4

Datum: GDA94

Multicom Resources Limited
Saint Elmo Vanadium Project

Figure 2
Indicative Mine Plan

1.1 Location

The western boundary of the Project is located 15 km east of the township of Julia Creek in Queensland, Australia and falls within the McKinlay Shire Council area. The Project's MLA100162 is located across several lots, namely:

- Lot 13 on Plan EN89, Freehold;
- Lot 1 on Plan EN15, Lands Lease;
- Lot 1 on Plan MF3, Lands Lease;
- Lot 3 on Plan EN147, Lands Lease;
- Lot 208 on MLAY, Stock Route;
- Lot 1 on Plan EN17, Reserve; and
- Lot 4 on Plan B157126, Lands Lease.

The Project is located in the Mitchell Grass Downs (MGD) bioregion and is comprised of open grassland used for grazing purposes, consistent with the bioregion.

1.2 Ecological Features

The MGD bioregion is dominated by Mitchell Grass (*Astrebla* spp.) tussock grasslands on rolling plains (downs). The soils are predominantly deep, heavy clays. The plains are interspersed with drainage lines, supporting open grasslands, herblands or eucalypt woodlands and isolated remnant plateaus. Although the nature of the bioregion is still poorly known, 60 REs are currently recognised in the bioregion (Queensland Herbarium 2018). Nineteen of the REs are grasslands, typically dominated by Mitchell Grass and 30 are woodlands dominated by either Gidgee *Acacia cambagei* (or *A*. *georginae*) or Mulga *A. aneura*. Eucalypt communities occur on the alluvial plains and are dominated by Coolabah *Eucalyptus coolabah* or River Red Gum *E. camaldulensis*.

Desktop analysis of remnant vegetation within the study area and surrounds showed a modified landscape with large areas converted to agricultural purposes (predominately grazing), although large patches of remnant grassland remain. The site is mapped as containing four REs (QG 2018a):

- RE 4.3.4f: *Eucalyptus coolabah* and/or *E. microtheca* low open woodland. Occurs on drainage lines on *Astrebla* spp. undulating plains and braided channels on alluvial plains.
- RE 4.3.15: *Astrebla squarrosa +/- Dichanthium* spp. *+/- Eulalia aurea* grassland on alluvium. Occurs immediately above drainage lines. Sparsely scattered shrubs and trees may occur along the channels. Soils moderately deep to deep, red and brown clays.
- RE 4.9.1c: *Astrebla* spp., *Iseilema* spp. tussock grassland, commonly with *Panicum decompositum*, *Dichanthium* spp., *Eulalia aurea*, *Chrysopogon fallax* and *Sorghum plumosum*. Emergent *Atalaya hemiglauca* commonly occur. Occurs on level to gently undulating downs.

- RE 4.9.2b: Mixed tussock grassland, with combinations of *Astrebla* spp.*, Aristida latifolia*, *Enneapogon* sp. mixed tussock grassland. Emergent *Atalaya hemiglauca, Ventilago viminalis* and *Corymbia terminalis* commonly occur. Occurs on rises of exposed shale and limestone with rocks to the surface of cracking clay soils.

1.3 Topographical and Water Features

The Project area consists of undulating plains, with no noticeable topographic features. Several ephemeral watercourses run through the Project, with several rural water storages (dams) located throughout (**Figure 3**). There is a small, unnamed creek toward the middle of the MLA.

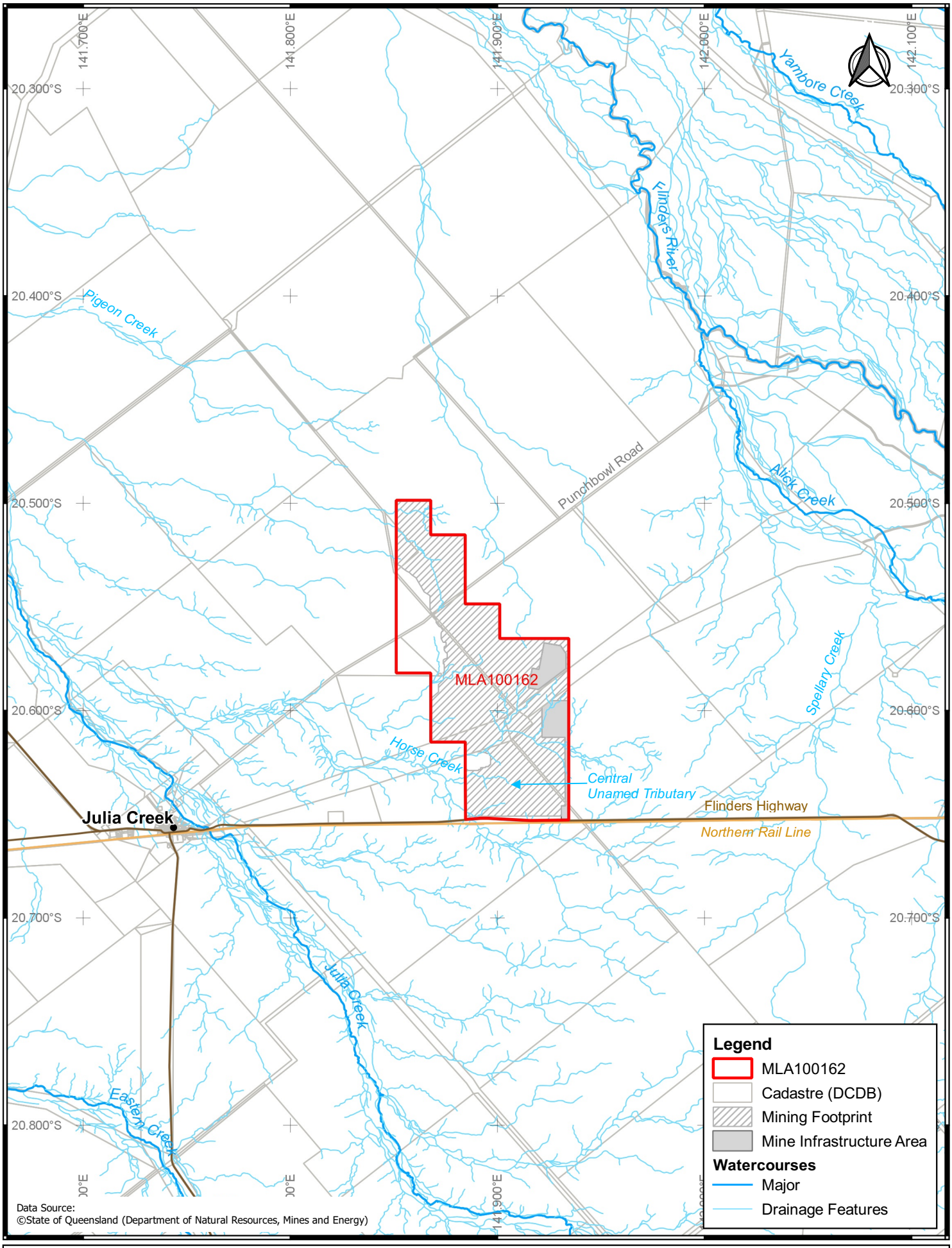
No referrable wetland, or wetland protected area was identified within the study area during the desktop assessment, nor during field assessment.

1.4 Existing Land use

The Project area is largely disturbed and situated across several rural properties. The area has been historically used for cattle grazing on unimproved pastures. Several vehicular tracks and fencing lines occur within MLA100162.

The site is bordered to the south by the Flinders Highway, and the Great Northern Line rail corridor, both running east-west along the southern border of the site (**Figure 1**).

There is a stock route that crosses the width of MLA100162 through the centre.



File Path: G:\Epic Environmental\Projects\BE180134.01 St Elmo-Phase IV EIS Development\Workspaces\Ecology Technical Report\Figure 3 Watercourses and Waterways.qgs

MULTICOM RESOURCES

epic ENVIRONMENTAL

0 5 10 km

Scale: 1:200,000 @ A4

Datum: GDA94

Multicom Resources Limited
Saint Elmo Vanadium Project

Figure 3
Watercourses and Waterways

1.5 Proposed Activities

Multicom is seeking to develop the Project for the purposes of mining and processing vanadium. The proposed activity involves the development of an intrusive resource harvesting facility, incorporating shallow <20 m deep (strip ratios: 0/1 – 2/1) strip mining practices, to obtain access to large known deposits of vanadium.

The Project will consist of a shallow open cut mine, ranging in depth from 20 to 40 m (depending on depth of overburden), with associated dump and haul operations in order to obtain access to large known deposits of vanadium bearing sedimentary material. A range of ancillary infrastructure will be required to support the mining activity, including:

- basic administrative and crib facilities;
- vehicle storage, maintenance and refuelling areas;
- site water storage and management facilities;
- overburden storage and management areas;
- ore processing facilities; and
- site access road, fencing and related security facilities.

Mining is proposed to be carried out sequentially from mining panels along the north – south axis of the Saint Elmo Block. Once the ore is removed, the panel can be back-filled with beneficiated gangue material, overburden material, contoured and sheeted with topsoil prior to revegetation with native species or as otherwise determined in conjunction with relevant stakeholders.

This ecological assessment has considered the range of associated infrastructure required for construction, operation and decommissioning of the mine. It is not anticipated that accommodation facilities will be required onsite, with the majority of the operational workforce coming from Julia Creek and surrounds.

1.6 Applicable Legislation

The following subsections summarise the Commonwealth and State legislation protecting the ecological values of the Project.

1.6.1 Commonwealth Legislation

Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the key piece of Commonwealth legislation governing environmental protection in Australia. Administered by the Commonwealth Government Department of Agriculture, Water and the Environment (DAWE), the EPBC

Act defines and protects nine matters considered to be of National Environmental Significance (MNES) including:

- World Heritage properties;
- National heritage places;
- wetlands of international importance (listed under the Ramsar Convention);
- listed threatened species and ecological communities;
- migratory species protected under international agreements;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park;
- nuclear actions (including uranium mines); and
- a water resource in relation to coal seam gas development and large coal mining development.

Under Part 3 of the EPBC Act, a person must not undertake an action (e.g. a project, a development, an undertaking, an activity or a series of activities, or an alteration of any of these things) that will have, or is likely to have, a significant impact on a protected matter, without approval from the Minister for the Department of Agriculture, Water and the Environment (DAWE) (the Minister).

EPBC Act Environmental Offsets Policy 2012

The EPBC Act *Environmental Offsets Policy October 2012* (EOP) provides upfront guidance on the role of offsets in environmental impact assessments, and how the DEE considers the suitability of a proposed offset. The EPBC Act Offset Policy aims to improve environmental outcomes through the consistent application of best practice offset principles, provide more certainty and transparency, and encourage advanced planning of offsets.

1.6.2 State Legislation

Environmental Protection Act 1994

The objective of the *Environmental Protection Act 1994* (EP Act) is to protect Queensland's environment and to promote ecologically sustainable development. The EP Act defines a General Environmental Duty under which all persons in Queensland have a responsibility not to carry out an activity that causes or is likely to cause environmental harm, and to take all reasonable and practicable measures to prevent or minimise the harm.

The EP Act also regulates Environmentally Relevant Activities (ERAs). ERAs are activities that require an Environmental Authority (EA) prior to activities commencing. Resource activities (mining) are defined under the EP Act as a resource ERA for which an EA is required. An Environmental Impact Statement (EIS) will be required for the Department of Environment and Science (DES) to assess the EA and ERAs.

Nature Conservation Act 1992

The *Nature Conservation Act 1992* (NC Act) and the *Nature Conservation Regulation 2006* (NC Regulation) regulate the environmental impacts of the mining industry through the requirement for vegetation clearing permits, species management programs and other permits.

A clearing permit is required to clear protected plants unless an exemption applies. In general, clearing of Endangered, Vulnerable or Near Threatened plants will require a clearing permit. Clearing permit applications are assessed on a case-by-case basis and approvals will be subject to conditions.

Where mining activities involve tampering with animal breeding places, the tampering may be authorised by application to DES through an approved species management program.

Vegetation Management Act 1999

The *Vegetation Management Act 1999* (VM Act) regulates the clearing of remnant vegetation in Queensland. The VM Act aims to conserve Queensland's biodiversity through vegetation management. The VM Act does not apply on mining leases; however, the assessment of the application for the mining lease will assess the vegetation clearing activities required as part of mining activities at the site.

Biosecurity Act 2014

The *Biosecurity Act 2014* ensures a consistent, modern, risk-based and less prescriptive approach to biosecurity in Queensland. The *Biosecurity Act 2014* provides comprehensive biosecurity measures to safeguard the economy, agricultural and tourism industries, environment and way of life from pests, diseases and contaminants. Decisions made under the *Biosecurity Act 2014* will depend on the likelihood and consequences of risk, allowing for more appropriate management of risks.

1.7 Previous and Similar Studies

The Project area has not been previously subjected to a detailed terrestrial ecology assessment. Based on desktop review, one project (linear infrastructure) was identified in the vicinity of the Project as being relevant and able to inform the Project's terrestrial ecology desktop research, namely:

- *Environmental Impact Statement for the CopperString Project* (CopperString Pty Ltd 2010): This EIS included ecological surveys of the transmission line from a new substation near Woodstock, south of Townsville, to a new substation south west of Cloncurry. The Project area runs approximately 20 km south of the Project, parallel to the Flinders Highway.

The relevant ecological sections from the Project were considered during preparation of this ecological assessment report.

1.8 Nomenclature and Taxonomy

Taxonomy of flora presented in this report follows that currently endorsed by the Queensland Herbarium in the Census of Queensland Flora 2013. The taxonomy of fauna follows the *Australian Faunal Directory* (DEE 2020a).

The common names of many flora and fauna species frequently vary between regions, and many species lack them altogether. For common and scientific names of flora, refer to Appendix A and for fauna species, refer to Appendix B.

The conservation status of Queensland wildlife is prescribed within the *Nature Conservation (Wildlife) Regulation 2006*, following provisions of the NC Act. The conservation status of species at a national level is defined under the EPBC Act.

2 Methods

2.1 Literature Review

Prior to commencing the field survey, desktop assessments were carried out to identify species and ecological communities of conservation significance that potentially occur within the Project area. Flora and fauna of conservation significance in this report include:

- flora and fauna species listed as Critically Endangered, Endangered or Vulnerable under the EPBC Act;
- flora and fauna species listed as Endangered, Vulnerable or Near Threatened or Special Least Concern under the NC Act;
- Regional Ecosystems (REs) listed as Endangered or Of Concern under the VM Act;
- fauna species listed as Migratory under the EPBC Act due to their inclusion under one or more of the following:
    - *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention)
    - *China-Australia Migratory Bird Agreement* (CAMBA)
    - *Japan-Australia Migratory Bird Agreement* (JAMBA)
    - *Republic of Korea-Australia Migratory Bird Agreement* (ROKAMBA)

Flora and fauna records listed in publicly available databases and resources were investigated to provide insight into species that are likely to inhabit the Project area. These included:

- DAWE Protected Matters Search Tool (PMST) (records within a 50 km radius of the point -20.609; 141.904);
- Queensland Government Wildlife Online (WildNet) database (records within a 50 km radius around the point -20.609; 141.904);
- Species profile search maintained by the Queensland Government (QG 2020);
- *Atlas of Living Australia*, a web-based search tool that is a partnership between CSIRO, Australian museums, herbaria and other biological collections, and the Australian Government;
- Online Zoological Collections of Australian Museums;
- Biodiversity Planning Assessments for the Mitchel Grass Downs (DERM 2009) and Gulf Plains (DEHP 2015) bioregions; and
- *Environmental Impact Statement for the CopperString Project* (CopperString Pty Ltd 2010); and
- *Copperstring Supplementary Environmental Impact Statement* (Copperstring Pty Ltd 2011).

2.2 Survey Timing

The Project area experiences a semi-arid climate, characterised by hot humid summers and dry warm winters, with the majority of rainfall occurring in the warmer months between December and March. The Julia Creek region receives an average of 435.5 mm of rain per annum, of which 64 percent falls in

the summer months (BoM 2018a). Most creeks in the area are dry for most of the year. Mean daily maximum temperatures range from 39.6°C in December to 27.1°C in June. Daily minimum temperatures vary from 8.9°C in July to 23.8°C in December to February (BoM 2018).

Such notable seasonality of rainfall and extreme temperatures underlies extensive variability in the presence or, more importantly, detectability of flora and fauna, for example:

- understorey herbs and grasses are best sampled in the late wet season when flowering and/or fruiting;
- amphibians are usually inactive in the cooler dry months, and are best sampled at the commencement of summer rains;
- migratory birds may be present in one season only (winter or summer), depending on species;
- rodents and other small mammals are best sampled in the early dry season when populations are at their densest (Dickman et al. 1999);
- some fossorial (burrowing) reptiles are most detectable after heavy rain; and
- many reptiles are most active and most easily detected at the commencement of breeding in spring (Spence-Bailey et al. 2010).

To account for this seasonal variation, the *Terrestrial Vertebrate Survey Guidelines for Queensland*, *Version 3.0* (Eyre et al. 2018) recommends undertaking two fauna surveys; one in Spring (September – early November) and one in Autumn (late February – May). Flora is best surveyed in the late wet season (March-May), when most herbs and grasses are actively flowering and/or seeding.

2.3 Flora Survey

The flora site survey was undertaken using RE code site sheets as a facsimile of tertiary sites, rather than quaternary or secondary site data. The RE code site sheets were chosen to simplify the process for a Property Map of Assessable Vegetation (PMAV) if required later. Data collected during the survey included:

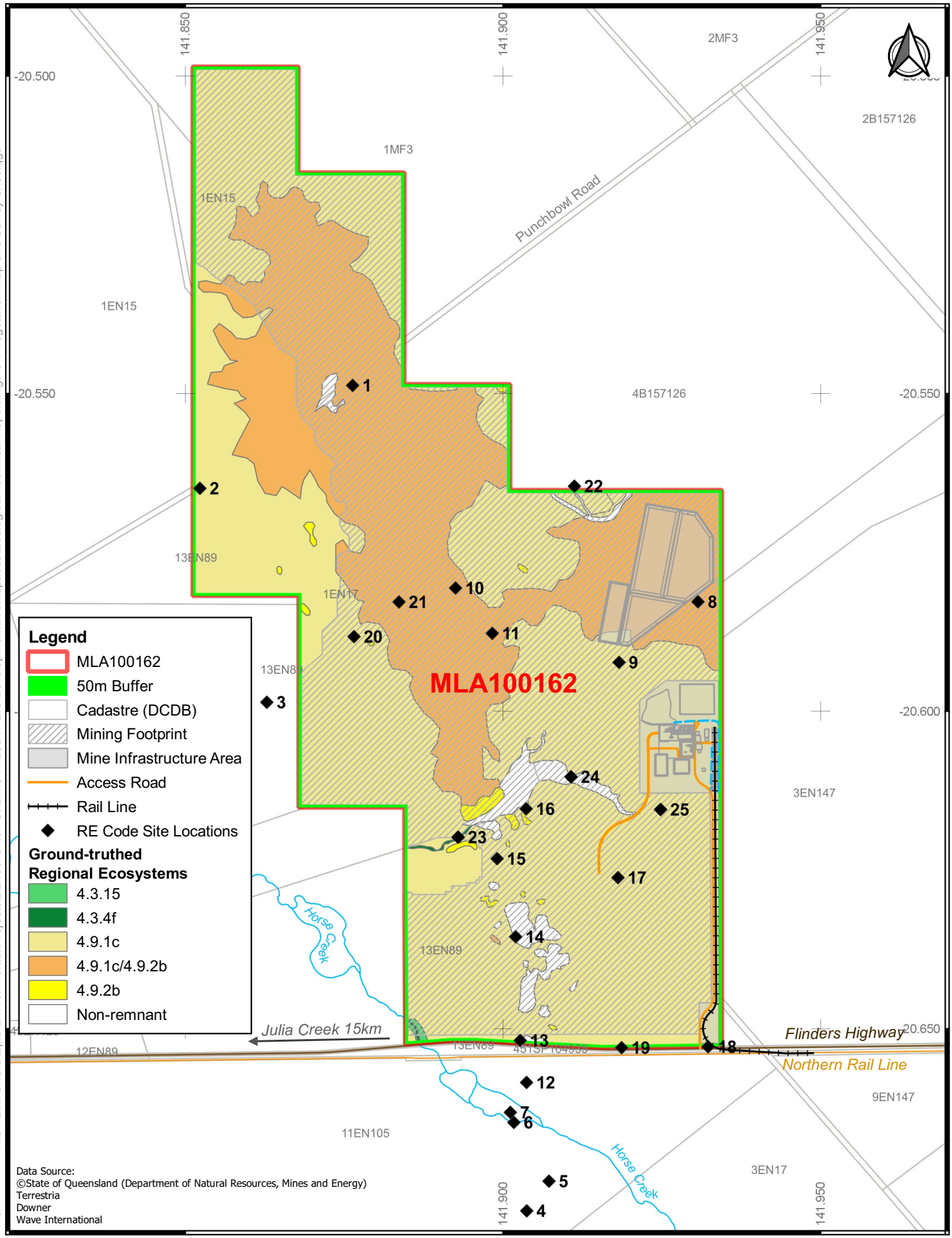
- a GPS-derived position;
- observations of geology and soil type;
- land unit types present;
- floristics within all structural layers, including dominance;
- presence of any conservation significant flora species; and
- estimated height ranges for all vegetation layers including median heights.

All flora species noted within the Project while moving between sites were identified and recorded. Online databases and reviews of surveys of nearby mining leases highlighted a number of conservation significant species that may occur *in situ*. Special effort was made to thoroughly search habitats identified as likely to support species of conservation significance.

2.3.1 Vegetation Mapping

On-ground vegetation mapping surveys included establishing field sites in all RE types present whilst attempting to traverse as much of the site as possible to establish changes in vegetation community type and surface geology/soil types using quaternary sites. Notes on condition including the presence of weed species were also undertaken throughout the survey.

Results from the flora survey were used to produce a vegetation map of the Project (**Figure 4**). For each mosaic polygon (vegetation blocks containing a mixture of RE types), a field-verified estimation of the percentage of each RE unit present was recorded. This enabled calculation of the total areas covered by each RE within the Project.



MULTICOM RESOURCES

epic ENVIRONMENTAL

0 1 2 3 km

Scale: 1:65,000 @ A4

Datum: GDA94

Multicom Resources Limited
Saint Elmo Vanadium Project

Figure 4
Vegetation Map and Survey Sites

BE180134.01 Rev 3 May 2020

2.4 Fauna Survey

The fauna survey catalogued all species of terrestrial vertebrates, including amphibious species such as frogs and turtles, recorded within and immediately adjacent to the Project area, with particular focus on detecting species of conservation significance. This was achieved through a combination of trapping, camera traps (motion-sensitive surveillance cameras), Anabat recording of ultra-sonic micro-bat calls, visual searches, audio surveys and targeted assessments of habitats considered to be of highest quality.

In accordance with the *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland, Version 3.0* (Eyre et al. 2018), the survey area was stratified into assessment units of environmentally similar habitats that are expected to support similar suites of species. This stratification was carried out to ensure that all habitat types were adequately sampled.

It is noted that the March 2017 survey was undertaken for the greater EPM26410 whilst the subsequent surveys were undertaken focusing on MLA100162.

Employment of a variety of survey methods results in the detection of the greatest diversity of wildlife (Garden et al. 2007). At each fauna trap site Elliott (box) and funnel traps were deployed and birds, diurnal mammals and reptiles were surveyed (**Figure 5**). Five target sites were used for Anabat detection and general observation. The methods employed followed standard survey techniques (Eyre et al. 2018) and are described in detail below. Star Finch walking transects were stratified across the Project site and in REs that represented potentially suitable foraging habitat for the species (**Figure 7**).

Site descriptions for each trap and target site and walking transects have been provided in **Table 1**.

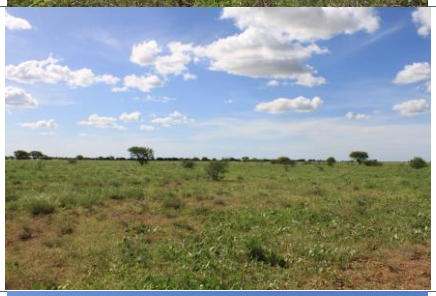
Table 1: Descriptions of Trap and Target Sites

Site	Description/Habitat Type	Photo
Trap Site 1 (March 2017)	Trap Site 1 was located in RE 4.9.1c: *Astrebla* spp., *Iseilema* spp. tussock grassland, commonly with other grasses including *Panicum decompositum*, *Dichanthium* spp., *Eulalia aurea*, *Chrysopogon fallax* and *Sorghum plumosum.* An emergent shrub, *Atalaya hemiglauca*, commonly occurs. The RE occurs on level to gently undulating downs. This RE is considered potential habitat for conservation significant fauna species including Julia Creek Dunnart *Sminthopsis douglasi* and a skink, Black Soil-rises Ctenotus *Ctenotus schevilli* (QG 2018a). The site had only sparse grass cover and some infestation of Prickly Acacia *Vachellia nilotica*, including a number of dead individuals. No *A. hemiglauca* was present in the trapping area.	

Site	Description/Habitat Type	Photo
Trap Site 2 (March 2017)	Trap Site 2 was located in RE 4.9.1c (see above). The site had grass cover varying from sparse to dense and with low-level infestation of Prickly Acacia.	
Trap Site 3 (March 2017)	Trap Site 3 was located in RE 4.9.1c (see above). The site had grass cover varying from sparse to quite dense and with low-level infestation of Prickly Acacia.	
Trap Site 4 (March 2017)	Trap Site 4 was located in RE 4.9.1c (see above). The site had grass cover varying from sparse to dense and with high-level infestation of Prickly Acacia.	
Trap Site 5 (March 2017)	Trap Site 5 was located in RE 4.9.1c/4.9.2b (see above for description of 4.9.1c). RE 4.9.2b is mixed tussock grassland, with combinations of *Astrebla* spp., *Aristida latifolia*, *Enneapogon* sp. mixed tussock grassland. Emergent *Atalaya hemiglauca*, *Ventilago viminalis* and *Corymbia terminalis* commonly occur. Occurs on rises of exposed shale and limestone with rocks to the surface of cracking clay soils. The site had mostly dense grass cover, with only a few scattered Prickly Acacia within the trapping area.	
Target Site 1 (March & July 2017, April & November 2018)	Target Site 1 is a large ephemeral dam surrounded by dense Prickly Acacia and adjacent to cattle yards. Target Site 1 provided resources to a considerable number of birds during the survey period, including a variety of duck and other waterbird species. Target Site 1 had reduced water levels in July 2017. The site still provided water and was used for bird surveys and Anabat recording. Water levels were low in November 2018, with large areas of exposed dam bed. Sixty-three bird species were recorded at this site, 69% of the species recorded in the Project. This included three species listed as Migratory under the EPBC Act.	

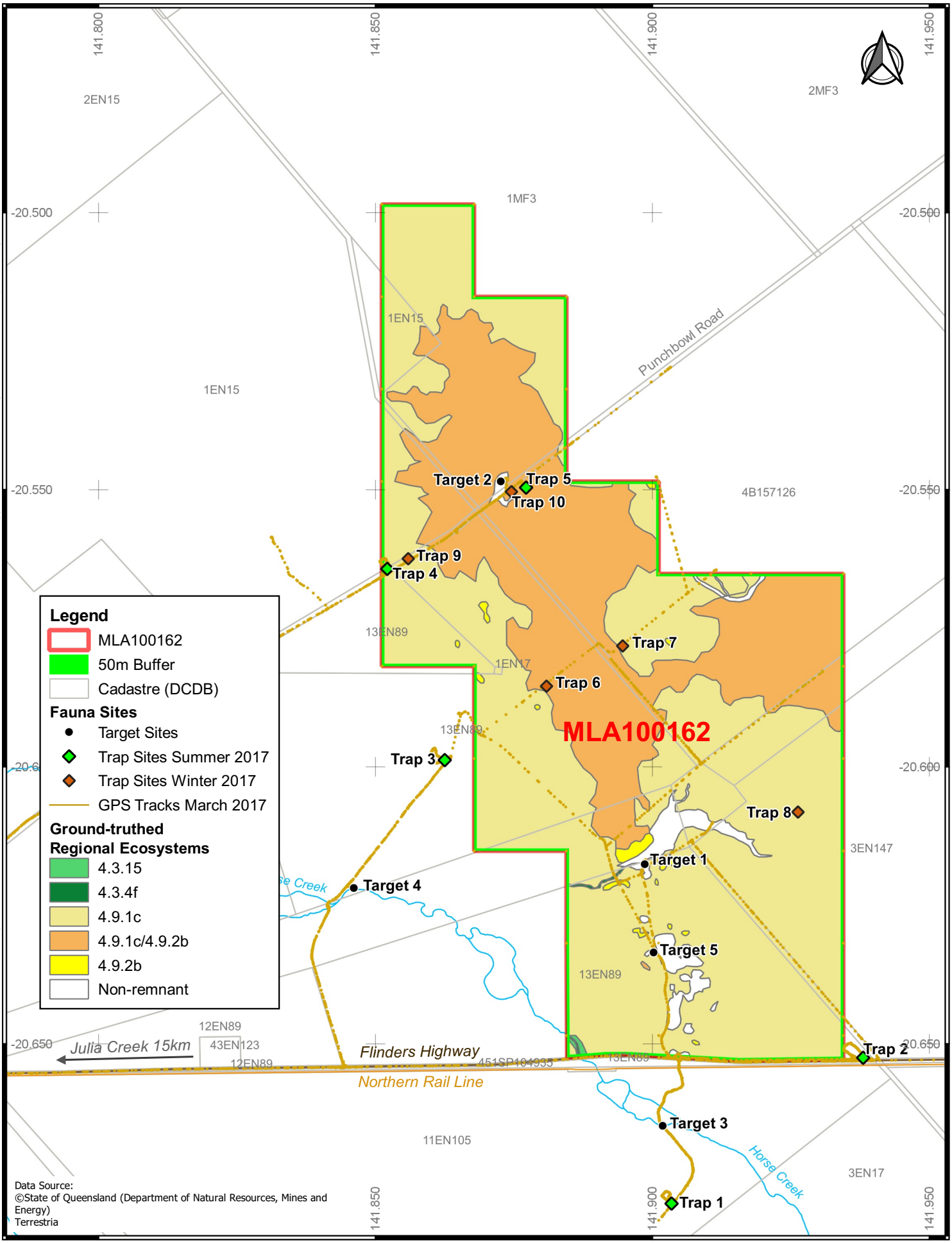
Site	Description/Habitat Type	Photo
Target Site 2 (March 2017 and April 2018)	Target Site 2 is a small quarry with casual water providing ephemeral foraging resources for a variety of waterbirds and a source of drinking water for other species. Target Site 2 is very similar to Target Site 5. Target Site 2 lacked water during April & November 2018.	
Target Site 3 (March 2017)	Target Site 3 is a dry shallow creek infested with Prickly Acacia.	
Target Site 4 (March 2017)	Target Site 4 is a small farm dam fringed by trees with ephemeral shallow water nearby.	
Target Site 5 (March 2017)	Target Site 5 is a small quarry with casual water. Target Site 5 was targeted for micro-bats. Target site 5 was dry in July 2017.	
Trap Site 6 (July 2017)	Trap Site 6 was located in RE 4.9.1c (see above). The site had grass cover varying from sparse to quite dense and with low-level infestation of Prickly Acacia.	

Site	Description/Habitat Type	Photo
Trap Site 7 (July 2017)	Trap Site 7 was located in RE 4.9.1c (see above). The site had grass cover varying from sparse to quite dense and with low-level infestation of Prickly Acacia.	
Trap Site 8 (July 2017)	Trap Site 8 was located in RE 4.9.1c (see above). The site had grass cover varying from sparse to quite dense and with low-level infestation of Prickly Acacia.	
Trap Site 9 (July 2017)	Trap Site 9 was located in RE 4.9.1c (see above). The site had grass cover varying from sparse to quite dense and with low-level infestation of Prickly Acacia.	
Trap Site 10 (July 2017)	Trap Site 10 was located in RE 4.9.1c (see above). The site had grass cover varying from sparse to quite dense and with low-level infestation of Prickly Acacia.	

Site	Description/Habitat Type	Photo
Transect 1 (April 2018)	Transect 1 was located in RE 4.9.1c/4.9.2b. *Panicum*, *Chrysopogon* and *Sorghum* spp. are identified as food species for Star Finch (DEE 2018b).	
Transect 2 (April 2018)	Transect 2 was located in RE 4.9.1c. *Panicum*, *Chrysopogon* and *Sorghum* spp. are identified as food species for Star Finch (DEE 2018b).	
Transect 3 (April 2018)	Transect 3 was located in RE 4.9.1c. *Panicum*, *Chrysopogon* and *Sorghum* spp. are identified as food species for Star Finch (DEE 2018b). The RE occurs on level to gently undulating downs and lacks native woody trees.	
Transect 4 (April 2018)	Transect 4 was located in RE 4.9.1c/4.9.2b and RE 4.9.1c, *Panicum*, *Chrysopogon* and *Sorghum* spp. are identified as food species for Star Finch (DEE 2018b).	
Transect 5 (April 2018)	Transect 5 was located in RE 4.9.1c. *Panicum*, *Chrysopogon* and *Sorghum* spp. are identified as food species for Star Finch (DEE 2018b). The RE occurs on level to gently undulating downs and lacks native woody trees.	
Transect 6 (April 2018)	Transect 6 was located in RE 4.9.1c. *Panicum*, *Chrysopogon* and *Sorghum* spp. are identified as food species for Star Finch (DEE 2018b). The RE occurs on level to gently undulating downs and lacks native woody trees.	

Site	Description/Habitat Type	Photo
Transect 7 (April 2018)	Transect 7 was located in RE 4.9.1c. *Panicum*, *Chrysopogon* and *Sorghum* spp. are identified as food species for Star Finch (DEE 2018b). The RE occurs on level to gently undulating downs and lacks native woody trees.	
Transect 8 (April 2018)	Transect 8 was located outside of MLA100162. Within RE 4.9.1c. *Panicum*, *Chrysopogon* and *Sorghum* spp. are identified as food species for Star Finch (DEE 2018b). The RE occurs on level to gently undulating downs and lacks native woody trees.	
Transect 9 (April 2018)	Transect 9 was located in RE 4.9.1c. *Panicum*, *Chrysopogon* and *Sorghum* spp. are identified as food species for Star Finch (DEE 2018b). The RE occurs on level to gently undulating downs and lacks native woody trees.	
Transect 10 (April 2018)	Transect 10 was located in RE 4.9.1c. *Panicum*, *Chrysopogon* and *Sorghum* spp. are identified as food species for Star Finch (DEE 2018b). The RE occurs on level to gently undulating downs and lacks native woody trees.	
Horse Creek (April 2018)	Horse Creek is heavily degraded and typically fringed by no more than one Coolabah on each bank. There are substantial stretches where the only tree species is Prickly acacia. The waterbody is mapped as RE: 4.3.4f: *Eucalyptus coolabah* and/or *E. microtheca* low open woodland occurring on drainage lines on *Astrebla* spp. undulating plains and braided channels on alluvial plains. *E. coolabah* is identified by Holmes (1998) as potential Star Finch habitat. Horse Creek, at least within the Project, was dry in November 2018.	
Windmill waterbody (April 2018)	Windmill waterbody provided a small pool of water onsite. It was surrounded by Prickly Acacia.	

Site	Description/Habitat Type	Photo
Dam 2 (April & November 2018)	Adjacent to Dam 1, Dam 2 is a smaller anthropogenic water storage area. Dam 2 did not hold water during the 2017 fauna surveys. It was fed from a turkey-nest dam adjacent to the cattle yards.	
Quarry 1 (April 2018)	Quarry 1 is a small, inactive quarry with casual water targeted for Star Finch waterhole-watching.	
Quarry 2 (April 2018)	Quarry 2 is a small, inactive quarry with casual water targeted for Star Finch waterhole-watching.	
Quarry 3 (April 2018)	Quarry 3 is a small, inactive quarry with casual water targeted for Star Finch waterhole-watching.	



MULTICOM RESOURCES

epic ENVIRONMENTAL

0 1 2 3 km

Scale: 1:60,000 @ A4

Datum: GDA94

Multicom Resources Limited
Saint Elmo Vanadium Project

Figure 5
Fauna Survey Sites

2.4.1 Trapping and Survey Techniques

Trapping sites used in March 2017 were chosen so that they could be accessed quickly given the 40°C temperature maximums. Traps needed to be cleared of captures and closed before the heat could cause any animal deaths. Sites where Julia Creek Dunnart *Sminthopsis douglasi* may occur were also selected, while still achieving a spatial spread.

An abundance of grasshoppers was noted during the surveys, providing potential food for Julia Creek Dunnart and other small carnivores, possibly reducing the likelihood of capture in an Elliott trap.

Elliott Traps

At each trap site, 20 Type-A Elliott Traps were placed 5-10 m apart and baited with standard small mammal mix (peanut butter, oats, oil and honey). Their exact placement targeted habitats of greatest complexity (vegetation and fallen timber) and, in March 2017, shade.

Each trap was opened late each afternoon and checked and closed the following morning before 08.00. Traps were operational for four nights per site.

Funnel Traps

Four pairs of funnel traps were placed per trap site. It was intended to arrange funnel traps in two parallel lines either side of a 10 m long drift fence. However, only a single drift fence was used at Trap Site 1 for the March 2017 survey due to equipment failure. The remaining trap sites (Sites 2-5) did not have drift fences. All traps sites in the July 2017 survey had drift fences, with paired funnel traps spaced evenly along the fence. Traps were operational for four consecutive nights at each survey site. Traps were checked and cleared each morning and late afternoon.

Remote Sensory Cameras

Remote-sensory camera ‘traps’ were used to complement the Type-A Elliott Traps in an effort to detect medium-size and large mammals. Each camera site was operational for four consecutive days and nights. Five camera sites were sampled during the survey, spanning a range of habitat types.

Bats

Micro-bat calls were recorded using four (4) Anabat SD2 recorders during the March 2017 survey. The July 2017 survey used one Anabat SD2 recorder over four (4) nights. The Anabat units were operational for the entire night, ensuring that recording took place during periods of peak activity. The units were set to high sensitivity in an effort to record for the potential presence of Ghost Bat *Macroderma gigas* a species listed as Vulnerable under both the NC Act and EPBC Act and predicted as possibly occurring by the Protected Matters Report (Appendix D).

Rather than record at systematic fauna survey sites as suggested by Eyre et al. (2018), locations for Anabat recording were selected in suitable flyways or near waterbodies where bat activity is typically high (Young & Ford 2000). This potentially increased the number and diversity of bats sampled. Anabat dates and locations have been provided in **Table 2.** Anabat analysis reports are included in Appendix C.

Table 2: Anabat Site Locations and Trapping Nights 2017

Site	Night (March 2017)			Night (July 2017)			
	27/28th	28/29th	29/30th	24/25th	25/26th	26/27th	27/28th
Trap Site 1	X						
Trap Site 2							
Trap Site 3		X					
Trap Site 4	X						
Trap Site 5		X					
Trap Site 6							
Trap Site 7							
Trap Site 8							
Trap Site 9							
Trap Site 10							
Target Site 1	X		X	X	X	X	X
Target Site 2			X				
Target Site 3							
Target Site 4		X					
Target Site 5			X				
Night Drive (North)		X					
Night Drive (Central)			X				

Spotlighting

Spotlighting was undertaken on foot and via vehicle on the nights of 28 – 29 March 2017 and 6 – 9 November 2018. Spotlighting was undertaken on calm, warm nights when faunal activity is highest.

Targeted Searches of Shelter Sites

Inspections of potential shelter sites (e.g. fallen timber, riparian zones) were carried out during the day to search for additional species not recorded using other survey techniques. All species of vertebrate observed opportunistically while travelling around the Project were recorded.

Birds

Bird species were recorded at each systematic site during the twice-daily visits to check traps. Birds were identified by sight or call. An area with an approximate radius of 100 m around each trap-line was included in these bird censuses. At least two (2) hours of survey effort was devoted to each site.

In addition to censuses of each systematic fauna site, a large number of species were recorded during targeted searches of the entire Project area. These targeted surveys were carried out opportunistically in all REs. The timing of the survey was optimal for detecting a broad range of migratory and resident species. Targeted survey methods were used to target the presence of Star Finch *N. r. ruficauda*.

Targeted Star Finch Survey Method

Star Finch *Neochmia ruficauda* is listed by the IUCN as Least Concern (Birdlife International 2016b). The nominate (eastern/southern) subspecies *N. r. ruficauda* is listed as Endangered under both the EPBC Act and NC Act. Approved Conservation Advice for the species is available, however there is no recovery plan for the subspecies or species.

The *Action Plan for Australian Birds 2010* (Garnett et al. 2011) lists the species as Critically Endangered (Possibly Extinct). There are 3 records from the Winton area (ALA 2020), two are from 1992 and 1993. The third, which has only recently been added to the ALA database is from 2017. The only detail provided is that it is a *Birdlife Australia* record of 12 birds in September 2017. These records would refer to the nominate subspecies based on known distribution. The 2017 record is not included in the data available through the species profiles maintained by DES (QG 2020) or the WildNet database and was not submitted to the *Records Appraisal Committee* for Birds Queensland (T. Reis is a committee member). An enquiry has been sent to *Birdlife Australia* but, as yet, there has been no reply.

Notwithstanding the 2017 record at Winton, the validity of which is unknown, there has been no definite record since 1995, despite targeted surveys. The nominate subspecies is thought to be possibly extinct (Garnett et al. 2011; Maute & Legge 2012; Birdlife International 2016b; DEHP 2017; Menkhorst et al. 2017) and is described by Parker and Ingwersen (2012: 248) as 'lost from Queensland'. Without further information is it impossible to ascertain the reliability of the 2017 record other than that it is unlikely to refer to escapees (the species is a popular cage bird) given the number recorded. The nominate subspecies is thought to be possibly extinct (Garnett et al. 2011; Maute & Legge 2012; Birdlife International 2016b; DEHP 2017; Menkhorst et al. 2017). A targeted survey was undertaken for the species within and adjacent to the Project.

Star Finches mostly occur in low, dense, damp grasslands and sedgelands fringing watercourses and wetlands. They also occur in open savannah woodlands (Higgins et al. 2006) but avoid expansive areas without woody plants (Holmes 1998). Holmes (1996) described vegetation at nine former sites of the nominate subspecies. Most were woodland sites, dominated by tree species strongly associated with permanent water or regular inundation, *Eucalyptus coolabah*, *E. tereticornis*, *E. camaldulensis*, *E. tessellaris*, *Melaleuca leucadendra* and *Casuarina cunninghamii*.

Table 3 summarises the REs present in the Project, respective coverage in hectares and relevance to Star Finch. As the Project area is more than 8,800 ha, methods were designed to target REs described as containing relevant habitat features. *Panicum*, *Chrysopogon* and *Sorghum* spp. are identified as food species for Star Finch (DEE 2018b) (described generally within RE 4.9.1.c). In addition, *E. coolabah* is identified by Holmes (1998) as potential Star Finch habitat (described generally within RE 4.3.4f). Therefore REs 4.3.4f and 4.9.1c were the focus of the targeted survey. Less focus was given to areas of RE 4.9.1c/4.9.2b unless the habitat was dominated by RE 4.9.1c.

Table 3: Regional Ecosystems of the Project Site and Relevance to Star Finch

Regional Ecosystem	RE Description	Area (ha)	Relevance to Star Finch
4.3.4f	*Eucalyptus coolabah* and/or *E. microtheca* low open woodland occurring on drainage lines on *Astrebla* spp. undulating plains and braided channels on alluvial plains.	6.6	*E. coolabah* is identified by Holmes (1998) as potential Star Finch habitat.
4.3.15	*Astrebla squarrosa* +/- *Dichanthium* spp. +/- *Eulalia aurea* grassland on alluvium.	6.5	This habitat is too open for Star Finch and invasion by Prickly Acacia doesn't increase its suitability.
4.9.1c	*Astrebla* spp., *Iseilema* spp. tussock grassland, commonly with *Panicum decompositum, Dichanthium* spp., *Eulalia aurea*, *Chrysopogon fallax*, *Sorghum plumosum*. Emergent *Atalaya hemiglauca* commonly occur. Occurs on level to gently undulating downs.	5319.6	The Star Finch is primarily granivorous, mostly eating seeds of native grasses, especially *Sorghum*. *Panicum*, *Chrysopogon* and *Sorghum* spp. are identified as food species for Star Finch (DEE 2018).
4.9.1c/4.9.2b	Combination of 4.9.1c/4.9.2b.	2969.9	This habitat may include *Panicum*, *Chrysopogon* and *Sorghum* spp.
4.9.2b	Mixed tussock grassland, with combinations of *Astrebla* spp., *Aristida latifolia, Enneapogon* sp. mixed tussock grassland. Emergent *Atalaya hemiglauca*, *Ventilago viminalis* and *Corymbia terminalis* commonly occur.	44.8	This habitat is not considered suitable for Star Finch. Tree occurrence is typically not associated with permanent water or regular inundation.

DEWHA's (2010) recommended methods to survey for the nominate subspecies of Star Finch consist of area searches or transect-point surveys, broadcast (call playback) surveys and surveys targeting waterholes. The first two methods relate to areas of less than 50 ha and were allocated lower priority given the size of the site. Surveys targeting waterholes are to be conducted over four days, for a total of 10 hours. Flocks of other finch species should also be checked.

2.4.2 March and July 2017 Survey Effort

The sampling effort during the 2017 surveys is summarised in **Table 4.** Locations of sampling sites are shown in **Figure 5.**

Table 4: Fauna Survey Effort

Survey Technique	Fauna Targeted	Total Effort	Unit
Type-A Elliott Trap	Small mammals, reptiles and frogs	800	Trap-nights
Funnel Trap	Reptiles and frogs	320	Trap-nights
Camera Trap	Medium-sized to large mammals, reptiles and birds	40	Trap-nights
Anabat Recorder	Micro-bats	15	Nights
Diurnal Targeted Searches	Birds and reptiles	12	Hours
Spotlighting	Nocturnal mammals, geckos, owls, frogmouths, nightjars, snakes	10	Hours

2.4.3 Star Finch Survey Effort

Ten hours and 55 minutes of waterhole watching were conducted over the four days, during which the survey team spent just over 31 hours onsite (**Table 5**). Seven waterbodies, only one of which was natural (Horse Creek), were surveyed (**Figure 3**). Initially, the majority of waterhole watching was conducted

during the three hours post-sunrise. However, the abundance and species richness of birds drinking were so low during this time that the focus was shifted to the middle of the day and mid-afternoon for days three and four. Star Finch is highly dependent on water, drinking often during the day, especially in hot weather (Higgins et al. 2006).

Table 5: Waterhole Survey Timing (April 2018)

Site	Time	Effort - Duration (minutes)
02 April 2018		
Dam 1 (Target 1)	6.50 – 8.50	120
Dam 2	11.30 – 12.30	60
Quarry 1	14.30 – 15.00	30
03 April 2018		
Horse Creek (RE 4.3.4f)	6.30 – 8.00	90
Dam 2	8.15 – 8.45	30
Dam 1	16.25 – 16.55	60*
04 April 2018		
Quarry 2	8.10 – 8.40	30
Dam 1	11.30 – 12.00	60*
Windmill	15.25 – 16.10	45
05 April 2018		
Quarry 3	6.30 – 7.00	30
Quarry 3	8.00 – 8.30	30
Horse Creek	13.15 – 13.55	40
Dam 1	14.10 – 14.40	30

* The two observers surveyed different parts of the same waterbody for a total of 1 person-hour.

2.4.4 November 2018 Survey Effort

The Project was visited in early November 2018, with six (6) hours of spotlighting, both from a vehicle and on foot, over three (3) nights. Eight (8) hours of observational survey was conducted in the mornings, targeting seasonal variation in the species assemblage.

3 Results

3.1 Desktop Research

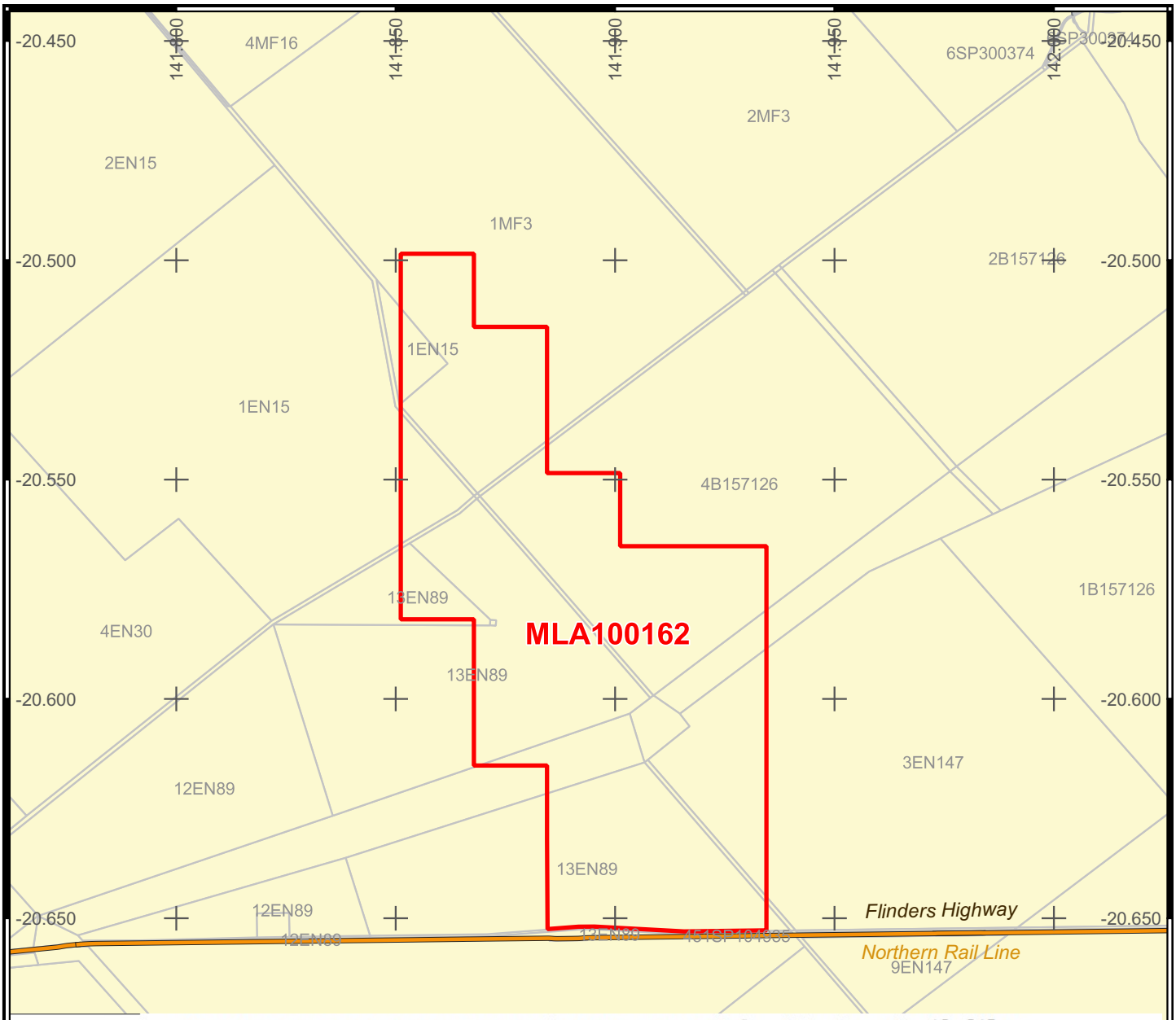
Prior to undertaking the field survey, desktop research was undertaken to ascertain the site condition and species likely to be present, including only seasonally or sporadically.

3.1.1 Environmentally Sensitive Areas

Activities within Environmentally Sensitive Areas (ESAs) are subject to approval by DES. ESAs fall under three categories; Category A and B areas are defined in the EP Regulation 2008, while Category C areas are defined within the Code of Environmental Compliance for Exploration and Mineral Development Projects 2001.

- Category A ESAs include National Parks, Conservation Parks and Forest Reserves under the NC Act.
- Category B ESAs include Coordinated Conservation Areas, Wilderness Areas, World Heritage management areas, areas of Critical Habitat for threatened species, Wetlands of International Importance, State Forest Parks or Scientific Areas under the *Forestry Act 1959*, marine plants or Endangered REs.
- Category C Environmentally Sensitive Areas may include any of the following environments: Nature Refuges and Resource Reserves, declared Catchment Areas, declared Irrigation Areas, Water Reservoirs and Drainage Areas, River Improvement Areas, State Forest or Timber Reserves, DPI Research Sites, Critical Areas and Public Purpose Reserves, areas subject to a State Planning Policy that designates an area for environmental protection, Coastal Management Districts and land occupied by the Bureau of Sugar Experiment Stations.

Using DES ESA mapping, it is evident that the Project does not contain any ESAs (**Figure 6**).



ENVIRONMENTALLY SENSITIVE AREAS - Mining Activities

- Selected Exploration Permit Mineral (EPM)

CATEGORY A
- National Parks
- Conservation Parks
- Forest Reserves
- Wet Tropics World Heritage Area
- Great Barrier Reef Marine Park Area
- Marine Parks other than General Use Zones

CATEGORY B
- World Heritage Areas
- Queensland Heritage Register Places
- Ramsar Sites
- Cultural Heritage Registered Areas and DLA's other than Stanbroke
- Special Forestry Areas
- Fish Habitat Areas
- Koala Plan
- Coordinated Conservation Areas
- Endangered Regional Ecosystems (Biodiversity Status)
- Marine Parks other than General Use Zones
- Marine Plants

CATEGORY C
- Nature Refuges
- Resources Reserve
- State Forests
- Timber Reserves
- Declared Catchment Areas
- Declared Irrigation Areas
- Drainage Areas
- River Improvement Areas
- Stanbroke DLA
- Coastal Management District
- Dams and Weirs

OTHERS
- Towns
- Roads
- Repealed Wild River Nominated Waterways
- Repealed Wild River Preservation Areas
- Repealed Wild River High Preservation Areas
- Mahogany Glider Habitat
- Directory of Important Wetlands
- Queensland

LOCALITY DIAGRAM

N

Information presented on this product is distributed by the Queensland Government as an information source only. While every care is taken to ensure the accuracy of this data, The State of Queensland makes no statements, representations or warranties about the accuracy, reliability, completeness or suitability of any information contained in this product.

The State of Queensland disclaims all responsibility for information contained in this product and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any way for any reason.

External contributors (non-government parties) of the data for this product are: Great Barrier Reef Marine Park Authority

Regional ecosystem mapping (remnant biodiversity status) may incorporate amendments, resulting from property level assessments, to the release version of the mapping available on QSpatial.

NOTE TO USER: Themes presented in this map are indicative only. Field survey may be required to verify the 'true' spatial extent and value. Not all environmentally sensitive areas are presented in this map. A user should refer to the particular circumstances relevant to their situation to assess the 'completeness' of themes provided.

The user should note that some boundaries and indicated values are ambient and may change over time (e.g. regional ecosystem boundaries and conservation status, watercourse mapping etc).

The user should be aware that due to multiple overlapping themes/ layers present, some themes/layers may be obscured by others. Ordering in the Legend does not accurately reflect the order by which themes/layers are displayed.

File Path: G:\GIS\Epic Environmental\Projects\BE180134.01 St Elmo-Phase IV EIS Development\Workspaces\Ecology Technical Report\Figure 6 Environmentally Sensitive Areas Mapping.qgs

MULTICOM RESOURCES

epic ENVIRONMENTAL

0 2 4 6 km

Scale: 1:120,000 @ A4

Datum: GDA94

Multicom Resources Limited
Saint Elmo Vanadium Project

Figure 6
Environmentally Sensitive Areas Mapping

3.1.2 Habitat Values

Habitat Diversity and Connectivity

Most of the site is composed of remnant vegetation however all this vegetation is subject to grazing pressure. The Project largely consists of *Astrebla lappacea* dominated tussock grassland. Despite comprising several subtly different REs, these grasslands constitute a relatively homogenous habitat type for fauna. A mosaic of other habitat types occurs in small patches around the periphery of several drainage lines throughout the Project area.

Biodiversity Assessment and Mapping

The Queensland Government, in conjunction with expert panels, has developed Biodiversity Planning Assessments for most of the state's bioregions. These assessments identify strategic wildlife corridors, assess the state of wildlife conservation, and indicate priorities for research and conservation efforts within each bioregion.

Aquatic Environment

Apart from amphibians, sampling of aquatic wildlife was beyond the scope of the current terrestrial ecology survey.

No referrable wetland, or wetland protected area, was identified within the study area during the desktop assessment, nor during field assessment.

3.1.3 Matters of National / State Environmental Significance

Under the EPBC Act, actions that have, or are likely to have, a significant impact on a Matter of National Environmental Significance (MNES) are controlled actions and require approval from the Commonwealth Government. Using the DEE EPBC Act Protected Matters Report (Appendix D), one listed Threatened Ecological Community was identified along with 12 listed Threatened Species and nine listed Migratory Species.

Due to the nature of ecological surveys, scarce or cryptic species may go undetected, even when surveys employ the full range of trapping techniques. The presence of such species was inferred if there are nearby records of the species in database, and suitable habitat was present onsite. The purpose of the likelihood of occurrence assessment (**Table 6**) was to identify those species that required further consideration.

Species of national and/or state level conservation significance were flagged via database searches (DAWE's EPBC Act Protected Matters Report (PMR) (DAWE 2020b), Queensland Government's Wildlife Online (QG 2020) and the *Atlas of Living Australia* (ALA 2018-2020)) as potential inhabitants of the

Project area. Of these, only some species were considered relevant to the Project, based on nearby records and the presence of suitable habitat. All species listed solely as 'marine' and/or 'migratory marine' identified by the PMR were excluded.

The Wildlife Online database identified one plant species, *Oldenlandia spathulata*, which is listed as Endangered under the NC Act. This species is associated with MGD and extends into the Northern Territory (Fisher et al. 2002). There are nine records of the species within approximately 50 km of the Project site, all to the northwest. The closest of these is a Queensland Herbarium record from 2012, approximately 21 km distant (ALA 2018a). This record appears to be located in RE 4.9.1c (DES 2019), an RE that is widespread in the Project site. No evidence of *Oldenlandia spathulata* was found during flora survey in the Project site but it may occur based on known distribution and habitat. The paucity of records of this species makes this assessment uncertain.

Terrestrial vertebrate species identified during the desktop study are discussed in **Table 6**.

Table 6: Likelihood of Occurrence of Conservation Significant Terrestrial Vertebrate Species[1, 2]

Species & Status[3, 4]	Source[5]	Comments
Endangered & Vulnerable Species		
Julia Creek Dunnart *Sminthopsis douglasi* EPBC Act: V NC Act: E	WO, ALA, PMR	**Possible**. There are two ALA records within 3 km, a Queensland Museum (QM) specimen, date of collection unknown but published in 1979, and a 2000 DEHP record (ALA 2020). Both are from Garomna Station, immediately south of the Project. There are 669 WO records within 50 km of the Project. None of these is in the Project and the closest is the 2000 record above (duplicated datum across databases). The species has a patchy distribution and low abundance. Most survey records indicate the species occurs in small, dispersed populations and local abundance can fluctuate significantly in relation to seasonal conditions (Mifsud 2001 in DERM 2009b). The species may be difficult to trap even in areas that it is known to occur. For example, Woolley (1992) reported a trapping success rate never greater than 0.8%, surveys at Lyrian in 1995 failed to capture any individuals despite the species being present in 1992 and 1994 (Mifsud 1999 in DERM 2009b) and it took five years of short annual surveys to record the species in Moorrinya National Park (DERM 2009b). It is possible that the species does not occur on the Project but given the difficulty in demonstrating the presence of Julia Creek Dunnart even from areas it is known to occur, a prolonged survey effort over many years would be required to adequately indicate absence. The species' habitat requirements and threatening processes are provided in Section 3.1.3 of Appendix A20, in part to determine habitat quality of the species within the Project site.
Greater Bilby *Macrotis lagotis* EPBC Act: V NC Act: E	PMR	**Unlikely**. The closest known record (ALA & WO) is from Elizabeth Springs in 2000, southeast of Boulia and approximately (approx.) 320 km southwest of the Project. Three major vegetation types are recognised as occupied by Greater Bilby: open tussock grassland on uplands and hills, Mulga *Acacia aneura* woodland/shrubland on ridges and rises, and hummock grassland on sand plains and dunes, drainage systems, salt lake systems and other alluvial areas. Mitchell Grass downs on deep clay soils are considered areas of potential habitat critical to the species in Queensland with major accumulations of burrows identified adjacent to the Diamantina River (Pavey 2006). This is consistent with the mapped locations of the species in Queensland, both in ALA (2018) and in the national recovery plan (Pavey 2006). The species is considered extinct over nearly 99 % of its former range in Queensland and is now restricted to southwestern Queensland (McRae 2012). In the bioregion, viable populations are present in the southern half of the Southwestern Downs subregion (DERM 2009a), south of Blackall. This is approx. 420 km south of the Project.
Ghost Bat *Macroderma gigas*	PMR	**Unlikely**. The closest known record (ALA and WO) is from a cave on Chudleigh Park Station in 1996, approx. 245 km to the northeast of the Project. To the west the

Species & Status[3, 4]	Source[5]	Comments
EPBC Act: V NC Act: E		closest ALA/WO record is from Esperanza Mine in 1989, approx. 275 km west northwest. Most Queensland records are from the Northwest Highlands, Cape York Peninsula and the Mackay region (ALA 2018a). In the bioregion, the species is best known from the cave systems in the Barkly Tableland subregion in the northwest, predominantly in the Camooweal area (DERM 2009a), approx. 390 km west of the Project. Permanent roost and maternity sites are in deep cave systems or large disused mines. Only 14 maternity colonies were known in 2012. Individuals may disperse well away from maternity sites (Worthington Wilmer 2012) but the lack of suitable roosting habitat on the Project indicates that the species would not occur other than for possible dispersing individuals. Even that is considered unlikely.
Red Goshawk *Erythrotriorchis radiatus* EPBC Act: V NC Act: E	PMR	**Not expected**. The closest ALA record is from approx. 100 km northwest of the Project. There are two records with the same co-ordinates, though with errors of 10 and 11.8 km respectively. One is a 1910 specimen from the South Australian Museum and the other is a historical *Birds Australia* Atlas record, i.e. prior to 1977. The closest WO records are from west of Georgetown in 1984, approx. 250 km to the north and the Gregory River in 1995, approx. 340 km to the northwest. Red Goshawk is found in north-western, northern and eastern Australia in coastal and subcoastal areas (Debus & Czechura 1988; Marchant & Higgins 1993). Occasional records from central Australia may be resident birds but could be dispersing individuals (Aumann 2001). The species occurs in woodlands and forests, particularly tall forests in areas of high rainfall (Woinarski 2007) and, ideally, with intact forest or woodland in a mosaic of vegetation types, particularly riverine forests (Marchant & Higgins 1993). Permanent freshwater is usually present close to tall emergent trees (Czechura 2012). Nests are restricted to trees taller than 20 m and within one km of a watercourse or wetland (Garnett & Crowley 2000). The species typically avoids both very dense and very open habitats (Marchant & Higgins 1993). There is no suitable habitat onsite. DERM refers to an 'unflagged record' in the bioregion, not a breeding, roosting or feeding site. The species was excluded from consideration under the Biodiversity Planning Assessment for the bioregion (DERM 2009a).
Australian Painted Snipe *Rostratula australis* EPBC Act: E NC Act: V	PMR	**Possible**. The closest known record is from Wyangarie Station in 2006, approx. 100 km to the east of the Project (QG 2020). There is a record from the Diamantina River near Kynuna in 1994, approx. 107 km to the south. There are also two records from Mount Isa (1961) and nearby Lake Moondarra (1984), approx. 235 km west of the Project. There is also a historical Bird Atlas record from Cloncurry (ALA 2020), approx. 140 km west. Australian Painted Snipe occurs in terrestrial shallow vegetated wetlands, usually freshwater but occasionally brackish, including temporarily inundated woodlands and grasslands, swamps, saltmarsh and artificial wetlands such as dams, rice crops, sewage farms and bore drains (Pringle 1987; Marchant & Higgins 1993; Garnett & Crowley 2000). Breeding occurs mainly in the Murray-Darling region and the species requires shallow wetlands with patches of bare mud, dense low cover and sometimes tall dense cover (Rogers et al. 2005). There is marginal habitat onsite seasonally. It is possible that the species may occur very sporadically as a transient. But it is very unlikely to breed locally or occur for any duration.
Curlew Sandpiper *Calidris ferruginea* EPBC Act: CE, M NC Act: V	WO PMR	**Possible**. There is a 2004 Birds Australia record for the Julia Creek sewage ponds (ALA 2020), approx. 14 km from the Project. The next closest known record is from west of Cloncurry in 1977, c. 200 km from the Project (ALA 2020). Curlew Sandpiper occurs mostly on intertidal mudflats in sheltered coastal areas but also on non-tidal swamps, lakes and lagoons near the coast. It also uses saltworks and sewage ponds. It is recorded on inland waterbodies though less often (Higgins & Davies 1996). Curlew Sandpipers do at times associate with Sharp-tailed Sandpipers and the March 2017 survey record of an individual Sharp-tailed Sandpiper at an ephemeral dam on the Project indicates that Curlew Sandpiper could also occur. However, any occurrence is likely to be very occasional and of short duration, most likely on passage.
Masked Owl (northern) *Tyto novaehollandiae kimberli* EPBC Act: V NC Act: V	PMR	**Not expected**. The closest known record is from the Barkly Tablelands pre-1993, approximately 377 km to the west of the Project (QG 2020). All other available Queensland records are coastal or subcoastal, from the Townsville area and further north. None is within 500 km of the Project. Some ALA records in the Northern Territory extend further inland but the closest record is around Borroloola, approx. 750 km northwest. Distribution mapping by the Queensland Government (Butler & Laidlaw 2012) shows all Queensland records of this subspecies to be coastal or

Species & Status[3, 4]	Source[5]	Comments
		subcoastal, and restricted to the Townsville area and further north around Cairns. Subspecies *kimberli* of the Masked Owl occurs mostly in coastal and upland areas, living in sclerophyll forest and woodland, often near ecotones with open areas (Debus 2012). There is no suitable habitat onsite.
Painted Honeyeater *Grantiella picta* EPBC Act: V NC Act: V	PMR	**Not expected**. The closest known record is from Nonda Waterhole in 2017, approx. 55 km east of the Project. Painted Honeyeater occurs from south-eastern Australia to north-western Queensland and the eastern Northern Territory (Higgins et al. 2001). Almost all breeding records and the greatest concentrations of individuals occur south of 26°S, i.e. south of the Roma area in Queensland (Higgins et al. 2001; Barrett et al. 2003). Breeding and north-south movements are closely aligned with fruiting mistletoes (Barea & Watson 2007). Diet consists primarily of mistletoe fruit, mostly *Amyema* species (Garnett et al. 2011). The species occurs mainly in dry open woodlands and forests with a strong association with mistletoe (Higgins et al. 2001). The species prefers woodlands with many mature trees, as these host more mistletoes (Oliver et al. 2003). Woodlands dominated by acacias (e.g. Brigalow *Acacia harpophylla*, Weeping Myall *A. pendula*, Mulga *A. aneura*) are particularly favoured, but the species also occurs in Belah *Casuarina cristata*, Bulloak *Allocasuarina luehmannii*, White Cypress Pine *Callitris glaucophylla* and riparian woodland of River Red Gum *Eucalyptus camaldulensis* (Barea & Watson 2007; Garnett et al. 2011; Watson 2012). They also occur on plains with scattered eucalypts and in remnant trees on farmland (Higgins et al. 2001, Oliver et al. 2003) and in narrow linear strips such as roadsides (Bowen et al. 2009). There is no suitable habitat onsite.
Yellow Chat *Epthianura crocea crocea* EPBC Act: not listed NC Act: V	WO	**Possible**. Details of WO records are not publicly available for this species, but there is a record within 50 km of the Project. There is a Birdlife Australia record (ALA 2018a) of two birds in 2005, approx.36 km south of the Project, which, given data sharing, is likely to be the WO record. There is also an ALA record approx. 90 km to the northwest, though this is from 1910. The nominate subspecies of Yellow Chat occurs in low vegetation around ephemeral wetlands, especially floodplains, swamps and bore drains, but also vegetated dams. It also forages in adjacent grasslands. Most records come from bore drains with tall cover such as sedges reeds and rank grasses (Houston 2012). Habitat onsite is not especially favourable to the species but it could occur sporadically.
Gouldian Finch *Erythrura gouldiae* EPBC Act: E NC Act: E	PMR	**Not expected**. Details of WO records are not publicly available for this species. The closest known record is an ALA record from Cloncurry, approx. 140 km west of the Project. The details of the record are uncertain and it is possibly a record taken from Storr (1973) who states that the north-western (gulf drainage) population extends south and east to Cloncurry. The closest record to the north is from around Croydon, approx. 250 km, and to the east at Torrens Creek, >300 km. The latter record is from 1984. Gouldian Finch was not considered by the fauna expert panel in the Biodiversity Planning Assessment for the bioregion (DERM 2009a). Gouldian Finch occurs in open grassy woodlands, particularly on ridges and foothills. Their distribution appears closely allied to spear-grasses (*Sorghum* spp.). The species moves into flatter terrain with the onset of the wet season, where a variety of perennial grasses are favoured, such as Cockatoo Grass *Alloteropsis semialata* and Golden Beard Grass *Chrysopogon fallax* (Dostine et al. 2001; Payne 2010). The species' range has declined substantially since the early 1970s, particularly in north Queensland where only scattered populations remain (Higgins et al. 2006). The 10 locations at which significant populations are known are all in Western Australia and the Northern Territory (O'Malley 2006b). In Queensland, records within the past 25 years have been sporadic and rarely at the same place twice (O'Malley 2006a). There is no recent breeding record for Queensland (Garnett et al. 2011; Maute & Legge 2012a). There is no suitable habitat on site.
Star Finch (eastern & southern) *Neochmia ruficauda ruficauda* EPBC Act: E	PMR	**Not expected**. The Star Finch (nominate) occurs only in central Queensland and is believed to extend north to Bowen, west to beyond Winton and, based on recent records, south to near Wowan, 80 km southwest of Rockhampton. It is possible that the distribution extends farther north to Mount Surprise and the Cloncurry-Mount Isa region, but records from these locations could relate to the subspecies *N. r. subclarescens* (Holmes 1996). The closest known record of Star Finch is from Cloncurry, approx. 140 km west of the Project site. The most recent of these records is 44 years ago (ALA 2020). The closest known record attributed to the nominate race

Species & Status[3, 4]	Source[5]	Comments
NC Act: E		available from the species profile (QG 2020) is pre-1986 from near Townsville, approx. 500 km to the east of the Project. There are 3 records from the Winton area (ALA 2020), two are from 1992 and 1993. The third, which has only recently been added to the ALA database is from 2017. The only detail provided is that it is a *Birdlife Australia* record of 12 birds in September 2017. These records would refer to the nominate subspecies based on known distribution. The fauna expert panel for the *Biodiversity planning assessment Mitchell Grass Downs bioregion* (DERM 2009a) did not include Star Finch in their review of species listed as Endangered, Vulnerable and Rare (now Near Threatened) under the EPBC and/or NC Acts. Star Finch is not included in a list of 'rare and threatened' fauna species for the MGD in Sattler and Williams (1999) despite their inclusion of species presumed extinct. BAAM (2011) did not identify any suitable habitat for Star Finch within their study area south of the Flinders Highway in habitats typical of the MGD. The nominate subspecies is not included in the *Southern Gulf Natural Resource Management Region Back on Track Actions for Biodiversity* (DERM 2010), which includes Julia Creek. The northern subspecies *clarescens* is included, though the Southern Gulf NRM extends to the coastline and outside the MGD, where suitable Star Finch habitat is present. Star Finches mostly occur in low, dense, damp grasslands and sedgelands fringing watercourses and wetlands. They also occur in open savanna woodlands (Higgins et al. 2006b). The site does contain 6.6 ha of RE 4.3.4f which includes Coolabah *Eucalyptus coolabah*, which is identified by Holmes (1998) as potential Star Finch habitat. However, the section of Horse Creek fringed by Coolabah (which includes virtually all of the Coolabah on the Project) is heavily disturbed and there is seldom more than one Coolabah tree on each bank. Much of Horse Creek is fringed by Prickly Acacia, with Coolabah only patchily present. Horse Creek does not currently provide suitable habitat for Star Finch and the lack of historical records in the area suggests it never has. Star Finches avoid expansive areas without woody plants (Holmes 1998). The Project is an expansive area supporting few native trees. It would originally have been a largely treeless grassland. *Panicum*, *Chrysopogon* and *Sorghum* spp. are identified as food species for Star Finch (DoE 2018b) and occur in REs 4.9.1c and 4.9.1c / 4.9.2b. However, the presence of food species is not in itself sufficient to indicate the presence of a particular fauna species. These grasses occur naturally far beyond the historical range of Star Finch (ALA 2018a). Notwithstanding the 2017 record at Winton, the validity of which is unknown, there has been no definite record since 1995, despite targeted surveys. The nominate subspecies is thought to be possibly extinct (Garnett et al. 2011; Maute & Legge 2012; Birdlife International 2016b; DEHP 2017; Menkhorst et al. 2017) and is described by Parker and Ingwersen (2012: 248) as 'lost from Queensland'. Without further information is it impossible to ascertain the reliability of the 2017 record other than that it is unlikely to refer to escapees (the species is a popular cage bird) given the number recorded. Nonetheless, the Project is not considered to contain suitable habitat for the nominate subspecies of Star Finch. Additional information is included in Section **Error! Reference source not found.** of this Chapter and Section 3 .2.2 of Appendix A20.
Plains Death Adder *Acanthophis hawkei* EPBC Act: V NC Act: V	PMR	**Unlikely**. There is no ALA record in Queensland (ALA 2020). There are 6 WO records, all of which are west of the Project. The closest record is approx. 138 km west of the Project (QG 2020). Plains Death Adder is said to be known only from the Barkly Tablelands of the Northern Territory and north-western Queensland around Camooweal, occurring on black soil plains with Mitchell Grass *Astrebla* spp. (Wells 2002; Cogger 2014). The species is found in flat, treeless and cracking soil riverine floodplain with tussock grassland. It shelters under ground debris and in earth fissures during the dry season (Chapple et al. 2019). However, 5 of the 6 known Queensland records are from the Northwest Highlands bioregion (QG 2020) and are very unlikely to be from black soil plains. Death adder taxonomy is very uncertain (Wüster et al. 2005), in part because even some populations cannot be identified morphologically with any certainty (Wilson 2015). This makes it difficult to define the

Species & Status[3, 4]	Source[5]	Comments
		distributions of various species and subspecies. Wüster et al. (2005) do not consider *hawkei* to be a separate species and Cogger (2014) states that this species remains undefined in distinguishing characteristics. No taxonomic work since Wüster et al. (2005) appears to have validated it as a species (Chapple et al. 2019). Despite this taxonomic uncertainty, *The Action Plan for Australian Lizards and Snakes* (Chapple et al. 2019) states that it has experienced a decline of at least 30 percent across its range in the past 10-15 years due to invasion by Cane Toads *Rhinella marina* and that it may be naturally scarce in MGD. There is potentially suitable habitat present onsite for death adder, though the identity of any such animal may be uncertain. The closest known record in similar habitat is from 400 km to the west (ALA 2020). The lack of nearby records suggests this species is unlikely to occur.
Migratory Species (EPBC Act: M, NC Act: SLC)		
Fork-tailed Swift *Apus pacificus*	WO PMR	**Known to occur**. Three birds were recorded during the April 2018 survey (Section 3.2.3). The species was also present at Julia Creek during in November 2019 and March 2020 and northeast of the Project at the Flinders River in March 2020 (T. Reis pers. obs.).
Glossy Ibis *Plegadis falcinellus*	WO ALA	**Known to occur**. One bird was recorded during the March 2017 survey (Section 3.2.3).
Oriental Plover *Charadrius veredus*	WO PMR	**Known to occur**. 10 birds were recorded during the November 2018 survey (Section 3.2.3).
Latham's Snipe *Gallinago hardwickii*	PMR	**Unlikely**. The closest known record is from 2017, approx. 196 km to the south-east of the Project. There is also a record from 1977, from west of Cloncurry, approx. 200 km west. Other records (WO and ALA) in the general area are from further west, around Mount Isa and Lake Moondarra. In Australia, Latham's Snipe occurs in a wide variety of permanent and ephemeral wetlands, preferring open freshwater wetlands with fringing vegetation. The species is also recorded from swamps, billabongs, lakes, edges of creeks and rivers, bogs and some artificial waterbodies (Higgins & Davies 1996). Suitable habitat for this species is likely onsite only during periods of temporary inundation.
Common Sandpiper *Actitis hypoleucos*	WO PMR	**Possible**. There is one ALA record for the Julia Creek sewage ponds in 2003 (ALA 2020). This is presumably the same record as for the 50 km WO search. However, the record does not show up in a download of WO records for the species. Other regional ALA and WO records include Cloncurry and, mostly, Mount Isa and Lake Moondarra. Common Sandpiper occurs on a wide variety of coastal and inland wetlands including around dams, billabongs and claypans (Higgins & Davies 1996). Habitat onsite is marginal but the species could occur in transit.
Pectoral Sandpiper *Calidris melanotus*	PMR	**Possible**. There is one ALA record with the location given as Cloncurry though the co-ordinates provided place the record some distance to the north of Cloncurry. This record is approx. 102 km west north-west of the Project. The next closest record to the Project is more than 270 km to the north-west (ALA 2018a). During the first *Atlas of Australian Birds* project, 1977-1981 (Blakers et al. 1984), there were 113 records of Pectoral Sandpiper, mostly in south-eastern Australia. In north Queensland the species was only recorded at Cairns. *The New Atlas of Australian Birds* (Barrett et al. 2003) covered the period 1998-2002. In north Queensland, Pectoral Sandpipers were recorded at two locations on Cape York Peninsula and on the east coast. In Australia, Pectoral Sandpiper is a regular visitor in small numbers, often solitary, but occasionally occurring in small groups of less than 10 individuals. The species mostly occurs on shallow fresh or saline wetlands, using brackish wetlands when freshwater is not available (Higgins & Davies 1996; Menkhorst et al. 2017). It usually occurs on or near the coast, though it does occasionally occur inland, where habitats include flooded grasslands, floodplains and artificial wetlands such as sewage farms. It forages in shallow water or soft mud at the edges of wetlands. Records in Queensland are generally east of the Great Dividing Range but the species is also known from inland locations such as Mount Isa and Longreach (Higgins & Davies 1996). The Pectoral Sandpiper associates with Sharp-tailed Sandpiper (Pringle 1987), which has been recorded twice on the Project.
Sharp-tailed Sandpiper *Calidris acuminata*	WO	**Known to occur**. One bird was recorded during the March 2017 survey and three birds were present during the November 2018 survey (Section 3.2.3).

Species & Status[3, 4]	Source[5]	Comments
Sanderling *Calidris alba*	WO	**Unlikely**. There is a record for the Julia Creek sewage ponds in 2003 (ALA 2020). This is presumably the same record as for the 50 km WO search. However, the record does not show up in a download of WO records for the species. The next closest known record is from west of Karumba in the Gulf of Carpentaria, more than 350 km to the north. Sanderling is almost always on the coast, mostly on sandy beaches. Inland records are very rare (Higgins & Davies 1996). The Julia Creek record may be a misidentification.
Common Greenshank *Tringa nebularia*	WO	**Possible**. There is one record for the Julia Creek sewage ponds in 2003 (ALA 2018a). This is presumably the same record as for the 50 km WO search. However, the record does not show up in a download of WO records for the species. Other regional ALA and WO records are mostly from Mount Isa and Lake Moondarra. Common Greenshank occurs on a wide variety of coastal habitats and inland wetlands. The species prefers sheltered coastal areas, typically with large mudflats, mangroves and saltmarsh (Lane 1987; Higgins & Davies 1996) but also uses permanent and ephemeral terrestrial wetlands including swamps, dams, creeks, inundated floodplains, claypans and sewage ponds (Higgins & Davies 1996). Habitat onsite is marginal but the species could occur in transit, particularly when the dam at target site 1 has shallow, exposed muddy edges.
Marsh Sandpiper *Tringa stagnatilis*	WO	**Known to occur**. One bird was recorded during the November 2018 survey (Section 3.2.3).
Oriental Pratincole *Glareola maldivarum*	PMR	**Unlikely**. The closest known record is un-dated but sometime prior to 1985. It is just north of Julia Creek (QG 2020). There are three ALA records between Cloncurry and Julia Creek (ALA 2020), one of which is duplicated in WO. It is a historical record. The other two records are from 1967 and 1969, the latter being the closest known record to the Project, approx. 50 km away. Oriental Pratincole occurs in open country, often near water. It is usually found on plains, floodplains or grassland with little vegetation. It also uses agricultural land, airfields and mudflats and occurs around the margins of wetlands, including artificial waterbodies. The species is widespread north of Julia Creek but occurs only sporadically further south (Lane 1987; Higgins & Davies 1996). Habitat onsite is marginal but the species could occur very sporadically in transit.
Caspian Tern *Hydroprogne caspia*	WO	**Possible**. There is one ALA record for the Julia Creek sewage ponds in 2003 (ALA 2020). This is presumably the same record as for the 50 km WO search. There are numerous ALA and WO records from Cloncurry, Mount Isa and Lake Moondarra. Caspian Tern mostly occurs in sheltered coastal areas but also on inland waterbodies, mostly dams, lakes and larger rivers. The species does use saltworks and sewage ponds (Higgins & Davies 1996). The fringing Prickly Acacia makes the largest waterbody onsite somewhat unsuitable but it could occur in transit. The smaller temporary pools in quarries are probably too small.
Oriental Cuckoo *Cuculus optatus*	PMR	**Unlikely**. The closest known record is from 2006, west of Richmond, approximately 100 km east of the Project (QG 2020). There are records from Lake Moondarra in 2004 and Mount Isa in 1983 (ALA 2020). Oriental Cuckoo occurs in rainforest, vine thicket and open forest and woodland. The species is often recorded in gardens and plantations (Higgins 1999). There is no suitable habitat onsite.
Grey Wagtail *Motacilla cinerea*	PMR	**Not expected**. There is no WO or ALA record within 500 km of the Project. Although Grey Wagtail may occur on beaches and rock pools during migration it is more typically associated with fast-flowing rocky streams and waterfalls (Menkhorst et al. 2017). There is no suitable habitat onsite.
Yellow Wagtail *Motacilla flava*	PMR	**Unlikely**. The closest WO or ALA record is from Torrens Creek in 2009, >300 km away. Yellow Wagtail occurs in open areas with low vegetation, especially in cultivation and on lawns, sporting fields and air fields (Higgins et al. 2006). Also referred to as Eastern Yellow Wagtail *M. tschutschensis*.

1. The species included in this table are taken from three 10 km radius searches the *Atlas of Living Australia* (ALA 2018a), a 50 km radius Wildlife Online database search (QG 2017b) and an EPBC Act Protected Matters Report with a 50 km buffer.
2. Conservation Significant fauna species are those listed as Critically Endangered, Endangered or Vulnerable under the EPBC Act, Endangered, Vulnerable or Near Threatened under the NC Act and/or Migratory under the EPBC Act.
3. EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth), NC Act = *Nature Conservation Act 1992* (Queensland)
4. E = Endangered, M = Migratory, SLC = Special Least Concern, V = Vulnerable.

5. WO = Wildlife Online, ALA = *Atlas of Living Australia*, PMR = EPBC Act Protected Matters Report. WO records have been searched beyond the 50 km search radius through the species profile search tool (QG 2020), which generates kml and csv files for some species. Species identified through the initial search where also searched for more widely through the interactive mapping available from ALA (ALA 2020).

Julia Creek Dunnart *Sminthopsis douglasi*

The species is restricted to the MGD country of north-west Queensland, which are characterised by tussock grass-covered cracking clay soils. It shelters in cracks when the soil is dry and ground cover is sparse and in vegetation when the cracks close after rain (DERM 2009b). Soil cracks and holes provide shelter from predators, fire and excessive temperatures in dry seasons and abundant ground cover provides shelter from predators during wet conditions (Mifsud 1999 in DERM 2009b). Soil cracks and substantive ground cover are necessary for the species' survival (McAlpine & Howes 2005 in DERM 2009b). The species may be nomadic within its home range, sheltering at the end of their night time foraging in any nearby crack or hole. A study of radio-collared animals in Bladensburg National Park found no individual, including a female with young in the pouch, reused the same daytime resting site over a period of up to nine consecutive days. Given that breeding occurs during the wet season, when cracks and holes may close, females may continue to be nomadic and use temporary nests, perhaps in vegetation (Woolley 2017).

Prior to 1992 the species was known only from four specimens collected between Richmond and Julia Creek (Woolley 1992). Subsequent surveys indicate a wider distribution within both the MGD and Desert Uplands bioregions (Woolley 2008; DERM 2009b). The species has a patchy distribution and low abundance. Most survey records indicate the species occurs in small dispersed populations and local abundance can fluctuate significantly in relation to seasonal conditions (Mifsud 2001 in DERM 2009b). The known range of the species has been extended recently but there is no published report to confirm the continued presence of animals in areas where they have been found in the past (Woolley 2015).

The *national recovery plan for the Julia Creek dunnart (*Sminthopsis douglasi*)* (DERM 2009b) identifies four important populations: Bladensburg and Moorrinya National Parks, Julia Creek aerodrome and Toorak Research Station. The western boundary of the Project is 20 km east of Julia Creek aerodrome and approx. 40 km north of Toorak Research Station and it is likely a majority of the records of Julia Creek Dunnart within 50 km are from the latter site. The national parks are approx. 200 km (Bladensburg) and 300 km (Moorrinya) distant, respectively.

Smith et al. (2007) predicted that most of the known range of Julia Creek Dunnart has low habitat suitability, which coincides with field survey findings. Notable exceptions were the two national parks, especially Bladensburg, road reserves, stock routes and Toorak Research Station. These areas are subject to either no (i.e. the national parks) or low level grazing pressure from livestock. Though Toorak has since closed as a research station, being sold to local graziers in 2012 (Tapp 2012) and the grazing pressure may have increased. These areas also have low density of Prickly Acacia and watering points.

Ground cover and grazing pressure were the most influential factors on habitat suitability. Areas of high habitat suitability also have extensive cracking soils and limited to no Prickly Acacia (Smith et al. 2007).

Areas of low suitability have limited ground cover, no cracking soils or presence of Prickly Acacia or extensive grazing. Mapping of probability of habitat suitability by Smith et al. (2007) show that the Project is an area of likely very low suitability (0.6 – 0.8, where 0.8 – 1 means the habitat is unsuitable) at times of below average rainfall (per annum) and likely medium suitability (0.4 – 0.6) at times of above average rainfall (per annum). The Project is subject to grazing throughout and has Prickly Acacia of variable density, ranging from closed canopy to absent. Ground cover varies with rainfall, with large areas at times having low percentage cover, i.e. <35% (as defined by Smith et al. 2007).

The Julia Creek Dunnart is known to be threatened by introduced predators, particularly Cats, by invasion of woody weeds, especially Prickly Acacia, which binds the soil, and by grazing which compacts the soil and degrades habitat. Potential threatening processes include fire and small population size, which leaves the species susceptible to local extinctions (DERM 2009b).

3.2 Survey Results

Field survey results are provided in this section.

3.2.1 Field Conditions

March 2017 Survey

The March 2017 survey was undertaken as a baseline survey for the Project. The late wet season survey took place from 27 to 31 March 2017 to coincide with maximal plant flowering and fruiting, peak small mammal densities and high levels of reptile activity.

During the survey period, the lowest minimum daytime temperature was 21.9°C and the highest maximum temperature was 42.0°C, with maximum daytime temperatures always above 40°C. It was noticeably cold on the night of 30 March, when temperatures dropped to 14.6°C. No rainfall was recorded during the survey period (BoM 2017a). Total monthly rainfall for March 2017 was 48.8 mm. However, it is noted that 16.6 mm of rain fell the week prior, on 22 March 2017.

July 2017 Survey

The July 2017 survey was intended as a targeted survey, specifically for Julia Creek Dunnart *Sminthopsis douglasi*, though other taxa were also recorded. The mid dry season survey took place from 24 to 29 July 2017, meeting the requirements of the *Terrestrial vertebrate fauna survey guidelines for Queensland, Version 3.0* (Eyre et al. 2018).

During the survey period, the lowest minimum daytime temperature was 18.7°C and the highest maximum temperature was 31.4°C. No rainfall was recorded during the survey period (BoM 2017b). Total monthly rainfall for July 2017 was 14.2 mm. However, it is noted that 13.8 mm of rain fell three weeks prior, on 8 July 2017.

April 2018 Survey

A targeted survey was undertaken from 01 to 06 April 2018 to search for the nominate subspecies of Star Finch *N. r. ruficauda*, meeting the requirements of the *Survey guidelines for Australia's threatened birds* (DEWHA 2010). During the survey period, the lowest minimum daytime temperature was 21.2°C and the highest maximum temperature was 36.4°C, with maximum daytime temperatures always above 30°C (BoM 2018a). No rainfall was recorded during the survey period (BoM 2018b).

Survey conditions were good during April 2018. High rainfall due to tropical cyclone activity in northern Australia meant the area was inundated in the weeks preceding the survey. As a result, several waterbodies were present throughout the site, providing ample water for granivores to drink from throughout the day. Total monthly rainfall for March 2018 was 247 mm. The last rainfall leading up to the survey period was detected on 10 March (BoM 2018b).

November 2018 Survey

To increase spotlighting effort and sample for seasonal variation in the species assemblage, a survey was undertaken from 06 to 09 November 2018. During the survey period, the lowest minimum temperature was 19.7°C and the highest maximum temperature was 42.9°C, with maximum daytime temperatures always above 35°C. The minimum temperature on 07 November was 30.2°C. No rainfall was recorded during the survey period (BoM 2018c).

3.2.2 Vegetation Communities and Regional Ecosystem Classification

The Herbarium RE mapping was found to be generally accurate in 2017 and 2018 with large areas of the northern area being correctly mapped as a mosaic of RE 4.9.1c and 4.9.2b. RE mapping version 10.1 was used. Some large and obvious areas of RE 4.9.2b have been mapped as homogenous polygons where possible. Much of the balance of the central area is correctly mapped as RE 4.9.1c. Areas throughout the Project are mapped as non-remnant due to the dominance of introduced grasses and the very dense infestation of Prickly Acacia *Vachellia nilotica* deemed to constitute the ecological dominant layer in these areas. In addition, there are three quarries within the Project site that have been mapped as non-remnant.

Riparian areas where land zone 3 is present have been better defined due to an increase in mapping resolution. This has led to the decrease in mapped extent of land zone 3 and the decrease in mapped

Coolabah woodland (RE 4.3.4) within this region. Most of the land zone 3 riparian zones are dominated by *Astrebla* grassland (RE 4.3.15) invaded by Prickly Acacia.

3.2.3 Nationally Listed Ecological Communities

The field survey identified that no Threatened Ecological Community (TEC) protected under the EPBC Act occurs within the Project. It is noted however that the EPBC Act Protected Matters Search (Appendix D) identified one TEC, the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin, within a 50 km radius of the Project.

3.2.4 Species Diversity

Field surveys undertaken in March and July 2017 and April and November 2018 detected:

- eleven (11) species of mammal,
- ninety-one (91) species of bird,
- nine (9) species of reptile, and
- seven (7) species of amphibian.

Fauna species detected onsite during the 2017 and 2018 surveys can be found in Appendix B. Species communities were generally representative of the Mitchell Grass Downs region, with most species widespread across the bioregion. All species recorded in the current surveys were already known to occur within the region and only Pied Honeyeater *Certhionyx variegatus* was somewhat unusual, Julia Creek being outside of even its irregular range (Schodde & Mason 1999; Menkhorst et al. 2017). In 2017 several *Ctenotus* caught in funnel traps were identified as *C. inornatus*, based on the dichotomous key in *A Field Guide to Reptiles of Queensland* (Wilson 2015). At the time, the known distribution of the species encompassed Julia Creek. Wilson (2015) stated that *C. inornatus* encompassed a number of former species, such as *C. helenae*. Wilson and Swan (2017) do not consider that *C. inornatus* occurs in the Julia Creek area and state that the species has a very close genetic relationship with five other *Ctenotus* species, including the resurrected *C. helenae*, among others. Based on Wilson and Swan (2017), the animals caught were probably *C. robustus*, a very widespread species that itself is probably a species complex. However, Rabosky et al. (2014) consider that *C. robustus* doesn't occur in Queensland and that those animals identified as *C. robustus* in Queensland are actually *C. spaldingi*. They also state that '*Ctenotus inornatus* is characterized by extreme geographic variation in colour pattern and may be confused with numerous species' (Rabosky et al. 2014: 79). The identity of the *Ctenotus* captured in the Project will remain uncertain until the genetics are finalised and even then may remain unknown.

These results were also consistent with the findings from the EIS undertaken for the CopperString Project (BAAM 2011).

3.2.1 Regional Ecosystems

Regional Ecosystems recorded within the Project are outlined in **Table 7** and **Figure 4**. Two of these REs were contained in certified mapping. The remainder occurred in patches that are too small (<4 ha) to be mapped at the scale (1:100,000) applied to certified mapping or were misidentified from satellite imagery used in the certified mapping. Secondary vegetation assessment site data, supporting the assignment of REs to the vegetation communities present, are presented in Appendix E.

None of the REs recorded onsite is listed as Endangered under the VM Act. Furthermore, none has an Endangered biodiversity status.

Table 7: Regional Ecosystems Recorded within the Project

Regional Ecosystem	Brief Description	VM Act* Status	Biodiversity Status	Total Area (ha)
RE 4.3.15	*Astrebla squarrosa +/- Dichanthium spp. +/- Eulalia aurea* grassland on alluvium	LC	NC	6.48
RE 4.3.4f	*Eucalyptus coolabah and/or E. microtheca* low open woodland. Occurs on drainage lines on *Astrebla spp.* undulating plains and braided channels on alluvial plains, particularly north-east Riverine wetland or fringing riverine wetland	LC	NC	6.62
RE 4.9.1c	*Astrebla lappacea +/- Aristida latifolia +/- Panicum decompositum* grassland on Cretaceous sediments	LC	NC	5,319.6
RE 4.9.2b	Mixed tussock grassland, with combinations of the species *Astrebla spp., Aristida latifolia, Enneapogon sp.* mixed tussock grassland. Emergent *Atalaya hemiglauca, Ventilago viminalis* and *Corymbia terminalis* commonly occur. Occurs on rises of exposed Cretaceous shale and limestone with rocks to the surface. Cracking clay soils	LC	NC	44.8
RE 4.9.1c/4.9.2b	The patches of 4.9.2b that occur within the mosaic of 4.9.1c are slight rises with surface limestone rocks. It was not possible to map them all out without walking the entire polygon therefore this particular polygon needs to remain mixed. RE 4.9.1c Occurs on level to gently undulating downs derived from Cretaceous mudstones (predominantly Allaru Mudstone) in the north of the bioregion (BVG1M: 30b). RE 4.9.2b occurs on rises of exposed Cretaceous shale and limestone with rocks to the surface. Cracking clay soils. (BVG1M: 30b)	LC	NC	2,969.9

*VM Act = *Vegetation Management Act 1999*; LC = Least Concern, NC = No Concern

3.2.2 Star Finch Survey Result

No Star Finch was observed during the general 2017/2018 surveys or targeted April 2018 survey. During the latter, in addition to traversing the site by vehicle, more than 59 km of the Project area was traversed on foot, mostly targeting RE 4.9.1c as a potential foraging habitat (**Figure 7**), with opportunistic observations of Zebra Finches *Taeniopygia guttata* in pursuit of possible mixed finch species flocks. In total, 206 km were covered during the targeted survey. Waterhole watching was undertaken at a variety of times of day (**Table 5**). Call playback of Star Finch was implemented using a speaker during waterhole watching and opportunistic encounters with Zebra Finch. Horse Creek (within RE 4.3.4f) was traversed on foot and the one waterhole present in this area was surveyed twice with call playback used.

The only finch species recorded onsite during the Star Finch survey, and during the two general fauna surveys, was Zebra Finch. Chestnut-breasted Mannikin *Lonchura castaneothorax* and Double-barred Finch *Taeniopygia bichenovii* are also recorded in the Julia Creek area (ALA 2020) and could occur onsite. However, neither species has been recorded during the four (4) fauna surveys conducted in 2107/18. Zebra Finch was recorded at four waterbodies, drinking at three and seen nesting at Horse Creek in a raptor nest. Zebra Finch was also recorded at four other locations, either from the vehicle or on walking transects. The most Zebra Finch individuals observed at one time was seven (7), on Horse Creek.

Grasses and low shrubbery near watercourses and wetlands support Star Finch (Holmes 1998; Higgins et al. 2006). Other than the ephemeral Horse Creek, waterbodies onsite include two dams (one of which was dry during the 2017 surveys), a number of quarries that periodically pool rainwater and a small overflow area adjacent to a windmill and dam (the dam was dry at the time of survey) (**Figure 7**). All waterbodies onsite are heavily impacted by cattle and horses. The quarries are largely denuded of fringing vegetation, other than some Prickly Acacia and, similarly, the dams are infested with the acacia, but little other vegetation is present. Livestock trampling potential habitat such as rank grasses around permanent freshwater waterbodies is likely a major cause of the decline of Star Finch (Rowland 1996; Garnett et al. 2011; Maute & Legge 2012b) and the Project's waterbodies are severely compromised in this regard. In November 2018, livestock had removed virtually all groundcover other than trees within a radius of more than 2.5 km of waterbodies.

Likelihood of Occurrence

The closest known record of Star Finch is from Cloncurry, approximately 140 km west of the Project (ALA 2018g). The most recent of these records is 44 years ago. Cloncurry is in a different bioregion to the Project - the Northwest Highlands. The Project is in the MGD. Although species can occur across multiple bioregions, bioregions reflect major structural geologies and climate and significant variation in floristic and faunal assemblages (Sattler & Williams 1999) and there are significant differences between the MGD and Northwest Highlands. Records of Star Finch from the Northwest Highlands (i.e. Cloncurry/Mount Isa area) may, in fact, relate to the subspecies *N. r. subclarescens*. The closest known

record to the Project that falls within the mapped distribution of the nominate subspecies is from Winton, approximately 220 km to the south (ALA 2018f).

The fauna expert panel for the *Biodiversity planning assessment Mitchell Grass Downs bioregion* (DERM 2009a) did not include Star Finch in their review of species listed as Endangered, Vulnerable and Rare (now Near Threatened) under the EPBC and/or NC Acts. Star Finch is not included in a list of 'rare and threatened' fauna species for the MGD in Sattler and Williams (1999) despite their inclusion of species presumed extinct. BAAM (2011) did not identify any suitable habitat for Star Finch within their study area south of the Flinders Highway in habitats typical of the MGD. The nominate subspecies is not included in the *Southern Gulf Natural Resource Management Region Back on Track Actions for Biodiversity* (DERM 2010), which includes Julia Creek. The northern subspecies *clarescens* is included, though the Southern Gulf NRM extends to the coastline and outside the MGD, where suitable Star Finch habitat is present. The dominate habitats of the bioregion are not suitable for Star Finch and the species is not considered relevant to the bioregion.

The ecology of the nominate subspecies is little known (Maute & Legge 2012b) but is assumed to be similar to that of the other two subspecies. The Star Finch is primarily granivorous, mostly eating seeds of native grasses, especially sorghum. Foraging occurs mainly in vegetation, typically grasses, rushes and reeds but also shrubs. *Panicum, Chrysopogon and Sorghum* spp. are identified as food species for Star Finch (DEE 2018b). *Chrysopogon fallax*, *Sorghum plumosum* and *Panicum decompositum* are species known to occur in RE 4.9.1c. and hence potentially in areas of RE 4.9.1c/4.9.2b, though large areas of purely RE 4.9.2b are presumably not suitable for foraging. All three grass species are widely distributed in Australia, extending at least into central Australia and New South Wales**.** *Panicum decompositum* occurs in every mainland state (ALA 2018b, d, e) and extends far beyond even the historical distribution of Star Finch. In this instance the presence of a food resource should not be allocated inappropriate weight in assessing likelihood of occurrence given the otherwise unsuitable nature of the habitat. Holmes (1998, p. 283) found that foraging data at four sites, including for the 1992 Winton record (see below), 'are insufficient to establish a correlation with food plants'.

Star Finches mostly occur in low, dense, damp grasslands and sedgelands fringing watercourses and wetlands. They also occur in open savannah woodlands (Higgins, Peter & Cowling 2006), such as RE 4.3.4f. RE 4.3.4f is *Eucalyptus coolabah* and/or *E. microtheca* low open woodland occurring on drainage lines on *Astrebla* spp. undulating plains and braided channels on alluvial plains (QG 2020). Holmes (1996) described vegetation at nine former sites of the nominate subspecies. Most were woodland sites, dominated by tree species strongly associated with permanent water or regular inundation. Coolabah *E. coolabah* is identified as a relevant dominant tree species. The Project includes a short section of Horse Creek, which has some Coolabah. However, within the Project, Horse Creek is heavily degraded and typically fringed by no more than one Coolabah on each bank (**Photos 1 - 4**). There are substantial stretches along the creek where the only tree species is Prickly Acacia.

Photo 1: Horse Creek, Flinders Highway

Photo 2: Horse Creek

Photo 3: Horse Creek, Prickly Acacia adjacent to Flinders Highway, April 2018

Photo 4: Horse Creek, upstream from Flinders Highway, April 2018

Holmes (1998, p. 280) states that '[e]xpansive areas without woody plants are not frequented by the species'. REs 4.9.1c, 4.9.2b and 4.3.15 are grasslands that may contain some trees, most typically *Corymbia terminalis, Ventilago viminalis and Atalaya hemiglauca* (QG 2020). The Project contains only scattered patches of these species, typically on small stony rises. Given their topography, such patches do not include waterbodies and provide little or no resources for Star Finch. Currently, the vast majority of the site is open grassland without woody plants except for areas infested with Prickly Acacia, a weed of national significance that spread throughout the MGD in the 1950s and 70s following good wet seasons. It was introduced to provide shade and fodder for livestock (NHT 2003; DAF 2016). Prickly Acacia is the only tree species present for most of the Project site that has been traversed (**Figure 7**). The Project was originally a largely treeless native grassland.

The Star Finch usually occurs near permanent water (Holmes 1998, p. 280). Horse Creek is the largest natural waterbody on the Project site. At the time of the targeted Star Finch survey (2-5 April 2018) the section of Horse Creek within the site included one somewhat discontinuous pool of stagnant water approximately 30 x 8 m. This was immediately adjacent to the Flinders Highway, on the southern boundary of the site, and was the most treed section of the creek traversed (**Table 8**). Julia Creek received 247 mm of rain in March 2018, albeit with rain last falling on 10 March (BoM 2018b), suggesting that for much of the year Horse Creek would not provide water for a granivorous species such as Star Finch that needs to drink every day. Punchbowl Road to the north crosses Horse Creek and another similar-sized pool was present at the roadside during the Star Finch survey. Aerial photography

suggests that Horse Creek immediately to the south of Punchbowl Road is more heavily vegetated than on the Project but this vegetation proved to be almost entirely large Prickly Acacia.

Grasses and low shrubbery near watercourses and wetlands support Star Finch (Holmes 1998; Higgins et al. 2006). Other than the ephemeral Horse Creek, waterbodies onsite include two dams (one of which was dry during the March 2017 survey), a number of quarries that fill with rainwater and a small overflow area adjacent to a windmill and dam (the dam was dry at the time of survey) (**Figure 7**). All waterbodies are heavily impacted by cattle. The quarries are largely denuded of fringing vegetation, other than some Prickly Acacia and, similarly, the dams are infested with the acacia but little other vegetation is present. Livestock trampling potential habitat such as rank grasses around permanent freshwater waterbodies is the likely major cause of the decline of Star Finch (Rowland 1996; Garnett et al. 2011; Maute & Legge 2012b) and the site's waterbodies are severely compromised in this regard.

Table 8: Artificial Waterbodies Onsite (April 2018)

Photo 5: Dam, target site 1

Photo 6: Windmill waterbody

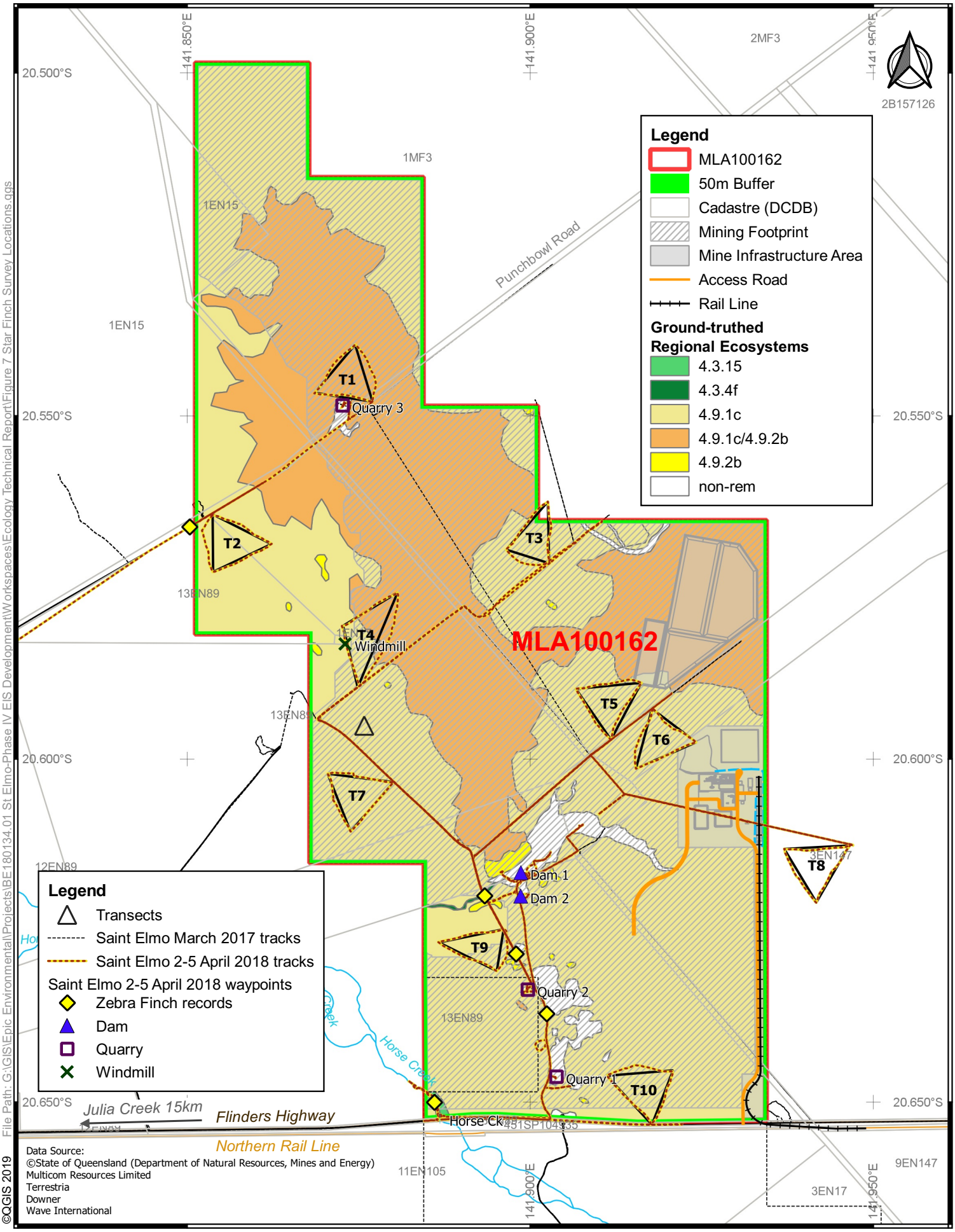
Photo 7: Dam 2

Photo 8: Quarry 1

Photo 9: Quarry 2

Photo 10: Quarry 3

Between 1835 and 1990 only 25 records of the nominate subspecies were accepted throughout their substantial range. Garnett et al. (2011) identify four definite and four probable records for the nominate subspecies between 1990 and 1995. Notwithstanding the 2017 record at Winton (discussed above), there has been no definite record since 1995, despite targeted surveys. The nominate subspecies is thought to be possibly extinct (Garnett et al. 2011; Maute & Legge 2012; Birdlife International 2016b; DEHP 2017; Menkhorst et al. 2017) and is described by Parker and Ingwersen (2012: 248) as 'lost from Queensland'. It is considered extremely unlikely that the Star Finch is present in the Julia Creek region and that the species is not present on, or in the immediate surrounds of the Project.



Multicom Resources Limited
Saint Elmo Vanadium Project

Figure 7
Star Finch Survey Locations

3.2.3 Confirmed Species of National and/or State Significance

One hundred and eighteen (118) fauna species were found within the Project area during the 2017 and 2018 surveys. Of these, five species of national and/or state-level conservation significance were recorded within the Project; Fork-tailed Swift, Glossy Ibis, Oriental Plover, Marsh Sandpiper and Sharp-tailed Sandpiper. Brief life histories, including known threats, are provided hereunder.

Fork-tailed Swift *Apus pacificus*
EPBC Act: Migratory (CAMBA, JAMBA, ROCAMBA); NC Act: Special Least Concern

In Australia the Fork-tailed Swift is almost exclusively an aerial species, probably even sleeping on the wing, though individuals are occasionally recorded roosting in trees. The species forages for aerial invertebrates at heights from less than a metre to at least 300 m and probably much higher. Foraging occurs over a wide variety of habitats including towns and cities, open areas, farmland, coastal areas and sometimes forest. Fork-tailed Swifts breed in Asia and occur throughout Australia from September/October to April, with some records in May. The species is widespread in Australia. In Queensland the species is most common west of the Great Divide except in the Wet Tropics bioregion (Higgins 1999). Three (3) birds were seen at Horse Creek in April 2018. The species was also present at Julia Creek in November 2018, November 2019 and March 2020 (T. Reis pers. obs.). There are three (3) ALA records (ALA 2020) of Fork-tailed Swift at Julia Creek in 1992 and 2011 (two records in 2011). There are also three (3) records in the Wildlife Online database (DES 2018), though these may be the same records due to data-sharing. Notwithstanding this comparative lack of records, it is likely that Fork-tailed Swift is present in the Project area for several months annually, sometimes in very large numbers.

Fork-tailed Swift is listed as Least Concern by the IUCN. Its global population is stable and no threat is documented (IUCN 2018). The species is occasionally killed by Cats *Felis catus* and sometimes collides with man-made structures (Higgins 1999), but there is no known significant threat to the Fork-tailed Swift in Australia (DE 2018a).

Glossy Ibis *Plegadis falcinellus*
EPBC Act: Migratory (Bonn); NC Act: Special Least Concern

Glossy Ibis is considered migratory and nomadic (Marchant & Higgins 1990; del Hoyo et al. 1992; Snow & Perrins 1998) and is generally uncommon and erratic in occurrence (Pringle 1985). The Australian population is estimated to be approximately 12 percent of the species' total population (Marchant & Higgins 1990). The Glossy Ibis occurs in terrestrial wetlands, preferring inland freshwater wetlands with abundant aquatic flora. (Pringle 1985; Marchant & Higgins 1990). Within Australia, the species moves in response to good rainfalls, expanding its range, however the core breeding areas used are within the Murray-Darling Basin region of New South Wales and Victoria, the Macquarie Marshes in New South Wales, and in southern Queensland. Breeding typically occurs in dense colonies, often with other waterbirds and occurs in response to flood events (Pringle 1985). One (1) bird was seen at a flooded

quarry in the Project in March 2017. There are three (3) ALA records (ALA 2018a) of Glossy Ibis in the Julia Creek area, this Project's survey record, one from the sewage ponds in 2003 and a historical record, possibly from 1967. There are also three (3) records in the Wildlife Online database (DES 2018), though these may be the same records due to data-sharing, certainly this survey record is included. The lack of records is a reflection of limited suitable habitat.

The species is threatened by destruction or modification of wetlands, including water diversion, invasion of wetlands by weeds and predation of breeding birds by Foxes *Vulpes vulpes* (Marchant & Higgins 1990). Changes to the timing of flows, water quality and the extent of flooding may affect breeding success (Kingsford & Johnson 1998). Other threats include clearing, grazing, increased salinity, groundwater extraction and invasion by exotic plants and fish species (DE 2018b).

Oriental Plover *Charadrius veredus*

EPBC Act: Migratory (Bonn, CAMBA, JAMBA, ROKAMBA); NC Act: Special Least Concern

Oriental Plover is a non-breeding visitor and birds arrive in Queensland from the Northern hemisphere in September, with numbers increasing into December. Once in Australia the species is dispersive, responding to weather conditions. Oriental Plovers occur mostly on open grasslands in arid and semi-arid areas. The species prefers flat inland plains, sparsely vegetated with short grass. It also occurs on claypans, sporting fields, lawns, around the margins of terrestrial wetlands and in woodland and heathland that has been recently burnt (Lane 1987; Marchant & Higgins 1993). Birds were observed in the Project on two (2) occasions on the same day in November 2018 (**Photos 11** and **12**). Three (3) birds were seen at the water's edge of the largest dam on the property, target site 1 (**Figure 5**). The water level in the dam was quite low, creating suitable habitat for the species. Seven birds were seen resting in the shade of Prickly Acacia in RE 4.9.1c. Given this was sometime later it is possible that this group of seven birds included the three (3) seen earlier, the two sites being a short distance apart. There are single ALA and Wildlife Online records for the Julia Creek area (ALA 2018a; DES 2018). The former is a 2003 record from the sewage ponds. It is possible the latter refers to the same record. In the Project the species is most likely to occur around the dam or in areas heavily impacted by livestock, with reduced ground cover.

Photo 11: Oriental Plover, Saint Elmo Station

Photo 12: Oriental Plover, Target Site 1

The species is listed globally as Least Concern (IUCN 2018). The world population is not severely fragmented and no threat to the species is known. The current population trend is unknown (Butchard & Symes 2016b). In Australia, Oriental Plovers occur mostly in sparsely settled areas and have no immediate threat to their survival (Lane 1987). The species is occasionally killed by vehicles on roads (Marchant & Higgins 1993).

Marsh Sandpiper *Tringa stagnatilis*
EPBC Act: Migratory (Bonn, CAMBA, JAMBA, ROKAMBA); NC Act: Special Least Concern

The Marsh Sandpiper occurs on both saline and freshwater habitats (Higgins & Davies 1996). It prefers freshwater wetlands (Pringle 1987), though in southern Australia it frequently occurs on saline inland wetlands, saltworks and sewage ponds (Lane 1987). It occasionally forages on tidal mudflats, in estuaries and on coastal lagoons (Pringle 1987). Marsh Sandpipers usually forage along shallow edges of wetlands (Lane 1987; Higgins & Davies 1996). One was seen foraging in the dam, target site 1, in November 2018 (**Photo 13**). There are single ALA and Wildlife Online records for the Julia Creek area (ALA 2018a; DES 2018). The former is a 2003 record from the sewage ponds. It is possible the latter refers to the same record. In the Project the species could occur on dams or flooded quarries during passage. It is unlikely to remain in such habitats for any duration. The quarries, in particular, are marginal habitat.

The species is listed globally as Least Concern (IUCN 2018) and the global population is decreasing (Butchard & Symes 2016a). In Australia, the Marsh Sandpiper faces threats common to most migratory shorebirds, including habitat loss and degradation, of both foraging and roosting habitat, disturbance from residential and recreational activities and direct mortality as a result of human activities around the migration pathways of shorebirds and at roosting and foraging sites, such as the construction of wind farms in migration or movement pathways, bird strike due to aircraft, hunting, and chemical and oil spills (DE 2018c).

Sharp-tailed Sandpiper *Calidris acuminata*
EPBC Act: Migratory (Bonn, CAMBA, JAMBA, ROKAMBA); NC Act: Special Least Concern

The Sharp-tailed Sandpiper spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, typically to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. An estimated 160,000 Sharp-tailed Sandpipers occupy the East Asian-Australasian Flyway (EAAF). During the non-breeding season, approximately 91 percent of the EAAF population occurs in Australia and New Zealand (Bamford et al. 2008). One (1) bird was seen at a dam, target site 1, in the Project in March 2017. Three (3) birds were present at the same location in November 2018 (**Photo 14**). There are three (3) ALA records (ALA 2018a) of Sharp-tailed Sandpiper in the Julia Creek area, this Project's March

survey record and two (2) from the sewage ponds in 2003 and 2004. There are also three (3) records in the Wildlife Online database (DES 2018), though these may be the same records due to data-sharing, certainly this survey record is included. Target site 1 is the largest dam in the Project and provides the most suitable habitat, though smaller dams and flooded quarries could also be used. The species is most likely to use the Project during passage.

In Australasia, Sharp-tailed Sandpipers prefer muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. They tend to occupy coastal mudflats mainly after ephemeral terrestrial wetlands have dried out, moving back during the wet season. After rain, they may forage in paddocks of short grass, well away from water. Habitat loss is a major threat to the Sharp-tailed Sandpiper (QG 2014). There is evidence to suggest that the European population has declined but populations in Asia are not thought to be declining (Birdlife International 2016a). The species is still considered a common visitor to Australia (Menkhorst et al. 2017).

Photo 13: Marsh Sandpiper, Target Site 1

Photo 14: Sharp-tailed Sandpiper, Target Site 1

3.2.4 Weeds and Pest Animals

Weeds

Eight species of weeds were recorded within the Project (**Table 9**).

Table 9: Weeds Recorded in the Project

Family	Species	Common name
Amaranthaceae	*Aerva javanica*	Kopak Bush or Desert Cotton
Amaranthaceae	*Gomphrena celosioides*	Gomphrena Weed
Apocynaceae	*Calotropis gigantea*	Giant Milkweed
Caesalpiniaceae	*Parkinsonia aculeata*†	Parkinsonia, Jerusalem Thorn, Jelly Bean Tree
Malvaceae	*Sida spinosa*	Indian Mallow
Mimosaceae	*Vachellia nilotica**†	Prickly Acacia, Gum Arabic Tree
Poaceae	*Cenchrus ciliaris*	Buffel Grass
Portulacaceae	*Portulaca oleracea*	Pigweed

*Species listed in *Biosecurity Act 2014*. †WoNS refers to weeds of national significance classified by the Australian Government.

Two introduced plant species detected onsite are declared under the *Biosecurity Act 2014* (Category 3); *Parkinsonia aculeata* and *Vachellia nilotica* are also listed as Weeds of National Significance (WoNS).

Pest Animals

Five (5) species of feral animal were recorded during the field survey at the Project (**Table 10**). Database searches identified an additional three (3) species likely to occur and a further two (2) were predicted by the EPBC Protected Matters Report. Of the 11 species, six (6) are listed under Schedule 2 of the Biosecurity Act as 'Restricted Matters'. Under the act a person who has control over a 'Restricted Matter' must not do the following:

- **Category 3**: You must not distribute this restricted matter. This means it must not be given as a gift, sold, traded or released into the environment unless the distribution or disposal is authorised in a regulation or under a permit.
- **Category 4**: You must not move this restricted matter to ensure that it does not spread into other areas of the state.
- **Category 5**: You must not possess or keep this restricted matter under your control. You may only keep this restricted matter under a permit of the Biosecurity Act or another Act.
- **Category 6**: You must not feed this category of restricted matter. Feeding for the purpose of preparing for or undertaking a control program is exempted.

Likelihood of these species occurring is provided in **Table 10**, taken from the Queensland Government Department of Agriculture and Fisheries Pest Distribution Mapping (DAF 2017).

Table 10: Pest Animals

Scientific Name	Common Name	Recorded	Database record	PMR	Biosecurity Act Categories	Likelihood of Occurrence[1]
Mus musculus	House Mouse	-	-	x	-	Common and widespread
Felis catus	(feral) Cat	x	x	x	3, 4, 6	Common and widespread
Oryctolagus cuniculus	Rabbit	-	-	x	3, 4, 5, 6	Occasional and localised
Canis familiaris (*dingo*)	(feral) Dog/ Dingo	x	-	x	3, 4, 5, 6	Common and localised
Vulpes vulpes	Fox	-	x	x	3, 4, 5, 6	Occasional and widespread
Sus scrofa	Pig	x	x	x	3, 4, 6	Occasional and localised
Capra hircus	Goat	x	-	-	3, 4, 6	Absent
Camelus dromedarius	Camel	-	x	-	-	Absent
Passer domesticus	House Sparrow	-	x	x	-	Common and widespread
Hemidactylus frenatus	House Gecko	-	x	-	-	Not mapped
Rhinella marina	Cane Toad	x	x	x	-	Common and widespread

1. PMR = Protected Matters Report generated by the EPBC Act Protected Matters Search Tool (DEE 2018c).
2. Derived from Queensland Government Department of Agriculture and Fisheries Pest Distribution Mapping (DAF 2017)

Four (4) of these species identified from the desktop assessment were seen on the Project, Cane Toad, Dingo, Cat and Pig. Three of these species were recorded at the dam, target site 1 (**Table 1**). One Cane Toad was recorded and it appears that this species has yet to establish in the Project. One feral Cat was observed in November 2018 during spotlighting. It is likely that this secretive species is widespread in the Project, though shelter may be a limiting factor in many areas, especially when ground cover is at a minimum due to grazing and low rainfall. Pig was also observed only once, with 13 animals, included piglets, seen in November 2018. The adults were foraging for mussels in the then shallow dam. No evidence of feral Pig had previously been found in the Project and their occurrence is likely to be sporadic. One Dingo was recorded on a camera trap in an area of RE 4.9.1c.

One pest animal species not identified at the desktop level was recorded within the Project area. Goat *Capra hircus* is listed as a Category 3 restricted matter under the Biosecurity Act. Goat can also be registered stock in Queensland. Around 10-15 individuals were seen immediately adjacent to the Project and not fenced from the Project. Goats, like many introduced stock species, can cause damage by trampling and degrading habitat in riparian areas. It is noted that the database search using the Queensland Government Department of Agriculture and Fisheries Pest Distribution Mapping showed that Goat was absent from the region. Dingo has been regarded as a serious predator of domestic stock since early European settlement in Australia. The Dingo is a restricted invasive animal under the Biosecurity Act.

3.2.5 Regionally Significant Fauna

Four (4) fauna species identified as priority species for the bioregion were recorded in the Project. Two of these, Flock Bronzewing *Phaps histrionica* and Australian Bustard *Ardeotis australis* (**Photo 15**), are prioritised as the MGD bioregion is a core area and core habitat, respectively. The other two species, Downs Bearded Dragon *Pogona henrylawsoni* and Speckled Brown Snake *Pseudonaja guttata* (**Photo 16**) are species endemic or near-endemic to the bioregion. The four species were also ranked as Low under the *Back on Track Species Prioritisation Framework*[1] (DERM 2009b). No species ranked as Critical or High under the Back on Track framework for the Southern Gulf NRM (DERM 2010) has been recorded on the Project.

[1] Queensland implemented the Back on Track framework in 2005 to guide conservation management and recovery by government and non-government organisations regardless of species' status under the Nc and EPBC Acts. One of the original aims was to highlight species whose status under the NC Act required elevation and to speed up the process. Back on Track is now out of date because insufficient time and resources were allocated to continuously update the information needed to sustain it. No funding has been allocated to implement phase II, which was developed between 2012 and 2014 (QAO 2018). Nonetheless, Back on Track remains a useful source of non-EVNT species that are regionally significant.

Photo 15: Australian Bustard, cattle yards

Photo 16: Speckled Brown Snake, Trap site 3

Flock Bronzewing was observed on the Project in small numbers on a number of occasions. Several were seen drinking at a water-filled quarry in April 2018 and birds were seen in flight around the large dam in November 2018. Presumably the species does drink there. Other observations were of birds in flight across open grasslands. Australian Bustard was common during all fauna surveys. Downs Bearded Dragon was captured in funnel traps and by hand and is likely to be common and widespread onsite. This species was seen to take shelter in a soil crack in November 2018. Speckled Brown Snake was caught twice in funnel traps and was observed on three occasions other occasions. It is likely to be common and widespread onsite.

All four (4) species are listed as Least Concern (common) under the NC Act and none is listed under the EPBC Act. Flock Bronzewing and Australian Bustard and were considered Near Threatened in *The Action Plan for Australian Birds 2000* (Garnett & Crowley 2000). Flock Bronzewing naturally undergoes large seasonal fluctuations in range and population size but was considered to have been subject to a substantial decline. Although the Australian Bustard still had a substantial population it had undergone a massive historical decline in southern Australia. Neither species was included in *The Action Plan for Australian Birds 2010* (Garnett et al. 2011). Flock Bronzewing is no longer considered Near Threatened as recent research demonstrates fluctuations but no decline. Australian Bustard has been reassessed due to revised criteria. The northern population, which includes the Julia Creek region, is relatively large and stable. Flock Bronzewing is threatened by grazing pressure and Australian Bustard by Prickly Acacia invasion (DERM 2009b). Flock Bronzewing is possibly threatened by Fox predation and by Prickly Acacia invasion. Australian Bustard readily desert their nests due to disturbance by cattle and eggs and chicks are eaten by Foxes (Garnett & Crowley 2000). No threat is identified for the two reptile species (DERM 2009a).

3.2.6 Faunal Habitat Quality

The MGD bioregion is dominated by Mitchell grass (*Astrebla* spp.) tussock grasslands on rolling plains. There may be a tree layer of low Gidgee *Acacia cambagei* and other species. The bioregion is mostly semi-arid, with soils predominantly deep, heavy clays, sometimes with a stony surface. Drainage lines may support eucalypt woodlands. The open plains of the MGD contrast sharply with surrounding

bioregions. Most of the land is used for sheep and cattle production. There are seven (7) provinces (subregions) within the MGD, which have distinctive geology, landform, vegetation and climate (Sattler & Williams 1999).

Sattler & Williams (1999) place Julia Creek and the Project within the Northern Downs province, which is dominated by *Astrebla* tussock grassland on cracking clay soils. Trees are mainly confined to watercourses or are scattered across the downs. However, the mapping used in the Biodiversity Planning Assessment for the MGD (DERM 2009a) places Julia Creek and the Project in the Central Downs province, which is greatly expanded to include much of the Northern Downs as shown in Sattler & Williams (1999). The Central Downs are also dominated by *Astrebla* tussock grassland on cracking clay soils with Gidgee scattered across the downs. The Mitchell grass grasslands are a relatively depauperate habitat for vertebrate fauna (Fisher 1996 in Sattler & Williams 1999) but do support a number of distinctive species, including specialist species that use soil cracks such as Julia Creek Dunnart and Collett's Snake *Pseudechis colletti* (Sattler & Williams 1999). No area of 'special biodiversity value' is identified by the fauna expert panel (DERM 2009a) for the Project area.

The habitats of the Project are typical of the bioregion and the provinces Northern Downs and Central Downs, though more so the former as no Gidgee is known to be present. Most of the Project was a largely treeless native grassland, with scattered trees on stony rises. Many of these stony areas are very small and contain only a few well-spaced trees (**Photo 17**). There are some Coolabah along Horse Creek and some minor drainage lines. The trees are widely spaced on the drainage lines. The section of Horse Creek within the Project is very heavily degraded, with very few Coolabah. The Project now has substantial areas with woody cover, Prickly Acacia, a weed that spread throughout the MGD in the 1950s and 70s. Pest distribution mapping by DAF (2015) shows Prickly Acacia as widespread and abundant in the Julia Creek area. Prickly Acacia is the only tree species present for most of the Project that has been traversed as part of this survey (**Figure 7**).

Photo 17: Scattered native trees on stony rise, RE 4.9.2b, St Elmo Station

Photo 18: Dense stand of Prickly Acacia, Target site 1, March 2017

Prickly Acacia creates a new and woody over-storey stratum (Adair & Groves 1998), substantially altering the tussock grassland habitat by binding the soil and excluding some native plant species (DERM

2009b). The acacia is especially dense around waterbodies, forming a closed canopy around the largest dam on the property (**Photo 18**). It prospers along watercourses and can out-compete native plants for water. Once established along water courses and artificial waterbodies such as dams, Prickly Acacia spreads into adjacent grasslands. The Project site is a cattle station, as typical of the MGD where most land is used for cattle and sheep production (Sattler & Williams 1999). Cattle preferentially graze the high protein seed pods which can remain viable after passing through the digestive tract, hence spreading the seeds as they move from infestations. Seeds can also be transported on cattle hair and hooves (DAF 2016).

Prickly Acacia, especially near water, does provide resources for a variety of native fauna species. In the Project, Zebra Finch has been seen nesting in Prickly Acacia and the dense stand around the largest dam supported species such as Restless Flycatcher *Myiagra inquieta*, Rufous-throated Honeyeater *Conopophila rufogularis* and Purple-backed Fairy-wren *Malurus assimilis*. These species are not found in treeless grasslands and originally would have been locally restricted to riparian vegetation. The actual artificial waterbodies also support species not found in grasslands, except during temporary periods of inundation. Twenty-three (23) species of waterbird were recorded (25 percent of the total number of species for the Project, Appendix B), all but one (1) of which were seen at the largest dam (Target site 1, **Photo 18**). Smaller dams and water-filled quarries supported various subsets of the 23 species. Four (4) species listed as Migratory under the EPBC Act (Section 3.3.3) were recorded at artificial waterbodies but the suitability of these waterbodies will vary with season and rainfall. Lower water levels, as present in November 2018, create more favourable foraging conditions for migratory sandpipers.

Dams and availability of shade also facilitate the presence of some mammal species. For example, Eastern Grey Kangaroo *Macropus giganteus* was only observed at the largest dam (**Photo 19**). This species has increased its range because of artificial water sources (Landsberg et al. 1997). It is generally accepted that increased access to water has allowed the species to extend into more arid areas, though changes in ground cover may also be relevant. Eastern Grey Kangaroos seek dense shade on hot days and forage at night (Dawson et al. 2006), as opposed to Red Kangaroo *Osphranter rufus* which is much more adapted to arid conditions and was seen throughout the Project both day and night. The largest dam provides both shade and water for Eastern Grey Kangaroos but also for feral species. A group of feral Pigs, including piglets, was seen at the dam in November 2018 (**Photo 20**). The dam and its weedy environs provide shelter, water and foraging opportunities. Woody weeds such as Prickly Acacia and Parkinsonia, which is also present at the dam, provide refuge for feral Pigs (NHT 2018). The dams support some native frog species such Pale Frog *Litoria pallida* and Bumpy Rocket Frog *L. inermis* but also provide habitat for the highly invasive Cane Toad. Dams facilitate the spread of Cane Toads (Letnic et al. 2014).

Photo 19: Eastern Grey Kangaroo, Target site 1

Photo 20: Feral Pig, Target site 1

Artificial water sources provide access to virtually all of the bioregion for grazing by domestic, feral and native animals (James et al. 1996 in Sattler & Williams 1999). Few areas of such habitats are more than 10 km from an artificial water source (Landsberg et al. 1997) and most are much closer (James et al. 1996 in Landsberg et al. 1997). This provision of water has facilitated the spread of species that need to drink frequently, both native and introduced species. Feral predators also focus on water points for hunting (Landsberg et al. 1997; James et al. 1999). The only feral Cat observed in the Project was at the largest dam.

A major indirect effect of artificial water sources is that provision of drinking water for livestock and native and feral mammalian herbivores creates focal points for grazing. Recorded changes in vegetation in response to grazing are the development of a zone of extreme degradation around the water where the soil crust is broken, erosion is high and unpalatable plants dominate (e.g. **Photo 21**); the number of unpalatable perennial shrubs beyond the extreme degradation zone increases, and there is a decrease in abundance of palatable native perennial grasses due to selective grazing (James et al. 1999). Changes to vegetation and ground cover are most marked within 2 – 3 km of water points due to high traffic of livestock (Landsberg et al. 1997). **Photo 22** shows the effects of livestock on groundcover 2.5 km from the nearest watering point. The image is looking away from the water point, showing the degradation extending some distance. Smith et al. (2007) used the variables, distance to water 0 – 5 km and $\geq$5 km, when modelling the suitability of habitat for Julia Creek Dunnart.

Photo 21: Small dam, November 2018

Photo 22: Groundcover, November 2018

There are major changes in the species assemblage at different distances to water. Some species increase in abundance and others decrease. In rangelands, between 15 and 38 percent of species decrease (Landsberg et al. 1997). In a semi-arid treed habitat in southern Australia, Harrington (2002) found the presence of water had a major controlling influence on the abundance and distribution of numerous bird species. Generally, and unsurprisingly, water-dependent species were more abundant closer to water. These species were all common and of little conservation concern. The abundance of water-dependent species decreased at distances beyond 12 km from water, although most species were detected up to 20 km from water. Although some the 23 species of waterbird recorded in the Project may use natural waterbodies such as Horse Creek others require substantial areas of open water and would not occur without the presence of artificial waterbodies.

The reptile species assemblage as identified in the Project is quite small, nine (9) species, though this reflects the lack of structural complexity. The Wildlife Online database search for a 50 km radius (QG 2020) provided only eight (8) additional species. Given the cryptic nature of many reptile species, more survey effort would undoubtedly find some of these additional species. The surveys found three (3) species very typical of treeless, cracking clay Mitchell Grass plains, Downs Bearded Dragon, Speckled Brown Snake and Soil-crack Whipsnake *Demansia rimicola*. These species hunt and/or shelter in deep soil cracks (Wilson & Swan 2017). Although Prickly Acacia binds the soil, the level of infestation onsite has not excluded these species. The effects of artificial water sources and livestock on reptiles is poorly known. Smith et al. (1996) found no effect on reptile species richness due to sheep grazing in semi-arid Western Australia. Fisher (1996 in James et al. 1999) found a weak trend of increasing reptile species richness with increasing distance from artificial sources of water in Mitchell Grass grasslands. Few threatened species are found in arid and semi-arid pastoral zones (Cogger et al. 1993), though the MGD do support two species of death adder listed as Vulnerable under the EPBC Act and/or NC Act and a skink, *Ctenotus schevilli*, listed as Near Threatened under the NC Act. None of these species is known to occur in or near the Project.

Studies from North American deserts indicate that grazing significantly decreases abundance of reptiles, but only sometimes affects species richness. Impacts are attributed to structural changes in the habitat associated with grazed vs. un-grazed areas (James et al. 1999). Even grazing by native herbivores can affect reptile assemblages. Howland et al. (2014) found that changes in grazing intensity by Eastern Grey Kangaroos because of provision of water significantly affected reptiles. Reptile abundance, species richness and diversity were highest where grazing intensity was low. Importantly, no species of reptile was more likely to occur at high grazing intensities (Howland et al. 2014). No reptile species was recorded at the two dams either side of the cattle yards, one of which is the largest dam onsite. However, a Speckled Brown Snake was seen swimming across a small dam in April 2018, albeit one less used by cattle.

Intense grazing is also thought to displace some ground-dwelling bird species (James et al. 1999). The presence of livestock and infestation by Prickly Acacia would be having an impact of grassland bird

species. Nonetheless, the Project continues to support species typical of the MGD. The bird species assemblage observed during the 2017/18 surveys included such open grassland species as Oriental Plover, Flock Bronzewing, Australian Pratincole *Stiltia isabella*, Horsfield's Bushlark *Mirafra javanica*, White-winged Fairy-wren *Malurus leucopterus*, two quail *Coturnix* spp., two (2) button-quail *Turnix* spp. and Brown Songlark *Cincloramphus cruralis*. In April 2018, when more than 59 km were walked during the Star Finch survey, Red-chested Button-quail *T. pyrrhothorax* and Little Button-quail *T. velox*, were both common.

The Project site and its surrounds are subject to three (3) of the four (4) major threats to biodiversity in the bioregion, grazing by livestock, feral predators and exotic weeds (Sattler & Williams 1999). The fourth threat, clearing of vegetation, was not particularly relevant given the nature of the REs present. These threats are undoubtedly affecting the fauna, though, with a possible exception of the small mammal assemblage, the Project continues to support a species assemblage typical of the MGD.

4 Impacts of Proposed Activities

4.1 General Impacts

4.1.1 Clearing of Vegetation

The clearing of vegetation is the most significant and direct impact of the Project on ecological values of the site. Land clearance is listed as a key threatening process under the EPBC Act. The removal of habitat reduces the size of local populations of flora and fauna dependent on that habitat. These impacts are immediate and significant in the short-term. Impacts may persist in the long-term if habitat created during mine rehabilitation does not closely resemble pre-mining ecosystems. In addition, if sufficient habitat refuges are not maintained locally prior to the maturation of rehabilitated land, local extinction of certain species may occur.

Vegetation will be removed to accommodate mining, demountables, minor roads and other infrastructure associated with the Project.

The duration of impact of clearing varies between species, and their ability to colonise rehabilitation areas. The Project will operate over approximately 30 years, and rehabilitation will commence as soon as practicable and in a progressive manner.

4.1.2 Habitat Fragmentation

Highly fragmented habitats support fewer species than connected blocks of habitat of the same size. This is because fragmentation restricts dispersal of fauna and plant seeds between available habitat. The impacts of habitat fragmentation depend on the degree to which dispersal is inhibited by habitat gaps, the size of the remaining habitat fragments, and ecological attributes of the species.

4.1.3 Direct Mortality

Clearing of vegetation for the Project presents a risk of direct mortality or injury to fauna. Fauna of low mobility are at risk of injury or death from heavy machinery during the construction and operation of the Project. The small scale and staged expansion of Project operations are likely to reduce the risk of these impacts.

In addition, clearing will only occur within designated areas and only during designated time periods. The presence of qualified Wildlife Spotter-Catcher/s to assist with initial clearing will decrease incidences of fauna mortality. Educating employees and contractors with regard to fauna and flora will further reduce direct mortality as part of the Project.

4.1.4 Critically Endangered, Endangered or Vulnerable Species Possibly Occurring

Four (4) species listed as Critically Endangered, Endangered or Vulnerable under either the EPBC Act and/or NC Act are considered to possibly occur in the Project site. Three of these species, Australian Painted Snipe, Curlew Sandpiper and Yellow Chat (nominate subspecies) are expected to use the Project only very sporadically, if at all, based on known distribution, habitat use and the nature and condition of habitats onsite. Any possible impacts to these three species would be negligible at worst and they are not discussed further. Although there is no evidence of Julia Creek Dunnart in the Project site, there is suitable habitat, albeit degraded, and there are records of the species in close proximity. Also, unlike the three highly mobile bird species, should Julia Creek Dunnart be present it is likely to be resident.

Julia Creek Dunnart

If present, there is a potential for direct and indirect impacts on the Julia Creek Dunnart (*Sminthopsis douglasi*) as a result of the Project. Direct threats comprise the loss of habitat or direct mortality of individuals through clearing and excavation works. Indirect threats refer to secondary threats that may occur as a result of the Project. Indirect threats associated with the Project may include:

- increased number of feral animals attracted to rubbish,
- increased chance of wildlife colliding with vehicles,
- increased number of human-wildlife interactions,
- increased levels of habitat fragmentation, i.e. changed fauna behaviours in response to human presence and/or physical habitat loss,
- decreased quality of remaining vegetation due to weed introductions, especially Prickly Acacia, and
- alteration to fire regimes.

These impacts may result in reductions in local population size and viability should a population be present. These potential impacts were considered as part of the assessment of EPBC Act significant impact criteria for a Vulnerable species. There is no evidence of a population of Julia Creek Dunnart in the Project, regardless of whether or not the population was an 'important population' as per the criteria. However, given the difficulty in recording the species and the extent of habitat in the Project that may be suitable, albeit degraded and containing threatening processes, it is accepted that there may be a significant residual impact with regard to the destruction and/or decrease of availability of habitat as per the criteria: *Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*.

4.1.5 Dust

Earthworks and vehicular traffic associated with mining can generate substantial amounts of dust during dry weather. The pronounced wet and dry seasons in northern Australia may make vegetation in these areas less susceptible to the impacts of dust. This is because most or all annual growth occurs during a period of the year when rainfall is highest. This coincides with the time of year when dust is least problematic, as rain inhibits the dispersal of dust in the air, and washes dust from leaves.

The moving nature of the proposed earthworks means that any one block of vegetation will only be exposed to significant levels of dust for a short period. Dust can affect vegetation by covering surfaces and affecting photosynthesis, respiration and transpiration, resulting in injury and decreased productivity (Farmer 1993). Dust has also been known to provide adsorption surfaces for volatile contaminants that are subsequently deposited either by dry or wet deposition, causing respiratory ailments in animals and humans. Microclimatic changes such as these can affect areas great distances from roads, changing the vegetation composition (Coffin 2007). It is noted however that some of these impacts refer more to sealed roads with high traffic flows, which contrast with the low traffic flows seen at the Project.

4.1.6 Altered Fire Regimes

Most Australian vegetation types experience regular fires, and fire is important for maintaining structural attributes of vegetation, as well as facilitating seed germination of certain species (Catling et al. 2001). Fires of inappropriate intensity or timing can have detrimental impacts on native flora and fauna by:

- removing fallen timber and low vegetation used as shelter,
- reducing the density or extent of fire-sensitive flora,
- temporarily removing seeds, insects and other foods used by fauna,
- leading to vegetation ‘thickening’, the unnatural increase in midstorey vegetation cover in response to infrequent fires, which results in a decrease in understorey density and diversity, and
- causing direct mortality to slow-moving fauna.

Fire is generally only possible in the MGD bioregion after an adequate wet season which promotes sufficient vegetative growth. When burnt with adequate soil moisture, Mitchell grass responds well to fire and is known to seed profusely after recovering from a burn. Despite this, the bioregion is rarely widely burnt due to the high fodder value of Mitchell Grass species (QPWS 2012). The lack of burning in times of good grass growth has sometimes led to extreme fire events as well the invasion of some acacia species into the grasslands. Lack of fire, or fire regimes that allow or promote the encroachment of woody species, are detrimental to the grazing and biodiversity values of the MGD.

In general, the Project is not expected to cause substantial changes to local fire regimes. The most likely change is the reduced frequency of fire due to fuel reduction from pre-construction and rehabilitation clearing. This is likely to benefit the fire-sensitive vegetation occurring along the periphery of drainage lines. Any change is expected to be short-term, as rehabilitated sites are expected to develop a grass layer with the potential to support fire within the first 1-2 years of development. Active fire exclusion from rehabilitated sites will be practiced for at least ten years, to allow for the establishment of trees and shrubs, if appropriate for the RE type.

4.1.7 Water and Contaminants

Mine-affected water has the potential to impact on vegetation health and wildlife. Providing the design and operation of water management infrastructure and chemical/fuel storage facilities are undertaken in accordance with relevant legislation and standards, no impacts from contaminants are anticipated.

4.1.8 Weeds and Pest Animals

Eight (8) weed species and five (5) species of introduced animal were recorded in the Project area. The following activities associated with the Project have the potential to promote the proliferation of weeds and pests within the Project area, or introduce new weeds and pests from surrounding areas:

- increased vehicular traffic may introduce and spread weed seeds;
- land clearance favours the establishment of weeds due to increased light and soil disturbance; and
- inappropriate disposal and storage of putrescible wastes may attract feral animals.

The pests and weeds currently occurring within the Project area are not expected to significantly proliferate in response to the mining activities. The major threat is the introduction of new weeds via contaminated vehicles or soils.

4.1.9 Cumulative Impacts

Individual projects may have relatively minor impacts on overall biodiversity whilst regional biodiversity is still mostly intact. However, the cumulative impacts of multiple developments in a small area may be greater than the sum of these impacts considered separately. This is because the threshold amount of habitat required for the local persistence of threatened species may be lost. Cumulative impacts increase exponentially with successive developments. Consideration of surrounding developments is important when making predictions concerning the long-term conservation of the region's biodiversity values.

The CopperString Project runs approximately 20 km south of the Project, parallel to the Flinders Highway. At this stage Copperstring has not commenced and may not do so. Nonetheless, considering

the linear nature of Copperstring and the relatively small impact areas that are in proximity to the Project, cumulative impacts are not considered to be an important risk to environmental values of the Project.

4.1.10 Summary

The primary ecological impact of the Project will be the clearing of remnant vegetation. Without management, the impacts of clearing could persist for 10-50 years. Given the dominant vegetation type to be cleared is grassland, the ability for rapid recovery of cover is potentially high, though the propagation success of Mitchell Grass species is uncertain. There is a potential significant residual impact on Julia Creek Dunnart and an offset strategy will be proposed.

The ecological impacts of edge effects, habitat fragmentation, dust, altered fire regime, artificial light, noise and vibration, water, contaminants, disturbance to terrestrial wildlife, turbidity and cumulative impacts will be negligible.

5 Impact Mitigation Recommendations

5.1 Avoidance

The avoidance and minimisation of impacts to national and state significant environmental values were a major consideration during the planning of the Project. The mine footprint has been positioned to limit disturbance, as much as practicable. Due to these avoidance measures, the majority of protected matters known from the area will not be significantly impacted by the Project.

5.2 Mitigation of General Impacts

Recommended mitigation strategies to reduce impacts to ecological values is presented in **Table 11**.

Table 11: Mitigation Measures Proposed for General Impacts of the Project

	Management Measure	Timing
Clearing of Vegetation		
1	Project employees and contractors should be made aware of environmental obligations and compliance requirements through the site induction program.	Induction
2	Clearing should remove habitats in stages, which will allow movement of fauna away from disturbed areas.	Ongoing
3	Ongoing rehabilitation throughout the life of the mine, to reduce environmental impacts.	Ongoing
4	Topsoil removed from one site in preparation for mining should be immediately deposited and spread in already-mined sites. By limiting the stockpiling of soil, natural seed banks will be retained.	Ongoing
Habitat Fragmentation		
1	Habitat fragmentation should be avoided by retaining vegetation corridors along drainage lines within the site.	Ongoing
Direct Mortality		
1	Fauna spotter-catchers should inspect sites prior to vegetation clearing.	Ongoing
2	Injured fauna should be taken to the nearest wildlife carer or veterinarian.	Ongoing
3	All fauna injuries and mortality must be communicated to DES within 24 hours.	Ongoing
Species of National / State Significance		
1	Project employees and contractors should be taught to identify species of significance and alert fauna spotter / catchers.	Ongoing
Dust		
1	Dust should be suppressed using water trucks / wetting to keep dust related impacts to a minimum.	As required
Altered Fire Regimes		
1	Reduced fire regimes will require onsite staff to be vigilant of the potential for fire. Fire awareness training should be included during the site induction process.	Induction / ongoing
Waste		
1	Wastes should be disposed of appropriately and collected by a licensed waste contractor and taken to a licensed waste facility. Waste tracking certificates should be kept and maintained as part of this process.	Ongoing
Weeds and Pest Animals		
1	Vehicle wash-downs should be required for all new vehicles entering the site to ensure seeds aren't spread onto the Project.	Ongoing
2	Disposal and storage of putrescible wastes must be undertaken appropriately to ensure feral animals aren't attracted to the site.	Ongoing

6 References

Adair, RJ & Groves, RH 1998, *Impact of environmental weeds on biodiversity: a review and development of a methodology*, Biodiversity Group, Environment Australia, Canberra.

ALA 2018a, *Atlas of Living Australia*, http://www.ala.org.au.

ALA 2018b, *Chrysopogon fallax.* Atlas of Living Australia, https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2919044.

ALA 2018c, *Julia Creek species list*. Atlas of Living Australia. https://biocache.ala.org.au/explore/your-area#-20.6561852|141.74422140000001|11|ALL_SPECIES.

ALA 2018d, *Panicum decompositum.* Atlas of Living Australia, https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2897459.

ALA 2018e, *Sorghum plumosum*. Atlas of Living Australia, https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/7785586.

ALA 2018f, *Neochmia ruficauda ruficauda*, Atlas of Living Australia occurrence download at https://biocache.ala.org.au/occurrences/search?&q=lsid%3Aurn%3Alsid%3Abiodiversity.org.au%3Aafd.taxon%3A42f4cb74-e2e2-453c-af08-f7564c5ed0dd accessed on Wed Mar 14 11:10:53 AEDT 2018.

ALA 2018g, *Star Finch*, Atlas of Living Australia occurrence download at https://biocache.ala.org.au/occurrences/search?&q=lsid%3Aurn%3Alsid%3Abiodiversity.org.au%3Aafd.taxon%3A5acc3a7b-c063-4e57-b7bf-96ead9f192d9 accessed on Wed Mar 14 14:29:32 AEDT 2018.

Aumann, T 2001, 'Habitat use, temporal activity patterns and foraging behaviour of raptors in the south-west of the Northern Territory, Australia', *Wildlife Research*, vol. 28, pp. 365-378.

BAAM 2011, *Copperstring Project SEIS Supplementary Terrestrial Ecology Assessment Report*, Biodiversity Assessment and Management, Cleveland, report prepared for Copperstring Pty Ltd.

Bamford M, Watkins, D, Bancroft, W, Tischler, G & Wahl, J 2008, *Migratory shorebirds of the East Asian - Australasian Flyway: population estimates and internationally important sites*, Canberra, ACT: Department of the Environment, Water, Heritage and the Arts, WetlandsInternationalOceania, http://www.environment.gov.au/biodiversity/migratory/publications/shorebirds-east-asia.html.

Barea, LP & Watson, DM 2007, 'Temporal variation in food resources determines onset of breeding in an Australian mistletoe specialist', *Emu*, vol. 107, pp. 203-209.

Barrett, G, Silcocks, A, Barry, S, Cunningham, R & Poulter, R. 2003, *The new atlas of Australian birds*, Birds Australia, Melbourne.

BirdLife International 2016a, *Calidris acuminata*, The IUCN Red List of Threatened Species 2016: e.T22693414A93405394. http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22693414A93405394.en. Downloaded on 25 July 2018.

BirdLife International 2016b, *Neochmia ruficauda*, The IUCN Red List of Threatened Species 2016: e.T22719673A94638309. http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22719673A94638309.en, Downloaded on 13 March 2018.

Blakers, M, Davies, SJJF & Reilly, PN 1984, *The atlas of Australian birds*, Melbourne University Press, Melbourne.

BoM 2017a, *Julia Creek, Queensland March 2017 Daily Weather Observations*, Bureau of Meteorology, http://www.bom.gov.au/climate/dwo/201703/html/IDCJDW4067.201703.shtml.

BoM 2017b, *Julia Creek, Queensland July 2017 Daily Weather Observations*, Bureau of Meteorology, http://www.bom.gov.au/climate/dwo/201703/html/IDCJDW4067.201703.shtml.

BoM 2018a, *Julia Creek, Queensland April 2018 Daily Weather Observations*, Bureau of Meteorology, http://www.bom.gov.au/climate/dwo/201803/html/IDCJDW4067.201803.shtml.

BoM 2018b, *Julia Creek, Queensland March 2018 Daily Weather Observations*, Bureau of Meteorology, http://www.bom.gov.au/climate/dwo/IDCJDW4067.latest.shtml

BoM 2018c, *Julia Creek, Queensland November 2018 Daily Weather Observations*, Bureau of Meteorology, http://www.bom.gov.au/climate/dwo/IDCJDW4067.latest.shtml

Bowen, ME, McAlpine, CA, House, APN & Smith, GC 2009, 'Agricultural landscape modification increases the abundance of an important food resource: mistletoes, birds and brigalow', *Biological Conservation*, vol. 142, pp. 122-133.

Butchart, S & Symes, A 2016a, Marsh Sandpiper *Tringa stagnatilis*, *The IUCN Red List of Threatened Species*, https://www.iucnredlist.org/species/22693216/86691256

Butchart, S & Symes, A 2016b, Oriental Plover *Charadrius veredus*, The IUCN Red List of Threatened Species, https://www.iucnredlist.org/species/22693872/93428298#habitat-ecology

Catling, PC, Coops, N & Burt, RJ 2001, 'The distribution and abundance of ground-dwelling mammals in relation to time since wildfire and vegetation structure in south-eastern Australia', *Wildlife Research*, vol. 28, 555-565.

Coffin, AW 2007, 'From roadkill to road ecology: a review of the ecological effects of roads', *Journal of Transport Geography*, vol. 15: pp. 396-406.

Cogger, HG, Cameron, EE, Sadlier, RA & Eggler, P 1993, *The action plan for Australian reptiles*, Australian Nature Conservation Agency, Canberra.

CopperString 2010, *Environmental Impact Statement for the CopperString Project*. Queensland.

Czechura, G 2012, 'Red Goshawk', in LK Curtis, AJ Dennis, KR McDonald, PM Kyne & SJS Debus (eds), *Queensland's threatened animals*, CSIRO Publishing, Collingwood, pp. 268-269.

DAF 2015, *Prickly acacia (*Acacia nilotica*) Queensland Distribution 2013 – 14*, Department of Agriculture and Fisheries, https://www.daf.qld.gov.au/__data/assets/pdf_file/0003/790500/Prickly-acacia_2013.pdf

DAF 2016, *Prickly acacia* Vachellia nilotica *subsp.* indica *(Benth) Kyal and Boatwr*, Department of Agriculture and Fisheries, https://www.daf.qld.gov.au/__data/assets/pdf_file/0007/73753/IPA-Prickly-Acacia-PP9.pdf.

DAF 2017, *Queensland Government Department of Agriculture and Fisheries Pest Distribution Mapping*, https://www.daf.qld.gov.au/plants/weeds-pest-animals-ants/pest-mapping/annual-pest-distribution-maps/ipa-maps.

Dawson, TJ, McTavish, KJ, Munn, AJ & Holloway, J 2006, 'Water use and the thermoregulatory behaviour of kangaroos in arid regions: insights into the colonisation of arid rangelands in Australia by the eastern grey kangaroo (*Macropus giganteus*)', *Journal of Comparative Physiology B*, vol. 176, pp. 45-53.

Debus, SJS 2012, 'Masked Owl (northern subspecies)', in LK Curtis, AJ Dennis, KR McDonald, PM Kyne & SJS Debus (eds), *Queensland's threatened animals*, CSIRO Publishing, Collingwood, pp. 306-307.

Debus, SJS & Czechura, GV 1988, 'The red goshawk *Erythrotriorchis radiatus*: a review', *Australian Bird Watcher*, vol. 12, pp. 175-199.

DE 2018a, *Apus pacificus* in Species Profile and Threats Database, Department of the Environment, Canberra, Available from: http://www.environment.gov.au/sprat. Accessed Wed, 6 Jun 2018 15:00:53 +1000.

DE 2018b, *Plegadis falcinellus* in Species Profile and Threats Database, Department of the Environment, Canberra, Available from: http://www.environment.gov.au/sprat. Accessed Wed, 7 Jun 2018 12:00:53 +1000.

DE 2018c, *Tringa stagnatilis* in Species Profile and Threats Database, Department of the Environment, Canberra, http://www.environment.gov.au/sprat, accessed Wed, 14 Nov 2018 10:34:46 +1100.

DEE 2018a, *Australian Faunal Directory*, Department of the Environment and Energy, Canberra, https://biodiversity.org.au/afd/mainchecklist.

DEE 2018b, *Neochmia ruficauda ruficauda* in Species Profile and Threats Database, Department of the Environment, Canberra, Available from: http://www.environment.gov.au/sprat. Accessed Wed, 14 Mar 2018 11:38:17 +1100.

DEE 2018c, *Protected Matters Search Tool*, Department of the Environment and Energy, Canberra, http://www.environment.gov.au/epbc/pmst/.

DEHP 2017, Star finch (eastern subspecies), Department of Environment and Heritage Protection, Brisbane, https://www.ehp.qld.gov.au/wildlife/animals-az/star_finch_eastern_subspecies.html.

DERM 2009a, *Biodiversity planning assessment Mitchell Grass Downs bioregion, Fauna expert panel report version 1.1*, Department of Environment and Resource Management, Brisbane.

DERM 2009b, *National recovery plan for the Julia Creek dunnart* (Sminthopsis douglasi), Report to the Department of the Environment, Water, Heritage and the Arts, Canberra, Queensland Parks and Wildlife Service, Department of Environment and Resource Management, Brisbane.

DERM 2010, *Southern Gulf Natural Resource Management Region Back on Track Actions for Biodiversity*, Department of Environment and Resource Management, Brisbane.

DES 2018, Wildlife Online Extract. Latitude: -20.6568 Longitude: 141.7448 Distance: 25. Department of Environment and Science. https://environment.ehp.qld.gov.au/report-request/species-list/.

DES 2019, *Copy of the Pre-clearing or Remnant Regional Ecosystem Map - Version 11,* Online RE Map, Department of Environment and Science, Brisbane.

DEWHA 2010, *Survey guidelines of Australia's threatened birds: guidelines for detecting birds listed as threatened under the* Environment Protection and Biodiversity Conservation Act 1999*,* Department of the Environment, Water, Heritage and Arts, Canberra.

Dickman, CR, Mahon, PS, Masters, P & Gibson, DF 1999, 'Long-term dynamics of rodent populations in arid Australia: the influence of rainfall', *Wildlife Research*, vol. 26, pp. 389-403.

Dostine, PL, Johnson, GC, Franklin, DC, Zhang, Y & Hempel, C 2001,' Seasonal use of savanna landscapes by the Gouldian finch, *Erythrura gouldiae,* in the Yinberrie Hills area, Northern Territory', *Wildlife Research*, vol. 28, 445-458.

Eyre, TJ, Ferguson, DL, Hourigan, CL, Smith, GC, Mathieson, MT, Kelly, AL, Venz MF, Hogan, LD and Rowland, J, 2018, *Terrestrial vertebrate fauna survey assessment guidelines for Queensland*, Department of Environment and Science, Queensland Government, Brisbane.

Farmer, AM, 1993, 'The effects of dust on vegetation – a review', *Environmental Pollution*, vo. 79, pp. 63-75.

Fisher, A 1996, *Conservation assessment and identification of gaps in protected areas in the Mitchell Grasslands, particularly in the Northern Territory*, Year 2 report to National Reserve System Cooperative Program, Australian Nature Conservation Agency, Canberra.

Fisher, A, Baker, B & Woinarski, J 2002, *Biodiversity audit – bioregional case study, Mitchell Grass Downs, Northern Territory*, Parks and Wildlife Commission of the Northern Territory and Departure of Infrastructure, Planning & Environment, Darwin.

Garden, JG, McAlpine, CA, Possingham, HP & Jones, DP 2007, 'Using multiple survey methods to detect terrestrial reptiles and mammals: what are the most successful and cost-efficient techniques?', *Wildlife Research*, vol. 34, pp. 218-227.

Garnett, ST & Crowley, GM 2000, *The action plan for Australian birds 2000*, Environment Australia, Canberra.

Garnett, ST, Szabo, JK & Dutson, G 2011, *The action plan for Australian birds 2010*, CSIRO Publishing, Collingwood.

Higgins, PJ (ed) 1999, *Handbook of Australian, New Zealand and Antarctic birds, Volume 4: parrots to dollarbird.* Oxford University Press, Melbourne.

Higgins, PJ & Davies, SJJF (eds) 1996, *Handbook of Australian, New Zealand and Antarctic birds, Volume 3: snipe to pigeons*, Oxford University Press, Melbourne.

Higgins, PJ, Peter, JM & Cowling, SJ (eds) 2006, *Handbook of Australian, New Zealand and Antarctic birds, Volume 7: boatbill to starlings, Part B: dunnock to starlings*, Oxford University Press, South Melbourne.

Higgins, PJ, Peter, JM & Steele, WK (eds) 2001, *Handbook of Australian, New Zealand and Antarctic birds, Volume 5: tyrant-flycatchers to chats*, Oxford University Press, Melbourne.

Holmes, G 1996, 'Distribution and status of the southern star finch', *Sunbird*, vol. 26, pp. 49-59.

Holmes, G 1998, 'A review of the distribution, status and ecology of the star finch *Neochmia ruficauda* in Queensland', *Australian Bird Watcher*, vol. 17, pp. 278-289.

Houston, W 2012, 'Yellow Chat (gulf subspecies)', in LK Curtis, AJ Dennis, KR McDonald, PM Kyne & SJS Debus (eds), *Queensland's threatened animals*, CSIRO Publishing, Collingwood, pp. 318-319.

IUCN 2018, *The IUCN Red List of Threatened Species. Version 2018*-2, International Union for Conservation of Nature and Natural Resources, http://www.iucnredlist.org

James, CD, Landsberg, J, Hobbs, T & Morton, SR 1996, *The relationship between the provision of artificial water sources in arid and semi-arid Australia, and changes in biodiversity*, A preliminary report on a consultancy undertaken for the Biodiversity Unit of the Department of Environment, Sport and Territories, CSIRO, Division of Wildlife and Ecology, Alice Springs.

James, CD, Landsberg, J & Morton, SR 1999, 'Provision of watering points in the Australian arid zone: a review of effects on biota', *Journal of Arid Environments*, vol. 41: pp. 87-121.

Kingsford, RT & Johnson, W 1998, 'Impact of water diversions on colonially-nesting waterbirds in the Macquarie Marshes of arid Australia', *Colonial Waterbirds*, vol. 21, pp. 159-170.

Landsberg, J, James, CD, Morton, SR. Hobbs, TJ, Stol, J, Drew, A & Tongway, H 1997, *The effects of artificial sources of water on rangeland biodiversity: final report to the Biodiversity Convention and Strategy Section of the Biodiversity Group, Environment Australia*, Environment Australia and CSIRO, Canberra.

Lane, BA 1987, *Shorebirds in Australia*, Nelson Publishers, Melbourne.

Letnic, M, Webb, JK, Jessop, TS, Florance, D & Dempster, T 2014, 'Artificial water points facilitate the spread of an invasive vertebrate in arid Australia', *Journal of Applied Ecology*, vol. 51, pp. 795-803.

Marchant, S & Higgins, PJ (eds) 1990, *Handbook of Australian, New Zealand and Antarctic birds, Volume 1: ratites to ducks*, Oxford University Press, Melbourne.

Marchant, S & Higgins, PJ (eds) 1993, *Handbook of Australian, New Zealand and Antarctic birds, Volume 2: raptors to lapwings*, Oxford University Press, Melbourne.

Maute, K & Legge S 2012a, 'Gouldian Finch,' in LK Curtis, AJ Dennis, KR McDonald, PM Kyne & SJS Debus (ed), *Queensland's threatened animals*, CSIRO Publishing, Collingwood, pp. 330-331.

Maute, K & Legge S 2012b, 'Star Finch (southern subspecies),' in LK Curtis, AJ Dennis, KR McDonald, PM Kyne & SJS Debus (ed), *Queensland's threatened animals*, CSIRO Publishing, Collingwood, pp. 328-329.

McAlpine, C & Howes, A 2005, *Identification and mapping of critical habitat for the Julia Creek dunnart (*Sminthopsis douglasi*)*, Report to the Environmental Protection Agency/Queensland Parks and Wildlife Service, Brisbane.

McRae, P 2012, 'Greater bilby', in LK Curtis, AJ Dennis, KR McDonald, PM Kyne & SJS Debus (eds), Queensland's threatened animals, CSIRO Publishing, Collingwood, pp. 350-351.

Menkhorst, P, Rogers, D & Clarke, R 2017, *The Australian bird guide*, CSIRO Publishing, Clayton South.

Mifsud, G 1999, *Ecology of the Julia Creek dunnart* Sminthopsis douglasi (*Marsupialia: Dasyuridae*), Masters Thesis, La Trobe University.

Mifsud, G 2001, *Monitoring of Julia Creek dunnart populations at Bladensburg National Park, April 2001*, Report to the Queensland Parks and Wildlife Service, Brisbane.

NHT 2018, *Weed management guide parkinsonia* Parkinsonia aculeata, Natural Heritage Trust, https://www.environment.gov.au/biodiversity/invasive/weeds/publications/guidelines/wons/pubs/p-aculeata.pdf.

O'Malley, C 2006a, *Appendix to the National Recovery Plan for the Gouldian Finch (*Erythrura gouldiae*)* Background Information. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/pubs/e-gouldiae-background.pdf.

O'Malley, C 2006b, *National recovery plan for the Gouldian Finch (*Erythrura gouldiae*),* WWF-Australia, Sydney and Department of Natural Resources, Environment and the Arts, NT Government, Palmerston.

Oliver, DL, Chambers, MA & Parker DG 2003, 'Habitat and resource selection of the painted honeyeater (*Grantiella picta*) on the northern floodplains region of New South Wales', *Emu*, vol. 103, pp. 171-176.

Pavey, C 2006, *National recovery plan for the great bilby* Macrotis lagotis. Northern Territory Department of Natural Resources, Environment and the Arts.

Payne, RB 2010, 'Family Estrildidae (waxbills)', in J del Hoyo, A Elliott & DA Christie (eds), *Handbook of the birds of the world*. *Vol. 15. Weavers to New World warblers*, Lynx Edicions, Barcelona, pp. 234-377.

Pringle, JD 1985, *The waterbirds of Australia: the National Photographic Index of Australian wildlife*, Angus and Robertson, North Ryde.

Pringle, JD 1987, *The shorebirds of Australia: the National Photographic Index of Australian wildlife*, Angus & Robertson, North Ryde.

QAO 2018, *Conserving threatened species Report 7: 2018-19*, Queensland Audit Office, Brisbane.

QG 2014, *Species profile search*, Queensland Government, Brisbane, https://environment.ehp.qld.gov.au/species-search/.

QG 2018a, *Regional ecosystem descriptions*, Queensland Government, Brisbane, https://environment.ehp.qld.gov.au/regional-ecosystems/.

QG 2019, *Species profile*—Oldenlandia spathulata *(Rubiaceae),* Queensland Government, https://apps.des.qld.gov.au/species-search/details/?id=8450

QG 2020, *Wildlife Online database*, Queensland Government, Brisbane, https://environment.ehp.qld.gov.au/report-request/species-list/.

QPWS 2012, *Queensland Park and Wildlife Service Enhanced Fire Management Team – Planned Burn Guidelines, Mitchell Grass Downs Bioregion of Queensland*, Brisbane.

Queensland Herbarium 2018, 'Regional Ecosystem Description Database (REDD) Version 10.1' March 2018, DSITI, Brisbane.

Rabosky, DL, Hutchinson, MN, Donnellan, SC, Talaba, AL & Lovette, IJ 2014, 'Phylogenetic disassembly of species boundaries in a widespread group of Australian skinks (Scincidae: *Ctenotus*)', *Molecular Phylogenetics and Evolution*, vol. 77, pp. 71-82.

Rogers, D, Hance, I, Paton, S, Tzaros, C, Griffioen, P, Herring, M, Jaensch, R, Oring, L, Silcocks, A & Weston, M 2005, 'The breeding bottleneck: breeding habitat and population decline in the Australian painted snipe', in P Straw, (ed), *Status and conservation of shorebirds in the East Asian-Australasian Flyway. Proceedings of the Australasian Shorebirds Conference 13-15 December 2003*, Wetlands International Global Series 18, International Wader Studies 17, Sydney, pp 15-23.

Rowland, P 1996, 'Star Finch *Neochmia ruficauda*', in R Strahan (ed) *Finches, bowerbirds & other passerines of Australia,* Angus&Roberston, Pymble, pp. 45-47.

Sattler, P & Williams, R (eds) 1999, *The conservation status of Queensland's bioregional ecosystems,* Environmental Protection Agency, Brisbane.

Schodde, R & Mason, IJ 1999, *The directory of Australian birds: passerines*, CSIRO Publishing, Collingwood.

Smith, CS, Howes, AL, Price, B & McAlpine, CA 2007, 'Using a Bayesian belief network to predict suitable habitat of an endangered mammal – the Julia Creek dunnart (*Sminthopsis douglasi*)', *Biological Conservation*, vol. 139, pp. 333-347.

Smith, GT, Arnold, GW, Sarre, S, Abensperg-Traun, M & Steven, DE 1996, 'The effect of habitat fragmentation and livestock grazing on animal communities in remnants of gimlet *Eucalyptus salubris* woodland in the Western Australian wheatbelt. II. lizards.', Journal of Applied Ecology, vol. 33, pp. 1302-1310.

Snow, DW & Perrins, CM 1998, *The birds of the western Palearctic*. Concise Edition, Oxford University Press, Oxford, UK.

Spence-Bailey, LM, Nimmo, DG, Kelly, LT, Bennett AF & Clarke, MF 2010, 'Maximising trapping efficiency in reptile surveys: the role of seasonality, weather conditions and moon phase on capture success', *Wildlife Research*, vol. 37, pp. 104–115.

Storr, GM 1973, *List of Queensland birds*, Western Australian Museum, Special Publication No. 5.

Tapp, V 2012, End of an era as research station sold at Julia Creek, ABC Rural, http://www.abc.net.au/site-archive/rural/news/content/201211/s3637905.htm.

Watson, D 2012 'Painted Honeyeater', in LK Curtis, AJ Dennis, KR McDonald, PM Kyne & SJS Debus (eds), *Queensland's threatened animals*, CSIRO Publishing, Collingwood, pp. 322-323.

Wells, RW 2002, 'Taxonomy of the genus *Acanthophis* (Reptilia: Elapidae) in Australia', *Australian Biodiversity Record*, vol. 2002, pp. 1-18.

Wilson, S 2015, *A field guide to reptiles of Queensland*, Second Edition, Reed New Holland, Sydney.

Wilson, S & Swan, G 2017, *A complete guide to reptiles of Australia*, Fifth edition, New Holland Publishers, Sydney.

Woinarski, J 2007, 'Red goshawk *Erythrotriorchis radiatus*', in J Woinarski, C Pavey, R Kerrigan, I Cowie & S Ward, (eds), *Lost from our landscape: threatened species of the Northern Territory*, Northern Territory Department of Natural Resources, Environment and The Arts, Palmerston, pp. 183.

Woolley, PA 1992, 'New records of the Julia Creek dunnart *Sminthopsis douglasi* (Marsupialia: Dasyuridae)', *Wildlife Research*, vol. 19, pp. 779-783.

Woolley, PA 2008, 'Julia Creek Dunnart *Sminthopsis douglasi'*, in S Van Dyck & R Strahan, (eds), *The mammals of Australia*, Third Edition, Reed New Holland, Sydney.

Woolley, PA 2015, 'The Julia Creek dunnart, *Sminthopsis douglasi* (Marsupialia: Dasyuridae): breeding of a threatened species in captivity and in wild populations', *Australian Journal of Zoology,* vol. 63, pp. 411-423.

Woolley, PA 2017, 'Diurnal resting sites of the nocturnal dasyurid marsupial *Sminthopsis douglasi* in Bladensburg National Park, Queensland', *Australian Mammalogy*, vol. 39, pp. 121–126.

Worthington Wilmer, J 2012, 'Ghost Bat', in LK Curtis, AJ Dennis, KR McDonald, PM Kyne & SJS Debus (eds), *Queensland's threatened animals*, CSIRO Publishing, Collingwood, pp. 382-383.

Wüster, W, Dumbrell, AJ, Hay, C, Pook, CE, Williams, DJ & Fry, BG 2005, 'Snakes across the strait: Trans-Torresian phylogeographic relationships in three genera of Australasian snakes (Serpentes: Elapidae: *Acanthophis*, *Oxyuranus*, and *Pseudechis*)', *Molecular Phylogenetics and Evolution*, vol. 34, pp. 1-14.

Young, RA & Ford, GI 2000, Bat fauna of a semi-arid environment in central western Queensland, Australia. *Wildlife Research*, vol. 27, pp. 203-215.

Appendix A – Flora Species – March and July 2017 Surveys

Family	Species
Acanthaceae	*Nelsonia campestris*
Acanthaceae	*Rostellularia adscendens*
Aizoaceae	*Trianthema triquetra*
Aizoaceae	*Zaleya galericulata*
Amaranthaceae	*Aerva javanica*
Amaranthaceae	*Alternanthera nodiflora*
Amaranthaceae	*Amaranthus mitchellii*
Amaranthaceae	*Gomphrena breviflora*
Amaranthaceae	*Gomphrena celosioides*
Amaranthaceae	*Ptilotus spicatus*
Apocynaceae	*Calotropis gigantea*
Asteraceae	*Streptoglossa adscendens*
Boraginaceae	*Trichodesma zeylanicum*
Byttneriaceae	*Waltheria indica*
Caesalpiniaceae	*Chamaecrista longipes*
Caesalpiniaceae	*Parkinsonia aculeata*
Caesalpiniaceae	*Senna planitiicola*
Celastraceae	*Denhamia oleaster*
Chenopodiaceae	*Atriplex spongosa*
Chenopodiaceae	*Chenopodium auricomum*
Chenopodiaceae	*Enchylaena tomentosa*
Chenopodiaceae	*Maireana villosa*
Chenopodiaceae	*Salsola australis*
Chenopodiaceae	*Sclerolaena bicornis*
Cleomaceae	*Cleome viscosa*
Convolvulaceae	*Evolvulus alsinoides*
Convolvulaceae	*Ipomoea diamantinensis*
Convolvulaceae	*Ipomoea lonchophylla*
Convolvulaceae	*Operculina aequisepala*
Convolvulaceae	*Polymeria longifolia*
Convolvulaceae	*Polymeria pusilla*
Cucurbitaceae	*Cucumis melo*
Cyperaceae	*Cyperus difformis*
Cyperaceae	*Cyperus gilesii*
Cyperaceae	*Cyperus victoriensis*
Cyperaceae	*Eleocharis spiralis*
Fabaceae	*Aeschynomene indica*
Fabaceae	*Alysicarpus muelleri*
Fabaceae	*Crotalaria dissitiflora subsp. dissitiflora*
Fabaceae	*Crotalaria medicaginea var. neglecta*
Fabaceae	*Desmodium muelleri*
Fabaceae	*Glycine falcata*
Fabaceae	*Indigofera linifolia*
Fabaceae	*Indigofera linnaei*
Fabaceae	*Rhynchosia minima*
Fabaceae	*Sesbania brachycarpa*
Fabaceae	*Vigna lanceolata*
Malvaceae	*Abelmoschus ficulneus*
Malvaceae	*Abutilon hannii*

Malvaceae	*Malvastrum americanum var. stellatum*
Malvaceae	*Sida fibulifera*
Malvaceae	*Sida laevis*
Malvaceae	*Sida spinosa*
Malvaceae	*Sida trichopoda*
Marsileaceae	*Marsilea hirsuta*
Mimosaceae	*Neptunia gracilis*
Mimosaceae	*Vachellia nilotica*
Myrtaceae	*Eucalyptus coolabah*
Nyctaginaceae	*Boerhavia spp.*
Phyllanthaceae	*Phyllanthus maderaspatensis*
Poaceae	*Astrebla lappacea*
Poaceae	*Astrebla pectinata*
Poaceae	*Astrebla squarrosa*
Poaceae	*Cenchrus ciliaris*
Poaceae	*Chloris pectinata*
Poaceae	*Dactyloctenium radulans*
Poaceae	*Enneapogon avenaceus*
Poaceae	*Eriachne mucronata*
Poaceae	*Eulalia aurea*
Poaceae	*Iseilema fragile*
Poaceae	*Iseilema membranaceum*
Poaceae	*Iseilema vaginiflorum*
Poaceae	*Panicum decompositum var. decompositum*
Portulacaceae	*Portulaca oleracea*
Rhamnaceae	*Ventilago viminalis*
Sapindaceae	*Atalaya hemiglauca*
Sparrmanniaceae	*Corchorus trilocularis*
Zygophyllaceae	*Tribulus terrestris*
Gentianaceae	*Centaurium spicatum*
Molluginaceae	*Glinus lotoides*

Appendix B – Fauna Species – March and July 2017, and April 2018 Surveys

Scientific Name	Common Name	EPBC Act	NC Act	trap 1	trap 2	trap 3	trap 4	trap 5	trap 6	trap 7	trap 8	trap 9	trap 10	target 1	target 2	target 3	target 4	target 5	target 6 (dam 2)	Horse Creek	incidental
Macropus giganteus	Eastern Grey Kangaroo	-	LC						x					x	x						
Osphranter rufus	Red Kangaroo	-	LC				x		x	x	x		x		x	x	x				
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	-	LC																		x
Chaerephon jobensis	Northern Mastiff Bat	-	LC																		x
Mormopterus lumsdenae	Northern Free-tailed Bat	-	LC																		x
Chalinolobus gouldii	Gould's Wattled Bat	-	LC																		x
Leggadina lakedownensis	Lakeland Downs Mouse	-	LC							x											
Canis familiaris	Dingo	-	I																		x
Felis catus	Cat	-	I											x							
Sus scrofa	Pig	-	I											x							
Capra hircus	Goat	-	I																		x
Dromaius novaehollandiae	Emu	-	LC																		x
Coturnix ypsilophora	Brown Quail	-	LC					x													
Coturnix pectoralis	Stubble Quail	-	LC																		x
Anas gracilis	Grey Teal	-	LC											x	x				x		
Anas superciliosa	Pacific Black Duck	-	LC											x							
Aythya australis	Hardhead	-	LC											x							
Malacorhynchus membranaceus	Pink-eared Duck	-	LC											x					x		
Stictonetta naevosa	Freckled Duck	-	LC											x							
Tachybaptus novaehollandiae	Australasian Grebe	-	LC											x							
Geopelia cuneata	Diamond Dove	-	LC			x								x		x			x	x	
Geopelia striata	Peaceful Dove	-	LC											x					x		
Ocyphaps lophotes	Crested Pigeon	-	LC	x		x				x	x		x	x	x	x	x		x	x	
Phaps histrionica	Flock Bronzewing	-	LC											x			x				
Podargus strigoides	Tawny Frogmouth	-	LC											x							
Eurostopodus argus	Spotted Nightjar	-	LC											x							
Apus pacificus	Fork-tailed Swift	M	SLC																	x	
Anhinga novaehollandiae	Australasian Darter	-	LC											x							
Phalacrocorax sulcirostris	Little Black Cormorant	-	LC											x							
Pelecanus conspicillatus	Australian Pelican	-	LC											x	x						
Ardea alba modesta	Eastern Great Egret	-	LC											x							
Ardea pacifica	White-necked Heron	-	LC											x			x				
Egretta novaehollandiae	White-faced Heron	-	LC											x			x				
Platalea regia	Royal Spoonbill	-	LC											x					x		
Platalea flavipes	Yellow-billed Spoonbill	-	LC											x							
Plegadis falcinellus	Glossy Ibis	M	SLC												x						
Threskiornis spinicollis	Straw-necked Ibis	-	LC											x			x		x	x	
Aquila audax	Wedge-tailed Eagle	-	LC											x						x	
Accipiter fasciatus	Brown Goshawk	-	LC											x							
Circus assimilis	Spotted Harrier	-	LC											x	x						
Haliastur sphenurus	Whistling Kite	-	LC						x	x			x	x						x	
Milvus migrans	Black Kite	-	LC	x	x	x		x	x					x		x				x	
Falco berigora	Brown Falcon	-	LC	x				x	x	x				x			x		x		
Falco cenchroides	Nankeen Kestrel	-	LC	x		x		x	x	x	x	x		x	x				x		
Falco longipennis	Australian Hobby	-	LC																		x
Falco subniger	Black Falcon	-	LC		x			x						x						x	
Fulica atra	Eurasian Coot	-	LC											x							
Tribonyx ventralis	Black-tailed Native-hen	-	LC											x			x				
Ardeotis australis	Australian Bustard	-	LC		x		x	x	x					x			x		x		
Himantopus himantopus	Black-winged Stilt	-	LC											x	x				x		
Vanellus miles	Masked Lapwing	-	LC											x							

Scientific Name	Common Name	EPBC Act	NC Act	trap 1	trap 2	trap 3	trap 4	trap 5	trap 6	trap 7	trap 8	trap 9	trap 10	target 1	target 2	target 3	target 4	target 5	target 6 (dam 2)	Horse Creek	incidental
Vanellus tricolor	Banded Lapwing	-	LC							x									x		
Charadrius veredus	Oriental Plover	M	SLC											x							
Elseyornis melanops	Black-fronted Dotterel	-	LC											x	x		x			x	
Erythrogonys cinctus	Red-kneed Dotterel	-	LC											x							
Tringa stagnatilis	Marsh Sandpiper	M	SLC											x							
Calidris acuminata	Sharp-tailed Sandpiper	M	SLC											x							
Turnix velox	Little Button-quail	-	LC	x																	
Turnix pyrrhothorax	Red-chested Button-quail	-	LC																		x
Stiltia isabella	Australian Pratincole	-	LC											x							
Cacatua galerita	Sulphur-crested Cockatoo	-	LC						x					x							
Cacatua sanguinea	Little Corella	-	LC				x		x			x	x	x	x						
Eolophus roseicapillus	Galah	-	LC						x	x	x	x	x	x	x	x	x		x	x	
Nymphicus hollandicus	Cockatiel	-	LC	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x	
Melopsittacus undulatus	Budgerigar	-	LC						x	x	x			x			x		x	x	
Chrysococcyx basalis	Horsfield's Bronze-cuckoo	-	LC											x							
Tyto javanica	Eastern Barn Owl	-	LC																		x
Todiramphus sancta	Sacred Kingfisher	-	LC																		x
Todiramphus pyrrhopygius	Red-backed Kingfisher	-	LC				x			x							x			x	
Merops ornatus	Rainbow Bee-eater	-	LC											x							
Ptilonorhynchus maculatus	Spotted Bowerbird	-	LC														x				
Malurus assimilis	Purple-backed Fairy-wren	-	LC											x		x					
Malurus leucopterus	White-winged Fairy-wren	-	LC		x																
Conopophila rufogularis	Rufous-throated Honeyeater	-	LC											x			x				
Lichmera indistincta	Brown Honeyeater	-	LC											x							
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	-	LC						x					x							
Ptilotula penicillata	White-plumed Honeyeater	-	LC											x						x	
Philemon citreogularis	Little Friarbird	-	LC											x							
Certhionyx variegatus	Pied Honeyeater	-	LC											x							
Epthianura aurifrons	Orange Chat	-	LC														x				
Epthianura tricolor	Crimson Chat	-	LC											x							
Coracina novaehollandiae	Black-faced Cuckoo-shrike	-	LC																x		
Lalage tricolor	White-winged Triller	-	LC			x								x						x	
Pachycephala rufiventris	Rufous Whistler	-	LC											x							
Artamus cinereus	Black-faced Woodswallow	-	LC	x			x														
Artamus personatus	Masked Woodswallow	-	LC		x		x	x	x						x	x	x			x	
Artamus superciliosus	White-browed Woodswallow	-	LC		x			x									x			x	
Cracticus nigrogularis	Pied Butcherbird	-	LC			x	x	x								x					
Cracticus tibicen	Australian Magpie	-	LC		x	x		x	x	x				x	x	x				x	
Rhipidura albiscapa	Grey Fantail	-	LC				x														
Rhipidura leucophrys	Willie Wagtail	-	LC	x	x	x	x							x	x		x		x	x	
Corvus orru	Torresian Crow	-	LC	x		x	x		x	x				x			x			x	
Grallina cyanoleuca	Magpie-lark	-	LC	x										x	x	x	x		x	x	
Myiagra inquieta	Restless Flycatcher	-	LC											x	x	x	x			x	
Struthidea cinerea	Apostlebird	-	LC	x						x				x			x		x		
Petroica goodenovii	Red-capped Robin	-	LC											x							
Mirafra javanica	Horsfield's Bushlark	-	LC							x											
Cincloramphus mathewsi	Rufous Songlark	-	LC																	x	
Cincloramphus cruralis	Brown Songlark	-	LC		x					x	x										

Scientific Name	Common Name	EPBC Act	NC Act	trap 1	trap 2	trap 3	trap 4	trap 5	trap 6	trap 7	trap 8	trap 9	trap 10	target 1	target 2	target 3	target 4	target 5	target 6 (dam 2)	Horse Creek	incidental
Petrochelidon nigricans	Tree Martin	-	LC																		x
Taeniopygia guttata	Zebra Finch	-	LC	x		x				x	x			x	x				x	x	
Anthus novaeseelandiae	Australasian Pipit	-	LC						x	x	x					x					
Heteronotia binoei	Bynoe's gecko	-	LC	x			x														
Ctenotus inornatus	Bar-shouldered Ctenotus	-	LC	x	x																
Lophognathus gilberti	Gilbert's Dragon	-	LC		x		x														
Pogona henrylawsoni	Downs Bearded Dragon	-	LC	x		x															
Tympanocryptis tetraporophora	Eyrean Earless Dragon	-	LC			x															
Varanus gouldii	Gould's Goanna	-	LC																		x
Demansia rimicola	Soil-Crack Whipsnake	-	LC				x		x												
Pseudonaja guttata	Speckled Brown Snake	-	LC		x	x															
Suta suta	Myall Snake	-	LC																		x
Limnodynastes tasmaniensis	Spotted Grass Frog	-	LC														x				
Cyclorana novaehollandiae	New Holland Frog	-	LC																		x
Litoria caerulea	Green Tree Frog	-	LC											x							
Litoria inermis	Bumpy Rocket Frog	-	LC																x		
Litoria latopalmata	Broad-palmed Frog	-	LC														x				
Litoria pallida	Pale Frog	-	LC											x					x		
Rhinella marina	Cane Toad	-	I											x							

Appendix C – Anabat Analysis Reports 2017

Brett Taylor

48 Broughton Rd

Kedron. 4031

Ph: 0439564918

Re: Microbat echolocation call analysis – Julia Creek Project

This report compiles the results of ten nights of microbat call recording analysis from four Anabat SD2 recorders used in the Julia Creek region (north Queensland) in late March 2017. A total of 110 bat calls were analysed out of a total of over 50,000 Anabat files provided. Calls were identified using available microbat call keys (Milne 2002; Pennay et al. 2004) and a personal call library from species recorded in Queensland.

Call quality was generally poor across sites and recording dates. It is understood recorders were set at a high sensitivity to allow recording of the potential presence of Ghost Bat (*Macroderma gigas*), a species listed as Vulnerable under the State's NC act and the Commonwealth's EPBC Act. Call records are described in Table 1 and have been identified here only by codes provided on the supplied SD cards as no other information was provided at the time. The majority of anabat files recorded were from a single recorder (over 45,000 calls), identified here as BERN 22-2-11. It is uncertain whether this machine may have malfunctioned as it appears the machine continuously recorded files over one and a half nights (27 and 28 March) before the SD card capacity was reached. No microbat echolocation calls were recorded on this card, or on the card identified as 04539 (28 and 29 March) over a total of four nights. The paucity of calls may well be a reflection of the local habitat resources on the Mitchell Grass Downs with few habitat trees available for microbat roosting.

Four bats could be confidently identified to species (Table 1). Examples of the calls interpreted for the species identification analysis are provided in the final section of this report. The most commonly recorded species was Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*).

Another bat could only be identified to the level of genus, *Nyctophilus*. Calls from bats in this genus are very similar and currently cannot be distinguished from each other through call analysis. However, the only species likely to occur in the area is *N. Geoffroyii.*

There were two calls in the range of approximately 40 kHz. Two species of *Scotorepens* (*greyii* or *sanborni*) as well as *Chalinolobus nigrogriseus* call at this frequency in a similar call shape and all have some potential to occur in the area. *C. nigrogriseus* also often calls in a distinctive call shape (see Milne 2002), however no calls of this style were recorded. The most likely species present is *Scotorepens greyii.*

A single very short and poor quality call has some potential to be that of a *Taphozous* species, however there is little certainty able to be applied to this identification.

Table 1 Anabat call records for Julia Creek survey - March 2017

		Anabat - 03041			Anabat – BERN 09		
Scientific name	Common name	27 Mar	28 Mar	29 Mar	27 Mar	28 Mar	29 Mar
Chaerophon jobensis	Northern Freetail Bat					2	No calls
Chalinolobus gouldii	Gould's Wattled Bat				1	3	
Mormopterus lumsdenae	Lumsden's Freetail Bat		3	6	4		
Nyctophilus species	Long-eared Bat species	1		1	3	1	
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat	2		27	9	19	
Scotorepens greyii/sanborni	Little/Northern Broad-nosed Bat					2	
	Unidentified	3	1	5	15	2	
	Total	6	4	39	32	29	0

Yellow-bellied Sheathtail Bat was the most commonly recorded species. This is a large distinctive species that roosts in tree hollows. Yellow-bellied Sheathtail Bat is found across most of the continent (not the south-west) and occupies most habitats except rainforest. The species is known to migrate to southern Australia during the northern summer.

Gould's Wattled Bat is found across much of Australia except for Cape York Peninsula. It is generally a common species, although not in the survey area, and can be found in all habitats. This is generally a tree hollow roosting species.

Lumsden's Freetail Bat (formerly Beccari's) is found across northern Australia including much of Queensland. They are found in a wide range of habitats. In arid areas they are commonly caught along watercourses lined with Red Gums. They roost in tree hollows for the most part but are known to roost in caves in Papua New Guinea and are often found in dwellings.

A number of unidentified calls could not be confidently attributed to bat species due to the poor quality and/or short duration of the calls. All of these were in the lower call frequency range (between 16 – 222 khz), therefore being one of three species identified above: Northern Freetail Bat, Lumsden's Freetail Bat or Yellow-bellied Sheathtail Bat.

No cave dwelling species were recorded except for a single potential record of a *Taphozous* species, although as stated above, there is a low confidence in this identification and the potential for this call to be other causes (such as insect noise) is likely. No calls resembling the known calls of Ghost Bat were identified although the species may be difficult to detect due to the low intensity of its calls. However, the Julia Creek area is not a known location for the species and, given no other cave dwelling microbat species were reliably detected it would seem unlikely the species will occur in the area.

References

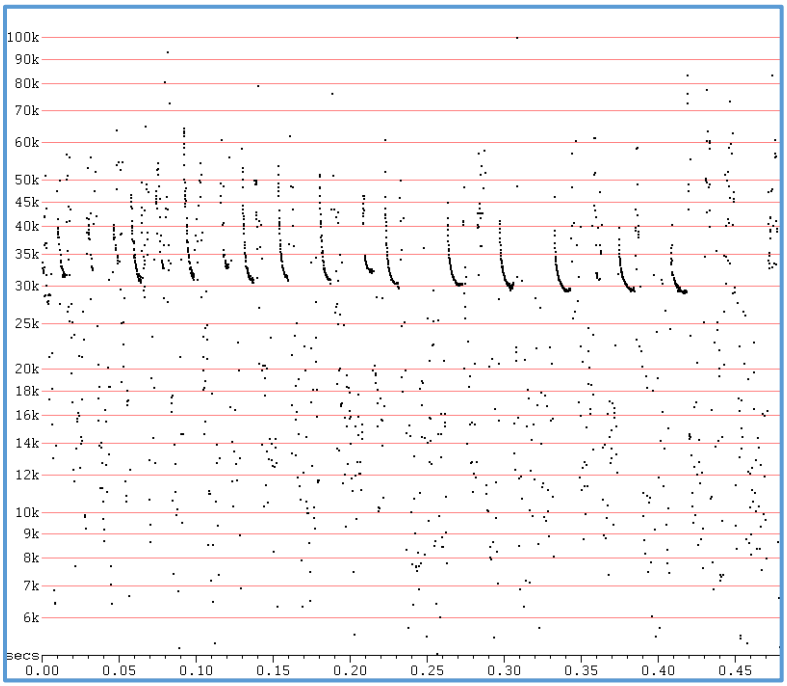
Churchill, S (2008). *Australian bats.* Allen and Unwin, Crows Nest, NSW.

Milne, D (2002). *Key to the bat calls of the Top End of the Northern Territory. Technical Report No. 71.* Parks and Wildlife Commission of the Northern Territory.

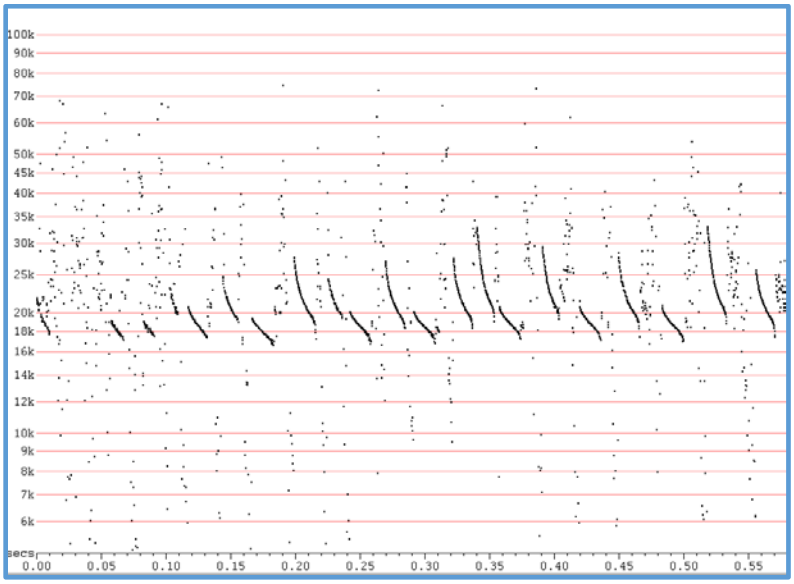
Pennay, M, Law, B and Reinhold, L (2004). *Bat calls of New South Wales: region based guide to the echolocation calls of microchiropteran bats.* NSW Department of Environment and Conservation, Hurstville.

Van Dyck, S and Strahan, R (eds.) (2008). *The mammals of Australia. 3rd edn*. New Holland Reed Books, Sydney.

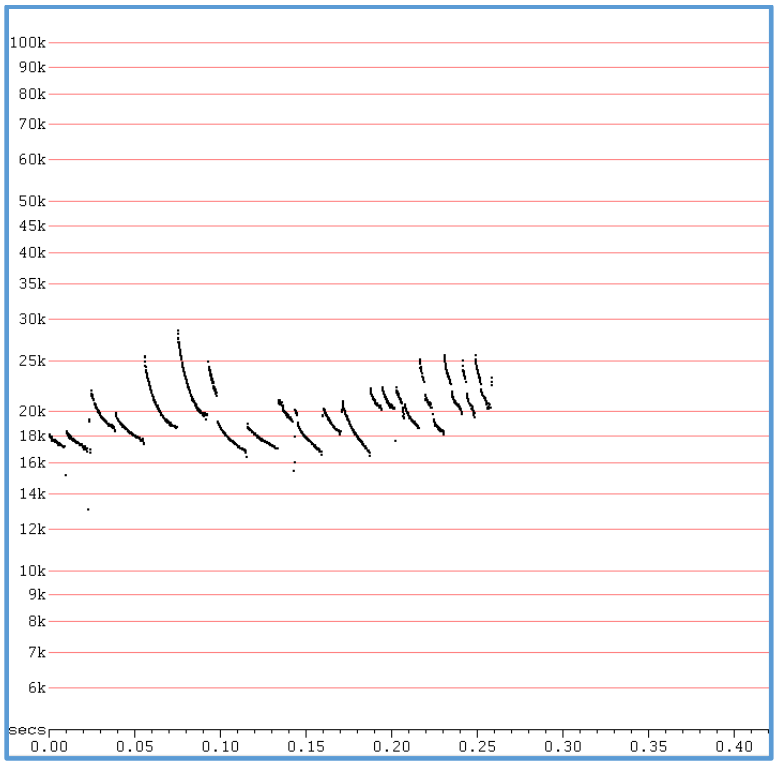
Echolocation Call Examples



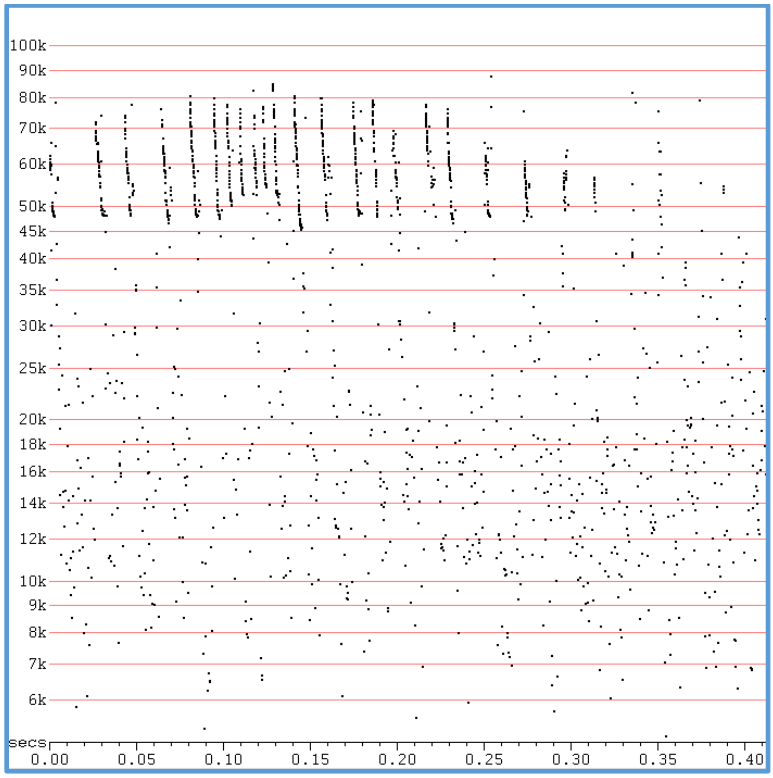
***Chalinolobus gouldii* – 27 Mar (BERN 09)**



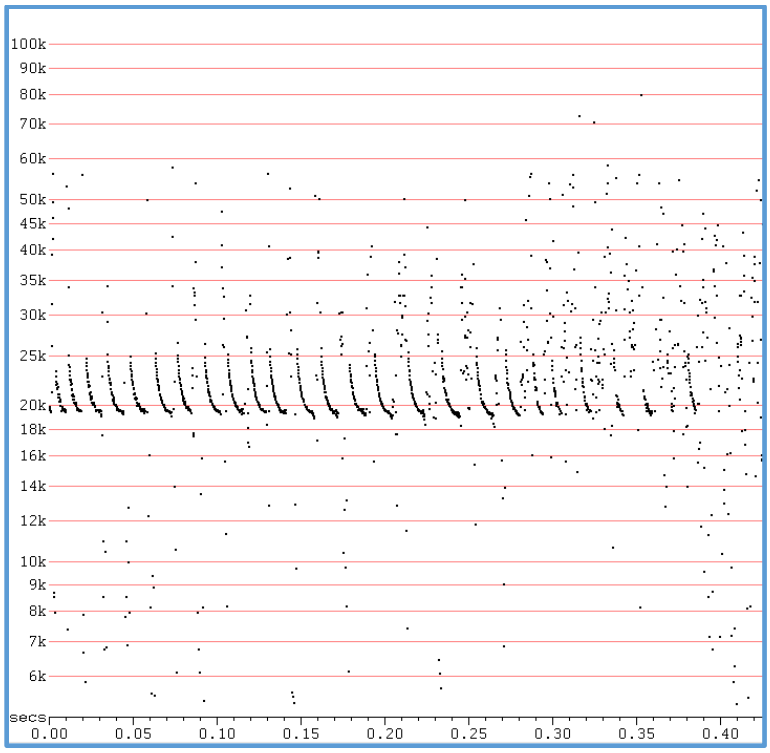
***Chaerophon jobensis* - 28 Mar (BERN 09)**



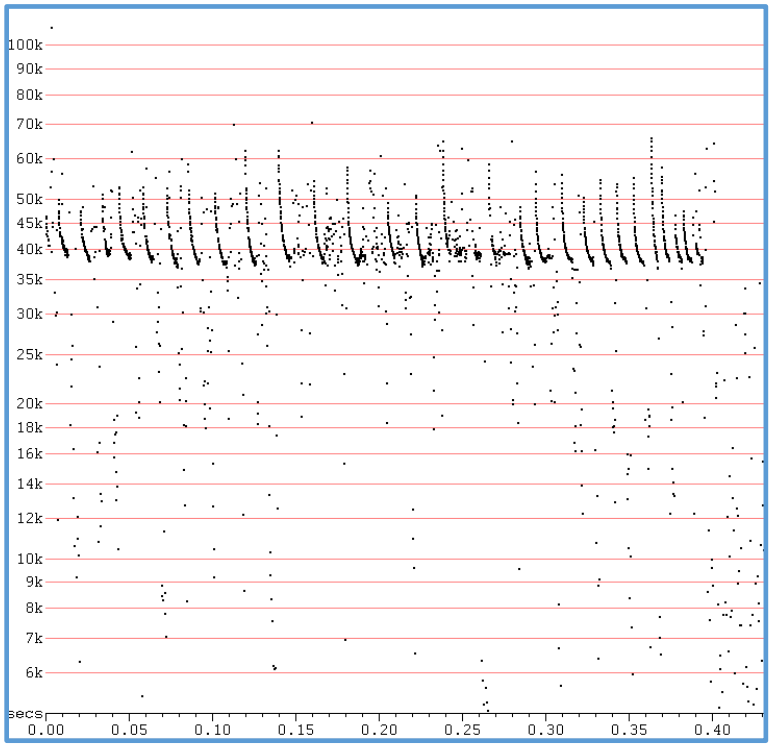
***Mormopterus lumsdenae* - 29 Mar (03041)**



***Nyctophilus sp.* - 27 Mar (BERN 09)**



***Saccolaimus flaviventris* - 28 Mar (BERN 09)**



***Scotorepens greyii* (likely) - 28 Mar (BERN 09)**

Microbat Call Identification Report

Prepared for ("Client"):	Epic Environmental
Survey location/project name:	St Elmo, Julia Creek
Survey dates:	24-29 July 2017
Client project reference:	
Job no.:	EPI-1702
Report date:	8 August 2017

Methods

Data received

A single raw data file (data.dat) and associated detector log file was received for analysis. Log entries indicate the Anabat SD2 detector (Titley Scientific, Brisbane) was deployed between 24th and 28th July 2017.

Data post-processing

CFCread (Corben 2017) was used to convert the raw data files to Anabat bat call sequence files in zero-crossing analysis format (ZC files). This process yielded just 23 ZC files for analysis.

Call identification

All ZC sequence files were viewed using *AnalookW* (Corben 2015), with species identification achieved manually by comparing the *AnalookW* sonograms with those of reference calls collected from northern Queensland and/or with reference to published call descriptions (e.g. Reinhold *et al.* 2001; Milne 2002).

Species' identification was also guided by considering probability of occurrence based on general distribution information (Churchill 2008; van Dyck *et al.* 2013) and/or on-line database records from the Atlas of Living Australia (http://www.ala.org.au).

Reporting standard

The format and content of this report follows Australasian Bat Society standards for the interpretation and reporting of bat call data (Reardon 2003), available on-line at http://www.ausbats.org.au/.

Species nomenclature follows Reardon *et al.* (2015).

Results & Discussion

Detector failure

A review of the log files downloaded from the detector shows that the detector was deployed in "forced record mode", commencing at 18:41 hr on 24th July and ceasing to operate due to flat batteries at 23:40 hr on the following night (25th July). The detector was switched on several times on subsequent days, but failed again shortly after start-up due to flat batteries.

Log file entries for the 24th and 25th July also show microphone voltage being less than expected (138-139 V rather than 150V). The cause of this fault is unknown, but it may have affected the ability of the detector to sense and record bat calls.

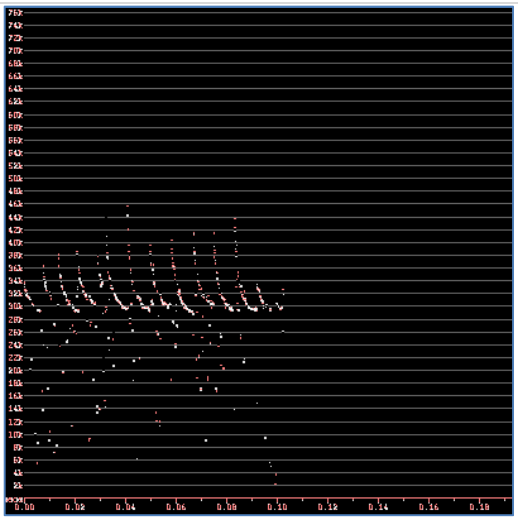
Species recorded

Only two species were recorded:

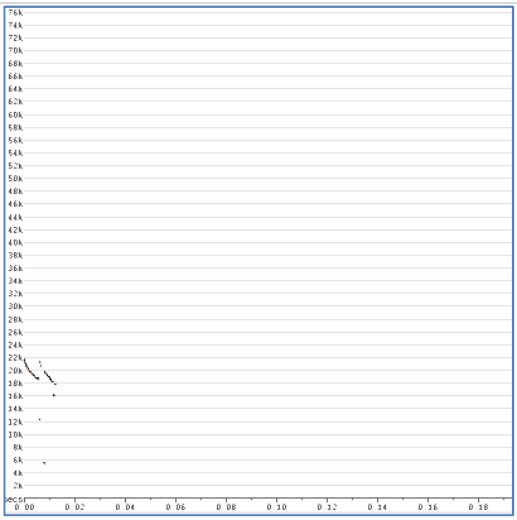
- *Chalinolobus gouldii* – 15 calls on 24th July and 5 calls on 25thJuly; and
- *Saccolaimus flaviventris* or *Chaerephon jobensis* – 1 call on 24th July.

The call allocated to *S. flaviventris/C. jobensis* has only two pulses, so cannot be positively identified.

Figure 1 Representative call sequences from the Julia Creek, July 2017 survey data.



Chalinolobus gouldii



S. flaviventris / C. jobensis

References

Churchill, S. (2008). *Australian Bats*. Jacana Books, Allen & Unwin; Sydney.

Corben, C. (2015). *AnalookW for bat call analysis using ZCA; Version 4.1z*; 20 September 2015.

Corben, C. (2017). *CFCread Storage ZCAIM interface. Version 4.5k;* 16 March 2017.

Milne, D.J. (2002). *Key to the Bat Calls of the Top End of the Northern Territory*. Technical Report No. 71, Parks and Wildlife Commission of the Northern Territory, Darwin.

Reardon, T. (2003). Standards in bat detector based surveys. *Australasian Bat Society Newsletter* **20**, 41-43.

Reardon, T.B., Armstrong, K.N. and Jackson, S.M. (2015). A current taxonomic list of Australian Chiroptera; Version 2015-05-15. Available from: *Australasian Bat Society*, URL http://ausbats.org.au/taxonomic-list/4589345107

Reinhold, L., Law, B., Ford, G. and Pennay, M. (2001). *Key to the bat calls of south-east Queensland and north-east New South Wales*. Department of Natural Resources and Mines, Brisbane.

van Dyck, S., Gynther, I. and Baker, A. (ed.) (2013). *Field Companion to the Mammals of Australia*. New Holland; Sydney.

Appendix D – EPBC Act Protected Matters Report

Australian Government
Department of the Environment and Energy

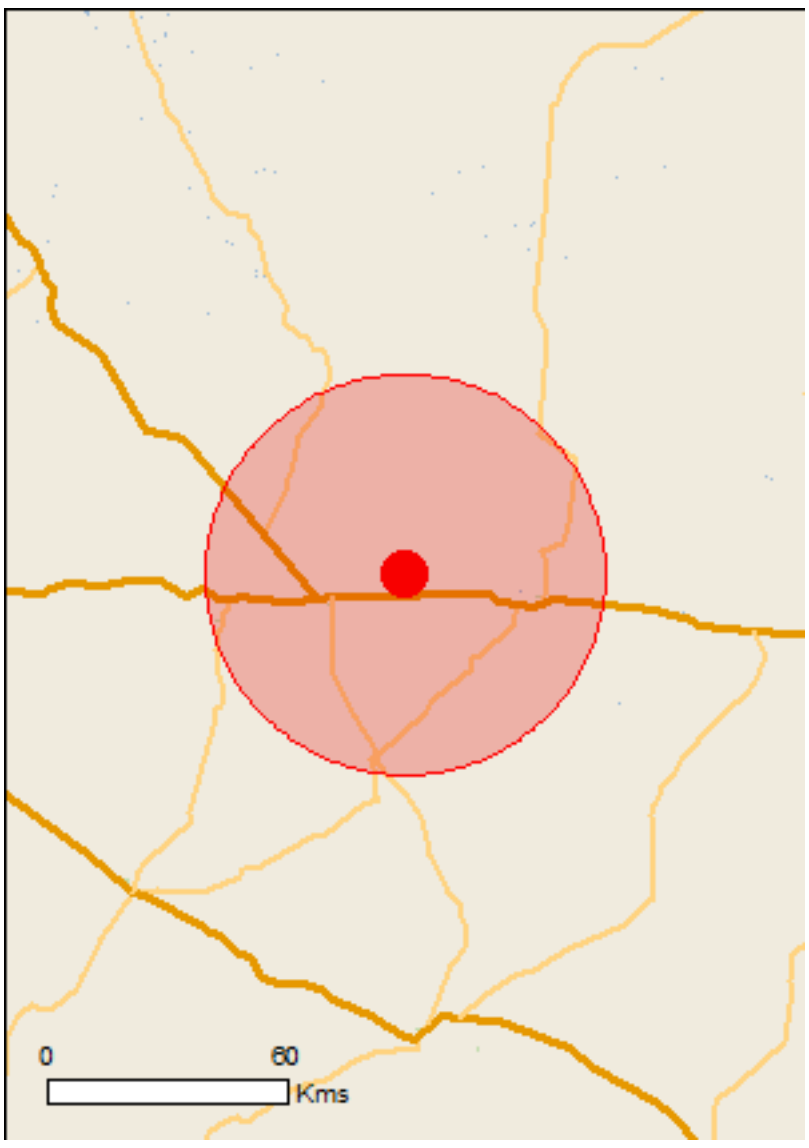
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

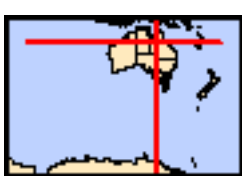
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 10/03/17 15:05:25



Coordinates
Buffer: 50.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	12
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	14
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	13
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin	Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat may occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Neochmia ruficauda ruficauda Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat may occur within area
Mammals		
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat may occur within area
Sminthopsis douglasi Julia Creek Dunnart [305]	Vulnerable	Species or species habitat known to occur within area
Reptiles		

Name	Status	Type of Presence
Acanthophis hawkei		
Plains Death Adder [83821]	Vulnerable	Species or species habitat may occur within area
Sharks		
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Marine Species		
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus		
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Glareola maldivarum		
Oriental Pratincole [840]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat known to occur

Name	Threatened	Type of Presence within area
[Ardea ibis](#) Cattle Egret [59542]		Species or species habitat may occur within area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
[Charadrius veredus](#) Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
[Cuculus saturatus](#) Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat may occur within area
[Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
[Glareola maldivarum](#) Oriental Pratincole [840]		Species or species habitat may occur within area
[Haliaeetus leucogaster](#) White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
[Merops ornatus](#) Rainbow Bee-eater [670]		Species or species habitat may occur within area
[Motacilla cinerea](#) Grey Wagtail [642]		Species or species habitat may occur within area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat may occur within area
[Rostratula benghalensis (sensu lato)](#) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Reptiles		
[Crocodylus johnstoni](#) Freshwater Crocodile, Johnston's Crocodile, Johnston's River Crocodile [1773]		Species or species habitat may occur within area

Extra Information

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Acacia nilotica subsp. indica Prickly Acacia [6196]		Species or species habitat likely to occur within area
Cryptostegia grandiflora Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]		Species or species habitat likely to occur within area
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area
Vachellia nilotica Prickly Acacia, Blackthorn, Prickly Mimosa, Black Piquant, Babul [84351]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-20.608857 141.904399

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

Appendix E – RE Field Sheets for Mapping

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - Site form **Regional ecosystem code**

Location

Site No.	**Recorder:** A Daniel
	Day/Date: Tues 28th March 17
Purpose St Almo EPM	
Locality: (inc. distance/direction to nearest town) Julia Crk	
GPS coordinates: Zone 54 0591350 7727553	**Datum:** GDA'94

W393

Vegetation structure

Median height of the EDL is to be measured

367
636

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E	1.0	0.5–5	VS
T1			
T2			
T3			
S1			
S2			
G	0.2	0–0.5	MD

Structural formation: (including height) Grassland

Ecologically dominant layer: G

Plant species

Record relative (numerical) dominance for each stratum;
d – dominant; *c* – codominant; *a* – associated; *s* – suppressed.

Str.	Rel. dom.	Scientific Name
E	d	Acacia farnesiana
G	d	Astrebla lappacea
G	a	Malvastrum americanum
G	a	Rhynchosia minima
G		Indigofera linifolia

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils: brown self-mulching clay

Field observation and notes:

Landzone: 9

RE code changes

Existing RE code: 4.9.16/4.9.26

Proposed RE code: 4.9.1

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - Site form **Regional ecosystem code**

Location

Site No. 2 **Recorder:** A Daniel **Day/Date:** Tue 28/03/17

Purpose St Alma EPBC

Locality: (inc. distance/direction to nearest town) Julia Creek

GPS coordinates: Zone 54 0588834 7725773 **Datum:** GDA 94

W394

638
639

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E	4.5	0.5 - 6	S
T1			
T2			
T3			
S1			
S2			
G	0.2	0 - 0.5	MD

Structural formation: (including height) Grassland

Ecologically dominant layer: G

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – codominant; ***a*** – associated; ***s*** – suppressed.

Str.	Rel. dom.	Scientific Name
E	d	Acacia farnesiana
G	d	Astrebla lappacea
G	a	Chloris Sericea
G	a	Iseilema glaucum
G	a	Mollugo cerviana
G	a	Boerhavia dominii
G	a	Ke[illegible]a vagans
G	a	[illegible] minimum
G	a	Senna florisicola

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils:

Field observation and notes:

Landzone: 9

RE code changes

Existing RE code: 4.9.1c

Proposed RE code: 4.9.1c

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - Site form **Regional ecosystem code**

Location

Site No. 3 **Recorder:** A Daniel **Day/Date:** Tue 28/03/17

Purpose 8th Mmo EPA

Locality: (inc. distance/direction to nearest town) Julia Creek

GPS coordinates: Zone 54 0589912 7722040 **Datum:** GDA'94

1395

640
641

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E	4	0.5–5	S
T1			
T2			
T3			
S1			
S2			
G	0.2	0–0.4	MD

Structural formation: (including height) Grassland

Ecologically dominant layer: G

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – codominant; ***a*** – associated; ***s*** – suppressed.

Str.	Rel. dom.	Scientific Name
E	d	Acacia farnesiana
G	d	Astrebla lappacea
G	a	Sclerolaena birchii
G	a	Senna planitricola
G	a	Dichanthium sericeum
G	a	Sida fibulifera
G	a	Salsola kali
G	a	Aristida contorta
G	a	Panicum queenslandicum

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils:

Field observation and notes:

Landzone: 9

RE code changes

Existing RE code: 4.9.1c

Proposed RE code: 4.9.1c

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - Site form Regional ecosystem code

Location

Site No. 4 Recorder: A Daniel Day/Date: Tue 25/08/17

Purpose Stratmap FPM

Locality: (inc. distance/direction to nearest town) Duke Creek

GPS coordinates: Zone 54 | 0594128 | 7713153 | Datum: GDA 94

396
642
643

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E	2	0.5 - 4	VS
T1			
T2			
T3			
S1			
S2			
G	0.2	0 - 0.3	MD

Structural formation: (including height) Grassland

Ecologically dominant layer: G

Plant species

Record relative (numerical) dominance for each stratum;
d – dominant; ***c*** – codominant; ***a*** – associated; ***s*** – suppressed.

Str.	Rel. dom.	Scientific Name
E	d	Acacia farnesiana
G	c	Astrebla lappacea
G	c	Iseilema [illegible]
G	c	Sporobolus caroli
G	c	Panicum decompositum
G	c	Chloris sp
G	a	Tricuspidata sp.
G	a	Chrysopogon sericeus
G	a	Senna planticola
G	a	Cleome viscosa

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils:

Field observation and notes:

Landzone: 9

RE code changes

Existing RE code: 4.9.1c

Proposed RE code: 4.9.1c

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - **Site form** **Regional ecosystem code**

Location

Site No. 5 **Recorder:** A. Dowd **Day/Date:** Tues 28/03/17

Purpose 8th Mino

Locality: (inc. distance/direction to nearest town) Julia Ck

GPS coordinates: Zone 54 E 494995 7713669 **Datum:** GDA'94

W397
646
647

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E			
T1			
T2			
T3			
S1			
S2			
G	0.1	0 - 0.3	VS

Structural formation: (including height) Grassland

Ecologically dominant layer: G

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – codominant; ***a*** – associated; ***s*** – suppressed.

Str.	Rel. dom.	Scientific Name
G	d	646 Enneapogon avenaceus

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils: Pale non-cracking brown clay with Sandstone gravel surface

Field observation and notes:

Landzone: 9

RE code changes

Existing RE code: 4.9.2

Proposed RE code: 4.9.2

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - Site form **Regional ecosystem code**

Location

Site No. 6 **Recorder:** A. Denniel **Day/Date:** Tues 28/06/17

Purpose St Alma EPRI

Locality: (inc. distance/direction to nearest town) Jerkin Creek

GPS coordinates: Zone 54 | 0539125 | 7714696 **Datum:** GDA '94

W398

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E	8	6 - 9	VS
T1			
T2			
T3			
S1	4	1 - 6	MD
S2	0.7	0.3 - 1	S
G	0.6	0 - 1	MD

Structural formation: (including height) Open Woodland ?

Ecologically dominant layer: E/S ?

Plant species

Record relative (numerical) dominance for each stratum;
d – dominant; ***c*** – codominant; ***a*** – associated; ***s*** – suppressed.

Str.	Rel. dom.	Scientific Name
E	d	Eucalyptus coolabah
S_1	d	Acacia farnesiana
S_2	d	Acacia farnesiana
G	a	Senna planticola
G	d	Panicum decompositum
G	a	Salsola sp.
G	a	Dactyloctenium radulans
G	a	Chloris virgata

a Isolated

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils:

Field observation and notes:

Landzone: 3

RE code changes

Existing RE code: 4.3.15 / 4.3.46

Proposed RE code: 4.3.46

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - Site form **Regional ecosystem code**

Location

Site No. 7 **Recorder:** A. Daniel **Day/Date:** Tue 28/08/17

Purpose St Mary ERM

Locality: (inc. distance/direction to nearest town) Julia Creek

GPS coordinates: Zone 54 0393967 7714871 **Datum:** GDA 94

653
654

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E	3	1 – 4	VS
T1			
T2			
T3			
S1			
S2			
G	001	0 – 0.2	MD

Structural formation: (including height) Grassland

Ecologically dominant layer: G

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – codominant; ***a*** – associated; ***s*** – suppressed.

Str.	Rel. dom.	Scientific Name
E	d	Acacia farnesiana
d	d	Salsola sp.

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils: deep cracking clay.

Field observation and notes:

Landzone: 3

RE code changes

Existing RE code: 4.3.19

Proposed RE code: 4.3.19

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - Site form Regional ecosystem code

Location

Site No. 8 Recorder: A. Daniel Day/Date: Tues 28/08/17

Purpose Stocking GPM

Locality: (inc. distance/direction to nearest town) Studio Cpk

GPS coordinates: Zone 54 0596996 7723752 Datum: GDA 94

W400
656
657

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E	3	1 - 5	S
T1			
T2			
T3			
S1			
S2			
G	0.2	0 - 0.3	MD

Structural formation: (including height) Grassland

Ecologically dominant layer: G

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – codominant; ***a*** – associated; ***s*** – suppressed.

Str.	Rel. dom.	Scientific Name
E	d	Acacia farnesiana
G	d	Aristida leptopoda
G	d	Eragrostis dampii

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils: light brown self mulching clay

Field observation and notes:

Landzone: 9

RE code changes

Existing RE code: 4.9.1c / 4.9.2b

Proposed RE code: 4.9.1c

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - Site form **Regional ecosystem code**

Location

Site No. 9 **Recorder:** A Danilka **Day/Date:** Tues 28/03/17

Purpose St Almo EPM

Locality: (inc. distance/direction to nearest town) Julia Crk

GPS coordinates: Zone 54 0595699 7722704 **Datum:** GDA 94

WA01

658
659

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E	1.5	0.5 – 3	VS
T1			
T2			
T3			
S1			
S2			
G	0.2	0 – 0.3	MD

Structural formation: (including height) Grassland

Ecologically dominant layer: G

Plant species

Record relative (numerical) dominance for each stratum;
d – dominant; ***c*** – codominant; ***a*** – associated; ***s*** – suppressed.

Str.	Rel. dom.	Scientific Name
E	d	Acacia farnesiana
G	d	Astrebla lappacea
G	a	Panicum decompositum

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils: light brown self-mulching clay

Field observation and notes:

Landzone: 9

RE code changes

Existing RE code: 4.9.1c

Proposed RE code: 4.9.1c

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - Site form **Regional ecosystem code**

Location

Site No. 11 **Recorder:** A Daniel **Day/Date:** Tues 28/03/17

Purpose 81st Area CPM

Locality: (inc. distance/direction to nearest town) Julia Ck

GPS coordinates: Zone 54 650302 7724013 **Datum:** GDA'94

402
661
660

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E	3	1 - 4	VS
T1			
T2			
T3			
S1			
S2			
G	0.2	0 - 0.3	MD

Structural formation: (including height) Grassland

Ecologically dominant layer: G

Plant species

Record relative (numerical) dominance for each stratum;
d – dominant; ***c*** – codominant; ***a*** – associated; ***s*** – suppressed.

Str.	Rel. dom.	Scientific Name
E	d	Acacia farnesiana
G	d	Astrebla lappacea

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils: light grey brown self-mulching clay

Field observation and notes:

Landzone: 9

RE code changes

Existing RE code: 4.9.1c / 4.9.2b

Proposed RE code: 4.9.1c

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - Site form **Regional ecosystem code**

Location

Site No. 11 **Recorder:** A. Daniel **Day/Date:** 29/08/17

Purpose St Arnaud ERM

Locality: (inc. distance/direction to nearest town) Yuleba Crk

GPS coordinates: Zone 54 0539619 7723221 **Datum:** GDA 94

WP03 662 663

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E			
T1			
T2			
T3			
S1			
S2			
G	0-1	0-0.2	S

Structural formation: (including height) Grassland

Ecologically dominant layer: G

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – codominant; ***a*** – associated; ***s*** – suppressed.

Str.	Rel. dom.	Scientific Name
G	d	Triodia longiceps

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils: Brown Self mulching cracking clay

Field observation and notes:

Landzone: 9

RE code changes

Existing RE code: 4.9.1c / 4.9.2b

Proposed RE code: 4.9.1c

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - Site form **Regional ecosystem code**

Location

Site No. 12 **Recorder:** E Daniel **Day/Date:** Wed 29/03/17

Purpose RE Mapping

Locality: (inc. distance/direction to nearest town) Julia Ck

GPS coordinates: Zone 54 0594136 7715391 **Datum:** GDA 94

404

664
665

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E	6	4 - 7	VS
T1			
T2			
T3			
S1			
S2			
G	0.2	0 - 0.3	MD

Structural formation: (including height) Grassland

Ecologically dominant layer: G

Plant species

Record relative (numerical) dominance for each stratum;
d – dominant; ***c*** – codominant; ***a*** – associated; ***s*** – suppressed.

Str.	Rel. dom.	Scientific Name
E	d	Alectryon oleifolius
E	a	Denhamia oleaefolius
G	a	Chrysopogon fallax S
G	c	Eriachne avenacea
G	c	Sclerolaena sp.
G	a	Dichanthium sericeum
G	a	Enneapogon polyphyllus

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils: Pale loam pan with gravel surface

Field observation and notes:

Landzone: 4

RE code changes

Existing RE code: 4.9.1c

Proposed RE code: 4.9.1c

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - Site form Regional ecosystem code

Location

Site No. 13 Recorder: A Daniel Day/Date: Wed 29/03/17

Purpose St Arno ERM

Locality: (inc. distance/direction to nearest town) Julia Ck

GPS coordinates: Zone 54 059037 7715123 Datum: GDA'94

404
666
669

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E	4	2-5	15
T1			
T2			
T3			
S1			
S2			
G	0.1	0 - 0.2	MD

Structural formation: (including height) Grassland

Ecologically dominant layer: G

Plant species

Record relative (numerical) dominance for each stratum;
d – dominant; *c* – codominant; *a* – associated; *s* – suppressed.

Str.	Rel. dom.	Scientific Name
E	d	Acacia farnesiana
G	d	Salsola sp

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils: Pale hard pan

Field observation and notes:

Landzone: 9

RE code changes

Existing RE code: 4.9.26

Proposed RE code: 4.9.26

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - Site form **Regional ecosystem code**

Location

Site No. 14 **Recorder:** A Dwind **Day/Date:** Wed 29/03/17

Purpose St Helens EPM

Locality: (inc. distance/direction to nearest town) Yulga Crk.

GPS coordinates: Zone 54 0593973 7717930 **Datum:** GDA94

W405

Vegetation structure

Median height of the EDL is to be measured 670 668 669

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E	1	0.5 – 2	VS
T1			
T2			
T3			
S1			
S2			
G	0.1	0 – 0.2	MD

Structural formation: (including height) Grassland

Ecologically dominant layer: G

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – codominant; ***a*** – associated; ***s*** – suppressed.

Str.	Rel. dom.	Scientific Name
E	d	Acacia farnesiana
G	c	Salsola sp.
G	c	Astrebla lappacea

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils: disturbed with flakes of sandstone

Field observation and notes:

Landzone: 9

RE code changes

Existing RE code: 4.9.26

Proposed RE code: non-remnant Cleared

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - Site form **Regional ecosystem code**

Location

Site No. 15 Recorder: A Dannock Day/Date: Wed 29/03/17

Purpose St Almo EPM

Locality: (inc. distance/direction to nearest town) Julia Crk

GPS coordinates: Zone 54 0593676 7719293 Datum: GDA 94

WQ406
671
672

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E	1	0.5 – 2	VS
T1			
T2			
T3			
S1			
S2			
G	0.1	0 - 0.3	MD

Structural formation: (including height) Grassland

Ecologically dominant layer: G

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – codominant; ***a*** – associated; ***s*** – suppressed.

Str.	Rel. dom.	Scientific Name
E	d	Acacia farnesiana
G	d	Salsola sp.

note: V. little Astrebla.

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils: limestone present on surface

Field observation and notes:

Landzone: 9

RE code changes

Existing RE code: 4.9.1c ~~4.12.5~~

Proposed RE code: 4.9.2b

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - **Site form** **Regional ecosystem code**

Location

Site No. 16 Recorder: A Daniel Day/Date: WED 29/03/17

Purpose St Alma EPM

Locality: (inc. distance/direction to nearest town) Julia Crk.

GPS coordinates: Zone 54 0594157 7720160 Datum: GDA'94

407
673
674

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E	2.5	1 - 4	VS
T1			
T2			
T3			
S1			
S2			
G	0.2	6 - 0.4	MD

Structural formation: (including height) Grassland

Ecologically dominant layer: G

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – codominant; ***a*** – associated; ***s*** – suppressed.

Str.	Rel. dom.	Scientific Name
E	d	Acacia farnesiana
G	d	Salsola sp.
G	s	Astrebla lappacea

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils: brown self-mulching cracking clay

Field observation and notes:

Landzone: 9

RE code changes

Existing RE code: 4.9.1c

Proposed RE code: 4.9.1c

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - Site form **Regional ecosystem code**

Location

Site No. 17 **Recorder:** A Daniel **Day/Date:** Wed 29/03/16

Purpose St Alma EPM

Locality: (inc. distance/direction to nearest town) Julia Ck

GPS coordinates: Zone 54 0595656 7715952 **Datum** GDA'94

408
675
676

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E	3	1 - 5	VS
T1			
T2			
T3			
S1			
S2			
G		- 0.3	MD

Structural formation: (including height) Grassland

Ecologically dominant layer: G

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – codominant; ***a*** – associated; ***s*** – suppressed.

Str.	Rel. dom.	Scientific Name
E	d	Acacia farnesiana
G	d	Astrebla lappacea
G	a	Walthenia indica
G	a	Indigofera linifolia
G	a	Salsola sp.

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils: Dale brown cracking clay

Field observation and notes:

Landzone: 9

RE code changes

Existing RE code: 4.9.1c

Proposed RE code: 4.9.1c

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - Site form **Regional ecosystem code**

Location

Site No. 18 **Recorder:** A. Daniel **Day/Date:** Wed 29/03/17

Purpose St Amo EPM

Locality: (inc. distance/direction to nearest town) Julia Ck

GPS coordinates: Zone 54 0597117 7715996 **Datum:** GDA 94

409
677
678

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E	3	1 - 5	VS
T1			
T2			
T3			
S1			
S2			
G	0.3	0.0 - 0.4	MD

Structural formation: (including height) Grassland

Ecologically dominant layer: G

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – codominant; ***a*** – associated; ***s*** – suppressed.

Str.	Rel. dom.	Scientific Name
E	d	Acacia farnesiana
G	c	Astrebla lappacea
G	c	Astrebla squarrosa
G	c	Salsola sp.

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils:

Field observation and notes:

Landzone: 9

RE code changes

Existing RE code: 4.9.1c

Proposed RE code: 4.9.1c

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - Site form **Regional ecosystem code**

Location

Site No. 19 **Recorder:** A. Dam **Day/Date:** Wed 29th 03/17

Purpose St Alwo EPM

Locality: (inc. distance/direction to nearest town) Julia Crk

GPS coordinates: Zone 54 0539698 7759888 **Datum:** GDA94

410
679

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E	3	1 - 4	VS
T1			
T2			
T3			
S1			
S2			
G	0.2	0 - 0.4	MD

Structural formation: (including height) Grassland

Ecologically dominant layer: G

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – codominant; ***a*** – associated; ***s*** – suppressed.

Str.	Rel. dom.	Scientific Name
E	d	Acacia farnesiana
G	c	Astrebla pappaea
G	c	Salsola sp.

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils: light brown cracking clay

Field observation and notes:

Landzone: 9

RE code changes

Existing RE code: 4.9.1c

Proposed RE code: 4.9.1c

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - Site form **Regional ecosystem code**

Location

Site No. 20 **Recorder:** A. Dunnes **Day/Date:** Thurs 30/03/17

Purpose 5th Alma ESM

Locality: (inc. distance/direction to nearest town) Julia Ck.

GPS coordinates: Zone 54 059134 9 7723175 **Datum:** GDA 94

411 9:28

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E	2	1 – 4	VS
T1			
T2			
T3			
S1			
S2			
G	0.2	0.03	MD

Structural formation: (including height) Grassland

Ecologically dominant layer: G

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – codominant; ***a*** – associated; ***s*** – suppressed.

Str.	Rel. dom.	Scientific Name
E	d	Atalaya hemiglauca
E	a	Acacia farnesiana
G	d	Astrebla lappacea
G	a	Eulalopogon
G	a	Panicum decompositum

Gibbsiave

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils: Pale brown cracking clay

Field observation and notes:

Landzone: 9

RE code changes

Existing RE code: 4.9.26

Proposed RE code: 4.9.26

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - Site form **Regional ecosystem code**

Location

Site No. 21 Recorder: A Daniel Day/Date: Thurs 30/03/17

Purpose St Amo EPM

Locality: (inc. distance/direction to nearest town) Julia Crk

GPS coordinates: Zone 54 0592030 7723775 Datum: GDA94

412

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E	5	3 - 6	VS
T1	1.5	0.5 - 3	S
T2			
T3			
S1			
S2			
G	0.1	0 - 0.2	MD

Structural formation: (including height) Grassland

Ecologically dominant layer: G

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – codominant; ***a*** – associated; ***s*** – suppressed.

Str.	Rel. dom.	Scientific Name
E	d	Alectryon oleifolius
T1	d	Acacia farnesiana
G	d	Astrebla sp (Small)

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils: Pale cracking clay, rock fragments present

Field observation and notes:

Landzone: 9

RE code changes

Existing RE code: 4.9.26

Proposed RE code: 4.9.25

END

Request for Assessment of Regional Ecosystem Map - DRAFT

SHEET F - Site form **Regional ecosystem code**

Location

Site No. 22 Recorder: A. Daniel Day/Date: Thurs 30/03/17

Purpose St Alma EPM

Locality: (inc. distance/direction to nearest town) Julia Ck.

GPS coordinates: Zone 54 0594980 7725777 Datum: GDA 94

413 9:47

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median Height	Height interval	Est. cover density (D,M,S,V)
E	3	1 - 4	MD
T1			
T2			
T3			
S1			
S2			
G	0.1	0 - 0.2	S

Structural formation: (including height) Tall Woodland

Ecologically dominant layer: T1

Plant species

Record relative (numerical) dominance for each stratum;
d – dominant; ***c*** – codominant; ***a*** – associated; ***s*** – suppressed.

Str.	Rel. dom.	Scientific Name
T1	d	Acacia farnesiana
G	c	Iseilema sp.
G	c	Astrebla sp.

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils:

Field observation and notes:

Landzone: 3?

RE code changes

Existing RE code: 4.9.1c

Proposed RE code: 4.9.1c

END

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No. 1 **Recorder:** A Daniel **Day/Date:** THURS 27/07/17

Purpose St Elmo

Locality: (inc. distance/direction to nearest town) Julia Crk

GPS: 54 6596361 7720135 GDA 94

W526 1682 1681

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	6	4 - 8	S
T2		-	
T3		-	
S1		-	
S2		-	
G		-	

Structural formation: (including height) low woodland

Ecologically dominant layer: T1

Plant species

Record relative (numerical) dominance for each stratum;
d – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
T1	d	Acacia nilotica
G	a	Salsola kali
G	d	Astrebla spp.

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils:

Field observation and notes: Brown self-mulching clay

Landzone: 3?

RE code changes

Existing RE code:

Proposed RE code:

END

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No. 2 **Recorder:** A. Daniel **Day/Date:** Thurs 27/07/17

Purpose

Locality: (inc. distance/direction to nearest town) Julia Ck

GPS: 54 0594896 7726713 QDA'94

1683
1684

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	8	4 - 10	S
T2		-	
T3		-	
S1		-	
S2		-	
G		-	

Structural formation: (including height) Woodland

Ecologically dominant layer: T1

Plant species

Record relative (numerical) dominance for each stratum; ***d*** – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
T1	d	Acacia nilotica
G	d	Bare ground

Geology, landform, soils

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils: Brown self-mulching clay

Field observation and notes:

Landzone: 3

RE code changes

Existing RE code:

Proposed RE code: non-remnant

END

A 3.3 Sheet D – Regional Ecosystem type assessment site

Location

Site No. 3 **Recorder:** A Daniel **Day/Date:** Thurs 27/07/17

Purpose & Flora. Julia etc

Locality: (inc. distance/direction to nearest town)

GPS: 54 | 0593039 | 7719671 | D 194

1685
1686

Vegetation structure

Median height of the EDL is to be measured

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	6	4 - 8	S
T2	3	1 - 4	S
T3		-	
S1		-	
S2		-	
G		-	

Structural formation: (including height) Woodland

Ecologically dominant layer: T1

Plant species

Record relative (numerical) dominance for each stratum;
d – dominant; ***c*** – co-dominant; **s** - subdominant, ***a*** – associated.

Str.	Rel. dom.	Scientific Name
T1	d	Eucalyptus coolabah
T2	d	Acacia oliticq
G	d	Salsola sp.

Geology, landform, soils

1687 1688

Geology map/scale/year:

Geology code and rock types:

Land system:

Landform:

Soils: ~~Soft~~ Sandy clay

Field observation and notes:

Landzone: 3

RE code changes

Existing RE code:

Proposed RE code:

END Rem

Non-rem East