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WADDI WIND FARM PTY LTD

WADDI WIND FARM PROJECT - CATABY

SUPPLEMENTARY FLORA, VEGETATION AND FAUNA SURVEY

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ACRONYMS

DBH	Diameter at breast height
DotEE	Department of the Environment and Energy
DPaW	Department of Parks and Wildlife
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1950* (Commonwealth)
IBRA	Interim Biogeographic Regionalisation for Australia
NVIS	National Vegetation Information System
WC Act	*Wildlife Conservation Act 1950* (WA)

EXECUTIVE SUMMARY

Waddi Wind Farm Pty Ltd proposes to develop the Waddi Wind Farm Project (the Project) north of Cataby, Western Australia, and have engaged *ecologia* Environment to conduct supplementary survey work (This Study) on areas of land not covered by previous ecological assessments. The areas to be surveyed comprised a 14 ha area requiring flora, vegetation and fauna survey work (the Study Area), and a 9.4 ha corridor requiring a targeted survey for tall trees (over 10 m in height; the Tall Tree Survey Corridor).

This report documents the outcomes of This Study. The specific objectives of This Study were to:

- conduct a flora and vegetation survey of the Study Area, including targeted survey for flora and ecological communities of conservation significance;
- conduct a fauna survey of the Study Area, including broad fauna habitat mapping and targeted survey for foraging habitat and significant trees for the Threatened Carnaby's Black-cockatoo (*Calyptorhynchus latirostris*); and
- conduct a targeted tree survey of the Tall Tree Survey Corridor, to identify any trees over 10 m in height or capable of growing over 10 m in height

The field component of This Study was conducted on 6 October 2016. Two *ecologia* personnel conducted a site visit that included quadrat-based floristic survey and vegetation mapping, fauna habitat mapping, and targeted tall and significant tree mapping. All of the Study Area was surveyed on foot, but due to time constraints only the western portion of the Tall Tree Survey Corridor was surveyed in the field. The eastern portion was subsequently assessed using desktop methods.

The flora and vegetation recorded in the Study Area are considered typical of the Swan Coastal Plain and Geraldton Sandplains bioregions, within which the Study Area is situated, and were consistent with the results of previous assessments. One Priority flora taxon, *Conostephium magnum*, was recorded. No Threatened flora taxa were detected. No Moodjar (*Nuytsia floribunda*) trees were recorded that had not been already mapped during previous assessments.

Five vegetation units were described and delineated. Of these, 5.05 ha of *Banksia* Low Open Woodland are considered to be representative of the Endangered *Banksia* Woodlands of the Swan Coastal Plain Threatened Ecological Community (EPBC Act). This vegetation is in 'Intact' (2) Condition.

Six broad fauna habitat types were recorded. Of these, 7.5 ha of *Banksia* Woodland represent good-quality foraging habitat for the Endangered Carnaby's Black-cockatoo (EPBC Act, WC Act), which was recorded in the Study Area during the field component of This Study. In addition, the Study Area contains 24 potentially significant trees, in the Cleared Farmland with Paddock Trees habitat type; these may represent breeding, foraging or night roost trees, or a combination of all three.

The Tall Tree Survey Corridor was not observed to contain any trees over 10 m in height, or trees with the potential to grow over 10 m in height, in its western portion. Conversely, the vegetation present was substantially below this threshold height. For the eastern portion of the Tall Tree Survey Corridor, which was assessed using aerial imagery, nearby site observations, existing vegetation mapping and background information on the species present, it was concluded that trees exceeding 10 m are similarly unlikely to be present.

The most significant environmental values of the Study Area relevant to the development of the Project relate to the presence of the *Banksia* Woodlands of the Swan Coastal Plain Threatened Ecological Community (Endangered), Carnaby's Black-cockatoo foraging habitat and potentially significant trees for Carnaby's Black-cockatoo. If the Project is likely to impact any of these values, for example via land clearing, it is recommended that the Project be referred to the appropriate State and Commonwealth regulators. It may be possible to avoid impacts to these significant environmental values by concentrating Project clearing to the Cleared/Disturbed and Cleared Farmland habitats, which make up a moderate portion of the Study Area (21.4%).

It is also recommended that the areas associated with the construction of transmission line poles are revegetated using locally endemic species via broadcast of collected seed of local provenance or planted tubestock. Both the seeding and/or planting should be undertaken prior to spring (ie June/July).

1 INTRODUCTION

1.1 PROJECT BACKGROUND

Waddi Wind Farm Pty Ltd (WWF) proposes to develop the Waddi Wind Farm Project (the Project) north of Cataby, Western Australia (Figure 1.1). WWF is in the process of obtaining the relevant regulatory approvals to progress the project, including Native Vegetation Clearing Permits (NVCPs).

To support these approvals, and in consultation with the Wind Prospect Group and RPS Group Australia, WWF commissioned ecological surveys of the transmission line area associated with the Project (Outback Ecology MWH 2013; RPS 2014). Due to subsequent alteration of the alignment of the transmission line area, a small amount of supplementary ecological survey work was determined to be required.

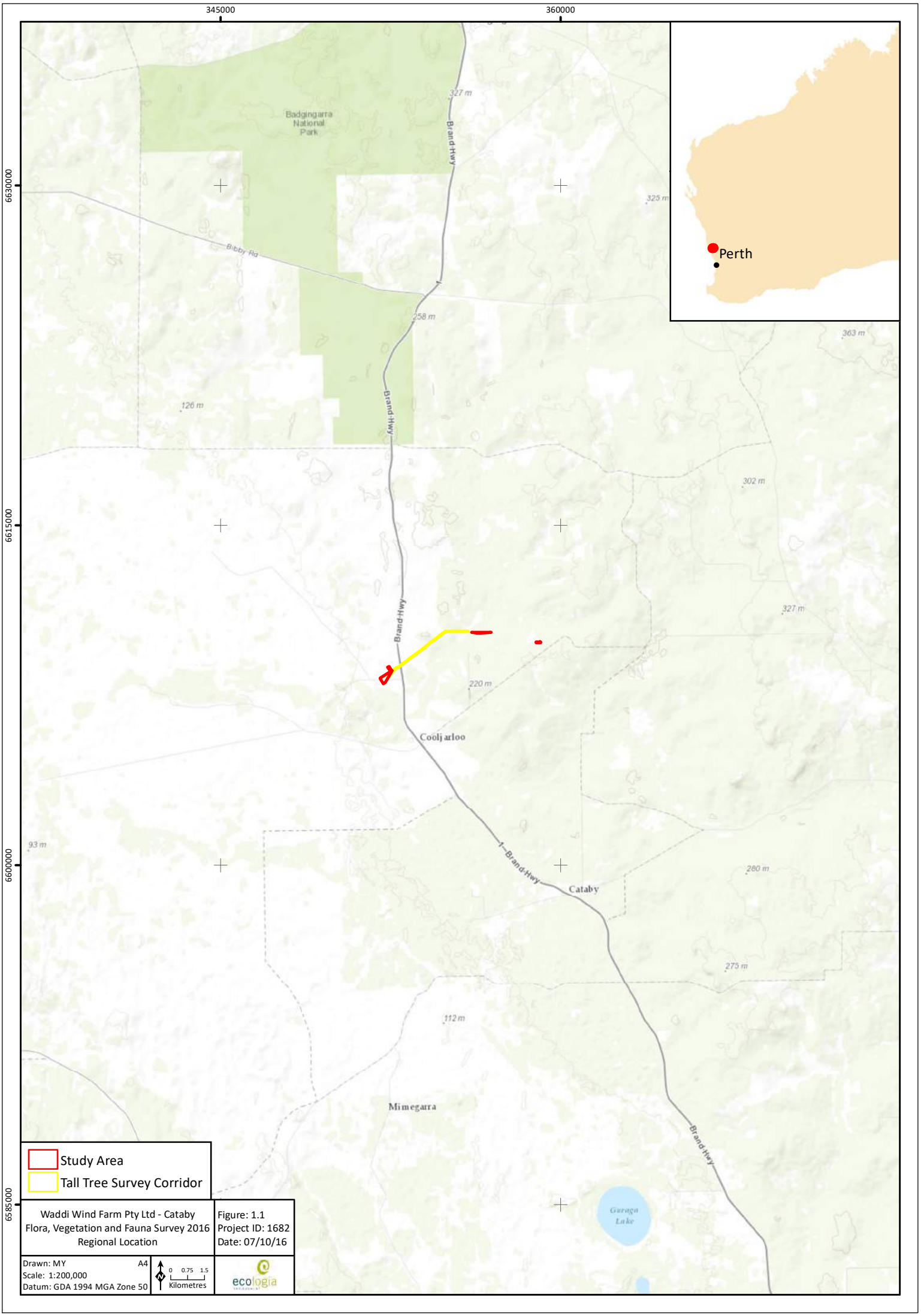
WWF engaged *ecologia* Environment to conduct this supplementary survey work (This Study), the outcomes of which are documented in this supplementary report. The areas to be surveyed comprised a 14 ha area requiring flora, vegetation and fauna survey work (the Study Area; Figure 1.2), and a 9.4 ha corridor requiring a targeted survey for tall trees (over 10 m in height; the Tall Tree Survey Corridor; Figure 1.2).

Moodjar Trees (*Nuytsia floribunda*) were identified and mapped throughout a previously defined survey area (Outback Ecology MWH 2013), the boundaries of which are broadly congruent with the current Tall Tree Survey Corridor. This previous work was not intended to document tree height, however, which is of relevance to the construction and operation of the Project.

1.2 OBJECTIVES

The overarching objective of this Study was to provide supplementary, high-level ecological data, pertaining to the gaps identified in existing survey datasets as a result of the modification of the transmission line alignment, to ensure the environmental values of the Project area had been adequately documented. The specific objectives of This Study were to:

- conduct a flora and vegetation survey of the Study Area, including targeted survey for flora and ecological communities of conservation significance;
- conduct a fauna survey of the Study Area, including broad fauna habitat mapping and targeted survey for foraging habitat and significant trees for the Threatened Carnaby's Black-cockatoo (*Calyptorhynchus latirostris*); and
- conduct a targeted tree survey of the Tall Tree Survey Corridor, to identify any trees over 10 m in height or capable of growing over 10 m in height, and to categorise any such trees as either Moodjar Trees (*Nuytsia floribunda*), potential Carnaby's Black-cockatoo habitat trees or other types of significant tree.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Garaga Lake
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Tall Tree Survey Corridor
Waddi Wind Farm Pty Ltd - Cataby
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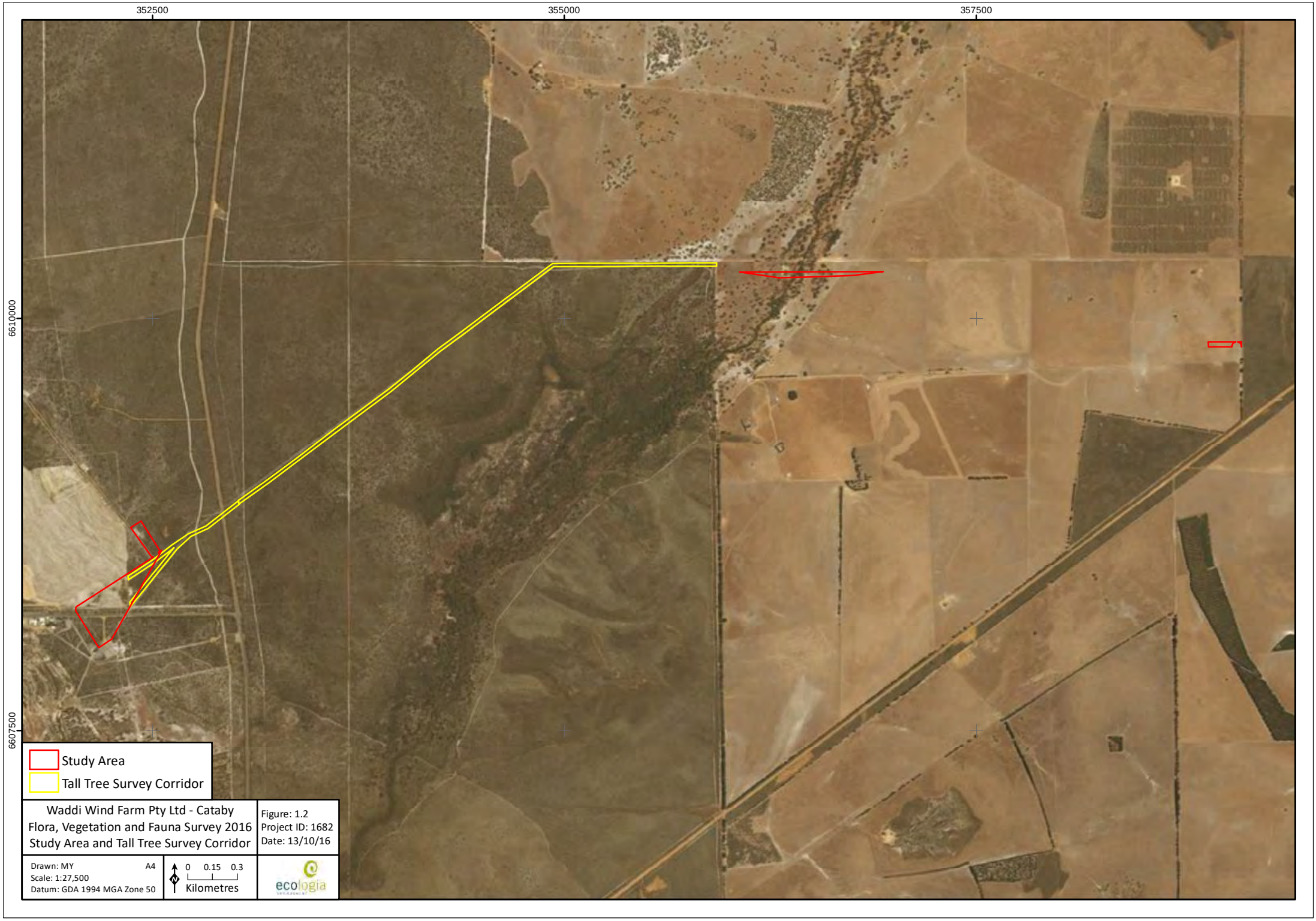
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Tall Tree Survey Corridor
Waddi Wind Farm Pty Ltd - Cataby
Flora, Vegetation and Fauna Survey 2016
Study Area and Tall Tree Survey Corridor
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2 METHODS

2.1 SURVEY TIMING AND WEATHER

The field component of This Study was conducted on 6 October 2016. This timing is consistent with a Spring survey, which is considered the most likely time to encounter the highest detectable diversity of flora and fauna in the South-west Botanical Province (as per Guidance Statement 51 and Guidance Statement 56; EPA 2004a, b).

The closest Bureau of Meteorology (BOM) weather station to the Study Area is the Badgingarra Research Station, approximately 32 km to the north. Data from Badgingarra show that the Study Area received better-than-average rainfall in the period prior to the field component of This Study (619 mm total for January to September 2016, versus a long-term average of 473 mm for the corresponding period).

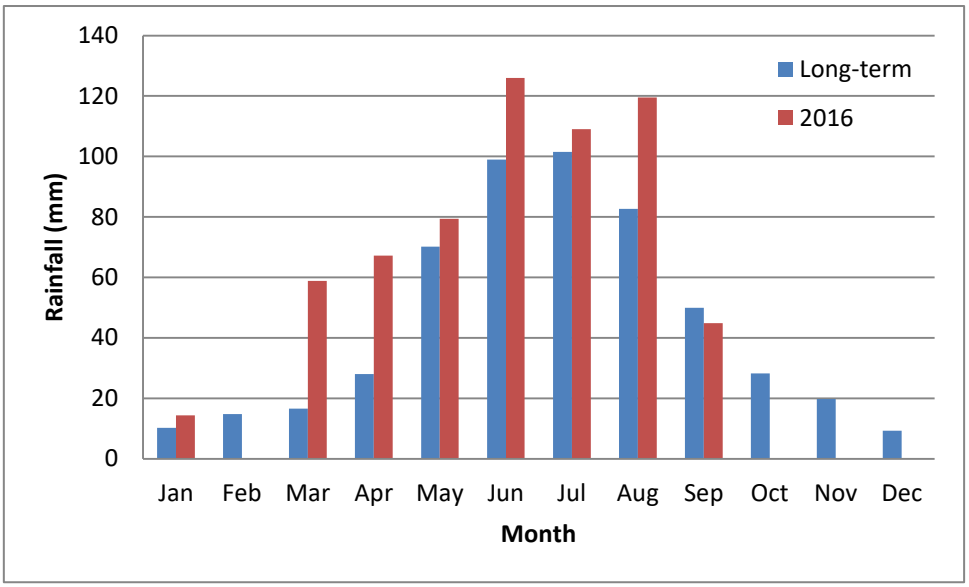


Figure 2.1: Rainfall for Badgingarra – long-term and 2016
Source: Bureau of Meteorology Climate Data Online (1962 to 2016)

2.2 PERSONNEL AND LICENSING

Table 2.1 details the personnel who contributed to This Study. Flora specimens were collected under a DPaW Scientific or Other Prescribed Purposes Licence issued to Dr Andrew Craigie (SL011876).

Table 2.1: *ecologia* personnel contributing to the Programme

Name	Qualifications	Position	Role in the Programme
Andrew Craigie	BSc (Hons), PhD	Senior Botanist	Field botany, botanical taxonomy, reporting
Mike Young	MEIANZ, BSc (Hons), PhD	Principal Ecologist	Field zoology, reporting
Shaun Grein	BAppSci, G.Dip Nat Res	Managing Director	Peer review

2.3 FIELD METHODS

2.3.1 Flora and Vegetation

Survey methods were based on Guidance Statement 51 (EPA 2004a) and the Flora and Vegetation Survey Technical Guide (EPA and DPaW 2015). The general approach of the flora and vegetation survey was sampling within bounded quadrats for statistical analysis, supplemented by a series of transects and relevés or unbounded quadrats.

Quadrats

Five non-permanent, 100 m^2 quadrats were established and sampled in the Study Area (these are mapped in Section 3.1). Quadrat locations were selected using a combination of aerial photography, topographic features, land systems and field observations to represent the diversity of vegetation and habitats present. The following parameters were recorded for each quadrat:

- all observed flora taxa and the observable presence/absence of fruit/flowers for each;
- average height and percentage cover (using the ranges cited by NVIS);
- vegetation structure (NVIS Level V);
- vegetation condition scale, based on the criteria in Table 2.2 (Trudgen 1991);
- estimated time since fire;
- GPS co-ordinates of all corners;
- digital photograph of the vegetation, taken from the north-west corner facing south-east;
- the landform element (morphological type, position and element type);
- the presence of rock outcrops (type and abundance);
- soil type (colour, profile, field texture and surface type); and
- slope and aspect.

Relevés

Two relevés were also sampled, to aid in the delineation of vegetation units. Relevés are unbounded sampling points, for each of which data for the following parameters were recorded:

- dominant flora species and observable presence/absence of fruit/flowers for each;
- vegetation structure (NVIS Level V);
- vegetation condition scale, based on the criteria in Table 2.2 (Trudgen 1991);
- estimated time since fire;
- a GPS co-ordinate;
- digital photograph of the vegetation;
- the landform element (morphological type, position and element type);
- the presence of rock outcrops (type and abundance);
- soil type (colour, profile, field texture and surface type); and
- slope and aspect.

Taxonomy

Nomenclature of the species recorded follows the protocols of the WA Herbarium (Western Australian Herbarium 1998-2015). All plant species were identified by Dr Andrew Craigie, a plant taxonomist with more than five years' experience in the identification of WA flora.

Vegetation Mapping

Vegetation mapping is the delineation of plant communities or vegetation units, based on distinctive characteristics that these communities share such as vegetation structure, dominant species and species composition. A combination of aerial photography, vegetation unit grouping during data analysis and ground-truthing was used to interpret the vegetation patterns of the Study Area and create vegetation maps.

Vegetation Condition Mapping

The vegetation condition of the study area was classified and mapped using the average condition recorded from quadrats in each vegetation unit. Condition is assessed based on criteria listed in Table 2.2 as described by the *Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA and DPaW 2015).

Table 2.2: Vegetation condition assessment, South West Botanical Province (EPA and DPaW 2015).

Cond.	Criteria
1	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
2	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
3	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
4	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
(5)	(Not applicable)
6	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
7	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.

2.3.2 Fauna

Habitat Assessments

Nine separate fauna habitat assessments were conducted, at locations considered representative of broad habitat patches (Figure 2.2). For each assessment, the following parameters were recorded:

- broad habitat type;
- digital photographs;
- landform type;
- soil colour, type and characteristics;
- type and extent of non-vegetative surface cover;
- type, height and percentage cover of vegetation in lower, middle and upper strata;
- observable fire history;
- evidence of disturbance;
- presence and extent of leaf litter and coarse woody debris;
- presence of, or distance to, water sources;
- presence of significant microhabitats such as tree hollows and rocky outcrops; and
- notes on suitability for hosting conservation significant fauna.

Habitat Mapping

A fauna habitat type broadly describes an area of habitat that is distinguishable in its vegetation and land features from its surroundings, and is likely to support a different fauna assemblage to that found in other fauna habitat types. Particular attention is also paid to the likelihood that certain species may be present and tend to be found only in specific habitat types.

Fauna habitat types in the Study Area were identified, described and mapped based on the outcomes of the habitat assessments, observations made during survey transects (Figure 2.2) and the following other information:

- IBRA bioregions and subregions;
- aerial photography;
- Beard vegetation associations (Shepherd et al. 2001);
- landform;
- vegetation type and structure; and
- fauna species observed using the habitats present.

Black-cockatoo Habitat Assessment

The Study Area falls within the modelled distribution of Carnaby's Black-cockatoo (DSEWPaC 2012). During the field component of This Study, therefore, specific effort was made to document significant trees, foraging habitat and feeding evidence for this species in the Study Area, including:

- potential breeding habitat, i.e. trees of species known to support breeding with a DBH of 500 mm or more, was mapped by recording the GPS location of individual trees (living and dead);
- potential roosting habitat, i.e. tall native or introduced trees within an area of foraging habitat and close to water, was mapped by recording the GPS location of individual trees;
- foraging habitat, i.e. *Banksia* woodlands, native shrublands, pine plantations and other foraging vegetation as defined by DSEWPaC (2012), was mapped according to extent; and
- feeding evidence, such as characteristically chewed *Banksia* cones, pine cones or Marri nuts, was searched for and recorded opportunistically (see next section).

The searching and mapping of Carnaby's Black-cockatoo habitat was undertaken by walking regularly-spaced transects in the Study Area (Figure 2.2). A targeted survey for black-cockatoos was not conducted, as short-term surveys for bird presence are unlikely to give a true representation of habitat use by black-cockatoos (DSEWPaC 2012).

Opportunistic Fauna Observations

This Study was not intended to be a detailed field survey, as extensive fauna survey work has previously been conducted for the Project (e.g. RPS 2014). However, opportunistic observations were made at all times in order to provide additional data to supplement the habitat mapping results.

Opportunistic observations consisted of direct observation of animals, as well as detection of secondary evidence including tracks, scats, remains and other traces. Specific efforts were made to detect the presence of conservation significant species, such as *Banksia* feeding evidence of black cockatoos and tracks or breeding mounds of Malleefowl (*Leipoa ocellata*).

Conservation Significant Fauna Likelihood of Occurrence Assessment

Various species of vertebrate fauna of conservation significance fauna were reported from previous studies for the Project, in the surrounds of the current Study Area (Appendix I; RPS 2014). An assessment of the likelihood of each of these taxa occurring in the Study Area was conducted, according to:

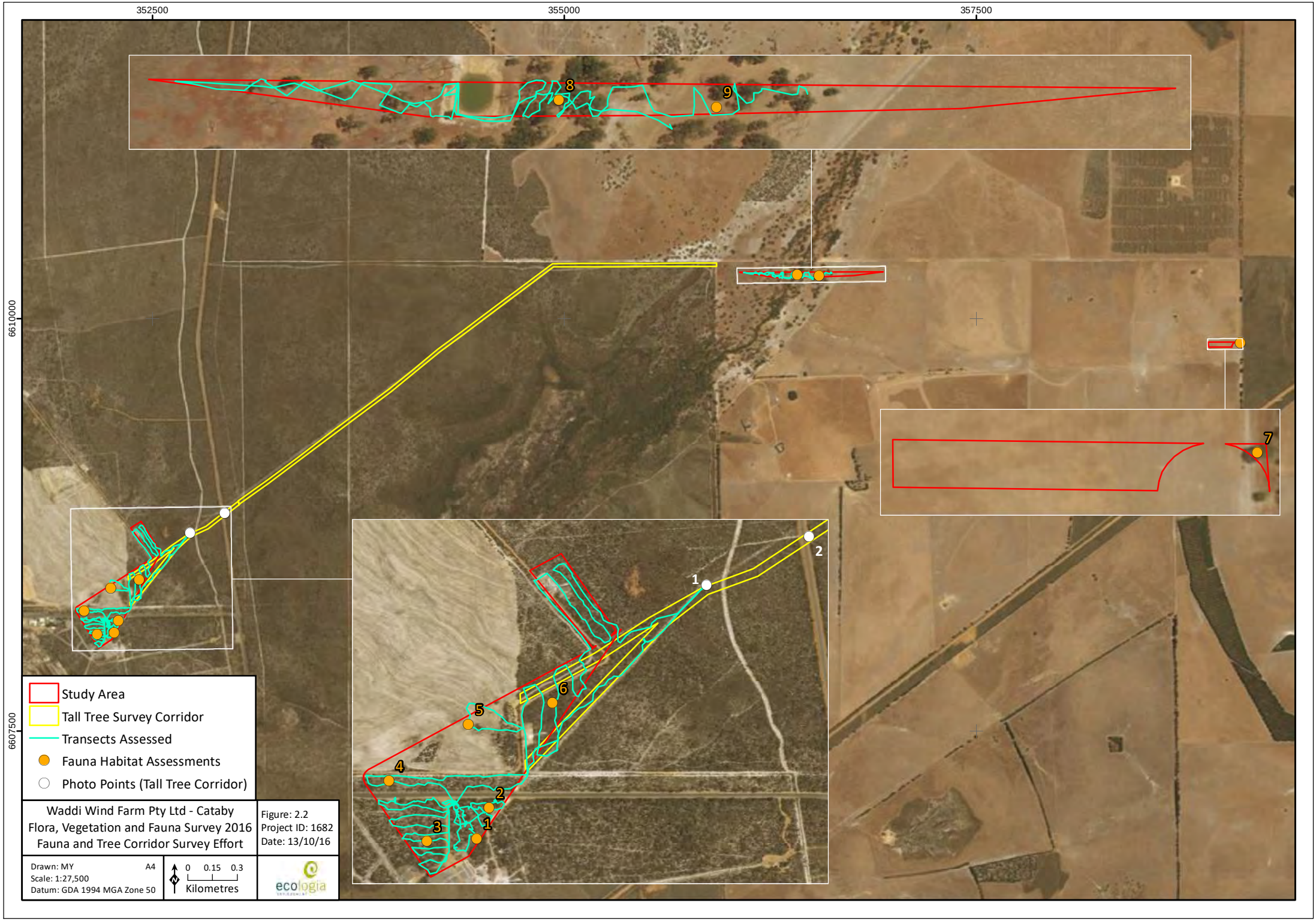
- the conclusions of RPS (2014) regarding species presence in the broader area;
- fauna habitats in the Study Area, and their condition as assessed during This Study;
- fauna observations made during This Study; and
- published information about species habitat preferences and distribution.

Based on the above, conservation significant species were categorised as unlikely to occur, possibly occurring, likely to occur or confirmed to occur in the Study Area. More detailed analyses are possible – e.g. based on distance to nearby records, age of nearby records and/or connectivity of habitat fragments in the broader landscape – but were outside the scope of This Study.

2.3.3 Tall Tree Survey Corridor

The western portion of the Tall Tree Survey Corridor was surveyed on foot and at two photo points accessible during survey activity in the western portion of the Study Area (Figure 2.2). The likelihood of tall tree presence in the remainder of the corridor was determined based on:

- vegetation mapping covering the Tall Tree Survey Corridor (Outback Ecology MWH 2013);
- Moodjar mapping within the Tall Tree Survey Corridor (Outback Ecology MWH 2013); and
- vegetation mapping and observations made during This Study.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Study Area
Tall Tree Survey Corridor
Transects Assessed
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Photo Points (Tall Tree Corridor)
Waddi Wind Farm Pty Ltd - Cataby
Flora, Vegetation and Fauna Survey 2016
Fauna and Tree Corridor Survey Effort
Figure: 2.2
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3 RESULTS AND DISCUSSION

3.1 FLORA AND VEGETATION

3.1.1 Threatened and Priority Flora

One Priority flora taxon, *Conostephium magnum*, was recorded in the Study Area (Table 3.1). This was within the *Banksia* Low Open Woodland vegetation unit in the western portion of the Study Area (Figure 3.1; refer to Section 3.1.2 for discussion of *Banksia* Low Open Woodland).

This taxon was reported by the previous assessment near the Study Area (Outback Ecology MWH 2013), which found six Priority taxa in total. Two of the five other Priority taxa found previously – *Arnocrinum gracillimum* (Priority 2) and *Lepidobolus quadratus* (Priority 3) – potentially occur in the Study Area, based on their preferences for white and grey sandplains in the area. Two others – *Stylidium aeonioides* (Priority 4) and *Tetratheca angulata* (Priority 3) – have been recorded from hillsides, hill crests, breakaways and boulder fields; such landforms are absent from the Study Area, and these taxa are thus unlikely to occur. The final Priority taxon reported previously – *Anigozanthos humilis* subsp. Badgingarra (S.D. Hopper 7114) – was not found during This Study; *A. humilis* was present in the Study Area and a specimen was submitted to the WA Herbarium, but the taxon was identified as *A. humilis* subsp. *humilis*.

No Threatened flora taxa were recorded during this Study. This is consistent with the previous assessment, which also did not detect any Threatened flora taxa (Outback Ecology MWH 2013).

Table 3.1: Conservation significant flora recorded in the Study Area

Taxon	DPaW Status	Number recorded
Conostephium magnum	Priority 4	33

3.1.2 Vegetation

Five vegetation units occur in the Study Area (Table 3.2, Figure 3.2 to Figure 3.5). These comprise:

- *Banksia* Low Open Woodland (Unit 1a and Unit 1b);
- *Corymbia* Mid Open Woodland (Unit 2 and Unit 3); and
- Cleared Farmland (Unit 4).

Vegetation in Unit 3 and Unit 4 was considered no longer intact and completely, or almost completely, without native species (Condition 7; Table 2.2). Vegetation in Unit 2 was considered severely impacted by disturbance (Condition 6; Table 2.2). Vegetation in Unit 1a and Unit 1b was considered intact, with minimal disturbance and only non-aggressive weeds (Condition 2; Table 2.2). The native vegetation in the Study Area is considered typical of the Swan Coastal Plain and Geraldton Sandplains IBRA bioregions, and is consistent with vegetation previously documented in the vicinity of the Study Area (Outback Ecology MWH 2013).

3.1.3 Threatened and Priority Ecological Communities

The western portion of the Study Area straddles both the Swan Coastal Plain and Geraldton Sandplains IBRA bioregions (Figure 3.6). Portions of the *Banksia* Low Open Woodland (Unit 1a) and *Banksia* Low Open Woodland (Unit 1b) vegetation units are therefore considered to be representative of the *Banksia* Woodlands of the Swan Coastal Plain Threatened Ecological Community (TEC), listed in 2016 as Endangered under the EPBC Act.

The extent of this TEC in the Study Area is 5.05 ha (Figure 3.6). It is recommended that the Project is referred to the Department of the Environment and Energy (DotEE) if it project actions are likely to impact any vegetation within the extent of this TEC.


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Waddi Wind Farm Pty Ltd - Cataby
Flora, Vegetation and Fauna Survey 2016
Priority Flora Recorded in the Study Area
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ecologia
Study Area
Tall Tree Survey Corridor
Priority flora
Conostephium magnum

Table 3.2: Vegetation units recorded in the Study Area

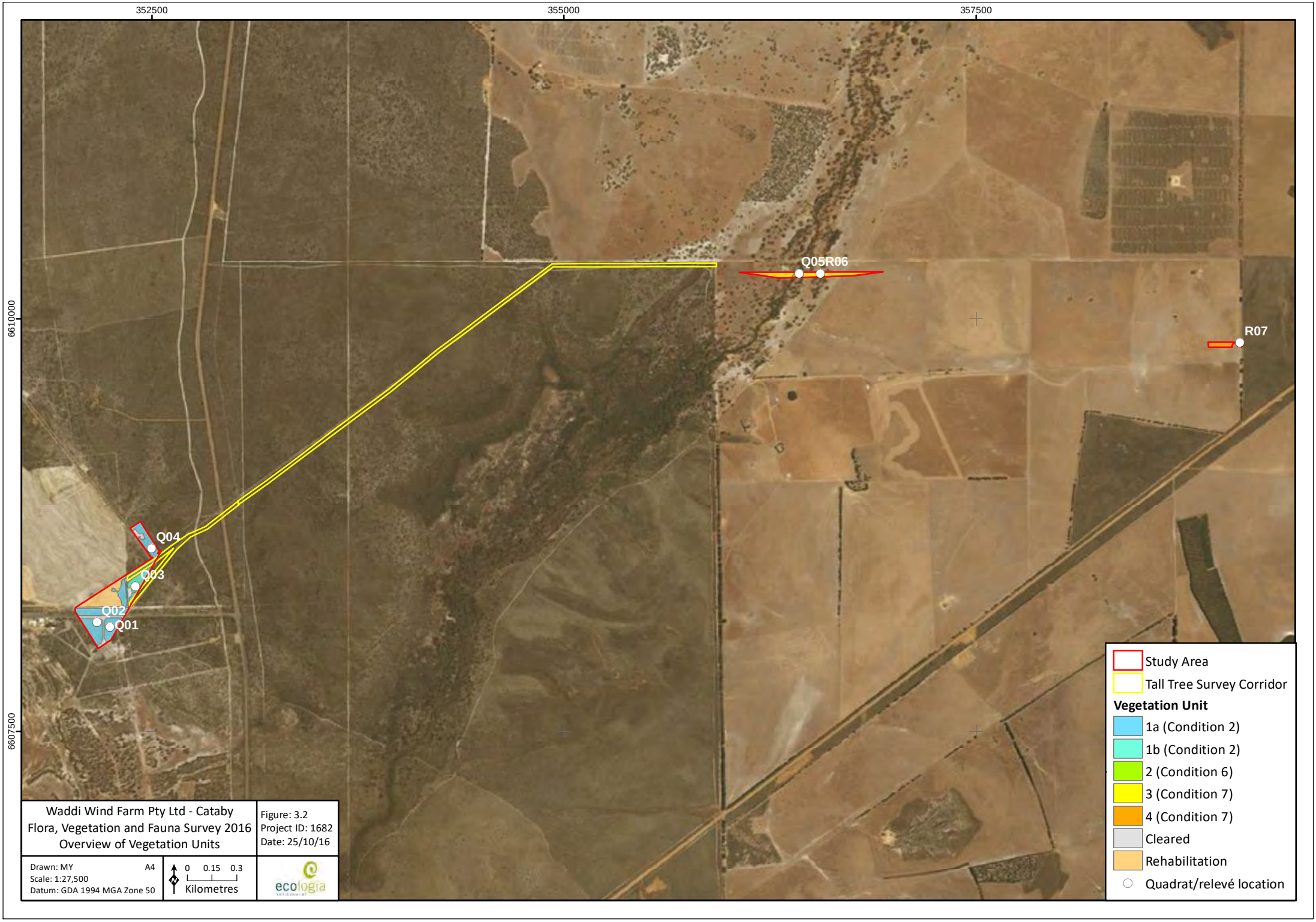
Vegetation unit mapping code	Quadrats	Vegetation description (NVIS Level III and Level VI)	Associated species	Area (ha & % of the study area), average species richness and landform
1a	Q01, Q02, Q04	*Banksia* low open woodland. *Banksia attenuata* and *B. menziesii* low open woodland (with scattered *Eucalyptus todtiana* and *Banksia ilicifolia*), over *Adenanthos cygnorum* tall sparse shrubland, over *Melaleuca clavifolia*, *Hibbertia hypericoides* subsp. *hypericoides* and/or *H. subvaginata* low sparse shrubland, over *Patersonia occidentalis* sparse herbland.	*Bossiaea eriocarpa* *Conospermum crassinervium* *Dasypogon obliquifolius* *Drosera microphylla* *Hibbertia subvaginata* *Hypocalymma xanthopetalum* *Jacksonia floribunda* *Trachymene pilosa*	**Area**: 6.34 ha (45.2%) **Average species richness (mean ± SE):** 29 ± 1 **Landform**: Sand plain
				

Vegetation unit mapping code	Quadrats	Vegetation description (NVIS Level III and Level VI)	Associated species	Area (ha & % of the study area), average species richness and landform
1b	Q03	*Banksia* low open woodland. *Banksia attenuata* and *B. menziesii* low open woodland (with scattered *B. prionotes* and *Eucalyptus todtiana*) over *Adenanthos cygnorum* tall sparse shrubland, over *Eremaea pauciflora* var. *pauciflora* and *Hibbertia hypericoides* subsp. *hypericoides* low sparse shrubland, over *Mesomelaena pseudostygia* sparse sedgeland.	*Acacia pulchella* var. *reflexa* *Austrostipa macalpinei* *Conospermum stoechadis* *Conostephium preissii* *Eremaea asterocarpa* *Hypocalymma xanthopetalum* *Melaleuca clavifolia* *Petrophile scabriuscula* *Synaphea spinulosa*	**Area**: 1.04 ha (7.47%) **Species richness:** 24 **Landform**: Sand plain
				

Vegetation unit mapping code	Quadrats	Vegetation description (NVIS Level III and Level VI)	Associated species	Area (ha & % of the study area), average species richness and landform
2	Q05	*Corymbia* mid open woodland. *Corymbia calophylla* (with *Eucalyptus rudis* subsp. *rudis* in creek) mid open woodland, over *Melaleuca raphiophylla* tall sparse shrubland, over *Ehrharta calycina* tussock grassland.	*Arctotheca calendula* *Bromus diandrus* *Cotula coronopifolia* *Ehrharta longiflora* *Isolepis congrua* *Juncus acutus* *Ornithopus compressus* *Polypogon monspeliensis* *Ptilotus polystachyus* *Sonchus oleraceus* *Ursinia anthemoides*	**Area**: 0.15 ha (1.06%) **Species richness :** 16 **Landform**: Small creek

Vegetation unit mapping code	Quadrats	Vegetation description (NVIS Level III and Level VI)	Associated species	Area (ha & % of the study area), average species richness and landform
3	R06	*Corymbia* mid open woodland. *Corymbia calophylla* mid open woodland over *Bromus diandrus* grassland and *Arctotheca calendula* herbland.	*Austrostipa macalpinei* *Bromus rubens* *Ehrharta longiflora* *Lolium perenne* *Ptilotus polystachyus*	**Area**: 1.78 ha (12.56%) **Species richness :** n/a (relevé) **Landform**: Undulating plain

Vegetation unit mapping code	Quadrats	Vegetation description (NVIS Level III and Level VI)	Associated species	Area (ha & % of the study area), average species richness and landform
4	R07	Cleared Farmland Completely degraded (dominant weed species include *Arctotheca calendula*, *Bromus diandrus*, and *Ehrharta longiflora*)	n/a	**Area**: 0.45 ha (3.23%) **Species richness :** n/a (relevé) **Landform**: Undulating plain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Study Area
Tall Tree Survey Corridor
Vegetation Unit
1a (Condition 2)
1b (Condition 2)
2 (Condition 6)
3 (Condition 7)
4 (Condition 7)
Cleared
Rehabilitation
Quadrat/relevé location
Waddi Wind Farm Pty Ltd - Cataby
Flora, Vegetation and Fauna Survey 2016
Overview of Vegetation Units
Figure: 3.2
Project ID: 1682
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Kilometres
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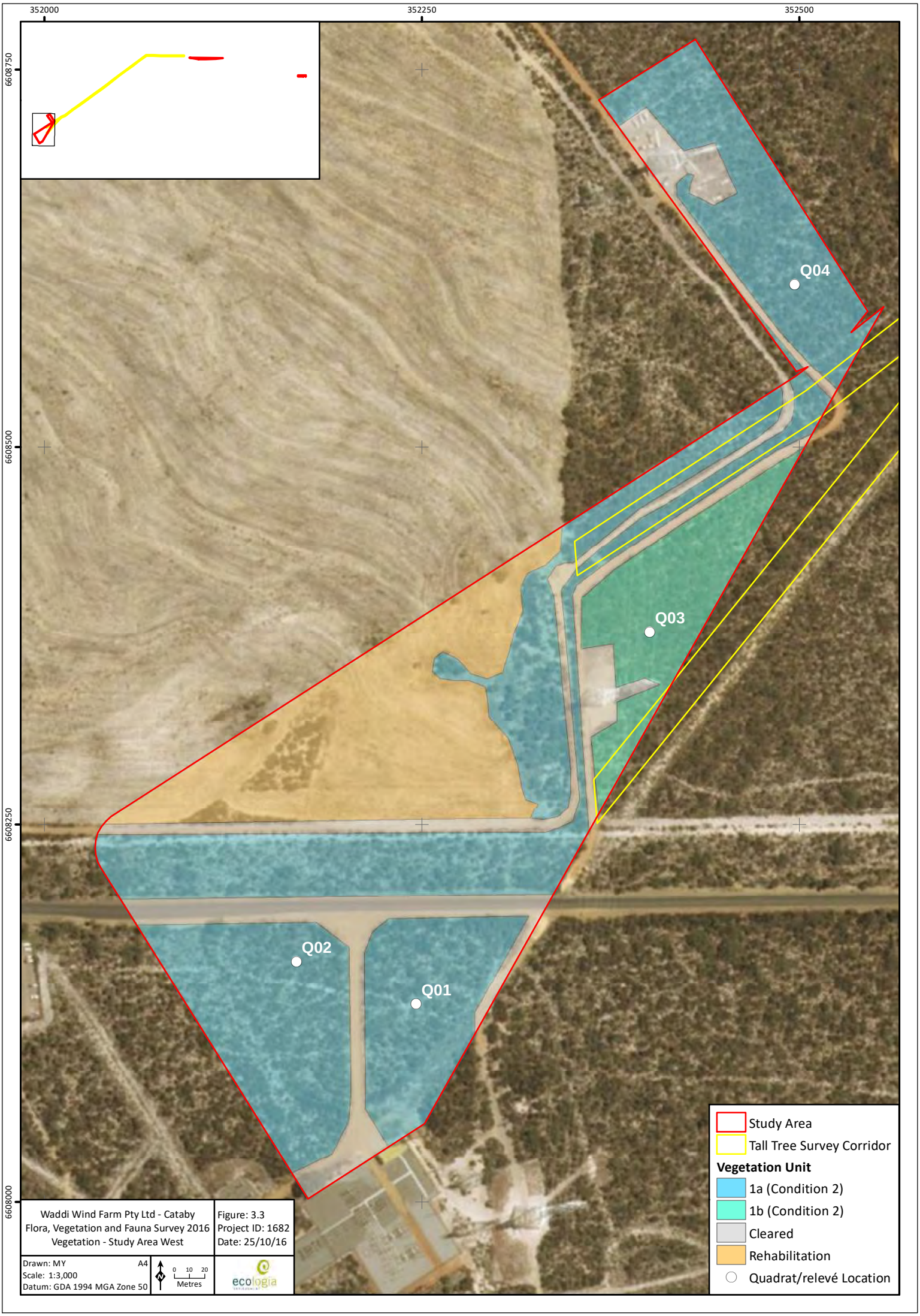
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Study Area
Tall Tree Survey Corridor
Vegetation Unit
1a (Condition 2)
1b (Condition 2)
Cleared
Rehabilitation
Quadrat/relevé Location
Waddi Wind Farm Pty Ltd - Cataby
Flora, Vegetation and Fauna Survey 2016
Vegetation - Study Area West
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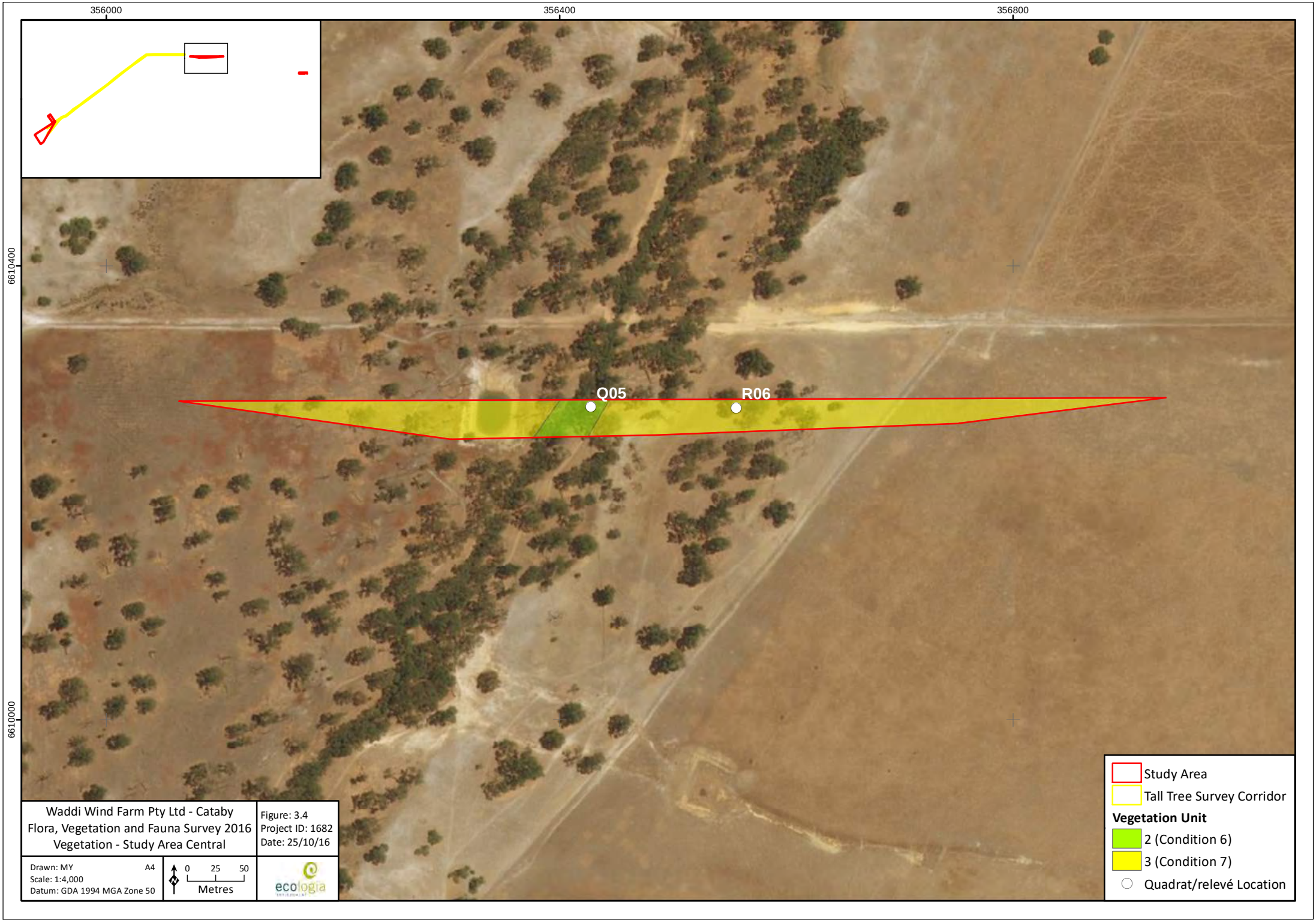
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Study Area
Tall Tree Survey Corridor
Vegetation Unit
2 (Condition 6)
3 (Condition 7)
Quadrat/relevé Location
Waddi Wind Farm Pty Ltd - Cataby
Flora, Vegetation and Fauna Survey 2016
Vegetation - Study Area Central
Figure: 3.4
Project ID: 1682
Date: 25/10/16
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Study Area
Tall Tree Survey Corridor
Vegetation Unit
4 (Condition 7)
Quadrat/relevé Location
Waddi Wind Farm Pty Ltd - Cataby
Flora, Vegetation and Fauna Survey 2016
Vegetation - Study Area East
Figure: 3.5
Project ID: 1682
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Metres
ecologia


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Swan Coastal Plain
Geraldton Sandplains
Study Area
Tall Tree Survey Corridor
Banksia Woodlands of the Swan Coastal Plain TEC
Banksia Low Open Woodland (Units 1a and 1b)
IBRA Bioregion Boundary
Waddi Wind Farm Pty Ltd - Cataby
Flora, Vegetation and Fauna Survey 2016
Banksia Woodlands TEC in the Study Area
Figure: 3.6
Project ID: 1682
Date: 19/10/16
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Scale: 1:3,000
Datum: GDA 1994 MGA Zone 50
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Metres
ecologia

3.1.4 Weeds

Fifteen species of weed were recorded in the Study Area, from five families (Table 3.3). None of the weeds detected are Weeds of National Significance or are of any other particular relevance to the Project; all are common agricultural weeds and are typical of the surrounding area.

Table 3.3: Weeds recorded in the Study Area.

Family	Species	Common name
Asteraceae	*Arctotheca calendula*	Cape Weed
	Cotula coronopifolia	Waterbuttons
	Sonchus oleraceus	Common sowthistle
	Ursinia anthemoides	Ursinia
Fabaceae	*Medicago* sp.	Medic
	Ornithopus compressus	Yellow serradella
Juncaceae	*Juncus acutus*	Spiny rush
Poaceae	*Aira elegantissima*	Hairgrass
	Bromus diandrus	Great brome
	Bromus rubens	Red brome
	Ehrharta calycina	Perennial veldt grass
	Ehrharta longiflora	Annual veldt grass
	Lolium perenne	Perennial ryegrass
	Polypogon monspeliensis	Annual beardgrass
Primulaceae	*Lysimachia arvensis*	Pimpernel

3.2 FAUNA

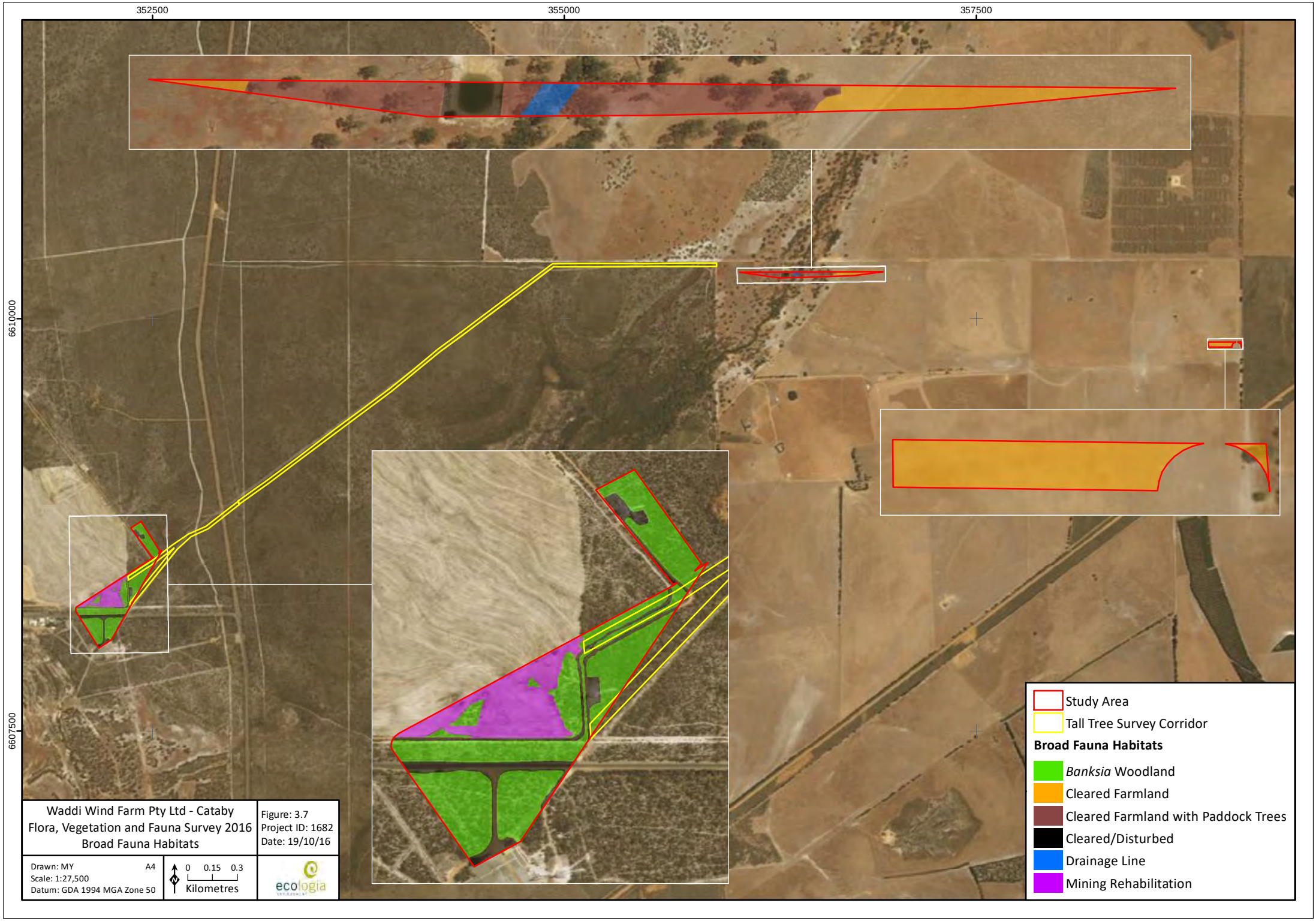
3.2.1 Fauna Habitats

The Study Area contains six broad fauna habitat types (Table 3.4, Figure 3.7 and Figure 3.8 to Figure 3.13). This includes a Cleared/Disturbed habitat type, which contains remnant vegetation in parts but is so highly modified that it is unlikely to support unique, resident fauna assemblages.

Table 3.4: Broad fauna habitat types in the Study Area.

Habitat type	Extent (ha)	% Study Area	Significance to fauna assemblages
Banksia Woodland	7.5	53.6	Significant
Mining Rehabilitation	2.3	16.4	Man-made habitat; significance unknown
Cleared/Disturbed	2.0	14.3	Not significant
Cleared Farmland with Paddock Trees	1.1	7.9	Trees significant; understorey not significant
Cleared Farmland	1.0	7.1	Not significant
Drainage Line	0.1	0.7	Significant

The habitats of the Study Area are typical of the Geraldton Sandplains and Swan Coastal Plain bioregions, and are consistent with those reported by the previous assessments of the immediate surrounds of the Study Area (RPS 2014). Details of the intact habitats are presented in Appendix B; these descriptions should be interpreted in conjunction with the vegetation and quadrat data for the Study Area (Section 3.1.2, Appendix A), which contain additional information on plant taxa present.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Study Area
Tall Tree Survey Corridor
Broad Fauna Habitats
Banksia Woodland
Cleared Farmland
Cleared Farmland with Paddock Trees
Cleared/Disturbed
Drainage Line
Mining Rehabilitation
Waddi Wind Farm Pty Ltd - Cataby
Flora, Vegetation and Fauna Survey 2016
Broad Fauna Habitats
Figure: 3.7
Project ID: 1682
Date: 19/10/16
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Scale: 1:27,500
Datum: GDA 1994 MGA Zone 50
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ecologia

Figure 3.8: *Banksia* Woodland habitat in the Study Area (to the north-east)

Figure 3.9: *Banksia* Woodland habitat in the Study Area (to the south-west)

Figure 3.10: Mining Rehabilitation habitat in the Study Area

Figure 3.11: Cleared Farmland with Paddock Trees habitat in the Study Area

Figure 3.12: Cleared Farmland habitat in the Study Area

Figure 3.13: Drainage Line habitat in the Study Area

3.2.2 Opportunistic Fauna Species Records

Thirteen species of native fauna and one species of introduced fauna, not including conservation significant species (Section 3.2.3), were recorded during the field component of This Study (Table 3.5). None of these species is of particular ecological significance with respect to the Project, all are typical of the area and habitats observed, and all were documented during the previous assessments in the broader vicinity of the Study Area (RPS 2014).

Table 3.5: Non-conservation significant fauna recorded opportunistically in the Study Area.

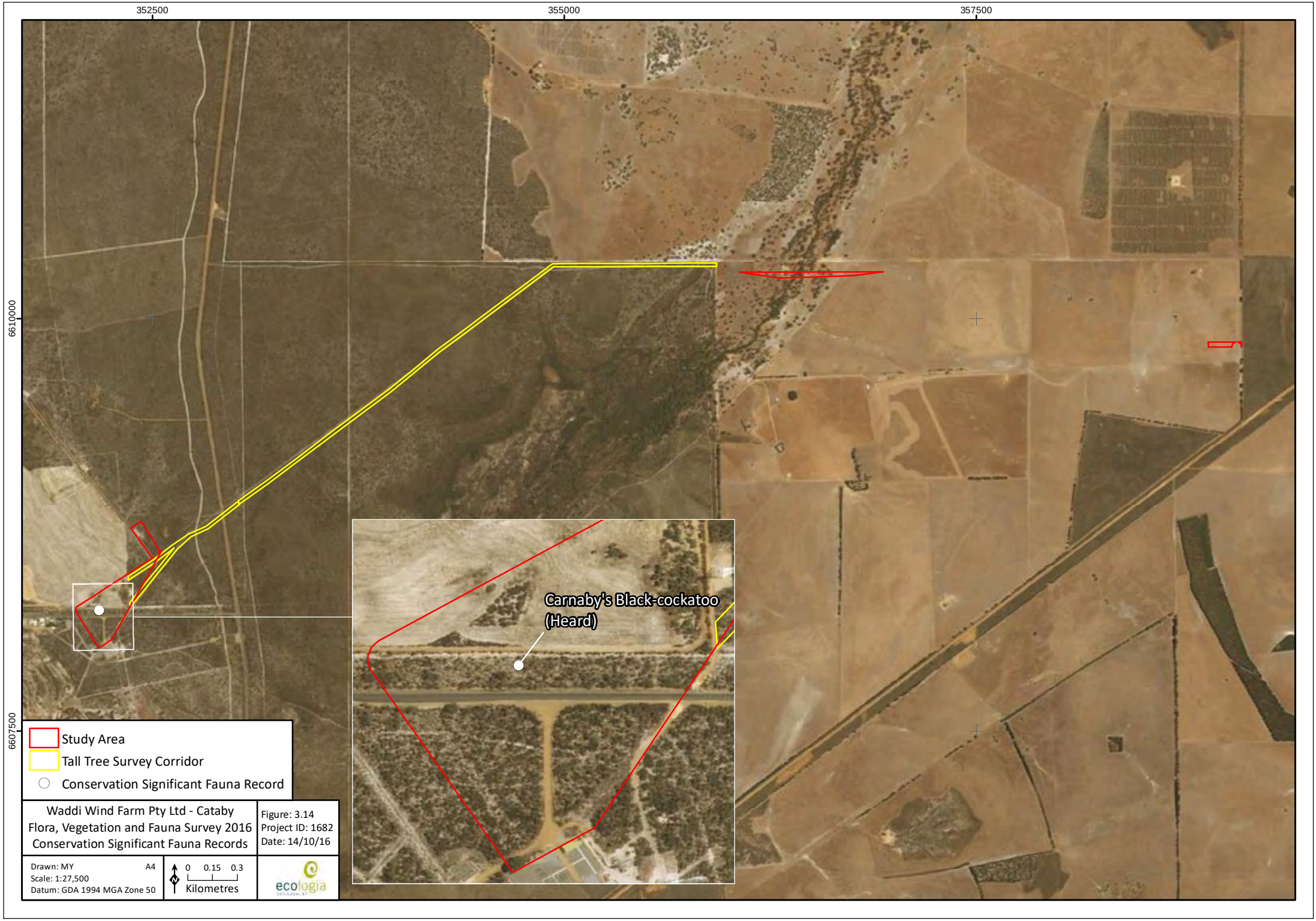
Group	Species	Common name	Record type	n
Birds	*Cracticus tibicen*	Australian Magpie	Seen	1
	Corvus coronoides	Australian Raven	Heard	1
	Accipiter cirrocephalus	Collared Sparrowhawk	Seen	1
	Dromaius novaehollandiae	Emu	Tracks	1
	Eolophus roseicapilla	Galah	Heard	1
	Colluricincla harmonica	Grey Shrike-thrush	Heard	1
	Pachycephala rufiventris	Rufous Whistler	Heard	1
	Gavicalis virescens	Singing Honeyeater	Heard	1
	Anthochaera lunulata	Western Wattlebird	Seen	1
Mammals	*Oryctolagus cuniculus* *	European Rabbit *	Scats	1
	Macropus fuliginosus	Western Grey Kangaroo	Scats	1
Reptiles	*Tiliqua rugosa*	Bobtail Skink	Seen	1

* introduced species

3.2.3 Conservation Significant Fauna Species in the Study Area

One conservation significant species, Carnaby's Black-cockatoo, was recorded in the Study Area during the field component of This Study. This species was heard flying above the *Banksia* Woodland habitat type, at location 352177 mE 6608229 mN (GDA94 MGA Z50; Figure 3.14).

Although not observed during the field component of This Study, it is likely that other species of conservation significant fauna also occur in the Study Area. A brief assessment of their likelihoods of occurrence is presented in Table 3.6, in accordance with Section 2.3.2.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Carnaby's Black-cockatoo (Heard)
Study Area
Tall Tree Survey Corridor
Conservation Significant Fauna Record
Waddi Wind Farm Pty Ltd - Cataby
Flora, Vegetation and Fauna Survey 2016
Conservation Significant Fauna Records
Figure: 3.14
Project ID: 1682
Date: 14/10/16
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Datum: GDA 1994 MGA Zone 50
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Table 3.6: Likelihoods of occurrence of conservation significant fauna species in the Study Area.

Common name † Species name	WC Act	EPBC Act	DPaW	Likelihood of occurrence in the Study Area
Carnaby's Black-cockatoo *Calyptorhynchus latirostris*	S2 (End)	EN	-	**Confirmed to Occur** – refer to text in this Section (3.2.3), see also Sections 0 and 3.2.5.
Australasian Bittern *Botaurus poiciloptilus*	S2 (End)	EN	-	**Unlikely to Occur** – requires intact, dense wetland habitats, Drainage Line in Study Area is too open.
Malleefowl *Leipoa ocellata*	S3 (Vul)	VU	-	**Possibly Occurs** – unlikely to breed or reside in Study Area (habitat unsuitable and no mounds or other evidence detected), but may use for dispersal.
Chuditch / Western Quoll *Dasyurus geoffroii*	S3 (Vul)	VU	-	**Possibly Occurs** – unlikely to breed or reside in Study Area (known to prefer wooded sclerophyll forests and mallee), but may use for dispersal or foraging.
Brush-tailed Phascogale (SW) *Phascogale tapoatafa* ssp.	S3 (Vul)	-	-	**Unlikely to Occur** – prefers intact, dry sclerophyll woodlands, and is unlikely to disperse over expanses of unsuitable habitat such as are in the Study Area.
Rainbow Bee-eater *Merops ornatus*	S5 (Mig)	Marine	-	**Likely to Occur** – widespread and abundant throughout mainland Australia, may forage in or above all habitats in the Study Area.
Great Egret *Ardea modesta*	S5 (Mig)	Marine	-	**Possibly Occurs** – covers large distances and may stop in Drainage Line habitat in the Study Area; unlikely to reside permanently.
Cattle Egret *Ardea ibis*	S5 (Mig)	Marine	-	**Possibly Occurs** – covers large distances and may stop in Drainage Line habitat in the Study Area; unlikely to reside permanently.
Peregrine Falcon *Falco peregrinus*	S7 (Oth)	-	-	**Likely to Occur** – widespread throughout mainland Australia, may hunt in or above all habitats in the Study Area, but unlikely to breed in Study Area.
Black-striped Snake *Neelaps calonotos*	-	-	P3	**Likely to Occur** – known to be locally abundant in coastal *Banksia* sandplain habitats, such as those within the Study Area, between Perth and Lancelin.
Western Rosella (Inland) *Platycercus icterotis*	-	-	P4	**Likely to Occur** – can feed in grassy clearings and pasture such as those in the Study Area. Unlikely to be dependent on habitat patches in the Study Area.
Western Brush Wallaby *Macropus irma*	-	-	P4	**Likely to Occur** – may occur as resident or foraging individuals in *Banksia* Woodland habitat, and may use other habitat types for dispersal/transit.
Rakali / Water Rat *Hydromys chrysogaster*	-	-	P4	**Possibly Occurs** – may disperse along Mullering Brook (Drainage Line habitat) when sufficient water is present, but unlikely to be a permanent resident.

† list based on previously completed desktop study (Appendix I, RPS 2014)

3.2.4 Black Cockatoo Foraging Habitat

Approximately 7.5 ha (53.6%) of the Study Area is considered suitable foraging habitat for Carnaby's Black-cockatoo, as defined by DSEWPaC (2012). This comprises the *Banksia* Woodland fauna habitat type (Figure 3.15, and see also Figure 3.8 and Section 3.2.1), which is characterised by *B. menziesii*, *B. attenuata*, *B. prionotes* and *B. illicifolia*. Other known foraging species are also scattered throughout this habitat type, such as Prickly Bark (*Eucalyptus todtiana*; also known as Coastal Blackbutt).

At the time of the survey, the *Banksia* species in the Study Area had completed flowering and cones were abundant. Although a food resource analysis was not conducted as part of This Study, the foraging habitat in the Study Area appeared to be productive and of good quality.

If the Project will require clearing of more than one hectare of this foraging habitat, there is a high risk that the development will result in significant impacts to Carnaby's Black-cockatoo (DSEWPaC 2012). In this scenario, referral of the development to the DotEE would be strongly recommended.

Other potential Carnaby's Black-cockatoo foraging habitat may also occur in the Study Area, in the form of low shrubland containing *Banksia* species in the Mining Rehabilitation habitat type (Figure 3.8, and see also Section 3.2.1). The current value of this broad fauna habitat type is not immediately obvious, due to its young age and the uncertainty as to how successful the *Banksia* component of the rehabilitation will be; nonetheless, this may have potential to develop into significant foraging habitat over time.

3.2.5 Potentially Significant Black-cockatoo Habitat Trees

Potentially significant Carnaby's Black-cockatoo habitat trees were present as isolated, individual living and stag Marri (*Corymbia calophylla*) trees in the Cleared Farmland with Paddock Trees habitat type. A total of 24 trees with DBH estimated to be greater than 500 mm were mapped (Figure 3.16). Both living and stag trees contained hollows, potentially able to be used by Carnaby's Black-cockatoo for breeding, although a comprehensive census of hollows was not possible and they are therefore not quantified here. The living Marri trees also represent a potential food resource, as they are a known foraging tree for this species (DSEWPaC 2012).

These potentially significant trees also potentially represent night roost habitat, along with the slightly smaller Flooded Gums (*Eucalyptus rudis*) present in the adjacent Drainage Line habitat. The potential use of tall trees as night roosts is dependent on their proximity to high-quality foraging habitat and a permanent water source (DSEWPaC 2012); the potentially significant trees in the Study Area are near high-quality foraging habitat (see Section 3.2.4), but the permanency and quality of the water source in the Drainage Line habitat, Mullering Brook, is unknown. A nearby farm dam also represents a potential water source (Figure 3.16), but again the water quality is unknown.

The use of these potentially significant trees by Carnaby's Black-cockatoo has not been confirmed, i.e. there are no data to suggest they are 'known' breeding or night roosting trees. However, the precautionary principle should be considered and it should be assumed that until proven otherwise, clearing or other impacts to these trees as a result of the Project may have a significant impact on Carnaby's Black-cockatoo. In cases such as this, where uncertainty surrounding impacts exists, it is recommended that the Project be referred to the DotEE.


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Waddi Wind Farm Pty Ltd - Cataby
Flora, Vegetation and Fauna Survey 2016
Black-cockatoo *Banksia* foraging habitat
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Project ID: 1682
Date: 20/10/16
Drawn: MY
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Scale: 1:3,000
Datum: GDA 1994 MGA Zone 50
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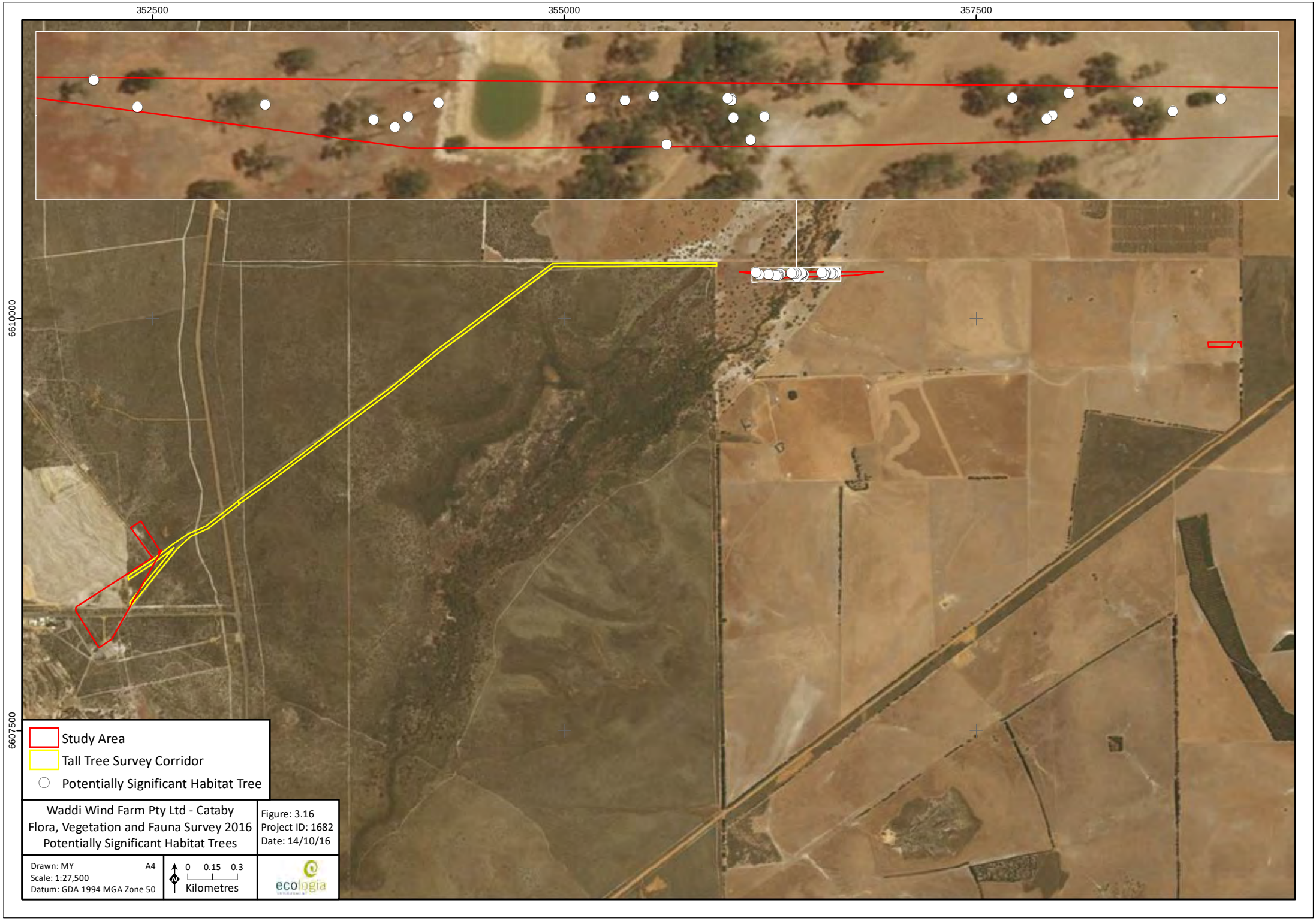
ecologia
Study Area
Tall Tree Survey Corridor
Banksia Woodland Broad Fauna Habitat
Carnaby's Black-cockatoo Foraging Habitat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Flora, Vegetation and Fauna Survey 2016
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3.3 TALL TREE SURVEY CORRIDOR

In the western portion of the Tall Tree Survey Corridor, which was surveyed on foot (Section 2.3.3), no trees over 10 m in height, or with capability to grow over 10 m in height, were recorded. On the contrary, it was apparent that the existing vegetation was substantially lower than this 10 m threshold (Figure 3.17, Figure 3.18).

For the remainder of the corridor, which was assessed by review of aerial imagery and previously collected survey data (Section 2.3.3), it was determined that the vegetation communities present are low open woodlands and proteaceous heaths (Outback Ecology MWH 2013). This is consistent with field observations made in the area during This Study. The tallest trees present are reported as Prickly Bark (*Eucalyptus todtiana*; also known as Coastal Blackbutt), *Banksia attenuata*, *B. prionotes*, *B. menziesii*, Moonah (*Melaleuca preissiana*) and Moodjar (*Nuytsia floribunda*). The generally accepted size range for each of these species is only up to 10 m in height (DPaW 2016); therefore, it is considered very unlikely that the eastern portion of the Tall Tree Survey Corridor contains any trees greater than 10 m in height or of other significance to the Project.

Unusually large Prickly Bark trees may reach heights in excess of 10 m. However, those recorded during This Study, in the western portion of the Tall Tree Survey Corridor and the western portion of the Study Area, were all within the more common size range for this species (quoted as being two to eight metres; DPaW 2016). Furthermore, the Prickly Bark seen in the Study Area were widely scattered, and the nutrient-poor nature of the sandy, Tall Tree Survey Corridor soils would not be expected to foster exceptionally tall Prickly Bark trees (compared to lateritic soils, in which they can also be found). Given these observations, it is considered unlikely that exceptionally tall Prickly Bark are present in the vicinity, and less likely still that such specimens would fall within the Tall Tree Survey Corridor boundary.

Figure 3.17: Tall Tree Survey Corridor – Photo Point 1, facing east

Figure 3.18: Tall Tree Survey Corridor – Photo Point 2, facing east

4 RECOMMENDATIONS

For the construction of the proposed transmission line it is anticipated that approximately 120m^2 of clearing of native vegetation will be required for the allow for the installation of each transmission line pole. Maintenance tracks for ongoing servicing of the transmission line will also be cleared though will not be revegetated.

Following completion of construction, it is recommended the disturbed area around each pole be ripped and revegetated using a mix of locally endemic species (low to mid shrub species), either via broadcast of collected seed of local provenance or planted tubestock (ie seedlings). Both the seeding and tubestock planting should be undertaken immediately following the period of highest rainfall for the region (ie June/July).

5 REFERENCES

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APPENDIX A VEGETATION SURVEY QUADRAT SITE SHEETS

Site 1

Botanist	Andrew Craigie
Date	6/10/2016
Quadrat Size	10 x 10 m
NW Corner Coordinates	50J 0352237 6608132
Landform	Plain
Slope & Aspect	Slope - Negligible
Soil Group	Sandy; Surface - Loose
Soil Colour	Grey; White
Soil Texture	Sand; Loam
Rock Type	No Rocks
Rock Size and Abundance	Sand or Smaller (<2 mm)
Vegetation Condition	Condition 2 (Intact, minimal disturbance)
Disturbance Type	Weeds
Time since Fire	> 5 years
Leaf Litter Distribution and Cover	Low <10%

Taxon	Height	Cover (%)
Banksia attenuata	Tree (<10 m)	5
Banksia menziesii	Tree (<10 m)	5
Chamelaucium uncinatum	Shrub (1-2 m)	<1
Xanthorrhoea preissii	Shrub (1-2 m)	1
Acacia pulchella var. *reflexa*	Shrub (0-1 m)	<1
Andersonia heterophylla	Shrub (0-1 m)	<1
Bossiaea eriocarpa	Shrub (0-1 m)	<1
Conospermum crassinervium	Shrub (0-1 m)	<1
Conostephium preissii	Shrub (0-1 m)	<1
Gompholobium tomentosum	Shrub (0-1 m)	<1
Hibbertia hypericoides subsp. *hypericoides*	Shrub (0-1 m)	1
Hibbertia subvaginata	Shrub (0-1 m)	1
Hypocalymma xanthopetalum	Shrub (0-1 m)	<1
Jacksonia floribunda	Shrub (0-1 m)	<1
Leucopogon ?sp. Cataby (F. Hort 1638)	Shrub (0-1 m)	<1

Taxon	Height	Cover (%)
Melaleuca clavifolia	Shrub (0-1 m)	1
Patersonia occidentalis	Shrub (0-1 m)	2
Petrophile linearis	Shrub (0-1 m)	<1
Petrophile sp.	Shrub (0-1 m)	<1
Austrostipa macalpinei	Grass	<1
Arctotheca calendula	Herb	<1
Crassula colorata	Herb	<1
Desmocladus sp.	Herb	<1
Drosera microphylla	Herb	<1
Drosera pulchella	Herb	<1
Phyllangium paradoxum	Herb	<1
Podotheca gnaphalioides	Herb	<1
Stylidium piliferum	Herb	<1
Stylidium spiciforme	Herb	<1
Trachymene pilosa	Herb	<1

Site 2

Botanist	Andrew Craigie
Date	6/10/2016
Quadrat Size	10 x 10 m
NW Corner Coordinates	50J 0352162 6608164
Landform	Plain
Slope & Aspect	Slope - Negligible
Soil Group	Sandy; Surface - Loose
Soil Colour	Grey; White
Soil Texture	Sand; Loam
Rock Type	No Rocks
Rock Size and Abundance	Sand or Smaller (<2 mm)
Vegetation Condition	Condition 2 (Intact, minimal disturbance)
Disturbance Type	No Disturbance
Time since Fire	> 5 years
Leaf Litter Distribution and Cover	Low <10%

Taxon	Height	Cover (%)
Adenanthos cygnorum	Tree (<10 m)	1
Banksia attenuata	Tree (<10 m)	2
Banksia ilicifolia	Tree (<10 m)	<1
Banksia menziesii	Tree (<10 m)	2
Conostephium magnum	Shrub (1-2 m)	<1
Andersonia heterophylla	Shrub (0-1 m)	<1
Bossiaea eriocarpa	Shrub (0-1 m)	<1
Calytrix flavescens	Shrub (0-1 m)	<1
Conospermum crassinervium	Shrub (0-1 m)	<1
Conostylis angustifolia	Shrub (0-1 m)	<1
Dasypogon obliquifolius	Shrub (0-1 m)	<1
Hibbertia hypericoides subsp. *hypericoides*	Shrub (0-1 m)	<1
Hibbertia subvaginata	Shrub (0-1 m)	1
Hypocalymma xanthopetalum	Shrub (0-1 m)	<1
Jacksonia floribunda	Shrub (0-1 m)	<1

Taxon	Height	Cover (%)
Melaleuca clavifolia	Shrub (0-1 m)	<1
Scholtzia involucrata	Shrub (0-1 m)	<1
Schoenus curvifolius	Sedge	<1
Arctotheca calendula	Herb	<1
Conostylis angustifolia	Herb	<1
Desmocladus sp.	Herb	<1
Drosera microphylla	Herb	<1
Patersonia occidentalis	Herb	<1
Phyllangium paradoxum	Herb	<1
Poranthera sp.	Herb	<1
Stylidium spiciforme	Herb	<1
Trachymene pilosa	Herb	<1
Thysanotus patersonii	Vine	<1

Site 3

Botanist	Andrew Craigie
Date	6/10/2016
Quadrat Size	10 x 10 m
NW Corner Coordinates	50J 0352399 6608379
Landform	Plain
Slope & Aspect	Slope - Negligible
Soil Group	Sandy; Surface - Loose
Soil Colour	Grey; White
Soil Texture	Sand; Loam
Rock Type	No Rocks
Rock Size and Abundance	Sand or Smaller (<2 mm)
Vegetation Condition	Condition 2 (Intact, minimal disturbance)
Disturbance Type	Weeds
Time since Fire	> 5 years
Leaf Litter Distribution and Cover	Moderate 10-40%

Taxon	Height	Cover (%)
Banksia attenuata	Tree (<10 m)	5
Banksia menziesii	Tree (<10 m)	1
Banksia prionotes	Tree (<10 m)	1
Adenanthos cygnorum	Shrub (>2 m)	2
Petrophile scabriuscula	Shrub (1-2 m)	<1
Acacia pulchella var. *reflexa*	Shrub (0-1 m)	<1
Conospermum stoechadis subsp. *stoechadis*	Shrub (0-1 m)	<1
Conostephium preissii	Shrub (0-1 m)	<1
Eremaea asterocarpa subsp. *asterocarpa*	Shrub (0-1 m)	<1
Eremaea pauciflora var. *pauciflora*	Shrub (0-1 m)	1
Hibbertia hypericoides subsp. *hypericoides*	Shrub (0-1 m)	5
Hypocalymma xanthopetalum	Shrub (0-1 m)	<1
Melaleuca clavifolia	Shrub (0-1 m)	<1
Synaphea spinulosa subsp. *spinulosa*	Shrub (0-1 m)	<1
Austrostipa macalpinei	Grass	<1

Taxon	Height	Cover (%)
Mesomelaena pseudostygia	Sedge	2
Anigozanthos humilis	Herb	<1
Burchardia congesta	Herb	<1
Drosera erythrorhiza	Herb	<1
Drosera microphylla	Herb	<1
Drosera pulchella	Herb	<1
Hibbertia huegelii	Herb	<1
Trachymene pilosa	Herb	<1
Thysanotus patersonii	Vine	<1

Site 4

Botanist	Andrew Craigie
Date	6/10/2016
Quadrat Size	10 x 10 m
NW Corner Coordinates	50J 0352503 6608608
Landform	Plain
Slope & Aspect	Slope - Negligible
Soil Group	Sandy; Surface - Loose
Soil Colour	Grey; White
Soil Texture	Sand; Loam
Rock Type	No Rocks
Rock Size and Abundance	Sand or Smaller (<2 mm)
Vegetation Condition	Condition 2 (Intact, minimal disturbance)
Disturbance Type	Weeds
Time since Fire	> 5 years
Leaf Litter Distribution and Cover	Moderate 10-40%

Taxon	Height	Cover (%)
Banksia attenuata	Tree (<10 m)	5
Banksia menziesii	Tree (<10 m)	1
Eucalyptus todtiana	Mallee (3-10 m)	2
Adenanthos cygnorum	Shrub (>2 m)	1
Eremaea pauciflora var. *pauciflora*	Shrub (1-2 m)	1
Bossiaea eriocarpa	Shrub (0-1 m)	<1
Conospermum crassinervium	Shrub (0-1 m)	<1
Desmocladus sp. (indet.)	Shrub (0-1 m)	<1
Hibbertia hypericoides subsp. *hypericoides*	Shrub (0-1 m)	2
Hibbertia subvaginata	Shrub (0-1 m)	<1
Hypocalymma xanthopetalum	Shrub (0-1 m)	<1
Jacksonia floribunda	Shrub (0-1 m)	<1
Jacksonia sternbergiana	Shrub (0-1 m)	<1
Melaleuca clavifolia	Shrub (0-1 m)	<1
Scholtzia involucrata	Shrub (0-1 m)	1

Taxon	Height	Cover (%)
Stirlingia latifolia	Shrub (0-1 m)	<1
Synaphea spinulosa subsp. *spinulosa*	Shrub (0-1 m)	<1
Mesomelaena pseudostygia	Sedge	<1
Anigozanthos humilis	Herb	<1
Burchardia congesta	Herb	<1
Conostylis angustifolia	Herb	<1
Conostylis juncea	Herb	<1
Dasypogon obliquifolius	Herb	1
Desmocladus sp.	Herb	<1
Drosera erythrorhiza	Herb	<1
Drosera microphylla	Herb	<1
Levenhookia stipitata	Herb	<1
Patersonia occidentalis	Herb	1
Stylidium sp. (indet)	Herb	<1
Trachymene pilosa	Herb	<1
Thysanotus patersonii	Vine	<1

Site 5

Botanist	Andrew Craigie
Date	6/10/2016
Quadrat Size	10 x 10 m
NW Corner Coordinates	50J 0356427 6610275
Landform	Undulating Plain; Minor Creek (<5m)
Slope & Aspect	Slope - Negligible
Soil Group	Loamy; Non-Cracking Clay; Surface - Loose
Soil Colour	Brown
Soil Texture	Sand Clay Loam
Rock Type	Other
Rock Size and Abundance	Pebbles (2-64 mm) - Few (<10%)
Vegetation Condition	Condition 6 (Severely impacted)
Disturbance Type	Weeds; No native understorey; Veg structure altered
Time since Fire	> 5 years
Leaf Litter Distribution and Cover	High >40%

Taxon	Height	Cover (%)
Corymbia calophylla	Tree (10-30 m)	20
Eucalyptus rudis subsp. *rudis*	Tree (10-30 m)	1
Melaleuca rhaphiophylla	Tree (<10 m)	5
Bromus diandrus	Grass	1
Ehrharta calycina	Grass	50
Polypogon monspeliensis	Grass	<1
Isolepis congrua	Sedge	<1
Arctotheca calendula	Herb	<1
Cotula coronopifolia	Herb	<1
Ehrharta longiflora	Herb	<1
Juncus acutus	Herb	<1
Medicago sp.	Herb	<1
Ornithopus compressus	Herb	1
Ptilotus polystachyus	Herb	<1
Sonchus oleraceus	Herb	<1
Ursinia anthemoides	Herb	<1

Site 6

Botanist	Andrew Craigie
Date	6/10/2016
Quadrat Size	Releve
NW Corner Coordinates	50J 0356557 6610274
Landform	Undulating Plain
Slope & Aspect	Slope - Negligible
Soil Group	Surface - Loose
Soil Colour	Brown
Soil Texture	Sand Clay Loam
Rock Type	No Rocks
Rock Size and Abundance	Sand or Smaller (<2 mm)
Vegetation Condition	Condition 7 (No longer intact)
Disturbance Type	Vehicle Tracks; Weeds; Animal Tracks; Faeces; No native understorey; Veg structure altered
Time since Fire	> 5 years
Leaf Litter Distribution and Cover	Moderate 10-40%

Taxon	Height	Cover (%)
Corymbia calophylla	Tree (10-30 m)	5
Austrostipa macalpinei	Grass	1
Bromus diandrus	Grass	10
Bromus rubens	Grass	1
Ehrharta longiflora	Grass	1
Lolium perenne	Grass	1
Arctotheca calendula	Herb	10
Ptilotus polystachyus	Herb	<1

APPENDIX B FAUNA HABITAT ASSESSMENT DATA

	9	8	7	6	5	4	3	2	1
Date	6/10/2016	6/10/2016	6/10/2016	6/10/2016	6/10/2016	6/10/2016	6/10/2016	6/10/2016	6/10/2016
Time	4:30 PM	4:20 PM	3:16 PM	1:03 PM	12:38 PM	12:12 PM	11:38 AM	10:55 AM	10:00 AM
Observer	MY	MY	MY	MY	MY	MY	MY	MY	MY
mE, GDA94 z50	356412	356546	359103	352418	352247	352085	352165	352292	352267
mN, GDA94 z50	6610265	6610260	6609852	6608417	6608364	6608228	6608086	6608167	6608094
Photo	See report text	See report text	See report text	See report text	See report text	See report text	See report text	See report text	See report text
Habitat name	Drainage Line	Cleared Farmland with Paddock Trees	Cleared Farmland	*Banksia* Woodland	Mining Rehabilitation	*Banksia* Woodland	*Banksia* Woodland	*Banksia* Woodland	*Banksia* Woodland
Landform	Drainage Line	Undulating Plain	Undulating Plain	Sand Plain	Sand Plain	Sand Plain	Sand Plain	Sand Plain	Sand Plain
Soil colour	Grey-brown	Grey-white	Grey-white	Grey-white	Grey-white	Grey-white	Grey-white	Grey-white	Grey-white
Soil type	Clayey Loam	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand
Soil note	Saturated	Loose	Loose	Loose	Loose, with regular windrows	Loose, with small pebbles	Loose, with small pebbles	Loose, with small pebbles	Loose, with small pebbles
Cover type in non-vegetated areas	None - fully vegetated	None - fully vegetated	None - fully vegetated	Leaf litter, banksia cones, bark	Leaf litter, bark chips	Leaf litter, pebbles	Leaf litter, pebbles	Leaf litter, pebbles	Leaf litter, pebbles
Cover in non-veg areas (%)	N/A	N/A	N/A	80	30	60	70	60	50
Lower stratum type	Weeds, paddock grasses	Weeds, paddock grasses	Weeds, paddock grasses	Small herbs, annuals, low shrubs, sedges, orchids	Small herbs, annuals, low shrubs, tree seedlings	Small herbs, annuals, low shrubs	Small herbs, annuals, low shrubs	Small herbs, annuals, low shrubs	Small herbs, annuals, low shrubs
Lower stratum height (cm)	60	45	45	60	30	40	40	50	40
Lower stratum cover (%)	100	100	100	75	70	50	40	50	50
Middle stratum type	None	None	None	Woody shrubs, *Acacia* spp.	Small shrubs, Smokebush, *Acacia* spp., juvenile *Banksia* spp., juvenile Woolly Bush	Woody shrubs, Smokebush	Woody shrubs	Woody shrubs, *Xanthorrhoea* spp., *Acacia* spp.	Woody shrubs, *Xanthorrhoea* spp.
Mid stratum height (m)	N/A	N/A	N/A	1.5	1	1	1.5	2	1.5
Mid stratum cover (%)	N/A	N/A	N/A	60	30	25	30	50	50

	9	8	7	6	5	4	3	2	1
Upper stratum type	Flooded Gum and Swamp Paperbark (with some Marri further from Drainage Line; some stag trees, but trees mostly living)	Tall paddock trees (living; predominantly Marri, but with Flooded Gum toward drainage line), stag trees	None	*Banksia* spp. trees, Woolly Bush trees, eucalypts	None	*Banksia* spp. trees, Woolly Bush trees, eucalypts	*Banksia* spp. trees, Woolly Bush trees	*Banksia* spp. trees, Woolly Bush trees, small eucalypts	*Banksia* spp. trees, Woolly Bush trees
Upper stratum height (m)	10	10	N/A	6	N/A	6	6	5	4
Upper stratum cover (%)	75	10	N/A	50	N/A	15	20	25	25
Fire history	None obvious	None obvious	None obvious	None obvious	None obvious	None obvious	None obvious	None obvious	None obvious
Disturbance	Land clearing, tracks, livestock, some rubbish, farm activities and infrastructure	Land clearing, tracks, some rubbish, farm activities and infrastructure	Land clearing, tracks, some rubbish, farm activities and infrastructure	Tracks, fences, infrastructure. Dieback status unknown, possibly dieback free	Tracks, fences, infrastructure.	Tracks, fences, infrastructure. Dieback present, according to Tronox	Tracks, fences, infrastructure. Dieback present, according to Tronox	Tracks, fences, infrastructure. Dieback present, according to Tronox	Tracks, fences, infrastructure. Dieback present, according to Tronox
Leaf litter	Very small amounts around fringes of drainage	None	None	Large amounts	Some present, but, no significant microhabitats	Moderate amounts	Moderate amounts	Moderate amounts	Moderate amounts
Coarse woody debris	Occasional fallen branches and logs	Occasional fallen branches and logs	Nil	Yes, abundant, banksia logs and cones	None	Yes, abundant, banksia logs and cones	Yes, abundant, banksia logs and cones	Yes, abundant, banksia logs and cones	Yes, abundant, banksia logs and cones
Water	Present, permanency unknown	Small drainage line nearby	None	None	None	None	None	None	None
Tree hollows	Present in stag trees and Marri, none observed in Flooded Gum but potentially present	Present in stag trees, several observed in living trees, likely to be common in habitat overall	None	None	None	None	None	None	None
Rocks, outcrops	None	None	None	None	None	None	None	None	None

	9	8	7	6	5	4	3	2	1
Conservation significant fauna potential	Carnaby's Black-cockatoo foraging habitat (living Marri trees) and potential breeding habitat (hollows in Marris, stag trees and Flooded Gums). Possible night roost habitat due to water presence, but depends on water permanency. May be an important dispersal corridor for fauna in general.	Carnaby's Black-cockatoo foraging habitat (living Marri trees) and potential breeding habitat (hollows in Marris, stag trees and Flooded Gums). Possible night roost habitat due to water proximity, but depends on water permanency. Understorey not likely to represent important fauna habitat.	Limited. Unlikely to represent critical habitat for conservation significant fauna.	Good quality, dense Carnaby's Black-cockatoo foraging habitat, several large blackbutt around this point. Lots of recruiting *Banksia* spp., lots of cones on adult trees, despite possibility of dieback presence – area looks healthy and highly productive overall. See report text for other conservation significant fauna notes.	Limited at present, but may develop into significant Carnaby's Black-cockatoo foraging habitat, as juvenile banksias are present and may represent a substantial food resource over time.	Good quality Carnaby's Black-cockatoo foraging habitat, several large blackbutt around this point. Lots of recruiting *Banksia* spp., lots of cones on adult trees, despite reported presence of dieback in vicinity. See report text for other conservation significant fauna notes.	Good quality Carnaby's Black-cockatoo foraging habitat. Lots of recruiting *Banksia* spp., lots of cones on adult trees, despite reported presence of dieback in vicinity. See report text for other conservation significant fauna notes.	Good quality Carnaby's Black-cockatoo foraging habitat. Lots of recruiting *Banksia* spp., lots of cones on adult trees, despite reported presence of dieback in vicinity. See report text for other conservation significant fauna notes.	Good quality Carnaby's Black-cockatoo foraging habitat. Lots of recruiting *Banksia* spp., lots of cones on adult trees, despite reported presence of dieback in vicinity. See report text for other conservation significant fauna notes.