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Ecology Assessment Report

Vegetation Assessment and Predictive MNES Fauna Habitat Mapping for Fairview Holding (Lot 6 on Plan CP908635), Fairview Gas Field.

Compiled by BOOBOOK for Santos

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Executive Summary and Caveat

This report provides a description of selected ecological values documented during a desktop assessment and field survey undertaken by BOOBOOK Ecological Consulting (BOOBOOK) at 'Fairview' Holding (hereafter referred to as 'the Site') between 13th to 17th July and 3rd to 14th August 2015. The Site is a 5518 ha grazing property described as Lot 6 on Plan CP908635 and is located approximately 45 km east-northeast of Injune, southern inland Queensland. The ecological assessment was originally conducted to assist Santos in determining the Site's value in terms of meeting offset requirements of disturbances associated with Santos Gladstone Liquefied Natural Gas (GLNG) projects in Queensland (BOOBOOK 2015a). As such this report focuses on vegetation mapping and predictive Matters of National Environmental Significance (MNES) threatened fauna mapping.

The desktop and field assessment included identification of remnant and regrowth regional ecosystems (RE), condition assessment (using the BioCondition methodology) and fauna habitat values assessment. BioCondition assessment was completed at 20 sites which were pre-selected within Queensland government mapped REs or following subsequent field inspection of vegetation.

A desktop review of aerial imagery and subsequent ground-truthing detected 14 RE types at the Site comprising 24 assessment units. Note that not all vegetation was ground-truthed hence confidence ratings were applied to each RE polygon (refer to spatial data associated with this report). Confidence ratings applicable to vegetation polygons should be checked prior to the use of this mapping for planning purposes. Further on-ground assessments may be required within areas having low levels of confidence.

The presence of two Threatened Ecological Communities (TECs) was confirmed at the Site these being:

- ✦ Brigalow (*Acacia harpophylla* dominant and co-dominant): 50.1 ha; and
- ✦ Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions: 358.0 ha.

Areas of young regrowth of Brigalow (8.9 ha) and young and advanced regrowth of semi-evergreen vine thicket (SEVT) (37.8 ha) were identified which may represent future potential TEC with appropriate rehabilitation and management.

No comprehensive fauna surveys were performed. Fauna surveys were limited to incidental observations at BioCondition assessments. Though animals were not observed directly, evidence of the presence of Koala (*Phascolarctos cinereus*) was obtained at two locations. This species is listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999) and *Nature Conservation Act 1992* (NC Act).

Fauna habitat and likelihood of occurrence assessments were conducted for 16 threatened fauna species nominated by Santos for consideration under the Scope of Works. This assessment considered that habitat is potentially suitable for 13 of the nominated species at the Site acknowledging that three of these species (Northern Quoll, Eastern Star Finch and Black-throated Finch) are, or are likely to be, locally extinct:

- ✦ *Dasyurus hallucatus* (Northern Quoll) – 3242.1 ha;
- ✦ *Chalinolobus dwyeri* (Large-eared Pied Bat, Large Pied Bat) – 3242.1 ha;
- ✦ *Nyctophilus corbeni* (South-eastern Long-eared Bat) – 3242.1 ha;
- ✦ *Botaurus poiciloptilus* (Australasian Bittern) – 68.5 ha;
- ✦ *Geophaps scripta scripta* (Squatter Pigeon (Southern)) – 2830.5 ha;
- ✦ *Erythrotriorchis radiatus* (Red Goshawk) – 3242.1 ha;
- ✦ *Neochmia ruficauda ruficauda* (Eastern Star Finch) – 68.5 ha;
- ✦ *Poephila cincta cincta* (Black-throated Finch) – 68.5 ha;
- ✦ *Rostratula australis* (Australian Painted Snipe) - 68.5 ha;
- ✦ *Turnix melanogaster* (Black-breasted Button-quail) – 411.2 ha;
- ✦ *Delma torquata* (Collared Delma) – 2761.9 ha;
- ✦ *Egernia rugosa* (Yakka Skink) – 2773.0 ha; and

✎ *Furina dunmalli* (Dunmall's Snake) – 2830.5 ha.

Areas of young regrowth of several vegetation communities were identified which may represent future potential habitat for threatened fauna with appropriate rehabilitation and management.

Note that this report utilises data obtained from desktop searches conducted in 2015. Desktop search results presented in this report should therefore not be relied upon for planning and management purposes.

List of Abbreviations

ALA	Atlas of Living Australia
AU (s)	assessment unit
BOO	Best on Offer
BOM	Bureau of Meteorology
DBH	diameter at breast height
DEHP	Department of Environment and Heritage Protection
DERM	Department of Environment and Resource Management
DEWHA	Department of Environment, Water, Heritage and the Arts
Dia.	diameter
DNRM	Department of Natural Resources and Mines
DoTE	Department of the Environment
DSITIA	Department of Science, Information Technology, Innovation and the Arts
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
GLNG	Gladstone Liquefied Natural Gas
GPS	Global Positioning System
ha	hectare (s)
km	kilometre (s)
m	metre (s)
NC Act	<i>Nature Conservation Act 1992</i>
NP	National Park
PMST	Protected Matters Search Tool
RE (s)	Regional Ecosystem (s)
REDD	Regional Ecosystem Description Database
SEVT	Semi-evergreen vine thicket
SPRAT	Species Profile and Threats Database
TEC (s)	Threatened Ecological Community (ies)
TSSC	Threatened Species Scientific Committee

1. Introduction

1.1. Purpose and Scope

This report provides a description of REs and MNES fauna habitat documented during a desktop assessment and field surveys undertaken by BOOBOOK Ecological Consulting (hereafter BOOBOOK) at 'Fairview' (hereafter referred to as 'the Site'), southern inland Queensland. The results are based on an initial desktop assessment, involving examination of imagery, followed by field surveys to confirm type and extent of vegetation communities, presence of habitat features which may support threatened fauna, and determination of potential extent of threatened fauna species habitat.

This report forms part of an assessment undertaken for two additional contiguous properties within the Fairview gas field these being 'Waddy Brae' (BOOBOOK 2015b) and 'Springwater' (BOOBOOK 2015c). The properties have very similar geology, topography and vegetation and also share a similar land use history. Potential Assessment Unit (AU) types and preliminary locations of BioCondition sites were determined by initial examination of aerial imagery (Santos Quickbird), RE mapping (DNRM and ground-truthed datasets) and review of data collected from previous field surveys at the Site, 'Waddy Brae' (BOOBOOK 2015b) and 'Springwater' (BOOBOOK 2015c).

1.2. Site Description

The Site is a 5518 ha grazing property described as Lot 6 on Plan CP908635 which is located approximately 45 km east-northeast of Injune, southern inland Queensland (Appendix A). The Site is accessed via Fairview Road (off the Carnarvon Developmental Road) and is under the jurisdiction of the Maranoa Regional Council. The Site is located within subregion 24 (Carnarvon Ranges) of the Brigalow Belt South bioregion (Sattler and Williams 1999). Current land uses at the Site include cattle grazing and coal seam gas extraction. The northern end of the Site is adjoined by Expedition (Limited Depth) National Park (NP). The Site is owned and managed by Santos and situated within tenements operated by Santos, these being PL91 and PL92.

Surface geology mapping for the Site shows that it is comprised entirely of Lower Jurassic sediments (Forbes 1968). In the north of the Site the terrain is rugged with outcropping of Precipice Sandstone forming a steep cliffs and gorges dissected by Baffle Creek and the Dawson River. Soils in this region are coarse sands with expansive areas of surface rock especially within close proximity to Baffle Creek and the Dawson River. Vegetation in the north is dominated by dry sclerophyll *Eucalyptus* and *Acacia* woodlands with patches of semi-evergreen vine thicket (SEVT) in sheltered parts of the gorges. The dominant land zone (Sattler and Williams 1999) in this area is land zone 10 (coarse-grained sediments) with a small area of land zone 3 (alluvium) along Baffle Creek and the Dawson River.

A plateau comprised of the Boxvale Sandstone Member is the most prominent geological feature in the central part of the Site and forms the divide between northern and southern drainages. Soils on the plateau are brown to pale brown sands or reddish-brown sandy loams. The plateau scarps are steep and contain sandy soils and clays with numerous surface rocks and boulders. Vegetation on the plateau has mostly been cleared and formerly comprised *Eucalyptus* spp. woodlands. Vegetation on the scarp is mostly intact and comprises mainly ironbark (*Eucalyptus crebra* and *E. melanophloia*) woodlands on the north-facing slopes and primarily SEVT with small pockets of Brigalow (*Acacia harpophylla*) woodland and open forest on the south-facing slopes. Dominant land zones associated with the plateau include land zone 9 (fine-grained sediments) and land zone 10 (coarse-grained sediments).

Topography to the south of the plateau comprises a series of narrow valleys with low undulating sandstone hills formed on the Evergreen Formation. These valleys have soils ranging from sands and loams to clays. The valleys and hill slopes have been largely cleared and formerly comprised *Eucalyptus* woodlands with patches of Brigalow and SEVT. The valleys drain in a generally southward direction to a major drainage feature, being Hutton Creek. South of Hutton Creek, slopes rise rapidly on the scarps of plateaux of the Boxvale Formation on the adjoining property 'Springwater'. The dominant land zone in the south of the Site is land zone 10 (coarse-grained sediments) with smaller areas of land zone 9 (fine-grained sediments) and land zone 3 (alluvium) along Hutton Creek.

The northern boundary of the Site is bounded by Baffle Creek, which joins the Dawson River to the northeast of the Site. Hutton Creek crosses the Site in the south. These are stream order 4 and 6 watercourses respectively. Streams within the northern half of the Site drain into Baffle Creek while those in the south drain into Hutton Creek. Baffle and Hutton Creeks both flow into the Dawson River and are therefore part of the Fitzroy River Basin. The nearest

weather station to the Site is at Injune within 45 km of the Site. Yearly average temperatures range from a maximum of 33.6°C in January to a minimum of 3.1°C in July (BOM 2015). Average annual rainfall is 636.3 mm, with the highest monthly average rainfall occurring in December (89.1 mm) and the lowest occurring in August (25.2 mm) (BOM 2015).

1.3. Survey Team

Field surveys of the Site were conducted by Craig Eddie (Principal Ecologist) and Angela Bendall (Field Technician) on the 13th to 17th July and by Richard Johnson (Senior Ecologist), Rosamund Aisthorpe (Botanist) and Angela Bendall (Field Technician) between 3rd and 14th August 2015.

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:

- ✦ EPBC Act Protected Matters Search Tool (PMST) (DoTE 2015a);
- ✦ Queensland Department of Environment and Heritage Protection (DEHP) Wildlife Online database (DEHP 2015a);
- ✦ Atlas of Living Australia (ALA) database (ALA 2015);
- ✦ remnant and regrowth REs at the property scale (DNRM 2015a); and
- ✦ Essential Habitat (EH) (DNRM 2015b) and Essential Regrowth Habitat (ERH) mapping (DNRM 2015c).

Data searches were performed using the property lot/plan number or using a 10km buffer around the coordinates - 25.6499°S, 148.9670°E (these equate to the approximate centre point of the Site).

2.2. Field Survey

2.2.1. BioCondition Survey

To assist in the evaluation of the Site's ecological function and condition a series of BioCondition assessments were undertaken. BioCondition assessments were completed at 20 sites which were pre-selected within each mapped AU or RE type (DNRM 2015a) or following field inspection of vegetation at the Site. BioCondition data relevant to RE at the Site was also obtained in field surveys at the adjacent 'Waddy Brae' and 'Springwater' properties (BOOBOOK 2015b, 2015c). Pooling of data for RE on the three properties, which are contiguous and occur on similar topography, have similar vegetation and patterns of land use, allowed for development of condition benchmarks for several RE which lack published benchmarks (DSITIA 2014).

BioCondition assessments were undertaken as per the methodologies described by Eyre *et al.* (2011, 2015). This involved the establishment of a 100 m x 50 m transect containing five assessment areas (plots/quadrats) to record values for defined ecological attributes. These values were used as indicators to provide a quantitative measure for the performance of ecosystem function within the context of biodiversity conditions.

The following information was recorded at each BioCondition site:

- ✦ Date;
- ✦ Observers;
- ✦ Description of location (bioregion, general description, co-ordinates for plot origin and centre, plot bearing and alignment);
- ✦ General habitat description and RE type;
- ✦ Median height for canopy, emergent and subcanopy strata;
- ✦ Slope position/slope degree and slope aspect;

- ✂ Tree species richness (within 100 m x 50 m plot);
- ✂ Native plant species richness (within 50 m x 10 m plot);
- ✂ Non-native plant cover (within 50 m x 10 m plot);
- ✂ Total length of coarse woody debris (length >10 cm diameter and >0.5 m long within 50 m x 20 m plot);
- ✂ Number and average diameter at breast height (DBH) of large eucalypt and non-eucalypt trees (within 100 m x 50 m plot);
- ✂ Recruitment of canopy species (within the 100 m x 50 m plot);
- ✂ Tree and shrub canopy cover (within 100 m transect);
- ✂ Ground cover within 1 m x 1 m plots (native perennial grass and organic litter cover in the ground layer);
- ✂ Disturbances (severity, last event and observation type).

Large tree DBH thresholds for each RE were used where benchmark documents were available, otherwise the default >30 cm DBH for eucalypts and >20 cm DBH for non-eucalypts was applied. For SEVT-dominant communities (i.e. RE 11.9.4, 11.10.8), the threshold for RE 11.9.4 (>17 cm DBH for non-eucalypts) was applied to all sites due to similarities in vegetation structure and composition.

Site photographs were taken using a Canon digital camera in accordance with Eyre *et al.* (2011, 2015) (i.e. one photograph at plot origin and north, east, south and west photographs at the plot centre). Photograph numbers were recorded. Locations of BioCondition sites were determined using a handheld Global Positioning System (GPS) (Garmin GPSmap 78S) and BioCondition assessment data was captured by mobile GIS devices (Motion CFT-003 tablet device).

Field data was recorded using the BioCondition reference site sheet template (Eyre *et al.* 2011) to ensure data was collected consistently for all sites regardless of whether a benchmark document was available for any particular RE or not. Canopy recruit and non-native plant cover attributes are not normally recorded on this template, however this data was added to field sheets so it could be used for calculating BioCondition scores. Site data has been presented as either BioCondition assessment or reference form templates to differentiate between sites with or without published benchmarks. Due to the remoteness and terrain of the BioCondition site locations, permanent 0 m and 50 m markers were not established using steel fence posts as described in the methodology Eyre *et al.* (2015) and Eyre *et al.* (2011).

Scores for BioCondition sites were calculated in accordance with Eyre *et al.* (2015) which compares the values obtained at each survey site with values in the benchmark document for that particular RE (DSITIA 2014). Sub-scores are awarded to each site and landscape attribute then are added together and divided by the maximum possible score for that RE. This provides a numeric value along a continuum of biodiversity condition, where scores closer to 0 indicates that sites are 'dysfunctional' and those closer to 1 indicates that sites have 'functional' condition.

2.2.2. Vegetation Assessment and Mapping

High resolution aerial photography was provided for the Site by Santos in 2015. Detailed review of this imagery enabled a desktop vegetation assessment to be conducted. Potential RE types and their extent were identified as well as determining highly disturbed areas. Examination of imagery enabled vegetation to be divided into four categories:

- ✂ Remnant: woody vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has greater than 70% of the height and greater than 50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy (Neldner *et al.* 2012).
- ✂ Advanced Regrowth: areas previously cleared or disturbed (e.g. by wildfire) and containing well advanced woody vegetation floristically and structurally consistent with the RE but typically <70% of the height and <50% density of the RE. Such regrowth with appropriate management will likely achieve remnant status (potentially <30 years).

- ✦ Young Regrowth: areas previously cleared or disturbed (e.g. by wildfire) and containing varying densities of woody vegetation floristically consistent with the RE type. Such regrowth lacks structural elements typical of the RE but with appropriate management may eventually achieve remnant status (likely >30 years).
- ✦ Non-remnant: areas previously cleared or otherwise significantly disturbed which have little or no woody vegetation present.

Vegetation assessments were undertaken within 50 m x 50 m plots at the BioCondition sites for the purpose of typifying the vegetation community under assessment. Vegetation assessments were consistent with the quaternary level of detail as per Neldner *et al.* (2012).

At each quaternary survey site the following was recorded:

- ✦ height (median and maximum/minimum) and % cover of each stratum of vegetation (i.e. ground, shrub, tree and emergent layers);
- ✦ dominant flora in each stratum of vegetation;
- ✦ RE type mapped and observed;
- ✦ geology, landform and soil descriptions;
- ✦ presence and abundance of weeds (declared and non-declared species) as well as estimated % coverage of the site;
- ✦ a list of all other flora encountered at the survey site.

Determination of RE type and status (as per the Regional Ecosystem Description Database (REDD) (DEHP 2015b)) was possible for areas at and immediately adjoining formal survey sites. REs were also able to be described and mapped for a range of other areas traversed within the Site and areas that were visible from suitable vantage points. Locations of each vegetation survey site were determined using a handheld Global Positioning System (GPS) (Garmin GPSmap 78S) and/or a Motion CFT-003 tablet device. Locations of vegetation survey sites are shown in Appendix A.

Information obtained from the BioCondition survey sites and other field observations was also used to identify TEC by comparison of field assessment results with TEC technical descriptions which include floristic, structural and condition criteria (TSSC 2013, Environment Australia 2003).

Mapping protocols applied to remnant and regrowth RE within this assessment are as follows:

- ✦ Two SEVT communities/REs were recognised as present at the Site. SEVT on coarse-grained sedimentary rocks (RE 11.10.8) was present on colluvium on the lower slopes of gorges (e.g. Baffle Creek) associated with the Precipice Sandstone, where it was readily differentiated and mapped. This RE also occurred on sheltered scarp crests where rocky terrain protected the vegetation from fire. Many of these occurrences were patches too small to be mapped. In many areas this RE was contiguous with larger patches of SEVT present on scarp slopes and growing on soils derived from fine-grained sedimentary rocks (Land Zone 9) and attributable to RE 11.9.4. In this situation, where possible the two REs have been mapped separately but where mapping scale issues prevent differentiation between the two REs, the vegetation is mapped as the dominant RE present. Note that tiny (often <1 ha) patches of SEVT-dominated communities may occur within larger areas of non-SEVT vegetation (e.g. RE 11.10.1, 11.10.7) particularly along cliff lines and other sheltered or long unburnt areas. These areas have not been mapped at the scale of the current mapping.
- ✦ Remnant *Eucalyptus crebra* dominated communities were mapped for the purposes of this assessment as RE 11.10.7 or 11.10.7a (where *Callitris glaucophylla* is co-dominant in the canopy or dominant in the subcanopy). These communities are mapped partly as RE 11.10.1 by DNRM (2015a).
- ✦ Remnant *E. melanophloia* dominated communities were also mapped as RE 11.10.7 (these are mapped partly as RE 11.3.39 by DNRM) as RE 11.10.7 may be dominated by *E. crebra* or *E. melanophloia*.
- ✦ Woodland communities dominated by a mix of *Eucalyptus*, *Corymbia* and *Acacia* spp. occurring on sandstone plateaux and scarps were mapped for the purposes of this assessment as RE 11.10.13. It is acknowledged that minor areas of other RE including 11.10.1, 11.10.3 and 11.10.4 may form components of areas mapped as RE 11.10.13. *Acacia burrowii*-dominated communities are likely to be an artefact of fire history at the Site and are included within the broader interpretation of RE 11.10.3.

Identification of categorised regional ecosystems forms the basis of Assessment Units as per the DEHP (2014) 'Guide to determining terrestrial habitat quality'.

Where cited within this report species names for flora follow Bostock and Holland (2014).

2.2.3. Threatened Fauna Habitat Value Assessment

No comprehensive fauna surveys were undertaken under this Scope of Works. Fauna surveys were limited to incidental observations at BioCondition sites or general property traverses. Where time permitted active searches were conducted particularly targeting threatened reptiles. This included overturning rocks, logs, fallen bark and other ground debris raking leaf litter, peeling loose bark on trees/stumps, checking burrows and crevices with torches, looking for animal traces (scats, sloughs, shells, scratches, diggings and burrows) and scanning logs for basking reptiles.

Fauna habitat assessments were conducted for the following species nominated by Santos:

- ✦ *Dasyurus hallucatus* (Northern Quoll);
- ✦ *Chalinobus dwyeri* (Large-eared Pied Bat, Large Pied Bat);
- ✦ *Nyctophilus corbeni* (South-eastern Long-eared Bat);
- ✦ *Petrogale penicillata* (Brush-tailed Rock-wallaby);
- ✦ *Botaurus poiciloptilus* (Australasian Bittern);
- ✦ *Erythrotriorchis radiatus* (Red Goshawk);
- ✦ *Geophaps scripta scripta* (Squatter Pigeon (Southern));
- ✦ *Neochmia ruficauda ruficauda* (Star Finch);
- ✦ *Poephila cincta cincta* (Black-throated Finch);
- ✦ *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); and
- ✦ *Rheodytes leukops* (Fitzroy River Turtle).

Fauna habitat assessments were undertaken at each BioCondition site. Although BioCondition measures some microhabitat features, such as length of coarse woody debris, and leaf litter cover, not all fauna habitat features likely to be utilised by threatened fauna are measured under the BioCondition methodology. Presence/absence, abundance or density of habitat features was recorded within a 50 m x 50 m plot at each survey site including:

- ✦ embedded and loose rocks and boulders: (estimated % cover);
- ✦ logs (abundance);
- ✦ trees >18m height (abundance);
- ✦ logs with hollows (abundance);
- ✦ trees with hollows (abundance);
- ✦ trees and/or logs with loose bark (abundance);
- ✦ burrows, sinkholes and tunnel erosion (abundance);
- ✦ fallen bark (estimated % cover);
- ✦ shrub layer (estimated % cover);

- ✂ ground cover (estimated % cover);
- ✂ leaf litter (estimated % cover);
- ✂ termite mounds (abundance);
- ✂ mistletoe (abundance);
- ✂ rock structures (caves, overhangs and crevices);
- ✂ cliffs, escarpments and steep rocky slopes within 5km (presence);
- ✂ watercourses with permanent water, pools and riffles and abundant woody/rock cover (presence);
- ✂ cracking clays soils (presence);
- ✂ gilgai and ephemeral wetlands (presence); and
- ✂ canopy dominated by Myrtaceae species (presence).

Habitat feature data allowed assessment of the likelihood of occurrence of the listed fauna at each survey site and, by inference, within similar vegetation (REs) at the Site. Mapping of threatened fauna habitat is based on preliminary remnant and regrowth RE polygons identified during this survey. Field data collected for each fauna habitat assessment has been supplied in electronic format to the client separately.

Where cited within this report species names for fauna follow those used by the Queensland Government's Wildlife Online database (DEHP 2015a).

2.2.4. Survey Limitations

The field investigations undertaken were limited to passive techniques (e.g. no live trapping) and were undertaken in winter only. Additional survey effort would be required to provide a more comprehensive inventory of species, both threatened and common.

Due to the scale and accessibility of the Site and the resources available some vegetation polygons identified within this report have not been ground-truthed. However sufficient sampling of remnant and regrowth RE was conducted to give a high level of confidence in the extrapolation of these field assessments to vegetation in inaccessible areas.

Timing (season) and duration of the survey period (for the Site, 'Waddy Brae' and 'Springwater' properties) during late March to early April and mid-September was favourable for BioCondition assessment (Eyre *et al.* 2011, 2015). As per the methodology, most sites were located >50 m away from any major disturbances (e.g. road/ track) (Eyre *et al.* (2015), however this may not have been possible for sites in REs with limited extents. This is important when undertaking BioCondition reference sites, or 'Best on Offer' (BOO) sites, which need to be carried out in mature and long undisturbed sites to calculate benchmark values averaged over several reference sites.

Five REs occurring at the Site did not have benchmark documents available, these being RE 11.10.1c, RE 11.10.2, RE 11.10.7, RE 11.10.7a and RE 11.10.8. To score these AUs, at least three reference BioCondition sites per unit should be sampled to generate thresholds for each RE. Survey sites should also be placed >3 km apart and within patches >5 ha (Eyre *et al.* 2011). This was not always practical during this survey due to limited access in parts of the Site. Note that, as described above, pooled data from reference sites on Waddy Brae, Fairview and Springwater was used to derive thresholds for each of these RE.

3. Results & Discussion

3.1. BioCondition Assessment

BioCondition assessments were completed at 20 locations at the Site (Appendix A). BioCondition site characteristics and scores are summarised in Table 1. Existing RE benchmark values (DSITIA 2014) were available for eight of the BioCondition sites and their corresponding scores have been calculated and presented below. Twelve BioCondition reference sites were used to derive benchmarks for their REs, and therefore calculation of BioCondition scores, are also given below. Raw data for BioCondition assessment sheets are contained within Appendix B.

Scores for sites in RE 11.9.5 were derived from the comparison of values collected in the field and the ‘western form’ benchmark of the RE. The geographic locality of the Site (within subregion 24) which lies within the western zone and examples of remnant Brigalow (*Acacia harpophylla*) with average height approximately 16 m and average of 39 large trees per hectare at the Site supported using the western benchmark values.

Nine BioCondition sites (FV06, FV07, FV09, FV10, FV11, FV12, FV14, FV15 and FV20) received high scores (>0.80) which indicated vegetation at these sites displayed ‘functional biodiversity condition’. These sites represent examples of remnant RE 11.9.4, RE 11.10.1c, RE 11.10.2, RE 11.10.7, RE 11.10.8 and RE 11.10.13.

The highest score, 0.97, corresponds to BioCondition site FV11, one of two sites assessed within RE 11.10.2. The second RE 11.10.2 BioCondition site FV06 also received a high score of 0.81. These high scores are based on a comparison with a benchmark derived from the average of two sites, which due to the small sample size will have skewed the scores towards 1. Similarly, sites assessed in RE 11.10.1c, RE 11.10.7 and RE 11.10.8 were also measured against benchmarks created from averages of values from three sites each and their scores may be affected similarly. A larger number of reference sites and/or comparison with future-published benchmark documents to account for local variances in vegetation, aspect, geology and disturbance history would provide scores with a higher degree of confidence around their functional biodiversity condition.

The lowest score, 0.42, was calculated for BioCondition site FV17, located in a patch of young RE 11.9.5 regrowth. However no sites received low scores (<0.40) and thus indicated vegetation at none of the sites displayed ‘dysfunctional biodiversity condition’.

Most assessment sites had above average functional biodiversity condition. Eighteen BioCondition sites achieved scores >0.60. All of these sites were within remnant vegetation except for four patches of good quality regrowth RE 11.9.5 (FV16), RE 11.10.7 (FV01 and FV08) and RE 11.10.13 (FV18).

Generally, these scores reflect exposure to various disturbances. For example, the six lowest scoring BioCondition assessments at the Site were recorded in regrowth that most had achieved low values for number of large trees, canopy height and canopy cover. These low scores are likely to be associated with disturbances present at these sites, namely historic clearing and wildfire.

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Table 1: Summary of BioCondition sites and their calculated scores.

BioCondition Survey Site	Site Type	RE	Structural Class/Condition	Field Vegetation Description	Site Score	Landscape Score	BioCondition Score
FV01	Assessment	11.10.7	Young regrowth	<i>Eucalyptus crebra</i> and <i>Acacia longispicata</i> low open forest (young regrowth); sparse midlayer dominated by <i>Alphitonia excelsa</i> and canopy recruits; grassy ground layer dominated by <i>Aristida</i> spp. and <i>Eremochloa bimaculata</i>	0.57	0.95	0.65
FV02	Reference	11.3.39	Remnant	<i>Eucalyptus melanophloia</i> woodland; sparse midlayer of <i>Geijera parviflora</i> , <i>Psydrax odorata</i> , <i>Atalaya hemiglauca</i> and <i>Carissa ovata</i> ; grassy ground layer dominated by <i>Cymbopogon refractus</i> , <i>Dinebra decipiens</i> and other native spp.	0.74	1.00	0.80
FV03	Reference	11.10.8	Remnant	Semi-evergreen vine thicket	0.75	1.00	0.80
FV04	Reference	11.10.7	Remnant	<i>Eucalyptus crebra</i> woodland; very sparse midlayer of <i>Acacia longispicata</i> , <i>Alphitonia excelsa</i> and <i>Acacia burrowii</i> ; grassy ground layer dominated by <i>Bothriochloa decipiens</i> and <i>Eremochloa bimaculata</i> .	0.76	0.90	0.80
FV05	Assessment	11.10.13	Remnant	<i>Corymbia trachyphloia</i> , <i>Eucalyptus rhombica</i> and <i>Angophora leiocarpa</i> woodland; midlayer composed of <i>Callitris endlicheri</i> , <i>Leptospermum lamellatum</i> and <i>Xylomelum cunninghamianum</i> ; low shrub layer dominated by <i>Notelaea</i> sp. Barakula; sparse ground layer of <i>Cleistochloa subjuncea</i> , <i>Aristida</i> sp. and <i>Digitaria</i> sp.	0.61	1.00	0.69
FV06	Reference	11.10.2	Remnant	<i>Eucalyptus longirostrata</i> woodland; midlayer composed of <i>Lophostemon suaveolens</i> and <i>Leptospermum lamellatum</i> ; ground layer composed of <i>Aristida</i> spp., <i>Lomandra longifolia</i> and <i>Scleria sphacelata</i>	0.76	1.00	0.81
FV07	Reference	11.10.8	Remnant	Semi-evergreen vine thicket	0.76	1.00	0.82
FV08	Assessment	11.10.7	Young regrowth	<i>Eucalyptus crebra</i> and <i>E. melanophloia</i> low open woodland (young regrowth); midlayer dominated by <i>Acacia leiocalyx</i> ; grassy ground layer dominated by <i>Aristida</i> spp., <i>Bothriochloa decipiens</i> and <i>Eulalia aurea</i>	0.57	0.90	0.64
FV09	Reference	11.10.7	Remnant	<i>Eucalyptus melanophloia</i> and <i>Callitris glaucophylla</i> open forest; midlayer dominated by <i>Eremophila mitchellii</i> and <i>Acacia leiocalyx</i> ; grassy ground layer composed of <i>Chloris ventricosa</i> , <i>Bothriochloa decipiens</i> and <i>Aristida</i> spp.	0.83	0.90	0.85
FV10	Assessment	11.10.13	Remnant	<i>Eucalyptus tenuipes</i> and <i>Corymbia trachyphloia</i> woodland with associated <i>Lysicarpus angustifolius</i> ; midlayer dominated by <i>Acacia longispicata</i> and <i>Callitris endlicheri</i> ; low shrub layer dominated by <i>Phebalium nottii</i> and <i>Daviesia filipes</i> ; ground layer dominated by <i>Cleistochloa subjuncea</i> .	0.78	1.00	0.83
FV11	Reference	11.10.2	Remnant	<i>Eucalyptus longirostrata</i> woodland with associated <i>Eucalyptus melanophloia</i> ; sparse midlayer composed of <i>Callitris endlicheri</i> ; low shrub layer dominated by <i>Hovea longipes</i> ; grassy ground layer composed of <i>Austrostipa ramosissima</i> and <i>Ancistrachne uncinulata</i> .	0.95	1.00	0.97

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BioCondition Survey Site	Site Type	RE	Structural Class/Condition	Field Vegetation Description	Site Score	Landscape Score	BioCondition Score
FV12	Reference	11.10.1c	Remnant	<i>Eucalyptus fibrosa</i> woodland; midlayer dominated by canopy recruits, <i>Acacia leiocalyx</i> and <i>Geijera parviflora</i> ; grassy ground layer dominated by <i>Ancistrachne uncinulata</i> , <i>Eragrostis lacunaria</i> , <i>Aristida</i> sp. and <i>Scleria sphacelata</i> .	0.94	0.75	0.91
FV13	Assessment	11.10.1	Remnant	<i>Corymbia citriodora</i> subsp. <i>variegata</i> woodland with associated <i>Eucalyptus fibrosa</i> ; midlayer dominated by canopy recruits; grassy ground layer dom. by <i>Eulalia aurea</i> , <i>Aristida</i> spp. and <i>Cenchrus ciliaris</i> .	0.63	0.95	0.70
FV14	Reference	11.10.1c	Remnant	<i>Eucalyptus fibrosa</i> woodland with scattered <i>E. crebra</i> ; midlayer composed of canopy recruits and <i>Callitris glaucophylla</i> ; grassy ground layer dominated by <i>Aristida</i> spp.	0.89	0.90	0.90
FV15	Assessment	11.9.4	Remnant	Semi-evergreen vine thicket	0.84	0.90	0.86
FV16	Assessment	11.9.5	Advanced regrowth	<i>Acacia harpophylla</i> low open forest (advanced regrowth); very sparse shrub layer of canopy recruits; very sparse ground layer of <i>Paspalidium caespitosum</i> .	0.68	0.55	0.66
FV17	Assessment	11.9.5	Young regrowth	<i>Acacia harpophylla</i> low woodland (young regrowth); shrub layer composed of <i>Carissa harpophylla</i> , <i>Eremophila mitchellii</i> and canopy recruits; grassy ground layer dominated by <i>Cenchrus ciliaris</i> .	0.43	0.40	0.42
FV18	Assessment	11.10.13	Young regrowth	<i>Acacia burrowii</i> , <i>Eucalyptus melanophloia</i> and <i>E. exserta</i> low open forest (advanced regrowth); sparse midlayer of canopy recruits and <i>Dodonaea boronifolia</i> ; sparse ground layer of <i>Aristida caput-medusae</i> and <i>Digitaria</i> sp.	0.61	0.80	0.66
FV19	Assessment	11.9.4	Young regrowth	Semi-evergreen vine thicket	0.59	0.20	0.52
FV20	Reference	11.10.7	Remnant	<i>Eucalyptus crebra</i> and <i>E. melanophloia</i> woodland with associated <i>Callitris glaucophylla</i> ; midlayer composed of <i>C. glaucophylla</i> , <i>Acacia decora</i> and <i>A. longispicata</i> ; shrub layer composed of <i>Hovea longipes</i> , <i>Notelaea microcarpa</i> and <i>Cryptandra amara</i> ; grassy ground layer composed of <i>Aristida</i> spp., <i>Chrysopogon fallax</i> and <i>Ancistrachne uncinulata</i> .	0.95	0.55	0.88

3.2. Vegetation Mapping

3.2.1. Desktop Mapping

DNRM (2015a) mapped remnant REs are described (as mapped) in Table 2 and shown in Appendix C.

Table 2: Description of remnant REs mapped by DNRM within the Site.

RE Code	VM Act Class	Biodiversity Status	Short Description (DEHP 2015b)	Extent (ha)
11.10.1	LC	NCAP	<i>Corymbia citriodora</i> woodland on coarse-grained sedimentary rocks	76.2
11.10.7	LC	NCAP	<i>Eucalyptus crebra</i> woodland on coarse-grained sedimentary rocks	1006.9
11.10.4 / 11.10.7	LC / LC	NCAP / NCAP	<i>Eucalyptus decorticans</i> , <i>Lysicarpus angustifolius</i> and/or <i>Eucalyptus</i> spp., <i>Corymbia</i> spp., <i>Acacia</i> spp. woodland on coarse-grained sedimentary rocks / <i>Eucalyptus crebra</i> woodland on coarse-grained sedimentary rocks	9.8
11.10.1 / 11.10.13	LC / LC	NCAP / NCAP	<i>Corymbia citriodora</i> woodland on coarse-grained sedimentary rocks / <i>Eucalyptus</i> spp. and/or <i>Corymbia</i> spp. open forest on scarps and sandstone tablelands	343.7
11.3.39	LC	NCAP	<i>Eucalyptus melanophloia</i> and/or <i>E. chloroclada</i> open woodland on undulating plains and valleys with sandy soils	19.8
11.10.3 / 11.3.25	LC / LC	NCAP / OC	<i>Acacia catenulata</i> or <i>A. shirleyi</i> open forest on coarse-grained sedimentary rocks. Crests and scarps / <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	682.8
11.3.39 / 11.3.2	LC / OC	NCAP / OC	<i>Eucalyptus melanophloia</i> and/or <i>E. chloroclada</i> open woodland on undulating plains and valleys with sandy soils / <i>Eucalyptus populnea</i> woodland on alluvial plains	409.7
11.3.2	OC	OC	<i>Eucalyptus populnea</i> woodland on alluvial plains	0.4
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	441.5

DNRM (2015a) mapped regrowth REs are described (as mapped) in Table 3 and shown in Appendix C.

Table 3: Description of regrowth REs mapped by DNRM within the Site.

RE Code	VM Act Class	Biodiversity Status	Short Description (DEHP 2015b)	Extent (ha)
11.10.7	LC	NCAP	<i>Eucalyptus crebra</i> woodland on coarse-grained sedimentary rocks	144.9
11.10.1 / 11.10.13	LC / LC	NCAP / NCAP	<i>Corymbia citriodora</i> woodland on coarse-grained sedimentary rocks / <i>Eucalyptus</i> spp. and/or <i>Corymbia</i> spp. open forest on scarps and sandstone tablelands	10.3
11.10.3 / 11.3.25	LC / LC	NCAP / OC	<i>Acacia catenulata</i> or <i>A. shirleyi</i> open forest on coarse-grained sedimentary rocks. Crests and scarps / <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	1.4
11.3.39 / 11.3.2	LC / OC	NCAP / OC	<i>Eucalyptus melanophloia</i> and/or <i>E. chloroclada</i> open woodland on undulating plains and valleys with sandy soils / <i>Eucalyptus populnea</i> woodland on alluvial plains	16.5
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	51.1
11.9.5	E	E	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on fine-grained sedimentary rocks	0.4

3.2.2. Ground-truthed Mapping

Ground-truthing and examination of aerial imagery identified 13 remnant and 7 regrowth RE types at the Site. Regrowth REs were assessed as either advanced or young regrowth. Mapping of remnant and regrowth REs based on desktop interpretation and field analysis is presented in Appendix D. The extent (total area) of each mapped remnant and regrowth RE is summarised in Table 4. These RE essentially represent AUs for the Site as defined by the *Guide to Determining Terrestrial Habitat Quality* (DEHP 2014).

Table 4: 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 2015b)	Extent - Remnant (ha)	Extent – Advanced Regrowth (ha)	Extent – Young Regrowth (ha)
11.3.25	LC	OC	<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	68.5	Not identified	Not identified
11.3.39	LC	NCAP	<i>Eucalyptus melanophloia</i> +/- <i>E. chloroclada</i> open woodland on undulating plains and valleys with sandy soils	6.5	Not identified	Not identified
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	358.0	30.8	7.0
11.9.5	E	E	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on fine-grained sedimentary rocks	30.5	19.5	8.9
11.9.7	OC	OC	<i>Eucalyptus populnea</i> , <i>Eremophila mitchellii</i> shrubby woodland on fine-grained sedimentary rocks	Not identified	Not identified	4.1
11.10.1	LC	NCAP	<i>Corymbia citriodora</i> woodland on coarse-grained sedimentary rocks	47.1	Not identified	Not identified
11.10.1c	LC	NCAP	<i>Eucalyptus fibrosa</i> woodland on coarse-grained sedimentary rocks	53.5	Not identified	Not identified
11.10.2	OC	OC	Tall open forest in sheltered gorges on coarse-grained sedimentary rocks	14.3	Not identified	Not identified
11.10.3	LC	NCAP	<i>Acacia catenulata</i> or <i>A. shirleyi</i> open forest on coarse-grained sedimentary rocks. Crests and scarps	55.2	72.5	Not identified
11.10.7	LC	NCAP	<i>Eucalyptus crebra</i> woodland on coarse-grained sedimentary rocks	832.3	126.5	209.8
11.10.7a	LC	NCAP	<i>Eucalyptus crebra</i> woodland on coarse-grained sedimentary rocks	338.8	Not identified	4.4
11.10.8	OC	OC	Semi-evergreen vine thicket on medium to coarse-grained sedimentary rocks	22.8	Not identified	Not identified
11.10.11	LC	NCAP	<i>Eucalyptus populnea</i> , <i>E. melanophloia</i> ± <i>Callitris glaucophylla</i> woodland on coarse-grained sedimentary rocks	7.5	Not identified	Not identified
11.10.13	LC	NCAP	<i>Eucalyptus</i> spp. and/or <i>Corymbia</i> spp. open forest on scarps and sandstone tablelands	1150.7	7.0	34.5

This assessment identified seven remnant RE types which were not mapped by DNRM (2015a) namely:

- ✂ RE 11.9.5;
- ✂ RE 11.10.1c;
- ✂ RE 11.10.2;
- ✂ RE 11.10.3;
- ✂ RE 11.10.7a;
- ✂ RE 11.10.8; and
- ✂ 11.10.11.

This assessment did not identify the presence of two remnant RE types which were mapped by DNRM (2015a) namely:

- ✎ RE 11.3.2; and
- ✎ RE 11.10.4.

3.2.3. Threatened Ecological Communities

The field survey confirmed the presence of two TECs at the Site. The TEC ‘Brigalow (*Acacia harpophylla* dominant and co-dominant)’ is represented by RE 11.9.5, while the TEC ‘Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions’ is represented by RE 11.9.4. Note that the SEVT RE 11.10.8, also present at the Site, is not defined as a component RE in this TEC (TSSC 2001). The mapped extent of TEC at the Site is shown within Appendix E. Note that not all areas of TEC have been ground-truthed, however, there is a high degree of confidence relating to the location and extent of remnant TEC.

For the purposes of this assessment all remnant and advanced regrowth RE that are a listed component of the TEC are mapped as TEC for Brigalow (TSSC 2013). There are currently no condition criteria for SEVT regrowth (TSSC 2001) therefore no SEVT regrowth is mapped as TEC. Table 5 describes the extent (ha) of each TEC. BioCondition site data for remnant REs equivalent to TEC is presented within Appendix B.

Table 5: Description and extent of TEC within the Site.

TEC Description	RE Code	Extent of REs Listed as TEC (ha)	Potential future TEC (ha)
Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant)	11.9.5	50.1*	8.9
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	11.9.4	358.0	37.8**

*includes remnant and advanced regrowth of the REs

** includes advanced and young regrowth of the RE

RE 11.9.5 is a component RE of the Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC (TSSC 2013). To be classified as TEC vegetation conforming to the RE description vegetation must also meet certain structural, floristic and condition criteria. Regrowth vegetation must contain the species composition and structural elements found in undisturbed (remnant) RE. Typically, regrowth greater than 15 years old is considered to contain these features (TSSC 2013). Both remnant and regrowth must be in good condition. Butler (2007) defined component RE in poor condition as having one or more of the following characteristics: vegetation that has been cleared within 15 years; vegetation in which exotic perennial plants have more than 50% cover, assessed in a minimum area of 0.5 ha; and individual patches of Brigalow that are smaller than 0.5 ha.

Areas of advanced and young regrowth of RE 11.9.5 were sampled during the field survey. General field observations noted that young regrowth comprises a layer of Brigalow shrubs from 1 to 5 metres height. A lower shrub layer has not yet formed and the species associated with the subcanopy (e.g. *Geijera parviflora*, *Eremophila mitchellii*) and emergent layers are absent or very rare. Though this vegetation has the potential in time to develop to remnant status young regrowth does not currently meet TEC criteria in that it lacks some of the structural elements typical of the RE (TSSC 2013). For the purposes of this assessment all identified advanced Brigalow regrowth is mapped as TEC.

3.3. Threatened Fauna

3.3.1. Likelihood of Occurrence Assessment

Searches of Wildlife Online (DEHP 2015a) and Atlas of Living Australia (ALA 2015) databases did not indicate the recorded presence of any EPBC Act or NC Act listed fauna. Though animals were not observed directly, evidence of the presence of Koala (*Phascolarctos cinereus*) was obtained at two locations. Scats were found beneath an ironbark in RE 11.10.13 at survey site FV05, and characteristic scratches on the bark of Grey Gums (*Eucalyptus longirostrata*) were common in RE 11.10.2 at survey site FV11.

General habitat requirements and distribution for all EPBC Act and NC Act species nominated for assessment under the Scope of Works is provided in Table 6. Analysis of distributional data indicates that three of these species do not

occur at the Site, these being the Brush-tailed Rock-wallaby (*Petrogale penicillata*), Fitzroy River Turtle (*Rheodytes leukops*) and Ornamental Snake (*Denisonia maculata*). Two other species recorded historically from the region, the Black-throated Finch (*Poephila tincta tincta*) and Star Finch (Eastern) (*Neochmia ruficauda ruficauda*), may have formerly occurred at the Site. However, the ranges of these species have contracted markedly and both are likely to be extinct in southern Queensland, including the Site.

Table 6: General habitat requirements and distribution of threatened fauna assessed for the Site.

Class	Scientific/ Common Name	NC Act Status	EPBC Act Status	PMST Likelihood of Occurrence (DoTE 2015a)	General Habitat Requirements	Site Distribution Context
Birds	<i>Botaurus poiciloptilus</i> Australasian Bittern	LC	E	-	Well-vegetated permanent and ephemeral wetlands dominated by sedges, rushes (and sometimes in rice-fields and other irrigated areas) (DoTE 2015b)	Within (at limits of) species known range (Birdlife Australia 2015).
	<i>Erythrotriorchis radiatus</i> Red Goshawk	E	V	species or species habitat likely to occur within area	Woodlands and open forests, especially near permanent water bodies; high prey bird populations; tall trees for nest site (Marchant and Higgins 1993).	Within (at limits of) species known range (Birdlife Australia 2015).
	<i>Geophaps scripta scripta</i> Squatter Pigeon (southern)	V	V	species or species habitat likely to occur within area	Grassy woodlands with open areas for foraging habitat; usually nearby water source (Higgins and Davies 1996).	Within species known range (Birdlife Australia 2015).
	<i>Neochmia ruficauda ruficauda</i> Star Finch (eastern, southern)	E	E	species or species habitat likely to occur within area	Tall grasslands often associated with watercourses (DoTE 2015b).	Within species known historical range (Birdlife Australia 2014) but the subspecies is possibly extinct (Garnett <i>et al.</i> 2011).
	<i>Poephila cincta cincta</i> Black-throated Finch	E	E	-	Grassy open woodlands and forests typically dominated by <i>Eucalyptus</i> , <i>Corymbia</i> and <i>Melaleuca</i> and occasionally in tussock grasslands (DoTE 2015b) usually within a few kilometres of a water source (Grice 2012).	Within species known historical range (Birdlife Australia 2015) but there are no recent records from southern Queensland (DoTE 2015b) and may be locally extinct
	<i>Rostratula australis</i> Australian Painted Snipe	V	E	species or species habitat may occur within area	Forages at shallow edges and adjacent vegetated margins of freshwater wetlands (DoTE 2015b).	Within species known range (Birdlife Australia 2015).
	<i>Turnix melanogaster</i> Black-breasted Button-quail	V	V	-	SEVT and other closed forest types with dense leaf litter and low shrubs (DoTE 2015b, Mathieson and Smith 2009).	At edge of species known range (Birdlife Australia 2015).
Mammals	<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	V	V	species or species habitat likely to occur within area	Forages in open forests and woodlands and roosts in adjacent caves and overhangs of cliffs and rocky hills; occasionally shelters in disused Fairy Martin nests (Hoye and Schultz 2008).	Within species known range (Churchill 2008);
	<i>Dasyurus hallucatus</i> Northern Quoll	LC	E	species or species habitat known to occur within area	Shelter in crevices in rocky hills and escarpments; forage in associated woodland and forest habitats (DoTE 2015b).	Within species historical range (Oakwood 2008) though recent records are lacking (DEHP 2015b).

Class	Scientific/ Common Name	NC Act Status	EPBC Act Status	PMST Likelihood of Occurrence (DoTE 2015a)	General Habitat Requirements	Site Distribution Context
	<i>Nyctophilus corbeni</i> South-eastern Long-eared Bat	V	V	species or species habitat may occur within area	<i>Eucalyptus</i> and <i>Callitris</i> woodlands and roosts in tree hollows and crevices and under loose bark (DoTE 2015b).	Within species known range (Churchill 2008).
	<i>Petrogale penicillata</i> Brush-tailed Rock-wallaby	V	V	-	Rocky habitats, including loose boulder-piles, rocky outcrops, steep rocky slopes, cliffs, gorges and isolated rock stacks (DoTE 2015b).	Outside of species known range (Lundie-Jenkins 2012).
Reptiles	<i>Delma torquata</i> Collared Delma	V	V	species or species habitat may occur within area	Occupies eucalypt woodlands and open forests; lives under surface rock and large woody debris (Wilson 2005).	Within species known/predicted range (DSEWPaC 2011a) though occupancy within range apparently patchy.
	<i>Denisonia maculata</i> Ornamental Snake	V	V	species or species habitat may occur within area	Woodland and grassland with cracking clay soils, usually in close proximity to at least seasonally wet areas e.g. billabongs, gilgais, floodplains, riparian corridors (DoTE 2015b).	At edge of species known range (DSEWPaC 2011a) with no records for the upper Dawson catchment upstream of about Theodore (ALA 2015).
	<i>Egernia rugosa</i> Yakka Skink	V	V	species or species habitat may occur within area	Woodland and open forest, also derived grassland with regrowth trees; requires suitable soils for burrows, sinkholes, abandoned rabbit warrens or large fallen woody material for shelter (Eddie 2012).	Within species known range (Wilson 2005).
	<i>Furina dunmalli</i> Dunmall's snake	V	V	species or species habitat may occur within area	<i>Eucalyptus</i> , <i>Acacia</i> and <i>Callitris</i> woodlands and open forests; may be reliant on presence of abundant fallen woody debris (Hobson 2012).	Within species known range (DSEWPaC 2011a);
	<i>Rheodytes leukops</i> Fitzroy River Turtle	V	V	species or species habitat may occur within area	Dependent on permanent streams with a preference for deep pools often with intervening riffle zones (DoTE 2015b).	Outside of known range (not recorded within upper drainages of the Fitzroy River catchment) (Limpus <i>et al.</i> 2011).

An assessment of fauna microhabitat features observed and recorded at each BioCondition site is summarised in Table 7. The presence or absence (and abundance) of fauna microhabitat features as well as incorporation of local distribution information and expert knowledge has also informed the likelihood of occurrence assessment for threatened fauna at the Site (Table 7).

Table 7: Fauna microhabitat features and predicted occurrence of nominated threatened fauna at the Site.

BioCondition Survey Site	RE	Microhabitat Features Present	Predicted Occurrence of Threatened Fauna Based on Microhabitat Habitat Features Present
FV01	11.10.7 (young regrowth)	Fallen bark, leaf litter, ground cover, coarse woody debris, hollow logs, trees/logs with loose bark, cliffs within 5km, myrtaceous canopy	Nil Potential future: Large-eared Pied Bat, Collared Delma, Squatter Pigeon (Southern), Yakka Skink, Dunmall's Snake, South-eastern Long-eared Bat

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BioCondition Survey Site	RE	Microhabitat Features Present	Predicted Occurrence of Threatened Fauna Based on Microhabitat Habitat Features Present
FV02	11.3.39 (remnant)	Embedded and loose rock, boulders, leaf litter, ground cover, coarse woody debris, hollow-bearing trees, trees/logs with loose bark, termite mounds, cliffs within 5km, myrtaceous canopy	Northern Quoll, Large-eared Pied Bat, Collared Delma, Squatter Pigeon (Southern), Yakka Skink, Dunmall's Snake, South-eastern Long-eared Bat
FV03	11.10.8 (remnant)	Embedded and loose rocks, boulders, dense shrub layer, leaf litter, ground cover, crevices and ledges, coarse woody debris, hollow-bearing trees, trees/logs with loose bark, cliffs within 5km	Northern Quoll, Large-eared Pied Bat, Black-breasted Button-quail, South-eastern Long-eared Bat
FV04	11.10.7 (remnant)	Fallen bark, leaf litter, ground cover, coarse woody debris, hollow logs, hollow-bearing trees, trees/logs with loose bark, termite mounds, cliffs within 5km, myrtaceous canopy	Northern Quoll, Large-eared Pied Bat, Collared Delma, Squatter Pigeon (Southern), Yakka Skink, Dunmall's Snake, South-eastern Long-eared Bat
FV05	11.10.13 (remnant)	Embedded and loose rocks, boulders, fallen bark, leaf litter, ground cover, coarse woody debris, hollow logs, hollow-bearing trees, trees/logs with loose bark, termite mounds, cliffs within 5km, myrtaceous canopy	Northern Quoll, Large-eared Pied Bat, Collared Delma, Squatter Pigeon (Southern), Yakka Skink, Dunmall's Snake, South-eastern Long-eared Bat
FV06	11.10.2 (remnant)	Embedded and loose rocks, boulders, crevices and ledges, overhangs and caves, trees >18m, fallen bark, leaf litter, ground cover, coarse woody debris, hollow-bearing trees, trees/ with loose bark, cliffs within 5km, myrtaceous canopy	Northern Quoll, Large-eared Pied Bat, Red Goshawk, Collared Delma, Squatter Pigeon (Southern), Yakka Skink, Dunmall's Snake, South-eastern Long-eared Bat
FV07	11.10.8 (remnant)	Embedded and loose rocks, boulders, dense shrub layer, leaf litter, ground cover, crevices and ledges, coarse woody debris, hollow-bearing trees, trees/logs with loose bark, cliffs within 5km	Northern Quoll, Large-eared Pied Bat, Black-breasted Button-quail, South-eastern Long-eared Bat
FV08	11.10.7 (young regrowth)	Leaf litter, ground cover, sinkholes/tunnel erosion, coarse woody debris, hollow logs, trees/logs with loose bark, cliffs within 5km, myrtaceous canopy	Nil Potential future: Northern Quoll, Large-eared Pied Bat, Collared Delma, Squatter Pigeon (Southern), Yakka Skink, Dunmall's Snake, South-eastern Long-eared Bat
FV09	11.10.7 (remnant)	Embedded and loose rocks, fallen bark, leaf litter, ground cover, coarse woody debris, hollow logs, trees/logs with loose bark, cliffs within 5km, myrtaceous canopy	Northern Quoll, Large-eared Pied Bat, Collared Delma, Squatter Pigeon (Southern), Yakka Skink, Dunmall's Snake, South-eastern Long-eared Bat

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BioCondition Survey Site	RE	Microhabitat Features Present	Predicted Occurrence of Threatened Fauna Based on Microhabitat Habitat Features Present
FV10	11.10.13 (remnant)	Embedded and loose rocks, boulders, crevices and ledges, fallen bark, leaf litter, ground cover, coarse woody debris, hollow logs, hollow-bearing trees, trees/logs with loose bark, cliffs within 5km, myrtaceous canopy	Northern Quoll, Large-eared Pied Bat, Collared Delma, Squatter Pigeon (Southern), Yakka Skink, Dunmall's Snake, South-eastern Long-eared Bat
FV11	11.10.2 (remnant)	Embedded and loose rocks, boulders, crevices and ledges, overhangs and caves, trees >18m, fallen bark, leaf litter, ground cover, coarse woody debris, hollow logs, hollow-bearing trees, trees/ with loose bark, cliffs within 5km, myrtaceous canopy	Northern Quoll, Large-eared Pied Bat, Red Goshawk, Collared Delma, Squatter Pigeon (Southern), Yakka Skink, Dunmall's Snake, South-eastern Long-eared Bat
FV12	11.10.1c (remnant)	Fallen bark, leaf litter, ground cover, coarse woody debris, hollow logs, hollow-bearing trees, trees/logs with loose bark, cliffs within 5km, myrtaceous canopy	Northern Quoll, Large-eared Pied Bat, Collared Delma, Squatter Pigeon (Southern), Yakka Skink, Dunmall's Snake, South-eastern Long-eared Bat
FV13	11.10.1 (remnant)	Fallen bark, leaf litter, ground cover, coarse woody debris, hollow logs, hollow-bearing trees, trees >18m, cliffs within 5km, myrtaceous canopy	Northern Quoll, Large-eared Pied Bat, Red Goshawk, Collared Delma, Squatter Pigeon (Southern), Yakka Skink, Dunmall's Snake, South-eastern Long-eared Bat
FV14	11.10.1c (remnant)	Fallen bark, leaf litter, ground cover, coarse woody debris, hollow logs, trees >18m, hollow-bearing trees, trees/logs with loose bark, cliffs within 5km, myrtaceous canopy	Northern Quoll, Large-eared Pied Bat, Red Goshawk, Collared Delma, Squatter Pigeon (Southern), Yakka Skink, Dunmall's Snake, South-eastern Long-eared Bat
FV15	11.9.4 (remnant)	Embedded and loose rocks, boulders, crevices and ledges, overhangs and caves, fallen bark, leaf litter, ground cover, trees >18m, coarse woody debris, hollow logs, hollow-bearing trees, trees/logs with loose bark, mistletoe, cliffs within 5km	Northern Quoll, Large-eared Pied Bat, Black-breasted Button-quail, Red Goshawk, South-eastern Long-eared Bat
FV16	11.9.5 (advanced regrowth)	Embedded and loose rocks, boulders, leaf litter, ground cover, coarse woody debris, cliffs within 5km	Northern Quoll, Large-eared Pied Bat, Collared Delma, Yakka Skink, Dunmall's Snake, South-eastern Long-eared Bat, Red Goshawk, Squatter Pigeon (southern)
FV17	11.9.5 (young regrowth)	Leaf litter, ground cover, coarse woody debris, cliffs within 5km	Nil Potential future: Northern Quoll, Red Goshawk, Large-eared Pied Bat, Collared Delma, Yakka Skink, Dunmall's Snake, South-eastern Long-eared Bat, Squatter Pigeon (southern)
FV18	11.10.13 (young regrowth)	Embedded and loose rocks, leaf litter, ground cover, coarse woody debris, cliffs within 5km	Nil Potential future: Northern Quoll, Red Goshawk, Large-eared Pied Bat, Collared Delma, Squatter Pigeon (Southern), Yakka Skink, Dunmall's Snake, South-eastern Long-eared Bat

BioCondition Survey Site	RE	Microhabitat Features Present	Predicted Occurrence of Threatened Fauna Based on Microhabitat Habitat Features Present
FV19	11.9.4 (young regrowth)	Embedded and loose rocks, boulders, fallen bark, leaf litter, ground cover, coarse woody debris, burrows, trees/logs with loose bark, mistletoe, cliffs within 5km	Nil Potential future: Northern Quoll, Large-eared Pied Bat, Black-breasted Button-quail, South-eastern Long-eared Bat
FV20	11.10.7 (remnant)	Embedded and loose rocks, fallen bark, leaf litter, ground cover, trees >18m, coarse woody debris, hollow logs, hollow-bearing trees, trees/logs with loose bark, myrtaceous canopy	Northern Quoll, Large-eared Pied Bat, Red Goshawk, Collared Delma, Squatter Pigeon (Southern), Yakka Skink, Dunmall's Snake, South-eastern Long-eared Bat

3.3.2. Threatened Fauna Predictive Habitat Mapping

Results of microhabitat analyses provided a basis for the indicative presence of threatened fauna based on the microhabitat requirements of each species. Predictive fauna habitat mapping based on these analyses and expert knowledge is shown within Appendix F. Summary data for the estimated extent of General Habitat and Potential Future Habitat for each fauna species is presented in Table 8.

Table 8. List of potentially suitable REs and estimated extent of potentially suitable habitat for nominated threatened fauna at the Site.

Species name	Potentially Suitable REs	Mapped extent of General Habitat (ha)	Mapped extent of Potential Future Habitat (ha)	Habitat Mapping Rules/Notes
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	11.3.25, 11.3.39, 11.9.4, 11.9.5, 11.9.7, 11.10.1, 11.10.11, 11.10.13, 11.10.1c, 11.10.2, 11.10.3, 11.10.7, 11.10.7a & 11.10.8	3242.1	268.8	<ul style="list-style-type: none"> ✦ Mapped General Habitat includes all areas of remnant vegetation and advanced regrowth that may be suitable for foraging or shelter. ✦ Young regrowth of all REs represents Potential Future Habitat. ✦ RE 11.9.4 is included on the basis that this RE may contain potentially suitable shelter sites.
<i>Dasyurus hallucatus</i> Northern Quoll	11.3.25, 11.3.39, 11.9.4, 11.9.5, 11.9.7, 11.10.1, 11.10.11, 11.10.13, 11.10.1c, 11.10.2, 11.10.3, 11.10.7, 11.10.7a & 11.10.8	3242.1	268.8	<ul style="list-style-type: none"> ✦ Mapped General Habitat includes all remnant and advanced regrowth vegetation (includes foraging habitat and vegetation containing potentially suitable den sites). ✦ Young regrowth of all REs represents Potential Future Habitat.
<i>Nyctophilus corbeni</i> South-eastern Long-eared Bat	11.3.25, 11.3.39, 11.9.4, 11.9.5, 11.9.7, 11.10.1, 11.10.11, 11.10.13, 11.10.1c, 11.10.2, 11.10.3, 11.10.7, 11.10.7a & 11.10.8	3242.1	268.8	<ul style="list-style-type: none"> ✦ Mapped General Habitat includes all areas of remnant vegetation and advanced regrowth that may be suitable for foraging or shelter. ✦ Young regrowth of all REs represents Potential Future Habitat.
<i>Petrogale penicillata</i> Brush-tailed Rock-wallaby	N/A	nil	nil	<ul style="list-style-type: none"> ✦ The Site is not within the range of this species (Lundie-Jenkins 2012).

Species name	Potentially Suitable REs	Mapped extent of General Habitat (ha)	Mapped extent of Potential Future Habitat (ha)	Habitat Mapping Rules/Notes
<i>Botaurus poiciloptilus</i> Australasian Bittern	11.3.25	68.5	nil	✂ Mapped General Habitat includes all remnant 11.3.25. However, no mapping is available for preferred habitat within this RE (off-stream shallow vegetated wetlands).
<i>Erythrotriorchis radiatus</i> Red Goshawk	11.3.25, 11.3.39, 11.9.4, 11.9.5, 11.9.7, 11.10.1, 11.10.11, 11.10.13, 11.10.1c, 11.10.2, 11.10.3, 11.10.7, 11.10.7a & 11.10.8	3242.1	268.8	✂ Mapped General Habitat includes all remnant and advanced regrowth of potentially suitable REs. ✂ Young regrowth of all REs represents Potential Future Habitat with appropriate rehabilitation. ✂ This species may also forage within sub-optimal and non-remnant vegetation throughout the Site.
<i>Geophaps scripta scripta</i> Squatter Pigeon	11.3.25, 11.3.39, 11.9.5, 11.9.7, 11.10.1, 11.10.11, 11.10.13, 11.10.1c, 11.10.2, 11.10.3, 11.10.7 & 11.10.7a	2830.5	261.8	✂ Mapped General Habitat includes remnant and advanced regrowth of potentially suitable REs. ✂ Advanced regrowth of all REs represents Potential Future Habitat with appropriate rehabilitation. ✂ This species may also forage within non-remnant vegetation.
<i>Neochmia ruficauda ruficauda</i> Star Finch (Eastern)	11.3.25	68.5	nil	✂ Mapped General Habitat includes remnant 11.3.25. ✂ This species may potentially forage elsewhere on the Site. ✂ Note that this subspecies is considered likely to be extinct in Queensland (Garnett <i>et al.</i> 2011).
<i>Poephila cincta cincta</i> Black-throated Finch	11.3.25	68.5	nil	✂ Mapped General Habitat includes remnant 11.3.25. ✂ This species may potentially forage elsewhere on the Site. ✂ Note that there are no recent records for southern Queensland (DoTE 2015b, Birdlife Australia 2015).
<i>Rostratula australis</i> Australian Painted Snipe	11.3.25	68.5	nil	✂ Mapped General Habitat includes all remnant RE 11.3.25. However, no mapping is available for preferred habitat within this RE (off-stream shallow vegetated wetlands)
<i>Turnix melanogaster</i> Black-breasted Button-quail	11.9.4 & 11.10.8	411.2	7.0	✂ Mapped General Habitat includes all remnant and advanced regrowth RE 11.9.4 and 11.10.8 that have linkages to other woody vegetation. ✂ Young regrowth of RE 11.9.4 represents Potential Future Habitat with appropriate rehabilitation.
<i>Delma torquata</i> Collared Delma	11.3.39, 11.9.5, 11.9.7, 11.10.1, 11.10.11, 11.10.13, 11.10.1c, 11.10.2, 11.10.3, 11.10.7 & 11.10.7a	2761.9	261.8	✂ Mapped General Habitat includes all areas of remnant and advanced regrowth of all REs except RE 11.9.4 and 11.10.8. ✂ Young regrowth of potentially suitable REs has been mapped as Potential Future Habitat.
<i>Denisonia maculata</i> Ornamental Snake	N/A	nil	nil	✂ No General Habitat has been mapped for this species as no suitable habitat is considered to be present. The presence of the species at the Site is unconfirmed and doubtful.

Species name	Potentially Suitable REs	Mapped extent of General Habitat (ha)	Mapped extent of Potential Future Habitat (ha)	Habitat Mapping Rules/Notes
<i>Egernia rugosa</i> Yakka Skink	11.3.39, 11.9.5, 11.9.7, 11.10.1, 11.10.11, 11.10.13, 11.10.1c, 11.10.2, 11.10.3, 11.10.7 & 11.10.7a	2761.9	261.8	<ul style="list-style-type: none"> ✦ Mapped General Habitat includes all remnant vegetation and advanced regrowth of the nominated REs. ✦ Young regrowth of potentially suitable REs has been mapped as Potential Future Habitat.
<i>Furina dunmalli</i> Dunmall's Snake	11.3.25, 11.3.39, 11.9.5, 11.9.7, 11.10.1, 11.10.11, 11.10.13, 11.10.1c, 11.10.2, 11.10.3, 11.10.7 & 11.10.7a	2830.5	261.8	<ul style="list-style-type: none"> ✦ Mapped General Habitat includes all remnant vegetation and advanced regrowth of the nominated REs. ✦ Young regrowth of potentially suitable REs has been mapped as Potential Future Habitat.
<i>Rheodytes leukops</i> Fitzroy River Turtle	N/A	nil	nil	<ul style="list-style-type: none"> ✦ The Site is not within the range of this species (Limpus <i>et al.</i> 2011).

4. Recommendations

No fauna surveys conducted in accordance with best practice State (Eyre *et al.* 2012, Ferguson and Mathieson 2014) and/or Commonwealth (DEWHA 2010b, 2010c; DSEWPaC 2011b, 2011c) survey guidelines have been undertaken for the nominated species under this Scope of Works. It is recommended that surveys for the target fauna nominated as potentially occurring at the Site be conducted in accordance with State applicable survey guidelines at appropriate times. Such surveys would potentially confirm presence of these and additional threatened fauna species, contribute to documentation of habitat utilisation and significant habitats for threatened species as well as potentially informing management planning documents.

5. Conclusions

The desktop assessment and preliminary field survey confirmed the following ecological values are present at the Site:

- ✦ Approximately 50.1 ha of Brigalow (*Acacia harpophylla* dominant and dominant) TEC.
- ✦ Approximately 358.0 ha of 'Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions' TEC.
- ✦ Presence of 14 RE types.
- ✦ Confirmed presence of habitat potentially suitable for the following threatened fauna:
 - *Dasyurus hallucatus* (Northern Quoll) – 3242.1 ha;
 - *Chalinolobus dwyeri* (Large-eared Pied Bat, Large Pied Bat) – 3242.1 ha;
 - *Nyctophilus corbeni* (Eastern Long-eared Bat) – 3242.1 ha;
 - *Botaurus poiciloptilus* (Australasian Bittern) – 68.5 ha;
 - *Geophaps scripta scripta* (Squatter Pigeon (Southern)) – 2830.5 ha;
 - *Erythrotriorchis radiatus* (Red Goshawk) – 3242.1 ha;
 - *Neochmia ruficauda ruficauda* (Eastern Star Finch) – 68.5 ha;
 - *Poephila cincta cincta* (Black-throated Finch) – 68.5 ha;
 - *Rostratula australis* (Australian Painted Snipe) - 68.5 ha;
 - *Turnix melanogaster* (Black-breasted Button-quail) – 411.2 ha;

- *Delma torquata* (Collared Delma) – 2761.9 ha;
- *Egernia rugosa* (Yakka Skink) – 2773.0 ha; and
- *Furina dunmalli* (Dunmall's Snake) – 2830.5 ha.

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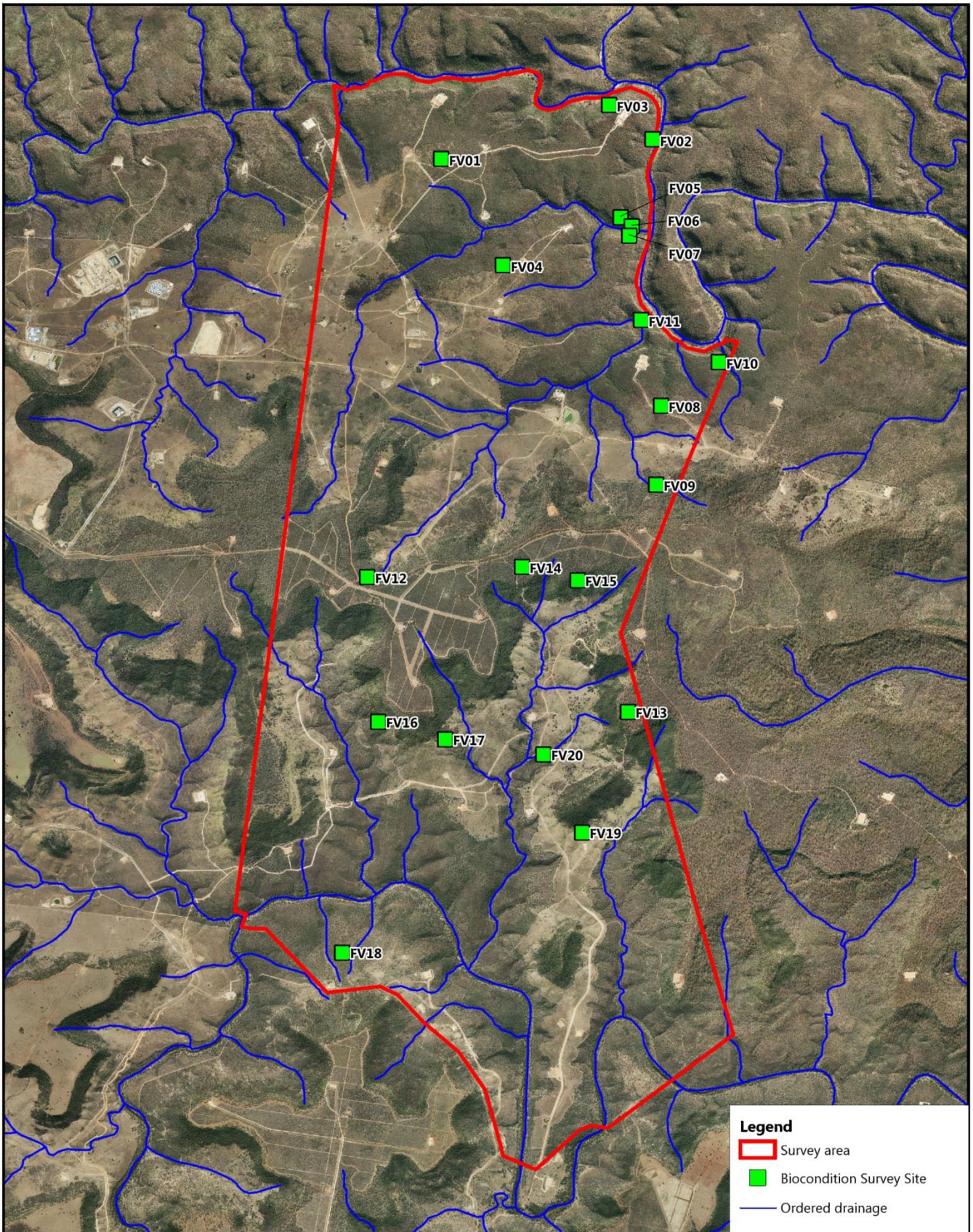
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Appendix A. Site Location & Survey Sites.



**Appendix A
Site Location
& Survey Sites**

1 October 2015

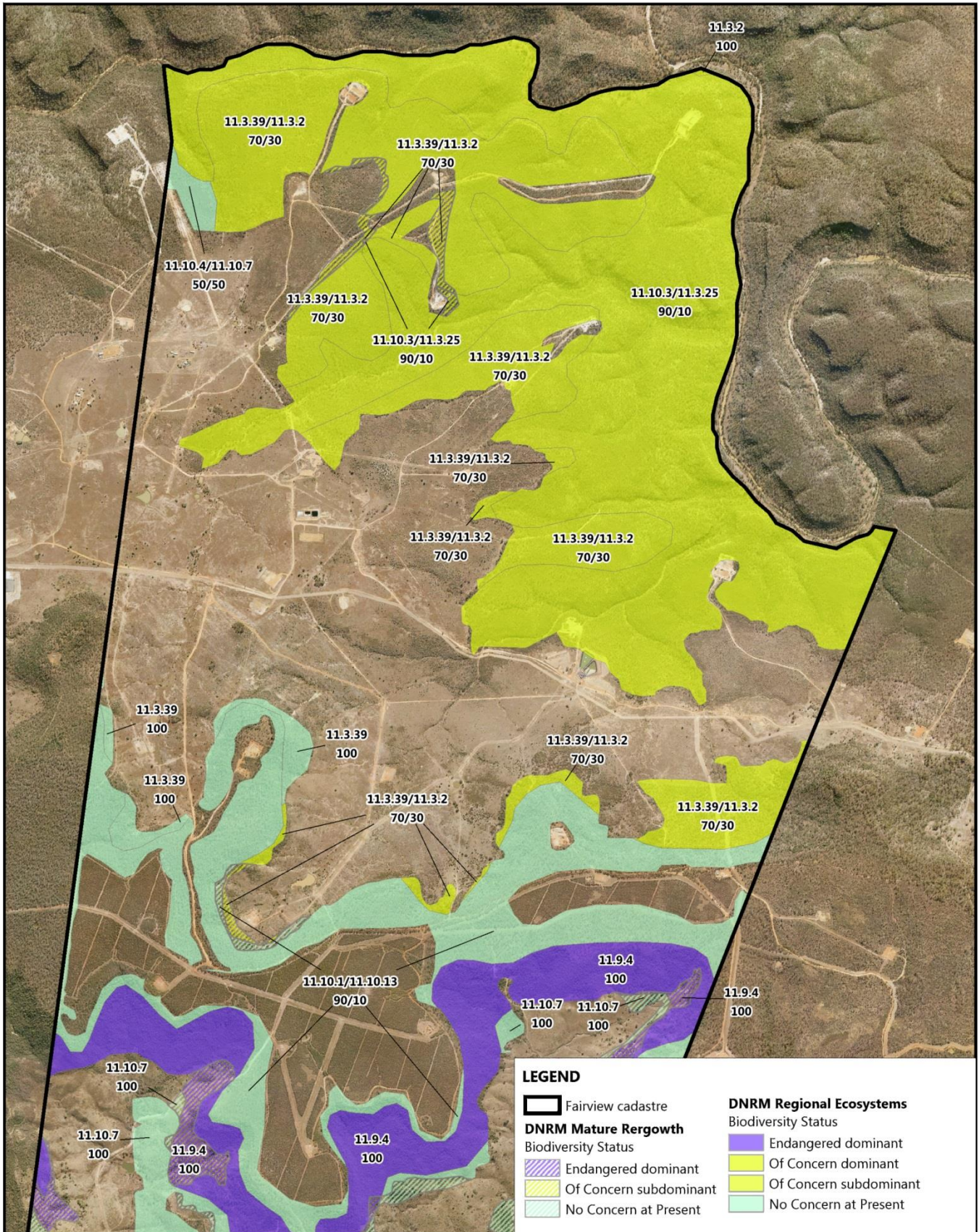


MGA Zone 55 (GDA 94)

Scale: 1:60 000 @ A4

Appendix B. BioCondition Assessment Field Sheets.

Appendix C. DNRM Mapped Regional Ecosystems.



Appendix C1
DNRM Mapped Regional Ecosystems - North Region



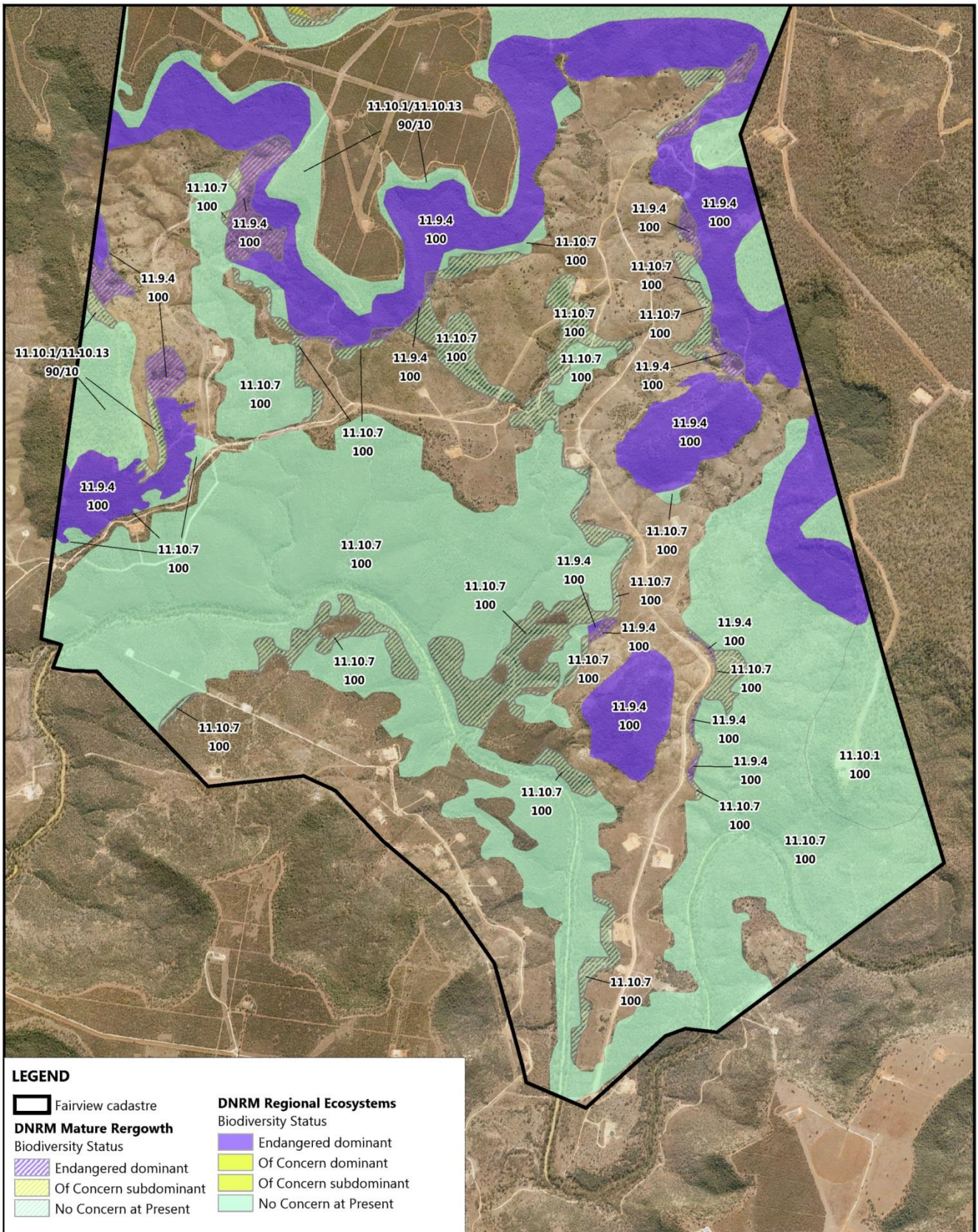
1 October 2015



500 0 500 1000 m

MGA Zone 55 (GDA 94)

Scale: 1:32 000 @ A4



LEGEND

- | | |
|------------------------------|---------------------------------|
| Fairview cadastre | DNRM Regional Ecosystems |
| DNRM Mature Rergrowth | Biodiversity Status |
| Biodiversity Status | Endangered dominant |
| Endangered dominant | Of Concern dominant |
| Of Concern subdominant | Of Concern subdominant |
| No Concern at Present | No Concern at Present |



**Appendix C2
DNRM Mapped Regional
Ecosystems - South Region**

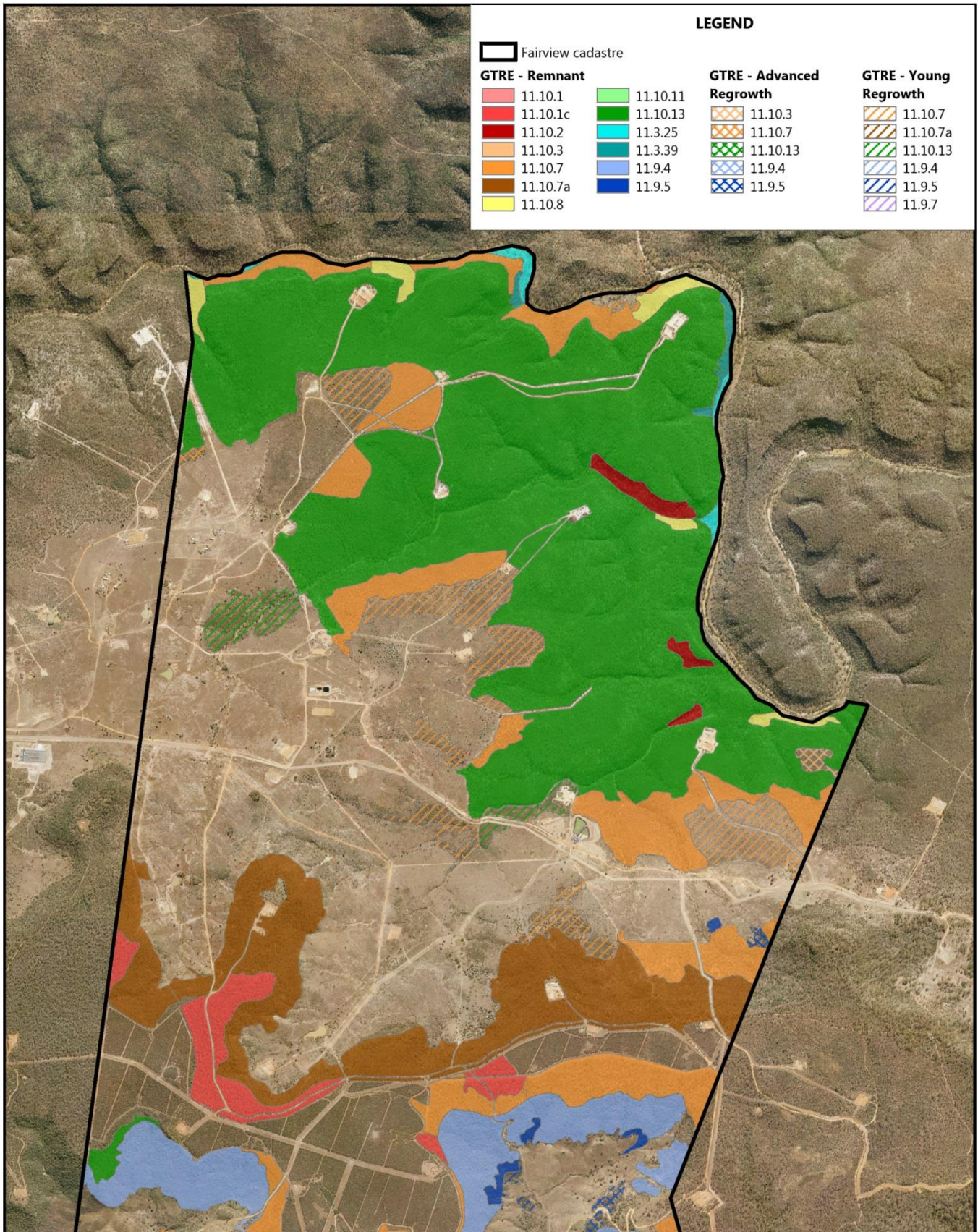
1 October 2015



MGA Zone 55 (GDA 94)

Scale: 1:32 000 @ A4

Appendix D. Ground-truthed Vegetation Mapping



**Appendix E1
Ground-truthed Regional
Ecosystems - North Region**

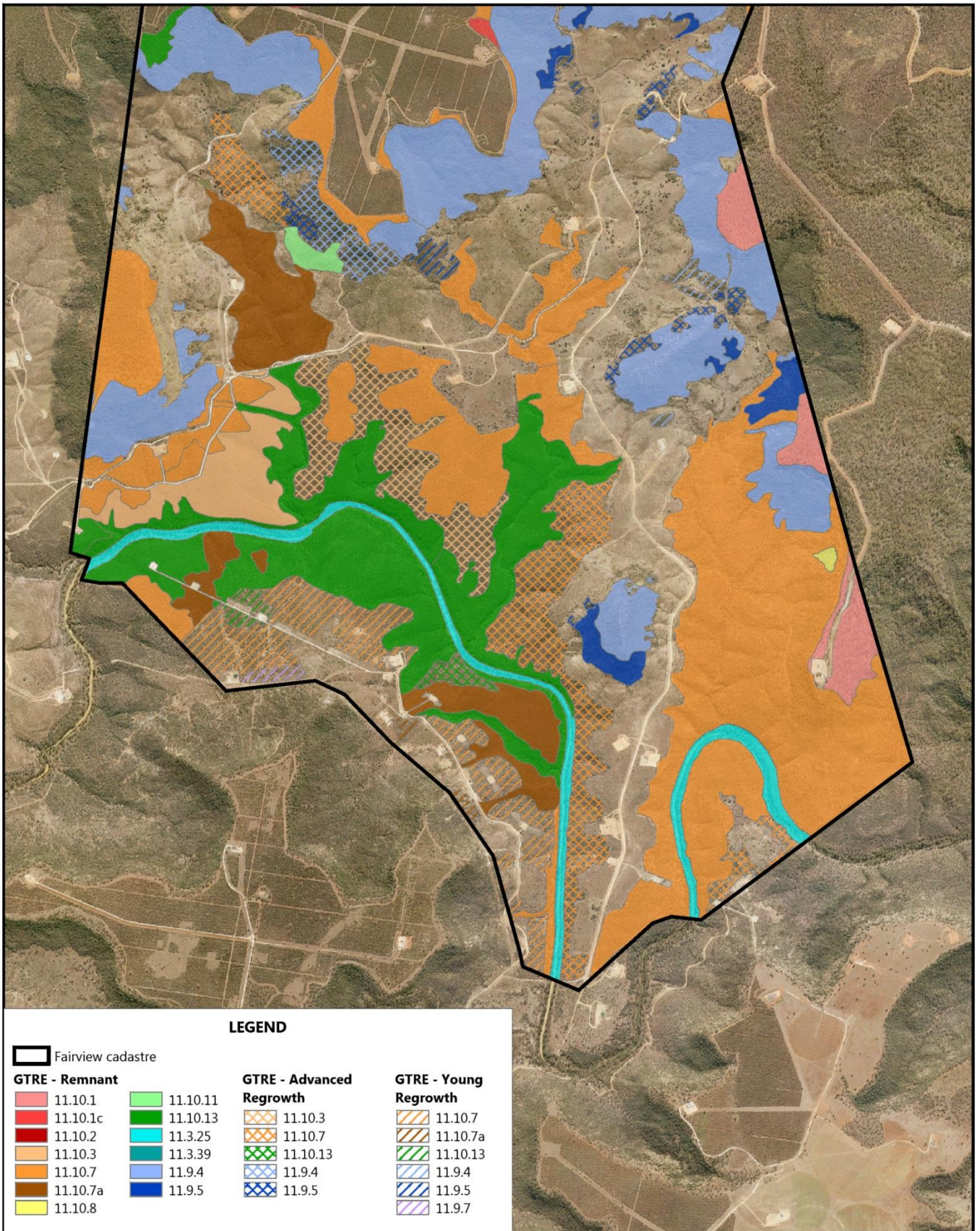
1 October 2015



600 0 600 1200 m

MGA Zone 55 (GDA 94)

Scale: 1:35 000 @ A4



Appendix E2
Ground-truthed Regional
Ecosystems - South Region

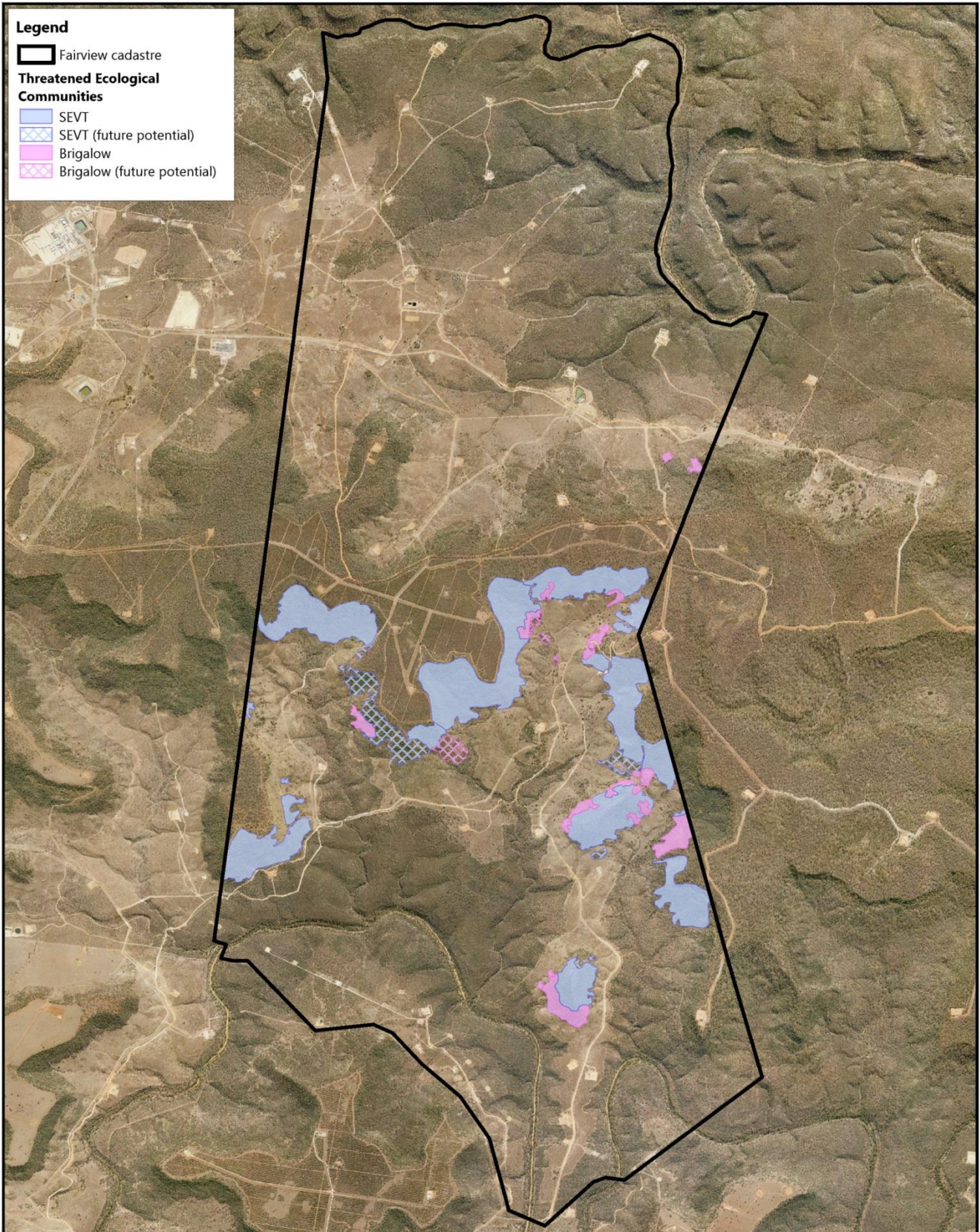
1 October 2015



MGA Zone 55 (GDA 94)

Scale: 1:35 000 @ A4

Appendix E. Extent of Threatened Ecological Communities



Appendix F
Ground-truthed Threatened
Ecological Communities

1 October 2015



MGA Zone 55 (GDA 94)

Scale: 1:55 000 @ A4

Appendix F. Threatened Fauna Habitat Mapping

