

Broad-scale Ecological Assessment Report

Maisey West Gas Field PL 1020, PL 1021 and PL 315

Compiled by BOOBOOK for Santos



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A	31/08/2018	Draft issued to client for review	R. Johnson, R. Aisthorpe, L. Hardwick	C. Eddie	C. Eddie
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List of Abbreviations

DEHP	Department of Environment and Heritage Protection (State)
DES	Department of Environment and Science (State)
DNRME	Department of Natural Resources, Mines and Energy (State)
DoEE	Department of the Environment and Energy (Commonwealth)
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (Commonwealth)
E	Endangered
EH	Essential Habitat
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
ERE	Endangered Regional Ecosystems
EVNT	Endangered, Vulnerable and Near Threatened
GPS	Global Positioning System
ha	hectare (s)
HMAT	Habitat Modelling and Assessment Tool (Santos)
km	Kilometre (s)
LC	Least Concern
m	metre (s)
NC Act	<i>Nature Conservation Act 1992</i>
NCAP	No Concern At Present
OC	Of Concern
PMST	Protected Matters Search Tool
RE	Regional Ecosystem (s)
REDD	Regional Ecosystem Description Database
SEVT	Semi-evergreen vine thicket
TEC	Threatened Ecological Community (ies)
TSSC	Threatened Species Scientific Committee

Conclusions drawn in this report are based on available information at the time of writing. Any additional information may alter such conclusions and the author reserves the right to do so if such information becomes available. This report has been made as at the date of the report and is not to be used after six (6) months and not if there are any material changes meanwhile. In either event it should be referred back for review. To the extent permitted by law BOOBOOK does not accept liability for any loss or damage which any person may suffer arising from any negligence or breach of contract on its part. This report was prepared for the benefit of the party to whom it is directed only and for the purpose identified within. BOOBOOK does not accept responsibility to any other person for the contents of the report.

1. Introduction

1.1. Purpose and Scope

Santos (the Client) required the following services in relation to identifying ecological values of vegetation in the Maisey West Gas Field (parts of PL 1020, PL 1021 and PL 315) and hereafter referred to as 'the Site', located north of Wallumbilla in south central Queensland:

- ✦ Regional Ecosystem (RE) mapping using the functional RE condition thresholds;
- ✦ Quantification of Threatened Ecological Communities (TEC);
- ✦ Fauna general habitat mapping and assessment for Client-identified species (*Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed threatened fauna and *Nature Conservation Act 1992* (NC Act) listed Endangered and Vulnerable fauna), including fauna habitat values assessments using the Habitat Modelling and Assessment Tool (HMAT: Santos 2016);
- ✦ EPBC Act and NC Act listed Endangered, Vulnerable and Near Threatened (EVNT) flora general habitat mapping and assessment;
- ✦ Searches for the presence of EPBC Act or NC Act EVNT flora, including review of flora survey trigger maps; and
- ✦ Incidental EVNT fauna observations.

The vegetation requiring assessment and mapping was within the entirety of the tenement however ground-truthing of vegetation was only possible for a series of lot/plans for which land access was available.

1.2. Survey Team

Field surveys of the Site were conducted by Craig Eddie (Principal Ecologist), Richard Johnson (Senior Ecologist), Rose Aisthorpe (Botanist) and Lynda Hardwick (Field Technician) in the period 25th June –25th July 2018.

The project supervisor (Craig Eddie) was approved by the Department of the Environment and Energy (DoEE), formerly the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC), in writing on the 28th of January 2011 for the purpose of undertaking ecological assessment works for the Gladstone Liquefied Natural Gas (GLNG) project. All aspects of the project including field survey and reporting were conducted under the supervision of Craig Eddie.

2. Methodology

2.1. Desktop Assessment

A desktop assessment was conducted to inform the field survey. Sources of information utilised during the desktop assessment included the following:

- ✦ Remnant RE (DES 2018a) and mature regrowth (DEHP 2012) mapping – biodiversity status;
- ✦ Essential Habitat (EH) (DNRME 2018) mapping;
- ✦ EPBC Act Protected Matters Search Tool (PMST: DoEE 2018);
- ✦ Wildlife Online fauna and flora records (DES 2018d);
- ✦ Atlas of Living Australia species records and information (ALA 2018);
- ✦ Protected Plants Flora Survey Trigger Map (DES 2018b); and
- ✦ Previous ecological assessment reports and associated mapping (BOOBOOK 2013a; 2013b; 2014a; 2014b; 2014c; 2014d; 2014e; 2014f; 2014g; 2014h; 2014i; 2014j; 2017a; 2017b).

Survey site and vegetation ground-truthing data collected for the eastern adjoining Maisey tenement (BOOBOOK 2017a) was amalgamated and/or updated to ensure consistency where these two survey areas overlapped.

2.2. Field Survey and Assessment

In-field verification of desktop findings and additional findings of significance were undertaken in general accordance with the following:

- ✦ *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland* (Neldner *et al.* 2017);
- ✦ *Santos Methodology for Conducting Ecological Assessments – GLNG Areas Rev 4.1* (Santos 2014); and
- ✦ *Santos Functional Thresholds for Assessing Regional Ecosystem Functionality* (Santos 2015).

Methodologies that were employed for each element of the field survey are further described in the following sections.

Six privately-owned properties were visited to examine areas of remnant and regrowth vegetation. These are listed as follows, including the date of the visit:

- ✦ 542WV451, 25th June 2018
- ✦ 2RP129705, 26th June 2018
- ✦ 469WAL53530 & 62WV421, 5th July 2018
- ✦ 134WV415 & 135WV1678, 18th July 2018

Additional areas were also assessed in road reserves throughout the Site and, to the extent that it was practicable, on properties for which access was not available but views of vegetation could be gained from adjacent properties or roadsides. For some vegetation only assessable from a distance, visual inspection was conducted using binoculars. Representative photographs of these areas were used as a guide in post-field delineation of map polygon boundaries. Areas of vegetation that were neither accessible nor visible from a distance were assessed by aerial photography interpretation and aligning this to similar vegetation types ground-truthed within the Site.

The Site, including pre-defined Santos areas of interest and properties accessed within the area, is mapped at Appendix A.

2.2.1. RE and TEC Assessment

Ground-truthing (and confidence level scoring) of the DSITI regional ecosystem (RE) designation was undertaken using the quaternary level of data collection as described by Neldner *et al.* (2017).

Assessments were undertaken within 50 m x 10 m plots (as appropriate) for the purpose of typifying the vegetation community under assessment. The number of vegetation community assessments undertaken at each property depended on the diversity of vegetation communities present at each. Plots were chosen within representative areas of each vegetation type encountered. Locations of quaternary assessment sites are mapped in Appendix A.

Vegetation community polygons were verified in accordance with Queensland RE description and biodiversity status as per the Regional Ecosystem Description Database (REDD) (DES 2018c) and classified as remnant RE, vegetation consistent with RE or non-remnant vegetation (Santos 2014a). For each area of potential TEC an assessment of vegetation survey data was made against TEC threshold criteria (TSSC 2001, 2008, 2013).

Vegetation community data was captured in the field and entered into Santos-specific data fields within spatial databases via Motion tablet devices. Representative photographs were taken via a Canon digital camera at each vegetation survey site and at vegetation patches as supporting evidence of the identity of the subject vegetation community where full documentation was not required. Capture and delineation of RE and TEC boundaries was undertaken using a combination of mobile GIS devices, GPS and/or delineation from imagery. A minimum mappable width of 30 m for linear vegetation corridors (e.g. road corridors and shade lines) was applied. Patches were mapped to their full extent within the Site within practical limits (including land access constraints).

For identified regrowth (i.e. vegetation floristically equivalent to an RE but not meeting structural thresholds of remnant RE) an ecosystem functionality assessment was conducted. This assessed selected vegetation characteristics against the parameters described in Santos (2015).

Plant names used within this document conform to those given in Bostock and Holland (2017).

2.2.2. Threatened Species Habitat Assessment and Mapping

Habitat assessment and mapping was conducted for a number of conservation-listed fauna and flora species nominated by the Client. These species are described below:

- | | |
|---|--|
| ✱ <i>Chalinolobus dwyeri</i> (Large-eared Pied Bat, Large Pied Bat); | ✱ <i>Denisonia maculata</i> (Ornamental Snake); |
| ✱ <i>Dasyurus hallucatus</i> (Northern Quoll); | ✱ <i>Egernia rugosa</i> (Yakka Skink); |
| ✱ <i>Nyctophilus corbeni</i> (South-eastern Long-eared Bat, Corben's Long-eared Bat); | ✱ <i>Elseya albagula</i> (White-throated Snapping Turtle); |
| ✱ <i>Ornithorhynchus anatinus</i> (Platypus); | ✱ <i>Furina dunmalli</i> (Dunmall's Snake); |
| ✱ <i>Petauroides volans</i> (Greater Glider); | ✱ <i>Hemiaspis damelii</i> (Grey Snake); |
| ✱ <i>Phascolarctos cinereus</i> (Koala); | ✱ <i>Rheodytes leukops</i> (Fitzroy River Turtle); |
| ✱ <i>Tachyglossus aculeatus</i> (Short-beaked Echidna); | ✱ <i>Strophurus taenicauda</i> (Golden-tailed Gecko); |
| ✱ <i>Calidris ferruginea</i> (Curlew Sandpiper); | ✱ <i>Maccullochella peelii</i> (Murray Cod); |
| ✱ <i>Calyptorhynchus lathami</i> (Glossy Black-Cockatoo); | ✱ <i>Jalmenus eubulus</i> (Pale Imperial Hairstreak); |
| ✱ <i>Erythrorhynchus radiatus</i> (Red Goshawk); | ✱ <i>Cadellia pentastylis</i> (Ooline); |
| ✱ <i>Geophaps scripta scripta</i> (Squatter Pigeon (Southern)); | ✱ <i>Dichanthium setosum</i> (A bluegrass); |
| ✱ <i>Grantiella picta</i> (Painted Honeyeater); | ✱ <i>Homopholis belsonii</i> (Belson's Panic); |
| ✱ <i>Rostratula australis</i> (Australian Painted Snipe); | ✱ <i>Picris barbarorum</i> (Hawkweed); |
| ✱ <i>Acanthophis antarcticus</i> (Common Death Adder); | ✱ <i>Rutidosis lanata</i> (Red-soil Woolly Wrinklewort); |
| ✱ <i>Aspidites ramsayi</i> (Woma); | ✱ <i>Solanum stenopterum</i> (Winged Nightshade); |
| ✱ <i>Delma torquata</i> (Collared Delma); | ✱ <i>Swainsona murrayana</i> (Slender Darling-pea); and |
| | ✱ <i>Tylophora linearis</i> (Slender Tylophora). |

Assessment was a two-stage process. Initially, the likelihood of presence of the species was assessed as a desktop procedure involving interrogation of the known distribution and habitat preferences of each species and comparison with known (desktop) or field-derived information for the Site (e.g. geographic location, soils and vegetation, known habitat associations). This procedure derived a 'shortlist' of species likely to be, or potentially, present within the Site.

For the fauna species, field-based microhabitat assessments were undertaken in conjunction with vegetation community surveys at each survey plot, or as required where significant variation in the type and abundance of habitat features occurred. These assessments quantified the presence of a range of microhabitat variables known to influence the presence or abundance of fauna, and included:

- hollow-bearing live trees, stags and logs;
- logs by size class;
- leaf and woody litter, stone/rock and grassy ground cover;
- rock outcrops, gilgais, termite mounds and burrows; and
- mistletoe and other potential food plants.

This information was incorporated into assessment of habitat suitability for the selected species. The findings of these assessments, with relevant floristic and structural data from vegetation assessments, were also incorporated into HMAT to assess habitat suitability for selected fauna species. The results of these assessments combined with ecologist knowledge, were used to develop GIS-based mapping of potential habitat for the identified species within the Site.

Note that HMAT assessment results for each assessment site are provided separately to this report.

2.2.3. Threatened Flora Survey

Targeted surveys for threat-listed flora were informed by the desktop search results and local experience. Searches for threat-listed flora under the EPBC and/or NC Act were carried out at vegetation assessment sites and in random meanders in targeted habitat types, including remnant and non-remnant vegetation.

If detected, counts and extent of each population of threat-listed flora were made as well as structural characteristics and representative photographs taken. Data was recorded using the Santos-specific Notable Species - Flora Point or Region data capture layer.

2.2.4. Incidental Threatened Fauna Records

Any incidental records of threatened fauna obtained during vegetation assessments and general property traverses to and between sites (on foot and driving) were fully documented including species name, location (with site co-ordinates or area of extent), habitat and number detected.

2.2.5. Survey Limitations

Due to land access constraints within the Site many vegetation polygons identified within this report have not been ground-truthed. Vegetation mapping accuracy was dependent on the ability to examine areas in the field, reliability of imagery interpretation and the degree of heterogeneity within given vegetation polygons (i.e. diversity of RE present) (Neldner *et al.* 2017). Individual mapped vegetation polygons have been assigned a confidence level (high, moderate, low) for both boundary accuracy and vegetation attributes within the polygon. Within the spatial database confidence ratings are designated as 'A' for high, 'B' for moderate and 'C' for low. The following schema was applied to vegetation polygons:

Table 1: Boundary accuracy confidence ratings applied to mapped polygons.

Boundary Accuracy			
Confidence	Range of Accuracy	Homogenous Patches	Heterogeneous Patches
High (A)	<1 - <10 m	Ground-truthed on site, or viewed at a distance	Ground-truthed on site
Moderate (B)	>10 - <50 m	Not ground-truthed (image interpretation only)	Portion ground-truthed on site
Low (C)	>50 - >200 m	nil	No ground truthing: vegetation viewed at a distance or image interpretation only

Table 2: Vegetation attribute confidence ratings applied to mapped polygons.

Vegetation Attributes		
Confidence	Homogenous Patches	Heterogeneous Patches
High (A)	Ground-truthed on site	Ground-truthed on site
Moderate (B)	No ground truthing: vegetation viewed at a distance	Portion ground-truthed on site
Low (C)	Image interpretation only	Viewed at a distance or image interpretation only

In some instances vegetation communities could not be readily assigned to an RE, even when ground-truthed, as their floristics and structure reflected historical disturbance patterns such as clearing, thinning and fire history. In these cases RE have been allocated on the basis of 'best fit' with current RE descriptions.

For areas of vegetation for which land access was not possible microhabitat assessments were not performed as the presence and abundance of microhabitat features could not be assessed. As a result predictive flora and fauna habitat mapping for these areas was given a low confidence level. A conservative approach has been taken with

regard to mapping of species habitat where no ground-truthing has been undertaken. That is, where patches have not been ground-truthed, relevant fauna and flora habitat features were assumed to be present and patches have been mapped as habitat until further assessments can be undertaken.

Threatened fauna searches were confined to incidental observations only (i.e. no trapping or targeted search techniques were employed). Additional survey effort would be required to provide a more comprehensive inventory of threatened fauna species present at the Site. Generally cool conditions prevailing during the survey were considered to have greatly reduced reptile activity and detectability.

Timing (season) and duration of the survey period during winter and following some rainfall was generally favourable for identification of woody plants. However, summer-growing grasses and forbs were senescent and it is possible that some herbaceous threatened flora species (e.g. *Picris barbarorum*, *Homopholis belsonii*) potentially present in these locations were not detectable.

3. Results & Discussion

3.1. Vegetation Mapping

3.1.1. Desktop RE Mapping

Mapped remnant RE (DSITI 2017a) and mature regrowth (DEHP 2012) is shown in Appendix B.

3.1.2. Revised RE Mapping

Ground-truthing, inspection at a distance and examination of aerial imagery identified 11 remnant and four regrowth RE types within the Site. Mapping of remnant and regrowth RE based on desktop interpretation and field analysis is presented in Appendix C. The extent (total area) of each mapped remnant and regrowth RE is summarised in Table 3. In total, approximately 724.06 ha of vegetation (remnant and regrowth) was mapped within the Site, which covers an area of approximately 5684 ha.

Table 3: Summary of extent of individual mapped REs from ground-truthing and imagery analysis within the Survey Area.

RE Code	VM Act Class	Biodiversity Status	Short Description (DES 2018c)	Extent – remnant (ha)	Extent – regrowth (ha)
11.3.2	OC	OC	<i>Eucalyptus populnea</i> woodland on alluvial plains	21.71	Not detected
11.3.25	LC	OC	<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	13.43	Not detected
11.3.27	LC	OC	Freshwater wetlands	1.72	Not detected
11.7.2	LC	NCAP	<i>Acacia</i> spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone	54.17	11.26
11.7.2/11.7.6	LC/LC	NCAP/NCAP	<i>Acacia</i> spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone / <i>Corymbia citriodora</i> or <i>Eucalyptus crebra</i> woodland on Cainozoic lateritic duricrust	24.10	Not detected
11.7.4	LC	NCAP	<i>Eucalyptus decorticans</i> and/or <i>Eucalyptus</i> spp., <i>Corymbia</i> spp., <i>Acacia</i> spp., <i>Lysicarpus angustifolius</i> woodland on Cainozoic lateritic duricrust	4.71	Not detected
11.7.6	LC	NCAP	<i>Corymbia citriodora</i> or <i>Eucalyptus crebra</i> woodland on Cainozoic lateritic duricrust	156.72	63.00
11.9.4	OC	E	Semi-evergreen vine thicket or <i>Acacia harpophylla</i> with a semi-evergreen vine thicket understorey on fine-grained sedimentary rocks	Not detected	4.61
11.9.5	E	E	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on fine-grained sedimentary rocks	37.69	273.02
11.9.7	OC	OC	<i>Eucalyptus populnea</i> , <i>Eremophila mitchellii</i> shrubby woodland on fine-grained sedimentary rocks	2.05	Not detected

RE Code	VM Act Class	Biodiversity Status	Short Description (DES 2018c)	Extent – remnant (ha)	Extent – regrowth (ha)
11.9.10	OC	E	<i>Eucalyptus populnea</i> open forest with a secondary tree layer of <i>Acacia harpophylla</i> and sometimes <i>Casuarina cristata</i> on fine-grained sedimentary rocks	15.63	31.35
11.10.9	LC	NCAP	<i>Callitris glaucophylla</i> woodland on coarse-grained sedimentary rocks	5.96	Not detected
11.10.11	LC	NCAP	<i>Eucalyptus populnea</i> , <i>E. melanophloia</i> +/- <i>Callitris glaucophylla</i> woodland on coarse-grained sedimentary rocks	2.93	Not detected

E = Endangered; OC = Of Concern; LC = Least Concern; NCAP = No Concern at Present

3.1.3. TEC Assessment

The field survey confirmed the presence of two TEC, these being Brigalow (*Acacia harpophylla* dominant and co-dominant); and Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (SEVT).

For the purposes of this assessment all remnant and regrowth RE 11.9.5 (a listed component of the Brigalow TEC) were mapped as TEC (TSSC 2013) provided that Brigalow (*Acacia harpophylla*) was dominant in the canopy and that the vegetation otherwise met condition criteria (TSSC 2013). Note that for vegetation for which close examination was not possible, due to land access constraints, assessment of the condition criteria was limited. For patches potentially equivalent to Brigalow TEC, but for which no ground-truthing has been undertaken, a precautionary approach has been applied in that these patches are assumed to meet TEC condition criteria and are therefore mapped as TEC until further assessments can be undertaken. However, a low confidence level was applied to assignment of TEC status in these areas.

One patch of regrowth semi-evergreen vine thicket was identified during field survey. This was attributable to the SEVT TEC.

No Coolibah-Black Box Woodlands TEC or Weeping Myall Woodlands TEC was detected at the Site. Though Myall (*Acacia pendula*) was occasionally present, no accessible vegetation met all the criteria for the TEC (TSSC 2008).

The location and extent of TEC may not have been accurately identified in inaccessible areas.

The mapped extent of TEC at the Site is shown within Appendix D. Table 4 shows the extent (total area) of TEC mapped within the Site.

Table 4: Description and extent of TEC within the Survey Area.

TEC Description	RE Code	Extent of TEC (ha)
Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant)	11.9.5	265.93
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	11.9.4	4.61

3.2. Threatened Species

No threatened flora or fauna species were detected during the field survey. The following section provides discussion of predicted habitat and likelihood of occurrence of threatened flora and fauna at the Site.

3.2.1. Likelihood of Occurrence of Flora and Fauna of Conservation Concern at the Site

An assessment of the likelihood of occurrence of the Client-nominated EPBC Act and/or NC Act listed threatened flora and fauna and NC Act listed Special Least Concern fauna potentially occurring in the Site is summarised in Table 5.

Table 5: Assessment of threatened flora and fauna likelihood of occurrence at the Site.

Plant Family/ Animal Class	Scientific & Common Name	EPBC Act Status ⁱ	NC Act Status	Distribution and Known Habitat Use	Likelihood of Occurrence	Field Survey Results
Apocynaceae	<i>Tylophora linearis</i> Slender Tylophora	E	E	Found in drier open forests and woodlands of <i>Eucalyptus</i> , <i>Callitris</i> and <i>Allocasuarina</i> species (DoEE 2017b). It has been collected at numerous localities in NSW, principally on the western slopes of the Great Dividing Range from Temora to the Linton - Yetman area (ALA 2018). It is only known in Queensland from one specimen collected near Glenmorgan in 1960 (ALA 2018).	Unlikely to be present. Although potentially suitable habitat is present the Site is outside the known range of this species (ALA 2018).	Not recorded within the Site.
Asteraceae	<i>Picris barbarorum</i> A hawkweed	-	V	Known to occur in grassy woodlands (ALA 2018). A record (ALA 2018) exists in roadside vegetation near Roma: this vegetation is RE 11.9.7 and 11.9.10.	Potentially present. Although potentially suitable habitat is present this species is not currently known from the Site. A specimen record is known to occur 15 km southwest of the Site (ALA 2018).	Not recorded within the Site.
Asteraceae	<i>Rutidosia lanata</i> Red-soil Woolly Wrinklewort	-	V	Occurs along ecotones between dry sclerophyll woodland communities dominated by Brigalow (<i>Acacia harpophylla</i>), Gum-topped Box (<i>Eucalyptus woollsiana</i>), Narrow-leaved Red Ironbark (<i>Eucalyptus crebra</i>), Broad-leaved Ironbark (<i>E. fibrosa</i>) and Poplar Box (<i>E. populnea</i>) on clay, loam and sand (DES 2018e).	Unlikely to be present. Although potentially suitable habitat is present the Site is outside the known range of this species. Specimen record closest to the Site occurs 33 km to east-southeast (ALA 2018).	Not recorded within the Site.
Fabaceae	<i>Swainsona murrayana</i> Slender Darling-pea	V	V	This herbaceous species often grows in heavy soils, especially depressions, and is also found on grey and red to brown clay and clay-loam soils in Bladder Saltbush (<i>Atriplex vesicaria</i>) herbland, Black Box (<i>Eucalyptus largiflorens</i>) woodland and grassland communities and is frequently associated with <i>Maireana</i> species (DoEE 2017b). This species is known in Queensland from five specimens; one collected south of Surat in Brigalow Belt subregion 29 (Weribone High); and four from central western Queensland between Boulia, Birdsville and Longreach (ALA 2018).	Unlikely to be present. Although minor areas of potentially suitable habitat are present the Site is outside the known range of this species (ALA 2018).	Not recorded within the Site.
Poaceae	<i>Dichanthium setosum</i> A bluegrass	V	LC	Occurs in Queensland and north-eastern NSW (ALA 2018). In Queensland, it is patchily recorded from Toowoomba in the south to the upper Burdekin River catchment in the north. It grows on basaltic black clays and hard-setting red-brown loams (DoEE 2017b) in woodland or open grassy woodland dominated by Brigalow (<i>Acacia harpophylla</i>) and/or eucalypt species (DES 2018e). In Queensland and NSW it has also been found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture (DoEE 2017b).	Unlikely to be present. Although potentially suitable habitat is present this species is not currently known from the Site. Specimen records closest to the Site occur in Carnarvon NP and the Springsure / Emerald area (ALA 2018).	Not recorded within the Site.

Plant Family/ Animal Class	Scientific & Common Name	EPBC Act Status ⁱ	NC Act Status	Distribution and Known Habitat Use	Likelihood of Occurrence	Field Survey Results
Poaceae	<i>Homopholis belsonii</i> Belson's Panic	V	E	Occurs in northern NSW and the southern Brigalow Belt of Queensland (ALA 2018, DoEE 2017b). Within Queensland it principally occurs in Poplar Box (<i>Eucalyptus populnea</i>), Brigalow (<i>Acacia harpophylla</i>) and Belah (<i>Casuarina cristata</i>) dominated communities where it grows preferentially in shaded areas (DoEE 2017b).	Potentially present. Although potentially suitable habitat is present this species is not currently known from the Site. A specimen record is known to occur 15 km southwest of the Site (ALA 2018).	Not recorded within the Site.
Solanaceae	<i>Solanum stenopterum</i> Winged Nightshade	-	V	Inhabits grassland or woodlands of Belah (<i>Casuarina cristata</i>) and Poplar Box (<i>Eucalyptus populnea</i>) on black, brown or red clay loam soils. It also grows on loamy ridges, along roadsides and in paddocks. (Bean 2004).	Unlikely to be present. Although potentially suitable habitat is present the Site is outside the known range of this species. Specimen record closest to the Site occurs 33 km to east-southeast (ALA 2018).	Not recorded within the Site.
Surianaceae	<i>Cadellia pentastylis</i> Ooline	V	V	Occurs in northern NSW and southern Queensland (DoEE 2017b). Within Queensland it occurs patchily from near Rockhampton westward to near Blackall and southward to the State border (ALA 2018) where it occurs on undulating plains, valley slopes, hillsides and scarps, often in association with Brigalow and SEVT communities (DoEE 2017b, Santos 2012). Potentially suitable RE within the Site include 11.9.5.	Unlikely to be present. Although some areas of potentially suitable habitat are present this species, a large and conspicuous tree, is not currently known from the Site. Specimen records closest to the Site occur about 75 km east of the Site (ALA 2018).	Not recorded within the Site.
Birds	<i>Calidris ferruginea</i> Curlew Sandpiper	CE	SLC	A migratory species usually encountered on coastal and near-coastal saline and freshwater wetlands (Pizzey and Knight 1997). Passage migrants are occasionally present on inland wetlands, and the species is sparsely recorded across inland Queensland (ALA 2018).	Unlikely to be present. Suitable habitat (shallow vegetated or open wetlands with a muddy substrate) is very limited within the Site.	Not recorded within the Site.
	<i>Calyptorhynchus lathami</i> Glossy Black-Cockatoo	-	V	Dependent on the fruits of several species of <i>Casuarina</i> and <i>Allocasuarina</i> spp. and occurs in a variety of forest types (Pizzey and Knight 2010, Garnett <i>et al.</i> 2011). It will visit isolated trees and remnant patches where food trees are present (Holmes 2012). Nesting habitat is hollow-bearing live or dead trees (Higgins 1999).	Potentially present. Potentially suitable habitat with food plants including <i>Casuarina cristata</i> is present within the Site. Occurrence within the Site is likely to be on a transient basis.	Not recorded within the Site.
	<i>Erythroriorchis radiatus</i> Red Goshawk	V	V	A highly mobile species with a large home range; breeding habitat is in intact tall forest associated with major drainage lines, especially near permanent water bodies and where there is high avian prey diversity, but the species could potentially forage much further away from these areas (Marchant and Higgins 1993).	Unlikely to be present. Limited areas of riparian habitat with tall trees that could potentially support this species are present within the Site; however the Site is outside the species known range.	Not recorded within the Site.

Plant Family/ Animal Class	Scientific & Common Name	EPBC Act Status ¹	NC Act Status	Distribution and Known Habitat Use	Likelihood of Occurrence	Field Survey Results
	<i>Geophaps scripta scripta</i> Squatter Pigeon (southern subspecies)	V	V	Inhabits grassy woodlands with open areas for foraging habitat usually within proximity to a nearby water source (Higgins and Davies 1996).	Unlikely to be present. The species was formerly known from the broader Roma – Wallumbilla area but there are no recent records and the species appears to be locally absent (BOOBOOK 2015)	Not recorded within the Site.
	<i>Grantiella picta</i> Painted Honeyeater	V	V	Lives/breeds in woodlands and open forests with high densities of suitable food plants (i.e. mistletoes, family Loranthaceae) (Higgins, Peter and Steele 2001).	Potentially present. Habitats containing mistletoe including Brigalow and eucalypt woodlands are present within the Site.	Not recorded within the Site.
	<i>Rostratula australis</i> Australian Painted Snipe	E	V	Forages at shallow edges and adjacent vegetated margins of freshwater wetlands (DoEE 2017b) and is able to use both artificial and natural ephemeral and permanent wetlands (Marchant and Higgins 1993).	Potentially present. Potentially suitable habitat is present at farm dams at the Site.	Not recorded within the Site.
Fish	<i>Maccullochella peelii</i> Murray Cod	V	-	In Queensland naturally-occurring populations of this species are confined to permanent water in riverine environments in the Condamine, Maranoa-Balonne, Weir and Moonie River catchments (Lintermans 2007).	Unlikely to be present. No suitable riverine habitat exists within the Site.	Not recorded within the Site.
Mammals	<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	V	V	All known occurrences of this species are within or near forested landscapes with relatively high relief (DES 2018e). The species may be present in uplands with likely presence of appropriate geology (usually sandstone) providing essential habitat (caves, crevices, holes) and associated foraging habitat.	Unlikely to be present. Potentially suitable habitat (i.e. rock holes/crevices in rocky hills) is very limited within the Site and the Site is outside the known range of the species.	Not recorded within the Site.
	<i>Dasyurus hallucatus</i> Northern Quoll	E	LC	Formerly widespread in south-central Queensland this species has declined markedly and is now confined to rugged and remote areas throughout its distribution (Burnett 2012). Forested uplands with high relief and/or containing abundant rock outcrops may support the species.	Unlikely to be present. The Site is within the species' historical range and limited areas of potentially suitable den sites (i.e. rock holes/crevices) are present within the Site. However, no recent records exist within the Site, with nearest recent records being in the Carnarvon Range (ALA 2018).	Not recorded within the Site.
	<i>Nyctophilus corbeni</i> South-eastern Long-eared Bat	V	V	The distribution and habitat preferences of this species are very poorly known; it inhabits a range of dry forest types in south central Queensland (Reardon 2012).	Potentially present. Potentially suitable foraging and roosting habitat is present in remnant woodland within the Site.	Not recorded within the Site.
	<i>Ornithorhynchus anatinus</i> Platypus	-	SLC	Widespread species in eastern Australia but confined to permanent freshwater rivers and streams. It is patchily distributed in inland Queensland and is not recorded in the Roma-Wallumbilla area (ALA 2018).	Unlikely to be present. No suitable riverine habitat exists within the Site and the Site is outside the species' known range.	Not recorded within the Site.

Plant Family/ Animal Class	Scientific & Common Name	EPBC Act Status ¹	NC Act Status	Distribution and Known Habitat Use	Likelihood of Occurrence	Field Survey Results
	<i>Petauroides volans</i> Greater Glider	V	LC	Occurs in eucalypt woodlands and open forest particularly those with mature trees containing large hollows (TSSC 2016).	Potentially present. Potentially suitable habitat is present within the Site, which is within the known range of the species.	Not recorded within the Site.
	<i>Phascolarctos cinereus</i> Koala (combined populations of QLD, NSW and the ACT)	V	V	This species requires eucalypt woodland and forest habitat with suitable food trees (primarily <i>Eucalyptus</i> spp.) (DoEE 2017b). Woodlands containing food trees in riparian/alluvial areas are particularly favoured (Melzer et al. 2014). Potential food trees occurring within the Site include <i>Eucalyptus tereticornis</i> , <i>E. camaldulensis</i> , <i>E. populnea</i> , <i>E. melanophloia</i> , <i>E. orgadophila</i> , <i>E. woollsiana</i> and <i>E. crebra</i> .	Likely to be present. Suitable habitat is present within the Site. The species has been recorded within 10 km of the Site centroid (DES 2018d).	Not recorded within the Site.
	<i>Tachyglossus aculeatus</i> Short-beaked Echidna	-	SLC	A ubiquitous inhabitant of a wide variety of land forms and climatic regimes across Australia (Augee 2008) where it digs in soil and litter for ants, termites and their larvae and eggs. It is commonly found in cleared pastoral and farming lands.	Likely to be present. Suitable habitat is present within the Site. The Site is within the known range of the species.	Recorded within the Site at 3 assessment sites (Q07-MW, Q13-MW, Q18-MW).
Reptiles	<i>Acanthophis antarcticus</i> Common Death Adder	-	V	A widespread but patchily distributed snake (ALA 2018). Lives in woodlands, open forests and heathlands; requires abundant shelter/ambush predation cover e.g. low shrubs, rocks, logs, dense leaf litter (Wilson 2015).	Potentially present. Potentially suitable habitat with shelter sites (e.g. dense low shrubs, rocks) is present within parts of the Site.	Not recorded within the Site.
	<i>Aspidites ramsayi</i> Woma	-	NT	A snake recorded from a variety of woodland and shrubland habitats in sub-humid to arid Australia (Wilson and Swan 2008). It preys on reptiles and small mammals. There are several records in the Roma area, including one from near Wallumbilla, ca. 11 km from the Site (ALA 2018).	Potentially present. The Site is within the known range of the species and areas of potentially suitable habitat (rock crevices, log piles, animal burrows) are present or likely to be present within the Site.	Not recorded within the Site.
	<i>Delma torquata</i> Collared Delma	V	V	Occupies a range of eucalypt woodlands and open forests; lives under surface rock and large woody debris (Wilson 2015). The Site is within the species' known range with several records from locations north-west of Roma (ALA 2018).	Potentially present. Eucalypt woodland with potentially suitable shelter sites (e.g. small rocks, woody debris) is present within the Site.	Not recorded within the Site.
	<i>Denisonia maculata</i> Ornamental Snake	V	V	Occurs in lowlands associated with the Dawson and Fitzroy catchments (DoEE 2017b). Known southerly distribution limit is approximately Lake Nuga Nuga (ALA 2018). Lives in woodland and grassland with cracking clay soils, usually in close proximity to wet or seasonally wet areas e.g. billabongs, gilgais, floodplains, riparian corridors (DoEE 2017b).	Unlikely to be present. Habitat with preferred substrate (e.g. deep cracking clay, gilgais) is likely to be present at the Site but the Site is not within the known range of the species (ALA 2018).	Not recorded within the Site.

Plant Family/ Animal Class	Scientific & Common Name	EPBC Act Status ⁱ	NC Act Status	Distribution and Known Habitat Use	Likelihood of Occurrence	Field Survey Results
	<i>Egernia rugosa</i> Yakka Skink	V	V	Lives in a range of woodland and open forests dominated by <i>Eucalyptus</i> , <i>Acacia</i> and <i>Callitris</i> spp.; also grassland with regrowth trees (DoEE 2017b). Requires suitable soils for burrows or shelters in sinkholes, abandoned rabbit warrens or large fallen/piled woody material (Eddie 2012).	Likely to be present. Eucalypt woodland and non-remnant area with potentially suitable shelter sites (e.g. large logs, log piles) is present within the Site.	Not recorded within the Site.
	<i>Eseya albagula</i> White-throated Snapping Turtle	CE	E	Occurs in the Fitzroy and Dawson River catchments where it requires permanent water in riverine environments (Limpus <i>et al.</i> 2011).	Unlikely to be present. No suitable riverine habitat is present within the Site and the Site is not within the known range of the species.	Not recorded within the Site.
	<i>Furina dunmalli</i> Dunmall's Snake	V	V	Occupies woodlands and open forests; may be reliant on presence of abundant fallen woody debris (Hobson 2012a).	Potentially present. Potentially suitable foraging and shelter habitat is present in remnant and regrowth REs throughout the Site.	Not recorded within the Site.
	<i>Hemiaspis damelii</i> Grey Snake	-	E	Associated with usually ephemeral waterbodies in woodlands and open forests on heavy cracking clays, where it shelter in soil cracks (Hobson 2012b). It is also known to use cleared areas where suitable shelter and foraging habitat exists.	Potentially present. Potentially suitable foraging and shelter habitat is likely to be present within the Site, which is within the species' known range.	Not recorded within the Site.
	<i>Rheodytes leukops</i> Fitzroy River Turtle	V	V	The species is confined to the Fitzroy and Dawson River catchments where it requires permanent water in riverine environments (Limpus <i>et al.</i> 2011).	Unlikely to be present. No suitable riverine habitat is present within the Site and the Site is not within the known range of the species.	Not recorded within the Site.
	<i>Strophurus taenicauda</i> Golden-tailed Gecko	-	NT	Lives in dry open forest and woodlands, especially those with well-developed shrub layer where it shelters in tree hollows and splits, and under loose bark (QMDC 2008).	Likely to be present. Potentially suitable habitat with shelter sites (e.g. trees with loose bark) is present within parts of the Site.	Not recorded within the Site.
Insects	<i>Jalmenus eubulus</i> Pale Imperial Hairstreak	-	V	Usually associated with Brigalow (<i>Acacia harpophylla</i>) open forests and woodlands (Valentine and Johnson 2012).	Potentially present. Habitat with suitable food plants (e.g. <i>Acacia harpophylla</i>) is present within the Site.	Not recorded within the Site.

ⁱ CE = Critically Endangered; E = Endangered; V = Vulnerable; NT = Near Threatened; SLC = Special Least Concern; LC = Least Concern

3.2.2. Habitat Assessment and Predictive Habitat Mapping

Twenty-eight (28) microhabitat assessments were conducted for a selection of threatened species as listed at Section 2.2.2. The results of these assessments were then combined with ecologist knowledge to develop predictive habitat mapping for those species. Mapping rules and the estimated total availability of General Habitat within the survey area for the species is given in Table 6.

The suitability of areas of vegetation as fauna habitat is determined by the presence and abundance of microhabitat features relevant to the needs of individual species or groups of species (e.g. terrestrial reptiles, hollow-dependent arboreal mammals). In general, mature vegetation (remnant or advanced regrowth) is more likely to support appropriate levels of these microhabitat features, while their presence in younger regrowth and clearings is less likely. This is particularly the case where clearing for agriculture has involved the destruction of fallen timber and coarse woody debris, such that where young regrowth is present it lacks necessary microhabitat for ground-dwelling fauna.

Similarly, young trees are unlikely to contain hollows suitable for arboreal mammals such as the Greater Glider (*Petauroides volans*). These scenarios apply to almost all vegetation originally occurring within the Site. Though it is acknowledged that some areas of young regrowth and derived grassland (pasture) may contain suitable habitat for some species (e.g. log piles used by reptiles), due to access constraints it was not possible to adequately assess the majority of these areas.

Therefore for the purposes of this report, General Habitat is assumed to be present only in remnant and advanced regrowth vegetation. This is further restricted in the case of hollow-dependent arboreal mammals in it is assumed that only remnant vegetation would contain hollows of suitable size and number.

Where microhabitat assessments were conducted at sites with direct on-ground access a high degree of confidence can be assigned to predictive habitat mapping at that site. A similar level of confidence is applied to similar sites where more distant visual assessment of vegetation, and in some cases microhabitat features, was possible. For other areas of vegetation where access constraints prevented such an assessments, predictive habitat is mapped with a lower degree of confidence. Habitat maps for the selected species are shown at Appendix E.

Table 6: List of potentially suitable RE and estimated extent of General Habitat for nominated fauna and flora species potentially present at the Site.

Species name	Potentially Suitable REs	Mapped extent of General Habitat (ha)	Habitat Mapping Rules/Notes
<i>Nyctophilus corbeni</i> South-eastern Long-eared Bat	11.3.2, 11.3.25, 11.3.27, 11.7.2, 11.7.4, 11.7.6, 11.9.5, 11.9.7, 11.9.10, 11.10.9, 11.10.11	719.45	Mapped General Habitat includes all areas of remnant vegetation and advanced regrowth that may be suitable for foraging or shelter.
<i>Petauroides volans</i> Greater Glider	11.3.2, 11.3.25, 11.3.27, 11.7.4, 11.7.6, 11.9.7, 11.9.10, 11.10.9, 11.10.11	248.96	Mapped General Habitat includes all remnant vegetation dominated by Myrtaceae species. As the species is tree hollow-dependent, regrowth is excluded as habitat as hollows are likely to be absent or scarce.
<i>Phascolarctos cinereus</i> Koala	11.3.2, 11.3.25, 11.3.27, 11.7.4, 11.7.6, 11.9.7, 11.9.10, 11.10.9, 11.10.11	343.30	Mapped General Habitat includes all remnant and advanced regrowth of RE dominated by Myrtaceae species.
<i>Calyptorhynchus lathami</i> Glossy Black-Cockatoo	11.9.5, 11.9.10	357.69	Mapped General Habitat includes all areas of remnant vegetation and advanced regrowth that may be suitable for foraging i.e. communities containing <i>Allocasuarina</i> or <i>Casuarina</i> species.
<i>Grantiella picta</i> Painted Honeyeater	11.3.2, 11.3.25, 11.3.27, 11.7.2, 11.7.4, 11.7.6, 11.9.4, 11.9.5, 11.9.7, 11.9.10, 11.10.9, 11.10.11	724.06	Mapped General Habitat includes all areas of remnant vegetation and advanced regrowth that may be suitable for foraging i.e. eucalypt or acacia-dominated communities supporting (or potentially supporting) mistletoe populations.
<i>Rostratula australis</i> Australian Painted Snipe	11.3.2, 11.3.25, 11.3.27	36.86	Mapped General Habitat includes all remnant RE 11.3.2, 11.3.25 and 11.3.27. However, no mapping is available for preferred habitat within RE 11.3.2, 11.3.27 (off-stream shallow vegetated wetlands). The species is also likely to use the margins of farm dams.

Species name	Potentially Suitable REs	Mapped extent of General Habitat (ha)	Habitat Mapping Rules/Notes
<i>Acanthophis antarcticus</i> Common Death Adder	11.7.2, 11.7.4, 11.7.6, 11.9.4, 11.9.5	629.29	Mapped General Habitat includes all areas of remnant and advanced regrowth of the nominated RE. However, the species appears dependent on dense ground cover including grasses, low shrubs and woody debris: not all areas of nominated RE may be suitable.
<i>Aspidites ramsayi</i> Woma	11.3.2, 11.3.25, 11.7.2, 11.7.4, 11.7.6, 11.9.5, 11.9.7, 11.9.10, 11.10.9, 11.10.11	717.73	Mapped General Habitat includes all areas of remnant and advanced regrowth of the nominated RE.
<i>Delma torquata</i> Collared Delma	11.3.2, 11.3.25, 11.7.2, 11.7.4, 11.7.6, 11.9.5, 11.9.7, 11.9.10, 11.10.9, 11.10.11	717.73	Mapped General Habitat includes all areas of remnant and advanced regrowth of the nominated RE.
<i>Egernia rugosa</i> Yakka Skink	11.3.2, 11.7.2, 11.7.4, 11.7.6, 11.9.5, 11.9.7, 11.9.10, 11.10.9, 11.10.11	704.30	Mapped General Habitat includes all remnant vegetation and advanced regrowth of the nominated RE.
<i>Furina dunmalli</i> Dunmall's Snake	11.3.2, 11.3.25, 11.7.2, 11.7.4, 11.7.6, 11.9.4, 11.9.5, 11.9.7, 11.9.10, 11.10.9, 11.10.11	722.34	Mapped General Habitat includes all remnant vegetation and advanced regrowth of the nominated RE.
<i>Hemiaspis damelii</i> Grey Snake	11.3.2, 11.3.25, 11.3.27	36.86	Mapped General Habitat includes all areas of remnant and advanced regrowth of the nominated RE. The species is also likely to use ephemeral wetlands in gilgai areas and the margins of farm dams.
<i>Strophurus taenicauda</i> Golden-tailed Gecko	11.3.2, 11.3.25, 11.7.2, 11.7.4, 11.7.6, 11.9.5, 11.9.7, 11.9.10, 11.10.9, 11.10.11	717.73	Mapped General Habitat includes all areas of remnant and advanced regrowth of the nominated RE.
<i>Jalmenus eubulus</i> Pale Imperial Hairstreak	11.9.5, 11.9.10	357.69	Mapped General Habitat includes all areas of remnant and advanced regrowth of the nominated RE.
<i>Homopholis belsonii</i> Belson's Panic	11.3.2, 11.9.5, 11.9.7, 11.9.10	381.45	Mapped General Habitat includes all areas of remnant and advanced regrowth of the nominated RE.
<i>Picris barbarorum</i> Hawkweed	11.9.7, 11.9.10	49.03	Mapped General Habitat includes all areas of remnant and advanced regrowth of the nominated RE.

4. Conclusions

The desktop assessment and field survey identified the following potential ecological values and/or constraints within the Site:

- ✎ Approximately 265.93 ha of Brigalow (*Acacia harpophylla* dominant and dominant) TEC.
- ✎ Approximately 4.61 ha of SEVT TEC.
- ✎ Presence of 362.3 ha of Endangered RE.
- ✎ Presence of 38.91 ha of Of Concern RE.
- ✎ Indicative General Habitat mapping for the following threatened species:
 - *Nyctophilus corbeni* (South-eastern Long-eared Bat, Corben's Long-eared Bat) – 719.45 ha;
 - *Petauroides volans* (Greater Glider) – 248.96 ha;
 - *Phascolarctos cinereus* (Koala) – 343.3 ha;
 - *Calyptorhynchus lathami* (Glossy Black-Cockatoo) – 357.69 ha;
 - *Grantiella picta* (Painted Honeyeater) – 724.06 ha;

- *Rostratula australis* (Australian Painted Snipe) – 36.86 ha;
- *Acanthopis antarcticus* (Common Death Adder) – 629.29 ha;
- *Aspidites ramsayi* (Woma) – 717.73 ha;
- *Delma torquata* (Collared Delma) – 717.73 ha;
- *Egernia rugosa* (Yakka Skink) – 704.30 ha;
- *Furina dunmalli* (Dunmall's Snake) – 722.34 ha;
- *Hemiaspis damelii* (Grey Snake) – 36.86 ha;
- *Strophurus taenicauda* (Golden-tailed Gecko) – 717.73 ha;
- *Jalmenus eubulus* (Pale Imperial Hairstreak) – 357.69 ha;
- *Homopholis belsonii* (Belson's Panic) – 381.45 ha; and
- *Picris barbarorum* (Hawkweed) – 49.03 ha.

5. Recommendations

It is recommended that:

- ✎ All mapping within this report be used within its limitations. As detailed above land access constraints limited the ability to ground truth RE, TEC, ecological function and habitat values of all vegetation within the Site. Results should be viewed as indicative only until further assessments are undertaken.
- ✎ Pre-clearance surveys for threatened fauna microhabitat and threatened flora are conducted prior to any infrastructure development in vegetation within the Site.

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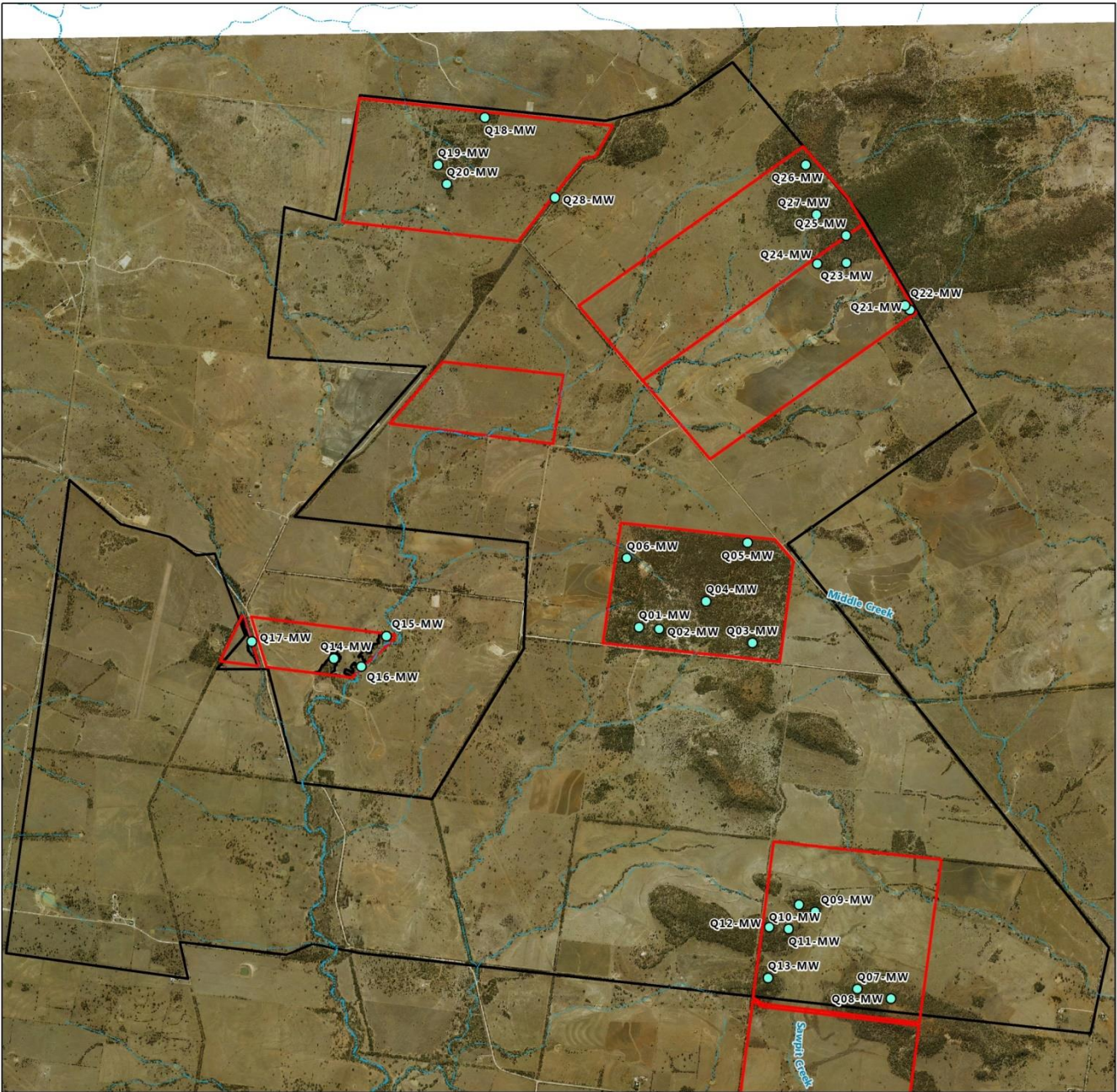
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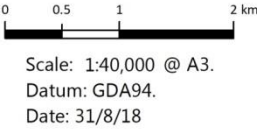
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Appendix A. Location of 'the Site' & Assessment Sites.

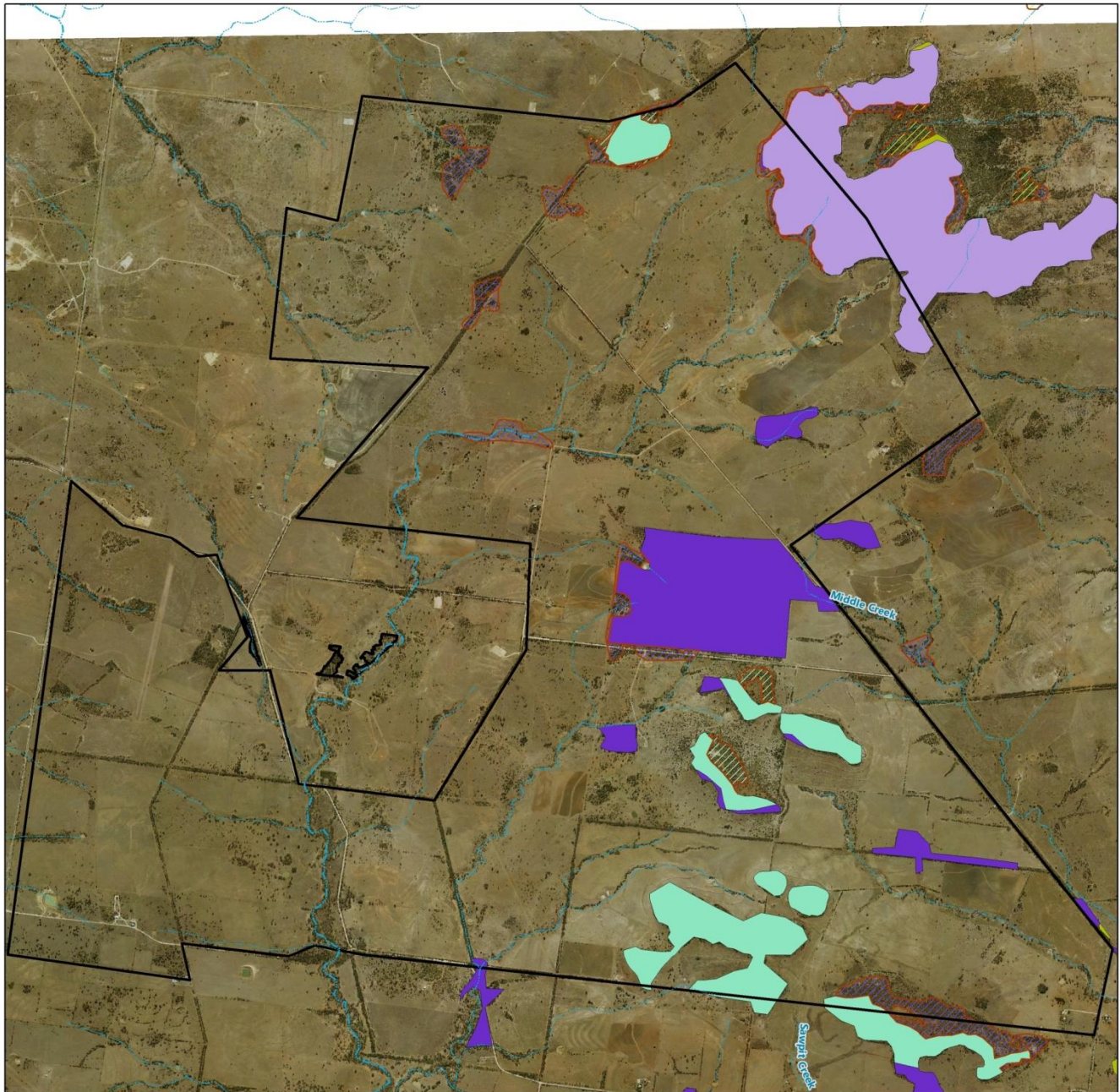


Appendix A: Location of 'the Site' & Assessment Sites.

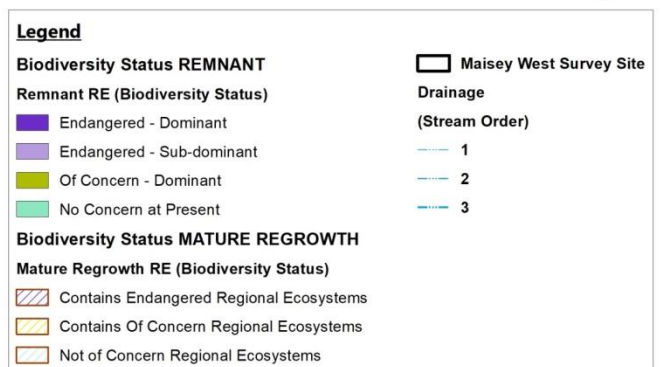


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Appendix B: State Government Remnant & Mature Regrowth RE.



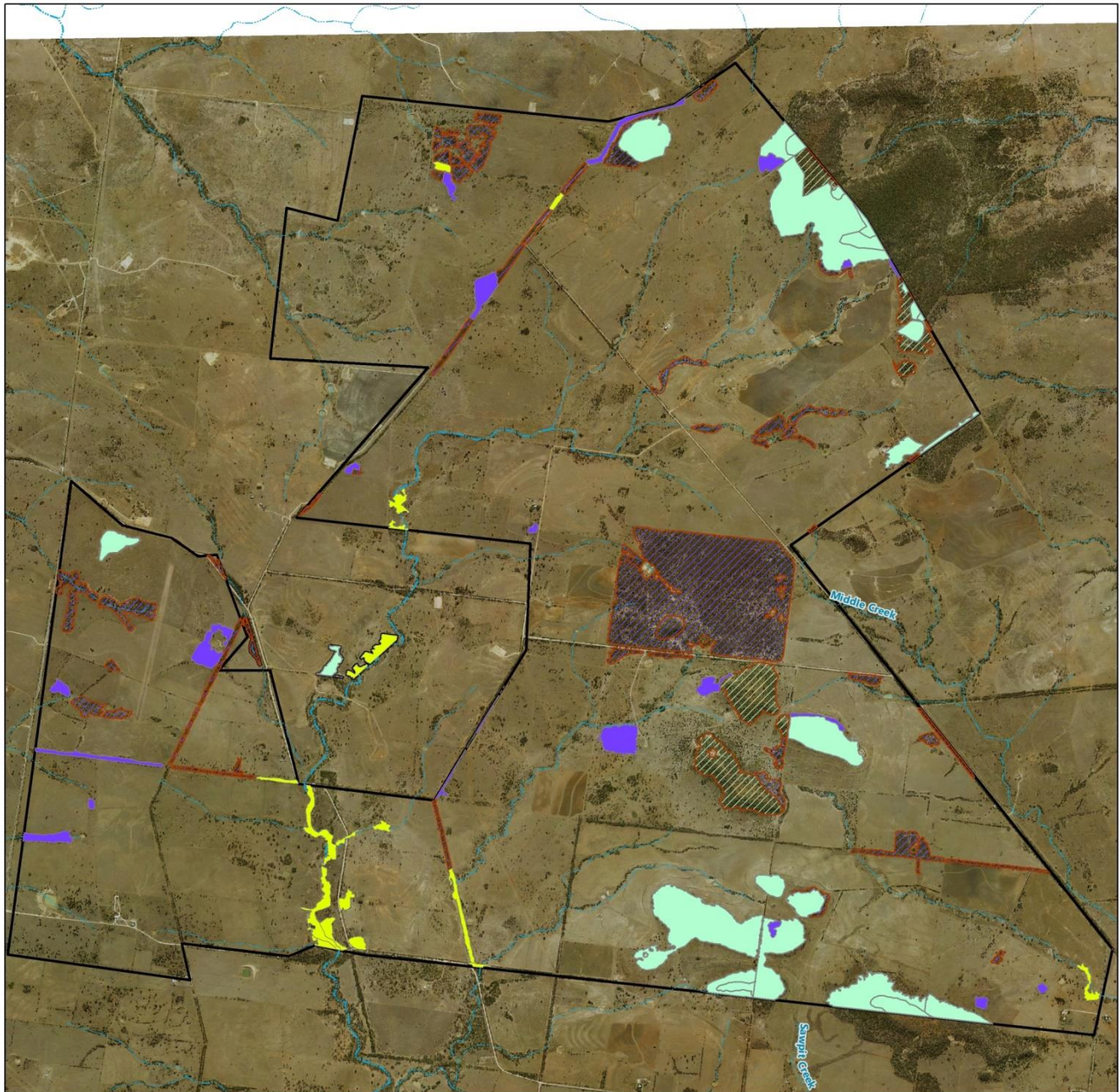
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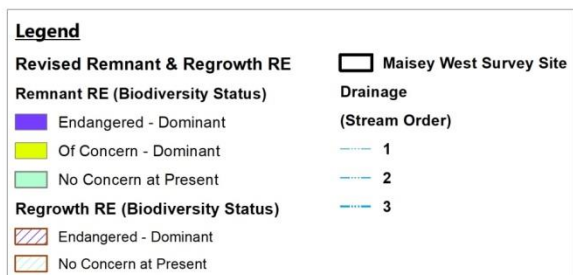
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Date: 31/8/18

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Appendix C: Revised Remnant & Regrowth RE.



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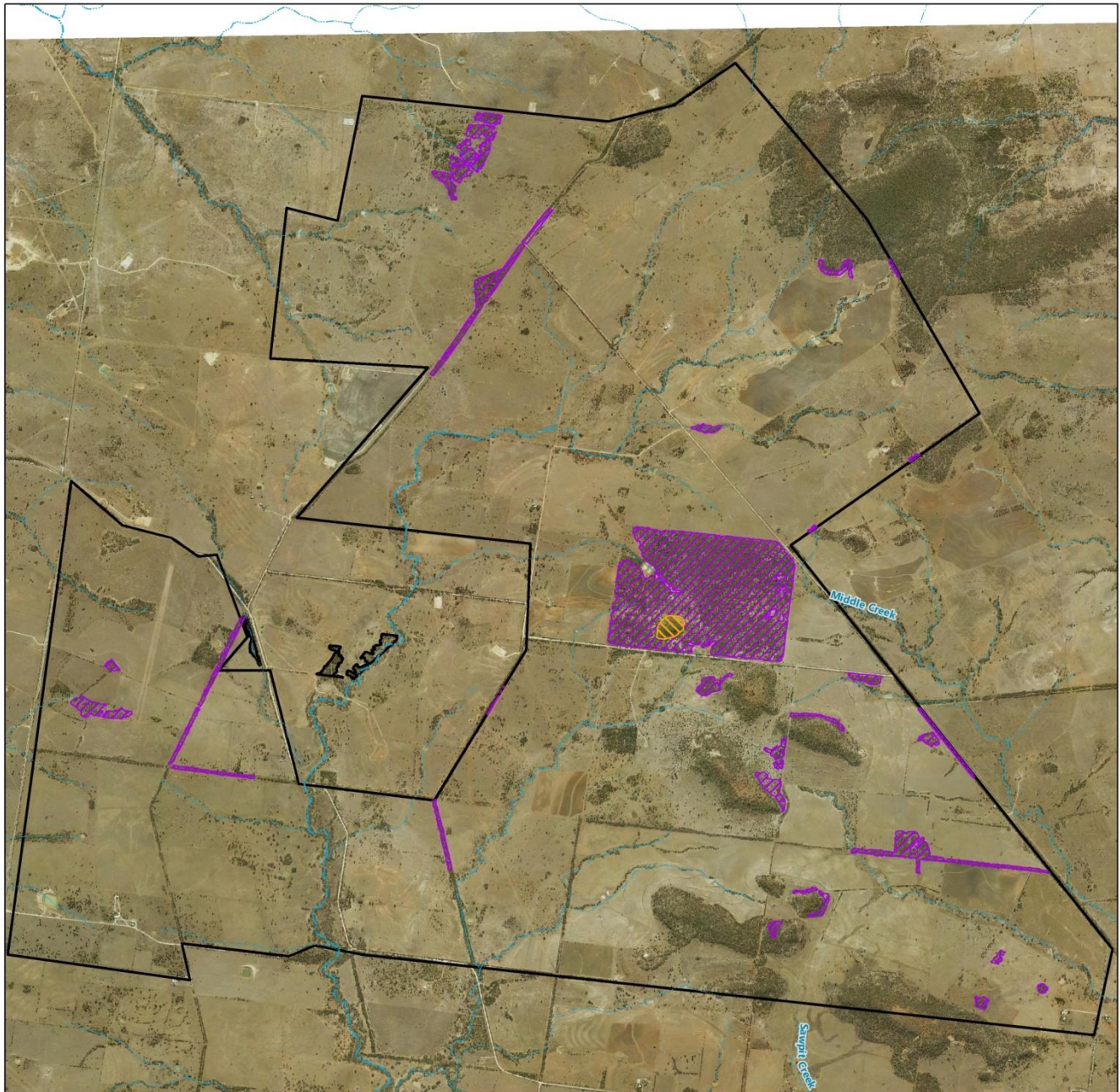


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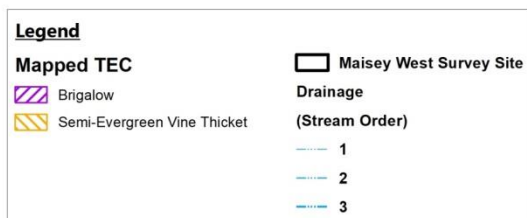


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Appendix D. Indicative TEC Mapping.



Appendix D: Indicative TEC Mapping.

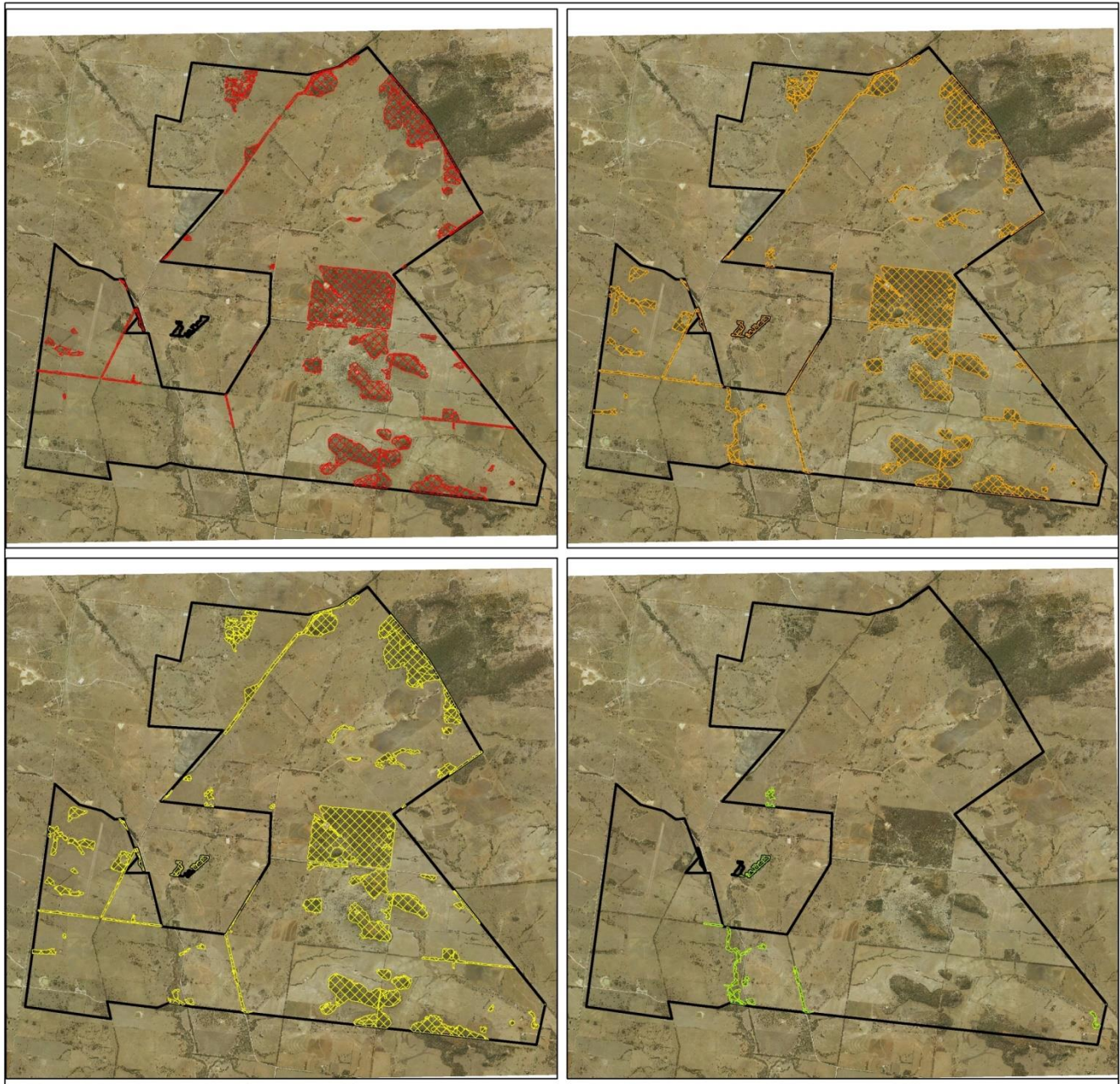


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Appendix E1: Predictive Threatened Species Habitat Mapping.

Legend

Maisey West Survey Site

Common Death Adder

Acanthopis antarcticus

Woma, Collared Delma, Golden-tailed Gecko

Aspidites ramsayi, *Delma torquata*, *Strophurus taenicauda*

Yakka Skink

Egernia rugosa

Grey Snake, Australian Painted Snipe

Hemiaspis damelii, *Rostratula australis*



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0 0.5 1 2 3 4 5 km

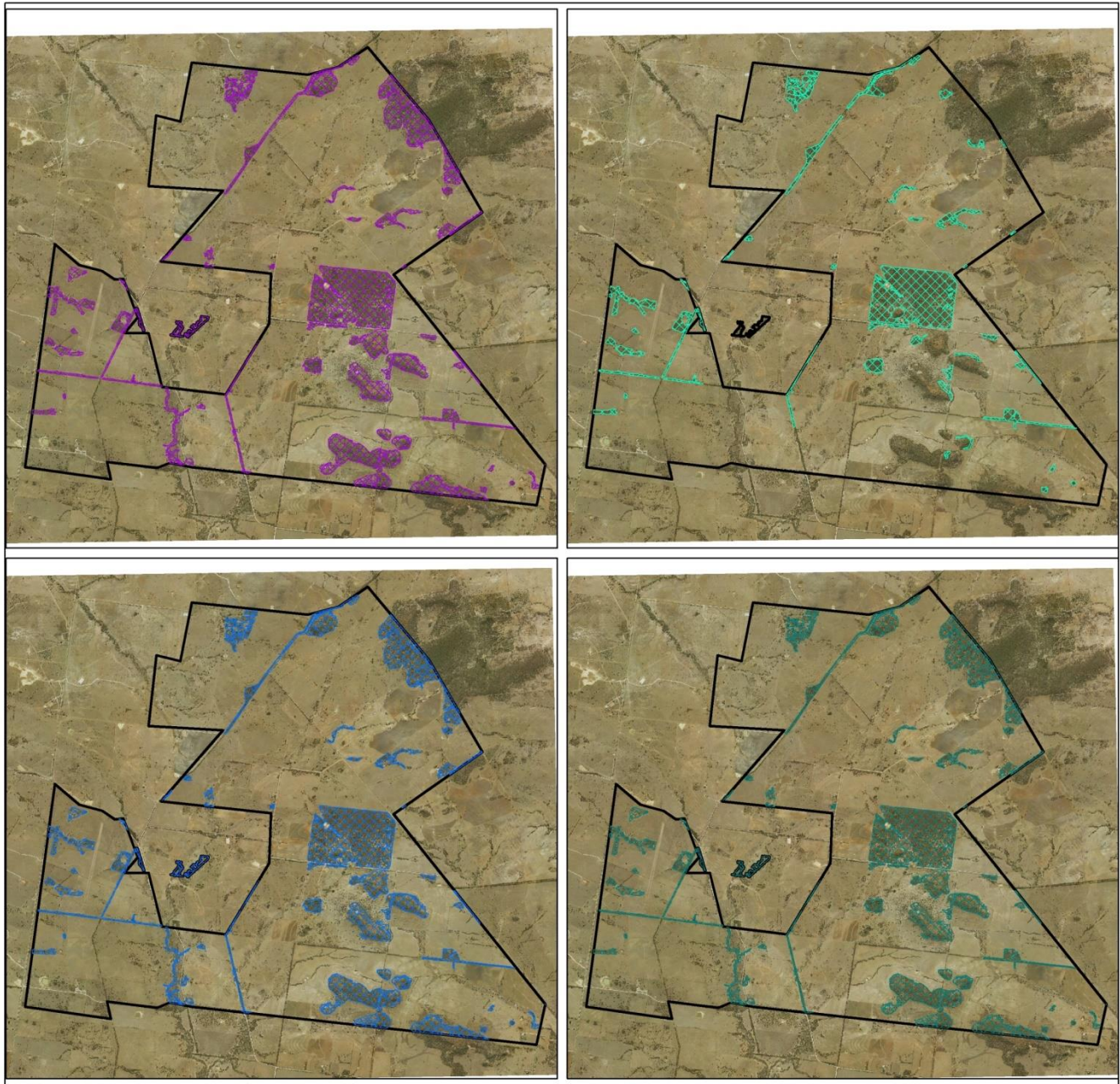
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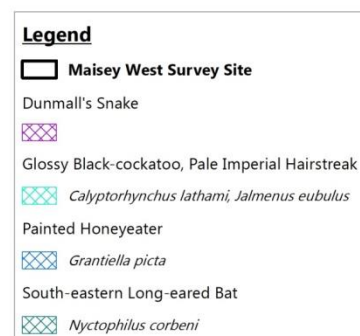
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Appendix E2: Predictive Threatened Species Habitat Mapping.



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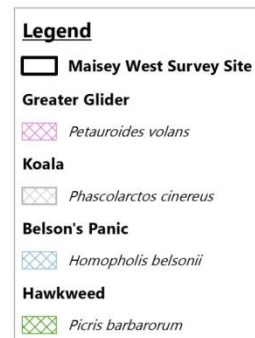
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Appendix E3: Predictive Threatened Species Habitat Mapping.



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Scale: 1:85,000 @ A3.
Datum: GDA94.
Date: 31/8/18



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