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Broad-scale Ecological Assessment Report

Part of Arcadia Gas Field (Lots 3TR21, 6TR20, 5TR18, 9TR17 and 8TR15)

Compiled by BOOBOOK for Santos

Revision	Date	Description	Author	Verifier	Approved
A	21/12/2015	Draft issued to client for review	R. Aisthorpe, R. Johnson, M. Klein	C. Eddie	C. Eddie
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1	12/2/2016	Amended report incorporating client comments	C. Eddie	-	C. Eddie

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DEHP	Department of Environment and Heritage Protection (State)
DNRM	Department of Natural Resources and Mines (State)
DoTE	Department of the Environment (Commonwealth)
DSITIA	Department of Science, Information Technology, Innovation and the Arts
E	Endangered
EH	Essential Habitat
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ERE	Endangered Regional Ecosystems
ERH	Essential Regrowth Habitat
EVNT	Endangered, Vulnerable and Near Threatened
GPS	Global Positioning System
ha	hectare (s)
HMAT	Habitat Mapping Assessment Tool
km	Kilometre(s)
LC	Least Concern
m	metre (s)
NC Act	*Nature Conservation Act 1992*
NCAP	No Concern At Present
NP	National Park
OC	Of Concern
RE	Regional Ecosystem (s)
REDD	Regional Ecosystem Description Database
SEVT	Semi-evergreen vine thicket
TEC	Threatened Ecological Community (ies)
TSSC	Threatened Species Scientific Committee
VM Act	*Vegetation Management Act 1999*

1. Introduction

1.1. Purpose and Scope

Santos required the following services in relation to identifying ecological values of vegetation on an identified part of the Arcadia gas field, south central Queensland:

- An assessment of any regional ecosystems (RE) and Threatened Ecological Communities (TEC);
- Functionality assessments for any endangered regrowth RE encountered;
- Assessment of fauna habitat value of vegetation, using the Habitat Mapping Assessment Tool (HMAT) methodology;
- Searches for the presence of endangered, vulnerable and near threatened (EVNT) flora; and
- Incidental EVNT fauna observations.

The vegetation requiring assessment was identified in Santos-supplied mapping for parts of five properties located in the Arcadia gas field. These five properties were Lot 3 on Plan TR21, Lot 6 on Plan TR20, Lot 5 on Plan TR18, Lot 9 on Plan TR17 and Lot 8 on Plan TR15, and are hereafter collectively referred to as the "Site".

1.2. Survey Team

A field survey of the Site was conducted by Rosamund Aisthorpe (Botanist) and Angela Bendall (Field Technician) in the period 9-13th November 2015. The project supervisor (Craig Eddie) was approved by the Department of the Environment (DoTE), 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 and regrowth REs (DNRM 2015a);
- Essential Habitat (EH) (DNRM 2015b) and Essential Regrowth Habitat (ERH) mapping (DNRM 2015c); and
- Available ground-truthed RE mapping, TEC and fauna habitat assessments conducted previously for Santos by BOOBOOK on various infrastructure project ecological assessments within the Site.

2.2. Field Survey

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.* 2012);
- Santos *Methodology for Conducting Ecological Assessments – GLNG Areas Rev 4.1* (Santos 2014a); 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.

The Site was visited to examine areas of vegetation which were pre-identified by Santos staff as of interest, were detected on imagery prior to the visit, or were detected during the field visit. Additional areas were also assessed in adjoining road reserves. 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. The Site, including the survey area for each property, is mapped at Appendix A.

2.2.1. RE and TEC Assessment

Ground-truthing (and confidence level scoring) of the DNRM regional ecosystem (RE) designation was undertaken using the quaternary level of data collection as described by Neldner *et al*. (2012).

Assessments were undertaken within 50 m x 50 m or 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 (i.e. an assessment plot in each patch of vegetation was not required). 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) (DEHP 2015) 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, 2013).

Where practical, all RE and TEC within the valley floor of the Site i.e. <400 m elevation were ground-truthed during vehicle and/or walking traverses. Where a TEC patch extended beyond the areas of interest nominated by Santos, it was mapped to the full extent of the patch within practical limits (including access constraints). The exception to this was vegetation on parts of the Expedition Range where TEX extended beyond areas pre-identified by Santos staff and/or the cadastral boundary into Expedition (Limited Depth) National Park (NP). Mapping of this vegetation was completed by obtaining views from a distance and/or aerial imagery interpretation. Additional time and survey effort would be required to map the entirety of intact vegetation associated with the Expedition Range (>6300 ha), predominantly on Lots 6TR20 and 5TR18, and on part of the Carnarvon Range on Lot 3TR21 .

Vegetation community data was captured in the field and later entered into Santos-specific data fields within spatial databases. 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.

Plant names used within this document conform to those given in Bostock and Holland (2014).

2.2.2. Ecosystem Functionality Assessment

For identified regrowth (i.e. vegetation floristically equivalent to an RE but not meeting structural thresholds) of an biodiversity status Endangered RE (ERE) an ecosystem functionality assessment was conducted. This assessed selected vegetation characteristics against the parameters described in Santos (2015). As for RE and TEC assessment, assessments were conducted within practical limits in representative areas of each ERE type encountered (i.e. an assessment in each patch of vegetation was not required). Ecosystem function data collected in the field was entered using a Motion tablet data capture system.

2.2.3. Fauna Habitat Assessment and Mapping

Fauna habitat 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. The HMAT assessment tool (*HMAT_Santos_RevA4.xls* (Santos 2014b)) was used to predict habitat suitability for the following species:

- *Chalinolobus dwyeri* (Large-eared Pied Bat, Large Pied Bat);
- *Dasyurus hallucatus* (Northern Quoll);
- *Nyctophilus corbeni* (South-eastern Long-eared Bat, Corben's Long-eared Bat);
- *Phascolarctos cinereus* (Koala);
- *Erythrotriorchis radiatus* (Red Goshawk);
- *Geophaps scripta scripta* (Squatter Pigeon (Southern));
- *Rostratula australis* (Australian Painted Snipe);
- *Turnix melanogaster* (Black-breasted Button-quail);
- *Delma torquata* (Collared Delma);

- *Denisonia maculata* (Ornamental Snake);
- *Egernia rugosa* (Yakka Skink);
- *Furina dunmalli* (Dunmall's Snake);
- *Paradelma orientalis* (Brigalow Scaly-foot);
- *Rheodytes leukops* (Fitzroy River Turtle);
- *Maccullochella peelii* (Murray Cod); and
- *Adclarkia dawsonensis* (Boggomoss Snail).

The results of HMAT analysis were used to develop GIS-based mapping of potential habitat for the identified species within the Site. HMAT analyses were completed electronically using a Motion tablet data capture system.

2.2.4. Threatened Flora Survey

Searches for threat-listed flora under the EPBC and/or NC Act were carried out at RE/TEC/ERE assessment sites and in random meanders in targeted habitat types, including RE and non-remnant vegetation.

If detected, counts and extent of each population of threat-listed flora were made and data was recorded using the Santos-specific Notable Species - Flora Point or Region data capture field. Representative photographs were taken.

2.2.5. 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.

2.2.6. Survey Limitations

Due to time and access constraints for some remote areas within the Site some 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.* 2012). 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. In these cases RE have been allocated on the basis of 'best fit' with current RE descriptions.

For areas of vegetation for which access was not possible HMAT assessments were not performed as the presence and abundance of microhabitat features could not be assessed. As a result predictive habitat mapping for these areas was given a low confidence level.

Threatened fauna searches were confined to incidental observations only (e.g. 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.

Timing (season) and duration of the survey period during spring and following some localised rainfall was generally favourable for identification of plants. However, rainfall varied between locations within the Site (and therefore so did plant growth response) and it is likely that some herbaceous threatened flora species potentially present in these locations were not detectable.

3. Results & Discussion

3.1. Vegetation Mapping

3.1.1. Desktop Regional Ecosystem Mapping

DNRM (2015a) mapped remnant RE is shown in Appendix C.

3.1.2. Revised Regional Ecosystem Mapping

Ground-truthing, inspection at a distance and examination of aerial imagery identified 10 remnant and 8 regrowth RE types within the Site. Mapping of remnant and regrowth REs 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.

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

RE Code	*VM Act* Class	Biodiversity Status	Short Description (DEHP 2015)	Extent – remnant (ha)	Extent – regrowth (ha)
11.3.1	E	E	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains	2.39	-
11.3.2	OC	OC	*Eucalyptus populnea* woodland on alluvial plains	450.47	6.31
11.3.4	OC	OC	*Eucalyptus tereticornis* and/or *Eucalyptus* spp. woodland on alluvial plains	25.09	38.21
11.3.17	OC	E	*Eucalyptus populnea* woodland with *Acacia harpophylla* and/or *Casuarina cristata* on alluvial plains	94.56	122.78
11.3.19	LC	NCAP	*Callitris glaucophylla, Corymbia* spp. and/or *Eucalyptus melanophloia* open forest to woodland on Cainozoic alluvial plains	-	10.81
11.3.25	LC	OC	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	252.27	-
11.9.4	OC	E	Semi-evergreen vine thicket or *Acacia harpophylla* with a semi-evergreen vine thicket understory on fine-grained sedimentary rocks	17.36	1.36
11.9.5a	E	E	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	324.14	309.49
11.10.3	LC	NCAP	*Acacia catenulata* or *A. shirleyi* open forest on coarse-grained sedimentary rocks. Crests and scarps	-	4.69

RE Code	*VM Act* Class	Biodiversity Status	Short Description (DEHP 2015)	Extent – remnant (ha)	Extent – regrowth (ha)
11.10.4	LC	NCAP	*Eucalyptus decorticans, Lysicarpus angustifolius* ± *Eucalyptus* spp., *Corymbia* spp., *Acacia* spp. woodland on coarse-grained sedimentary rocks	133.96	19.92
11.10.7	LC	NCAP	*Eucalyptus crebra* woodland on coarse-grained sedimentary rocks	6.46	-
11.10.13	LC	NCAP	*Eucalyptus* spp. and/or *Corymbia* spp. open forest on scarps and sandstone tablelands	57.65	-

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

3.1.3. Threatened Ecological Communities

The field survey confirmed the presence of two TEC. The occurrence of Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC was confirmed at multiple locations. The occurrence of Semi-evergreen vine thickets (SEVT) of the Brigalow Belt (North and South) and Nandewar Bioregions TEC was confirmed in vegetation on part of the Expedition Range. The mapped extent of TEC at the Site is shown within Appendix D.

For the purposes of this assessment all remnant and regrowth RE that are a listed component of the Brigalow TEC were mapped as TEC (TSSC 2013) provided that the vegetation otherwise met condition criteria (TSSC 2013). Note that for vegetation for which access was not possible, assessment of these condition criteria was limited. As a result a low confidence level was applied to assignment of TEC status to these areas. Nineteen areas of remnant or regrowth Brigalow were identified as TEC within the Site.

No SEVT TEC was ground-truthed during the field survey but two areas were mapped on the Expedition Range where it was identified through imagery interpretation and examination of the results of previous surveys (BOOBOOK 2012). There are currently no condition criteria for SEVT regrowth (TSSC 2001) therefore only mature SEVT (i.e. remnant status) was mapped as TEC. Further survey is required to distinguish RE 11.9.4 from the non-TEC SEVT RE 11.10.8. Further, areas currently mapped as 11.9.5a which were not ground-truthed may also contain SEVT. As a result of these constraints the total extent of SEVT TEC within the Site may be underestimated.

Table 4 shows the extent (total area) of each TEC mapped within the Site.

Table 4: Description and extent of TEC within the Site.

TEC Description	RE Code	Extent of TEC (ha)
Brigalow (*Acacia harpophylla* dominant and co-dominant)	11.9.5	328.26
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	11.9.4	17.36

3.2. Threatened Flora Survey

One species of threatened flora was detected during the assessment, this being Ooline (*Cadellia pentastylis*) which is listed as Vulnerable under both the EPBC and NC Acts. Six occurrences of this species were observed on Lot 3TR21 and which comprised clumps of mostly mature trees. No other populations of Ooline (*C. pentastylis*) or other threatened flora were observed within the Site. Habitat and location details are summarised in Table 5. The location of Ooline patches is mapped at Appendix E.

Table 5: Incidental records of threatened flora compiled during the assessment.

Family	Scientific/ Common Name	NC Act Status	EPBC Act Status	Location & Position co-ordinates (datum GDA 94)	Habitat notes
Surianaceae	*Cadellia pentastylis* Ooline	V	V	Lot/Plan 3TR21 55J 680720E 7192497N	Clump of *C. pentastylis* (21 individuals) surrounded by cleared paddock dominated by *Acacia harpophylla* and *Carissa ovata* shrubs; *Cenchrus ciliaris* ground layer.

Family	Scientific/ Common Name	NC Act Status	EPBC Act Status	Location & Position co-ordinates (datum GDA 94)	Habitat notes
				Lot/Plan 3TR21 55J 680909E 7192378N	Clump of *C. pentastylis* surrounded by cleared paddock dominated by *Acacia harpophylla* and *Carissa ovata* shrubs; *Cenchrus ciliaris* ground layer.
				Lot/Plan 3TR21 55J 681205E 7192501N	Clump of *C. pentastylis* surrounded by cleared paddock dominated by *Acacia harpophylla* and *Carissa ovata* shrubs; *Cenchrus ciliaris* ground layer.
				Lot/Plan 3TR21 55J 681140E 7192590N	Clump of *C. pentastylis* surrounded by cleared paddock dominated by *Acacia harpophylla* and *Carissa ovata* shrubs; *Cenchrus ciliaris* ground layer.
				Lot/Plan 3TR21 55J 681310E 7192602N	*C. pentastylis* open forest with associated *Brachychiton rupestris*; midlayer composed of *Acacia harpophylla* (around edges) and *Geijera parviflora*; shrub layer of *Alectryon diversifolius* and *Carissa ovata*; grassy ground layer of *Cenchrus ciliaris* and *Megathyrsus maximus.*
				Lot/Plan 3TR2155J 681295E 7192842N	Clump of *C. pentastylis* and *Acacia harpophylla* surrounded by cleared paddock dominated by *Acacia harpophylla* and *Carissa ovata* shrubs; *Cenchrus ciliaris* ground layer.

3.3. Threatened Fauna Survey

3.3.1. Incidental Observations

No species of threatened fauna were detected during the survey of the Site.

3.3.2. HMAT Assessment and Predictive Habitat Mapping.

Sixteen HMAT assessments were conducted for a selection of threatened fauna as nominated by Santos. The location of HMAT assessment sites is shown in Appendix A. Raw data for HMAT assessments has been provided separately to this report. The results of these assessments were then combined with ecologist knowledge to develop rules for the development of predictive habitat mapping for the selected species (listed at Section 2.2.3). 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). 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. This scenario applies 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) it was not possible under the access constraints operating in this project 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, with the following exception.

Two of the selected species, the Australian Painted Snipe (*Rostratula australis*) and the Ornamental Snake (*Denisonia maculata*), are able to forage and breed in or at the margins of shallow ephemeral wetland habitat available around farm dams and in areas of gilgai-forming soils. These habitat values are independent of the presence of woody-dominated vegetation. Though it was beyond the scope of this project to map this potential habitat in detail, three relatively large habitat areas were identified. One large shallow wetland complex centred on farm dams was located on Lot/Plan 6TR20 (survey site H1-AV). Two large patches of gilgai habitat were identified on Lot/Plan 3TR21. One patch was ground truthed at survey site H2-AV and a further patch located by image interpretation.

The area in hectares of these three features was calculated and added to the total of RE-based potential habitat for each species (Table 6). Note however that this may underestimate the amount of habitat present. Other, smaller areas of gilgai and numerous farm dams are present within the Site and their contribution to potential habitat for the two species is not accounted for.

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

Note that three of the selected species do not occur in the gas field tenement (i.e. PL234) covering the Site (BOOBOOK 2015a, 2015b, 2015c). No predictive mapping is provided for these species, listed below:

- *Rheodytes leukops* (Fitzroy River Turtle);
- *Maccullochella peelii* (Murray Cod); and
- *Adclarkia dawsonensis* (Boggomoss Snail).

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

Species name	Potentially Suitable REs	Mapped extent of General Habitat (ha)	Habitat Mapping Rules/Notes
Chalinolobus dwyeri Large-eared Pied Bat	11.3.1, 11.3.17, 11.3.19, 11.3.2, 11.3.25, 11.3.4, 11.9.4, 11.9.5a, 11.10.3, 11.10.4, 11.10.7, 11.10.13	1404.3	This species is dependent on the presence of suitable shelter habitat in the form of caves and deep crevices in extensive rock formations (commonly sandstone). Mapped General Habitat includes all areas of remnant vegetation and advanced regrowth that may be suitable for foraging and are <5km from potentially suitable shelter habitat.
Dasyurus hallucatus Northern Quoll	11.3.1, 11.3.17, 11.3.19, 11.3.2, 11.3.25, 11.3.4, 11.9.4, 11.9.5a, 11.10.3, 11.10.4, 11.10.7, 11.10.13	785.8	This species is dependent on the presence of suitable shelter habitat in the form of caves and deep crevices in extensive rock formations (commonly sandstone) though it may forage at a distance from this habitat. A conservative (minimum) estimate of potential habitat should include areas of woodland or open forest vegetation contiguous with suitable shelter habitat. Mapped General Habitat includes all remnant vegetation and advanced regrowth contiguous with suitable shelter habitat on valley slopes.
Nyctophilus corbeni South-eastern Long-eared Bat	11.3.1, 11.3.17, 11.3.19, 11.3.2, 11.3.25, 11.3.4, 11.9.4, 11.9.5a, 11.10.3, 11.10.4, 11.10.7, 11.10.13	1878.2	Mapped General Habitat includes all areas of remnant vegetation and advanced regrowth that may be suitable for foraging or shelter.
Phascolarctos cinereus Koala	11.3.1, 11.3.17, 11.3.19, 11.3.2, 11.3.25, 11.3.4, 11.10.3, 11.10.4, 11.10.7, 11.10.13	1225.9	Mapped General Habitat includes all remnant and advanced regrowth of REs dominated by Myrtaceae species.
Erythrotriorchis radiatus Red Goshawk	11.3.1, 11.3.17, 11.3.19, 11.3.2, 11.3.25, 11.3.4, 11.9.4, 11.9.5a, 11.10.3, 11.10.4, 11.10.7, 11.10.13	1878.2	Mapped General Habitat includes all remnant and advanced regrowth of potentially suitable REs. This species may also forage within sub-optimal and non-remnant vegetation throughout the Site.
Geophaps scripta scripta Squatter Pigeon	11.3.1, 11.3.17, 11.3.19, 11.3.2, 11.3.25, 11.3.4, 11.9.5a, 11.10.3, 11.10.4, 11.10.7, 11.10.13	1859.4	Mapped General Habitat includes remnant and advanced regrowth of potentially suitable REs. This species may also forage within non-remnant vegetation.
Rostratula australis Australian Painted Snipe	11.3.1, 11.3.2, 11.3.25	854.7	Mapped General Habitat includes all remnant RE 11.3.1, 11.3.2 and 11.3.25. However, no mapping is available for preferred habitat within these RE (off-stream shallow vegetated wetlands). The species is also likely to use ephemeral wetlands in cleared gilgai areas, and the vegetated margins of farm dams.

Species name	Potentially Suitable REs	Mapped extent of General Habitat (ha)	Habitat Mapping Rules/Notes
Turnix melanogaster Black-breasted Button-quail	11.9.4	18.7	Mapped General Habitat includes all remnant and advanced regrowth RE 11.9.4 that has substantial linkages to other woody vegetation.
Delma torquata Collared Delma	11.3.1, 11.3.17, 11.3.19, 11.3.2, 11.3.25, 11.3.4, 11.9.5a, 11.10.3, 11.10.4, 11.10.7, 11.10.13	1859.4	Mapped General Habitat includes all areas of remnant and advanced regrowth of the nominated REs.
Denisonia maculata Ornamental Snake	11.3.1, 11.3.17, 11.3.19, 11.3.2, 11.3.25, 11.3.4, 11.9.5a	1064.2	Mapped General Habitat includes all remnant vegetation and advanced regrowth of the nominated REs except areas >360m elevation. The species is also likely to use ephemeral wetlands in cleared gilgai areas, and the vegetated margins of farm dams.
Egernia rugosa Yakka Skink	11.3.1, 11.3.17, 11.3.19, 11.3.2, 11.3.25, 11.3.4, 11.9.5a, 11.10.3, 11.10.4, 11.10.7	1801.6	Mapped General Habitat includes all remnant vegetation and advanced regrowth of the nominated REs.
Furina dunmalli Dunmall's Snake	11.3.1, 11.3.17, 11.3.19, 11.3.2, 11.3.25, 11.3.4, 11.9.5a, 11.10.3, 11.10.4, 11.10.7, 11.10.13	1859.4	Mapped General Habitat includes all remnant vegetation and advanced regrowth of the nominated REs.
Paradelma orientalis Brigalow Scaly-foot	11.3.1, 11.3.17, 11.3.19, 11.3.2, 11.3.25, 11.3.4, 11.9.4, 11.9.5a, 11.10.3, 11.10.4, 11.10.7, 11.10.13	1878.2	Mapped General Habitat includes all areas of remnant and advanced regrowth of the nominated REs.

4. Conclusions

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

- Approximately 328.26 ha of Brigalow (*Acacia harpophylla* dominant and dominant) TEC.
- Approximately 17.36 ha of 'Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions' TEC.
- Presence of 872.08 ha of Endangered RE (remnant and functional ecosystem).
- Presence of 772.35 ha of Of Concern RE.
- Confirmed presence of one species of threatened flora listed as vulnerable under the EPBC Act and NC Act this being Ooline (*Cadellia pentastylis*).
- Indicative General Habitat mapping for the following threatened fauna:
    - *Erythrotriorchis radiatus* (Red Goshawk) – 1878.2 ha;
    - *Geophaps scripta scripta* (Squatter Pigeon (southern)) – 1859.4 ha;
    - *Rostratula australis* (Australian Painted Snipe) – 854.7 ha;
    - *Turnix melanogaster* (Black-breasted Button-quail) – 18.7 ha;
    - *Delma torquata* (Collared Delma) – 1859.4 ha;
    - *Denisonia maculata* (Ornamental Snake) – 1064.2 ha;
    - *Egernia rugosa* (Yakka Skink) – 1801.6 ha;
    - *Furina dunmalli* (Dunmall's Snake) – 1859.4 ha;

- *Paradelma orientalis* (Brigalow Scaly-foot) – 1878.2 ha;
- *Chalinolobus dwyeri* (Long-eared Pied Bat) – 1404.3 ha;
- *Dasyurus hallucatus* (Northern Quoll) – 785.8 ha;
- *Nyctophilus corbeni* (Eastern Long-eared Bat) – 1878.2 ha;
- *Phascolarctos cinereus* (Koala) – 1225.9 ha.

5. Recommendations

It is recommended that:

- All mapping within this report be used within its limitations. As detailed above 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 (e.g. *Xerothamnella herbacea*) are conducted prior to any infrastructure development in vegetation within the Site; and
- Further surveys are conducted in vegetation on the Expedition Range, in particular on the western slopes, to confirm and quantify the presence of Brigalow and SEVT TEC.

6. References

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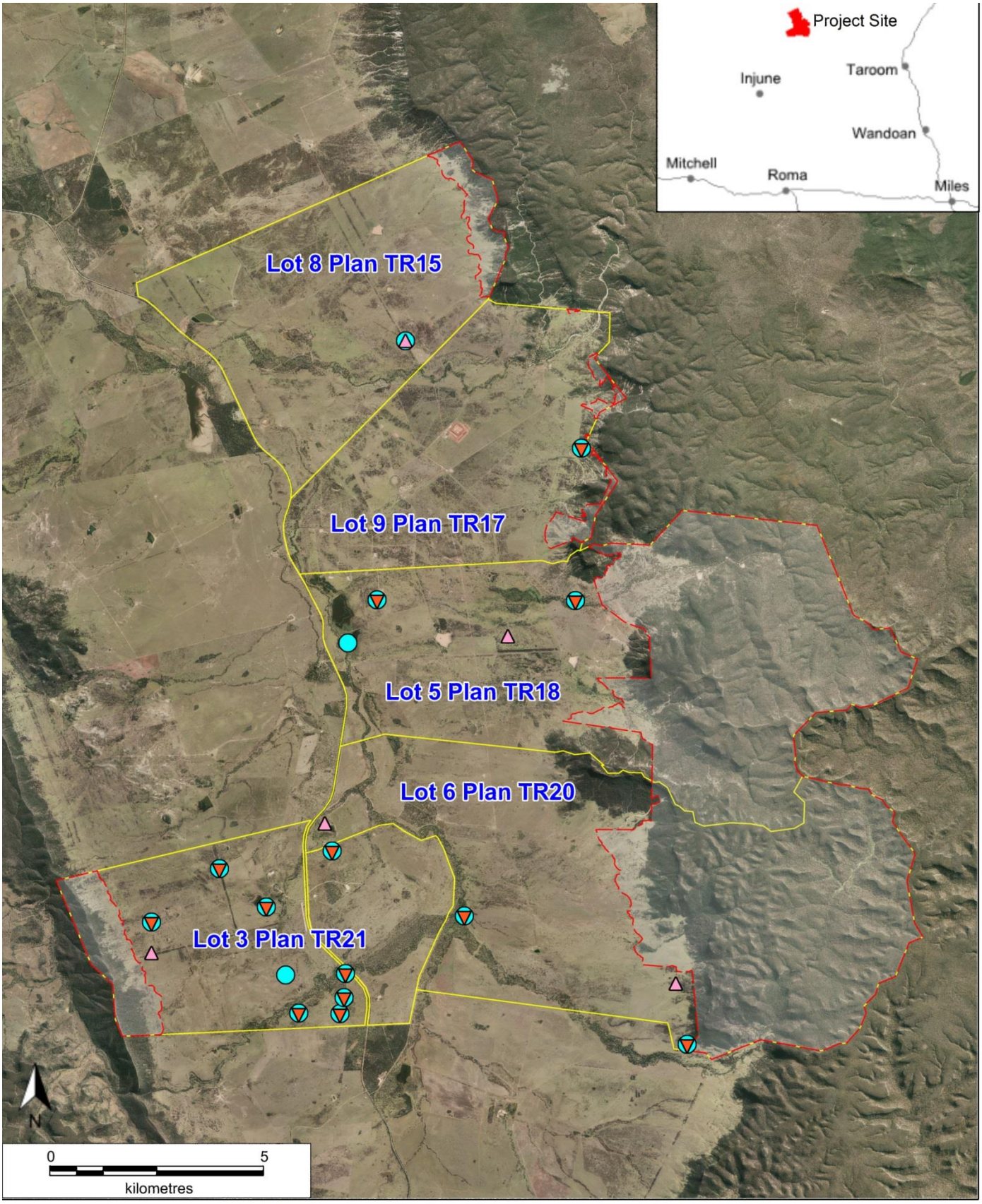
Appendix A. Assessment Area & Survey Sites.



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Appendix A. Assessment Area & Survey Sites

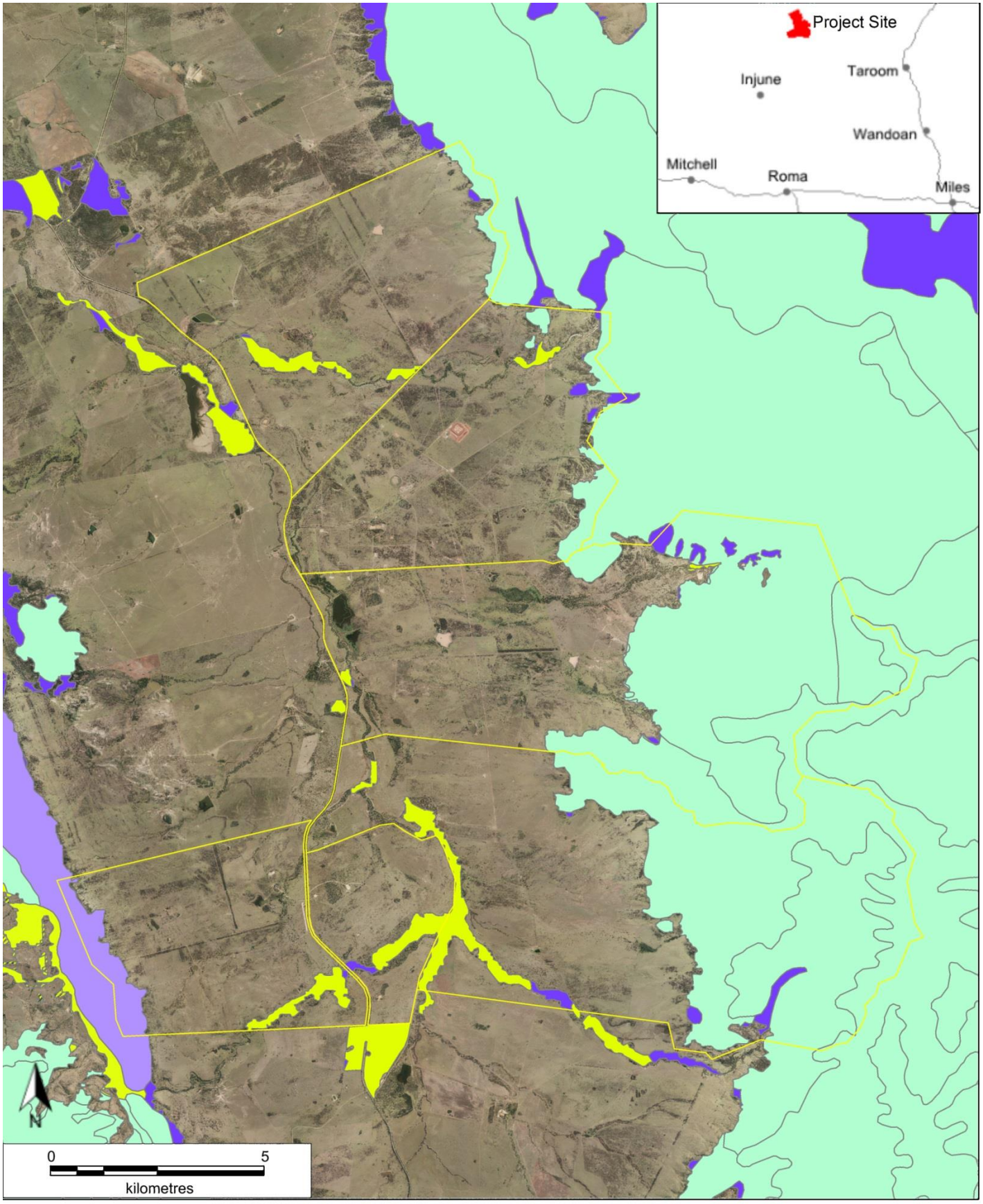
18 December 2015

Assessment Sites
- HMAT
- Quaternary
- Functionality Site

Area excluded from survey

Cadastral boundary

Appendix B. DNRM Mapped Regional Ecosystems.



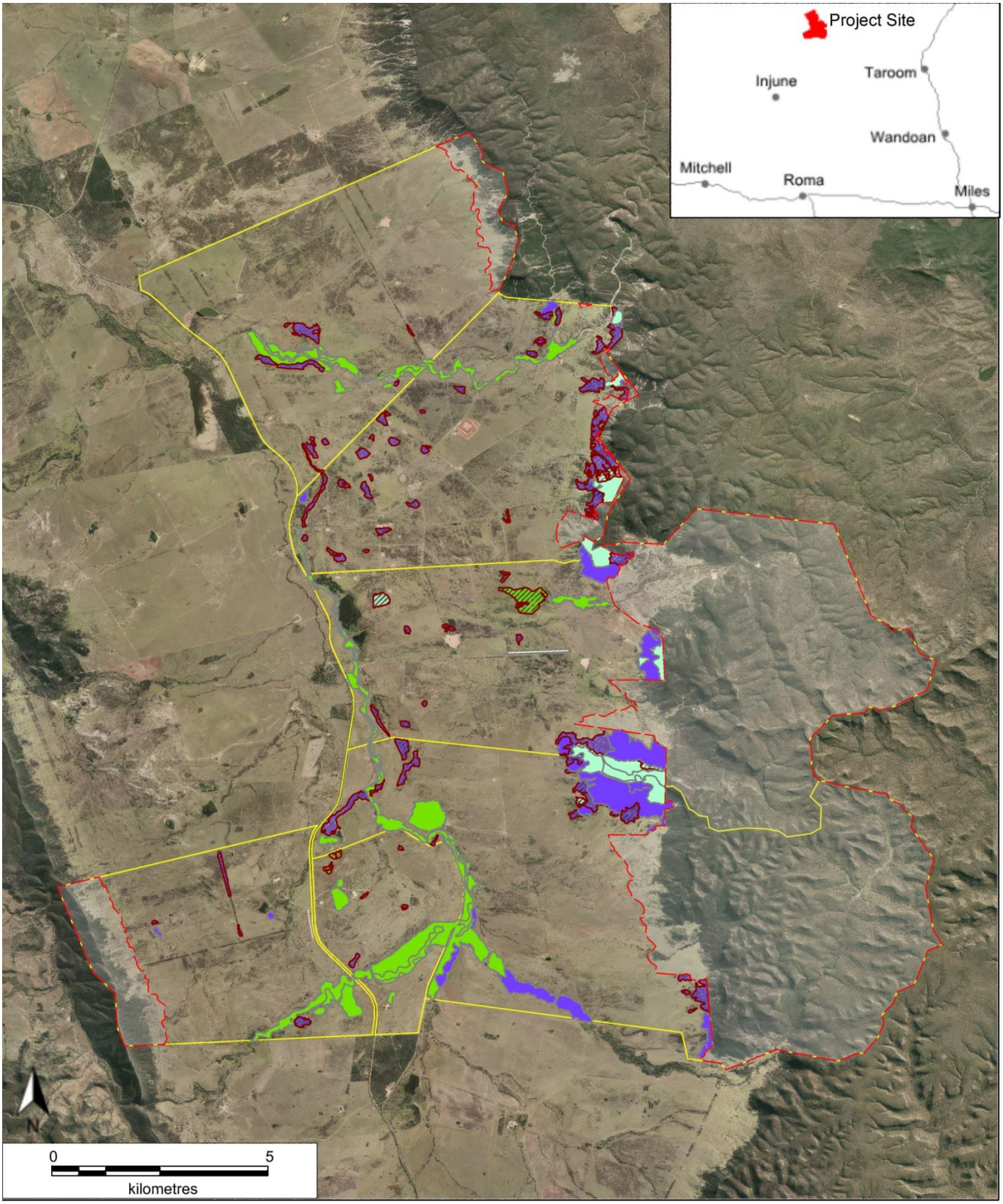
Appendix B.
DNRM Mapped RE

18 December 2015

Biodiversity Status

- Endangered dominant
- Endangered sub-dominant
- Of concern dominant
- Of concern sub-dominant
- Of concern dominant; regrowth
- No concern at present
- No concern at present; regrowth
- Cadastral boundary

Appendix C. Revised Regional Ecosystem Mapping.



Appendix C.
Revised Regional Ecosystems

Biodiversity Status

- Endangered
- Endangered; regrowth
- Of concern
- Of concern; regrowth
- No concern at present
- No concern at present; regrowth
- Plantation
- Cadastral boundary
- Area excluded from survey

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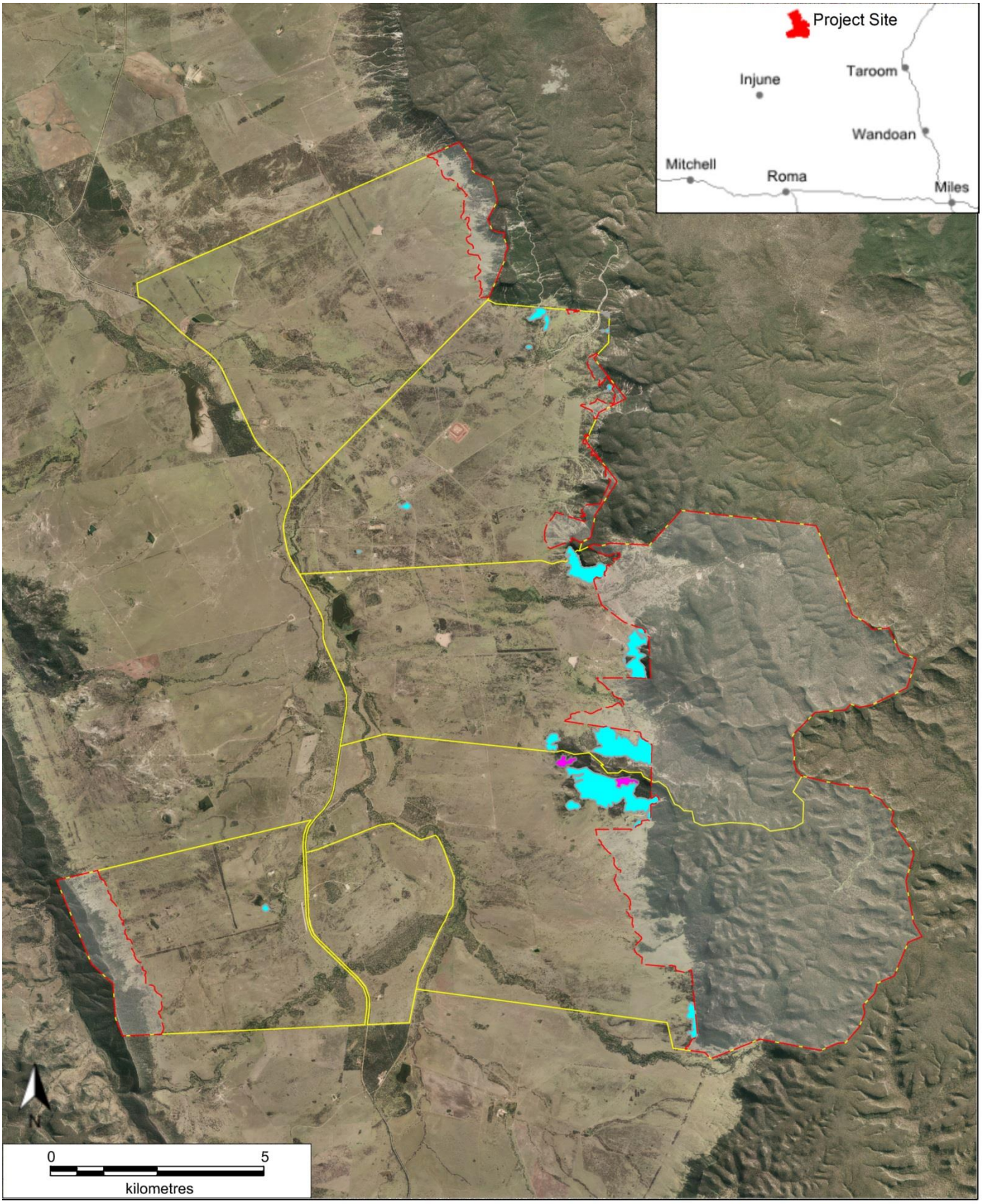
18 December 2015

Appendix D. Indicative TEC Mapping.



Appendix D.
Indicative TEC

TEC

- Semi-Evergreen Vine Thicket
- Brigalow
- Area excluded from survey
- Cadastral boundary

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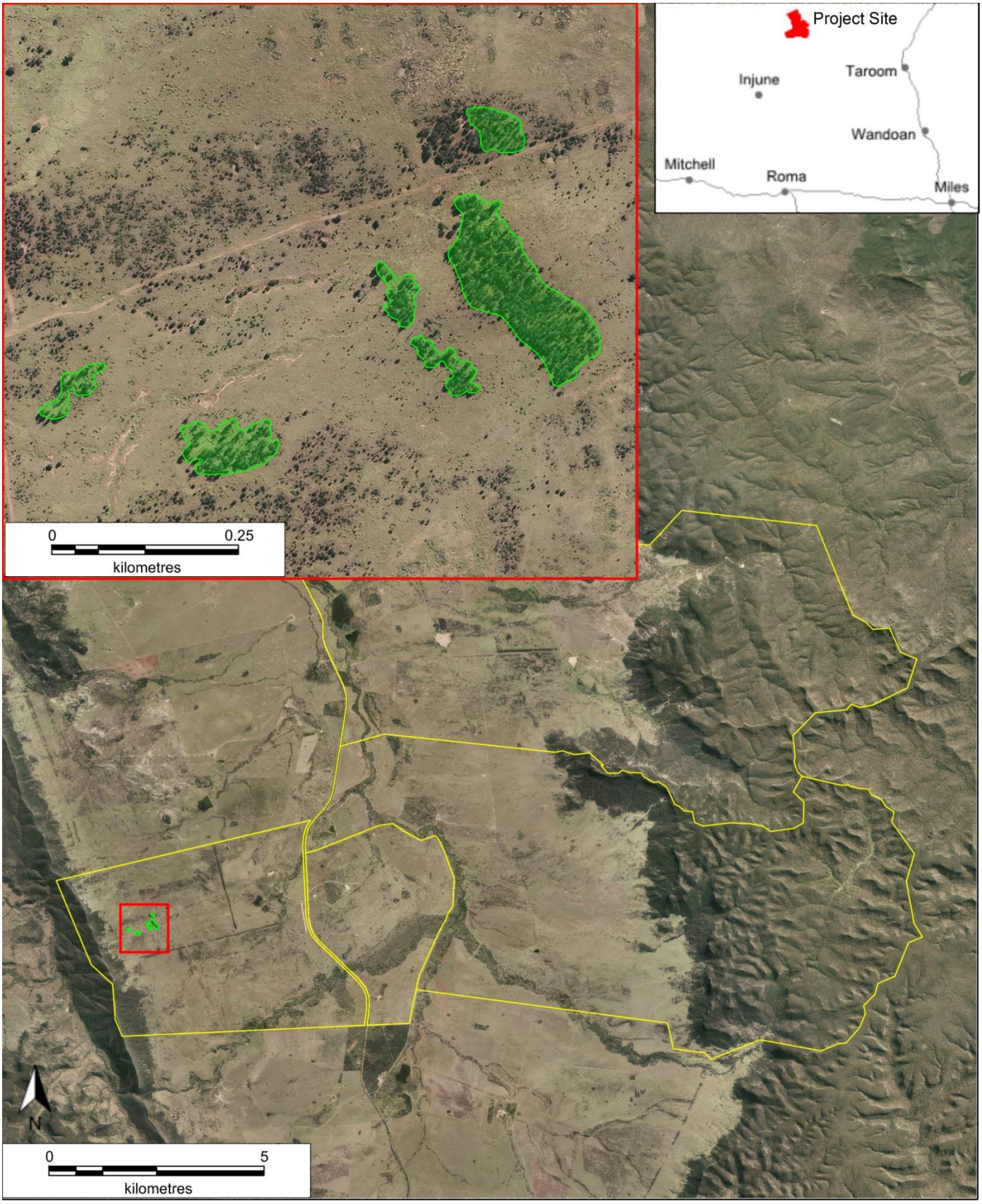
18 December 2015

Appendix E. Locations of EVNT Flora Detected during the Survey.



Appendix E.
EVNT Flora

EVNT Flora
Ooline
Cadastral boundary

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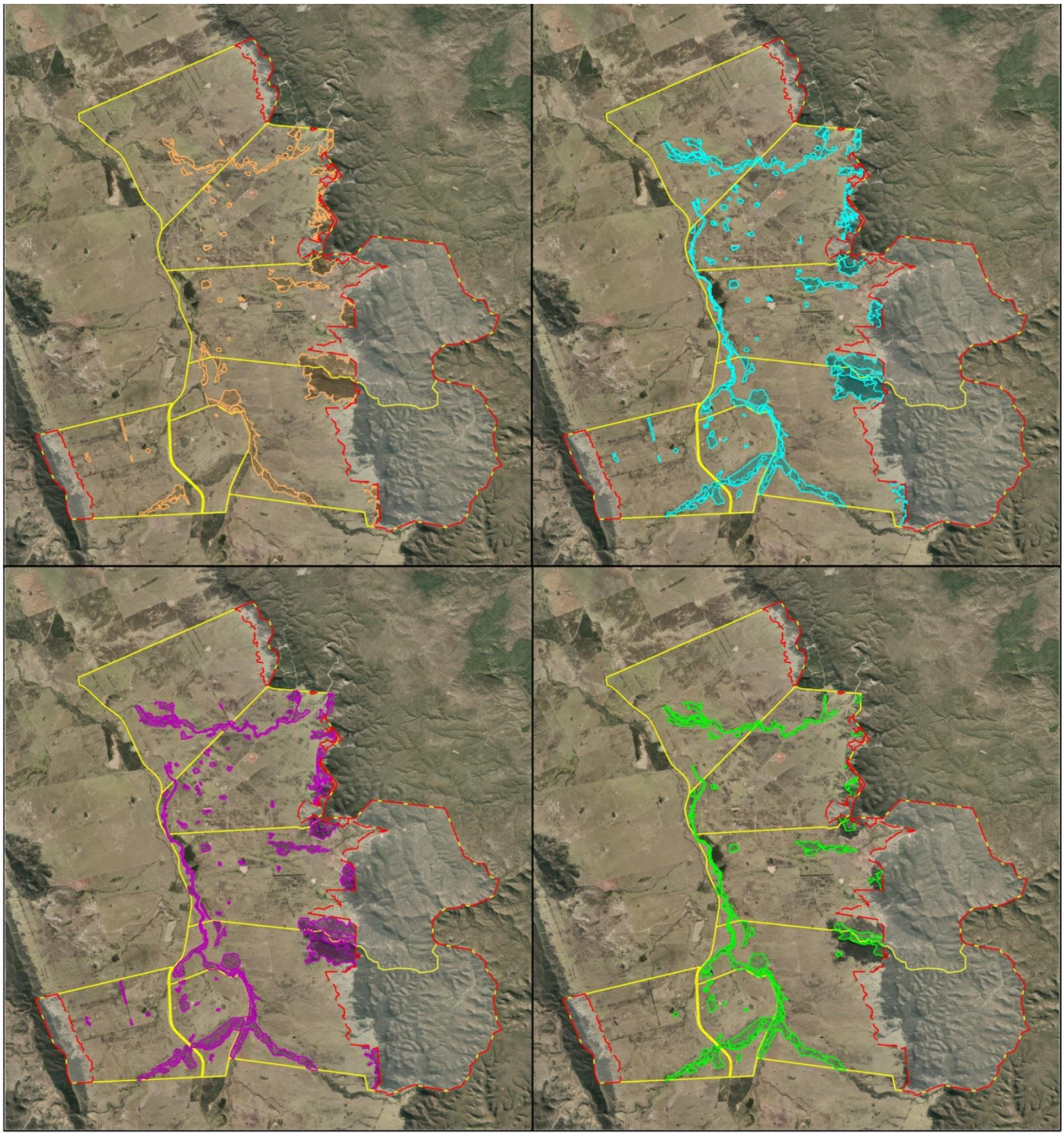
18 December 2015

Appendix F. Predictive Threatened Fauna Habitat Mapping



Appendix F. Predictive Threatened Fauna Habitat

18 December 2015

Large-eared Pied Bat

South-eastern Long-eared Bat, Red Goshawk, Brigalow Scaly-foot

Squatter Pigeon, Collared Delma, Dunmall's Snake

Koala

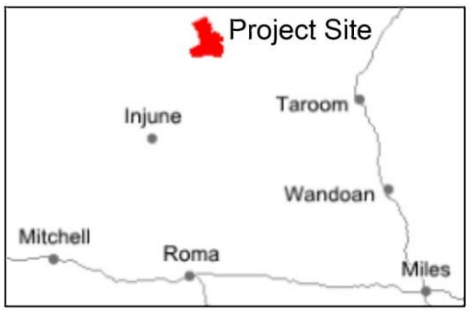
Cadastral boundary

Area excluded from survey

N

0 10

kilometres



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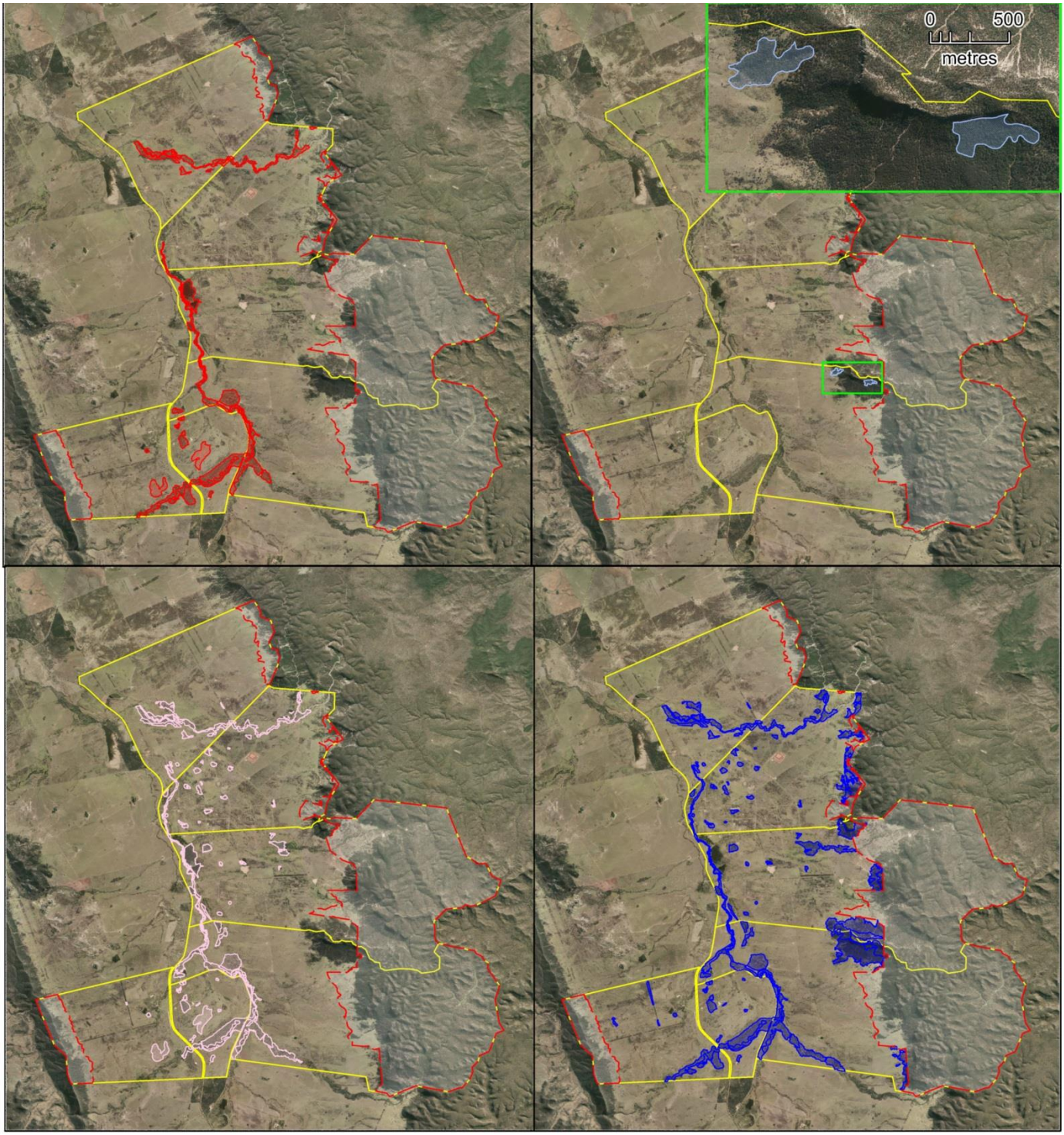
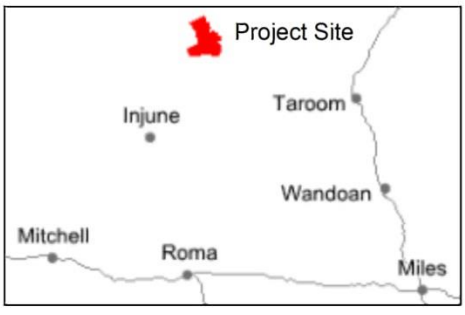


Appendix F. Predictive Threatened Fauna Habitat

18 December 2015

Predicted Habitat
- Australian Painted Snipe
- Black-breasted Button-quail
- Ornamental Snake
- Yakka Skink

- Area excluded from survey
- Cadastral boundary



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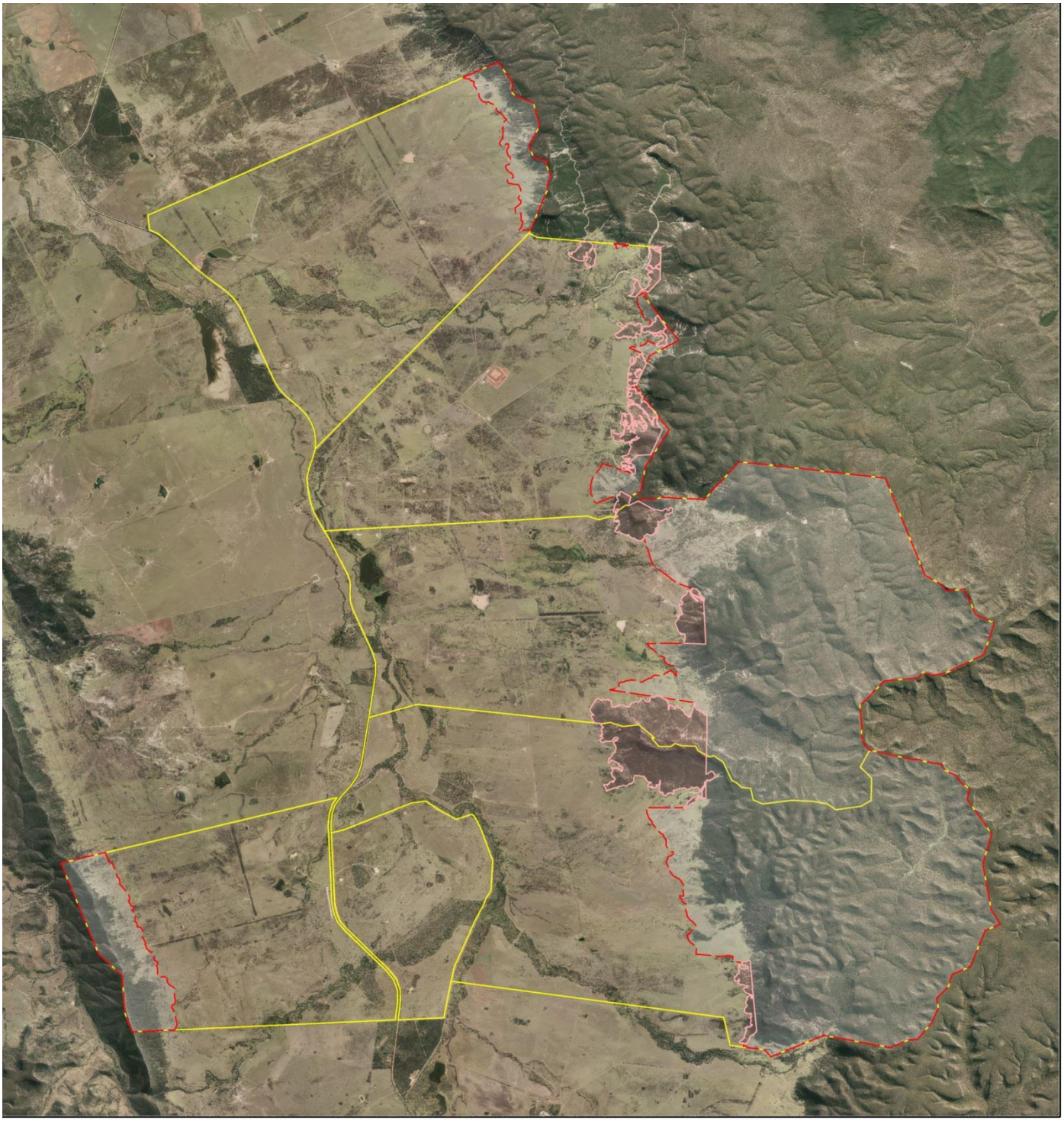
N

0 10
kilometres



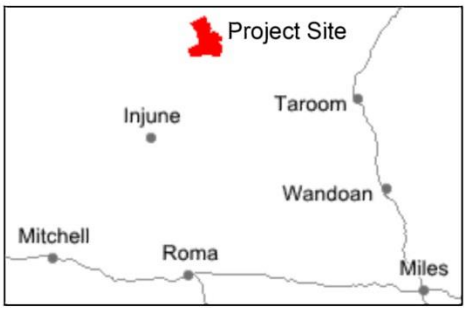
Appendix F. Predictive Threatened Fauna Habitat

2 February 2016

Northern Quoll

Area excluded from survey

Cadastral boundary



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N

0 10

kilometres