Report of a Flora and Vegetation Survey of Lot 2626 Jamisons Road, Boallia

Prepared for B&J Catalano Pty Ltd
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Executive Summary

Ecoedge was engaged by B & J Catalano in September 2017 to undertake a quadrat-based Flora and Vegetation Survey on Lot 2626 Jamisons Road, in the City of Busselton ('Survey Area'). The survey was to include reconnaissance, detailed and targeted components, as described in the Environmental Protection Authority Technical Guidance (Environmental Protection Authority, 2016).

The survey was required as part of B&J Catalano's investigations into the potential future extraction of Basic Raw Materials from the site.

The Survey Area is located approximately 16 km south southwest of Busselton townsite on Jamisons Road. It comprises 4.6 ha of remnant vegetation plus 19 paddock trees.

Ninety-two species of vascular flora were identified within the Survey Area, of which five were naturalised. No Threatened flora, species listed under the EPBC Act, Priority flora or other flora of conservation significance were found in the Survey Area. None of the introduced species are Declared Pest Plants under the *Biosecurity and Agriculture Management Act 2007* (Department of Agriculture and Food Western Australia, 2007).

Only one vegetation unit was recognised within the Survey Area, which is comprised of an open forest of Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) with occasional patches of Sheoak (*Allocasuarina fraseriana*) on sandy gravel soil. The low understorey appears to be recovering from livestock grazing.

Of the Whicher Scarp floristic vegetation types identified by Keighery *et al*. (2008), it appears to have the closest resemblance to FCT C4 – "Whicher Scarp/Blackwood Plateau Jarrah and Marri woodland". This vegetation type is widespread and common on the Whicher Scarp and adjacent Blackwood Plateau.

The Survey Area vegetation does not resemble any Threatened or Priority ecological community.

Just over half the vegetation was classified as Very Good condition, with three quarters in Good or Very Good condition. All the small remnants north of the access track were Completely Degraded.

The whole of the Survey Area is covered by an Environmentally Sensitive Area which is associated with known occurrences of a Threatened ecological community and of Threatened flora within the Treeton Forest block. Clearing regulation exemptions do not apply to vegetation that forms part of an Environmentally Sensitive Area.

The Survey Area vegetation directly forms part of a South West Regional Ecological Linkage, as mapped by Molloy *et al.* (2009).

The vegetation in the Survey Area does not have any particular conservation significance, however it is situated on the Whicher Scarp, which has been identified as a biodiversity 'hotspot' (Keighery *et al*., 2008), most of it is in Good or Very Good condition, and it forms part of a regional ecological linkage.

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Statement of Limitations

Reliance on Data

In the preparation of this report, Ecoedge has relied on data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report. Unless stated otherwise in the report, Ecoedge has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report are based in whole or in part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Ecoedge will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, unavailable, misrepresented or otherwise not fully disclosed to Ecoedge.

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1 Introduction

Ecoedge was engaged by B & J Catalano in September 2017 to undertake a quadrat-based Flora and Vegetation Survey on Lot 2626 Jamisons Road, in the City of Busselton ('Survey Area') (**Figures 1** and **2**). The survey was to include reconnaissance, detailed and targeted components, as described in the Environmental Protection Authority Technical Guidance (Environmental Protection Authority, 2016).

The survey was required as part of B&J Catalano's investigations into the potential future extraction of Basic Raw Materials from the site. The purpose of the survey was to delineate key flora and vegetation values and their potential sensitivity to impact. The outcomes of the survey and information supplied in the survey report will be used to inform the environmental assessment and approvals process.

The Survey Area comprises 4.6 ha of remnant vegetation plus 19 paddock trees (**Figure 3**).

The flora and vegetation survey was undertaken in accordance with the Environmental Protection Authority (EPA) Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016).

This report compiles findings of the field survey.

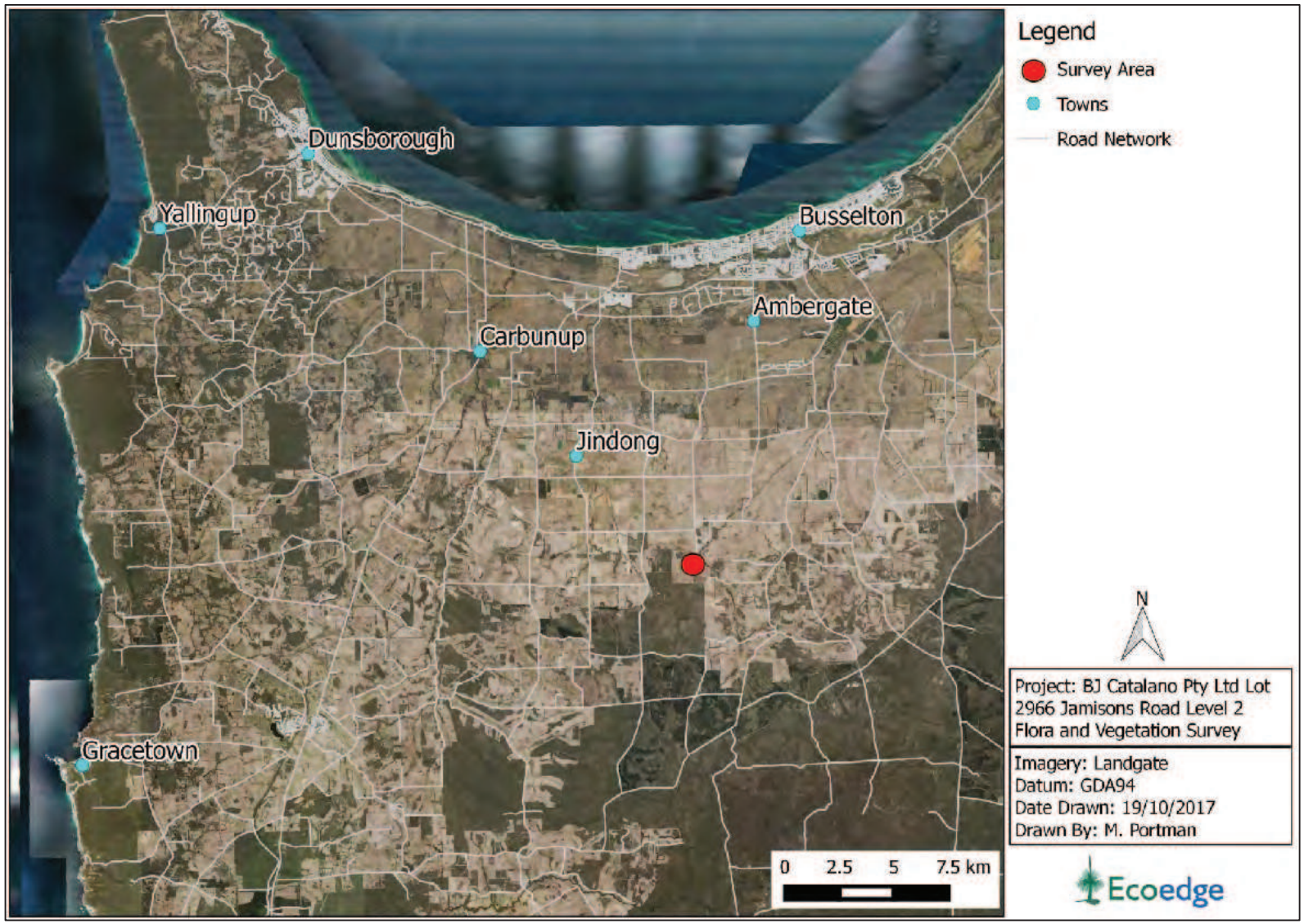

Figure 1. Aerial Photograph showing location of Survey Area.

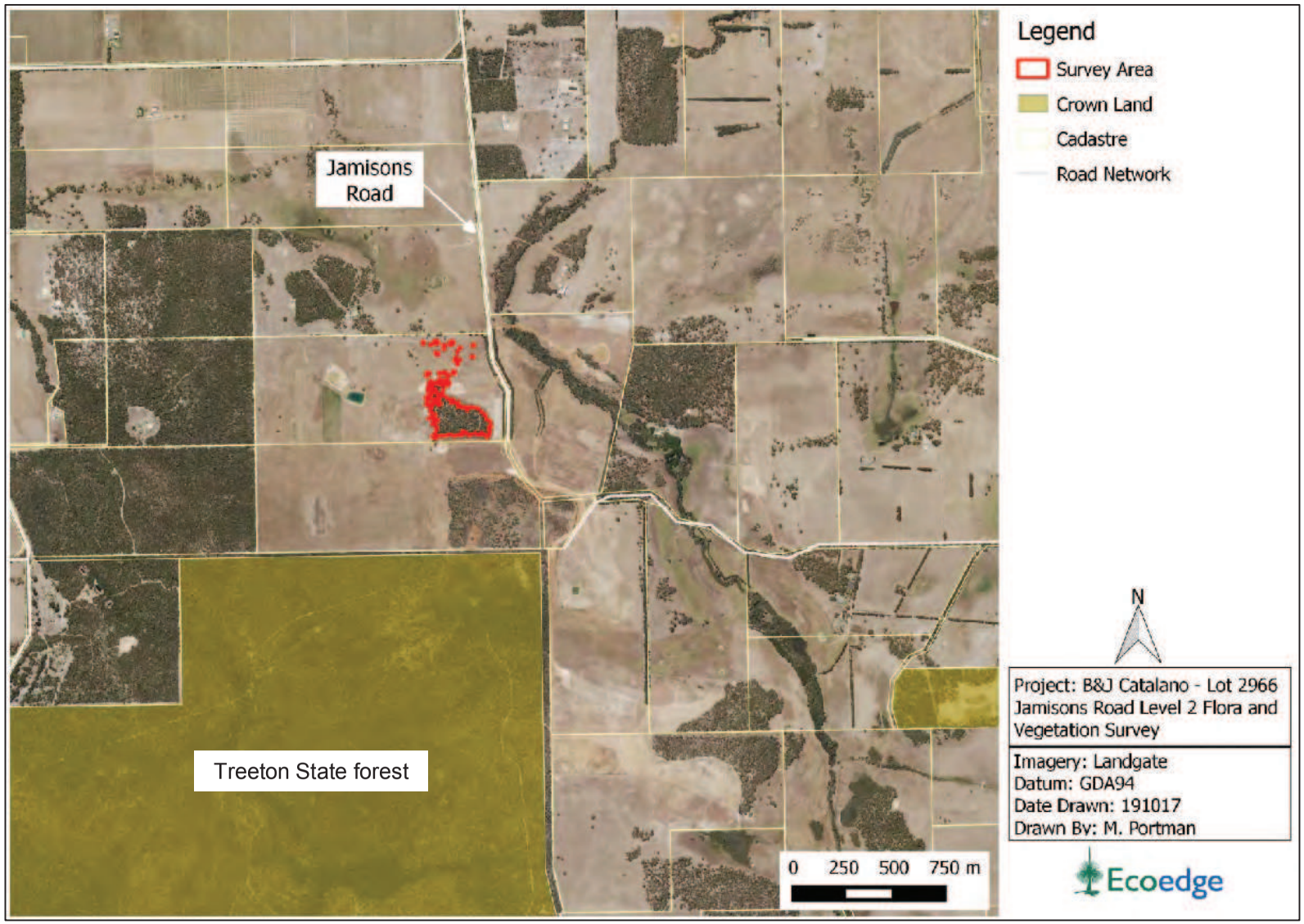

Figure 2. The Survey Area in relation to surrounding land uses and the Treeton State forest.

1.1 Project Scope

The scope of the survey was to conduct a quadrat-based (previously referred to as Level 2) Flora and Vegetation Survey of approximately 4.9 ha of remnant vegetation on Lot 2626, Jamisons Road, Boallia, as follows:

- Provide a review of, and search for, native plant species considered to be rare or potentially endangered and other species of interest, including those of limited distribution or outliers from their known range;
- Provide an inventory of the plant species present in the survey area;
- Describe and map vegetation units;
- Assess vegetation condition using the scale specified in EPA (2016); and
- Describe and map Threatened and Priority Ecological Communities.

The survey report was required to detail the scope, methodology and outcomes of the flora survey and provide the following:

1. Details of the project's purpose, background and location;
2. Description of the methodology used to assess biological factors in the desktop and field survey;
3. Presentation and discussion of the results of the survey and any resulting conclusions and/or recommendations;

Mapping of field survey data was required to consist of:

- Location and extent of vegetation units including Threatened Ecological Communities;
- Vegetation condition; and
- Location of any Threatened and/or Priority flora found during the survey.

1.2 Biogeographic Region and Location

The Survey Area is situated within the Perth (SWA02) subregion of the Swan Coastal Plain bioregion as defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Commonwealth of Australia, 2016).

The Survey Area is located approximately 16 km south southwest of Busselton townsite, on Jamisons Road in the City of Busselton. The Survey Area is surrounded by cleared farmland; the nearest remnant native vegetation is approximately 180-400 metres away, and State Forest 32 (Treeton Block) is located 800 metres to the south (**Figure 2**).

1.3 Geology and Geomorphology

The Survey Area is situated on the Whicher Scarp, a sickle shape band of low hills thought to have formed as a result of marine erosion of the Perth Sedimentary Basin around two

million years ago in the Pleistocene or late Tertiary period. Following ancient shorelines at the foot of the Whicher Scarp is the Yoganup Formation, a gently sloping shelf which contains localised concentrations of heavy minerals (Churchward and McArthur, 1980). The nature of its geology, landform and soils gives the Whicher Scarp affinities with the Swan Coastal Plain. The Survey Area is located on the 'Central Whicher Scarp', which is described by Keighery *et al.* (2008) as having moderate north facing slopes with areas of laterite capped rises and soils ranging from deep sands to sand, gravel, silt, clay and ironstone

The Survey Area is situated on the Yelverton subsystem of the Whicher Scarp soil landscape system, on the Yelverton Flats soil mapping unit (214WsYL1) (**Figure 3**). The Yelverton Flats soils are described as 'Raised flats. Duplex sandy gravels, semi-wet soils, yellow deep sands and sandy earths and loamy gravels' (Tille and Lantzke, 1990).

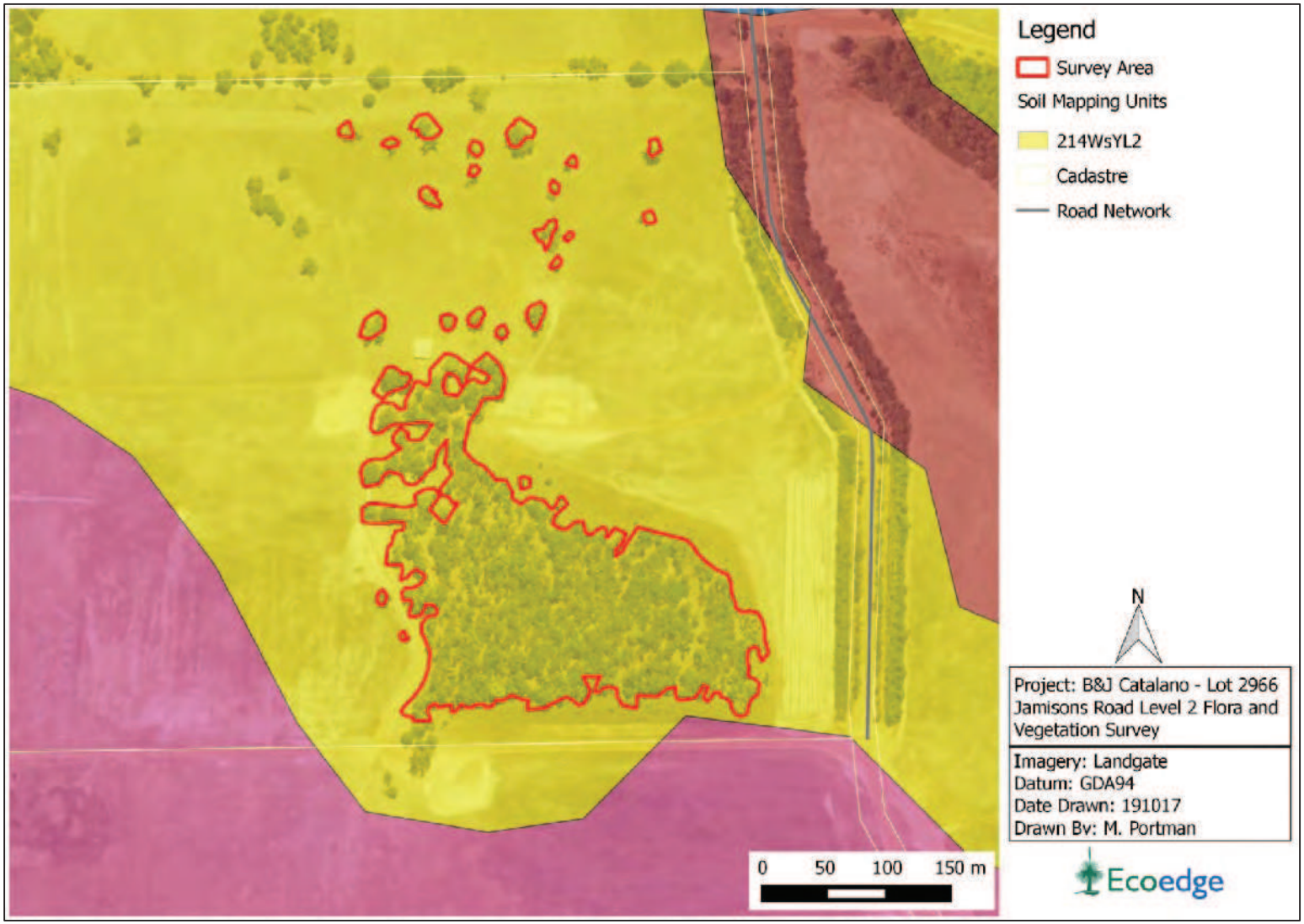

Figure 3. The Survey Area is situated on soils of the Yelverton Flats soil mapping unit (Tille and Lantzke, 1990).

1.4 Vegetation Description according to pre-European Mapping Datasets

Variation in vegetation mainly reflects the variations in soil and moisture condition of a landscape.

1.4.1 Vegetation Complexes

In 2016, the Department of Parks and Wildlife (DPaW) revised the mapping datasets for the Darling Scarp and Plateau Regional Forest Agreement (RFA) mapping of Mattiske and Havel (1998) and the Swan Coastal Plain mapping of Heddle *et al.* (1980). The purpose of the revision was to fill data gaps and improve alignment and correlation between the two datasets (Webb, *et al.* 2016).

According to the 1:50,000 Mapping of Vegetation Complexes in the South West Forest Region of Western Australia (Mattiske & Havel 1998) as updated by Webb *et al*. (2016), all of the Survey Area was mapped as the Yelverton (Y) vegetation complex (**Figure 4**), which is described as 'Woodland of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Allocasuarina fraseriana-Agonis flexuosa* and open woodland of *Corymbia calophylla* on low undulating uplands in the humid zone.'

1.4.2 Assessment of Remaining Extent against Pre-European Extent

In 2001, the Commonwealth of Australia stated National Targets and Objectives for Biodiversity Conservation, which recognised that the retention of 30%, or more, of the pre-clearing extent of each ecological community was necessary if Australia's biological diversity was to be protected (Environment Australia, 2001).

Table 1 lists the percentage remaining of the Yelverton (Y) vegetation complex according to the Statewide Vegetation Statistics (Government of Western Australia, 2017). The Yelverton complex meets the 30% National retention target.

Table 1. Vegetation Complexes mapped within the Survey Area with regard to the National retention target (Government of Western Australia, 2017).

Vegetation Complex	% Remaining of pre-European	Is the 30% Target Met?	Current percentage remaining within all DPaW managed land* (%)
Yelverton (Y)	35.79%	Yes	18.83%

* Excludes Crown Freehold Department Interest Lands that are managed under Section 8(a) of the *Conservation and Land Management Act 1984*.

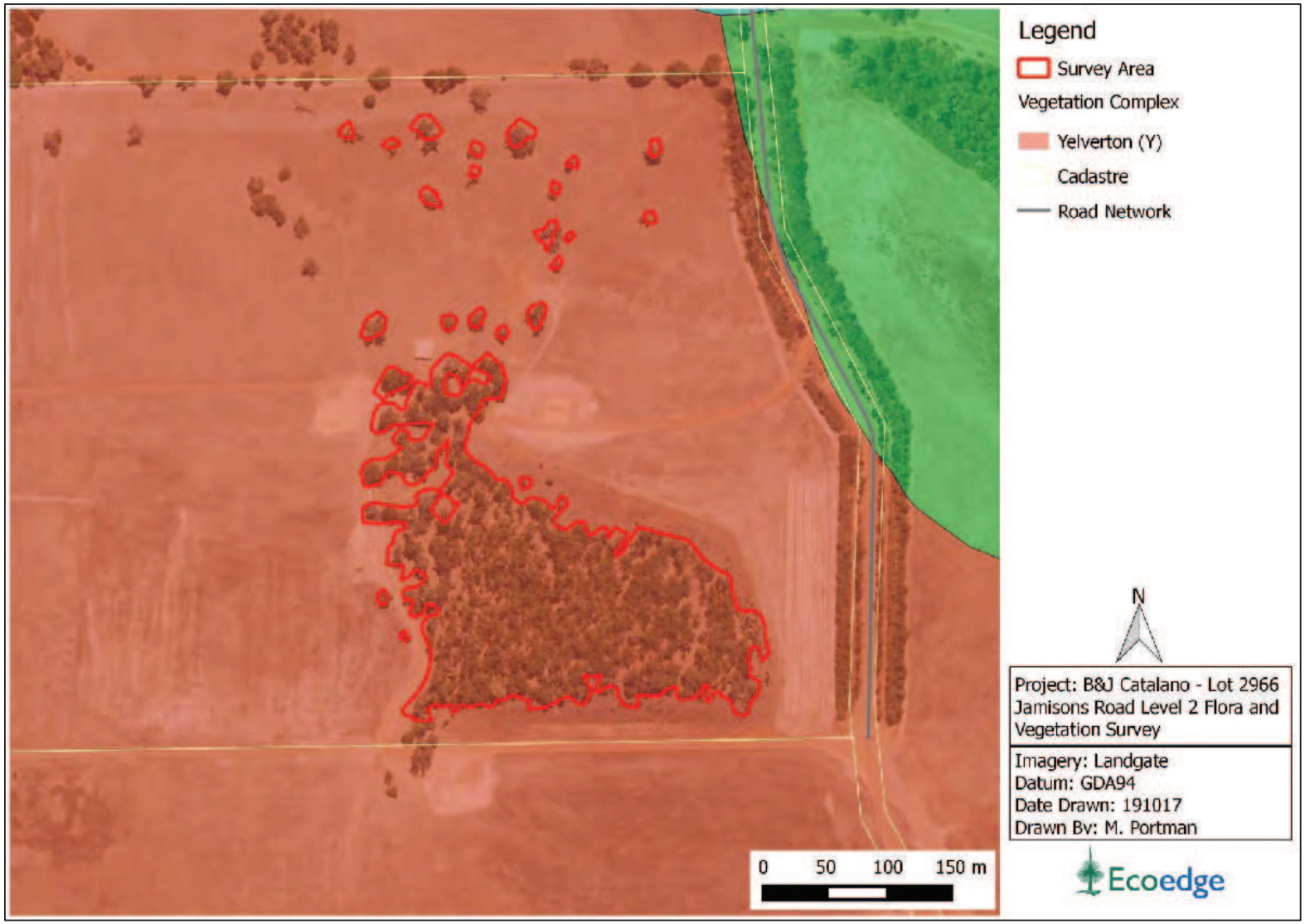

Figure 4. The Survey Area vegetation is mapped as the Yelverton complex (Webb *et al*., 2016).

1.5 Threatened and Priority Ecological Communities

Ecological communities are defined by Western Australia's DBCA (previously DPaW and the Department of Environment and Conservation (DEC)) as "...naturally occurring biological assemblages that occur in a particular type of habitat. They are the sum of species within an ecosystem and, as a whole, they provide many of the processes which support specific ecosystems and provide ecological services." (DEC, 2013).

Through a non-statutory process, the Minister for Environment may list communities that are considered to be at threat as either Threatened or Priority Ecological Communities. A Threatened Ecological Community (TEC) is one which is found to fit into one of the following categories; Presumed Totally Destroyed (PD), Critically Endangered (CE), Endangered (E) or Vulnerable (V) (DEC, 2013). Possible threatened ecological communities that do not meet survey criteria are added to DBCA's Priority Ecological Community Lists under Priorities 1, 2 and 3 (referred to as P1, P2, P3). Ecological Communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4 (P4). These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5 (P5) (DEC, 2013). The current listing of Threatened and Priority Ecological Communities is specified in DPaW (2016a) and DBCA (2017a).

Threatened Ecological Communities can also be listed under the Commonwealth EPBC Act (Department of the Environment and Energy (DotEE), 2017a; Department of Environment, Water, Heritage and the Arts (DEWHA), 1999). There are three categories of TEC under the *EPBC Act*: Critically Endangered (CE), Endangered (E) and Vulnerable (V). These are defined in **Appendix 1**.

A Protected Matters Search Tool query for communities listed under the EPBC Act occurring within a 10 km radius of the Survey Area was undertaken (DotEE, 2017b, **Appendix 2**), and the current TEC and PEC listings were consulted (DPaW (2016a) and DBCA (2017a)).

Threatened and Priority Ecological Communities known to occur within 10 km of the Survey Area are listed in **Table 2.**

Table 2. Threatened Ecological Communities occurring within 10 km of the Survey Area (DPaW, 2016a; DBCA, 2017a; DotEE, 2017b).

Community Name	Community Description	Status (WA)	Status (EPBC Act)
Banksia woodlands of the Swan Coastal Plain	*Banksia attenuata* woodland over species rich dense shrublands (a component of the Banksia woodlands of the Swan Coastal Plain EPBC listed TEC) Swan Coastal Plain. *Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain (a component of the Banksia woodlands of the Swan Coastal Plain EPBC listed TEC) Swan Coastal Plain. '*Banksia* Woodlands of the Swan Coastal Plain' – a federally listed TEC consisting of numerous State-listed threatened and priority communities and non-listed communities	Various	EN
Shrublands on southern Swan Coastal Plain ironstones	Shrublands on southern Swan Coastal Plain Ironstones (Busselton area)	CR	EN
SWAFCT1b	*Corymbia calophylla* woodlands on heavy soils of the southern Swan Coastal Plain	VN	

Note: This table only includes TECs that are known of and mapped by DBCA and are included in their database.

1.6 Threatened and Priority Flora

Species of flora and fauna are defined as having Threatened or Priority conservation status where their populations are restricted geographically or threatened by local processes. The Department of Environment Regulation recognises these threats of extinction and consequently applies regulations towards population and species protection.

Threatened flora species are gazetted under Subsection 2 of Section 23F of the *Wildlife Conservation Act 1950* (*WC* Act) and therefore it is an offence to "take" or damage rare flora without Ministerial approval. Section 6 of the *WC Act* defines "to take" as "… to gather, pick, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means."

Priority Flora are under consideration for future declaration as "rare flora", dependent on more information. Species classified as Priority One to Three (referred to as P1, P2 and P3) are in need of further survey to determine their status, while Priority Four (P4) species

require monitoring every 5-10 years. Under the WC Act, Threatened Flora are ranked according to their level of threat using IUCN Red List categories and criteria of Extinct (EX), Critically Endangered (CE), Endangered (EN) or Vulnerable (VU). Definitions of categories of Threatened and Priority Flora as defined by the WC Act are included in **Appendix 3** (DBCA, 2017b).

Under the EPBC Act, a species may be listed in one of six categories; the definitions of these categories are summarised in **Appendix 4** (DotEE, 2017c).

A list of Threatened or Priority flora occurring within 10 km of the Survey Areas generated from results of the DBCA data search (DBCA, 2017c) and NatureMap search (DBCA, 2017d, **Appendix 2**) is presented in **Table 3** and the locations of these species is shown in **Figure 5**. Taxa listed under the EPBC Act are noted.

Very few of the species listed in **Table 3** could potentially occur within the Survey Area, based on an assessment of their preferred habitats. Most species listed would have either been flowering at the time of survey or could be identified in the field without flowers.

Table 3. Threatened and Priority listed Flora within 10 km of the Survey Area (DBCA, 2017c, 2017d; DotEE, 2017b).

Species	Cons Status*	Flowering	Description and Habitat	Likelihood of Occurrence
Brachyscias verecundus	T(CE)		Annual (or ephemeral), herb, 0.012-0.022 m high, entirely glabrous. Fl. white/cream. In a moss sward. On a granite outcrop.	None
Reedia spathacea	T(CE)	Nov - Dec or Jan	Robust, tufted perennial, grass-like or herb (sedge), 2-4 m high, clumps 1.5-2 m wide. Fl. brown. Peaty sand. Swamps, river edges.	None
Banksia nivea subsp. *uliginosa*	T(EN)	Aug-Sep	Dense, erect, non-lignotuberous shrub, 0.2–1.5 m high. Fl. yellow, brown. Sandy clay, gravel.	None
Caladenia excelsa	T(EN)	Sep-Oct	Tuberous, perennial, herb, 0.45-0.9 m high. Fl. green, white, red. White, grey or brown sand, sandy loam.	Low
Caladenia hoffmanii	T(EN)	Aug - Oct	Tuberous, perennial, herb, 0.13-0.3 m high. Fl. green & yellow & red. Clay, loam, laterite, granite. Rocky outcrops and hillsides, ridges, swamps and gullies.	None
Caladenia huegelii	T(EN)	Sep-Oct	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green, cream, red. Grey or brown sand, clay loam.	Low
Caladenia winfieldii	T(EN)	Oct - Nov	Tuberous, perennial, herb, 0.3-0.6 m high. Fl. pink. Grey-black sand, sandy loam. Winter-wet depressions, swamps.	None
Darwinia whicherensis	T(EN)	Oct - Nov	Erect low shrub to 30 cm, flowers green, outer red. Winter-wet area of shrubland over shallow red clay over ironstone	Low
Gastrolobium papilio	T(EN)	Oct - Dec	Tangled, clumped shrub, to 1.5 m high. Fl. cream-red. Sandy clay over ironstone and laterite. Flat plains.	Low
Lambertia echinata subsp. *occidentalis*	T(EN)	Feb/May-Jun/Oct	Prickly, much-branched, non-lignotuberous shrub, to 3 m high. Fl. yellow. White sandy soils over laterite, orange/brown-red clay over ironstone.	Low
Petrophile latericola	T(EN)	Nov	Multi-stemmed shrub, 0.4-1.5 m high. Fl. yellow. Red lateritic clay. Winter-wet flats.	Low
Sphenotoma drummondii	T(EN)	Sep - Dec	Tufted shrub, 0.15-0.5 m high. Fl. white. Stony or shallow soils over granite or quartzite. Steep rocky slopes, crevices of rocks.	Low
Verticordia densiflora var. *pedunculata*	T(EN)	Dec-Jan	Erect to spreading shrub, 0.3-0.6 m high. Fl. pink/pink-white. Grey/yellow sand, sandy loam. Winter-wet low-lying areas.	None

Species	Cons Status*	Flowering	Description and Habitat	Likelihood of Occurrence
Verticordia plumosa var. *ananeotes*	T(EN)	Nov-Dec	Erect, sparsely branched shrub, 0.3-0.5 m high. Fl. pink-purple/white. Sandy loam. Seasonally inundated plains.	Low
Verticordia plumosa var. *vassensis*	T(EN)	Sep-Feb	Shrub, 0.3–1 m high. Fl. pink. White/grey sand. Winter-wet flats.	None
Banksia squarrosa subsp. *argillacea*	T(VU)	Jun-Nov	Erect, open, non-lignotuberous shrub, 1.2–4 m high. Fl. yellow, Jun–Nov. White/grey sand, gravelly clay or loam. Winter-wet flats, clay flats.	None
Chamelaucium sp. S Coastal Plain (R.D. Royce 4872)	T(VU)	Oct-Dec	Winter-wet areas, loams and ironstone.	Low
Daviesia elongata subsp. *elongata*	T(VU)	Dec-Feb	Spreading shrub, 0.4–1 m high. Fl. yellow, orange, red. Sandy soils.	Low
Diuris micrantha	T(VU)	Sep-Oct	Tuberous, perennial, herb, 0.3–0.6 m high. Fl. yellow, brown. Brown loamy clay. Winter-wet swamps, in shallow water.	Low
Drakaea micrantha	T(VU)	Sep-Oct	Tuberous, perennial, herb, 0.15–0.3 m high. Fl. red, yellow. White-grey sand.	Low
Gastrolobium modestum	T(VU)	Sep-Nov	Prostrate to clumped shrub, to 0.5 m high. Fl. cream-green-pink. Shallow red clay-loam or grey sand, ironstone. Gullies and edges of flats.	Low
Eucalyptus x phylacis	T	May	Mallee or tree, to 5 m high, bark rough & flaky on trunk. Fl. cream. Laterite, loam over granite. Coastal areas.	None
Grevillea brachystylis subsp. *grandis*	T	Aug - Sep	Shrubs, 0.3–1 m high. Fl red, very irregular. Amongst medium trees, or tall (sclerophyll) shrubland; in sand, or loam.	Low
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	T	Oct	Dense, clumped shrub, to 0.3 m high, to 0.4 m wide. Fl. Yellow. Sandy with lateritic pebbles. Near winter-wet flats, in low woodland with weedy grasses.	None
Tetraria australiensis	T	Nov - Dec	Rhizomatous, tufted perennial, grass-like or herb (sedge), to 1 m high. Fl. brown.	Low
Andersonia ferricola	P1	Oct	Shrub, 0.2-0.5 m high. Fl. purple. White sand or red-brown loam over ironstone. Seasonally wet flats.	Low
Loxocarya striata subsp. *implexa*	P1	Jul-Dec	Winter-wet flats. Tall rush to 1.2 m tall.	Low

Species	Cons Status*	Flowering	Description and Habitat	Likelihood of Occurrence
Platychorda rivalis	P1		Densely clumped herb, to 0.2 m wide. Peat, laterite. Edges of swamps, valleys.	None
Schoenus sp. Jindong (R.D. Royce 2485)	P1		Grass-like or herb (sedge). Red loamy soils. Stream banks.	Low
Stylidium ferricola	P1		Caespitose perennial, herb, 0.09-0.15 m high. Shallow red-brown clay loam over ironstone. Seasonally wet poorly-drained slopes.	Low
Andersonia longifolia	P2	Mar - May	Sprawling to upright shrub, 0.1-0.6 m high. Fl. cream-white. Sandy loam over sandstone, laterite gravel. Breakaways, ridges.	Low
Drosera binata	P2	Aug-Oct	Fibrous-rooted herb, to 0.15 m high. Fl. white. Black peat. Winter-wet swamps.	None
Leptomeria furtiva	P2	Aug-Oct	Lax, sprawling shrub, 0.2–0.45 m high. Fl. orange, brown. Grey or black peaty sand. Winter-wet flats.	None
Leucopogon incisus	P2	Sep - Oct		Low
Leucopogon sp. Busselton (D. Cooper 243)	P2	Aug-Sep	Slender, erect shrub to 70 cm; flowers white. Pericalymma ellipticum wet shrubland, Marri-Jarrah woodland.	Low
Synaphea petiolaris subsp. *simplex*	P2	Sep-Oct	Tufted shrub, 0.1–0.6 m high. Fl. yellow. Sandy soils. Flats, winter-wet areas.	Low
Boronia anceps	P3	Sep - Dec or Jan	Perennial, herb, 0.3-0.6 m high, lacking lignotuber, stem flattened and ancipitous when young. Fl. pink/pink-purple. White sand, gravelly laterite. Seasonally swampy heaths.	Low
Boronia capitata subsp. *gracilis*	P3	Jun-Nov	Slender shrub, 0.3-0.6(-3) m high, branches pilose. Fl. pink. White/grey or black sand. Winter-wet swamps,	Low
Boronia tetragona	P3	Oct-Dec	Perennial, herb, 0.3–0.7 m high, leaves sessile, entire, with papillate margins, branches quadrangular, sepals ciliate. Fl. pink, red. Black/white sand, laterite, brown sandy loam. Winter-wet flats, swamps, open woodland.	Low
Carex tereticaulis	P3	Sep-Oct	Monoecious, rhizomatous, tufted perennial, grass-like or herb (sedge), 0.7 m high. Fl. brown. Black peaty sand.	None
Caustis sp. Boyanup (G.S.	P3	Dec-Jan	Rhizomatous, clumped perennial, grass-like or herb (sedge), 0.7–	Low

Species	Cons Status*	Flowering	Description and Habitat	Likelihood of Occurrence
McCutcheon 1706)			1 m high. White or grey sand.	
Dampiera heteroptera	P3	Sep-Oct	Erect to semi-prostrate perennial, herb or shrub, 0.3–0.6 m high. Fl. blue. Sandy soils. Swampy areas.	None
Grevillea brachystylis subsp. *brachystylis*	P3	Aug-Nov	Much-branched, prostrate or decumbent, non-lignotuberous shrub, 0.2-0.5 m high, to 3 m wide. Fl. red. Black sand, sandy clay. Swampy situations.	None
Hakea oldfieldii	P3	Aug-Oct	Open, straggling shrub, up to 2.5 m high. Fl. white, cream, yellow. Red clay or sand over laterite. Seasonally wet flats.	None
Isopogon formosus subsp. *dasylepis*	P3	Jun-Dec	Low, bushy or slender, upright, non-lignotuberous shrub, 0.2–2 m high. Fl. pink, purple, red. Sand, sandy clay, gravelly sandy soils over laterite. Often swampy areas.	None
Jacksonia gracillima	P3	Oct-Nov	Decumbent shrub - 20 cm high and 50 cm wide. Flowers standard orange-yellow; eye yellow with red halo; wings/keel red. Seasonally damp shrublands and woodlands, on sandy loams or clay loams	Low
Lasiopetalum laxiflorum	P3	Sep-Oct	Jarrah forest, lateritic soils.Erect, compact, perennial shrub 50 cm high x 50 cm wide. Flowers pink, sticky. Fruit absent.	Low
Leptinella drummondii	P3	Nov -Dec orJan - Feb	Small herb. Fl. yellow-cream. Clay loam, mud. Along rivers.	None
Loxocarya magna	P3	Sep-Nov	Rhizomatous, perennial, herb (sedge-like), 0.5-1.5 m high. Sand, loam, clay, ironstone. Seasonally inundated or damp habitats.	Low
Pithocarpa corymbulosa	P3	Jan-Apr	Erect to scrambling perennial, herb, 0.5-1 m high. Fl. white. Gravelly or sandy loam. Amongst granite outcrops.	None
Pultenaea pinifolia	P3	Oct-Nov	Erect, slender shrub, 1-3 m high. Fl. yellow, orange. Loam or clay. Floodplains, swampy areas.	None
Schoenus benthamii	P3	Oct-Nov	Tufted perennial, grass-like or herb (sedge), 0.15-0.45 m high. Fl. brown. White, grey sand, sandy clay. Winter-wet flats, swamps.	None
Adenanthos detmoldii	P4	Jan or Apr	Erect, diffuse, lignotuberous shrub, 0.9-4 m high. Fl. yellow-	None

Species	Cons Status*	Flowering	Description and Habitat	Likelihood of Occurrence
		or Jun or Aug - Dec	orange. Grey or black peaty sand, wet. Swamps, roadsides.	
Calothamnus quadrifidus subsp. *teretifolius* A.S.George & N.Gibson ms	P4	Nov-Dec	Erect, compact, perennial shrub 1.7 m high x 1 m wide. Fl. Red. Seeds held. Fruit exposed.	Low
Chamelaucium sp. Yoongarillup (G.J. Keighery 3635)	P4	Jul-Oct	Non-lignotuberous shrub, to 2.5 m high. Fl. cream, yellow. Jarrah-marri forest. Loams, sandy clays. Riverbanks, lower slopes, below laterite breakaways.	Low
Lambertia rariflora subsp. *rariflora*	P4	Feb-May	Small tree or shrub, to 7 m high. Fl. green, yellow. Red-brown clay soils, black organic loam, laterite. Near intermittent streams.	Low
Thysanotus glaucus	P4	Oct-Mar	Caespitose, glaucose perennial, herb, 0.1–0.2 m high. Fl. purple. White, grey or yellow sand, sandy gravel.	Moderate

Note: The WC Act Conservation Status is shown, EPBC Act status, where relevant, is in brackets.

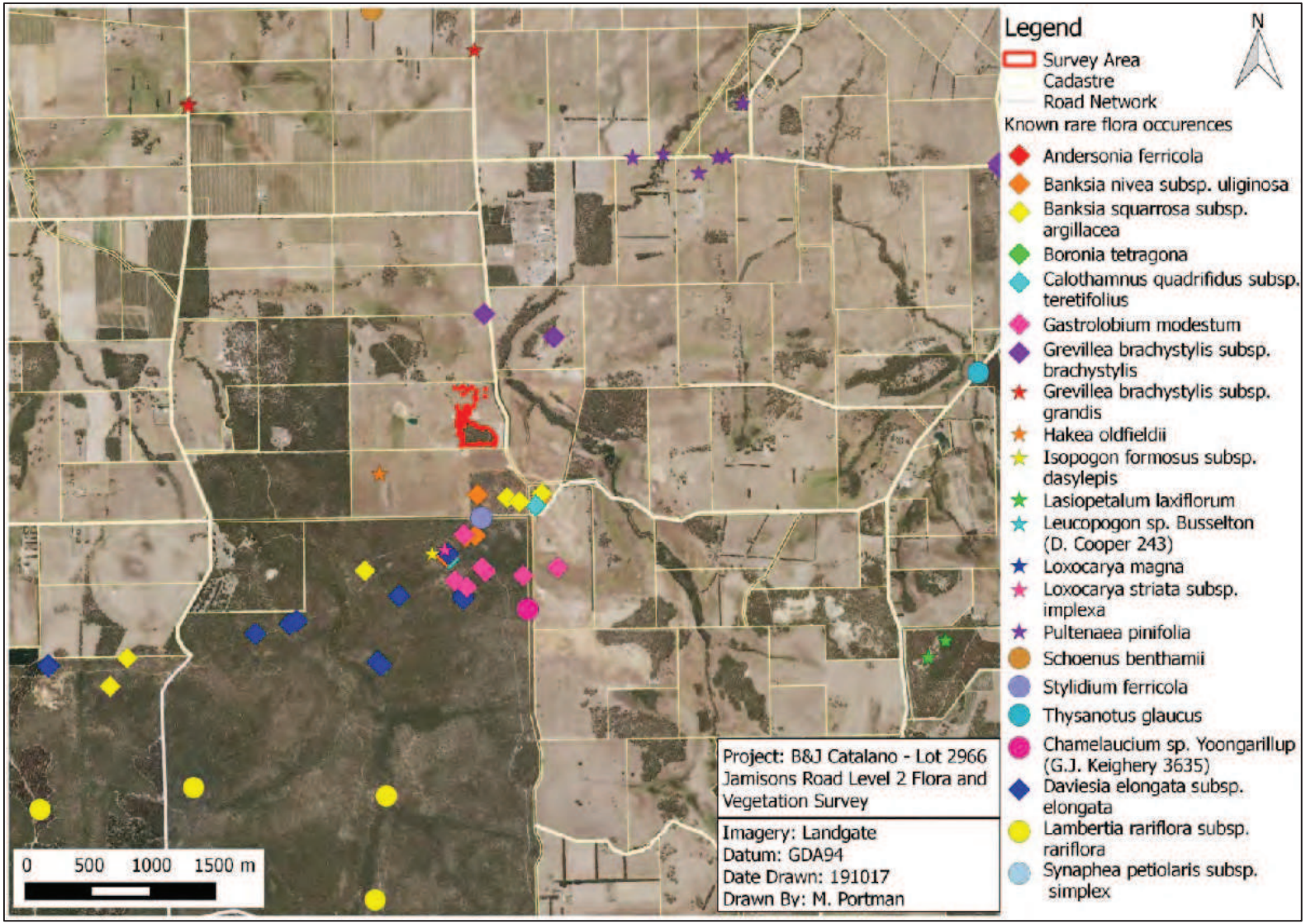

Figure 5. Known occurrences of Threatened and Priority listed flora within 10 km of the Survey Area (DBCA, 2017c).

1.7 Ecological Linkages

Information for this section is taken from Molloy *et al*. (2009) and their report on the South West Regional Ecological Linkages (SWREL) Project.

Ecological linkages are defined as:

> "*A series of (both contiguous and non-contiguous) patches which, by virtue of their proximity to each other, act as stepping stones of habitat which facilitate the maintenance of ecological processes and the movement of organisms within, and across, a landscape*."

Regional ecological linkages link protected patches of regional significance by retaining the best (condition) patches available as stepping stones for flora and fauna between regionally significant areas. This increases the long-term viability of all the constituent areas.

The SWREL report is the result of collaboration between the Western Australian Local Government Association's *South West Biodiversity Project* and the then Department of Environment and Conservation's *Swan Bioplan* to provide a tool for the identification of ecological linkages and guidance for the protection of linkages through planning policy documents.

Molloy *et al.* (2009) assessed and assigned "proximity value ratings" to all patches of remnant native vegetation as a way of indicating their distance from the nearest regional ecological linkage axis line. These values are defined in **Figure 6.** It should be noted however, that the proximity value of a patch of remnant vegetation to an ecological linkage is not intended to replace the need to consider the other biodiversity conservation values of that patch of remnant vegetation.

The Survey Area is situated between two regional ecological linkage axis lines as identified by Molloy *et al.* (2009), however does not directly form part of either linkage. Survey Area vegetation has been assigned a proximity rating of 2b, indicating its distance from the linkages.

While there is no statutory basis for regional ecological linkages identified through the SWREL project, the importance of ecological linkages has been recognised as an environmental policy consideration in EPA and Planning policy over the last decade (EPA, 2009 and references therein). In its statement regarding the SWREL Project, the EPA stated that even though Ecological Linkages are just one measure of the conservation values of a patch of remnant vegetation it expected that:

> *In preparing plans and proposals for development, consideration will be given to both the site-specific biodiversity conservation values of patches of native vegetation, as well as the landscape function and core linkage significance of a patch in supporting the maintenance of ecological linkage* (EPA, 2009).

Figure 6. Linkage proximity rating values assigned to patches of remnant vegetation within a landscape (from Molloy et al., 2009).

1.8 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are protected under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 and are selected for their environmental values at state or national levels (Government of Western Australia, 2005). They include;

- Defined wetlands and riparian vegetation within 50 m;
- Areas covered by Threatened Ecological Communities;
- Area of vegetation within 50 m of Threatened Flora;
- Bush Forever sites; and
- Declared World Heritage property sites.

The entire Survey Area lies within an ESA associated with occurrences of Threatened ecological communities and Threatened flora within the Treeton Forest block (**Figure 8**).

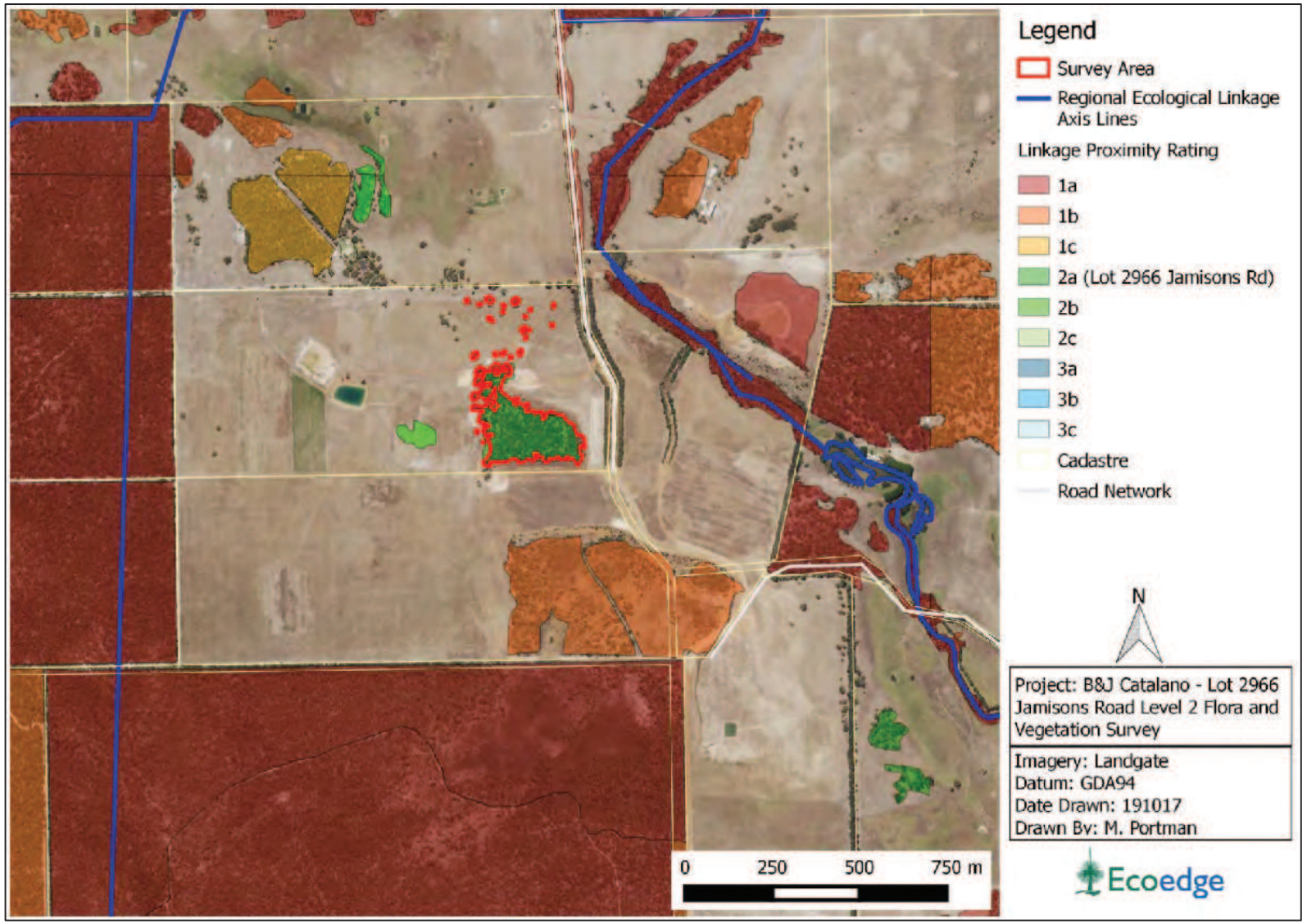

Figure 7. The Survey Area in relation to regional ecological linkages (Molloy *et al.*, 2009).

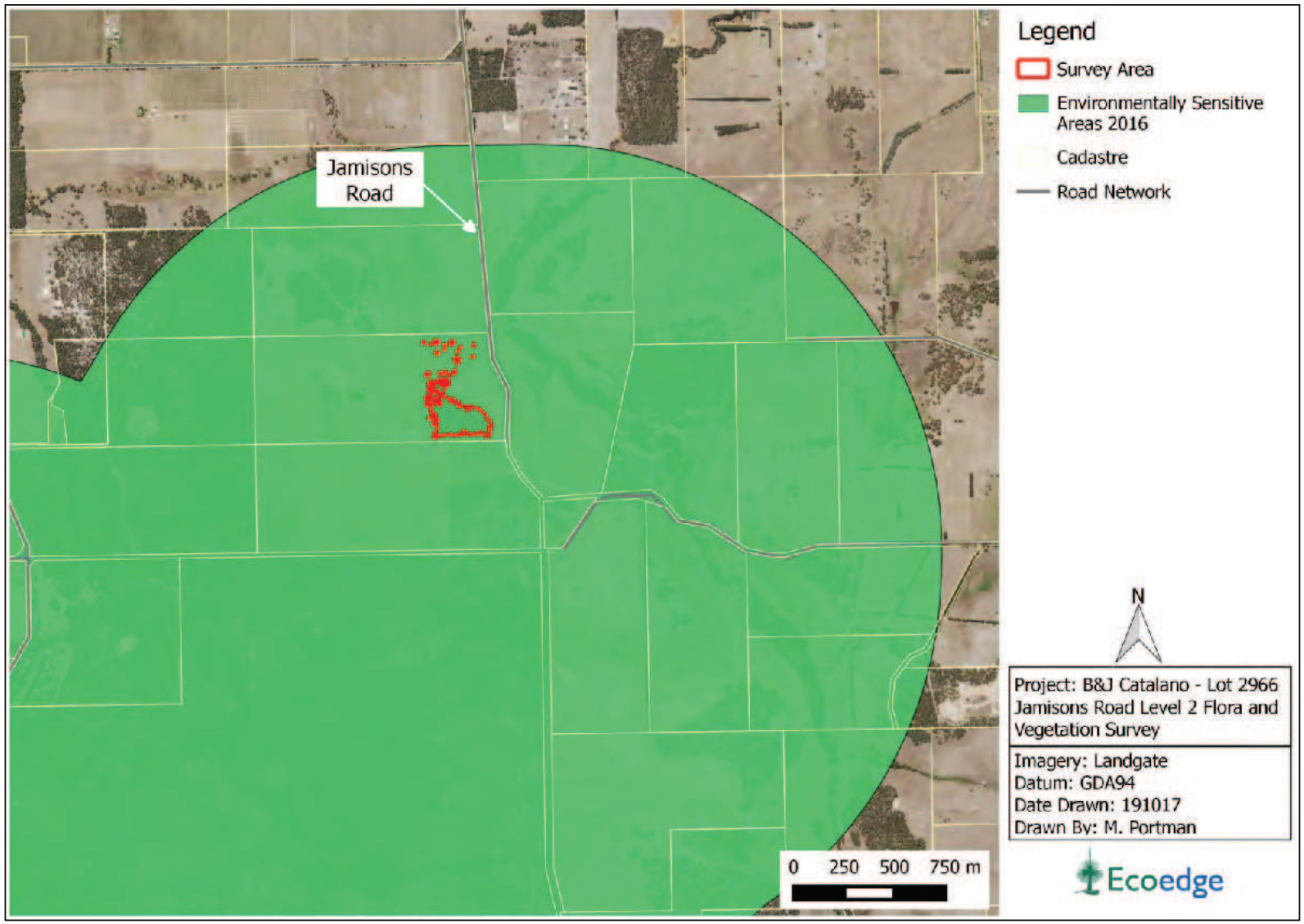

Figure 8. The Survey Area is located within a designated Environmentally Sensitive Area.

2 Methods

2.1 Desktop Assessment

Prior to the field survey, a "desktop assessment" was carried out by downloading from NatureMap (DBCA, 2017d) a list of all flora (including Threatened flora) occurring within 10 km of the Survey Area (**Appendix 2**). A download of data from the Threatened and Priority Flora (TPFL) and W.A. Herbarium databases (dated 18th September 2017) of records occurring within 10 km of the Survey Area was also provided by DBCA (DBCA, 2017c). A Protected Matters Search Tool report was generated to determine whether any Matters of National Environmental Significance were known to occur within or near to the Survey Area. This report detailed all species and threatened ecological communities listed under the EPBC Act that were known to occur or may occur within the Survey Area (DotEE, 2017b) (**Appendix 2**). This data was used to establish the list of Threatened and Priority flora to target during the survey, as well as providing a list of what other plant taxa might be encountered during the survey.

2.2 Field Survey

The survey was carried out on 19th September and 11th October 2017 by Russell Smith (SL flora permit SL011843). The vegetation patches were thoroughly searched on foot and a comprehensive list of vascular flora species was compiled. Taxonomy and conservation status were checked against DBCA databases (DBCA, 2017e, 2017f).

Three 100 m^2 floristic quadrats were installed within the largest remnant in the Survey Area to enable a comparison with the floristic community types described by Keighery *et al*. (2008) (**Figure 9**). All species within the quadrat were recorded along with an estimate of cover. Notes on vegetation condition were taken at 18 assessment points to assist with mapping of the vegetation.

Vegetation condition was assessed against the method of the EPA (2016) (**Appendix 5**), and mapped using a combination of field observations and recent aerial photography.

2.3 Survey Limitations

Potential limitations with regard to the assessment are addressed in **Table 4.**

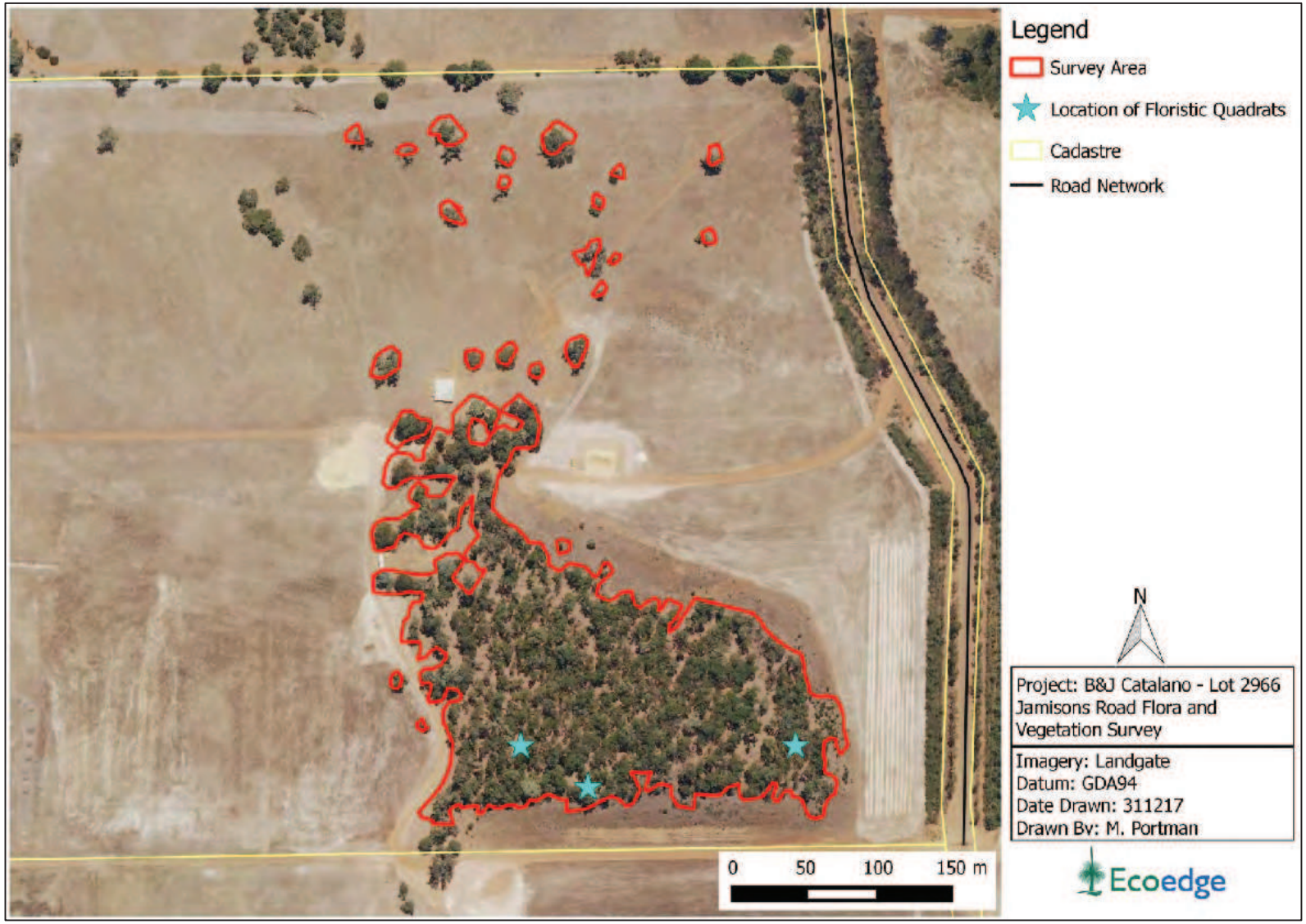

Figure 9. Location of floristic quadrats installed during the survey.

Table 4. Limitations with regard to assessment adequacy and accuracy.

Aspect	Constraint	Comment
Scope	No	The survey scope was prepared in consultation with the client and was designed to comply with EPA requirements.
Proportion of flora identified	Negligible	The survey was carried out at the time of year when the highest proportion of species would be flowering.
Climatic and seasonal effects	Slight	Rainfall for the wet season in the Busselton area (1st April – 31st October) was below average. This may have resulted in a lower proportion of some annual species germinating, however rainfall over the "spring" growing season was about average.
Availability of contextual information	Negligible	Comprehensive regional surveys of remnant vegetation, as well as more localised surveys, have been carried out on the southern Swan Coastal Plain.
Completeness of the survey	Negligible	All parts of the Survey Area were accessible. Timing of the survey was optimal for flowering.
Skill and knowledge of the botanists	Negligible	The senior field botanist conducting the survey has had extensive experience in botanical surveys in south west Australia over a period of 25 years.

3 Results

3.1 Flora

Ninety-two species of vascular flora were identified within the Survey Area, of which five were naturalised (**Appendix 6**). No Threatened flora, species listed under the EPBC Act, Priority flora or other flora of conservation significance were found in the Survey Area. None of the introduced species are Declared Pest Plants under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) (Department of Agriculture and Food Western Australia, 2007).

Species lists and information pertaining to each of the three quadrats installed for the survey are presented in **Appendix 7**.

3.2 Vegetation Units

Only one vegetation unit was identified within the Survey Area, although it varies substantially in the number of understorey species. Most of the smaller remnants lacked native understorey species altogether, whereas within the largest remnant, the three 100 m^2 floristic quadrats had between 25 and 32 understorey species, most of them native. The vegetation is described below based on the National Vegetation Information System (NVIS) structural terminology (DEH, 2003), and a photograph is included in **Figure 10**.

Open forest of *Eucalyptus marginata*, *Corymbia calophylla*, (*Allocasuarina fraseriana*) (10-30 m) over *Banksia grandis* scattered trees (< 10 m) over *Acacia extensa*, *A. pulchella*, *Dillwynia laxiflora*, *Hibbertia glomerata*, *Hovea chorizemifolia*, *Lechenaultia biloba*, *Xylomelum occidentale* open shrubland (< 1 m), *Caesia micrantha*, *Chamaescilla corymbosa*, *Lagenophora huegelii*, *Millotia tenuifolia*, *Opercularia hispidula*, *Patersonia umbrosa* var. *xanthina* open forbland and *Lepidosperma pubisquameum* and *Tetraria capillaris* scattered sedges.

Figure 10. View of Quadrat 2.

3.3 Vegetation Condition

Just over half of the remnant vegetation in the Survey Area was classed as "Very Good" condition and over three quarters was Good or Very Good (**Table 5**) and shown in **Figure 11**. All the remnant vegetation has been grazed in the past, but a large part of it is relatively weed-free. The weeds present within much of the bushland are herbaceous and have not deleteriously affected the structure of the vegetation. The degree of livestock grazing appears to have declined in recent years and the understorey in the largest remnant has recovered somewhat.

All the small remnants in the northern part of the Survey Area, most of them consisting of only two or three trees are completely degraded.

Table 5. Summary of vegetation condition classes within the Survey Area.

Condition	Area (Ha)	%
Very Good	2.47	50.5
Good	1.35	27.7
Degraded	0.69	14.2
Completely Degraded	0.37	7.6
Total	**4.88**	**100.0**

4 Discussion and Conclusions

A spring survey was carried out over approximately 4.9 ha of remnant vegetation on Lot 2626, Jamisons Road, Boallia. Ninety-two species of vascular flora were identified of which five were naturalised. No Threatened flora, Priority flora, flora listed under the EBPC Act or other flora of conservation significance were found in the Survey Area and none of the introduced species are Declared Pest Plants under the BAM Act.

Only one vegetation unit was recognised within the Survey Area which is comprised of an open forest of Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) with occasional patches of Sheoak (*Allocasuarina fraseriana*) on sandy, gravel soil. The low understorey appears to be recovering from livestock grazing. The vegetation does not resemble any threatened or priority ecological community. Of the Whicher Scarp floristic vegetation types identified by Keighery *et al*. (2008) it appears to have the closest resemblance to FCT C4 – "Whicher Scarp/Blackwood Plateau Jarrah and Marri woodland". This vegetation type is widespread and common on the Whicher Scarp and adjacent Blackwood Plateau.

Just over half the vegetation was classified as Very Good condition. All the small remnants north of the access track were Completely Degraded.

The vegetation in the Survey Area does not have any particular conservation significance, other than that it is situated on the Whicher Scarp, which has been identified as a biodiversity 'hotspot' (Keighery *et al*., 2008), and that most of it is in Very Good condition.

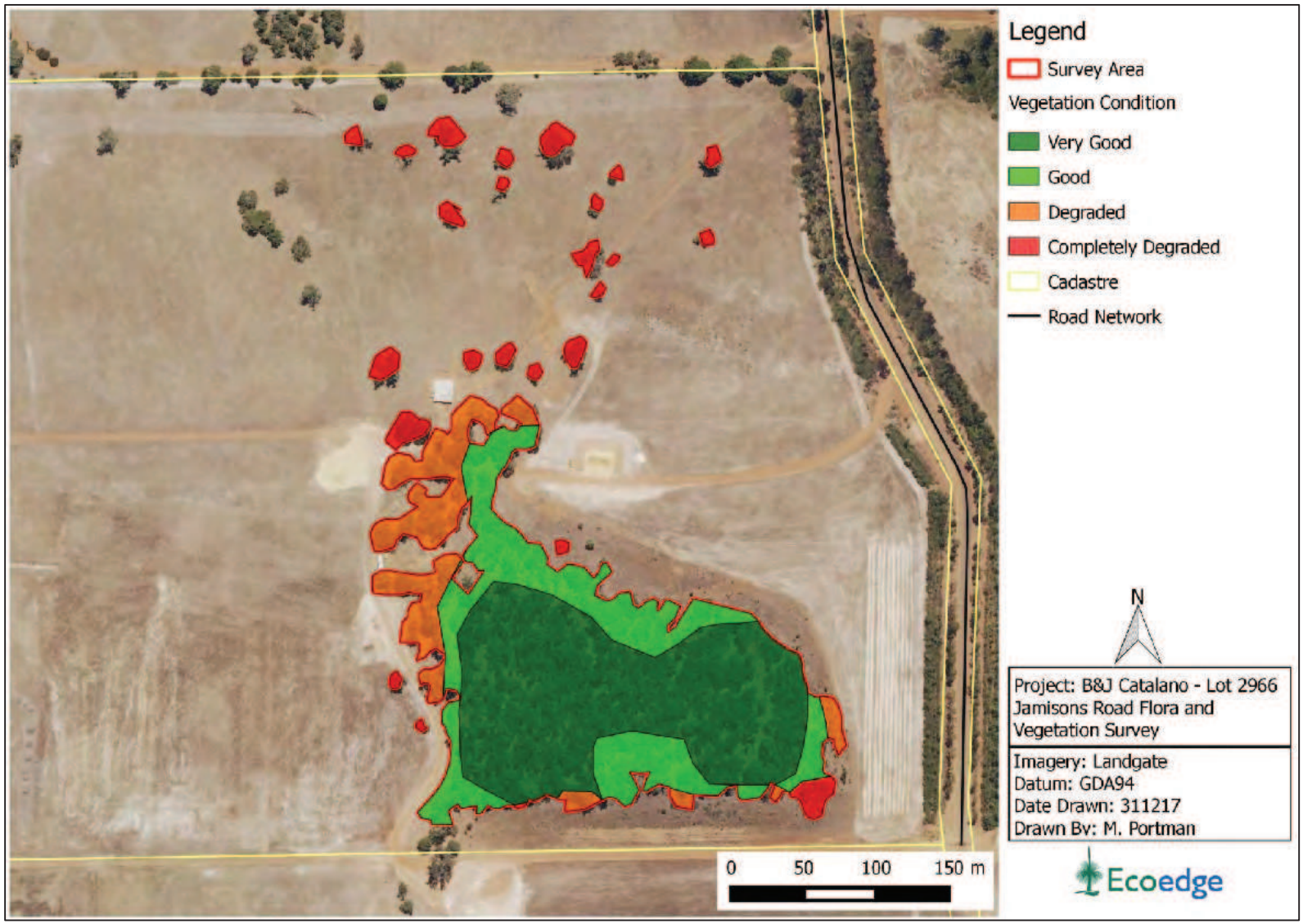

Figure 11. Condition of vegetation within the Survey Area.

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Appendix 1. Categories of Threatened Ecological Communities under the EPBC Act (DotEE, 2017a).

Category	Definition
Critically endangered	If, at that time, an ecological community is facing an extremely high risk of extinction in the wild in the immediate future (indicative timeframe being the next 10 years).
Endangered	If, at that time, an ecological community is not critically endangered but is facing a very high risk of extinction in the wild in the near future (indicative timeframe being the next 20 years).
Vulnerable	If, at that time, an ecological, community is not critically endangered or endangered but is facing a high risk of extinction in the wild in the medium–term future (indicative timeframe being the next 50 years).

Appendix 2. Protected Matters Search Tool and NatureMap Reports for the Survey Area.

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

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

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

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

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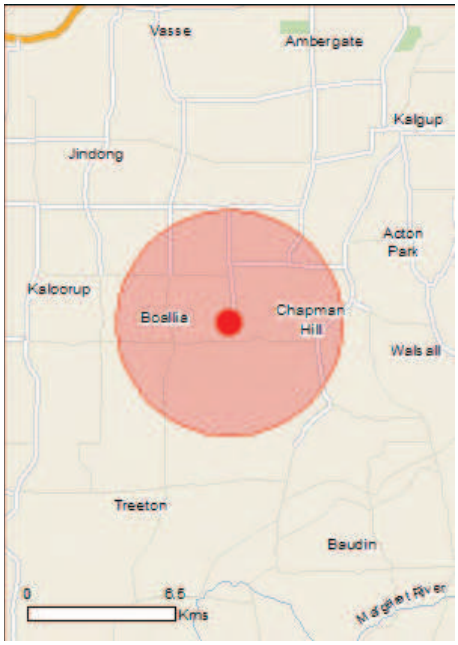

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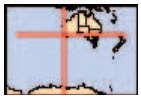

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	34
Listed Migratory Species:	10

Other Matters Protected by the EPBC Act

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

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

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

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

Extra Information

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

State and Territory Reserves:	1
Regional Forest Agreements:	1
Invasive Species:	23
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Vasse-wonnerup system	10 - 20km upstream

Listed Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Shrublands on southern Swan Coastal Plain ironstones	Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Breeding likely to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Fish		
Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Banksia nivea subsp. uliginosa Swamp Honeypot [82766]	Endangered	Species or species habitat known to occur within area
Banksia squarrosa subsp. argillacea Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat known to occur within area
Brachyscias verecundus Ironstone Brachyscias [81321]	Critically Endangered	Species or species habitat likely to occur within area
Caladenia hoffmanii Hoffman's Spider-orchid [56719]	Endangered	Species or species habitat likely to occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
Caladenia winfieldii Majestic Spider-orchid [64504]	Endangered	Species or species habitat may occur within area
Chamelaucium sp. S coastal plain (R.D.Royce 4872) Royce's Waxflower [87814]	Vulnerable	Species or species habitat likely to occur within area
Darwinia whicherensis Abba Bell [83193]	Endangered	Species or species habitat may occur within area
Daviesia elongata subsp. elongata Long-leaved Daviesia [64883]	Vulnerable	Species or species habitat known to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat may occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat may occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus x phylacis Meelup Mallee [87817]	Endangered	Species or species habitat may occur within area
Gastrolobium modestum Broad-leaved Gastrolobium [78361]	Vulnerable	Species or species habitat likely to occur within area
Gastrolobium papilio Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area
Grevillea brachystylis subsp. grandis Large-flowered Short-styled Grevillea [85001]	Critically Endangered	Species or species habitat known to occur within area
Lambertia echinata subsp. occidentalis Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Petrophile latericola Laterite Petrophile [64532]	Endangered	Species or species habitat likely to occur within area
Sphenotoma drummondii Mountain Paper-heath [21160]	Endangered	Species or species habitat may occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat may occur within area
Tetraria australiensis Southern Tetraria [10137]	Vulnerable	Species or species habitat likely to occur within area
Verticordia densiflora var. pedunculata Long-stalked Featherflower [55689]	Endangered	Species or species habitat likely to occur within area
Verticordia plumosa var. ananeotes Tufted Plumed Featherflower [23871]	Endangered	Species or species habitat likely to occur within area
Verticordia plumosa var. vassensis Vasse Featherflower [55804]	Endangered	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
NTWA Bushland covenant (0069)	WA

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

Invasive Species [Resource Information]

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

Name	Status	Type of Presence
Birds		
Anas platyrhynchos		
Mallard [974]		Species or species habitat likely to occur within area
Columba livia		
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia senegalensis		
Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris		
Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus		
Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris		
Domestic Dog [82654]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-33.79015 115.293

Acknowledgements

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

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

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

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

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Jamisons Road, Boallia NatureMap report, conservation significant species

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
1	18102	Andersonia ferricola		P1	
2	32204	Banksia nivea subsp. uliginosa		T	
3	32046	Banksia squarrosa subsp. argillacea		T	
4	17804	Boronia tetragona		P3	
5	35796	Calothamnus quadrifidus subsp. teretifolius		P4	
6	35657	Chamelaucium sp. Yoongarillup (G.J. Keighery 3635)		P4	
7	3808	Daviesia elongata		T	
8	20510	Gastrolobium modestum		T	
9	14011	Grevillea brachystylis subsp. brachystylis		P3	
10	19414	Grevillea brachystylis subsp. grandis		T	
11	2190	Hakea oldfieldii		P3	
12	16522	Isopogon formosus subsp. dasylepis		P3	
13	16879	Lambertia rariflora subsp. rariflora		P4	
14	45084	Lasiopetalum laxiflorum		P3	
15	29492	Leucopogon sp. Busselton (D. Cooper 243)		P2	
16	13779	Loxocarya magna		P3	
17	37320	Loxocarya striata subsp. implexa		P1	
18	8163	Pithocarpa corymbulosa (Corymbose Pithocarpa)		P3	
19	4179	Pultenaea pinifolia		P3	
20	974	Schoenus benthamii		P3	
21	31872	Stylidium ferricola		P1	
22	16862	Synaphea petiolaris subsp. simplex		P3	
23	1334	Thysanotus glaucus		P4	
24	12448	Verticordia plumosa var. ananeotes		T	

Appendix 3. Definitions of Threatened and Priority List flora under the WC Act (DBCA, 2017a).

Conservation code	Category
T	Threatened flora is flora that has been declared to be 'likely to become extinct or is rare, or otherwise in need of special protection', pursuant to section 23F(2) of the *Wildlife Conservation Act 1950*. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria (CR, EN, VU, EX). A species that is listed as Threatened and assessed as 'Critically Endangered' would therefore have its status written as T (CR).
P1	Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2	Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P3	Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora', but are in need of further survey.
P4	Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

Appendix 4. Categories of Threatened Species under the EPBC Act (DotEE, 2017c).

Category	Definition
Extinct (Ex)	A native species is eligible to be included in the ***extinct*** category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild (ExW)	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered (CE)	A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (EN)	A native species is eligible to be included in the endangered category at a particular time if, at that time (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	A native species is eligible to be included in the vulnerable category at a particular time if, at that time (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent (CD)	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Appendix 5. Vegetation condition scale (EPA, 2016).

Vegetation Condition	South West and Interzone Botanical Provinces
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	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.
Very Good	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.
Good	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.
Degraded	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.
Completely Degraded	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.

Appendix 6. List of vascular flora found within the Survey Area at Lot 2626 Jamisons Road.

FAMILY	LATIN NAME	NATURALISED
Apiaceae	*Platysace tenuissima*	
Apiaceae	*Platysace filiformis*	
Apiaceae	*Xanthosia candida*	
Apiaceae	*Xanthosia huegelii*	
Araliaceae	*Trachymene pilosa*	
Asparagaceae	*Lomandra integra*	
Asparagaceae	*Lomandra purpurea*	
Asparagaceae	*Lomandra sericea*	
Asparagaceae	*Thysanotus arbuscula*	
Asparagaceae	*Thysanotus manglesianus*	
Asteraceae	*Cotula turbinata*	*
Asteraceae	*Hypochaeris glabra*	*
Asteraceae	*Ursinia anthemoides*	*
Asteraceae	*Lagenophora huegelii*	
Asteraceae	*Millotia tenuifolia*	
Asteraceae	*Senecio glomeratus*	
Asteraceae	*Sonchus oleraceus*	
Casuarinaceae	*Allocasuarina fraseriana*	
Celastraceae	*Stackhousia monogyna*	
Colchicaceae	*Burchardia congesta*	
Cyperaceae	*Lepidosperma pubisquameum*	
Cyperaceae	*Tetraria capillaris*	
Cyperaceae	*Tetraria octandra*	
Dasypogonaceae	*Kingia australis*	
Dilleniaceae	*Hibbertia amplexicaulis*	
Dilleniaceae	*Hibbertia glomerata*	
Droseraceae	*Drosera pallida*	
Droseraceae	*Drosera stolonifera*	
Droseraceae	*Drosera erythrorhiza*	
Euphorbiaceae	*Stachystemon virgatus*	
Fabaceae	*Lotus angustissimus*	*
Fabaceae	*Lotus subbiflorus*	*
Fabaceae	*Acacia extensa*	
Fabaceae	*Acacia nervosa*	
Fabaceae	*Acacia pulchella*	
Fabaceae	*Bossiaea ornata*	
Fabaceae	*Daviesia physodes*	
Fabaceae	*Daviesia preissii*	
Fabaceae	*Dillwynia laxiflora*	
Fabaceae	*Gompholobium knightianum*	
Fabaceae	*Gompholobium tomentosum*	
Fabaceae	*Hovea chorizemifolia*	

FAMILY	LATIN NAME	NATURALISED
Fabaceae	*Hovea trisperma*	
Fabaceae	*Isotropis cuneifolia*	
Fabaceae	*Kennedia coccinea*	
Fabaceae	*Sphaerolobium medium*	
Goodeniaceae	*Dampiera linearis*	
Goodeniaceae	*Lechenaultia biloba*	
Goodeniaceae	*Scaevola calliptera*	
Goodeniaceae	*Velleia trinervis*	
Haemodoraceae	*Conostylis aculeata*	
Haemodoraceae	*Haemodorum laxum*	
Haemodoraceae	*Haemodorum spicatum*	
Hemerocallidaceae	*Agrostocrinum hirsutum*	
Hemerocallidaceae	*Caesia micrantha*	
Iridaceae	*Patersonia occidentalis*	
Iridaceae	*Patersonia umbrosa* var. *xanthina*	
Loganiaceae	*Orianthera serpyllifolia* subsp. *angustifolia*	
Myrtaceae	*Eucalyptus marginata* subsp. *marginata*	
Myrtaceae	*Hypocalymma angustifolium*	
Orchidaceae	*Caladenia attingens*	
Orchidaceae	*Caladenia flava*	
Orchidaceae	*Cyanicula sericea*	
Orchidaceae	*Elythranthera brunonis*	
Orchidaceae	*Pheladenia deformis*	
Orchidaceae	*Pyrorchis nigricans*	
Orchidaceae	*Thelymitra crinita*	
Poaceae	*Amphipogon turbinatus*	
Poaceae	*Microlaena stipoides*	
Poaceae	*Neurachne alopecuroidea*	
Poaceae	*Rytidosperma setaceum*	
Poaceae	*Tetrarrhena laevis*	
Podocarpaceae	*Podocarpus drouynianus*	
Proteaceae	*Banksia grandis*	
Proteaceae	*Hakea amplexicaulis*	
Proteaceae	*Xylomelum occidentale*	
Restionaceae	*Desmocladus fasciculatus*	
Restionaceae	*Hypolaena exsulca*	
Rubiaceae	*Opercularia hispidula*	
Rutaceae	*Boronia spathulata*	
Stylidiaceae	*Levenhookia stipitata*	
Stylidiaceae	*Stylidium androsaceum*	
Stylidiaceae	*Stylidium barleei*	
Stylidiaceae	*Stylidium piliferum*	
Stylidiaceae	*Stylidium schoenoides*	
Thymelaeaceae	*Pimelea rosea*	

FAMILY	LATIN NAME	NATURALISED
Thymelaeaceae	*Pimelea spectabilis*	
Thymelaeaceae	*Pimelea sylvestris*	
Xanthorrhoeaceae	*Chamaescilla corymbosa*	
Xanthorrhoeaceae	*Xanthorrhoea gracilis*	
Xanthorrhoeaceae	*Xanthorrhoea preissii*	
Zamiaceae	*Macrozamia riedlei*	

Appendix 7. Quadrat species lists and descriptions.

Quadrat 1.

Grey-brown sand over laterite Easting: 341921.7 E Northing: 6259744.9 N

TAXON	COVER	TAXON	COVER
Acacia extensa	1	*Lagenophora huegelii*	1
Acacia pulchella	1	*Lechenaultia biloba*	1
Bossiaea ornata	1	*Lepidosperma pubisquameum*	1
Burchardia congesta	1	*Levenhookia stipitata*	1
Caesia micrantha	1	**Lotus subbiflorus*	1
Chamaescilla corymbosa	1	*Millotia tenuifolia*	1
Conostylis aculeata	1	*Opercularia hispidula*	4
Corymbia calophylla	3	*Patersonia umbrosa* var. *xanthina*	1
Cyanicula sericea	1	*Pimelea rosea*	1
Desmocladus fasciculatus	1	*Pimelea sylvestris*	1
Drosera erythrorhiza	1	**Sonchus oleraceus*	1
Drosera stolonifera	1	*Tetraria capillaris*	1
Eucalyptus marginata subsp. *marginata*	3	*Tetraria octandra*	1
Hakea amplexicaulis	1	*Tetrarrhena laevis*	2
Hovea chorizemifolia	1	*Thelymitra crinita*	1
**Hypochaeris glabra*	2	*Xanthosia candida*	4
Isotropis cuneifolius	1	*Xylomelum occidentale*	1

* denotes introduced species.

Quadrat 2

Grey-brown sand over laterite Easting: 341967.4 E Northing: 6259716.9 N

TAXON	COVER	TAXON	COVER
Acacia extensa	1	*Millotia tenuifolia*	2
Acacia pulchella	2	*Opercularia hispidula*	1
Caesia micrantha	1	*Patersonia umbrosa* var. *xanthina*	1
Caladenia flava	1	*Pimelea rosea*	1
Chamaescilla corymbosa	1	*Platysace filifolius*	1
Corymbia calophylla	3	*Stackhousia monogyna*	1
Daviesia physodes	1	*Tetraria capillaris*	1
Dillwynia laxiflora	3	*Thysanotus manglesianus*	1
Eucalyptus marginata subsp. *marginata*	3	**Ursinia anthemoides*	2
Hovea chorizemifolia	1	*Xanthosia huegelii*	1
Hypolaena exsulca	1	*Xylomelum occidentale*	1
Isotropis cuneifolius	1		
Lagenophora huegelii	2		
Lechenaultia biloba	1		
Lepidosperma pubisquameum	1		
Lomandra integra	1		

* denotes introduced species.

Quadrat 3.

Grey sand over laterite Easting: 342109.2 E Northing: 6259744.9 N

TAXON	COVER	TAXON	COVER
Allocasuarina fraseriana	3	*Logania serpyllifolia* subsp. *angustifolia*	1
Banksia grandis	1	*Lomandra sericea*	1
Caesia micrantha	1	*Millotia tenuifolia*	1
Caladenia flava	1	*Neurachne alopecuroidea*	1
Chamaescilla corymbosa	1	*Opercularia hispidula*	1
Corymbia calophylla	3	*Patersonia umbrosa* var. *xanthina*	3
**Cotula turbinata*	1	*Pimelea spectabilis*	1
Eucalyptus marginata subsp. *marginata*	3	*Platysace tenuissima*	1
Gompholobium knightianum	1	*Scaevola calliptera*	1
Hibbertia glomerata	2	*Stylidium androsaceum*	1
Hovea chorizemifolia	1	*Tetraria capillaris*	1
Hovea trisperma	1	*Thysanotus manglesianus*	1
**Hypochaeris glabra*	1	*Trachymene pilosa*	1
Hypolaena exsulca	2	**Ursinia anthemoides*	1
Lagenophora huegelii	1	*Xanthosia huegelii*	1
Lepidosperma pubisquameum	1	*Xylomelum occidentale*	1

* denotes introduced species.

Report of a Level 1 Flora and Vegetation Survey at Lots 2629 and 2699 Jamisons Road and a Portion of the Treeton State forest, Boallia.

Prepared for B & J Catalano Pty Ltd
December 2016

Ecoedge

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Version	Origin	Review	Review date	Ecoedge release approval & purpose	Issue date
V1	M. Strang	R. Smith	23/12/2016		
V2	R. Smith	M. Strang	04/01/2016		
Final draft	M. Strang	P. Bennett (B&J Catalano)		M. Strang (to P. Bennett for review)	04/01/2016
Final					

Executive Summary

Ecoedge was engaged by B & J Catalano Pty Ltd in September 2016 to undertake a Level 1 Flora and Vegetation Survey of approximately 19.2 ha of remnant vegetation on Lots 2629 and 2699 Jamisons Road, Boallia, in the City of Busselton. The Level 1 survey included both a reconnaissance survey and a targeted rare flora survey. The assessment also included a rare flora survey over approximately 44.3 ha of remnant vegetation in the adjacent Treeton State forest block (State forest No. 32). The private property survey areas and State forest survey area together totalled 63.5 ha and, except where indicated otherwise, are referred to as the 'Survey Area'.

The primary objective of the survey was to determine whether there are any significant flora and/or vegetation values within the Survey Area, specifically in relation to the listed threatened (Declared Rare Flora (DRF)) species *Banksia squarrosa* subsp. *argillacea* and *Banksia nivea* subsp. *uliginosa*, and the Threatened Ecological Community (TEC) 'Shrublands on southern Swan Coastal Plain Ironstones'. The purpose of the rare flora survey in the adjoining Treeton forest block was to quantify the extent of populations of the aforementioned Threatened flora species.

The field survey was carried out by Russell Smith (Senior Botanist) on 11 October 2016 in accordance with the Environmental Protection Authority (EPA) and Department of Parks and Wildlife (DPaW) Technical Guide 2015.

Sixty-three taxa of vascular flora were identified within the private property, of which eight were introduced species. None of the introduced species are a declared Pest Plant under the under the *Biosecurity and Agriculture Management Act 2007*

It is estimated that within Lots 2629 and 2699, the population of the DRF *Banksia squarrosa* subsp. *argillacea* consists of approximately 3,728 individuals (+/-200), while there are approximately 22 individuals of the DRF *Banksia nivea* subsp. *uliginosa* (+/- 2). It is estimated that there are 6030 (+/- 500) individuals of *Banksia squarrosa* subsp. *argillacea* within the State forest, and approximately 1000 individuals of *Banksia nivea* subsp. *uliginosa* (+/- 200).

In addition to the two DRF *Banksias* mentioned above, four Priority list species were identified within the private property, these being: *Hakea oldfieldii*, *Isopogon formosus* subsp. *dasylepis*, *Loxocarya magna* (all P3) and *Calothamnus quadrifidus* subsp. *teretifolius* (P4). Of these, *H. oldfieldii*, *L. magna* and C. *quadrifidus* subsp. *teretifolius* were quite common within the shrubland on ironstone, while *I. formosus* subsp. *dasylepis* was restricted to the south-west corner of the private property.

Three vegetation units were recognised within the property, two of which are primarily comprised of shrubs, sedges and herbs (A1 and A2), and one that is a woodland or open forest unit (B).

Vegetation units A1 and A2 are similar, the main differences being the greater density of *B. squarrosa* subsp. *argillacea* in unit A1 (to the exclusion of many other species) and the more variable condition in unit A2, which ranges from scattered *Loxocarya magna* and *Calothamnus quadrifidus* subsp. *teretifolius* and native herbs and pasture species to tall shrubland in very good condition dominated by *Hakea oldfieldii*, *Calothamnus quadrifidus* subsp*. teretifolius* and *Banksia squarrosa* subsp. *argillacea*.

Vegetation unit B, which is dominated by Marri (*Corymbia calophylla*) trees is also quite variable in condition, ranging from very good to degraded (where understorey species are mainly pasture grasses).

Much of the remnant native vegetation on Lots 2699 and 2629 is consistent with it being an occurrence of the Critically Endangered TEC "Shrublands on southern Swan Coastal Plain Ironstones (Busselton area)" (SWAFCT10b). Vegetation unit A1 and portions of units A2 and B fit the description of this community. At total of 12.8 ha of vegetation consistent with belonging to this community occur on Lots 2699 and 2629 – this compares with approximately 16 ha in the adjacent State forest.

The condition of vegetation was quite variable within Lots 2629 and 2699 however, just over 60% was in Good or Very Good condition.

The Survey Area vegetation does not appear to have particular value with regard to regional ecological linkages.

All the Survey Area forms part of a designated Environmentally Sensitive Area and therefore has particular requirements regarding potential clearing under *the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (Clearing Regulations*).

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Statement of limitations

Reliance on Data

In the preparation of this report, Ecoedge has relied on data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report. Unless stated otherwise in the report, Ecoedge has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report are based in whole or in part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Ecoedge will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, unavailable, misrepresented or otherwise not fully disclosed to Ecoedge.

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1 Introduction

Ecoedge was engaged by B & J Catalano Pty Ltd in September 2016 to undertake a Level 1 Flora and Vegetation Survey of approximately 19.2 ha of remnant vegetation on Lots 2629 and 2699 Jamisons Road, Boallia, in the City of Busselton. The Level 1 survey included both a reconnaissance survey and a targeted rare flora survey. The assessment also included a rare flora survey over approximately 44.3 ha of remnant vegetation in the adjacent Treeton State forest block (State forest No. 32). The private property survey areas and State forest survey area together will henceforth be referred to as the 'Survey Area'.

The field survey was carried out by Russell Smith (Senior Botanist) on 11 October 2016 and was undertaken in accordance with the Environmental Protection Authority (EPA) and Department of Parks and Wildlife (DPaW) Technical Guide 2015.

This report compiles findings of the field survey.

1.1 Scope and Objectives

The primary objective of the Level 1 flora and vegetation survey was to determine whether there are any significant flora and/or vegetation values within the Survey Area, specifically in relation to the listed threatened species *Banksia nivea* subsp. *uliginosa* and *Banksia squarrosa* subsp. *argillacea*, and the Threatened Ecological Community (TEC) 'Shrublands on southern Swan Coastal Plain Ironstones'. The purpose of the rare flora survey in the adjoining Treeton forest block was to quantify the extent of populations of the afore mentioned Threatened flora species.

The following are standard requirements for a Level 1 flora and vegetation survey under the new EPA and DPaW Technical Guide (2015):

- Review the documented flora and vegetation of significance, based on Department of Parks and Wildlife (DPaW) records (databases);
- Conduct a review of other literature to summarise the values of flora and vegetation significance in the Survey Area;
- Conduct a field assessment to:
    - identify the vascular flora species present;
    - determine the presence or absence of Declared Rare Flora (DRF), Priority or Significant Species;
    - assess conservation significance of vegetation and flora;
    - define and spatially map vegetation condition;
    - define and spatially map vegetation communities;
    - define and map threatened and priority ecological communities;

    - determine whether the Survey Area are wholly or partly with an Environmentally Sensitive Area (ESA); and
- Prepare a report summarising findings
- Submit shapefiles of all field survey data

1.2 Previous Flora Surveys within the Local Area

To the Author's knowledge, no flora or vegetation assessments of vegetation within the Survey Area have been carried out, however, numerous surveys have been undertaken in the adjacent Treeton State forest. Based on correspondence B & J Catalano have received in 1999 from the then Departments of Conservation and Land Management and in 2003 from the then Department of Environment and Conservation (both now known as the Department of Parks and Wildlife), conservation values of the site are well known; it is known to contain an occurrence of the TEC 'Shrublands on southern Swan Coastal Plain Ironstones' (listed as a TEC in both State and Commonwealth legislation), and populations of the listed threatened flora *Banksia nivea* subsp. *uliginosa* and *Banksia squarrosa* subsp. *argillacea*, both of which are also listed as Threatened in both State and Commonwealth legislation.

Flora surveys, assessments and reviews have also been undertaken in nearby areas, although not all are publicly available and therefore could not be referenced. The most relevant and/or significant of those available that were referred to during the preparation of this report are listed below:

- Ecoedge (2014). Yoongarillup Level 2 Flora and Vegetation Survey Report, Rev. 03092014. Unpublished report prepared for Doral Mineral Sands.
- Mattiske Consulting Pty Ltd (2012). Flora and Vegetation Survey of Yoongarillup Resource Zone Survey Area. Unpublished report prepared for Doral Mineral Sands.
- Keighery, B.J., Keighery, G.J., Webb, A., Longman, V.M., Griffin E.A. (2008). A floristic survey of the Whicher Scarp. Department of Environment and Conservation, Perth.
- Meissner, R. and English, V. (2005). Shrubland association on southern Swan Coastal Plain ironstone (Busselton area) (southern ironstone association) interim recovery plan, 2005-2010. Dept. of Conservation & Land Management.

1.3 Biogeographic Region, Location and Site Description

The Survey Area is situated on the boundary between the Perth Coastal Plain (SWA2) sub-region of the Swan Coastal Plain biogeographic region, and the Southern Jarrah Forest (JF2) sub-region of the Jarrah Forest Bioregion as defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Australian Government, 2009). Approximately 95% of the Survey Area is mapped as being in the Southern Jarrah Forest (JF2) sub-region.

It is situated in the City of Busselton approximately 16 km south-southwest of the Busselton town site and 7.6 km southeast of Jindong (**Figure 1**), and covers a total area of 63.5 ha. The remnant vegetation on Lots 2629 and 2699 adjoins the Treeton State forest block at its southern boundary. Jamisons Road forms the north east and eastern boundary and it is bounded by cleared farmland adjoins on the north and west (**Figure 2**).

Elevation onsite is gently undulating and reflects the site's position in the landscape at the junction between the Swan Coastal Plain in the north and the Whicher Scarp in the south, gradually rising from 62 m above sea level (ASL) in the north to 72 m ASL in the south.

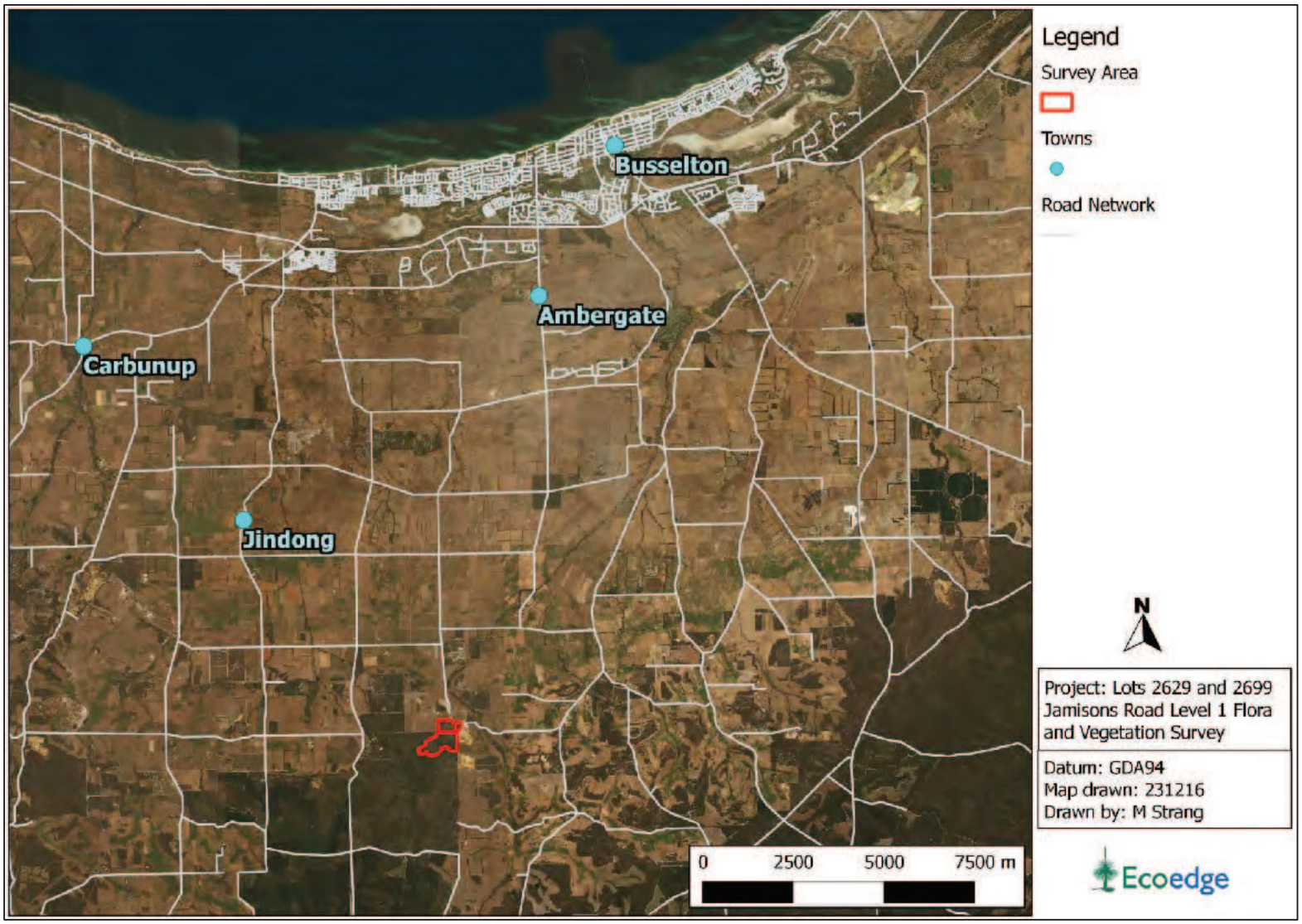

Figure 1. Aerial Photograph showing the location of the Survey Area.

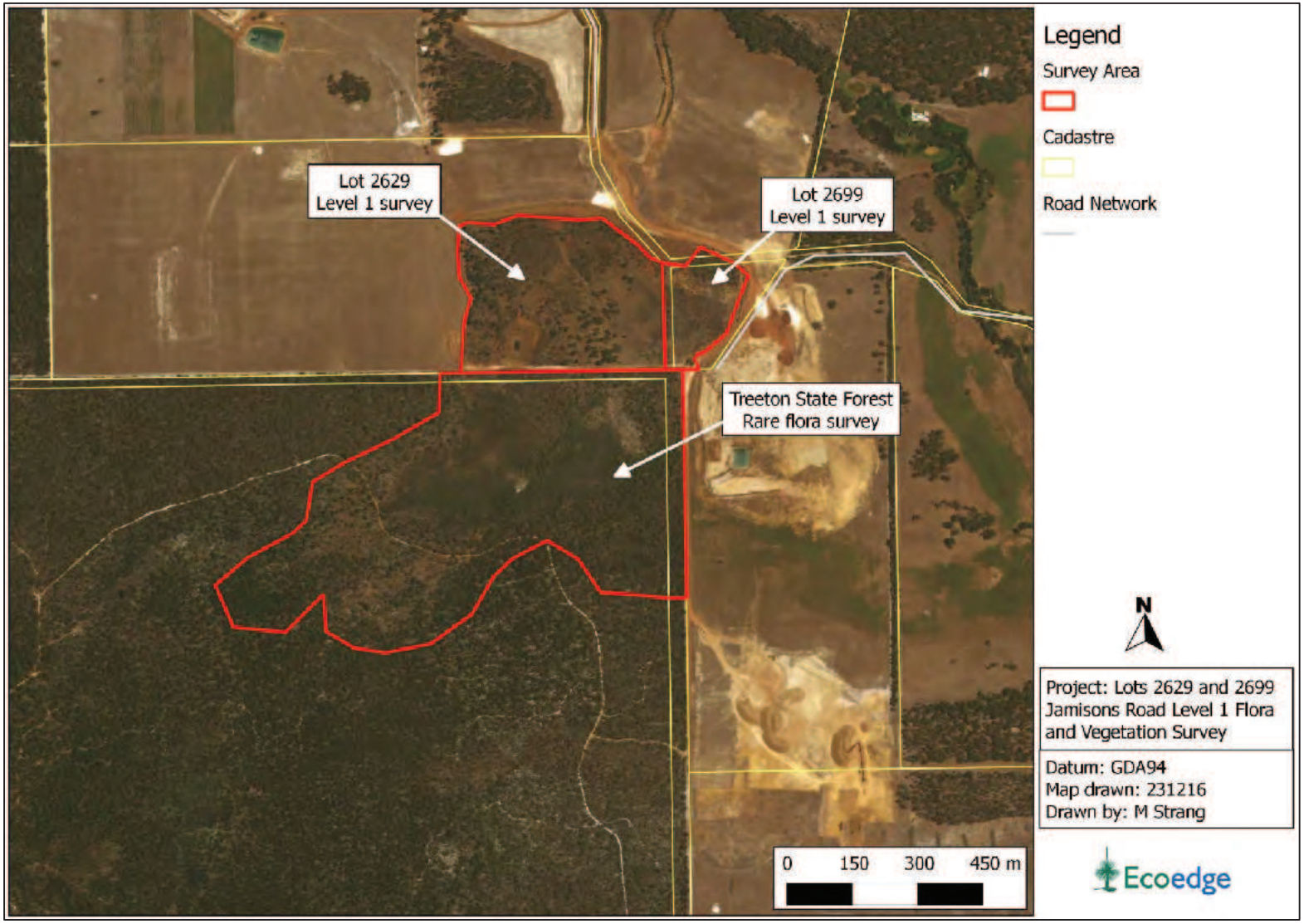

Figure 2. The survey area comprises private property on Lots 2629 and 2699 and a portion of the Treeton State forest block.

1.4 Geology

The Survey Area is situated on the Whicher Scarp, a sickle shape band of low hills thought to have formed as a result of marine erosion of the Perth Sedimentary Basin around two million years ago in the Pleistocene or late Tertiary period. Following ancient shorelines at the foot of the Whicher Scarp is the Yoganup Formation, a gently sloping shelf which contains localised concentrations of heavy minerals (Churchward and McArthur, 1980). The nature of its geology, landform and soils gives the Whicher Scarp affinities with the Swan Coastal Plain. The Survey Area is located on the 'Central Whicher Scarp', which is described by Keighery *et al.* (2008) as having moderate north facing slopes with areas of laterite capped rises and soils ranging from deep sands to sand, gravel, silt, clay and ironstone combinations.

The Survey Area is situated on the Whicher Scarp soil landscape system (214Ws) of Tille and Lantzke (1990), which is described as consisting of "….gentle lateritic slopes with gravels. These slopes form a low scarp which separates the Swan Coastal Plain and the Blackwood Plateau. This subsystem is similar to parts of the Cartis Land unit mapped by Churchward and McArthur (1980)."

Soil-landscape systems have been further divided into soil phases or mapping units; two occur in the Survey Area. These are mapped in **Figure 3** and are described in **Table 1.**

Table 1. Soil Mapping Units occurring within the Survey Area (Tille and Lantzke, 1990).

Soil Mapping Unit	Description
214WsYL1	Raised flats. Duplex sandy gravels, semi-wet soils, yellow deep sands and sandy earths and loamy gravels.
214WsYLw	Poorly drained depressions on the shelf surface. Soils are non-saline wet soils and grey-brown sands and loams.

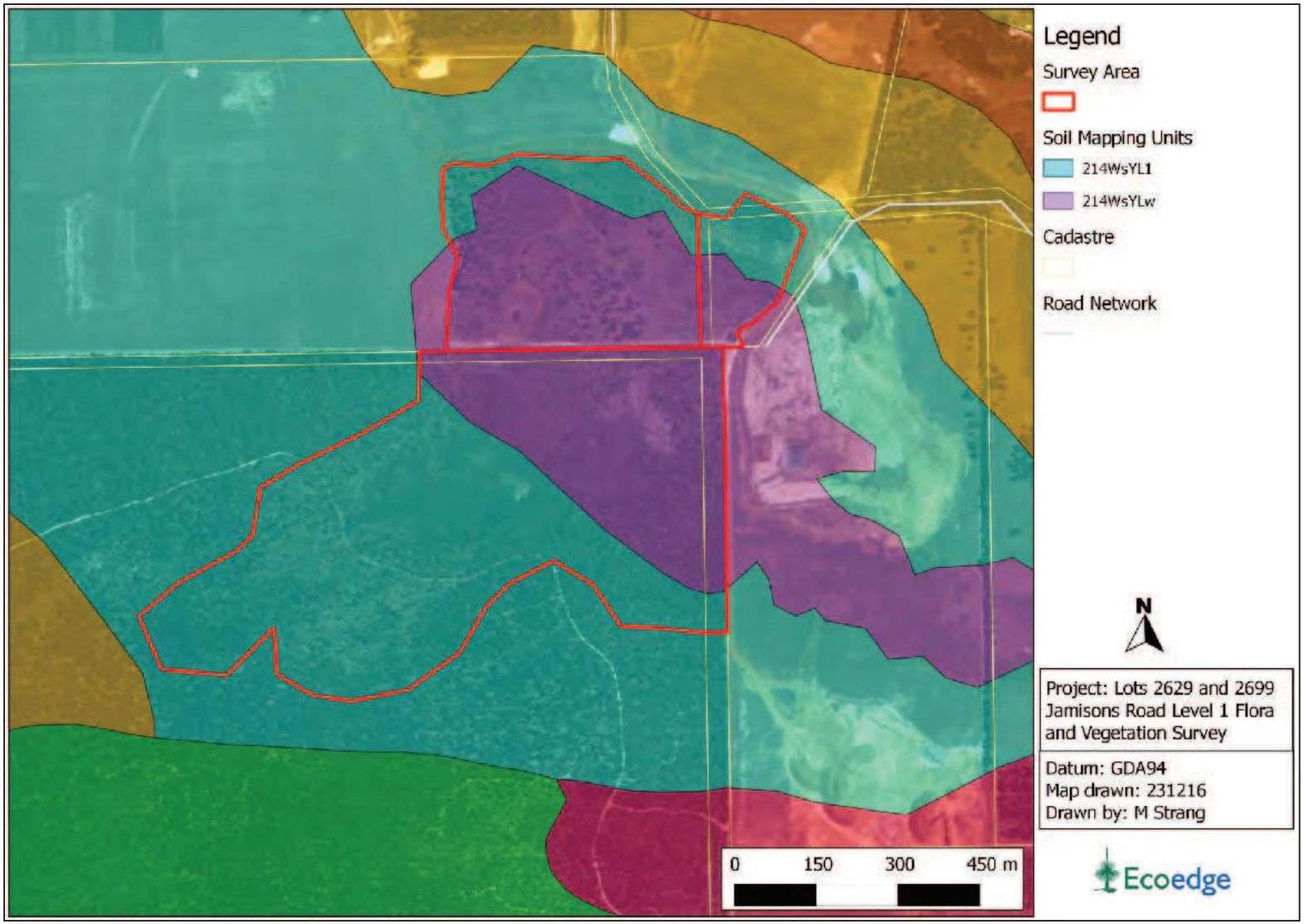

Figure 3. Soil mapping units occurring within the Survey Area.

1.5 Vegetation

Information presented in this section will relate only to the private property portion of the Survey Area. Lots 2629 and 2699 contain approximately 19.2 ha of remnant native vegetation.

A systematic survey of native vegetation in Western Australia was undertaken by J. S. Beard (along with others) during the 1970s, which described vegetation systems in the south-west of Western Australia at a scale of 1: 250,000. Beard's vegetation maps attempted to depict the vegetation as it might have been prior to European settlement in terms of type and extent (Beeston *et al.*, 2001). The Beard Vegetation Association dataset, also referred to as the pre-European native vegetation extent dataset, was digitised by Shepherd *et al.* (2002).

Beard vegetation associations have been described to a minimum standard of Level 3 'Broad Floristic Formation' for the National Vegetation Inventory System (NVIS) (state-wide to regional scale). Two Beard vegetation associations are mapped as occurring within the Survey Area; Association code 1181, which is described as 'Medium woodland, jarrah & *Eucalyptus (Corymbia) haematoxylon* (Whicher Ra.)', and Association 27 'Low woodland; paperbark (Melaleuca sp.)'.

Utilising the Regional Forest Agreement (RFA) mapping undertaken by Mattiske and Havel (1998), and the Swan Coastal Plain (SCP) mapping of Heddle *et al.* (1980), the South West Biodiversity Project (SWBP) Mapping and Information Installment 2 (Molloy *et al.*, 2007) provides mapping of vegetation complexes in the portion of the South West region not covered by either Heddle (1980) or Mattiske and Havel (1998).

As shown in **Figure 4**, vegetation within the Survey Area was mapped by the SWBP as supporting Yelverton Complex vegetation (**Table 2**).

Table 2. Description of Vegetation Complexes mapped as occurring within the Survey Area (Molloy *et al.*, 2007).

Vegetation Complex	Description
Yelverton (Yw)	Woodland of *Allocasuarina fraseriana-Nuytsia floribunda-Agonis flexuosa-Banksia attenuata* on slopes and open forest of *Corymbia calophylla-Eucalyptus patens-Eucalyptus marginata* subsp. *marginata* on the lower slopes and woodland of *Eucalyptus rudis-Melaleuca rhaphiophylla* on valley floors in the humid zone.
Yelverton (Y)	Woodland of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Allocasuarina fraseriana-Agonis flexuosa* and open woodland of *Corymbia calophylla* on low undulating uplands in the humid zone.

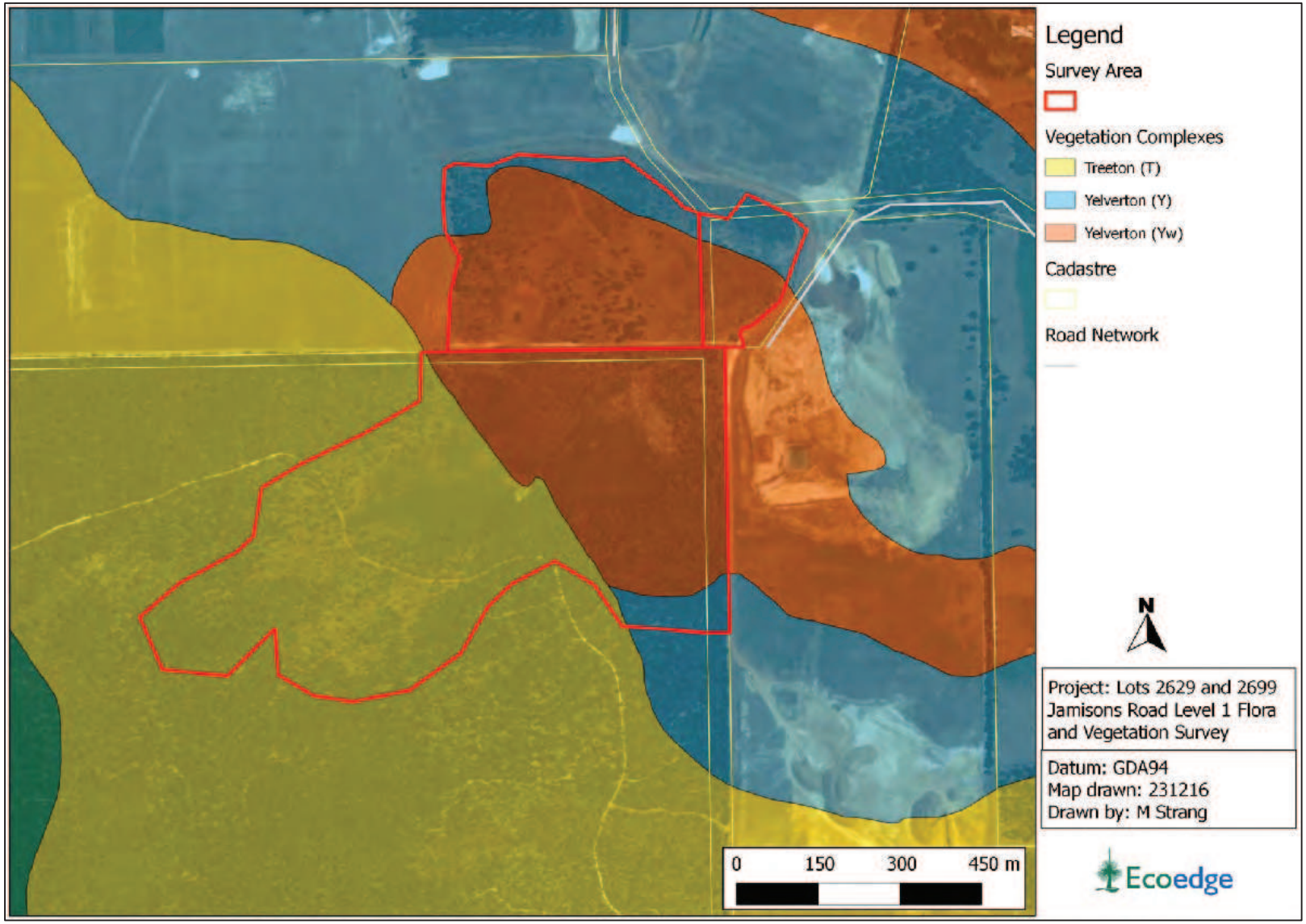

Figure 4. Vegetation complexes mapped by Heddle *et al.* (1980) as occurring within the Survey Area.

In 2001, the Commonwealth of Australia stated National Targets and Objectives for Biodiversity Conservation, which recognised that the retention of 30% or more of the pre-clearing extent of each ecological community was necessary if Australia's biological diversity was to be protected (Environment Australia, 2001). This level of recognition is in keeping with the targets set in the EPA's Position Statement on the 'Environmental protection of native vegetation in Western Australia: clearing of native vegetation, with particular reference to the agricultural area' (EPA, 2000). With regard to conservation status, the EPA has set a target of 15% of pre-European extent for each ecological community to be protected in a comprehensive, adequate and representative reserve system (EPA, 2006).

Table 3 lists the percentage remaining of each vegetation complex and the percentage of each vegetation complex in formal and formal plus informal reserves. It also lists whether each vegetation complex meets the Commonwealth's 30% target (Environment Australia, 2001) and the EPA's 15% target (EPA, 2006). As is evident in **Table 3**, the Yelverton (Y) Complex meets the Commonwealth target but not the EPA target, while the Yelverton (Yw) Complex meets neither target.

Table 3. Vegetation Complexes present in the Survey Area with regard to the EPA and Commonwealth retention targets (DEC, 2007).

Vegetation Complex	% Remaining of pre-European	Is the 30% Target Met?	% in Formal Reserves	% in Formal + All Informal Reserves	Is the 15% Target Met?
Yelverton (Yw)	26.5%	No	0.8%	8.7%	No
Yelverton (Y)	38.4%	Yes	3.1%	6.0%	No

1.5.1 Threatened and Priority Ecological Communities

Ecological communities are defined by Western Australia's Department of Parks and Wildlife (DPaW, previously the Department of Environment and Conservation (DEC)) as "...naturally occurring biological assemblages that occur in a particular type of habitat. They are the sum of species within an ecosystem and, as a whole, they provide many of the processes which support specific ecosystems and provide ecological services." (DEC, 2010).

A threatened ecological community (TEC) is one which is found to fit into one of the following categories; 'presumed totally destroyed', Critically Endangered (CE), Endangered (E) or Vulnerable (Vu) (DEC, 2010). Possible threatened ecological communities that do not meet survey criteria are added to DPaW's Priority Ecological Community (PEC) Lists under Priorities 1, 2 and 3 (referred to as P1, P2, P3). Ecological Communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4 (P4). These ecological

communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5 (P5) (DEC, 2010). The current listing of Threatened and Priority Ecological Communities is specified in DPaW, 2016a and 2016b. Threatened Ecological Communities can also be listed under the *EPBC Act* (Department of the Environment and Energy (DotEE), 2016a; Department of Environment, Water, Heritage and the Arts (DEWHA, 1999)).

There are three categories of TEC under the *EPBC Act*: Critically Endangered (CE), Endangered (E) and Vulnerable (V) (DotEE, 2016b). These are defined in **Table 4**.

Table 4. Categories of Threatened Ecological Communities under the *EPBC Act* (DotEE, 2016b).

Category	Definition
Critically endangered	If, at that time, an ecological community is facing an extremely high risk of extinction in the wild in the immediate future (indicative timeframe being the next 10 years).
Endangered	If, at that time, an ecological community is not critically endangered but is facing a very high risk of extinction in the wild in the near future (indicative timeframe being the next 20 years).
Vulnerable	If, at that time, an ecological, community is not critically endangered or endangered but is facing a high risk of extinction in the wild in the medium–term future (indicative timeframe being the next 50 years).

A Protected Matters Search Tool query for communities listed under the *EPBC Act* occurring within a 5 km radius of the Survey Area was undertaken (DotEE, 2015c, **Appendix 1**), and the current DPaW TEC and PEC listings were consulted (DPaW 2016a; 2016b).

Threatened or priority ecological communities known to occur or possibly occurring within 5 km of the Survey Area are listed in **Table 5**.

Table 5. Threatened and Priority Ecological Communities known to occur within 5 km of the Project Area (Gibson, *et al.* 1994; DPaW 2016d; DotEE, 2016c).

Community Name	Community Description	Status (WA)	Status (*EPBC Act*)
Shrublands on southern Swan Coastal Plain Ironstones (Busselton area) SCP10b	Rapidly drying clay flats, occurring on small areas of ironstone with thin skeletal soils in the Busselton area.	CR	EN
Banksia Woodlands of the Swan Coastal Plain			EN
Southern wet shrublands, Swan Coastal Plain SCP02	Shrublands or open low woodlands restricted to small remnants of Busselton. These occur on seasonally inundated sandy clay soils.	EN	
Corymbia calophylla woodlands on heavy soils of the southern Swan Coastal Plain SCP1b	Consists largely of *Eucalyptus* (*Corymbia*) *calophylla* forests and woodlands of bushland remnants on the plain south of Capel.	VU	
Corymbia haematoxylon - E. marginata woodlands on Whicher foothills ('community type 1a')	Community occurs along the northern edge of State Forest along the base of the Whicher Range and is composed of *Eucalyptus* (*Corymbia*) *haematoxylon – Corymbia calophylla - Eucalyptus marginata* forests and woodlands. Taxa virtually restricted to the type include *Acacia varia* subsp. *varia*, *Agonis grandiflora* and *Xanthosia pusilla*.	P3	
Central Whicher Scarp Mountain Marri woodland (Whicher Scarp woodlands of grey/white sands community A1)	Located on Whicher Scarp mid slopes. The taxa that identify the group include: *Ricinocarpos cyanescens*, *Hibbertia ferruginea*, *Platysace filiformis*, *Conospermum capitatum* subsp. *glabratum*, *Thysanotus arbuscula*, *Schoenus brevisetis*, *Phlebocarya filifolia*, *Leucopogon glabellus*, *Pimelea rosea* subsp. *rosea*, *Adenanthos obovatus*, *Stylidium carnosum* and *Gompholobium capitatum*.	P1*[1]	
Central Whicher Scarp Jarrah woodland (Whicher	Occurs on coloured sands on moderate to gentle slopes of the Central Whicher Scarp. The community has strong representation of a less common group of	P1*	

[1]* indicates Whicher Scarp Floristic Community Types (Keighery *et al.*, 2008)

Community Name	Community Description	Status (WA)	Status (*EPBC Act*)
Scarp woodlands of coloured sands and laterites community C1)	southern taxa including: *Podocarpus drouynianus*, *Loxocarya cinerea*, *Allocasuarina fraseriana*, *Drosera stolonifera*, *Amperea ericoides*, *Thysanotus triandrus*, *Cyathochaeta equitans*, *Hibbertia quadricolor*, *Comesperma calymega*, *Lepidosperma pubisquameum*, *Conospermum paniculatum*, *Acacia preissiana* and *Hybanthus debilissimus*.		
Swan Coastal Plain Paluslope Wetlands	These wetlands are very wet all year round and are associated with areas of groundwater seepage from the sandy low hills at the base of the Whicher Scarp. At times these wetlands are contiguous with areas of Pinjarra Plain wetlands, and the wetlands of the two landforms merge. Combinations of the following species are typically found in the type: *Melaleuca preissiana*, *Taxandria linearifolia*, *Taxandria fragrans*, *Melaleuca incana*, and *Cyathochaeta teretifolia*. Other species include: *Eucalyptus patens*, *Homalospermum firmum*, *Gahnia decomposita*, *Callistachys lanceolata*, *Hakea linearis*, *Melanostachya ustulata*, *Evandra aristata*, *Beaufortia sparsa*, *Callistemon glaucus* and *Pultenaea pinifolia*.	P1*	

1.5.2 Threatened and Priority Flora

Species of flora and fauna are defined as having Declared Rare (Threatened) or Priority conservation status where their populations are restricted geographically or threatened by local processes. The Department of Environment Regulation recognises these threats of extinction and consequently applies regulations towards population and species protection.

Declared Rare (Threatened) Flora species are gazetted under Subsection 2 of Section 23F of the *Wildlife Conservation Act 1950* (*WC Act*) and therefore it is an offence to 'take' or damage rare flora without Ministerial approval. Section 6 of the *WC Act* 1950 - 1980 defines 'to take' as "… to gather, pick, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means."

Priority Flora are under consideration for declaration as 'rare flora', but are in need of further survey (Priority One to Three) or require monitoring every 5-10 years (Priority Four).

Under the *WC Act*, Threatened Flora are ranked according to their level of threat using IUCN Red List categories and criteria of Extinct (EX), Critically Endangered (CE), Endangered (EN) or Vulnerable (VU). **Table 6** presents the categories of Declared Rare and Priority Flora as defined by the *WC Act* (DPaW 2015a).

Table 6. Definitions of Declared Rare and Priority List flora (DPaW, 2015a).

Conservation code	Category
T	Threatened flora is flora that has been declared to be 'likely to become extinct or is rare, or otherwise in need of special protection', pursuant to section 23F(2) of the *Wildlife Conservation Act 1950*. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria (CR, EN, VU, EX). A species that is listed as Threatened and assessed as 'Critically Endangered' would therefore have its status written as T (CR).
P1	Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2	Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P3	Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora', but are in need of further survey.
P4	Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

Under the *EPBC Act,* a species may be listed in one of six categories; the definitions of these categories are summarised in **Table 7** (DotEE, 2016d).

Table 7. Categories of Threatened Species under the *EPBC Act* (DotEE, 2016d).

Category	Definition
Extinct (Ex)	A native species is eligible to be included in the ***extinct*** category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild (ExW)	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered (CE)	A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (EN)	A native species is eligible to be included in the endangered category at a particular time if, at that time (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	A native species is eligible to be included in the vulnerable category at a particular time if, at that time (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Conservation Dependent (CD)	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Threatened or Priority flora occurring within 5 km of the Survey Area generated from a DPaW NatureMap search (DPaW, 2016c) and the Protected Matters Search Tool report (DotEE, 2016c) are listed in **Table 8**.

Table 8. List of Declared Rare and Priority List flora known to occur within 5 km of the Survey Area (DPaW, 2016c & 2016d; DotEE, 2016c).

Species	Cons Status*	Flowering	Habitat	Likelihood of Occurrence
Brachyscias verecundus	T (CE)		Annual (or ephemeral), herb, 0.012-0.022 m high, entirely glabrous. Fl. white/cream. In a moss sward. On a granite outcrop.	High
Caladenia procera	T (CE)	Sep-Oct	Tuberous, perennial, herb, 0.35-0.9 m high. Fl. yellow. Rich clay loam. Alluvial loamy flats, jarrah/marri/peppermint woodland, dense heath, sedges.	Moderate
Grevillea brachystylis subsp. *grandis*	T (CE)	Aug-Sep	Shrubs, 0.3–1 m high. Branchlets not glaucous. Leaves simple, 70–110 mm long overall. Flowers red, very irregular. Habitat amongst medium trees, or tall (sclerophyll) scrubland; in sand, or loam.	Moderate
Banksia nivea subsp. *uliginosa*	T (EN)	Aug-Sep	Dense, erect, non-lignotuberous shrub, 0.2–1.5 m high. Fl. yellow, brown. Sandy clay, gravel.	Very High
Caladenia hoffmanii	T (EN)	Aug-Oct	Tuberous, perennial, herb, 0.13-0.3 m high. Fl. green & yellow & red. Clay, loam, laterite, granite. Rocky outcrops and hillsides, ridges, swamps and gullies.	Moderate
Caladenia huegelii	T (EN)	Sep-Oct	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green, cream, red. Grey or brown sand, clay loam.	Moderate
Caladenia winfieldii	T (EN)	Oct-Nov	Tuberous, perennial, herb, 0.3-0.6 m high. Fl. pink. Grey-black sand, sandy loam. Winter-wet depressions, swamps.	Moderate
Darwinia whicherensis	T (EN)	Oct-Nov	Erect low shrub to 30 cm, flowers green, outer red. Winter-wet area of scrubland over shallow red clay over ironstone.	Moderate
Drakaea elastica	T (EN)	Oct-Nov	Tuberous, perennial, herb, 0.12-0.3 m high. Fl. red, green, yellow. White or grey sand. Low-lying situations adjoining winter-wet swamps.	Moderate
Eucalyptus phylacis	T (EN)	May	Mallee or tree, to 5 m high, bark rough & flaky on trunk. Fl. Cream. Laterite, loam over granite. Coastal areas.	None

Species	Cons Status*	Flowering	Habitat	Likelihood of Occurrence
Gastrolobium papilio	T (EN)	Oct-Dec	Tangled, clumped shrub, to 1.5 m high. Fl. cream-red. Sandy clay over ironstone and laterite. Flat plains.	Moderate
Lambertia echinata subsp. *occidentalis*	T (EN)	Feb/May-Jun/Oct	Prickly, much-branched, non-lignotuberous shrub, to 3 m high. Fl. yellow. White sandy soils over laterite, orange/brown-red clay over ironstone.	Moderate
Petrophile latericola	T (EN)	Nov	Multi-stemmed shrub, 0.4-1.5 m high. Fl. yellow. Red lateritic clay. Winter-wet flats.	High
Sphenotoma drummondii	T (EN)	Sep-Dec	Tufted shrub, 0.15-0.5 m high. Fl. white. Stony or shallow soils over granite or quartzite. Steep rocky slopes, crevices of rocks.	Moderate
Banksia squarrosa subsp. *argillacea*	T (VU)	Jun-Nov	Erect, open, non-lignotuberous shrub, 1.2–4 m high. Fl. yellow, Jun–Nov. White/grey sand, gravelly clay or loam. Winter-wet flats, clay flats.	Very High
Chamelaucium sp. S coastal plain (R.D.Royce 4872)	T (VU)	Oct-Dec	Winter-wet areas, loams and ironstone.	Moderate
Daviesia elongata subsp. *elongata*	T(VU)	Dec-Feb	Spreading shrub, 0.4–1 m high. Fl. yellow, orange, red. Sandy soils.	Moderate
Diuris micrantha	T (VU)	Sep-Oct	Tuberous, perennial, herb, 0.3–0.6 m high. Fl. yellow, brown. Brown loamy clay. Winter-wet swamps, in shallow water.	Moderate
Drakaea micrantha	T (VU)	Sep-Oct	Tuberous, perennial, herb, 0.15–0.3 m high. Fl. red, yellow. White-grey sand.	Moderate
Gastrolobium modestum	T (VU)	Sep-Nov	Prostrate to clumped shrub, to 0.5 m high. Fl. cream-green-pink. Shallow red clay-loam or grey sand, ironstone. Gullies and edges of flats.	Moderate
Tetraria australiensis	T (VU)	Nov-Dec	Rhizomatous, tufted perennial, grass-like or herb (sedge), to 1 m high. Fl. brown.	Moderate
Andersonia ferricola	P1	Oct	Shrub, 0.2-0.5 m high. Fl. purple. White sand or red-brown loam over ironstone. Seasonally wet flats.	Moderate
Loxocarya striata subsp. *implexa*	P1	Jul-Dec	Winter-wet flats.	Moderate

Species	Cons Status*	Flowering	Habitat	Likelihood of Occurrence
Stylidium ferricola	P1		Caespitose perennial, herb, 0.09-0.15 m high. Shallow red-brown clay loam over ironstone. Seasonally wet poorly-drained slopes.	Moderate
Leucopogon sp. Busselton (D. Cooper 243)	P2	Aug-Sep	Slender, erect shrub to 70 cm; flowers white. *Pericalymma ellipticum* wet scrubland, Marri-Jarrah woodland.	Moderate
Boronia tetragona	P3	Oct-Dec	Perennial, herb, 0.3–0.7 m high, leaves sessile, entire, with papillate margins, branches quadrangular, sepals ciliate. Fl. pink, red. Black/white sand, laterite, brown sandy loam. Winter-wet flats, swamps, open woodland.	Moderate
Grevillea brachystylis subsp. *brachystylis*	P3	Aug-Nov	Much-branched, prostrate or decumbent, non-lignotuberous shrub, 0.2-0.5 m high, to 3 m wide. Fl. red. Black sand, sandy clay. Swampy situations.	Moderate
Hakea oldfieldii	P3	Aug-Oct	Open, straggling shrub, up to 2.5 m high. Fl. white, cream, yellow. Red clay or sand over laterite. Seasonally wet flats.	High
Isopogon formosus subsp. *dasylepis*	P3	Jun-Dec	Low, bushy or slender, upright, non-lignotuberous shrub, 0.2–2 m high. Fl. pink, purple, red. Sand, sandy clay, gravelly sandy soils over laterite. Often swampy areas.	Moderate
Lasiopetalum laxiflorum	P3	Sep-Oct	Jarrah forest, lateritic soils.	Low
Loxocarya magna	P3	Sep-Nov	Rhizomatous, perennial, herb (sedge-like), 0.5-1.5 m high. Sand, loam, clay, ironstone. Seasonally inundated or damp habitats.	Very High
Pithocarpa corymbulosa	P3	Jan-Apr	Erect to scrambling perennial, herb, 0.5-1 m high. Fl. white. Gravelly or sandy loam. Amongst granite outcrops.	Moderate
Pultenaea pinifolia	P3	Oct-Nov	Erect, slender shrub, 1-3 m high. Fl. yellow, orange. Loam or clay. Floodplains, swampy areas.	Moderate
Schoenus benthamii	P3	Oct-Nov	Tufted perennial, grass-like or herb (sedge), 0.15-0.45 m high. Fl. brown. White, grey sand, sandy clay. Winter-wet flats, swamps.	Moderate
Synaphea petiolaris subsp. *simplex*	P3	Sep-Oct	Tufted shrub, 0.1–0.6 m high. Fl. yellow. Sandy soils. Flats, winter-wet areas.	Moderate

Species	Cons Status*	Flowering	Habitat	Likelihood of Occurrence
Calothamnus quadrifidus subsp. *teretifolius*	P4	Nov-Dec	Erect, compact, perennial shrub 1.7 m high x 1 m wide. Fl. Red. Seeds held. Fruit exposed.	High
Chamelaucium sp. Yoongarillup (G.J. Keighery 3635)	P4	Jul-Oct	Non-lignotuberous shrub, to 2.5 m high. Fl. cream, yellow. Jarrah-marri forest. Loams, sandy clays. Riverbanks, lower slopes, below laterite breakaways.	Moderate
Lambertia rariflora subsp. *rariflora*	P4	Feb-May	Small tree or shrub, to 7 m high. Fl. green, yellow. Red-brown clay soils, black organic loam, laterite. Near intermittent streams.	Moderate
Thysanotus glaucus	P4	Oct-Mar	Caespitose, glaucose perennial, herb, 0.1–0.2 m high. Fl. purple. White, grey or yellow sand, sandy gravel.	Moderate

Based on an assessment of their preferred habitats some of the species listed in **Table 8** could potentially occur within the Survey Area, based on an assessment of their preferred habitats. All species listed would have either been flowering at the time of survey or could be identified in the field without flowers.

1.6 Regional Ecological Linkages

Information for this section is taken from Molloy *et al*. (2009) and their report on the South West Regional Ecological Linkages (SWREL) Project.

Ecological linkages are defined as:

> *A series of (both contiguous and non-contiguous) patches which, by virtue of their proximity to each other, act as stepping stones of habitat which facilitate the maintenance of ecological processes and the movement of organisms within, and across, a landscape*.

Regional ecological linkages link protected patches of regional significance by retaining the best (condition) patches available as stepping stones for flora and fauna between regionally significant areas. This increases the long-term viability of all the constituent areas.

The SWREL report is the result of collaboration between the Western Australian Local Government Association's *South West Biodiversity Project* and the then Department of Environment and Conservation's *Swan Bioplan* to provide a tool for the identification of ecological linkages and guidance for the protection of linkages through planning policy documents.

Molloy *et al.* (2009) assessed and assigned 'proximity value ratings' to all patches of remnant native vegetation as a way of indicating their distance from the nearest regional ecological linkage axis line. These values are defined in **Figure 5.** Vegetation of the Survey Area is mapped as having a proximity value of 1b, which is the second highest category. It should be noted however, that the proximity value of a patch of remnant vegetation to an ecological linkage is not intended to replace the need to consider the other biodiversity conservation values of that patch of remnant vegetation.

Molloy *et al.* (2009) identify a regional ecological linkage axis line running approximately 460 m to the east of the Survey Area, associated with the Vasee River, and 1120 m to the west of the Survey Area, through the Treeton State Forest and adjacent vegetated private property (**Figure 6**).

While there is no statutory basis for regional ecological linkages identified through the SWREL project, the importance of ecological linkages have been recognised as an environmental policy consideration in EPA and Planning policy over the last decade (EPA, 2009 and references therein). In its statement regarding the SWREL Project, the EPA stated that even though Ecological Linkages are just one measure of the conservation values of a patch of remnant vegetation it expected that:

In preparing plans and proposals for development, consideration will be given to both the site-specific biodiversity conservation values of patches of native vegetation, as well as the landscape function and core linkage significance of a patch in supporting the maintenance of ecological linkage (EPA, 2009).

Figure 5. Linkage proximity rating values assigned to patches of remnant vegetation within a landscape (from Molloy et al., 2009).

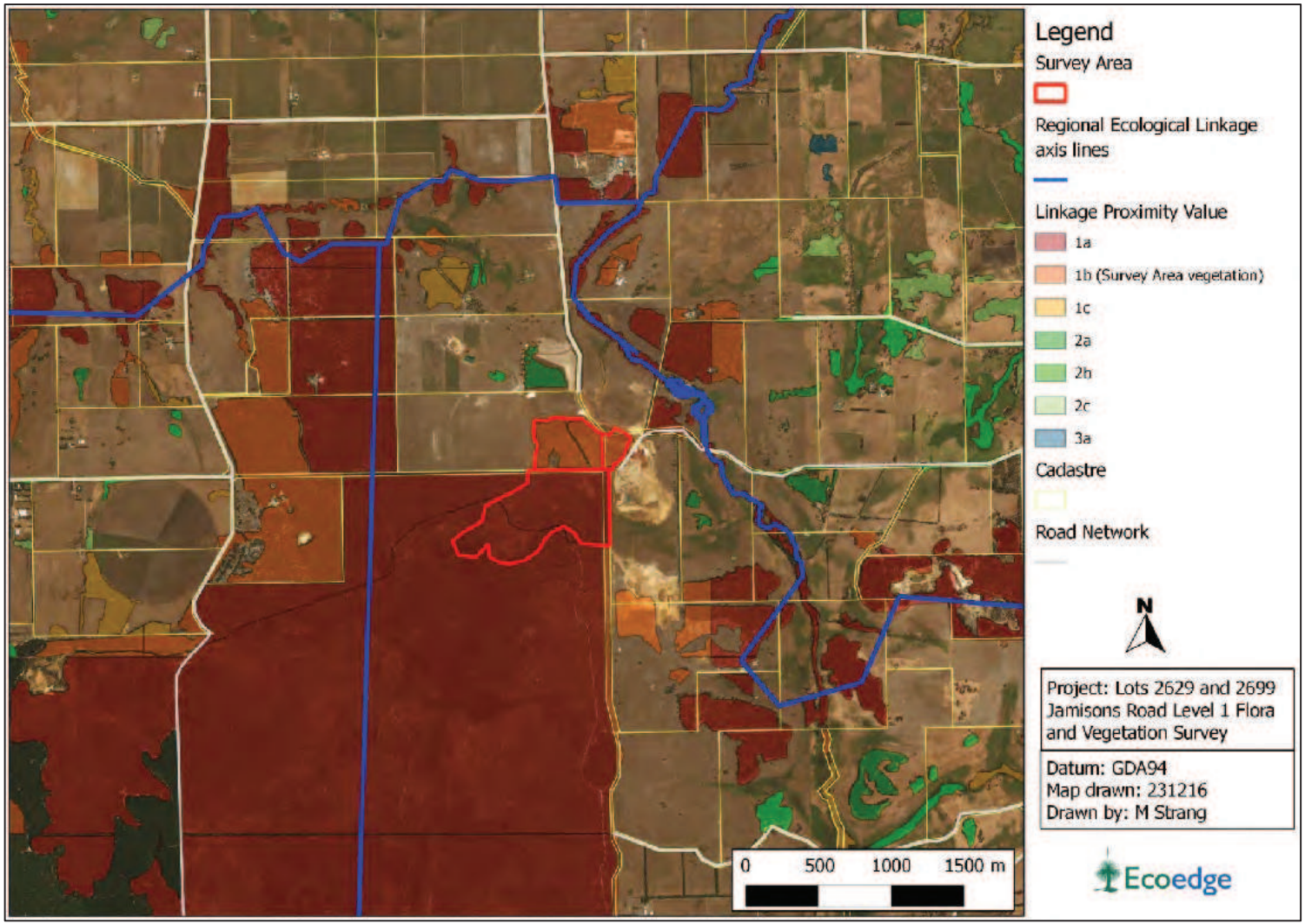

Figure 6. The Survey Area in relation to regional ecological linkages (Molloy et al., 2009).

1.7 Environmentally Sensitive Areas

Environmentally sensitive areas (ESAs) are declared by the Minister for Environment under section 51B of the *Environmental Protection Act 1986* (*EP Act*). ESAs are protected under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 and are selected for their environmental values at state or national levels (Government of Western Australia, 2005). They include;

- Defined wetlands and riparian vegetation within 50 m;
- Areas covered by Threatened Ecological Communities;
- Area of vegetation within 50 m of Declared Rare Flora;
- Bush Forever sites; and
- Declared World Heritage property sites.

According to the 2014 EPA database (EPA, 2014), the Survey Area forms part of an ESA (**Figure 7**), most likely associated with the known populations of the Threatened species *Banksia nivea* subsp. *uliginosa* and *Banksia squarrosa* subsp. *argillacea*, and the recognised occurrence of the TEC 'Shrublands on southern Swan Coastal Plain Ironstones'.

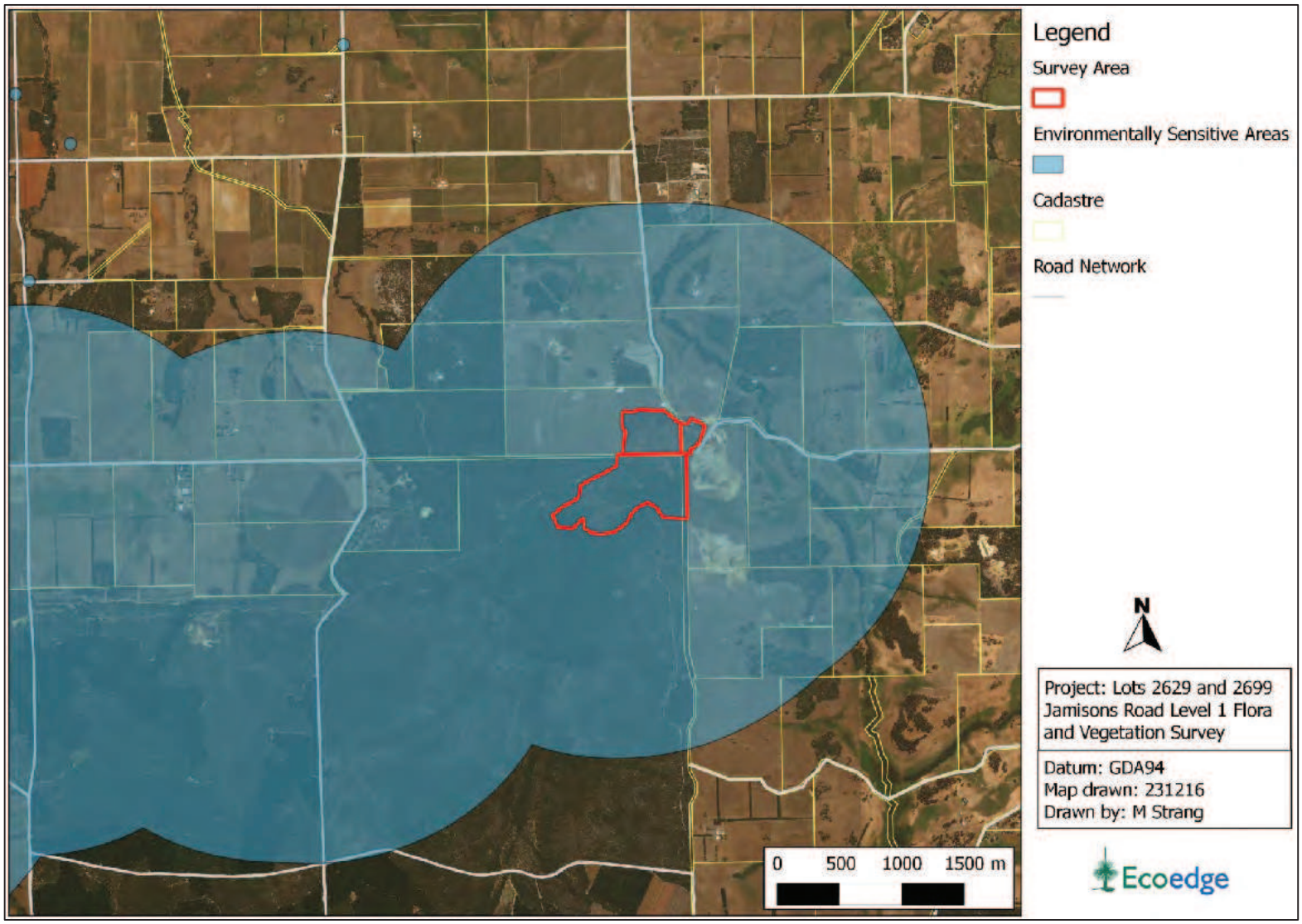

Figure 7. ESAs mapped around and near to the Survey Area.

2 Methods

2.1 Desktop survey

Prior to the field survey, a 'desktop survey' was carried out by downloading extracts from DPaW's and the Western Australian Museum's Rare and Priority flora databases (DPaW, 2016d, refer to **Section 1.5.2**), and from NatureMap (DPaW, 2016d) to produce a list of all flora (including rare flora) occurring within 5 km of the Survey Area. A Protected Matters Search Tool report was also generated, detailing all species listed under the *EPBC Act* known to occur, potentially occur or potentially have habitat occurring within 5 km of the Survey Area (DotEE, 2016c) (**Appendix 1**).

Vegetation condition was assessed using the categories of the EPA and DPaW (2015), which are defined in **Table 10**.

2.2 Field Survey

The field survey was carried out on 11 October 2016. One of the main tasks of the survey was to record the location and numbers of the DRF species *Banksia squarrosa* subsp. *argillacea* and *Banksia nivea* subsp*. uliginosa* – a combination of estimation based on capturing boundaries and estimating density, and also counting of individuals was employed.

Within the private property part of the Survey Area (lots 2629 and 2699 as well as the associated unmade road reserve), an estimate of the numbers of the two DRF taxa, *Banksia squarrosa* subsp. *argillacea* and B. *nivea* subsp. *uliginosa* was made by recording them on a GPS unit, either singly in the case of *B. nivea* subsp. *uliginosa*, or in groups of about seven for the much more numerous *B. squarrosa* subsp. *argillacea*. However, in the case of two particularly dense patches of *B*. *squarrosa* subsp. *argillacea,* the boundaries were captured and numbers estimated based on a count of individual within a 5 m x 15 m area.

The presence of other conservation significant species (Priority listed) was noted, although no attempt was made to estimate numbers. In addition, a list was made of non-conservation significant species, although because the survey was conducted in a single visit the list of taxa is not a full list of species for the private property.

Within the adjacent State forest, no attempt was made to count either of the DRF *Banksias* – instead the boundary of the ironstone vegetation where both were growing was logged on a GPS unit, or estimated from aerial photography where the vegetation was too thick to access. Then, based on a subsample method as described for the private property, an estimate of the number of individuals of both taxa was made.

Flora species that were not identified in the field were photographed for later identification. Taxonomy and conservation status of flora species was checked against DPaW databases (DPaW, 2016d and 2016e).

Notes were taken at 40 relevés within the private property of vegetation condition and dominant species. This, together with aerial photography, was used to map vegetation type and condition.

Table 9. Vegetation condition scale (EPA and DPaW, 2015).

Vegetation Condition	South West and Interzone Botanical Provinces
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	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.
Very Good	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.
Good	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.
Degraded	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.
Completely Degraded	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 Survey limitations

Potential limitations of the assessment are addressed in **Table 11**.

Table 10. Limitations of assessment adequacy and accuracy.

Aspect	Constraint	Comment
Scope	No	The survey scope was prepared in consultation with the client and was designed to comply with EPA requirements.
Accuracy of count	Minor	Within the time constraints of the survey.
Availability of contextual information	Minor	Comprehensive regional surveys of remnant vegetation have been carried out on the Swan Coastal Plain and Whicher Scarp.
Completeness of the survey	Negligible	Vegetation within the Survey Area was thoroughly searched on foot.
Skill and knowledge of the botanists	Negligible	The senior field botanist conducting the survey has had extensive experience in botanical survey in south west Australia over a period of 25 years.

3 Results

3.1 Flora

Sixty-three taxa of vascular flora were identified within the private property, of which eight were introduced species (**Appendix 2**). All of the introduced species were pasture species or common weeds of pasture and none are a declared Pest Plant under the under the *Biosecurity and Agriculture Management Act 2007* (Department of Agriculture and Food, 2007).

3.2 *Banksia squarrosa* subsp. *argillacea* and *B. nivea* subsp. *uliginosa*

Estimates of the numbers of *Banksia squarrosa* subsp. *argillacea* and B. *nivea* subsp. *uliginosa* on private property and State forest within the Survey Area are provided in **Table 11**. The accuracy of the estimate is greater for the private property than the State forest because the populations are more accessible. The extent of *Banksia squarrosa* subsp. *argillacea* within the Survey Area is shown in **Figure 8**, *B. nivea* subsp. *uliginosa* (together with other species of Priority flora) is shown in **Figure 9**.

Table 11. Estimates of the numbers of *Banksia squarrosa* subsp. *argillacea* and *B. nivea* subsp. *uliginosa* within the Survey Area.

Taxon	Private Property	State Forest
Banksia squarrosa subsp. *argillacea*	3,728 (+/- 200)	6,030 (+/= 500)
Banksia nivea subsp. *uliginosa*	22 (+/- 2)	1,000 (+/- 200)

Note: An estimate of the accuracy of the count is given in brackets.

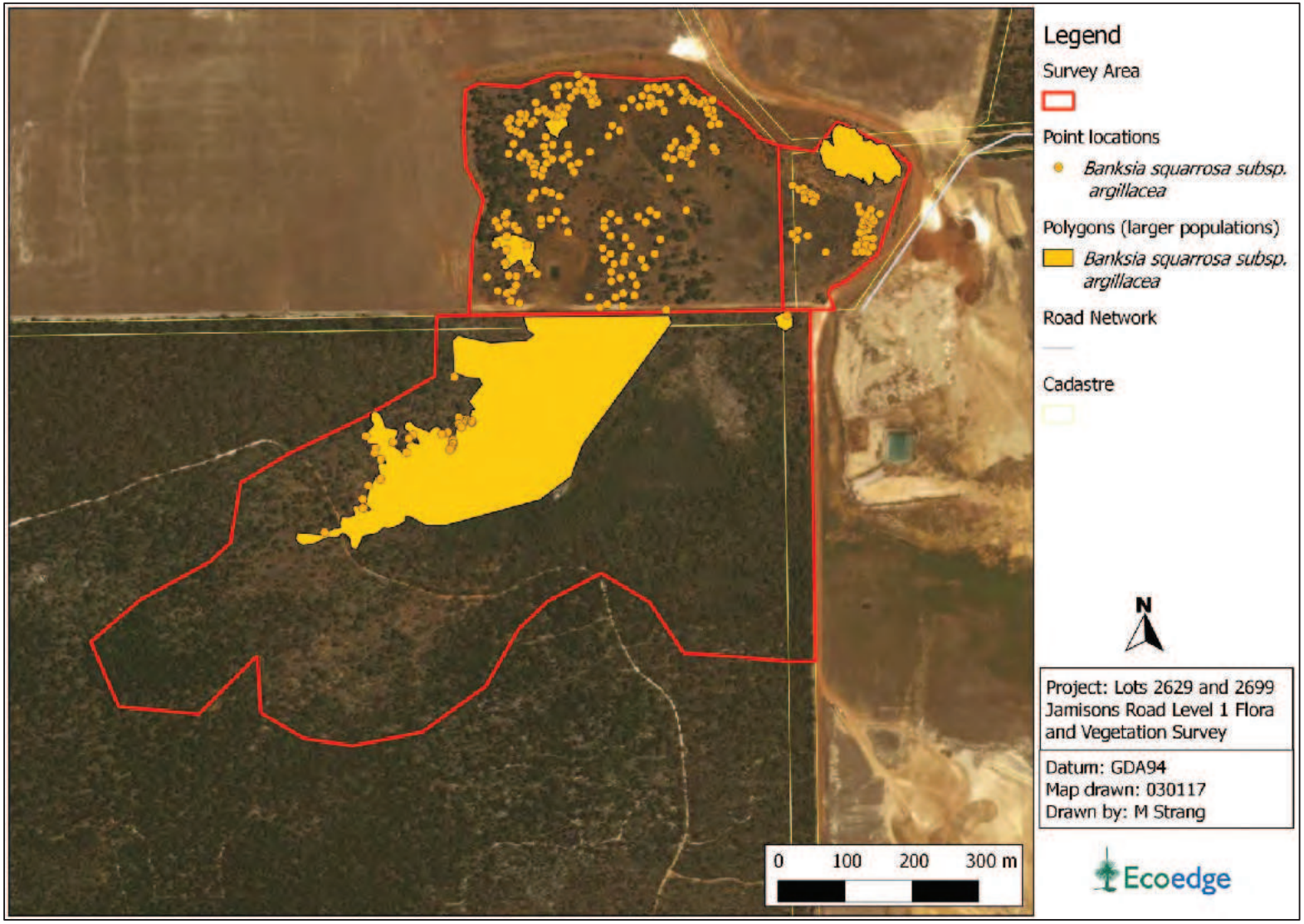

Figure 8. Location and extent of *Banksia squarrosa* subsp. *argillacea* within the Survey Area.

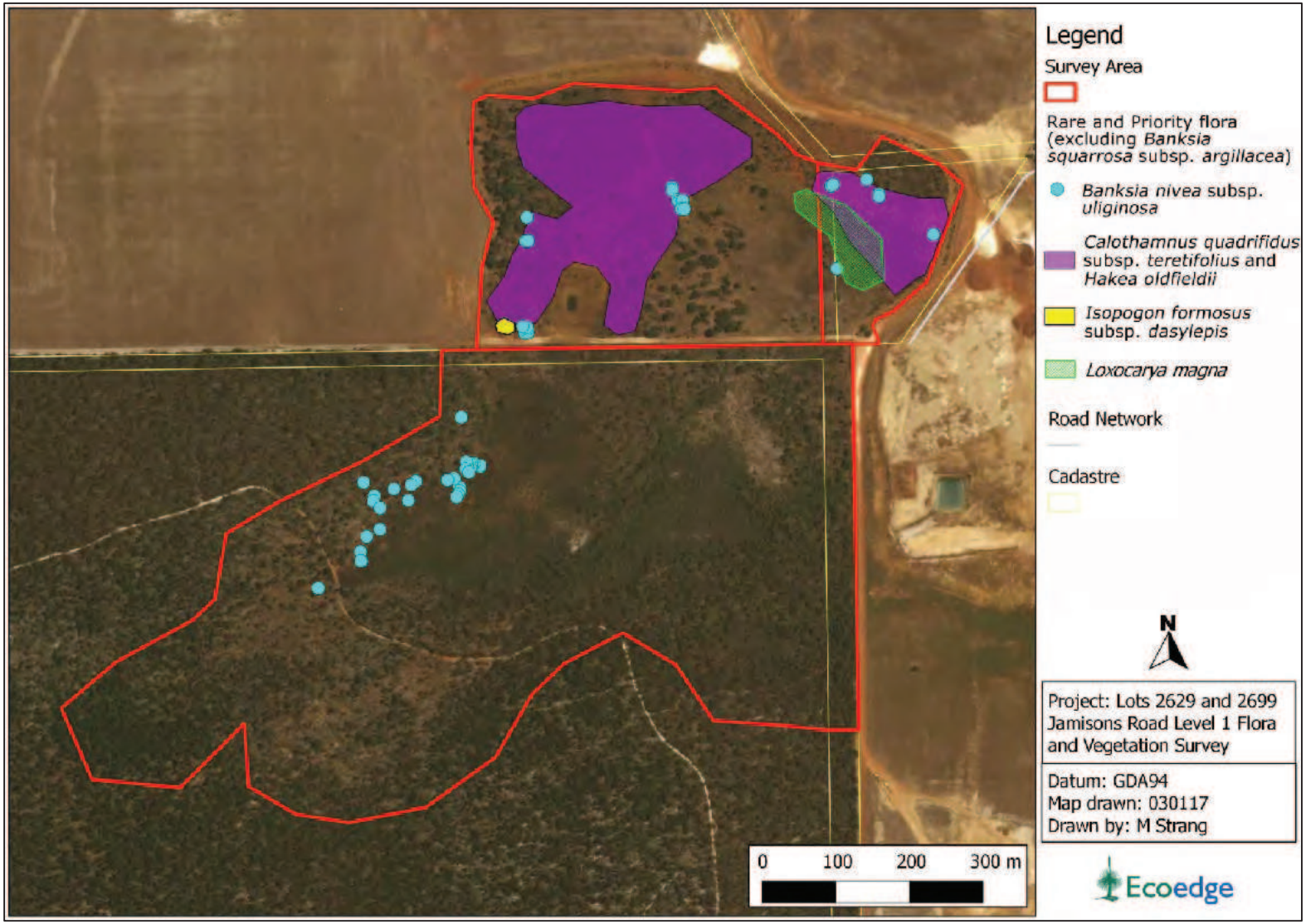

Figure 9. Location and extent of other rare and priority flora within the Survey Area.

3.3 Priority Flora

In addition to the two DRF *Banksias*, four Priority list species were identified within the private property, these being: *Hakea oldfieldii*, *Isopogon formosus* subsp. *dasylepis*, *Loxocarya magna* (all P3) and *Calothamnus quadrifidus* subsp. *teretifolius* (P4). Of the four, *H. oldfieldii*, *L. magna* and C. *quadrifidus* subsp. *teretifolius* were quite common within the shrubland on ironstone, while *I. formosus* subsp. *dasylepis* was restricted to the south-west corner of the private property (**Figure 9**).

3.4 Vegetation Types

3.4.1 Private Property (Lots 2629 and 2699)

Three vegetation units were recognised within the property, two of which are primarily comprised of shrubs, sedges and herbs, and one that is a woodland or open forest unit. Descriptions of each are given below, they are mapped in **Figure 10**, and photographs of the units are presented in **Appendix 3**.

> Unit A1. Tall shrubland of *Banksia squarrosa* subsp. *argillacea* with scattered emergent *Corymbia calophylla* low trees over open shrubland of *Hibbertia hypericoides*, *Pericalymma ellipticum* and open sedgeland of *Caustis dioica* and *Loxocarya magna* and low grassland of exotic species on ironstone.
>
> Unit A2. Tall open shrubland to open shrubland of *Hakea oldfieldii*, *Calothamnus quadrifidus* subsp. *teretifolius* and *Banksia squarrosa* subsp. *argillacea* with scattered emergent *Corymbia calophylla* low trees over scattered shrubs and sedges including *Caustis dioica* and *Loxocarya magna* and low grassland of exotic species on ironstone or shallow orange sand over ironstone.
>
> Unit B. Open forest or woodland of *Corymbia calophylla* over shrubland of Allocasuarina humilis, *Calothamnus quadrifidus* subsp. *teretifolius*, *Banksia squarrosa* subsp. *argillacea*, *Dillwynia laxiflora*, *Grevillea trifida*, *Hibbertia hypericoides*, *Melaleuca incana*, *M. viminea*, *Pericalymma ellipticum*, scattered sedges of *Caustis dioica* and *Loxocarya magna* (and in more open areas, pasture grasses on red-brown loam over ironstone.

Vegetation units A1 and A2 are similar, the main differences being the greater density of *B. squarrosa* subsp. *argillacea* in unit A1 (to the exclusion of many other species) and the more variable condition in unit A2, which ranges from scattered *Loxocarya magna* and *Calothamnus quadrifidus* subsp. *teretifolius* and native herbs and pasture species to tall shrubland in very good condition dominated by *Hakea oldfieldii*, *Calothamnus quadrifidus* subsp. *teretifolius* and *Banksia squarrosa* subsp. *argillacea*.

Vegetation unit B, which is dominated by Marri (*Corymbia calophylla*) trees is also quite variable in condition, ranging from very good to degraded (where understorey species are mainly pasture grasses).

3.4.2 State Forest

Vegetation type *per se* was not mapped in the State forest, however the boundary of the "Shrublands on southern Swan Coastal Plain Ironstones (Busselton area)" (Busselton Ironstone) TEC has been mapped (**Figure 11, Section 1.7**). The boundary delineation was mainly determined by the presence of species typical of this community, and the presence of sheet ironstone or shallow loam over ironstone. Approximately 16 ha of this threatened community was mapped in this survey within the State forest adjacent to Lots 2699 and 2629.

3.5 Vegetation Condition

Vegetation was quite variable within the private property (Lots 2629 and 2699) however, just over 60% was in Good or Very Good condition (**Table 12**, **Figure 12**). Degradation has been caused in the past through partial clearing and grazing, although some of the area previously subjected to physical disturbance (e.g. around the water-hole in the south west corner) has partially regenerated.

Table 12. Extent of vegetation within Lots 2629 and 2699 of the Survey Area in each condition class.

Condition	Area (ha)	%
Very Good	4.0	22.1
Good	6.9	38.2
Degraded	3.8	20.8
Completely Degraded	3.4	19.0
Total	**18.1**	**100.0**

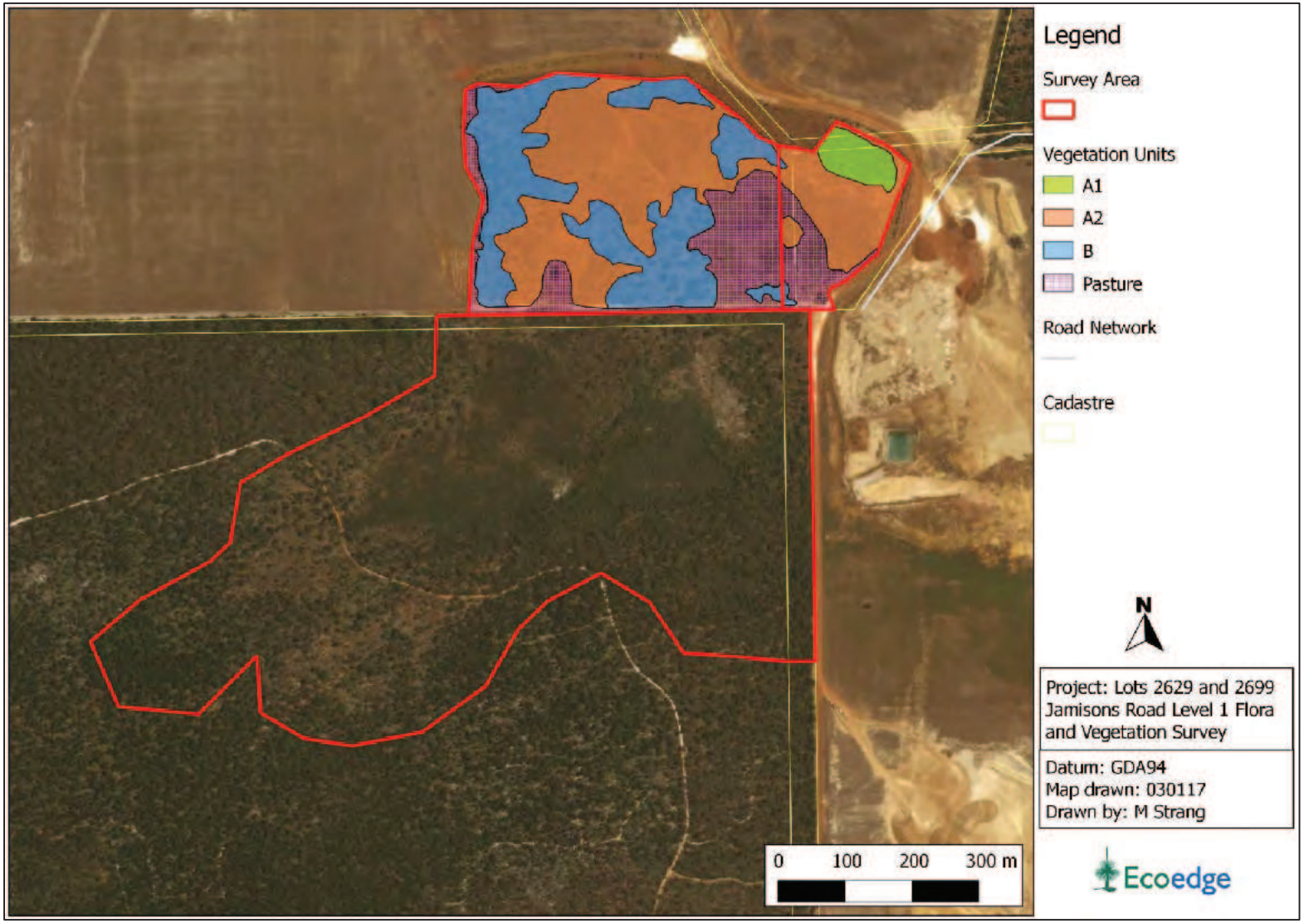

Figure 10. Vegetation units mapped within the private property portion of the Survey Area.

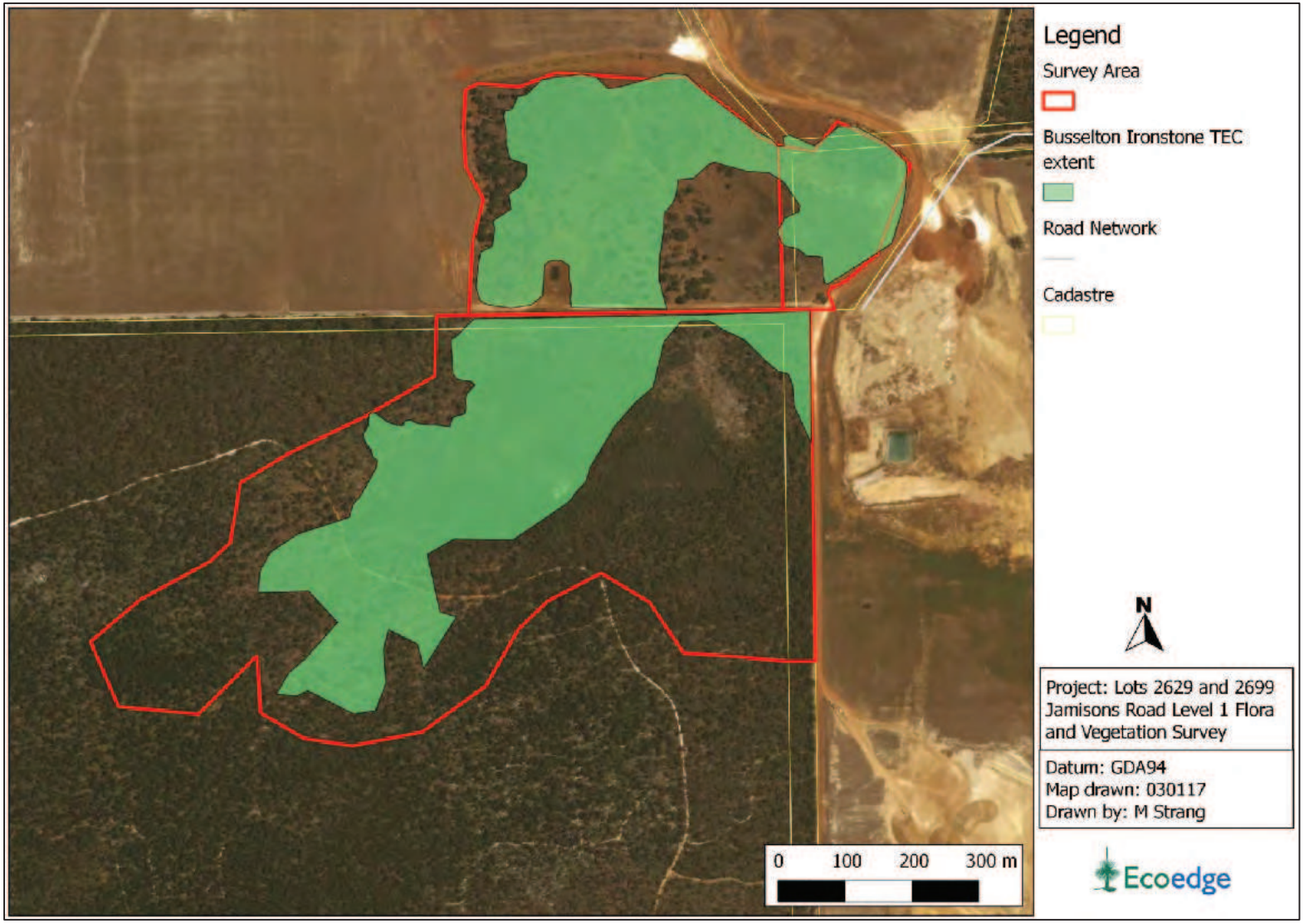

Figure 11. Extent of the "Shrublands on southern Swan Coastal Plain Ironstones (Busselton area)" (Busselton Ironstone) TEC within the Survey Area.

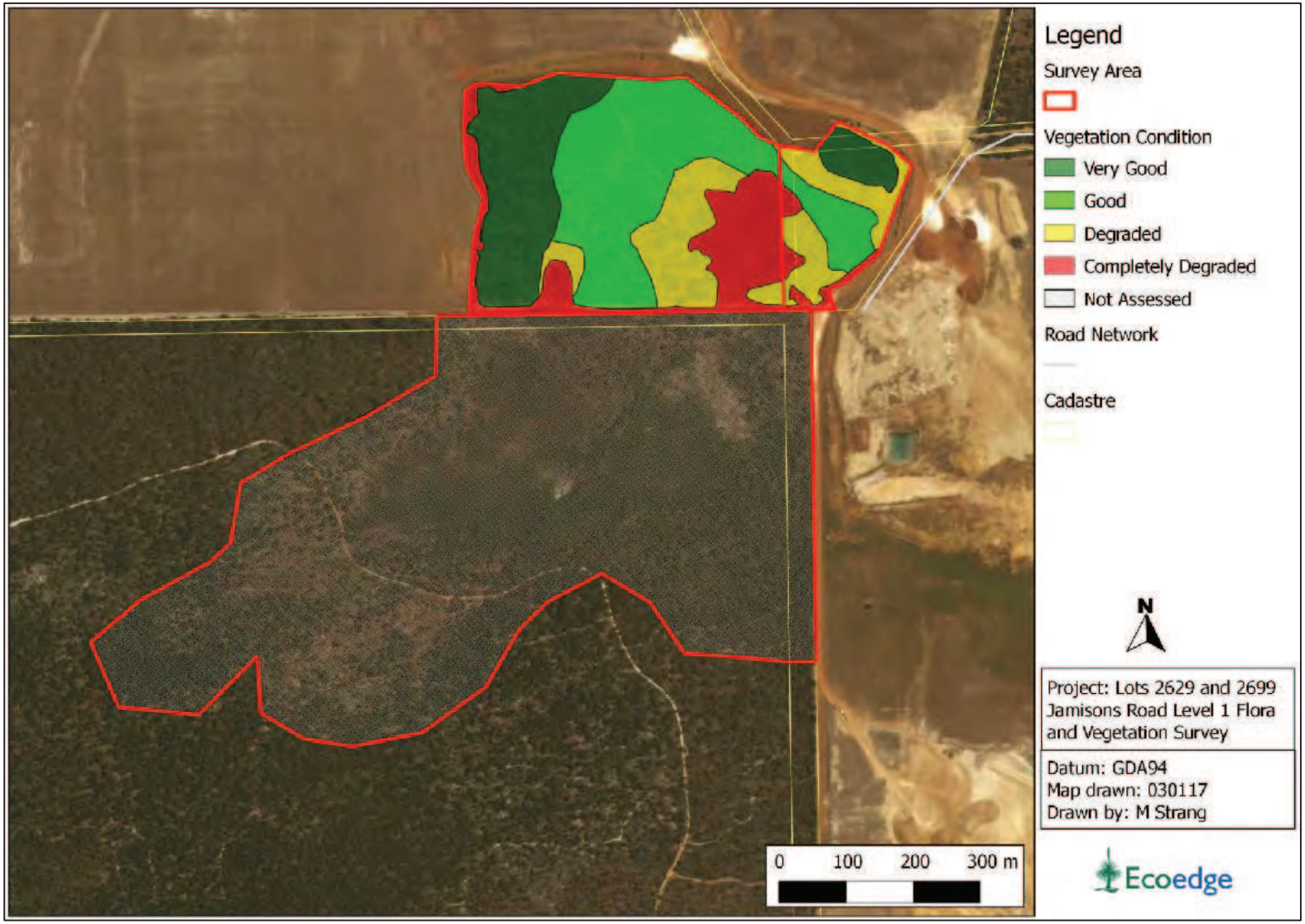

Figure 12. Condition of vegetation within the private property portion of the Survey Area.

4 Discussion and conclusions

4.1 Conservation Status of the Flora

Substantial populations of two threatened (DRF) taxa, *Banksia squarrosa* subsp. *argillacea* and *Banksia nivea* subsp. *uliginosa* occur within Lots 2699 and 2629. These species are protected under both State and Commonwealth legislation (**Table 6**, above). As can be seen from **Table 11** in **Section 3.3**, the sub-populations of these species on the private property (particularly in relation to *B. squarrosa* subsp. *argillacea*) form a substantial part of the total population of these species on both the private property and the adjacent State forest.

In addition, the Priority species *Hakea oldfieldii*, *Isopogon formosus* subsp. *dasylepis*, *Loxocarya magna* (all P3) and *Calothamnus quadrifidus* subsp. *teretifolius* (P4) all occur within the private property. *Hakea oldfieldii* and C. *quadrifidus* subsp. *teretifolius* are particularly numerous there. All of them are typical species of the Busselton Ironstone TEC.

4.2 Conservation Status of the Vegetation

Much of the remnant native vegetation on Lots 2699 and 2629 is consistent with it being an occurrence of the Critically Endangered TEC "Shrublands on southern Swan Coastal Plain Ironstones (Busselton area)" (SWAFCT10b). Vegetation unit A1 and portions of units A2 and B fit the description of this community (**Figure 10**). At total of 12.8 ha of vegetation consistent with belonging to this community occur on Lots 2699 and 2629 – this compares with approximately 16 ha in the adjacent State forest.

4.3 Regional ecological linkages

The Survey Area vegetation does not appear to have particular value with regard to regional ecological linkages.

4.4 Environmentally Sensitive Areas

As stated in **Section 1.7**, above, all the Survey Area forms part of an ESA, and therefore has particular requirements regarding potential clearing under *the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (Clearing Regulations*).

5 Recommendations

It is recommended that because of its high conservation values, all of the vegetation in Lots 2699 and 2269 within the Survey Area is protected from further disturbance or damage through clearing or grazing.

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Appendix 1. Protected Matters Search Tool Report

Appendix 2. List of vascular flora found within Lots 2629 and 2699 of the Survey Area

Appendix 3. Photographs and Descriptions of Vegetation units mapped within Lots 2629 and 2699 of the Survey Area

Appendix 1. Protected Matters Search Tool Report

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

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

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

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

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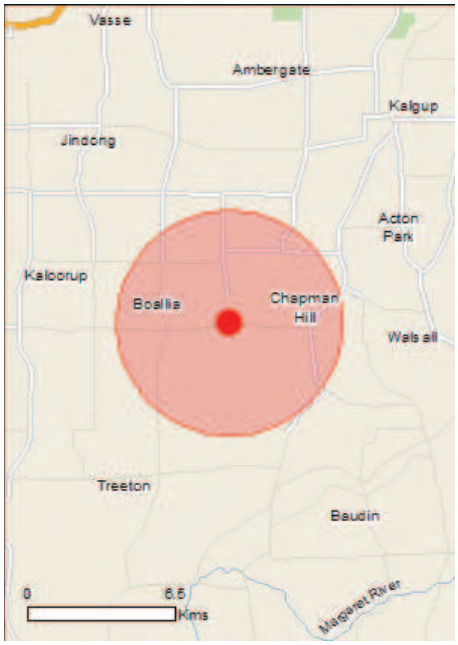

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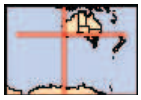

Summary

Matters of National Environmental Significance

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

□ orld □eritage Properties:	None
National □eritage Places:	None
□ etlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
□isted Threatened Ecological Communities:	2
□isted Threatened Species:	29
□isted Migratory Species:	6

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth □and:	None
Commonwealth □eritage Places:	None
□isted Marine Species:	10
□ hales and Other Cetaceans:	None
Critical □abitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	None
Regional □orest Agreements:	1
Invasive Species:	23
Nationally Important □ etlands:	None
Key Ecological □eatures (Marine)	None

Details

Matters of National Environmental Significance

etlands of International Importance (Ramsar) Resource Information

Name	Proximity
asse wonnerup system	10 20km upstream

isted Threatened Ecological Communities Resource Information

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

Name	Status	Type of Presence
Banksia oodlands of the Swan Coastal Plain	Endangered	Community likely to occur within area
Shrublands on southern Swan Coastal Plain ironstones	Endangered	Community likely to occur within area

isted Threatened Species Resource Information

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern 1001	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper 856	Critically Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso orest Red tailed Black Cockatoo, Karrak 6 034	ulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin s Cockatoo, Baudin s Black Cockatoo, ong billed Black Cockatoo 69	ulnerable	Breeding likely to occur within area
Calyptorhynchus latirostris Carnaby s Black Cockatoo, Short billed Black Cockatoo 59523	Endangered	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, ar Eastern Curlew 84	Critically Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroii Chuditch, estern uoll 330	ulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis estern Ringtail Possum, Ngwayir, omp, oder, Ngoor, Ngoolangit 25911	ulnerable	Species or species habitat likely to occur within area
Plants		
Banksia nivea subsp. uliginosa Swamp oneypot 82 66	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Banksia squarrosa subsp. argillacea □ hicher Range Dryandra □82□69□	□ulnerable	Species or species habitat known to occur within area
Brachyscias verecundus Ironstone Brachyscias □81321□	Critically Endangered	Species or species habitat likely to occur within area
Caladenia hoffmanii □offman□s Spider□orchid □56□19□	Endangered	Species or species habitat likely to occur within area
Caladenia huegelii King Spider□orchid, Grand Spider□orchid, Rusty Spider□orchid □□309□	Endangered	Species or species habitat likely to occur within area
Caladenia procera Carbunup King Spider Orchid □686□9□	Critically Endangered	Species or species habitat may occur within area
Caladenia winfieldii Ma□estic Spider□orchid □64504□	Endangered	Species or species habitat may occur within area
Chamelaucium sp. S coastal plain (R.D.Royce 48□2) Royce□s □ axflower □8□814□	□ulnerable	Species or species habitat likely to occur within area
Darwinia whicherensis Abba Bell □83193□	Endangered	Species or species habitat may occur within area
Daviesia elongata subsp. elongata □ong□leaved Daviesia □64883□	□ulnerable	Species or species habitat known to occur within area
Diuris micrantha Dwarf Bee□orchid □55082□	□ulnerable	Species or species habitat may occur within area
Drakaea elastica Glossy□leafed □ammer Orchid, Glossy□leaved □ammer Orchid, □ arty □ammer Orchid □16□53□	Endangered	Species or species habitat may occur within area
Drakaea micrantha Dwarf □ammer□orchid □56□55□	□ulnerable	Species or species habitat likely to occur within area
Eucalyptus phylacis Meelup Mallee □56422□	Endangered	Species or species habitat may occur within area
Gastrolobium modestum Broad□leaved Gastrolobium □□8361□	□ulnerable	Species or species habitat likely to occur within area
Gastrolobium papilio Butterfly□leaved Gastrolobium □□8415□	Endangered	Species or species habitat may occur within area
Grevillea brachystylis subsp. grandis □arge□flowered Short□styled Grevillea □85001□	Critically Endangered	Species or species habitat known to occur within area
□ambertia echinata subsp. occidentalis □ estern Prickly □oneysuckle □64528□	Endangered	Species or species habitat likely to occur within area
Petrophile latericola □aterite Petrophile □64532□	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Sphenotoma drummondii		
Mountain Paper heath 21160	Endangered	Species or species habitat may occur within area
Tetraria australiensis		
Southern Tetraria 1013	ulnerable	Species or species habitat likely to occur within area

listed Migratory Species Resource Information

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
ork tailed Swift 6 8		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea		
Grey agtail 642		Species or species habitat may occur within area
Migratory etlands Species		
Calidris ferruginea		
Curlew Sandpiper 856	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, ar Eastern Curlew 84	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus		
Osprey 952		Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank 832		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

listed Marine Species Resource Information

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

Name	Threatened	Type of Presence
Birds		
Apus pacificus		
ork tailed Swift 6 8		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, hite Egret 59541		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret 59542		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper 856	Critically Endangered	Species or species habitat may occur within area
aliaeetus leucogaster		
hite bellied Sea Eagle 943		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Merops ornatus Rainbow Bee□eater □6□0□		Species or species habitat may occur within area
Motacilla cinerea Grey □ agtail □642□		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, □ar Eastern Curlew □84□□	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey □952□		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank □832□		Species or species habitat likely to occur within area

Extra Information

Regional □orest Agreements — □Resource Information □

Note that all areas with completed R□As have been included.

Name	State
South □ est □ A R□A	□ estern Australia

Invasive Species — □Resource Information □

□ eeds reported here are the 20 species of national significance (□ oNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red □ox, Cat, Rabbit, Pig, □ ater Buffalo and Cane Toad. Maps from □andscape □ealth Pro□ect, National □and and □ ater Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard □9□4□		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon □803□		Species or species habitat likely to occur within area
Streptopelia senegalensis □aughing Turtle□dove, □aughing Dove □□81□		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling □389□		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle □16□		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog □82654□		Species or species habitat likely to occur within area

Name	Status	Type of Presence
□elis catus Cat, □ouse Cat, Domestic Cat □19□		Species or species habitat likely to occur within area
□eral deer □eral deer species in Australia □85□33□		Species or species habitat likely to occur within area
Mus musculus □ouse Mouse □120□		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit □128□		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat □84□		Species or species habitat likely to occur within area
Sus scrofa Pig □6□		Species or species habitat likely to occur within area
□ulpes vulpes Red □ox, □ox □18□		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal □eil Creeper, Smilax, □lorist□s Smilax, Smilax Asparagus □224□3□		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass □58□9□		Species or species habitat may occur within area
Cenchrus ciliaris Buffel□grass, Black Buffel□grass □20213□		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed □18983□		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed □16905□		Species or species habitat likely to occur within area
Genista sp. □ Genista monspessulana Broom □6□538□		Species or species habitat may occur within area
Olea europaea Olive, Common Olive □9160□		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, □ ilding Pine □20□80□		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry □68406□		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, □lowering Cypress, Salt Cedar □16018□		Species or species habitat likely to occur within area

Caveat

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

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

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

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

or species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. here appropriate, core breeding, foraging and roosting areas are indicated under type of presence. or species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non government organisations bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

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

- migratory and
- marine

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

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

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

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

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

Coordinates

33. 945 115.295 5

Acknowledgements

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

- Office of Environment and eritage, New South ales
- Department of Environment and Primary Industries, ictoria
- Department of Primary Industries, Parks, ater and Environment, Tasmania
- Department of Environment, ater and Natural Resources, South Australia
- Parks and ildlife Commission NT, Northern Territory Government
- Department of Environmental and eritage Protection, ueensland
- Department of Parks and ildlife, estern Australia
- Environment and Planning Directorate, ACT
- Birdlife Australia
- Australian Bird and Bat Banding Scheme
- Australian National ildlife Collection
- Natural history museums of Australia
- Museum ictoria
- Australian Museum
- South Australian Museum
- ueensland Museum
- Online oological Collections of Australian Museums
- ueensland erbarium
- National erbarium of NS
- Royal Botanic Gardens and National erbarium of ictoria
- Tasmanian erbarium
- State erbarium of South Australia
- Northern Territory erbarium
- estern Australian erbarium
- Australian National erbarium, Atherton and Canberra
- niversity of New England
- Ocean Biogeographic Information System
- Australian Government, Department of Defence
- orestry Corporation, NS
- Geoscience Australia
- CSIRO
- Other groups and individuals

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

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

Department of the Environment
GPO Box 8
Canberra ACT 2601 Australia
61 2 62 4 1111

Appendix 2. List of vascular flora found within Lots 2629 and 2699 of the Survey Area.

FAMILY NAME	LATIN NAME	NATURALISED	CONSV CODE
Asparagaceae	*Chamaescilla corymbosa*		
Asteraceae	*Hyalosperma cotula*		
	Hypochaeris glabra	*	
	Rhodanthe citrina		
Casuarinaceae	*Allocasuarina humilis*		
Celastraceae	*Stackhousia monogyna*		
Centrolepidaceae	*Aphelia drummondii*		
	Centrolepis aristata		
Cyperaceae	*Caustis dioica*		
	Lepidosperma squamatum		
	Mesomelaena tetragona		
Dilleniaceae	*Hibbertia hypericoides*		
Droseraceae	*Drosera erythrorhiza*		
Elaeocarpaceae	*Tetratheca hirsuta*		
Fabaceae	*Acacia pulchella*		
	Dillwynia laxiflora		
	Gompholobium tomentosum		
	Lotus subbiflorus	*	
	Trifolium dubium	*	
Goodeniaceae	*Dampiera linearis*		
	Scaevola calliptera		
Haemodoraceae	*Conostylis setigera*		
Hemerocallidaceae	*Tricoryne elatior*		
Hypoxidaceae	*Pauridia occidentalis*		
Iridaceae	*Romulea rosea*	*	
Lamiaceae	*Hemiandra pungens*		
Myrtaceae	*Calothamnus quadrifidus* subsp. *teretifolius*		P4
	Corymbia calophylla		
	Eucalyptus marginata		
	Hypocalymma angustifolium		
	Kunzea micrantha		
	Melaleuca incana		
	Melaleuca viminea		
	Pericalymma ellipticum		
Orchidaceae	*Caladenia flava*		
	Pterostylis recurva		
	Pyrorchis nigricans		
	Thelymitra crinita		
	Thelymitra macrophylla		
Poaceae	*Avena fatua*	*	
	Briza maxima	*	
	Lachnagrostis plebeia		
	Lolium multiflorum	*	
	Neurachne alopecuroidea		

FAMILY NAME	LATIN NAME	NATURALISED	CONSV CODE
	Vulpia myuros	*	
Podocarpaceae	*Podocarpus drouynianus*		
Proteaceae	*Adenanthos meisneri*		
	Banksia dallanneyi		
	Banksia nivea subsp. *uliginosa*		DRF (T)
	Banksia squarrosa subsp. *argillacea*		DRF (T)
	Conospermum caeruleum subsp. *spathulatum*		
	Grevillea trifida		
	Hakea amplexicaulis		
	Hakea lissocarpha		
	Hakea oldfieldii		P3
	Hakea ruscifolia		
	Isopogon formosus subsp. dasylepis		P3
Restionaceae	*Desmocladus fasciculatus*		
	Loxocarya magna		P3
Rhamnaceae	*Cryptandra arbutiflora* var. *tubulosa*		
Stylidiaceae	*Stylidium androsaceum*		
Xanthorrhoeaceae	*Xanthorrhoea gracilis*		
	Xanthorrhoea preissii		

Appendix 3. Photographs and Descriptions of Vegetation units mapped within Lots 2629 and 2699 of the Survey Area

Unit A1

Unit A1. Tall shrubland of *Banksia squarrosa* subsp. *argillacea* with scattered emergent *Corymbia calophylla* low trees over open shrubland of *Hibbertia hypericoides*, *Pericalymma ellipticum* and open sedgeland of *Caustis dioica* and *Loxocarya magna* and low grassland of exotic species on ironstone.

Unit A2

Unit A2. Tall open shrubland to open shrubland of *Hakea oldfieldii* and *Banksia squarrosa* subsp. *argillacea* with scattered emergent *Corymbia calophylla* low trees over scattered shrubs and sedges including *Caustis dioica* and *Loxocarya magna* and low grassland of exotic species on ironstone or shallow orange sand over ironstone.

Unit B

Unit B. Open forest or woodland of *Corymbia calophylla* over shrubland of Allocasuarina humilis, *Calothamnus quadrifidus* subsp. *teretifolius*, *Banksia squarrosa* subsp. *argillacea*, *Dillwynia laxiflora*, *Grevillea trifida*, *Hibbertia hypericoides*, *Melaleuca incana*, *M. viminea*, *Pericalymma ellipticum*, scattered sedges of *Caustis dioica* and *Loxocarya magna* (and in more open areas, pasture grasses on red-brown loam over ironstone.

Fauna
Habitat Assessment
of
Proposed Clearing Areas

Lot 2626
Jamison's Road
Chapman Hill

October 2017
Version 1

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SUMMARY

This report details the results of a fauna habitat assessment of proposed clearing areas within Lot 2626 Jamison's Road, Chapman Hill (the survey area). The survey area contains about 4.9 hectares of remnant vegetation that is required to be cleared to allow for a proposed extractive industry (gravel) to proceed.

The assessment was undertaken to identify the extent of black cockatoo habitat present with a proposed clearing area, to determine if south-western brush-tailed phascogales are present and to assess the likelihood of any other species of conservation significance occurring.

The assessment has included a daytime survey of the site, carried out on the 15, 19 and 29 September 2017, a camera trap survey (15 to 29 September 2017) and a review of available, relevant literature so as to comply with the requested scope of works and in line with the published guidelines.

The survey area was found to contain 130 potential "black cockatoo breeding habitat trees" (DBH $\geq$50cm). Eighteen of these trees appeared to contain hollows of a size possibly suitable for black cockatoos to utilise for nesting with at least one showing some inconclusive evidence of previous use. Some other larger hollows showed evidence of use by Australian wood ducks.

All of the proposed clearing area (~4.9 hectares) represents black cockatoo foraging habitat given the dominance of marri, jarrah and sheoak. No existing roosting trees (trees used at night by black cockatoos to rest) were positively identified during the survey.

No evidence of south western brush-tailed phascogales being present was found despite a detailed camera trap survey and this couple with the fact that habitat appears marginal at best would suggest they were absent from the area surveyed.

Habitat within the survey area also appears unsuitable for other species of concern such as the western ringtail possums and chuditch to utilise. This conclusion is supported by the fact that no evidence of any species of conservation significance (besides black cockatoos) being present was observed during the field assessment.

The results of this assessment should be provided to the relevant regulatory authorities for their consideration during the clearing permit assessment process.

1. INTRODUCTION

This report details the results of a fauna habitat assessment of proposed clearing areas within Lot 2626 Jamisons Road, Chapman Hill (the survey area).

It is understood that a clearing permit has been applied for so as to allow for an extractive industry to proceed. The extent of the proposed clearing is about 4.9 hectares (Figure 1).

2. SCOPE OF WORKS

The scope of works was:

1. Black cockatoo habitat assessment (habitat trees, existing and potential nest hollows, foraging and roosting habitat) over the proposed clearing area;

2. South-western Brush-tailed Phascogale habitat assessment (presence/absence, potential nest hollows and general habitat) over the proposed clearing area;

3. Recording of observations related to the presence of any other fauna species of conservation significance and/or their habitat (e.g. western ringtail possum and chuditch);

4. Report summarising results with management/planning/referral recommendations if required.

Note: For the purposes of this proposal the term black cockatoo is in reference to Baudin's black cockatoo *Calyptorhynchus baudinii*, Carnaby's black cockatoo *Calyptorhynchus latirostris* and the forest red-tailed black cockatoo *Calyptorhynchus banksii naso.*

3. METHODS

The habitat assessment has included a daytime survey of the site, carried out on the 15, 19 and 29 September 2017, a camera trap survey (15 to 29 September 2017) and a review of available, relevant literature utilising the following methods so as to comply with the requested scope of works and in line with the published guidelines.

3.1 BLACK COCKATOO HABITAT ASSESSMENT

The following methods were employed to comply with the defined scope of works and are based on guidelines published by the federal Department of the Environment and

Legend

- Cadastral Boundaries
- Proposed Extraction Area (Approx.)
- Camera Traps

N

0 25 50 75 100

Metres

Fauna Survey

Drawn: G Harewood

Date: Oct 2017

Scale: 1:2,250

Projection/Coordinate System: UTM/MGA Zone 50

Lot 2626 Jamison's Road Chapman Hill

Air Photo and Camera Trap Locations

Figure: 1

Energy (DotEE) (SEWPaC 2012) which states that surveys for Carnaby's, Baudin's and forest red-tailed black cockatoo habitat should:

- be done by a suitably qualified person with experience in vegetation or cockatoo surveys, depending on the type of survey being undertaken;
- maximise the chance of detecting the species' habitat and/or signs of use;
- determine the context of the site within the broader landscape—for example, the amount and quality of habitat nearby and in the local region (for example, within 10 km);
- account for uncertainty and error (false presence and absences); and
- include collation of existing data on known locations of breeding and feeding birds and night roost locations.

Habitat used by black cockatoos have been placed into three categories by the DotEE (SEWPaC 2012) these being:

- Breeding Habitat;
- Foraging Habitat; and
- Night Roosting Habitat.

3.1.1 Black Cockatoo Breeding Habitat

The black cockatoo breeding habitat assessment has involved the identification of all suitable breeding trees species within the subject site that had a DBH of equal to or over 50cm. The DBH of each tree was estimated using a pre-made 50 cm "caliper".

Target tree species included marri and jarrah and any other *Corymbia/Eucalyptus* species of a suitable size that are present. Peppermints, *banksia*, sheoak and melaleuca tree species (for example) were not be assessed as they typically do not develop hollows that are used by black cockatoos.

The location of each tree identified as being over the threshold DBH was recorded with a GPS and details on tree species, number and size of hollows (if any) noted. Trees observed to contain hollows (of any size/type) were marked with "H" using spray paint.

Potential hollows were placed into one of four categories, based on the size of the apparent hollow entrance, these being:

- Small = ~<5cm diametre (i.e. entrance too small for a black cockatoo);
- Medium = ~5cm-10cm diametre (i.e. entrance too small for a black cockatoo);

- Large = ~>10cm diametre (entrance large enough for a black cockatoo but possible hollow appears to be unsuitable for nesting i.e. wrong orientation, too small, too low or too shallow); or

- Large (cockatoo) = ~>10cm diametre (entrance appears big enough to provide access to a possible hollow that may be suitable for a black cockatoo to use for nesting).

Based on this assessment trees present within the survey area have then been place into one of four categories:

- Tree < 50cm DBH or an unsuitable species (not assessed/recorded);

- Tree ≥50cm DBH, no hollows seen;

- Tree ≥50cm DBH, one or more hollows seen, none of which appeared suitable for black cockatoos to use for nesting; or

- Tree >50cm DBH, one or more hollows seen, with at least one considered possibly suitable for black cockatoos to use for nesting.

For the purposes of this survey a tree containing a potential cockatoo nest hollow has been defined as:

Generally, any tree which is alive or dead that contains one or more visible hollows (cavities within the trunk or branches) suitable for occupation by black cockatoos for the purpose of nesting/breeding. Hollows that had an entrance greater than about 10cm in diameter and would allow the entry of a black cockatoo into a suitably orientated and sized branch/trunk, were recorded as a "potential nest hollow".

Identified hollows were examined using binoculars for evidence of actual use by black cockatoos (e.g. chewing around hollow entrance, scarring and scratch marks on trunks and branches). Trees with possible nest hollows were also scratched and raked with a large stick/pole in attempt to flush any sitting birds from hollows and calls of chicks were also listened for. It should be noted that the survey may have been conducted outside of the main breeding season of one or more of the three species of black cockatoo.

3.1.2 Black Cockatoo Foraging Habitat

The location and nature of black cockatoo foraging evidence (e.g. chewed fruits around base of trees) observed during the field survey was recorded. The nature and extent of potential foraging habitat present was also documented irrespective of the presence of any actual foraging evidence.

A review of available literature was carried out to determine the location/extent of any known/likely black cockatoo foraging habitat areas in the vicinity of the survey area.

3.1.3 Black Cockatoo Roosting Habitat

Direct and indirect evidence of black cockatoos roosting within trees on site was noted if observed (e.g. branch clippings, droppings or moulted feathers).

A review of available literature was also carried out to determine the location/extent of any known/likely black cockatoo roosting habitat areas in the vicinity of the survey area.

3.2 SOUTH-WESTERN BRUSH-TAILED PHASCOGALE SURVEY

Concurrent with the black cockatoo habitat assessment hollows considered suitable for phascogales were recorded. General information on the overall suitability of habitat for this species was also be compiled.

Ten infra-red motion sensing cameras ("camera traps") were also deployed across the area in an attempt to confirm phascogale activity if they are present. The camera traps were deployed on the 15 September 2017 and retrieved on the 29 September 2017 (140 "camera trap nights").

3.3 OTHER SPECIES OF CONSERVATION SIGNIFCANCE

Evidence of the presence or likely presence of other species of conservation significance (including suitable habitat) was also searched for and recorded concurrent with the black cockatoo/phascogale habitat assessment. The aim was to obtain sufficient information to make a definitive comment on the likely significance of the proposed clearing areas to other species of conservation significance.

4. SURVEY CONSTRAINTS

No seasonal sampling has been carried out as part of this fauna assessment. The conclusions presented are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of the field assessments. It should also be recognised that site conditions can change with time.

During the habitat survey trees with hollows were searched for. It should be noted that identifying hollows suitable for fauna species from ground level has limitations. Generally, the full characteristics of any hollow seen are not fully evident (e.g. internal dimensions). It is also difficult to locate all hollows within all trees as some are not observable from ground level.

The location of observations was recorded using a handheld GPS. The accuracy of the GPS cannot be guaranteed above a level of about 5 to 10 metres, though it should

be noted that in some circumstance the accuracy can increase or decrease beyond this range.

5. RESULTS

5.1 BLACK COCKATOO HABITAT ASSESSMENT

5.1.1 Black Cockatoo Breeding Habitat

Trees considered potentially suitable for black cockatoos to use as nesting habitat (using DotEE criteria - SEWPaC 2012, but ultimately subject to a suitable hollow being present or developing and a range of other factors) which were found within the survey area comprised the following species:

- Marri – *Corymbia calophylla;* and
- Jarrah - *Eucalyptus marginata.*

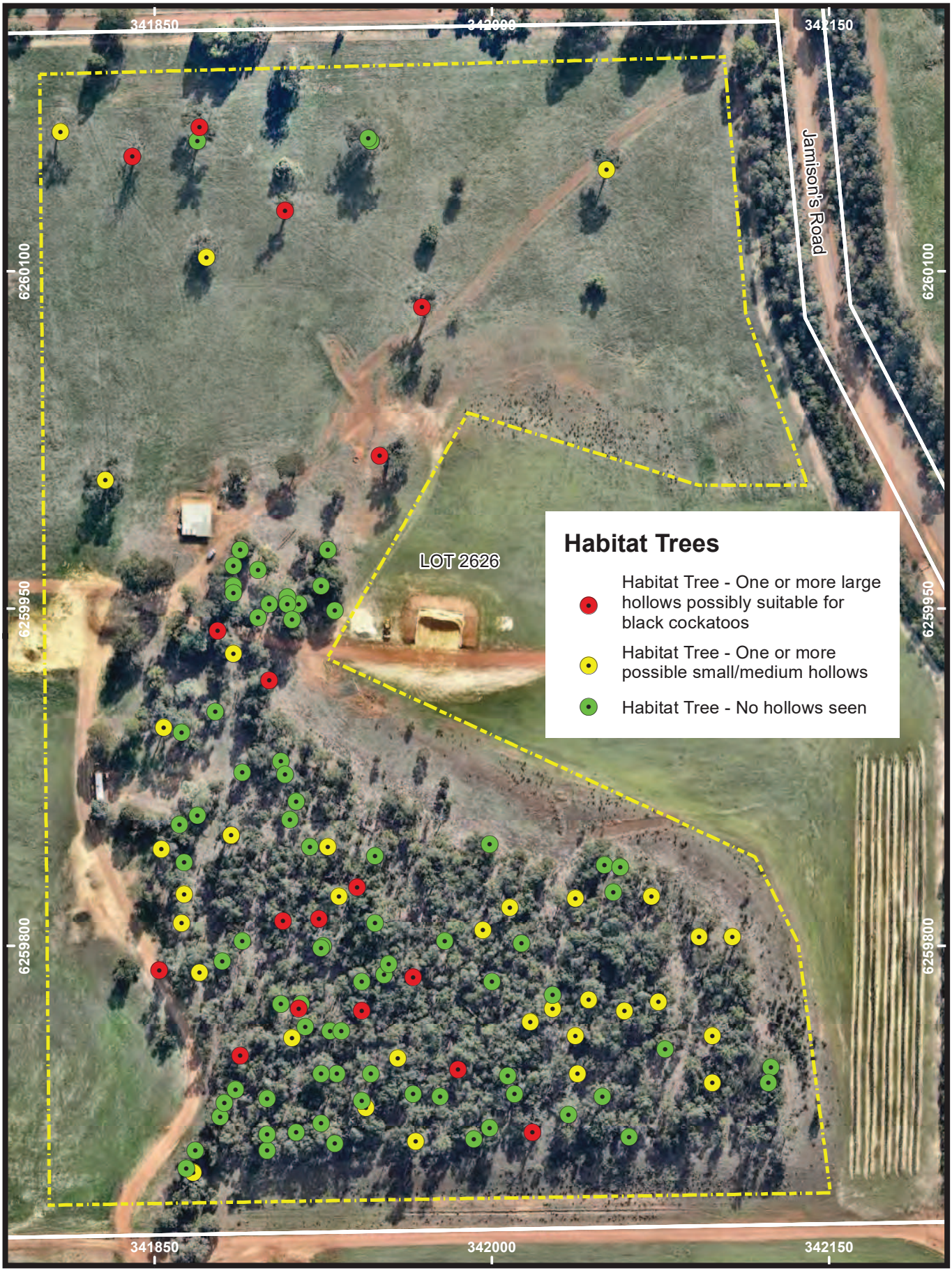
It should be noted that the likelihood of any one particular tree species developing hollows suitable for black cockatoos to use for breeding varies considerably. For example available data suggests that jarrah (*Eucalyptus marginata*) rarely produces hollows large enough for black cockatoos. Kirkby (2009) reports that from a database of 109 confirmed black cockatoo nest trees throughout the jarrah forest only six were located in jarrah trees.

A summary of the potential black cockatoo habitat trees observed within the survey areas is provided in Table 1 below and their location shown in Figure 2.

Table 1: Summary of Potential Black Cockatoo Habitat Trees (DBH ≥50cm) within the Survey Area

Total Number of Habitat (DBH ≥50cm) Trees	Number of Trees with No Hollows Observed	Number of Trees with Hollows Considered Unsuitable for Nesting Black Cockatoos	Number of Trees with Hollows Considered Possibly Suitable for Nesting Black Cockatoos	Tree Species	
				Marri	Jarrah
130	79	33	18	97	33

The assessment identified a total of 130 "habitat trees" within the survey area. The majority (79, ~60.8%) of the trees were not observed to contain hollows of any size. Thirty three (~25.4%) of the trees contained one or more "small" hollows (less than



Legend

Cadastral Boundaries

Proposed Extraction Area (Approx.)

N

0 25 50 75 100

Metres

Fauna Survey

Lot 2626 Jamison's Road
Chapman Hill

Habitat Trees (DBH >50cm)

Drawn: G Harewood

Date: Oct 2017

Scale: 1:2,250

Projection/Coordinate System: UTM/MGA Zone 50

Figure: 2

~10cm entrance size) considered by the Author not to be suitable for black cockatoos to use for nesting purposes. Eighteen (~13.8%) trees appeared to contain hollows with larger entrances (greater than ~10cm) that appeared big enough to possibly allow the entry of a black cockatoo into a suitably sized and orientated branch/trunk.

One hollow showed some evidence of use, possibly by black cockatoos in the form of chew marks around the hollow entrance, though this evidence was not conclusive. No black cockatoos appeared to be in attendance at this hollow at the time of the survey. Another hollow also showed evidence of use which was attributed at the time to smaller parrots (e.g. galah, corella, Australian ringneck parrot).

Three larger hollows appeared to have recently been used by ducks for nesting (most likely Australian wood ducks) as evidence by the presence of light grey down (feathers) around the hollow entrances, which they use to line their nests (unlike black cockatoos which lay eggs directly on the hollow floor). One large hollow was occupied by feral bees. The remaining 12 "potential nest hollows" showed no evidence of use.

Additional details on each habitat tree observed can be found in Appendix A.

A review of available data revealed no documented breeding records from the vicinity of the study area (i.e. within 10km). The survey area does not fall within the mapped breeding range of Carnaby's black-cockatoo within the most current recovery plan produced by DBCA (DEC 2012). The corresponding DBCA recovery plan for Baudin's and the forest red-tailed black-cockatoo (DEC 2007b) does not specifically define any known breeding areas for either species.

Johnstone and Kirkby (2011) also do not specifically mention breeding areas within the vicinity of the survey area though with respect to Baudin's and the forest red-tailed black-cockatoo, both species are noted as utilising marri trees (and other tree species) for breeding in the south west. So while no breeding data appears to exist for the general area there is potential for breeding to take place given the presence of large numbers of marri trees in remnant vegetation in the Chapman Hill area.

5.1.2 Black Cockatoo Foraging Habitat

Following is a list of the flora species recorded within the survey area during the course of the assessment that are known to be used as a food source by one or more species of black cockatoo:

- Marri - *Corymbia calophylla* – very common;
- Jarrah - *Eucalyptus marginata* – common;
- Sheoak – *Allocasuarina fraseriana* – common; and
- Bull Banksia – *Banksia grandis* – uncommon.

The proposed clearing area is highly degraded and lacks any significant amount of native groundcover, primarily as a consequence of long term grazing by livestock and possibly frequent fires. Despite this fact most of the proposed clearing area (4.9 hectares) represents black cockatoo foraging habitat given the dominance of marri, jarrah and to a lesser extent sheoak.

Other documented foraging species identified during the survey (i.e. *banksia*) are represented by a relatively small number of individual specimens and therefore they do not contribute to the total potential food resource to any significant degree.

Evidence of all three species of black cockatoo foraging onsite was observed during the field assessment. This evidence was in the form of chewed marri fruits (various examples specifically attributed to the forest red-tailed black cockatoo and Baudin's black cockatoo), chewed jarrah fruits (various examples attributed to the forest red-tailed black cockatoo and/or Carnaby's black cockatoo) and chewed sheoak fruits (attributed to the forest red-tailed black cockatoo) at several locations.

A number of Baudin's and/or Carnaby's black-cockatoos were also observed feeding on introduced pasture grasses (*Erodium* sp.?) just outside of the survey area.

Based on vegetation mapping compiled for the South West Biodiversity Project (2007) it is estimated that there is over 10,000 ha of native vegetation within 10 km the study area, much of which is very likely to represent potential black cockatoo foraging habitat of some type. There is also over 2,500 ha of pine plantations within 10km of the site. Pines are likely to be a significant foraging resource for Carnaby's black-cockatoos in this area. The proposed clearing within Lot 2629 represents 0.048% of this total area of potential foraging habitat.

5.1.3 Black Cockatoo Roosting Habitat

No existing roosting trees (trees used at night by black cockatoos to rest) were positively identified during the survey.

A review of available data did not reveal any documented roosts sites within 10km of the study area, though as with breeding habitat this could simply be a consequence of a lack of survey work or a lack of publicly available data. Many roosting options for black cockatoos are however likely to be present in the wider area given the relative large areas of remnant native vegetation within nearby state forest areas.

5.2 SOUTH-WESTERN BRUSH-TAILED PHASCOGALE SURVEY

The habitat tree assessment identified the presence of 51 trees with potential hollows of various sizes. A proportion of these are likely to be potentially suitable for phascogales to use for day time refuge. The suitability of the survey area for phascogales is however considerably lessened by the fact that it is relatively small (<5 ha) and isolated from other remnants in the immediate vicinity. Phascogales

occupy large home ranges (typically 20 ha to 40 ha for females, often over 100 ha for males – Van Dyck and Strahan 2008) within continuous areas of suitable habitat and therefore it would appear that in this respect, the survey area doesn't represent suitable habitat for the species despite the presence of trees with hollows.

The conclusion that the survey area lacks suitable habitat for phascogales is supported by the fact that no individuals were recorded during the camera trap survey. The 10 cameras, deployed over a period of 14 nights capture 779 images. Fauna species recorded were:

- Red Fox;
- Western Grey Kangaroo;
- Common Bronzewing Pigeon; and
- Australian Magpie.

5.3 OTHER SPECIES OF CONSERVATION SIGNIFCANCE

No evidence of any other fauna species of conservation significance was found during the course of the field survey. This couple with observations made in the field of habitat quality strongly suggest that the area proposed to be cleared is very unlikely to support individuals or a population of any other species of conservation significance (e.g. western ringtail possums, chuditch) under normal circumstances. The various species known from the wider are consider unlikely to be present given the fragmented and degraded nature of the remnant vegetation present and/or because their preferred habitat is completely absent.

6. CONCLUSION

The assessment reported on here was undertaken to identify the extent of black cockatoo habitat present with a proposed clearing area, to determine if south-western brush-tailed phascogales are present and to assess the likelihood of any other species of conservation significance occurring.

The survey area was found to contain 130 potential "black cockatoo breeding habitat trees" (DBH $\geq$50cm). Eighteen of these trees appeared to contain hollows of a size possibly suitable for black cockatoos to utilise for nesting with at least one showing some inconclusive evidence of previous use. Some other larger hollows showed evidence of use by Australian wood ducks.

All of the proposed clearing area (~4.9 hectares) represents black cockatoo foraging habitat given the dominance of marri, jarrah and sheoak. No existing roosting trees

(trees used at night by black cockatoos to rest) were positively identified during the survey.

No evidence of south western brush-tailed phascogales being present was found despite a detailed camera trap survey and this couple with the fact that habitat appears marginal at best would suggest they were absent from the area surveyed.

Habitat within the survey area also appears unsuitable for other species of concern such as the western ringtail possums and chuditch to utilise. This conclusion is supported by the fact that no evidence of any species of conservation significance (besides black cockatoos) being present was observed during the field assessment.

The results of this assessment should be provided to the relevant regulatory authorities for their consideration during the clearing permit assessment process.

7. REFERENCES

Department of Environment and Conservation (DEC) (2007). Forest Black Cockatoo (Baudin's Cockatoo - *Calyptorhynchus baudinii*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) Recovery Plan. Department of Environment and Conservation, Perth, Western Australia

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Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) (2012). *EPBC Act* Referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered) *Calyptorhynchus latirostris*, Baudin's cockatoo (vulnerable) *Calyptorhynchus baudinii*, Forest red-tailed black cockatoo (vulnerable) *Calyptorhynchus banksii naso*.

Johnstone, R. E. & Kirkby, T. (2011). Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) on the Swan Coastal Plain (Lancelin–Dunsborough), Western Australia. Studies on distribution, status, breeding, food, movements and historical changes. Report for the Department of Planning, Western Australia.

Kirkby, T. (2009). Results of Black Cockatoo Survey at Lot 2 Dawesville. Unpublished report for WA Limestone.

Van Dyck, S. & Strahan, R. Eds (2008). The Mammals of Australia. Third edition Queensland Museum.

APPENDIX A

BLACK COCKATOO HABITAT TREE DETAILS

Habitat trees (DBH ≥50cm)
Datum - GDA 94

Entrance Size Ranges - Small = >5cm, Medium = 5 - 10cm, Large = >10cm

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows	Hollow Size	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt001	50H	341930	6259949	Marri	20+	>50	0		No Signs	No Signs	No	
wpt002	50H	341924	6259960	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt003	50H	341914	6259952	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt004	50H	341909	6259955	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt005	50H	341909	6259952	Marri	10-15	>50	0		No Signs	No Signs	No	
wpt006	50H	341911	6259945	Marri	20+	>50	0		No Signs	No Signs	No	
wpt007	50H	341901	6259952	Marri	20+	>50	0		No Signs	No Signs	No	
wpt008	50H	341896	6259946	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt009	50H	341896	6259967	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt010	50H	341885	6259969	Marri	20+	>50	0		No Signs	No Signs	No	
wpt011	50H	341885	6259958	Marri	20+	>50	0		No Signs	No Signs	No	
wpt012	50H	341885	6259960	Marri	20+	>50	0		No Signs	No Signs	No	
wpt013	50H	341885	6259957	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt014	50H	341878	6259940	Marri	20+	>50	2+	Small, Medium & Large (Cockatoo)	No Signs	No Signs	Yes	Internal dimensions of hollows unknown
wpt015	50H	341885	6259930	Marri	20+	>50	2+	Small & Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt016	50H	341901	6259918	Marri	20+	>50	2+	Small, Medium & Large (Cockatoo)	Bees	No Signs	Yes	Bees in large hollow
wpt017	50H	341877	6259904	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt018	50H	341862	6259895	Marri	20+	>50	0		No Signs	No Signs	No	
wpt019	50H	341854	6259897	Marri	20+	>50	2+	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt020	50H	341861	6259854	Marri	20+	>50	0		No Signs	No Signs	No	
wpt021	50H	341869	6259858	Marri	20+	>50	0		No Signs	No Signs	No	
wpt022	50H	341884	6259849	Marri	20+	>50	2+	Medium & Large (Cockatoo)	No Signs	No Signs	Yes	Internal dimensions of hollows unknown
wpt023	50H	341863	6259837	Marri	20+	>50	0		No Signs	No Signs	No	
wpt024	50H	341853	6259843	Marri	20+	>50	2+	Small & Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt025	50H	341863	6259823	Marri	20+	>50	2+	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt026	50H	341862	6259810	Marri	20+	>50	2+	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt027	50H	341870	6259788	Marri	20+	>50	2+	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt028	50H	341852	6259789	Marri	20+	>50	2+	Small, Medium & Large (Cockatoo)	No Signs	No Signs	Yes	Internal dimensions of hollows unknown
wpt029	50H	341880	6259793	Marri	20+	>50	0		No Signs	No Signs	No	
wpt030	50H	341888	6259751	Marri	20+	>50	1	Large (Cockatoo)	Ducks	No Signs	Yes	Evidence of used by ducks (feathers/down)
wpt031	50H	341906	6259882	Marri	20+	>50	0		No Signs	No Signs	No	
wpt032	50H	341908	6259876	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt033	50H	341889	6259877	Marri	15-20	>50	0		No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows	Hollow Size	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt034	50H	341884	6259849	Marri	20+	>50	1	Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt035	50H	341907	6259811	Dead Jarrah	15-20	>50	2+	Medium & Large (Cockatoo)	No Signs	No Signs	Yes	Internal dimensions of hollows unknown
wpt036	50H	341906	6259774	Marri	20+	>50	0		No Signs	No Signs	No	
wpt037	50H	341828	6260007	Marri	15-20	>50	2+	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt038	50H	341808	6260162	Marri	15-20	>50	1	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt039	50H	341840	6260151	Marri	20+	>50	2+	Medium & Large (Cockatoo)	No Signs	No Signs	Yes	Internal dimensions of hollows unknown
wpt040	50H	341869	6260158	Marri	20+	>50	0		No Signs	No Signs	No	
wpt041	50H	341870	6260164	Marri	15-20	>50	1	Large (Cockatoo)	Ducks	No Signs	Yes	Evidence of used by ducks (feathers/down)
wpt042	50H	341873	6260106	Marri	15-20	>50	2+	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt043	50H	341908	6260127	Marri	15-20	>50	2+	Small, Medium & Large (Cockatoo)	Bees	No Signs	Yes	Internal dimensions of hollows unknown
wpt044	50H	341946	6260158	Marri	20+	>50	0		No Signs	No Signs	No	
wpt045	50H	341946	6260158	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt046	50H	341945	6260159	Marri	20+	>50	0		No Signs	No Signs	No	
wpt047	50H	342051	6260145	Marri	20+	>50	2+	Small & Medium	Parrots	Parrots	No	Evidence of use by parrots?
wpt048	50H	341969	6260084	Marri	20+	>50	2+	Small, Medium & Large (Cockatoo)	No Signs	No Signs	Yes	Internal dimensions of hollows unknown
wpt049	50H	341950	6260018	Marri	20+	>50	2+	Small, Medium & Large (Cockatoo)	Bees	No Signs	Yes	Internal dimensions of hollows unknown
wpt051	50H	341888	6259976	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt052	50H	341927	6259976	Marri	20+	>50	0		No Signs	No Signs	No	
wpt053	50H	341999	6259845	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt054	50H	342008	6259817	Marri	20+	>50	2+	Small & Medium	Parrots	Parrots	No	Evidence of use by parrots?
wpt055	50H	341996	6259807	Marri	15-20	>50	2+	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt056	50H	342013	6259801	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt057	50H	342037	6259821	Dead Jarrah	20+	>50	2+	Small & Medium	Bees	No Signs	No	Internal dimensions of hollows unknown
wpt058	50H	342050	6259836	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt059	50H	342057	6259835	Marri	20+	>50	0		No Signs	No Signs	No	
wpt060	50H	342054	6259824	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt061	50H	342071	6259822	Marri	15-20	>50	2+	Small & Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt062	50H	342092	6259804	Jarrah	20+	>50	2+	Small & Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt063	50H	342107	6259804	Jarrah	20+	>50	2+	Small & Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt064	50H	342098	6259760	Jarrah	20+	>50	2+	Small & Medium	Parrots	Parrots	No	Evidence of use by parrots
wpt065	50H	342124	6259746	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt066	50H	342123	6259739	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt067	50H	342098	6259739	Marri	15-20	>50	2+	Small & Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt068	50H	342077	6259754	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt069	50H	342074	6259775	Dead Marri	15-20	>50	2+	Small & Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt070	50H	342059	6259771	Jarrah	15-20	>50	2+	Small & Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt071	50H	342043	6259776	Marri	20+	>50	1	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows	Hollow Size	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt072	50H	342027	6259772	Jarrah	15-20	>50	2+	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt073	50H	342027	6259778	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt074	50H	342037	6259760	Dead Marri	10-15	>50	2+	Small & Medium	Bees	No Signs	No	Internal dimensions of hollows unknown
wpt075	50H	342049	6259733	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt076	50H	342061	6259715	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt077	50H	342034	6259725	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt078	50H	342018	6259717	Jarrah	20+	>50	2+	Small, Medium & Large (Cockatoo)	No Signs	No Signs	Yes	Internal dimensions of hollows unknown
wpt079	50H	342010	6259734	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt080	50H	341999	6259719	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt081	50H	341992	6259714	Dead Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt082	50H	341966	6259713	Marri	20+	>50	2+	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt083	50H	341944	6259728	Jarrah	20+	>50	2+	Small & Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt084	50H	341942	6259731	Marri	20+	>50	0		No Signs	No Signs	No	
wpt085	50H	341931	6259743	Marri	20+	>50	0		No Signs	No Signs	No	
wpt086	50H	341924	6259743	Marri	20+	>50	0		No Signs	No Signs	No	
wpt087	50H	341924	6259721	Marri	20+	>50	0		No Signs	No Signs	No	
wpt088	50H	341930	6259712	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt089	50H	341913	6259717	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt090	50H	341900	6259709	Marri	20+	>50	0		No Signs	No Signs	No	
wpt091	50H	341900	6259716	Marri	20+	>50	0		No Signs	No Signs	No	
wpt092	50H	341867	6259699	Marri	20+	>50	2+	Small & Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt093	50H	341864	6259701	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt094	50H	341868	6259709	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt095	50H	341879	6259724	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt096	50H	341881	6259730	Marri	20+	>50	0		No Signs	No Signs	No	
wpt097	50H	341886	6259736	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt098	50H	341900	6259732	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt099	50H	341911	6259759	Marri	20+	>50	2+	Small & Medium	Parrots	Parrots	No	Evidence of use by parrots
wpt100	50H	341914	6259772	Marri	20+	>50	2+	Small, Medium & Large (Cockatoo)	Ducks	No Signs	Yes	Evidence of used by ducks (feathers/down)
wpt101	50H	341915	6259774	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt102	50H	341917	6259764	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt103	50H	341928	6259762	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt104	50H	341933	6259762	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt105	50H	341942	6259771	Marri	20+	>50	2+	Small, Medium & Large (Cockatoo)	No Signs	Cockatoos	Yes	Cockatoo chew marks?
wpt106	50H	341942	6259784	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt107	50H	341952	6259787	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt108	50H	341965	6259786	Dead Jarrah	15-20	>50	2+	Small, Medium & Large (Cockatoo)	No Signs	No Signs	Yes	Internal dimensions of hollows unknown

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows	Hollow Size	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt109	50H	341979	6259802	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt110	50H	342000	6259784	Marri	20+	>50	0		No Signs	No Signs	No	
wpt111	50H	342017	6259766	Marri	15-20	>50	2+	Small & Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt112	50H	342007	6259742	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt113	50H	342038	6259743	Dead Marri	15-20	>50	2+	Small & Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt114	50H	341985	6259745	Marri	20+	>50	2+	Small, Medium & Large (Cockatoo)	No Signs	No Signs	Yes	Internal dimensions of hollows unknown
wpt115	50H	341958	6259750	Marri	20+	>50	1	Small	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt116	50H	341946	6259743	Marri	20+	>50	0		No Signs	No Signs	No	
wpt117	50H	341965	6259734	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt118	50H	341977	6259733	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt119	50H	341954	6259792	Marri	20+	>50	0		No Signs	No Signs	No	
wpt120	50H	341948	6259810	Marri	20+	>50	0		No Signs	No Signs	No	
wpt121	50H	341925	6259800	Marri	20+	>50	0		No Signs	No Signs	No	
wpt122	50H	341924	6259799	Marri	10-15	>50	0		No Signs	No Signs	No	
wpt123	50H	341889	6259802	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt124	50H	341910	6259856	Marri	20+	>50	0		No Signs	No Signs	No	
wpt125	50H	341913	6259864	Marri	20+	>50	0		No Signs	No Signs	No	
wpt126	50H	341919	6259844	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt127	50H	341927	6259844	Marri	15-20	>50	2+	Small & Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt128	50H	341948	6259840	Marri	20+	>50	0		No Signs	No Signs	No	
wpt129	50H	341940	6259826	Marri	20+	>50	2+	Medium & Large (Cockatoo)	No Signs	No Signs	Yes	Internal dimensions of hollows unknown
wpt130	50H	341932	6259822	Marri	20+	>50	2+	Small & Medium	No Signs	No Signs	No	Internal dimensions of hollows unknown
wpt131	50H	341923	6259812	Marri	20+	>50	2+	Medium & Large (Cockatoo)	Parrots	No Signs	Yes	Evidence of use by parrots?

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